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Analysis of Tentative Seismic Design Provisions for Buildings

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Analysis of Tentative Seismic Design Provisions for Buildings

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EXECUTIVE SUMMARY

The Tentative Provisions for the Development of Seismic Regulations for Buildings were prepared by the Applied Technology Council (ATC) for use in the development of standards and regulations for the reduction of earthquake hazards for buildings to serve as a guide to designers. The Provisions are a significant advance over existing seismic provisions in scope and content. It will be a challenging task to standards writers and regulators to abstract pertinent material from the Provisions for incorporation in the large number of existing standards and regulations through which the Provisions will be implemented. It also will be a challenge to designers and builders to study and understand the seismic design and construction concepts embodied in the Provisions and to incorporate these concepts in their design and construction practices.

The objective of this report and the analysis of the Provisions it contains is to assist standards writers, designers, builders, regulators and all other users of the Provisions by providing a formal representation of the logic of the provisions. The analysis is intended to serve as an aid in their understanding, further development, incorporation in existing standards and codes, and use in design and construction practices. The scope of the analysis includes each of the 13 principal chapters of the Provisions; it excludes the guidelines for repair, the guidelines for emergency evaluation of damage, and the appendix on masonry construction. The analysis provides:

1. A listing of each of the over 1200 discrete items of data or individual provisions referred to in the Provisions, with a cross-reference to the other data required for its evaluation and to the other provisions that use its value.

2. A decision table for each of 340 provisions that displays the logic of the provisions unequivocally and that has been tested to identify any gaps, redundancy or contradictions in the logic.

3. Information networks for each chapter as well as the whole document that represent the precedence relations between provisions. These networks are particularly useful for following the flow of logic and assessing interdependency in a document new to most users. The networks show that paths exist with as many as 51 provisions in series sequency between input data and the final evaluation of compliance.

4. An index locating provisions by reference to the pertinent physical elements of the building, building processes, and qualities required of these elements and processes and several alternative arrangements of the provisions to make them more accessible to various classes of users.

The analysis finds very few uncertainties in the logic of individual provisions. This is of great credit to the ATC team that formulated the provisions from recent research results and existing design standards. The analysis does reveal opportunities to improve the provisions as their further development proceeds. The four major aspects of the analysis listed above are presented in appendixes A1 through A4, respectively. The most significant findings are discussed in a self-contained chapter of the report.

The techniques used in the analysis have been adapted and developed by the authors from concepts of logic, taxonomy and computer science to provide technical aids for the formulation, expression and use of standards. The techniques provide several objective measures on the clarity, completeness, and consistency of standards. The formal representation provides another perspective from which their correctness, or technical validity, may be viewed. The report includes the introduction to the analytical techniques that is necessary for a good understanding of the formal representation.

The authors interacted within the ATC team during the development of the provisions. Because the analysis project started much later than the ATC project, there was not a full trial of the efficacy of the analysis techniques as an interactive aid to standards-writing groups. However, recommendations for effective cooperation are presented based on this initial experience. It is expected that the analysis results and techniques will be helpful to groups concerned with further development and use of the Provisions. The project also provides a valuable case study in the application of the analytical techniques to a standards generating project, which is likely to be of benefit to similar projects in fields other than aseismic design.

CONTENTS

ABSTRACT

This report presents the results of a thorough study of the internal logic of the Tentative Provisions for the Development of Seismic Regulations for Buildings developed by the Applied Technology Council. The methods of analysis employed in the study provide objective measures of clarity, completeness, and consistency and an alternative form in which to examine the technical validity of the provisions. These methods include decision logic tables for examining individual provisions, information networks for representing the precedence among provisions, and classification of the provisions to study their scope and arrangement. A formal representation of the provisions is presented by the data items, decision tables, networks, and classification systems developed in the study. An index and several alternate arrangements of the provisions are also included. Opportunities for improvement of the tentative provisions are identified and discussed, and considerations for their future development and implementation within various national standards are highlighted.

Keywords:

Buildings; building codes; building standards; classification; decision tables; earthquake-resistant design; information networks; network; seismic design; systems analysis.

CHAPTER 1

INTRODUCTION

1.1 Objectives and Scope of Study

This publication constitutes the final report on the cooperative research project between the National Bureau of Standards (NBS) and Carnegie-Mellon University (CMU) entitled "Formulation and Expression of Seismic Design Provisions." The project had a three-fold objective.

The first objective was to assist the Applied Technology Council (ATC) in the preparation of its report, Tentative Provisions for the Development of Seismic Regulations for Buildings [1]* (subsequently referred to as the Provisions). This assistance was to consist of systematic studies of successive drafts prepared during the development of the Provisions, in order to:

1) resolve possible discrepancies and inconsistencies;
2) investigate alternate arrangements which would make the document more readily usable; and
3) insure that the basic premises of the development (namely: ease of adoption, ease of updating, and consistency of provisions) are reflected in the document.

The activities undertaken to meet this objective are briefly described in section 1.2.2.

The second objective of the study was to augment the text of the published Provisions by providing a formal, consistent documentation of the text, as well as a constructive critique of possible clarifications and improvements of the text. It was the expectation of the investigators that this formal representation would be of assistance to a wide range of potential users of the Provisions, in particular to organizations intending to adopt all or selected portions of the Provisions as legal building codes. Most of the material in this report is intended to satisfy the second objective of the study.

The third objective was to provide alternate arrangements of the Provisions that would make them more readily usable by several categories of users. The classification, index and outlines contained in Appendix A4 of this report are presented to meet this objective.

It is recognized that the Provisions as issued are tentative in nature, and not intended for immediate consideration for adoption by code writing bodies. It is believed that the material presented in this report can be of major assistance in the assessment and implementation studies of the Provisions currently being planned. [2]

The study included chapters 1 through 13 of the Provisions. Chapter 12A, the appendix on masonry construction, was omitted because it is treated as a reference document by the remainder of the Provisions. Chapters 14 and 15 are guidelines that cover subjects beyond the scope of normal building code provisions, and thus were also omitted from this study.

1.2 Background

1.2.1 The ATC-3 Project

The Provisions have been developed by the Applied Technology Council (ATC) under contract with the National Bureau of Standards (NBS) with funding from the National Science Foundation (NSF).

The Provisions represent the work of a multi-disciplinary team of some 80 persons from industry, private practice, universities, and code regulatory agencies. The participants also solicited and received comments from a wide range of professional, business, and industry groups. While some parts of the Provisions are modeled after existing codes (such as those of the Structural Engineers Association of California and the International Conference of Building Officials) many of the parts are quite new, and are an order of magnitude more comprehensive in depth and breadth than existing provisions for seismic resistant design.

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*The numbers in brackets correspond to the sources cited in REFERENCES.

A partial listing of new concepts introduced is reproduced from the "INTRODUCTION" of the Provisions:

"1. The incorporation of more realistic seismic ground motion intensities.
2. Consideration of the effects of distant earthquakes on long-period buildings.
3. Response modification coefficients (reduction factors) which are based on consideration of the inherent toughness, amount of damping when undergoing inelastic response, and observed past performance of various types of framing systems.
4. Classification of building use-group categories into "Seismic Hazard Exposure Groups".
5. Seismic performance categories for buildings with design and analysis requirements dependent on the seismicity index and building seismic hazard exposure group.
6. Simplified structural response coefficient formulas related to the fundamental period of the seismic resisting system of the building.
7. Detailed seismic design requirements for architectural, electrical, and mechanical systems and components.
8. Materials design and analysis based upon stresses approaching yield.
9. Guidelines for systematic abatement of seismic hazards in existing buildings.
10. Guidelines for assessment of earthquake damage, strengthening or repair of damaged buildings, and potential seismic hazards in existing buildings."

The reader is referred to the INTRODUCTION of the Provisions for a discussion of the philosophy and objectives of the ATC effort, new concepts introduced, and the organization of the ATC project.

Of particular importance to the study reported herein was the early recognition that the Provisions could not develop in an evolutionary fashion from existing codes. For this reason, a Format Committee has been an integral part of the ATC effort, with the responsibility for developing the major organizational format of the Provisions. One of the principal investigators (S. J. Fenves) was a member of the Format Committee, as well as of the Coordinating Committee which compiled the January 1976 draft (ATC-3-04).

1.2.2 The NBS-CMU Project

As the ATC project progressed, it became apparent that it was impractical to assign to the ATC Format Committee the task of resolving all possible sources of inconsistency, or to analyze and explore possible alternate organizational formats. Therefore, under a separate grant from NSF, a cooperative project between NBS and CMU was initiated and charged with assisting in the "Formulation and Expression" of the Provisions.

The NBS-CMU project team brought to this task a methodology developed over several years and applied to a number of codes and design specifications. A general outline of the methodology is given in reference [3]. Aspects of the methodology pertinent to the use of this report are introduced in chapter 2. The application of the methodology in this project is described in detail in appendix B.

Briefly, the project consisted of two phases, corresponding to the objectives given in Section 1.1. From May 1976 through August 1977, the project team reviewed successive drafts of the Provisions, and provided feedback and suggestions to the ATC project. The most significant suggestions were compiled into three "Working Reports" [4], [5], [6] submitted to ATC. In addition, informal comments and suggestions were provided directly to the ATC staff and several of the Task Committees, particularly during the summer of 1977, when a number of rapid response comments were transmitted to ATC during the preparation of the final version of the Provisions.

The second phase began with the receipt of the pre-publication copy of the final version of the Provisions (ATC-3-06). Starting with the several portions developed on the basis of earlier drafts, the formal representation presented in this report was developed and completed, and the project findings and suggestions compiled.

1.3 Scope of Report

Chapter 2 describes briefly the methodology followed in the analysis of the Provisions, and provides a guide for reading and interpreting the formal representation. Chapter 3 presents the significant findings concerning the clarity, completeness, consistency, and, to a smaller extent, the technical validity of the published Provisions (ATC-3-06) discovered in the process of preparing the formal representation of the Provisions. Chapter 4 contains a summary of the conclusions, with recommendations for further use of the results of this study.

Appendixes A1 through A4 contain the formal representation with many detailed comments about the provisions. Appendixes B1 and B2 elaborate further on the application of the methodology for the analysis and representation in the development of standards.

1.4 Uses of Report

It is anticipated that this report can be of major assistance in the assessment of the Provisions, further studies in the development, testing and improvement of model seismic design and construction provisions based on the Provisions, and the eventual incorporation of the resulting provisions into local codes, standards and manuals of practice.

Chapter 3, which can be read independently of the rest of the report, should be reviewed by all groups assessing the Provisions, as it summarizes and documents a number of major issues resulting from the analysis of the Provisions which should be addressed before the Provisions can be considered ready for adoption by code-writing bodies.

The understanding of the data presented in appendixes A1 through A4 requires the reading of Chapter 2. The formal representation of the Provisions, consisting of data lists, decision tables, information networks and classification schemes, can be used in at least the following contexts:

- as a means of gaining better understanding of the intent and content of the Provisions, both at the detailed level of individual provisions documented by the decision tables and at the global level of interrelated provisions displayed by the information networks, classification schemes, and alternate arrangements.

- as a means of detecting areas of problems, again both at the detailed level (notably through the comments on the decision tables in appendix A2) and at the global level, by tracing the ramifications of provisions through the network;

- as a guide for assessment and future modifications, in greater detail than given in Chapter 3; and

- as a case study of the application of the methodology for the analysis and representation of standards discussed in appendix B.

CHAPTER 2

DESCRIPTION OF THE ANALYSIS AND REPRESENTATION

This chapter presents a brief overview of the methodology used for the analysis and representation of the Provisions. The primary emphasis of the chapter is to provide sufficient understanding for use of the remainder of the report, particularly the results presented in appendixes A1 through A4. A more complete discussion of the application of the methodology to the analysis of the Provisions is given in appendix B. A more detailed explanation of the basic concepts of the methodology can be found in references [3] and [7].

2.1 Overview

The Provisions, as implied in its title, consists of a set of individual provisions. Each provision has the function of assigning a value to a data item (or datum for short). Thus, the (partial) provision from section 4.2 of the Provisions:

> ". . . the seismic coefficient C_s shall be determined in accordance with the formula:
>
> $$C_s = \frac{1.2A_vS}{RT^{2/3}} \qquad (4\text{-}2)"$$

clearly specifies a procedure for assigning a (numerical) value to the datum "Seismic coefficient, C_s".

The (partial) provision from section 1.4.4:

> "No new building . . . assigned to Category D shall be sited where there is the potential for an active fault to cause rupture of the ground surface at the building."

can be viewed as assigning a (boolean) value of "satisfied" or "violated" to the datum "Category D site limitation".

Individual provisions are, of course, interrelated. This interrelationship can be made explicit by defining the ingredients of each datum, that is, the list of all data items that may be necessary to evaluate it. Thus, in the examples above, the ingredients of C_s are A_v, S, R and T, while the ingredients of "Category D site limitation" are the data items "Seismic Performance Category" (which may have values of: "A", "B", "C" or "D") and "Potential exists for ground rupture from active fault" (with possible values of "true" or "false").

A set of provisions can be analyzed to determine if they are clear, complete, consistent and, to some extent, correct. The analysis is conducted at several levels of detail. The primary benefit of the analysis is that it raises questions when points are detected that might indicate loss of clarity, completeness, etc. The technique does not provide corrective answers, for that generally involves actual change in the wording of the provisions. The results of the analysis can be displayed in a number of formats, depending on subsequent use.

Four principal tools were used in the analysis of the Provisions:

1) Data items are defined for every variable in the provisions. The list of data items is typically considerably longer than the conventional list of definitions and symbols, as it also includes boolean variables such as "potential exists for ground rupture from active fault". In addition to providing an explicit referencing scheme, the list of data items is useful for analysis purposes, as it uncovers possible ambiguities, such as using two (or more) names for the same datum, or using the same, or similar, names for different data items.

2) Decision tables are used to represent the meaning of individual provisions. A decision table is simply an orderly presentation of the reasoning leading to the assignment of a value to a datum. It is easily analyzed to assure that the reasoning process will lead to a unique result and that no possibility exists for encountering a situation not defined. Decision tables present an overall analysis of situations involving parallel thought processes, whereas the written text, and, to some extent, flow charts, both describe a sequential thought pattern.

3) Information networks are used to represent the precedence relations among the provisions. Each datum occupies one node in the network. The nodes are connected to their ingredient nodes by branches that represent the flow of information through a set of provisions.

4) The outline/classified index is used to represent the arrangement and scope of the provisions. The subset of the overall set of provisions which contains the likely points of entry by users is selected as a set of basic provisions. Each of these basic provisions is then classified using key words that define the scope of the provisions. The classifiers allow outlines and indexes to be constructed, and the basic provisions are entered at the appropriate points (thus, this tool involves synthesis as well as analysis). Several different arrangements of the basic provisions can be generated, allowing selection of the best arrangement for any given use.

Examples of the use of each of these tools in the analysis of the Provisions are presented in the following sections.

2.2 Data Items

A datum is a precise identification of a variable occurring in the provisions. The total set of data items, plus the relations between them, are intended to contain all the substantive information in the provisions. However, there is considerable leeway in defining data items. In this study, the general philosophy followed was to define as data items only those variables representing values that were explicitly needed to evaluate other data items or to judge compliance with the provisions. Thus, the data items in this study do not capture 100 percent of the subtleties of meaning carried in the textual expression of the provisions.

It is convenient to designate data items by several categories:

1) by the type of value it carries, e.g., numeric, boolean (with possible values of "true" or "false", or, equivalently, "satisfied" or "violated") or multi-valued (e.g., "Seismic performance category");

2) by position in the data hierarchy or information network. The most important distinctions are basic or input data items (i.e., data items with no ingredients), derived data items (i.e., data items with at least one ingredient), and terminal data items (i.e., data items with no dependents);

3) by classification category, namely whether the data item belongs to one of the classification categories used for indexing and outlining, such as physical entity, process or environment.

The primary function of the data lists is to provide an explicit referencing scheme for the data items. In this study, the following coding scheme was used:

1) each data item was assigned a unique numeric label, or data number, of the form nnmkk where:

   nn is the chapter number in the Provisions (1 through 13) where the data item occurs (in the common case of multiple occurrence, the location of best definition is used)

   m is the major section number (with the exception of sections 5.10 and 5.11 of the Provisions, where m = 9 is used) kk is an arbitrary number to distinguish the different data items within the section (it normally reflects the sequence of occurrence within the section);

2) derived data items were assigned a mnemonic <u>data label</u> of six or fewer characters (see section 2.3.2 for a further discussion of the coding system used in these labels); and

3) each data item was assigned a textual data description.

Thus, for example, the data items appearing in the second example presented earlier are identified in the Data List of appendix A1 as:

Number	Label	Description
1493	CDSLR	Category D site limitation requirement
1490	SPC	Seismic performance category
1230		Building stage
1496		Potential exists for ground rupture from active fault

Note that the datum "Building stage" is a boolean datum with possible values of "new" or "existing".

All of the data items in appendix A1 that have data labels are derived data items, that is, they each have one or more ingredients that were identified in this study. The way in which the ingredients are used to evaluate the derived data items is shown in the decision tables in appendix A2. The use of decision tables is discussed in the following section.

2.3 <u>Decision Tables</u>

2.3.1 Reading Decision Tables

A decision table is a tabular arrangement of conditions, actions, and rules. A condition is a logical statement that must have one of only two values: true or false. An action is any operation; in the context of this study it is the assignment of a value to a datum. A rule is a statement that prescribes a set of condition values in order that a specified set of actions can be performed. Thus, the second example introduced in section 2.1 is shown in decision table form as follows:

		Rule 1	Rule 2	Rule 3	Rule 4
Condition 1	Seismic performance category = D	Y	Y	N	N
Condition 2	Potential for ground rupture from active fault = true	Y	N	Y	N
Action 1	Category D site limitation requirement = satisfied		X	X	X
Action 2	Category D site limitation requirement = violated	X			

The table is read rule by rule. Rule 1 reads: <u>If</u> Seismic Performance Category is D <u>and</u> potential for ground rupture from active fault exists <u>then</u> Category D Site Limitation Requirement <u>is</u> violated; the other rules can be read similarly.

The actual format of decision tables presented in appendix A2 is shown in connection with the full Site limitation provision reproduced below (underlined words omitted in introductory example):

> "1.4.4 SITE LIMITATION FOR SEISMIC DESIGN PERFORMANCE CATEGORY D
>
> No new building <u>or existing building which is, because of change in use</u>, assigned to Category D shall be sited where there is the potential for an active fault to cause rupture of the ground surface at the building."

The corresponding decision table shown in appendix A2 is shown in table 2.1, below:

Table 2.1 Display of Typical Decision Table

DATUM: Category D site limitation requirement

SECTION: 1.4.4 LABEL: CDSLR NUMBER: 1493

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Building stage		1230
Proposed work on existing building		1240
Seismic performance category before proposed work	YSPCB	1264
Potential exists for ground rupture from active fault		1496

	DECISION TABLE	1	2	3	4	E
1	Seismic performance category = D	N	Y	Y	Y	
2	Building stage = new	.	Y	-	N	
3	Proposed work on existing building = change of use <u>and</u> Seismic performance category before proposed work ≠ D	.	-	Y	N	
4	Potential exists for ground rupture from active fault = true	.	N	N	.	
	* * * * * * * * * *					
1	CDSLR = satisfied	X	X	X	X	
2	CDSLR = violated					X

Note:
- \- means <u>false</u> predetermined by another condition value in that rule
- . means either true or false is acceptable for the condition in that rule (usually referred to as <u>immaterial</u>).
- E means ELSE; this rule applies if none of the preceding rules apply
- \+ is also used in many decision tables; it means <u>true</u> predetermined by another condition value in that rule

2.3.2 Functions

Not all provisions depend upon conditions for their evaluation, although the majority in this study do. A provision which does not require the evaluation of any conditions (i.e., a "degenerate" decision table with only one rule and one action) is called a function. The partial provision for C_s introduced earlier is an example of a function; however, the full provision for C_s requires a decision table because the use of formula 4-2 is conditional. That decision table is shown in appendix A2, the data number is 4210.

Sometimes the Provisions specify a set of ingredients for a datum, but do not specify precisely how they are to be used in evaluation. The following excerpt from section 4.2 of the Provisions illustrates this type of relation:

> "4.2.2 PERIOD DETERMINATION
>
> The fundamental period of the building, T, (used) in Formula 4-2 may be determined based on the properties of the seismic resisting system in the direction being analyzed and the use of established methods of mechanics assuming the base of the building to be fixed . . ."

In this instance the datum "Calculated fundamental period" (number 4250) is said to be an indefinite function of the following ingredients:

4251	Period calculated using established methods
4252	Properties of SRS in direction being analyzed
4253	Building assumed to be fixed at base

There are also instances in which the Provisions seem to indicate a precedential relation between data items, but the analyst must make some assumption as to just what the relation is. Sometimes the assumption is so strongly implied that the ingredience relation can be treated just as the indefinite function described previously. However, the implication may be weak or nonexistent. Such instances have been called assumed functions in this study. Two examples illustrate the typical characteristics of such provisions.

The first is a sentence from section 7.2.1 of the Provisions:

> "The strength of foundation components shall not be less than that required for forces acting without seismic forces."

It was assumed that the forces acting without seismic forces should include all other forces that are included in the Provisions. Thus the data item, "Required strength without seismic load" (number 7220) is said to be an assumed function of the ingredients:

3707	YQD	Dead load effect
3708	YQL	Live load effect
3710	YQS	Snow load effect

The second example is from section 1.2 of the Provisions:

> "These provisions establish requirements for strengthening of existing buildings where alterations reducing the seismic force resistance are made. . . "

Among the data items identified in this provision are: "Seismic force resistance before proposed activity" and "Seismic force resistance after proposed activity," (numbers 1250 and 1260). It was assumed that these resistances should be determined according to the provisions of the remaining chapters, however, no data items could be identified as specific ingredients. In this instance the data list shows a data label for both, indicating that they must be derived data items, but no ingredients are shown.

The data labels are coded to distinguish decision tables, functions, indefinite functions, and assumed functions as follows:

1) all labels beginning with the letter "X" indicate definite functions,
2) all labels beginning with "Y" indicate indefinite functions,
3) all labels beginning with "Z" indicate assumed functions,
4) all other labels indicate decision tables.

It is important to note that actions of decision tables are functions, and that some actions are indefinite or assumed. No coding exists for decision tables with such actions, but the assumptions made in preparing each decision table are noted below the decision table.

2.3.3 Decision Trees

Decision tables may be analyzed to provide some explicit checks on clarity and completeness by verifying that no two rules could be matched simultaneously and that all possible rules are included. The easiest and most reliable way to do this is by decomposing the decision table into a decision tree. The analysis is easily performed with a computer. [8], [9] Figure 2.1 shows the decision tree taken from the decision table shown earlier for the complete "Category D site limitation requirement" in two formats. First is a conventional graphic representation of a tree with tests of boolean conditions at all branching nodes and the associated rules at each terminal node. Second is a computer generated representation of the same tree with "Ci" indicating a test of the ith condition, "Rj" indicating the jth rule, "+" a branch following a true result for the previous condition, "-" a branch following a false result for the previous condition, and "ELSE" indicating a rule not found in the original table.

None of the decision tables shown in appendix A2 have rules that may be matched simultaneously. Such rules are either redundant (they have the same action) or contradictory (they have different actions) and always indicate ambiguity in the text or a fault in the construction of the decision table. The Provisions were interpreted so that all decision tables would be unambiguous. Comments included below the decision tables indicate these points for which the interpretation required to produce this result was not straightforward.

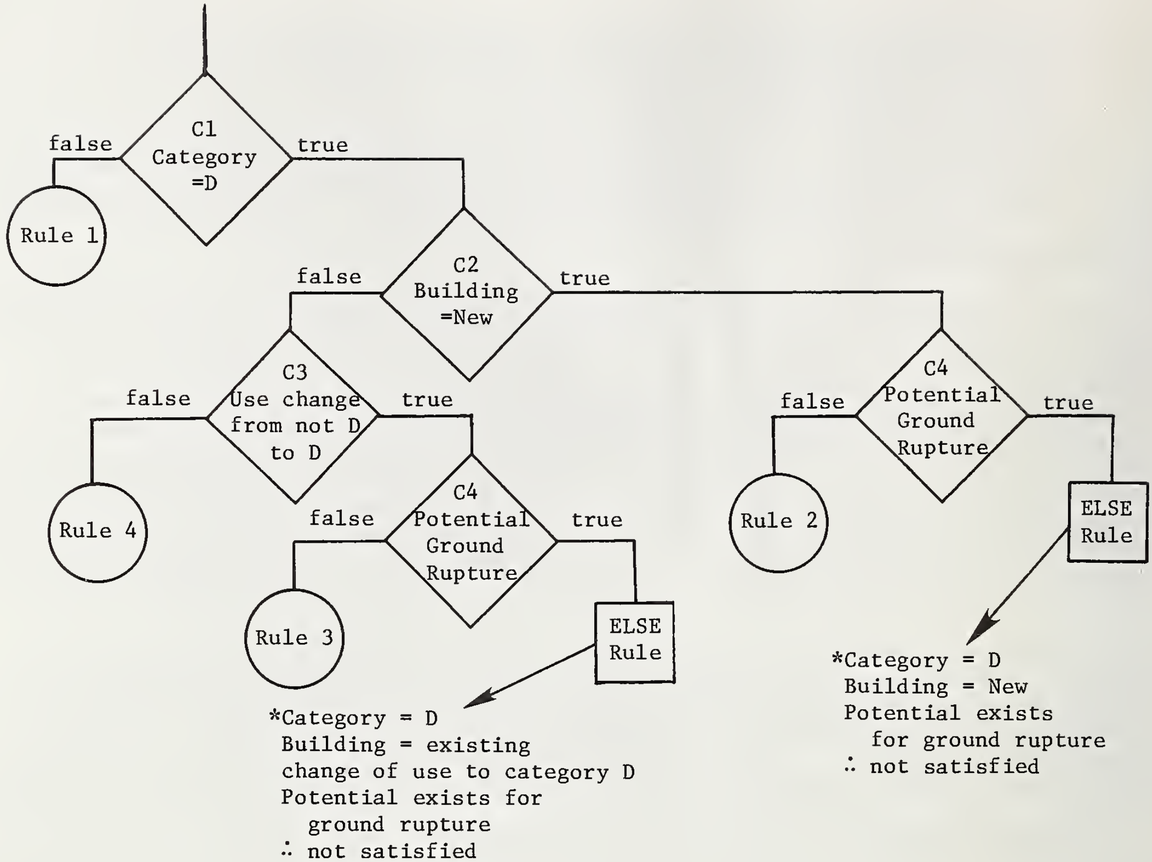
About three-fourths of the decision tables in appendix A2 are shown with an ELSE rule. For the overwhelming majority of these decision tables the ELSE rule clearly leads to one of the actions. Usually that action is to mark a provision as "violated" (e.g., the decision table for "Category D site limitation requirement"). In some instances, however, the ELSE rule represents possibly important omissions in the Provisions; these instances are always discussed in the comments in appendix A2. Note that a single ELSE rule in a decision table may represent more than one ELSE rule in a decision tree (for example, see figure 2.1). Those tables shown without the rule labeled "E" are complete; no other possible combination of condition values exist.

2.4 Information Network

The individual provisions, and their corresponding decision tables and functions, are interrelated by the fact that the ingredients of any one provision may themselves be the outputs or results of other provisions. In appendix A2, the direct ingredients of each derived datum are shown above the decision table or function, as illustrated previously for the "Category D site limitation requirement."

To provide a more global view, the information network represents graphically the flow of information through the decision points in a set of provisions. The entire network can be assembled once each of the nodes and their direct ingredients are known. The assembly is easily performed with a computer program. [7], [8] The complete information network can then be used for three general operations:

1) to determine the dependents of a data item
2) to trace the global ingredience of a particular node (that is, all the nodes that have any possible influence on the node in question) and
3) to trace the global dependence of a particular node, (that is, all the nodes that might be influenced by the node in question).



a) Conventional Format

```
C1 + + C2 + + C4 + ELSE
-      -      -
-      -      - - - R2
-      -
-      - - - C3 + + C4 + ELSE
-             -      -
-             -      - - - R3
-             -
-             - - - R4
-
- - - R1
```

b) Computer Representation

Figure 2.1 Decision Trees

These operations are useful to those actually designing with a set of provisions (particularly when using automatic data processing equipment) because they provide all the necessary cross-references. They are also useful in the development of a set of provisions; the global ingredience, in particular, can be used to guide the ordering and written expression of provisions. The network can also be used to detect loops in the precedence (corresponding to circular definitions) and detached (unreferenced) sets of provisions. Examination of how a datum is used in the evaluation of its dependents is a good check on consistency.

A graphical representation of a segment of the information network for sections 3.4 and 3.5 of the Provisions is shown in figure 2.2. These sections contain the provisions for the required level of seismic load analysis. For larger networks, it is more compact and convenient to display the information network in tabular form, using indentations to represent the levels of the nodes, i.e., their "distance" from the top node along the path through the decision points. This representation requires the use of a spanning tree of the network. The spanning tree is constructed by omitting from the graph all but one of the dependence branches originating from any one node. The omitted branches become cross-references to ingredients previously encountered along the spanning tree. The spanning tree and the tabular representation of the same segment of the Provisions, in the format used in appendix A3, are also shown in figure 2.3. The conventions used in the tabular format are as follows:

1) a minus sign before a datum number means that the datum has been defined previously;
2) an asterisk after a datum number means that the entire subnetwork of ingredients of the datum has been defined previously, and is not repeated. To locate the subnetwork, simply proceed up the network at the same level to find the original occurrence of the node and the complete subnetwork of ingredients.

The correspondence between the dashed branches in figure 2.3 a) and the - and * symbols in the tabular format of figure 2.3 b) should be noted.

The levels calculated for use in printing the global ingredience network represent the number of steps along the longest path from that node to the level of the terminal node and is called output level. It is also possible to print the global dependence network using the similar input level. Both these levels and the dependents of each data item are shown in the data list of appendix A1. In addition, a quantity called float is shown. Float for any node is the difference between the longest path from input to output through that node (the sum of the two levels) and the longest such path in the entire network. It is simply a measure of the depth of the chain of precedence involving a given node as contrasted to the depth of the entire network.

Appendix A3 contains one network for each of the chapters of the Provisions studied except chapter 2. Chapter 2 of the Provisions contains no precedence, only input data items. The appendix also contains a merged network for all of the chapters. To conserve space, this total network shows only derived data items. In the individual chapter networks, references to ingredients in other chapters are treated as input data items, even if they are really derived data items in their own chapter. These references are marked as follows:

1) the first character of the data description is "%", and
2) if the datum is actually a derived datum, the second character of the data description is "*".

2.5 Outline/Classified Index

The classification of provisions in a systematic fashion offers considerable insight into the overall organization of provisions for better access and retrieval. Appendix A4 contains a classification of all the decision tables and definite functions identified in this study (that is, all derived data items except indefinite and assumed functions). These provisions are treated in two groups in the appendix: requirements and other derived data items (herein referred to as determinations). Requirements are those data items which may take the value of "satisfied" or "violated". They may be identified by examining the action stub of the decision table (or generally speaking, by the title of the datum, since nearly all requirements include the word requirement in the data description). Earlier in this chapter, two provisions were introduced as examples of data items, one for the

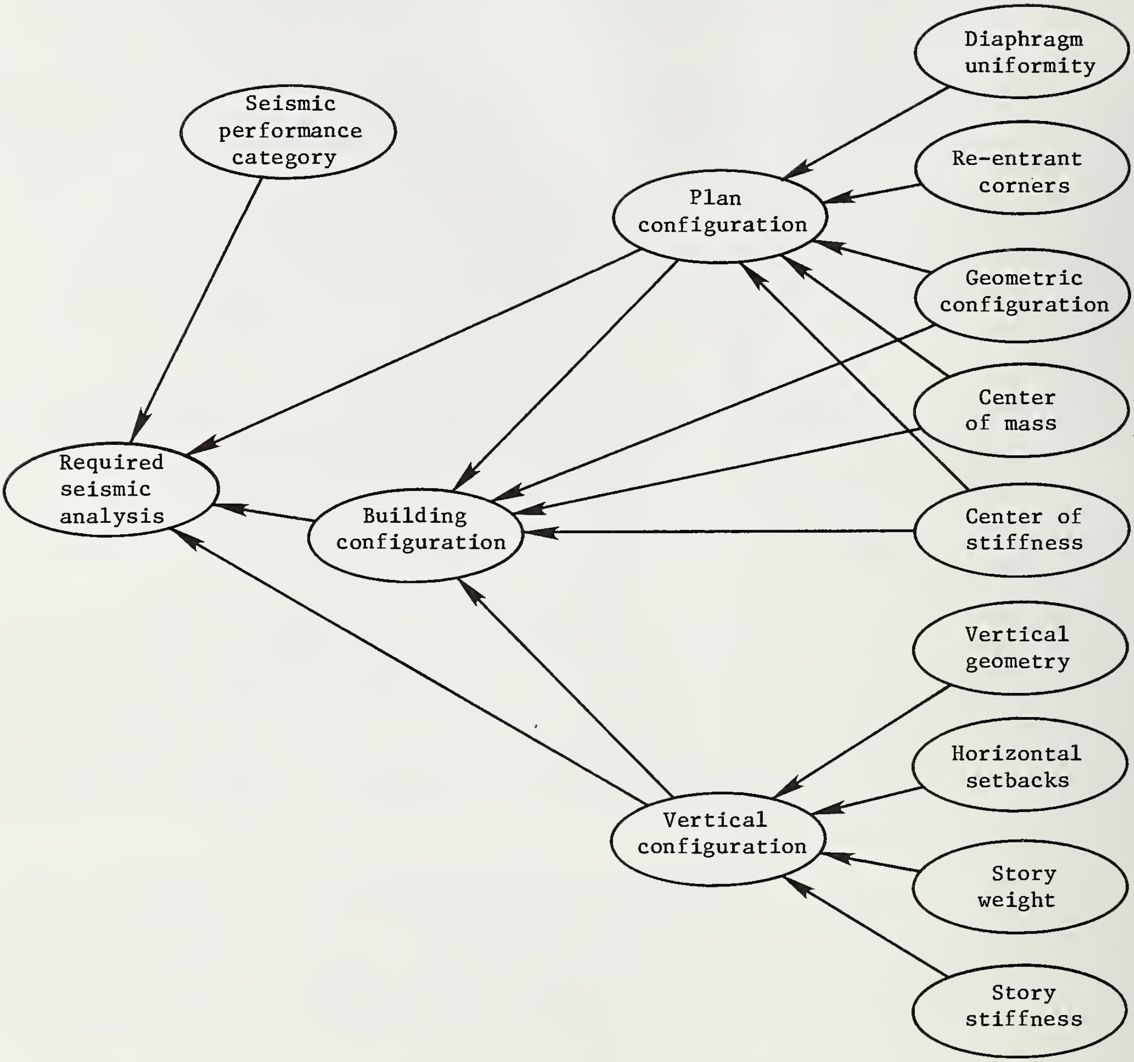


Figure 2.2 Conventional Precedence Network

a) Conventional network with dashed branches omitted to form spanning tree

```
3530  Required seismic load analysis
:....1490  Seismic performance category
:....3405  Building configuration
:    :....3410  Plan Configuration
:    :    :....3445  Any diaphragm has significant changes in strength or stiffness
:    :    :....3435  Building has re-entrant corners with significant dimensions
:    :    :....3420  Geometric configuration of building
:    :    :....3425  Location of center of mass
:    :    :....3430  Location of center of stiffness
:    :....3415  Vertical configuration
:    :    :....3450  Geometric configuration of building with respect to vertical axis
:    :    :....3455  Building has horizontal setbacks with significant dimensions
:    :    :....4340  Total weight at story X
:    :    :....3465  Story stiffness
:    :........-3420  Geometric configuration of building
:    :........-3425  Location of center of mass
:    :........-3430  Location of center of stiffness
:........-3410* Plan configuration
:........-3415* Vertical configuration
```

b) Computer representation (datum numbers correspond to appendix A)

Figure 2.3 Information Network

seismic coefficient, C_S, and a second for a limitation on the sites for seismic performance category D buildings. The provision for the "Category D site limitation" is a requirement, whereas the provision for C_s is not a requirement, but determines a numerical value, C_s, the seismic coefficient.

Requirements are classified according to a model in which the subject of an equivalent "basic" requirement names a physical entity or a process and the predicate specifies a quality required of that subject. [11, 12] Thus the following provision from section 1.6.4 of the Provisions (datum 1655), illustrates a requirement dealing with a process:

> "Each Special Inspector shall furnish to the Regulatory Agency, the owner, the persons preparing the Quality Assurance Plan, and the contractor copies of regular weekly progress reports of his observations noting thereon any uncorrected deficiencies and corrections of previously reported deficiencies."

It can be classified by the process implied by "Special Inspector" and "observations", which could be called INSPECTION, and by the quality implied by "regular weekly progress reports," which could be called DOCUMENTATION. Similarly, the following (partial) provision from section 3.1 of the Provisions (part of datum 3120), illustrates a requirement dealing with a physical entity:

> ". . . and the connections shall develop the strength of the connected members or the forces indicated above."

It can be classified by the named object, CONNECTION, and the quality implied by the phrase, "develop the strength . . . or the forces," which could be called STRENGTH REQUIRED. All of the processes referred to in the requirements of the Provisions are related to buildings or parts of buildings, and thus each requirement that has a process as its subject can also be classified by a physical entity.

The performance approach to design makes another basic category useful for classification of requirements, that of performance limit states. A limit state can be defined briefly as a mode (or degree) of behavior that renders a structure incapable of providing one or more of its intended performance attributes. For various reasons not all requirements in the Provisions can be related to a limit state. One which can be so related quite easily is the aforementioned "Category D site limitation" (datum 1493); the limit state could be called GROUND RUPTURE. Another example is the following provision from section 3.8 of the Provisions (datum 3810),

> "All portions of a building shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact under total deflection, δ_x (as determined in Sec. 4.6.1), or modified deflection δ_x (as determined in Sec. 6.2.3), corresponding to the seismic design forces."

which can be classified by a limit state called COLLISION.

There is no model for the classification of determinations comparable to the simple model for classifying requirements. [12] Such provisions often may be appropriately classed by the classifiers used for the requirements for which they serve as ingredients (for example, by the physical entity or process to which the value pertains, or by the required quality or limit state for which the value may be used as a measure). The technique adopted in this study was to class each determination according to the process in which it would normally be derived and used and by any other particularly meaningful classifiers. In addition, another category for the type of derived measures was added to the classification. Thus the seismic coefficient, C_s, discussed previously, can be classified by the process EQUIVALENT LATERAL FORCE ANALYSIS and by a type of derived measure, which could be called a STRUCTURAL RESPONSE MEASURE.

The models described [11, 12] for classifying provisions have been followed to assure that the classifiers selected for that provision are relevant to it. The vocabulary of words used for the classification has been tailored to be meaningful to the anticipated audience for the Provisions. However, use of classifiers that are relevant and meaningful does not assure a useful classification without further considerations. In this study the classical logical principles of classification have been followed wherever possible. That is, where a set of classifiers exists at one level, a provision must be classed by one and only one of the classifiers in the set. These principles have also been referred to as collective exhaustion and mutual exclusion. [3] Other considerations that have been followed in this study are that multi-level classifications be graded so that the scope varies regularly from one level to another, that the order of classifiers in a set at one level be in a progression that is relevant and meaningful, and that the breadth and depth of the classification should not be so large as to be unwieldy in a conceptual sense. [12]

Many of these considerations are illustrated in the three level classification of the building process of design:

I	II	III
Stages of Design Activity	Stages of Analysis	Methods of Seismic Load Analysis
Site/soil Investigation	Seismic Load Analysis	Equivalent Lateral Force
Conceptual Design	Member Force Analysis	Modal
Analysis		Soil Structure Interaction
Detailed Design		

Each of the levels is collectively exhaustive in the following sense: any provision classed as design can be classed as at least one of four stages in level I; any provision classed as analysis can be classed as at least one of the two stages in level II; and similarly for level III. The levels are mutually exclusive in that no provision is classed by more than one classifier at any level. Should more than one classifier from a set be appropriate for the provision, the provision is classed by the "parent" of the classifiers. Thus a provision that pertains to both the equivalent lateral force and the modal methods of analysis is classed as SEISMIC LOAD ANALYSIS. The combination of the logical principles and the property of a uniform gradation of scope across the levels means that a multi-level classification has a tree-like structure, which can be conveniently represented as an indented outline thus:

- Design
  - Site/soil Investigation
  - Conceptual Design
  - Analysis
    - Seismic Load Analysis
      - Equivalent Lateral Force
      - Modal
      - Soil structure Interaction
    - Member Force Analysis
  - Detailed Design

The progressive ordering of classifiers within a level is demonstrated in the first two levels by a correlation with time. That is, the second activity normally follows the first, and so on. At the third level, the three methods of analysis are ordered, roughly speaking, according to increasing sophistication of the mathematical modeling.

The preceding example does not illustrate any consideration of unwieldy breadth or depth because it is conveniently small. The classification of the Provisions according to physical entity contained in appendix A4 is much larger and illustrates the use of another practice to control the breadth and depth. The full tree-like structure of the physical entity classification is not developed. Rather, many tree-like structures of a manageable size are shown, with indications of how they might be combined into a large tree. This concept can be illustrated by considering the previously described three level, tree-like classification for design to be three separate trees in which the "root" of each tree might be the title of the level given previously. These roots are then identified as "transparent" classifiers, which means that they serve only to indicate that their tree would normally be attached to some other classifier and that they would not normally be used by themselves for classing a provision. The classifiers to which the transparent classifier might be attached may be discerned from the name of the transparent classifier. Thus the transparent classifier METHODS OF SEISMIC LOAD ANALYSIS would be attached to the classifier SEISMIC LOAD ANALYSIS. The transparent classifiers in appendix A4 frequently may be attached to more than one other classifier.

The construction of a classification system and the subsequent classing of requirements and determinations is not a once-through operation. Several cycles of classification, analysis, and modification are required. The elementary analytical checks used in this study are concerned with logical principles, primarily completeness. First, each requirement must be classed as a physical entity and as a required quality to satisfy the basic model. These two categories are said to be exhaustive for the requirements. Also, for this study it is appropriate that each determination be classed as a building process and as a type of derived measure. Second, each classifier that is at an extreme level from a root (that is, no classifiers exist which subdivide its scope) must be used to classify at least one provision.

This "scope" analysis can be carried to another level of detail, that of testing the existence of a requirement for every potential combination of physical entity and required quality classifiers. This type of analysis is particularly appropriate for the a priori analysis of a new set of provisions, but was not rigorously performed in this post-facto analysis of the Provisions. An a priori analysis would not normally include as large a set of classifiers as those contained in appendix A4.

Although the classification of the Provisions is quite useful for an analysis of scope at various levels, it is probably more useful as an aid in accessing particular provisions. Two principal types of aids for access are contained in appendix A4: index and outline. An index is simply an alphabetical ordering of the classifiers with the provisions listed for each classifier. Each provision appears in the index beneath each of the classifiers it is associated with (as many as ten times for some provisions, at least two times for all provisions). An outline is a unique ordering of the provisions in which a provision generally appears only once. Note that the number of levels of indentation in the outlines of appendix A4 could be reduced considerably should one desire to do so, because each heading in those outlines is limited to a single classifier whereas headings in conventional outlines frequently contain the equivalent of two or more classifiers. An example of such condensation is included in appendix A4 as table A4.18.

An index is used in a different fashion than an outline. It can be considered a "multiple point of access" tool for locating a provision, whereas an outline is a "single point" tool. For this reason, some of the previously described rules for classification may be deliberately ignored for the purpose of producing a more general index. For example, the provision requiring weekly reports by the special inspector, which was classed as INSPECTION and DOCUMENTATION, could also be classed as QUALITY ASSURANCE for the purpose of indexing even though QUALITY ASSURANCE would be implied in a strict sense because it is the "parent" of INSPECTION. Likewise a provision applying to both the equivalent lateral force and the modal methods of analysis would strictly be classed as SEISMIC LOAD ANALYSIS, but it could also be classed as both EQUIVALENT LATERAL FORCE and MODAL for the purpose of indexing. Thus the basic classification of a provision is frequently expanded for use in indexing.

In contrast, the basic classification is frequently reduced for the purpose of outlining. In the extreme, all provisions can be outlined according to a single tree of classifiers if that tree is exhaustive over the provisions. In this study no tree is exhaustive in this sense. However, several trees are exhaustive when considering either requirements or determinations alone, and outlines so generated are contained in appendix A4. In the more general case, outlines are generated by appending trees of classifiers from different basic categories on to one another. As an illustration, consider the provisions of section 1.6 of the Provisions. There are 13 requirements and five determinations, all of which are classified by the process QUALITY ASSURANCE, or one of its subactivities PLANNING, INSPECTION, and TESTING, and by the required quality SOCIAL QUALITY (a general classifier that is used to separate those required qualities pertaining to processes from those pertaining to physical entities, which are grouped under the general classifier PHYSICAL QUALITIES) or one of the appropriate types of social qualities, EXISTENCE OF PROCESS, TECHNIQUE, or DOCUMENTATION.

The two small tress of classifiers from the different categories are as follows:

QUALITY ASSURANCE	SOCIAL QUALITY
Planning	Existence of Process
Inspection	Method
Testing	Technique
	Principles and Assumptions
	Documentation

There are two ways of combining these two trees into outlines, and the results are shown in tables 2.2 and 2.3 (the negative datum number is used to signify that the provision is a determination, not a requirement). The string of classifiers at the top of each outline--BUILDING, PROPOSED (NEW), REQUIRED QUALITIES, BUILDING PROCESSES, QUALITY ASSURANCE, and SOCIAL QUALITIES--have no bearing on the arrangement of classifiers. They serve only to place this set of provisions in the overall context of the Provisions, and they might be considered the family tree of this set of provisions. The difference between the two outlines is due entirely to the order of appending the two trees into one. A comparison of the two outlines shows that the second is somewhat redundant in that four of the provisions are outlined three times each. This is one simple measure of quality, and on that basis the first outline is preferred over the second. Other measures of quality exist [12], but are not of great consequence in this study.

No strongly preferred arrangement for the Provisions is presented in appendix A4, because it is recognized that different arrangements suit particular individuals or particular purposes. In addition, a more thorough study of arrangement would be desirable, but such a study should include refinements in the decision tables of appendix A2. Some of those decision tables include more than one basic requirement, and this makes classification for the purpose of rearrangement difficult. This problem was recognized late in the conduct of this study and is the proper subject for a future study.

TABLE 2.2 - OUTLINE OF QUALITY ASSURANCE PROVISIONS, REQUIRED QUALITIES

OUTLINE OF PROVISIONS

CLASSIFIERS		PROVISIONS
BUILDING		
PROPOSED (NEW)		
REQUIRED QUALITIES		
BUILDING PROCESSES		
QUALITY ASSURANCE		
SOCIAL QUALITIES	1601	QUALITY ASSURANCE REQUIREMENT
	1625	QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
EXISTENCE OF PROCESS		
PLANNING (QA)	-1602	QUALITY ASSURANCE PLAN REQUIRED
INSPECTION		
TESTING	-1637	MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
METHOD		
TECHNIQUE	1651	QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
PLANNING (QA)	1605	DETAILS OF QUALITY ASSURANCE PLAN
INSPECTION	-1628	MINIMUM SPECIAL INSPECTION
TESTING	-1635	MINIMUM SPECIAL TESTING
	-1641	MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
	1644	MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
DOCUMENTATION	1640	MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
	1654	QUALITY ASSURANCE REPORTING REQUIREMENT
	1668	CONTRACTORS FINAL REPORT REQUIREMENT
PLANNING (QA)	1604	QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
	1613	STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
INSPECTION	1655	SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
	1662	SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
TESTING	1674	MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT

ALL PROVISIONS WERE OUTLINED

NO PROVISIONS WERE OUTLINED MORE THAN ONCE

TABLE 2.3 - OUTLINE OF QUALITY ASSURANCE PROVISIONS, QA ACTIVITIES FIRS

```
OUTLINE OF PROVISIONS

CLASSIFIERS                                                PROVISIONS


 BUILDING
   PROPOSED (NEW)
     REQUIRED QUALITIES
       BUILDING PROCESSES
         QUALITY ASSURANCE
           SOCIAL QUALITIES .................................  1601  QUALITY ASSURANCE REQUIREMENT
                                                               1625  QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
             PLANNING (QA)
               EXISTENCE OF PROCESS ......................... -1602  QUALITY ASSURANCE PLAN REQUIRED
               METHOD
                 TECENIQUE ..................................  1605  DETAILS OF QUALITY ASSURANCE PLAN
                                                               1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
               DOCUMENTATION ................................  1604  QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
                                                               1613  STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
                                                               1640  MECEANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
                                                               1654  QUALITY ASSURANCE REPORTING REQUIREMENT
                                                               1668  CONTRACTORS FINAL REPORT REQUIREMENT
             INSPECTION
               EXISTENCE OF PROCESS
               METHOD
                 TECHNIQUE .................................. -1628  MINIMUM SPECIAL INSPECTION
                                                               1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
               DOCUMENTATION ................................  1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
                                                               1654  QUALITY ASSURANCE REPORTING REQUIREMENT
                                                               1655  SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
                                                               1662  SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
                                                               1668  CONTRACTORS FINAL REPORT REQUIREMENT
             TESTING
               EXISTENCE OF PROCESS ......................... -1637  MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
               METHOD
                 TECENIQUE .................................. -1635  MINIMUM SPECIAL TESTING
                                                              -1641  MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
                                                               1644  MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
                                                               1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
               DOCUMENTATION ................................  1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
                                                               1654  QUALITY ASSURANCE REPORTING REQUIREMENT
                                                               1668  CONTRACTORS FINAL REPORT REQUIREMENT
                                                               1674  MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT
ALL PROVISIONS WERE OUTLINED


THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(3)  1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
(3)  1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
(3)  1654  QUALITY ASSURANCE REPORTING REQUIREMENT
(3)  1668  CONTRACTORS FINAL REPORT REQUIREMENT
```

CHAPTER 3

SIGNIFICANT FINDINGS

This chapter presents a digest of the results of the analysis of the Provisions along with the observations arising from the study. As much as is possible, these findings are presented in a way not requiring knowledge of the analytical techniques used in this study by the reader. None-the-less, the reader is urged to read chapter 2 and study the detailed data and comments given in appendix A for a more complete understanding. Familiarity with Chapter 2 is needed to appreciate the references made to specific locations in appendix A for more complete explanations.

It should be noted that this chapter concentrates on flaws perceived in the Provisions. The intent is to provide constructive criticism for the improvement of the provisions. The omission from this chapter of any discussion of what is good within the Provisions should not be interpreted to mean that the problems overwhelm the Provisions. Indeed the contrary is true; the authors consider the Provisions to be a most significant advance in the field of earthquake resistant design.

This chapter is organized according to the four qualities of provisions that are addressed by the analytical techniques used: clarity, completeness, consistency, and correctness. These four qualities provide convenient categories for discussion of problems with technical provisions, without regard to the particular analytical tool employed. One additional section is added at the end of the chapter to discuss the relation of the Provisions to existing codes and standards for structural design.

3.1 Clarity

There are several points within the Provisions that are not clear. These ambiguities occur at widely different levels of detail, from the specific wording of sentences to the implications of format and arrangement. The problems discussed in this section were detected in a generally objective fashion by the analytical techniques used in this study.

3.1.1 Circular Definition of the Response Modification Factor

Table 3-B defines the values of R, the response modification factor, and C_d, the defection amplification factor. These factors are then used in chapters 4 and 5 to evaluate the seismic force and its effects. A problem occurs, however, because table 3-B indicates that the value of R and C_d for buildings using moment frames to resist seismic forces depends on the strength of the frames as compared to the seismic forces (i.e., "Seismic force resistance is provided by Ordinary or Special Moment Frames capable of resisting the total prescribed forces"). The words ". . . capable of resisting . . ." can be interpreted to mean that one should "provide" the resistance in the moment frame "before" one uses the value of R in the seismic load analysis. While many users of the Provisions will avoid this problem (some consciously, others unconsciously), it is likely that some users will be confused by it, because it effectively creates two complete loops (circular definitions). The first involves chapters 3 and 4 thus: R depends on the total prescribed forces, which depend on the seismic force, which, in turn, depends on R. The second involves chapters 3, 4, and 11, because the strength of certain concrete components is given by chapter 11 in terms of the level of seismic force. That loop goes thus: R depends on the strength of the moment frame, which depends on the seismic force, which, in turn, depends on R.

A likely solution to this problem can be constructed by removing the strength requirements from table 3-B and placing them with other similar strength requirements in section 3.7. This has the effect of making the strength requirement a function of the values used for R and C_d in the analysis of the seismic forces and effects. A more complete discussion of this problem is found in the comments on the complete network, near the end of appendix A3.

3.1.2 Impact of Chapter 13, Systematic Abatement of Seismic Hazards in Existing Buildings

Section 1.3.4 makes the adoption of chapter 13 optional, and the preamble of chapter 13 provides the wording for amending chapter 1 if chapter 13 is adopted. There are, however, two questions of cross-reference between chapters 1 and 13 that remain ambiguous:

1) Sections 1.3.2, 1.3.3, and 8.1 all refer to "modifications permitted by Section 13.3." It is not clear whether these references are contingent on the adoption of chapter 13 or not; if the latter is intended, then where would the modifications be given if chapter 13 is not adopted?

2) It is not clear what modifications are intended to be covered in the above three references to section 13.3. That section essentially defines a required new earthquake capacity ratio for ". . . systems and components classified as potential seismic hazards as a result of the evaluation made in accordance with section 13.2", and a maximum time permitted for abatement.

Concerning the first, two plausible interpretations would be that: i) in case of alteration, repair, or change of use of an existing building, a complete evaluation according to section 13.2 would have to be made, and all nonconforming systems and components upgraded; or ii) that only the systems or components involved in the alteration or repair would have to conform. The implicit reference to the time permitted, which is specified in section 13.3.2, appears inappropriate when applied to alteration, repair, or change of use. Refer to the decision tables for data items 1380, 1390, and 8001 for more detail concerning the first item and to the decision table for datum 13301 for the second item.

3.1.3 Application of the Quality Assurance Provisions

The applicability of section 1.6 is not clearly stated. Section 1.6.1 does make it clear when a quality assurance plan is required. It must be assumed by the reader that the intent is for all of section 1.6 to be applicable only if a quality assurance plan is required. This small ambiguity becomes more significant because there are some portions of sections 1.6.3 and 1.6.5 that are apparently applicable even when a quality assurance plan is not. Section 1.6.3(E) requires special testing and certification (section 1.6.5) of certain mechanical and electrical equipment, depending on how that equipment is classified in chapter 8 (i.e., "For . . . components requiring S or G performance ratings in chapter 8, each component manufacturer shall test . . . . He shall submit a certificate of compliance . . ."). Components that require S or G performance rating will exist in buildings for which no quality assurance plan is required, thus casting doubt on the applicability of the rest of section 1.6. If the intent is correctly interpreted here, then the further ambiguity arises as to whether a special inspector should be hired and, if not, who fills the role of the special inspector in examining the test certification. The decision tables for data items 1601, 1625, 1637, 1640, and 1644 contain more information concerning these problems.

3.1.4 Application to Seismic Performance Category A

There is some ambiguity as to just what provisions should apply to a building belonging to seismic performance category A. The ambiguity stems from the fact that all buildings are grouped into four categories with regard to seismic performance category (i.e., A, B, C, and D), whereas the provisions are grouped into five categories (A, B, C, D and undifferentiated). It is not clear that all the undifferentiated provisions apply to category A buildings, and in fact, it is directly implied that some of them do not. For example, section 3.6.1 requires that category A buildings " . . . need only comply with the minimum seismic force requirements of Sec. 3.7.5 and 3.7.6, and to the requirements of Sec. 3.7.7 and 7.3." This implies rather strongly that sections 3.7.1 through 3.7.4 and 3.7.8 through 3.7.11 do not apply to category A, even though they are not specifically identified as pertaining to category B or higher. The full list of provisions with questionable applicability to category A buildings is contained in table A4.19 of appendix A4. The question of application of many of the provisions is a slight matter, involving little additional design or construction costs. The question is significant for section 3.8, because the deformation criteria would require an otherwise unnecessary seismic force analysis, and chapter 8, which includes many requirements. Because seismic performance category A applies to a large number of buildings, and because many of those buildings are in regions of the country where seismic resistant design is not a familiar art, it is particularly important that all the provisions pertaining to category A be clearly identified and that a clear path exist through the entire Provisions for satisfying those provisions.

A related problem associated with category A is the strength criterion to be used. Sections 3.7.5 through 3.7.7 specify minimum design forces for ties and anchorages, while Section 3.6.1 references the material in chapters 9 through 12 for the determination of component strengths. These chapters reflect the design basis of the Provisions, namely, that the deflection of the structure under the prescribed forces approaches "a point of significant yield" (Ref. [1], page 335). It is not clear from either the text or the commentary of the Provisions whether it is intended that category A building components resist the specified minimum design forces be proportioned on the basis of conventional strength criteria (e.g., working stress values for steel) or the modified strength criteria applicable to categories B through D. It could be assumed that the former is intended, although it is not stated. The decision table for datum 3120 is the point from which this problem can be tracked.

3.1.5 Duplicate Naming of the Same Item

There are several pairs of words or phrases used in the Provisions that probably mean the same thing, yet simply because different words are used, confusion is introduced. A few examples of this follow (underlining added for emphasis here):

1) "seismic force resistance" in section 1.2 and " lateral force resistance" in section 1.3.2;
2) "design earthquake forces" and "lateral forces," both in section 6.1, and "seismic force" in section 6.2.2;
3) "story" and "level" throughout the Provisions; and
4) "web reinforcement" in section 11.6.1 and "lateral reinforcement" in section 11.7.1(B), both of which apply to flexural members.

In some instances it appears the reason for the difference is simply stylistic variation, in other instances there may be a substantive difference that is unclear. In still other instances the difference may be due to an attempt to maintain consistency with an external reference document that suffers from the problem itself (item 4) is probably such an instance). Stylistic variation, even in the simple case of "earthquake" and "seismic", has no place in a document to be used as a standard or a code. Similar terms should be avoided unless it is made clear precisely what they mean. There is a general pattern to the use of "earthquake motions" and "seismic forces" in the Provisions, but since it is not explained that the difference is significant nor is it followed completely consistently, some reader may well be confused.

3.1.6 Functional Requirement for Seismic Hazard Exposure Group III

Sections 1.4.2(A) and 1.4.2(E) are quoted here, with underlining added for emphasis:

"(A) GROUP III. Seismic Hazard Exposure Group III shall be buildings having essential facilities which are necessary for post-earthquake recovery. Essential facilities, and designated systems contain therein, shall have the capacity to function during and immediately after an earthquake. Essential facilities are those which have been so designated by the Cognizant Jurisdiction. Access to essential facilities shall conform to the requirements of Sec. 1.4.2(E).

(E) PROTECTED ACCESS. Buildings assigned to seismic Hazard Exposure Group III shall be accessible during and after an earthquake . . ."

Note the similarity between the first underlined sentence and the first sentence of subsection (E). It can be interpreted that both are requirements for the design of Group III buildings. Yet the first is stated only within the provisions defining what a Group III building is while the second stands alone with a heading to flag it conspicuously. If it is intended that Group III buildings be designed to remain functional during an earthquake, then such an important requirement should be highlighted. If that is not the intent, the definition should reflect that the sentence is not a design requirement.

3.2 Completeness

The analytical techniques used in this study are particularly well suited to examining the completeness of individual provisions, of cross-references, and of sets of provisions. This section highlights problems found in the first two categories. Analysis of the scope of a set of provisions is not particularly meaningful in a post-facto study, so it is not reported here (such analysis is quite useful during the actual development of provisions).

3.2.1 Potentially Important Omissions in Individual Provisions

All of the instances of incompleteness cited in this section were detected using a decision tree analysis, as described in chapter 2. The complete decision tree and decision table for each of these instances is shown in appendix A2. The places where the Provisions appear to leave out important details are as follows:

1) Framing classes in table 3-B: no provision is made for buildings with the following seismic resisting systems:

   i) moment frames (unbraced frames) if some of the vertical load is supported on bearing walls;
   ii) moment frames that are made of materials other than steel or concrete;
   iii) shear walls or braced frames if the building is an inverted pendulum; and
   iv) shear walls other than the types listed in table 3-B.

   More detail on this issue can be found in the discussion of datum numbers 3303, 3330, and 3345 in appendix A2.

2) Capacity reduction factors (ϕ factors) for wood, steel and masonry: no provision is made for certain types of components and resistances as follows:

   i) shear stress in wood members;
   ii) plywood diaphragms with strength calculated according to the principles of mechanics where the species group of the framing members is I or II (note that this includes Douglas Fir and Southern Pine);
   iii) lateral resistance of nails in wood;
   iv) steel connections between beams and columns which do not develop the full strength of the member but do provide for adequate joint rotation through deformation of the connection materials;
   v) masonry components with tension stress that is neither parallel nor perpendicular to the bed joints;
   vi) masonry subject to a stress other than axial, flexural, or shear (e.g., torsion).

   More detail on these issues is given at datum numbers 9220 (wood), 10220 (steel), and 12220 (masonry) in appendix A2. Note that the chapter on concrete is the only chapter on materials that does not suffer this particular defect. The reference to the concrete reference document for capacity reduction factors in all other situations makes the Provisions complete by definition on this point.

3) Relation of "Conventional" and "Engineered" timber requirements: section 1.3.1 states that "One and two story wood frame dwellings not over 35 feet in height located in areas having a Seismicity Index of 3 or 4 in Table 1-B need only conform to the requirements for Conventional Light Timber Construction as set forth in Sec. 9.7." Chapter 9 provides other requirements for wood buildings, including section 9.8, "Engineered Timber Construction." Apparently it is not permissible for the wood frame houses meeting the definition of section 1.3.1 to violate section 9.7 even if they are designed to satisfy section 9.8. See datum 9001 in appendix A2 for a fuller discussion of the somewhat confusing applicability of section 9.7.

4) Amplification factor for the attachment of mechanical and electrical equipment: no provision is made for two support conditions:

i) a mounting system that is not classified as fixed, direct, or resilient; and
ii) a resilient mounting system with a restraint that is not elastic or seismic activated (note that chapter 2 defines a third type of restraint for resilient mounts, a fixed restraint.)

Datum 8315 in appendix A2 shows the complete decision table.

The impact of these omissions depends on the particular provision. For the classification of framing systems, it means that certain common types of buildings are not allowed, which is important enough to spell out specifically. For the capacity reduction factors, it probably means that designers will assume a value. Such omissions are likely spots for error and controversy in the application of the Provisions and their correction is strongly recommended.

3.2.2 Incomplete Cross-References

There are several instances in which cross-references are made or implied that are not complete enough to allow a reader to follow through. Three significant examples follow:

1) Section 3.4.1, which determines the plan configuration of a building contains the statement, "For purposes of determining diaphragm component forces and distribution of seismic forces to vertical components of the seismic reisting system, a building shall be classified as irregular when . . ." At no point in the Provisions is use made of plan configuration for either of the stated purposes. (Logical locations for such use might be sections 3.7.9 and 4.4.) The only use made of plan configuration is in section 3.5.3, and that is only by implication. Analytical verification of this type of textual cross-reference is made by determining the dependents of the datum in question from appendix A1, and then examining how that datum is used for the evaluation of those dependents by referring to appendix A2.

2) Sections 1.3.2, 1.3.3, and 8.1 make cross-references to, "the modifications permitted by Sec. 13.3," yet, as was discussed earlier in this chapter, some parts of section 13.3 do not appear to be applicable. The reference should be more specific.

3) Many locations refer to, "the seismic forces required by the provisions," (or the lateral forces . . ., or the earthquake forces . . ., or the resistance required, etc.). There are a great many provisions for seismic forces, and the cross-reference would be more useful if it were specific (e.g., to refer to the strength requirement of section 3.7).

3.3 Consistency

Examination of any set of provisions in the detail which was used in this study of the Provisions will generally raise questions about the consistency of various provisions with other provisions. This section presents the most significant observations pertaining to the consistency of the Provisions derived from the analysis.

3.3.1 Redundant Decision Points

Throughout the Provisions, the seismic performance category classification given in table 1-A is used as the primary decision point for defining discontinuous requirements on framing systems, materials, construction, etc. The seismic performance category depends on the seismicity index and the seismic hazard exposure group. The table is reproduced here for convenience:

TABLE 1-A

SEISMIC PERFORMANCE CATEGORY

Seismicity Index	Seismic Hazard Exposure Group III	II	I
4	D	C	C
3	C	C	B
2	B	B	B
1	A	A	A

In addition to this primary decision point, the Provisions contain the following three additional decision points dependent on different combinations of seismicity index and seismic hazard exposure group. Each such separate decision point is shown below in the format of Table 1-A, with a "y" denoting that the provision is required.

1) Section 1.6.1 (datum 1602), defining when a quality assurance plan is required:

Seismicity Index	Seismic Hazard Exposure Group III	II	I
4	y	y	
3	y		
2	y		
1			

2) Section 8.1 (datum 8100), defining buildings in which chapter 8 (the architectural, mechanical, and electrical provisions) is applicable:

Seismicity Index	Seismic Hazard Exposure Group III	II	I
4	y	y	y
3	y	y	y
2	y	y	
1	y		

3) Section 8.3.5 (datum 8372), defining when mechanical and electrical utility service interface shall be provided with shutoff devices:

Seismicity Index	Seismic Hazard Exposure Group III	II	I
4	y	y	
3	y	y	
2			
1			

Maintaining these separate classifications in the Provisions introduces a large number of redundant decision points and multiple groupings, e.g.:

1) Category B and C buildings with and without quality assurance plan requirements;
2) Category A and B buildings with and without anchorage of certain architectural, mechanical, and electrical components;
3) Category C buildings with and without utility shutoff devices.

It is recommended that in any revision of the Provisions an effort be made to convert all of the above classifications to the standard seismic performance categories wherever possible.

In addition there are a large number of decisions that depend on one of the two factors that combine to make the seismic performance category. These are listed according to the section of the Provisions and the datum number, where (SI) indicates dependence on the seismicity index and (SHEG) indicates dependence on the seismic hazard exposure group:

Section	Datum	Description
1.2	1210	dwellings excepted from all coverage (SI)
1.3.1	1345	wood dwellings excepted from general coverage (SI)
1.4.2	1469, 1472	functional and accessibility requirements (SHEG)
3.8	3860	allowable drift (SHEG)
6.2.1	6222, 6224, 6226	shear wave velocity and shear modulus of soils (SI - actually the table is presented in terms of the effective peak velocity-related acceleration, but using a finer subdivision of contours than the seismicity index)
8.1	8106, 8107	component performance levels (SHEG)
8.3.4	8363	certification and testing of mechanical and electrical equipment (SI)
11.2	11275	strength of anchor bolts in concrete (SI) (see footnote 2 on table 11-A)
13.1.1	13110	buildings requiring systematic hazard evaluation (SI)

It is recommended that these decision points be examined for the possibility of expressing them in terms of the seismic performance category.

The seismic performance category is not the only example of additional or redundant decision making imposed on a user of the Provisions. Height, both in terms of magnitude and number of stories, is used in at least 11 different provisions, mostly discriminating between 1, 2, and 3 story buildings, but 5 provisions discriminate on the magnitude. These can be tracked from the dependents listed for total height (datum 2227) and number of levels (2243) in appendix A1.

3.3.2 Inconsistent Limitations on Framing

Section 3.3.4 of the Provisions states the following requirement for the seismic resisting system of category C buildings:

> "Seismic resisting systems in buildings over 160 feet in height shall be one of the following:
>
> 1. Moment resisting frame system with Special Moment Frames
> 2. A Dual System
> 3. A system with structural steel or cast-in-place concrete braced frames or shear walls in which . . ."

This clearly would allow an "Ordinary Moment Frame" to be used as the seismic resisting system for buildings less than 160 feet tall. However, section 10.5.1 states the following requirement for steel components in Category C and D buildings:

> "Where a Moment Resisting Frame System is used as the seismic resisting system, it shall be composed of Special Moment Frames conforming to the requirements of Sec. 10.6.
>
> EXCEPTION: Moment frames in one- and two-story buildings assigned to seismic Performance Category C may be Ordinary Moment Frames."

This clearly does not allow "Ordinary Moment Frames" to be used as the seismic resisting system for many buildings less than 160 feet tall. Since section 11.5.2 contains a similar requirement for moment frames of reinforced concrete, and since steel and reinforced concrete are the only materials permitted for construction of Ordinary Moment Frames (according to table 3-B of the Provisions) the wording of section 3.3.4 is inconsistent and possibly misleading. The decision tables for these provisions are located in appendix A2 at datum numbers 3372, 10500, and 11556.

3.3.3 Potentially Cumbersome Arrangement

There are several instances in which the Provisions seem to jump from one subject to another. An example can be found in section 3.7, which seems to move between seismic force resistance requirements and general design and detailing requirements (e.g., 3.7.1 and 3.7.2 establish seismic force effects, 3.7.3 and 3.7.4 give general design considerations, 3.7.5 and 3.7.6 give both force effects and design/detail requirements, 3.7.7 deals with forces, 3.7.8 gives another general design requirement, 3.7.9 and 3.7.10 deal with both force effects and design/detail requirements, etc.). Chapter 3 as a whole provides another example; some portions establish parameters for later use in a seismic force analysis (e.g., section 3.2.2 and table 3-B), while other portions deal with the results of a seismic force analysis. Alternative orderings of chapters 3 through 6 are provided in tables A4.11 and A4.12 of appendix A4.

When compared with individual sections (e.g., sections 3.4 or 3.5) or whole chapters (e.g., chapter 6 or 7) that proceed directly through one subject, it can be seem that cumbersome arrangement may be a factor in making design provisions hard to use. Further insight on this issue can be found by examining the individual chapter information networks in appendix A3.

3.3.4 Treatment of Reference Standards for Materials

The treatment of reference standards in chapters 9 through 12 varies a great deal, reflecting, to a large extent, the quite varied states of the standards themselves for the respective materials. All four materials' chapters are intended to perform a two-fold function:

1) to define the component strength criteria corresponding to the design basis for the loads specified in chapter 3; and

2) to define the framing, material, and detailing requirements necessary to achieve the performance assumed in design.

This second objective is most clearly stated in the background section of chapter 12 of the Provisions, reproduced below:

> "The masonry design and construction procedures given in this Chapter and Chapter 12A are essential to providing the performance levels implicit in the selection of the factors used in determining the seismic forces in these provisions. The requirements embodied in chapters 12 and 12A have been demonstrated to be necessary by recent earthquakes and represent the latest developments in masonry construction to provide adequate seismic performance."

However, the manner in which this two-fold objective is achieved varies a great deal from chapter to chapter:

1) Chapter 10 on steel achieves its purpose by very explicit modifications to reference documents (see datum 10240, for example).

2) Chapter 11 on concrete is essentially self-contained; however, it requires a great deal of familiarity with the reference document for concrete to relate the Provisions to it, and interpret and resolve possible overlaps and contradictions.

3) Chapter 9 on wood satisfies the first function by first doubling the working stresses and then applying appropriate reduction factors; the second function also involves the definition of conventional light timber construction for buildings which do not require a seismic analysis.

4) Chapter 12 on masonry uses chapter 12A as an extensive masonry construction standard, and then applies strength modification and special requirements to it.

3.3.5 Performance Philosophy

The Provisions vary between being very performance oriented to very prescriptive. The following examples are cited:

1) qualitative performance requirements are stated with no criteria given to judge whether the requirement is satisfied (e.g., the functional requirement for buildings of seismic hazard exposure group III found in section 1.4.2(A) of the Provisions and discussed here in section 3.1.6).

2) qualitative performance requirements are stated and measurable criteria are given in as scheme independent a fashion as possible (e.g., the strength requirement of sections 3.1 and 3.7 in which the required strength is calculated from seismic forces in a way that actual building performance is represented as accurately as practicable).

3) quite prescriptive requirements are given with no indication of what qualitative performance is desired (e.g., the requirements on the connection between piles and pile caps given in section 7.4.4).

It would be desirable to have a consistent approach with respect to performance philosophy throughout, although such a goal is unattainable at this time in a document dealing with several different materials because there is great variance in the basic design standards for different materials. Notwithstanding the present problem, a consistent approach is a worthy goal. Of the three examples cited, the second one is preferable. The approach of the first example is difficult to use in the context of a building code because it offers no firm basis for decision. The approach of the third example leaves the designer in the dark about why he is following a provision and thus increases the likelihood of error. The approach of example 2 will entail more work in preparation than that of example 1. The approach of example 2 generally will entail less work in preparation and less written material than that of example 3 (e.g., specifying a force that the pile to pile cap connection must resist rather than specifying amount, type, and anchorage of reinforcement for many different types of piles). In the general case, provisions formulated and expressed as example 2 require the most careful preparation, but are the most likely to be well understood, to be used correctly, and to lead to safe and efficient buildings. The classification of requirements according to limit states as done in appendix A4 provides more insight to the performance concepts in the Provisions.

3.4 Correctness

The analysis techniques used in this study of the Provisions do not lead directly to questions or answers concerning the technical validity of any provisions. The objective of the analysis performed is to uncover errors of expression of provisions that get in the way of understanding their intent. Thus this study does not stand as a testimonial to either the correctness or the falsity of any portion of the Provisions. However, conducting the analysis does invariably lead to questions in the mind of the analyst about the "rightness" or "wrongness" of individual provisions. Study of the data in appendix A will also probably lead to similar questions in the mind of the reader. Generally speaking, these questions are the opinions of individuals, which are sometimes triggered, sometimes just given a format, by the analysis and representation techniques. As such, the opinions of the authors concerning individual provisions will not be offered in this publication, except that some brief comments are made on individual decision tables in appendix A2 that may touch on correctness.

3.5 Relation to Existing Standards

The Provisions are written in a format that is intended to conform to a model building code; that is, the Provisions are designed to be easily adaptable by model building code issuing organizations. Thus, they are in a position somewhat comparable to many standards for structural design, and will have important relations with such standards. It is instructive to speculate on the relation of the Provisions to existing standards, and on the possible feedback from the Provisions to these standards. In its simplest form, the Provisions, as any other structural design provisions, may be viewed in terms of load and resistance factor philosophy as a series of provisions insuring that:

Resistance $\geq$ Load Effect.

On this basis, conceivably the following scenario may eventually emerge:

1) provisions dealing with seismic load effects will become part of ANSI A58 "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures"

2) provisions pertaining to component strength criteria, and the appropriate requirements for framing and detailing applicable to the various materials will become appendixes of the corresponding reference documents.

The question then arises as to what provisions would remain to be handled by a specific earthquake resistant design document.

Certainly, in the foreseeable future, the parts of the Provisions dealing with quality assurance (section 1.6), with architectural, mechanical, and electrical components and systems (chapter 8), and, possibly to a lesser extent, with foundation design (chapter 7) are not likely to be incorporated in any other standard, and will have to be part of a set of seismic provisions. Similarly, the definition of the seismic performance categories, and the requirements and limitations pertaining to them will have to remain in the seismic provisions.

The most difficult and challenging problem that will arise will be that of separating to an appropriate degree the "resistance" and "load" effects. In the present Provisions, these effects combine in two ways:

1) the "load effect" is highly dependent on a number of resistance-related factors, notably the type of seismic resisting system, which determines the seismic response modification coefficient, R, and on the configuration of the building, which determines the method of analysis and thus the load effect distribution to the structural components;

2) the Provisions contain a large number of framing, material and detailing provisions intended to insure that the building is constructed so that it can in fact sustain the calculated load effects.

This problem will undoubtedly occupy much of the attention of groups working on improved seismic design documents. It is hoped that the analysis presented herein will be of some assistance in this task.

CHAPTER 4

SUMMARY OF CONCLUSIONS

4.1 Recommendation for Review and Revision of Provisions

The Provisions should be carefully reviewed in light of the findings presented in appendix A and briefly summarized in chapter 3 by all who are concerned with the future of provisions for designing buildings to resist the effects of earthquakes. It is anticipated that various individuals and organizations will soon undertake careful reviews of the Provisions, some to establish technical validity, some to establish enforceability in the context of current building codes, and others to become familiar enough to use the Provisions in the design of buildings. The data in appendix A have something to offer in all types of review, as they provide an alternate technical expression of the Provisions. The decision table and network expression may serve as a much clearer expression of design provisions than the conventional textual expression. Individuals undertaking a detailed review of the Provisions are encouraged to devote a small amount of time to studying chapter 2 so that they can gain full benefit of the data in appendix A.

Appendix A notes several possible needs for revision of the Provisions. Many of these comments are also discussed in chapter 3. For convenience, a brief summary of the possible points for revision is listed here (note that being brief and being a summary means that this list is not complete):

1) Points requiring clarification:

- the circular definition of R given in table 3-B
- the impact of not adopting chapter 13 on the remainder of the provisions
- the applicability of the provisions for quality assurance
- the proper method of calculating strength in category A buildings
- the use of similar terms for the same or different meanings
- the placement of the functional requirement within the definition of seismic hazard exposure group III

2) Points that appear to be incomplete:

- the types of framing systems listed in table 3-B
- the types of components and stress states listed for use in establishing capacity reduction factors for wood, steel, and masonry components
- the potential ways of designing wood frame buildings
- the types of attachments considered in evaluating the amplification factor for the attachment of mechanical and electrical equipment
- cross-references for the use of plan configuration, for the use of the modifications allowed in section 13.3, and for the seismic forces required

3) Points that appear to be inconsistent:

- redundant decisions involving the seismic performance category, seismicity index, and seismic hazard exposure group
- potentially conflicting limitations on moment frame systems
- potentially awkward arrangements of certain chapters
- the treatment of reference standards for the materials of construction
- the variation in the style, or philosophy, of the provisions between performance oriented and prescriptive

4) Point that appears to require careful consideration:

- the relation to existing standards for building design

4.2 Recommendations for the Planned Assessment

The National Bureau of Standards with support from the National Science Foundation has proposed a plan for the assessment of the Provisions and the implementation of improved provisions for seismic resistant design. [2] A large number of concerned organizations have participated in the planning, will contribute to its further development and participate in the activities of assessment and implementation. It is anticipated that the first phase of the assessment will be to review and refine the Provisions. It is recommended that the data in appendix A serve as one resource for this review for the reasons discussed earlier. It should be noted that the information network in appendix A3 and the classified index in appendix A4 both can serve as practical aids in dividing the review work among individuals and committees. A second recommendation is that the formal representation (the data in appendix A, much of which is stored in computer processable form) be updated to conform to the refined provisions that are to be the product of the first phase in the assessment, thus allowing the usefulness of this resource to continue as further assessment and review is made.

4.3 Conclusion of This Project

With the data presented in appendix A and the observations made in chapter 3 and appendix B, this project is complete. The project has been of use not only for the general aim of improving provisions for seismic resistant design and construction, but also for the improvement of the methodology for analyzing and representing technical provisions. This particular study has probably been the largest single such study undertaken to date, in terms of the number of provisions analyzed, and many lessons were learned. Appendix B contains a more thorough discussion of these issues, including recommendations for future improvements that are desirable.

Appreciation for aid and support in the conduct of this project is due many individuals. Charles Culver of the National Bureau of Standards was quite helpful throughout the project. Irving Oppenheim of Carnegie-Mellon University made substantial contributions to the earlier stages of the work. The many participants in the ATC-3 project were very cooperative; Roland Sharpe, the project director, Norton Remmer, the chairman of Task Group 4 (liaison and format), and the members of Task Group 4, particularly Edwin Zacher, deserve special mention. The authors would also like to acknowledge the work of John Melin and Mary Miller of the University of Illinois; they prepared an analysis of chapter 11 of the Provisions that was the starting point for the work on chapter 11 reported herein, and they conducted a profitable interchange with the some of ATC participants responsible for chapter 11 [12]. John Worman, then a student at Carnegie-Mellon University, conducted portions of the detailed analysis used in the early stages of the project. The careful reviews of E. V. Leyendecker, James Pielert, Patrick Cooke, and Sandra Berry of NBS were also helpful.

APPENDIX A

DATA AND DETAILED ANALYSIS

APPENDIX A1

DATA LIST

The data list contains 1206 data items, each developed as described in chapter 2. The following keys for reading the data list are repeated here for easy reference:

1) The data number is a unique numeric label of the form nnmkk where:

   nn is the chapter number (1 through 13)
   m is the major section number (for section 5.10 and 5.11, m = 9 was used)
   kk is an arbitrary number that normally reflects the sequence of occurrence within the section

2) The data label is a mnemonic reference that is assigned to all and only derived data items. The first letter of the label indicates the type of derivation:

   "X" indicates a definite function
   "Y" indicates an indirect function
   "Z" indicates an assumed function

   All other initial letters indicate a decision table.

3) The data description is the full name of the data item, subject to the abbreviations necessary to fit within the 60 character limitation imposed by the format of the data list.

4) The ingredients are the data numbers of all data items that are ingredients of the datum.

5) The dependents are the data numbers of all data items for which the information network has shown that the datum is an ingredient. This includes all chapters.

6), 7), and 8) The input level, output level, and total float are respectively the number of steps along the longest path from the node to input, the equivalent number related to output, and the difference between the longest path through the node from input to output and the longest such path through the entire network. These quantities are shown as calculated for the combined network created by merging all chapters.

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
1210	PAPPL	PROVISIONS APPLICABLE	1220 1230 1240 1250 1260 1264 1266 1270 1280 1425 13000	1305	4	1	46
1220		STRUCTURE TYPE		1210	0	2	49
1230		BUILDING STAGE		1210 1305 1493 8001	0	3	48
1240		PROPOSED WORK ON EXISTING BUILDING		1210 1305 1493 8001	0	3	48
1250	ZSFRB	SEISMIC FORCE RESISTANCE BEFORE PROPOSED ACTIVITY		1210 1380	0	2	49
1260	ZSFRA	SEISMIC FORCE RESISTANCE AFTER PROPOSED ACTIVITY		1210 1380 1390	0	2	49
1264	YSPCB	SEISMIC PERFORMANCE CATEGORY BEFORE PROPOSED CHANGE	1490	1210 1493	3	2	46
1266	YSPCA	SEISMIC PERFORMANCE CATEGORY AFTER PROPOSED CHANGE	1490	1210	3	2	46
1270		BUILDING USE		1210 1345 4215 9001 13185	0	48	3
1280		SIZE OF DWELLING		1210	0	2	49
1305	APPLR	APPLICATION REQUIREMENT	1210 1310 1230 1345 1240 1380 1390 1315 13001		51	0	0
1310		DESIGN DOCUMENTS SUBMITTED TO REGULATORY AGENCY		1305	0	1	50
1315	LCR	LOAD COMBINATION REQUIREMENT	1320 3702 1335 1340	1305	38	1	12
1320		DESIGN LOAD EFFECTS		1315	0	2	49
1335		NON SEISMIC LATERAL LOAD EFFECTS		1315	0	2	49
1340		GRAVITY LOAD EFFECTS		1315	0	2	49
1345	NBR	NEW BUILDING REQUIREMENT	2001 3001 4001 5001 6001 7001 8001 9001 10001 11001 12001 1601 1270 1350 2243 2227 1425 9701 1365 1370	1305	50	1	0
1350		CONSTRUCTION TYPE		1345 9001 9300 9802	0	11	40
1365	SADR	STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS	3001 4001 5001 6001 7001	1345	49	2	0
1370	MDCR	MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS	9001 10001 11001 12001	1345	47	2	2
1380	ARR	ALTERATION AND REPAIR REQUIREMENT	1250 1260 1385 13301	1305	40	1	10
1385	ZSFRRP	SEISMIC FORCE RESISTANCE REQUIRED BY THESE PROVISIONS		1380 1390	0	2	49
1390	CUR	CHANGE OF USE REQUIREMENT	1260 1385 13301	1305	40	1	10
1405	EPA	EFFECTIVE PEAK ACCELERATION	1410	4210 5520 5860 6204 6320 8372	1	37	13
1410		MAP AREA FROM FIGURE 1-1		1405	0	38	13
1415	EPV	EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION	1420	3731 3765 3771 4210 5520 5860 6204 6222 6224 6256 6320 7428 7520 8215 8309	1	45	5
1420		MAP AREA FROM FIGURE 1-2		1415 1425	0	51	0

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
1425	SI	SEISMICITY INDEX	1420	1210 1345 1490 1602 8100 8363 8372 9001 11275 13110	1	50	0
1430	SHEG	SEISMIC HAZARD EXPOSURE GROUP	1433 1436 1439 1442 1445 1448 1451 1454 1457 1460	1469 1472 1490 1602 3860 8100 8106 8107 8372	1	50	0
1433		FACILITY DESIGNATED ESSENTIAL BY COGNIZANT JURISDICTION		1430	0	51	0
1436		NUMBER OF OCCUPANTS IN BUILDING IS LARGE		1430	0	51	0
1439		MOVEMENT OF OCCUPANTS IS RESTRICTED		1430	0	51	0
1442		MOBILITY OF OCCUPANTS IS IMPAIRED		1430	0	51	0
1445		NUMBER OF USE CLASSES IN BUILDING		1430	0	51	0
1448		PORTION OF AREA DESIGNATED AS ESSENTIAL BY COGNIZANT JURIS		1430	0	51	0
1451		PORTION OF AREA WITH LARGE NUMBER OF OCCUPANTS		1430	0	51	0
1454		PORTION OF AREA WITH OCCUPANTS FREE MOVEMENT RESTRICTED		1430	0	51	0
1457		PORTION OF AREA WITH OCCUPANTS WITH IMPAIRED MOBILITY		1430	0	51	0
1460		BUILDING PROVIDES ACCESS TO ANOTHER WITH SHEG = III		1430	0	51	0
1463		BUILDING HAS CAPACITY TO FUNCTION IMMEDIATELY AFTER EQ		1469	0	1	50
1466		DESIGNATED SYSTEMS HAVE CAPACITY TO FUNCTION IMMED AFTER EQ		1469	0	1	50
1469	G3FR	GROUP III FUNCTIONAL REQUIREMENT	1430 1463 1466		2	0	49
1472	G3AR	GROUP III ACCESS REQUIREMENT	1430 1475 1478 1481 1484 1487		2	0	49
1475		BUILDING IS ACCESSIBLE DURING AND AFTER EARTHQUAKE		1472	0	1	50
1478		ACCESS PROVIDED BY ADJACENT STRUCTURE		1472	0	1	50
1481		SEISMIC HAZARD EXPOSURE GROUP OF ADJACENT STRUCTURE		1472	0	1	50
1484		DISTANCE FROM ACCESS POINT TO SIDE PROPERTY LINE		1472	0	1	50
1487		PROTECTION PROVIDED AGAINST POTENTIAL ADJACENT HAZARDS		1472	0	1	50
1490	SPC	SEISMIC PERFORMANCE CATEGORY	1425 1430	1264 1266 1493 1628 3001 3369 3372 3530 3610 3702 3704 7001 9002 9230 9739 10002 10500 11002 11230 12002 12700 13110 13150 13210 13262 13360 13380	2	49	0
1493	CDSLR	CATEGORY D SITE LIMITATION REQUIREMENT	1490 1230 1240 1264 1496		4	0	47
1496		POTENTIAL EXISTS FOR GROUND RUPTURE FROM ACTIVE FAULT		1493	0	1	50
1510	AA	ALTERNATE ACCEPTABLE	1520 1530 1540 1550		1	0	50
1520		USE OF ALTERNATE MATERIAL OR METHOD DESIRED		1510	0	1	50
1530		REGULATORY AGENCY APPROVES ALTERNATE		1510	0	1	50
1540		ALTERNATE IS EQUAL IN STRENGTH, DURABILITY, SEISMIC RESIST		1510	0	1	50
1550		SUBSTANTIATING EVIDENCE SUBMITTED TO REG AGENCY		1510	0	1	50
1601	QAR	QUALITY ASSURANCE REQUIREMENT	1602 1604 1651 1637 1640 1644	1345	7	2	42
1602	QAPR	QUALITY ASSURANCE PLAN REQUIRED	1425 1430	1601	2	3	46
1604	QAPAR	QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT	1605 1613	1601	6	3	42
1605	DQAP	DETAILS OF QUALITY ASSURANCE PLAN	1607 1608 1610 1628 1611 1635	1604	5	4	42
1607		PLAN SPECIFIES THOSE DSS WHICH REQUIRE SPECIAL PERFORMANCE		1605	0	5	46
1608		PLAN FOR EACH DSS PREPARED BY DESIGNER OF THAT DSS		1605	0	5	46

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
1610		PLANNED SPECIAL INSPECTION		1605 1651	0	5	46
1611		PLANNED SPECIAL TESTING		1605 1651	0	5	46
1613	SCQAP	STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN	1614 1616 1617	1604	1	4	46
			1618 1619 1620				
			1622 1623				
1614		STATEMENT IS WRITTEN		1613	0	5	46
1616		STATEMENT IS SUBMITTED PRIOR TO START OF WORK ON DSS		1613	0	5	46
1617		STATEMENT ACKNOWLEDGES AWARENESS OF REQTS OF Q A PLAN		1613	0	5	46
1618		STATEMENT ACKNOWLEDGES THAT CONTROL WILL EXERCISED		1613	0	5	46
1619		STATEMENT CONTAINS PROCEDURES FOR CONTROL		1613	0	5	46
1620		STATEMENT CONTAINS METHOD, FREQ, AND DISTR OF REPORTS		1613	0	5	46
1622		STATEMENT NAMES PERSON RESPONSIBLE FOR CONTROL		1613	0	5	46
1623		STATEMENT SHOWS POSITION WITHIN MGT OF RESPONSIBLE PERSON		1613	0	5	46
1625	QAPA	QUALITY ASSURANCE PERSONNEL ARRANGEMENTS	1626 1632 1634	1651	1	4	46
			2192				
1626		SPECIAL INSPECTOR EMPLOYED BY BUILDING OWNER		1625	0	5	46
1628	MSI	MINIMUM SPECIAL INSPECTION	2114 1631 8105	1605	4	5	42
			1490				
1631		CONSTRUCTION ACTIVITY		1628	0	6	45
1632		SPECIAL INSPECTOR APPROVED BY REGULATORY AGENCY		1625	0	5	46
1634		SPECIAL TESTING AGENCY APPROVED BY REGULATORY AGENCY		1625	0	5	46
1635	MST	MINIMUM SPECIAL TESTING	2114	1605	1	5	45
1637	MEETR	MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED	1638 8363	1601	5	3	43
1638		COMPONENT IS A PART OF A DESIGNATED SEISMIC SYSTEM		1637 1644	0	6	45
1640	MEETPA	MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT	1643 1641 1674	1601	6	3	42
1641	MSTMEE	MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT	2114 8369	1640	5	4	42
1643		PLANNED SPECIAL TESTING FOR MECH/ELECT EQUIPMENT		1640 1644	0	6	45
1644	MEETC	MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT	1646 1643 1647	1601 8360	1	5	45
			1649 1638 1650				
1646		ACTUAL SPECIAL TESTING FOR MECH/ELECT EQUIPMENT		1644	0	6	45
1647		MANUFACTURER SUBMITS CERTIFICATE OF COMPLIANCE		1644	0	6	45
1649		REGULATORY AGENCY APPROVES CERTIFICATE		1644	0	6	45
1650		SPECIAL INSPECTOR VERIFIES THAT EQUIPMENT CONFORMS TO CERT		1644	0	6	45
1651	QAPC	QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT	1652 1610 1653	1601	3	3	45
			1611 1625 1654				
1652		ACTUAL SPECIAL INSPECTION		1651 12600	0	8	43
1653		ACTUAL SPECIAL TESTING		1651	0	4	47
1654	QARR	QUALITY ASSURANCE REPORTING REQUIREMENT	1655 1662 1668	1651	2	4	45
1655	SIWRR	SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT	1656 1657 1659	1654	1	5	45
			1661				
1656		SPECIAL INSPECTOR PREPARES PROGRESS REPORTS EACH WEEK		1655	0	6	45
1657		SIW REPORT TO REG AGENCY, OWNER, Q A PLAN AUTHOR, CONTR		1655	0	6	45
1659		SIW REPORT NOTES ANY DEFICIENCIES		1655	0	6	45
1661		SIW REPORT NOTES ANY CORRECTIONS OF PAST DEFICIENCIES		1655	0	6	45
1662	SIFRR	SPECIAL INSPECTORS FINAL REPORT REQUIREMENT	1664 1665 1667	1654	1	5	45
1664		SIF REPORT SUBMITTED TO REGULATORY AGENCY AT COMPLETION		1662	0	6	45
1665		SIF REPORT CERTIFIES INSPECTED WORK SUBSTANTIALLY OK		1662	0	6	45
1667		SIF REPORT NOTES ANY WORK NOT IN COMPLIANCE		1662	0	6	45
1668	CFRR	CONTRACTORS FINAL REPORT REQUIREMENT	1670 1671 1673	1654	1	5	45
1670		CF REPORT SUBMITTED TO REG AGENCY AT COMPLETION		1668	0	6	45
1671		CF REPORT CERTIFIES ALL DSS SUBSTANTIALLY IN COMPLIANCE		1668	0	6	45
1673		CF REPORT NOTES ANY DEFICIENCIES		1668	0	6	45
1674	MEEMCP	MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT	1685 1686 1688	1640	1	4	46
1685		MANUFACTURER MAINTAINS A QUALITY ASSURANCE PROGRAM		1674	0	5	46

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
1686		QUALITY CONTROL PROGRAM APPROVED BY REG AGENCY		1674	0	5	46
1688		EACH COMPONENT MARKED WITH REG AGENCY APPROVAL		1674	0	5	46
2001		REQUIREMENTS OF CHAPTER 2		1345	0	2	49
2114		ELEMENT OF BUILDING (COMPONENT)		1628 1635 1641	0	49	2
				3706 3731 3770			
				5820 5830 8100			
				8105 8106 8107			
				8110 8115 8220			
				8240 8312 8313			
				8372 9220 9230			
				9898 10220 10400			
				11210 11230 11340			
				11514 11521 11563			
				11584 11800 11832			
				11880 11881 12220			
				12409 12430 12454			
				12518 12566 12602			
				12726 12754 12764			
				13210 13262 13360			
				13380			
2115		MATERIAL OF COMPONENT OR SYSTEM		3390 10240 10400	0	45	6
				10500 11310 11400			
				11556 12403 12518			
				12566			
2146		DEAD LOAD		3707 4215 12740	0	48	3
2148		LIVE LOAD		3708 4215 12740	0	48	3
2151		BASIC SNOW LOAD		4230	0	49	2
2152		CONDITIONS WARRANT REDUCTION OF SNOW LOAD		4230	0	49	2
2153		REDUCTION OF SNOW LOAD APPROVED BY REGULATORY AGENCY		4230	0	49	2
2154		SNOW LOAD REDUCTION COEFFICIENT		4230	0	49	2
2160		TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT		8315 8330 8345	0	22	29
				8363 8369			
2161		HORIZ FORCE DISPLACEMENT RATIO OF RESILIENT MOUNTING SYSTEM		8321	0	23	28
2162		VERT FORCE DISPLACEMENT RATIO OF RESILIENT MOUNTING SYSTEM		8321	0	23	28
2166		TYPE OF RESTRAINING DEVICE		8315 8345	0	20	31
2192		QUALIFICATION OF PERSON WITH RESPONS CHARGE OF TEST/INSPEC		1625	0	5	46
2223		ACCELERATION OF GRAVITY		5640 6212 6226	0	46	5
2226		HEIGHT TO LEVEL X		4320 4520 4522	0	46	5
				6268 6330 6340			
				8318			
2227		TOTAL HEIGHT		1345 3372 3788	0	47	4
				4255 6217 8106			
				8318 9001 12403			
2228		STORY HEIGHT BELOW LEVEL X		3860 4640	0	25	26
2235		OVERALL LENGTH OF BLDG AT BASE PARALLEL TO SEISMIC FORCE		4255	0	47	4
2236		OVERALL LENGTH OF FOUNDATION PARALLEL TO SEISMIC FORCE		6258	0	42	9
2243		NUMBER OF LEVELS (STORIES)		1345 3860 4320	0	46	5
				4410 4520 4522			
				4530 5310 5530			
				5620 6330 8106			
				9001 9300 9535			
				9739 9819 10500			
2273		WEIGHT OF COMPONENT		3771	0	19	32

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
2275		NUMBER OF THE LEVEL X		4520 4522 4530	0	30	21
				5910			
3001	SDR	STRUCTURAL DESIGN REQUIREMENT	3105 3120 3140	1345 1365	48	3	0
			1490 3145 3160				
			3369 3610				
3105	SAR	STRUCTURAL ANALYSIS REQUIREMENT	3510 3115	3001	8	4	39
3115		INTERNAL MEMBER FORCES DETERMINED WITH LINEAR ELASTIC MODEL		3105	0	5	46
3120	SR	STRENGTH REQUIREMENT	3125 3130 3702	3001	38	4	9
3125	YMS	MEMBER STRENGTH	9210 10210 11210	3120 3720 7428	5	11	35
			12210	7520 7595 13250			
3130	YCS	CONNECTION STRENGTH	9210 10210 11210	3120 3720 3770	5	11	35
			12210	7595 13250			
3140	DR	DEFORMATION REQUIREMENT	3850 3810	3001	30	4	17
3145	LPR	LOAD PATH REQUIREMENT	3150 3155	3001	1	4	46
3150		CONTINUOUS LOAD PATH EXISTS TO TRANSFER ALL FORCES		3145	0	5	46
3155		LOAD PATH HAS ADEQUATE STRENGTH AND STIFFNESS		3145	0	5	46
3160	FDCR	FOUNDATION DESIGN CRITERIA REQUIREMENT	3165 3170	3001 7270	1	6	44
3165		FOUNDATION DESIGNED TO ACCOMMODATE DESIGN GROUND MOTIONS		3160	0	7	44
3170		FOUNDN DES CRIT BASED ON DYNAMICS AND STRUCT DESIGN PHILOS		3160	0	7	44
3210	SPT	SOIL PROFILE TYPE	3230 3240 3250	4210 5520 5860	1	37	13
			3260	6204 6320			
3220	SSC	SEISMIC SOIL COEFFICIENT	3230 3240 3250	4210 5520 5860	1	37	13
			3260	6204 6320			
3230		SOIL TYPE		3210 3220	0	38	13
3240		DEPTH OF SOIL TO ROCK		3210 3220	0	38	13
3250		DEPTH OF SOFT TO MEDIUM CLAY		3210 3220	0	38	13
3260		SOIL TYPE KNOWN		3210 3220	0	38	13
3270	SSIUR	SOIL STRUCTURE INTERACTION USE REQUIREMENT	3280 3520	3510	1	6	44
3280		DESIGNER WISHES TO USE SOIL STRUCTURE INTERACTION		3270 4205 4610	0	34	17
				5510 5630 6001			
3303	GFC	GENERAL FRAMING CLASS	3306 3309 3312	3345 3348 3369	12	39	0
			3315 3318	3372 10400 10500			
				11310 11400 11556			
				11818			
3306		VERTICAL LOAD SYSTEM		3303 12724	0	40	11
3309		SEISMIC RESISTING SYSTEM		3303 3345 3348	0	47	4
				3381 4255 10500			
				11310			
3312		STRUCTURE IS CHARACTERIZED AS AN INVERTED PENDULUM		3303 4520	0	40	11
3315	MFR	MOMENT FRAME REQUIREMENT	3321 3324 3327	3303	11	40	0
			3330 3336				
3318	DSR	DUAL SYSTEM REQUIREMENT	3336 3339 3342	3303	11	40	0
3321	YSMFS	STRENGTH OF MOMENT FRAME SYSTEM	10210 11210	3315	5	41	5
3324	ZRS	TOTAL REQUIRED STRENGTH**		3315	0	41	10
3327		FRAME RESPONSE TYPE		3315 3345 3348	0	41	10
				3372 10500 11310			
				11400 11556 12736			
3330	OMFR	ORDINARY MOMENT FRAME REQUIREMENT	3333 10450 11600	3315	9	41	1
3333		FRAME MATERIAL		3330 3336 3345	0	48	3
				3348 4260 12736			
3336	SMFR	SPECIAL MOMENT FRAME REQUIREMENT	3333 10600 11700	3315 3318	10	41	0
3339	YSSMFS	STRENGTH OF SPECIAL MOMENT FRAME SYSTEM ALONE	10210 11210	3318	5	41	5
3342	ZRS25	TOTAL REQUIRED STRENGTH WITH 25% OF THE SEISMIC FORCE**		3318	0	41	10

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
3345	RX	SINGLE SYSTEM RESPONSE MODIFICATION FACTOR	3303 3309 3351 3327 3333	3354	13	38	0
3348	CD	DEFLECTION AMPLIFICATION FACTOR	3303 3309 3351 3327 3333	4608 4640 5630 5635	13	31	7
3351		SHEAR WALL TYPE		3345 3348	0	39	12
3354	R	RESPONSE MODIFICATION FACTOR	3357 3360 4215 3345	4210 5520 5860 6204 6320	14	37	0
3357		NUMBER OF DIFFERENT FRAMING SYSTEMS IN THE BUILDING		3354 3363	0	38	13
3360	YWRX	WEIGHT SUPPORTED BY INDIVIDUAL FRAMING SYSTEM	4215	3354	3	38	10
3363	CFR	COMBINED FRAMING REQUIREMENT	3357 3366	3610	1	5	45
3366		COMPONENT DETAILED TO REQTS FOR SYSTEM WITH HIGHEST RX		3363	0	6	45
3369	GFR	GENERAL FRAMING REQUIREMENT	3303 1490 3372 3381 3390	3001	36	4	11
3372	CCDSRS	CATEGORY C AND D SEISMIC RESISTING SYSTEM LIMITATION	1490 3303 3327 3375 3706 2227 3378	3369	35	5	11
3375		SEISMIC RESISTING SYSTEM MATERIAL		3372	0	6	45
3378		SPECIAL MOMENT FRAME EXTENDS DOWN TO FOUNDATION		3372	0	6	45
3381	CCDIR	CATEGORY C AND D INTERACTION REQUIREMENT	3309 3384 3387	3369	30	5	16
3384		SRS ENCLOSED OR ADJOINED BY MORE RIGID ELEMENTS		3381 4255	0	47	4
3387	ZSRSID	SRS DESIGN PROVIDES FOR REACTION OF RIGID ELEMENTS TO DRIFT	4660	3381	29	6	16
3390	CCDDCR	CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT	3393 3396 2115 11563	3369	30	5	16
3393	ZSNSRS	STRENGTH OF STRUCTURAL COMPONENTS NOT A PART OF SRS	9210 10210 11210 12210	3390	5	6	40
3396	YQVD	EFFECT OF VERTICAL LOADS AND DESIGN STORY DRIFT	3707 3708 3710 4660	3390	29	6	16
3405	BC	BUILDING CONFIGURATION	3410 3415 3420 3425 3430	3530	5	7	39
3410	PC	PLAN CONFIGURATION	3420 3435 3425 3430 3445	3405 3530	1	8	42
3415	VC	VERTICAL CONFIGURATION	3450 3455 4340 3465	3405 3530	4	8	39
3420		GEOMETRIC CONFIGURATION OF BUILDING		3405 3410	0	9	42
3425		LOCATION OF CENTER OF BUILDING MASS		3405 3410	0	9	42
3430		LOCATION OF CENTER OF SEISMIC RESISTING SYSTEM		3405 3410	0	9	42
3435		BLDG HAS RE-ENTRANT CORNERS WITH SIGNIFICANT DIMENSIONS		3410	0	9	42
3445		ANY DIAPHRAGM HAS SIGNIFICANT CHANGES IN STRENGTH OR STIFF		3410	0	9	42
3450		GEOMETRIC CONFIG OF BLDG WITH RESPECT TO VERTICAL AXIS		3415	0	9	42
3455		BUILDING HAS HORIZ OFFSETS WITH SIGNIFICANT DIMENSIONS		3415	0	9	42
3465		STORY STIFFNESS		3415	0	9	42
3510	SLAR	SEISMIC LOAD ANALYSIS REQUIREMENT	3520 3530 3270 3540 4255	3105	7	5	39
3520		SEISMIC LOAD ANALYSIS USED		3270 3510 3560 4001 4410 4515 4605 4610 5001 6208 6211 6218	0	45	6
3530	RSLA	REQUIRED SEISMIC LOAD ANALYSIS	1490 3405 3410 3415	3510	6	6	39
3540		FUNDAMENTAL PERIOD OF BUILDING USED IN ANALYSIS		3510	0	6	45
3550		EARTHQUAKE FORCE EFFECT FROM MORE RIGOROUS ANALYSIS		3560 4410 4515 4605 4610	0	27	24
3560	QANAL	ANALYZED EARTHQUAKE FORCE EFFECT	3520 4010 3550	3711 3717	31	20	0

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
3610	SDDR	STRUCTURAL DESIGN AND DETAILING REQUIREMENT	1490 3620 3630 3670 3680 3363	3001	47	4	0
3620	CADDR	CATEGORY A DESIGN AND DETAILING REQUIREMENT	3737 3741 3747 7300 9300 10300 11300 12300	3610 3630	15	8	28
3630	CBDDR	CATEGORY B DESIGN AND DETAILING REQUIREMENT	3620 3700 3640 7400 9400 10400 11400 12400	3610 3670	41	7	3
3640	CBOR	CATEGORY B OPENINGS REQUIREMENT	3645 3650 3655 3660	3630	1	8	42
3645		OPENINGS PRESENT IN SHEAR WALLS, DIAPHRAGMS, OR PLATE ELEM		3640	0	9	42
3650		CHORDS PROVIDED AT EDGES OF EACH OPENING		3640	0	9	42
3655		CHORDS RESIST LOCAL STRESSES CAUSED BY OPENING		3640	0	9	42
3660		CHORDS EXTEND BEYOND OPENING TO DEVEL & DISTR CHORD STRESS		3640	0	9	42
3670	CCDDR	CATEGORY C DESIGN AND DETAILING REQUIREMENT	3630 3790 7500 9500 10500 11500 12500	3610 3680	45	6	0
3680	CDDDR	CATEGORY D DESIGN AND DETAILING REQUIREMENT	3670 7600 9600 10500 11500 12600	3610	46	5	0
3700	CDR	COMPONENT DESIGN REQUIREMENT	3701 3719 3725 3737 3741 3747 3752 3755 3770	3630	40	8	3
3701	CEQFDR	CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT	3715 3716	3700	1	9	41
3702	RS	REQUIRED STRENGTH	1490 3731 3704	1315 3120 3720 7210 7230 11833 11834	37	14	0
3704	QTOT	COMBINED LOAD EFFECT	1490 3796 3705 3713 3797	3702	36	15	0
3705	XQADD	ADDITIVE LOAD COMBINATION	3707 3708 3710 3706	3704	35	16	0
3706	QE	EARTHQUAKE FORCE EFFECT	3711 2114 3765 3771 3786 3788	3372 3705 3713 3780 3797 9846 11868 11872 12742 13256	34	17	0
3707	YQD	DEAD LOAD EFFECT	2146	3396 3705 3713 3734 3797 7220 11866	1	17	33
3708	YQL	LIVE LOAD EFFECT	2148	3396 3705 3734 7220 11866	1	17	33
3710	YQS	SNOW LOAD EFFECT	4230	3396 3705 7220 11866	2	17	32
3711	QCRIT	CRITICAL EARTHQUAKE LOAD EFFECT	3716 3717 3560	3706	33	18	0
3713	QOPPOS	COUNTERACTING LOAD COMBINATION	3714 3707 3706	3704	35	16	0
3714		COMPONENT BEHAVIOUR		3713	0	17	34
3715		DIRECTION OF SEIS FORCE PRODUCES MOST CRIT EFFECT IN EA COMP		3701	0	10	41
3716		COMBO OF ORTHOGONAL DIRECTIONS USED FOR CRIT DIRECTION		3701 3711	0	19	32
3717	QORTBO	ORTHOGONAL COMBINATION EARTHQUAKE FORCE EFFECT	3560	3711	32	19	0
3719	DISR	DISCONTINUITY REQUIREMENT	3720 3722 3723	3700	39	9	3
3720	YSSR	STORY STRENGTH RATIO	3702 3125 3130	3719	38	10	3
3722		DESIGN CONSIDERS POTENTIAL EFFECTS OF STRENGTH RATIO		3719	0	10	41
3723		STRENGTHS ADJUSTED TO COMPENSATE FOR STRENGTH RATIO		3719	0	10	41
3725	RR	REDUNDANCY REQUIREMENT	3726 3728 3729	3700	1	9	41
3726		STABILITY OF BLDG ENDANGERED BY FAILURE OF SINGLE COMPONENT		3725	0	10	41
3728		DESIGN CONSIDERS POTENTIALLY ADVERSE EFFECT OF INSTABILITY		3725	0	10	41

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
3729		BLDG MODIFIED TO MITIGATE EFFECTS OF COMPONENT FAILURE		3725	0	10	41
3731	NFP	MINIMUM SEISMIC FORCE	2114 1415 3732	3702	8	15	28
			3734 3749				
3732	YWSP	WEIGHT OF SMALLER PORTION OF BUILDING	4215	3731	3	16	32
3734	YBGTR	BEAM, GIRDER, OR TRUSS REACTION	3707 3708	3731	2	16	33
3737	IR	INTERCONNECTION REQUIREMENT	3740	3620 3700	1	9	41
3740		ALL PARTS OF THE BUILDING ARE INTERCONNECTED		3737	0	10	41
3741	CMWAR	CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT	3743 3744 3746	3620 3700	1	9	41
3743		DIRECT CONN PROVIDED BETW EA CONC/MAS WALL AND EA FLOOR/ROOF		3741	0	10	41
3744		SPACING OF WALL ANCHORAGE CONNECTORS		3741	0	10	41
3746		WALL DESIGNED TO RESIST BENDING BETWEEN CONNECTORS		3741	0	10	41
3747	NSAR	NONSTRUCTURAL ANCHORAGE REQUIREMENT	3749 3750	3620 3700	8	9	34
3749	YQFP	EFFECT OF NONSTRUCTURAL SEISMIC FORCE	8115	3731 3747	7	16	28
3750		ANCHORAGE PROVIDED FOR NONSTRUCTURAL COMPONENT		3747	0	10	41
3752	CR	COLLECTOR REQUIREMENT	3753	3700	1	9	41
3753		COLLECTOR ELEMENTS PROVIDED		3752	0	10	41
3755	DIAPR	DIAPHRAGM REQUIREMENT	3756 3758 3761	3700	1	9	41
			3762 3764				
3756		DEFLECTION IN PLANE OF DIAPHRAGM		3755 9819	0	10	41
3758		PERMISSIBLE DEFLECTION OF ELEMENTS ATTACHED TO DIAPHRAGM		3755 9819	0	10	41
3761		DIAPHRAGM DESIGN PROVIDES FOR BOTH SHEAR & BENDING STRESS		3755	0	10	41
3762		DIAPHRAGM PROVIDES ANCHORAGE FOR SEISMIC WALL FORCES		3755	0	10	41
3764		TIES OR STRUTS PROVIDED TO DISTR SEISMIC WALL FORCES		3755	0	10	41
3765	XQDIAP	MINIMUM DIAPHRAGM SIESMIC FORCE EFFECT	1415 3767 3768	3706	25	18	8
3767	YWD	WEIGHT OF DIAPHRAGM AND ATTACHED COMPONENTS	4215	3765	3	19	29
3768	YVX	PORTION OF STORY SHEAR TRANSFERRED BY THE DIAPHRAGM	4420	3765	24	19	8
3770	BWR	BEARING WALL REQUIREMENT	3780 2114 3130	3700	36	9	6
			3776 3777				
3771	XQBW	MINIMUM BEARING WALL SEISMIC FORCE	1415 2273	3706	2	18	31
3776		DUCTILITY		3770	0	10	41
3777		ROTATION CAPACITY		3770	0	10	41
3780	YQBWC	COMBINED LOAD EFFECT ON WALL CONNECTIONS	3783 3782 3785	3770	35	10	6
			3706				
3782		SHRINKAGE EFFECT		3780	0	11	40
3783		THERMAL CHANGES EFFECT		3780	0	11	40
3785		SETTLEMENT EFFECT		3780	0	11	40
3786		TYPE OF SEISMIC FORCE EFFECT		3706 9898	0	18	33
3788	XAOMIP	ADJUSTMENT TO OVERTURNING MOMENT OF INVERTED PENDULUM	4520 2227 3789	3706	21	18	12
3789		HEIGHT TO POINT ALONG INVERTED PENDULUM		3788	0	19	32
3790	CCDVMR	CATEGORY C AND D VERTICAL MOTION REQUIREMENT	3791 3792 3794	3670	1	7	43
			3795 3796				
3791		MEMBER POSITION		3790 3797 12253	0	17	34
				12256			
3792		MEMBER SUPPORT		3790 3797	0	17	34
3794		MEMBER IS PRESTRESSED		3790 3797	0	17	34
3795		VERT MOTIONS CONSIDERED IN DETERMINATION OF EQ EFFECT		3790	0	8	43
3796		ALTERED LOAD COMBO USED TO SATISFY VERT MOTION REQT		3704 3790	0	16	35
3797	QV	ALTERED LOAD COMBO FOR EFFECTS OF VERT MOTION	3791 3792 3794	3704	35	16	0
			3706 3707				
3810	SEPR	SEPARATION REQUIREMENT	3820 3830 3840	3140	27	5	19
3820		SEPARATION BETWEEN ADJACENT PORTIONS OF BUILDINGS		3810	0	6	45
3830	YSEPR	SEPARATION REQUIRED TO AVOID DAMAGING CONTACT	4610	3810	26	6	19
3840		ADJACENT PORTIONS OF BLDG ACT AS AN INTEGRAL UNIT IN EQ		3810	0	6	45
3850	DL	DRIFT LIMIT	4660 3860	3140	29	5	17

DATA NØ.	DATA LABEL	DATA DESCRIPTIØN	INGREDIENTS	DEPENDENTS	INPUT LEVEL	ØUTPUT LEVEL	TØTAL FLØAT
3860	ASD	ALLØWABLE STØRY DRIFT	1430 2243 3870 2228	3850 13248	2	7	42
3870		BUILDING CØNTAINS BRITTLE FINISHES		3860	0	8	43
4001	ELFAR	EQUIVALENT LATERAL FØRCE ANALYSIS REQUIREMENT	3520 4002 4560	1345 1365	2	3	46
4002		SPECIFIED ELF ANALYSIS PRØCEDURES FØLLØWED		4001	0	4	47
4010	QELFMD	EARTHQUAKE LØAD EFFECT FRØM ELF/MØDAL ANALYSIS	4420 4450 4510 4640 4665	3560	30	21	0
4205	V	SEISMIC BASE SHEAR	3280 4208 6200	4310 4630 5880	18	31	2
4208	XVELF	ELF SEISMIC BASE SHEAR WITHØUT SØIL STRUCTURE INTERACTIØN	4210 4215	4205 6200 6268	16	33	2
4210	CS	SEISMIC DESIGN CØEFFICIENT	1405 1415 3210 3220 4235 4240 3354	4208 6202	15	34	2
4215	W	TØTAL GRAVITY WEIGHT ØF BUILDING	1270 2146 2148 4230	3354 3360 3732 3767 4208 4340 4645 5860 6207	2	47	2
4230	ESL	EFFECTIVE SNØW LØAD	2151 2152 2153 2154	3710 4215	1	48	2
4235		BUILDING PERIØD CALCULATED		4210	0	35	16
4240	T	BUILDING PERIØD	4245 4250 4255	4210 4330 6211 8315	3	45	3
4245		FUNDAMENTAL BUILDING PERIØD CALCULATED BY DESIGNER		4240 4615	0	46	5
4250	YTF	CALCULATED FUNDAMENTAL BUILDING PERIØD	4251 4252 4253	4240 4615 4630	1	46	4
4251		PERIØD CALCULATED USING ESTABLISHED METHØDS		4250	0	47	4
4252		PRØPERTIES ØF SRS IN DIRECTIØN BEING ANALYZED		4250	0	47	4
4253		BUILDING ASSUMED FIXED AT BASE		4250 4615	0	47	4
4255	TA	APPRØXIMATE BUILDING PERIØD	3309 3384 4260 2227 2235	3510 4240 4615 5860	2	46	3
4260	CT	CØEFFICIENT FØR APPRØXIMATE PERIØD	3333	4255	1	47	3
4310	XFX	SEISMIC STØRY FØRCE	4205 4320	4410 4520 4522 4615	19	30	2
4320	XCVX	VERTICAL DISTRIBUTIØN FACTØR	4340 2226 4330 2243	4310 4630	5	31	15
4330	K	VERTICAL DISTRIBUTIØN EXPØNENT	4240 4360	4320	4	32	15
4340	YWX	TØTAL WEIGHT AT LEVEL X	4215	3415 4320 5530 5620 5640 6330	3	46	2
4360		INTERPØLATIØN USED FØR VERTICAL DISTRIBUTIØN EXPØNENT		4330	0	33	18
4410	VX	SEISMIC STØRY SHEAR	3520 2243 4310 5820 3550	4420 4460 4480 4510 4640	22	25	4
4420	YQVX	STØRY SHEAR FØRCE EFFECT	4410 4430 4440	3768 4010 4510	23	23	5
4430		STIFFNESS ØF VERTICAL CØMPØNENTS		4420 4450	0	24	27
4440		STIFFNESS ØF DIAPHRAGM		4420 4450	0	24	27
4450	YQTM	TØRSIØNAL MØMENT EFFECT	4460 4430 4440	4010	25	22	4
4460	XTM	TØRSIØNAL MØMENT	4410 4470 4480	4450	24	23	4
4470		ECCENTRICITY BETWEEN CENTER ØF MASS AND CENTER ØF STIFFNESS		4460	0	24	27
4480	XTMA	ACCIDENTAL TØRSIØNAL MØMENT	4410 4490	4460	23	24	4
4490		LENGTH ØF BUILDING PERPENDICULAR TØ SEISMIC FØRCE		4480	0	25	26
4510	ZQØM	ØVERTURNING MØMENT EFFECT	4515 4410 4420	4010	24	22	5
4515	ØMX	ØVERTURNING MØMENT AT LEVEL X	3520 4520 5910 3550	4510	23	23	5
4520	ELFØMX	ELF ØVERTURNING MØMENT AT LEVEL X	2275 3312 4530 4310 2243 2226	3788 4515	20	24	7
4522	XØMØ	ØVERTURNING MØMENT AT FØUNDATIØN WITHØUT REDUCTIØN	4530 4310 2275 2226 2243	6268	20	28	3
4530	KAPPA	ØVERTURNING MØMENT REDUCTIØN FACTØR	2243 2275	4520 4522	1	29	21

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
4550		LOCATION OF RESULTANT OF FORCES AT FOUND-SOIL INTERFACE		4560	0	5	46
4560	OMR	OVERTURNING MOMENT REQUIREMENT	4550	4001	1	4	46
4605	DRIFT1	FIRST ORDER DESIGN STORY DRIFT	3520 3550 5840 4610	4640 4660	26	25	0
4608	XDXNSS	ELF DEFLECTIONS WITHOUT SOIL STRUCTURE INTERACTION	4615 3348	4610 6268	21	28	2
4610	DEFLX	DEFLECTION AT STORY X	3280 3520 3550 6268 5850 4608	3830 4605	25	26	0
4615	EDFLX	ELASTIC DEFLECTION AT STORY X	4617 4245 4620 4250 4255 4310 4630 4635 4253	4608	20	29	2
4617		DEFLECTION TO BE USED ONLY FOR CHECKING DRIFT REQT		4615	0	30	21
4620		DEFLECTION TO BE BASED ON CALCULATED FUNDAMENTAL PERIOD		4615	0	30	21
4630	ZFX	REDUCED SEISMIC FORCES CORRESPONDING TO CALCULATED PERIODS	4250 4205 4320	4615	19	30	2
4635		ELASTIC ANALYSIS		4615	0	30	21
4640	XTHETA	STABILITY COEFFICIENT	4645 4605 4410 2228 3348	4010 4660	27	24	0
4645	YPX	TOTAL GRAVITY LOAD ABOVE LEVEL X	4215	4640	3	25	23
4650	YAD	INCREMENTAL FACTOR FOR SECOND ORDER EFFECTS	4655	4660	1	24	26
4655		RATIONAL ANALYSIS		4650 4665	0	25	26
4660	DRIFT	DESIGN STORY DRIFT	4640 4605 4650	3387 3396 3850 4665 8240 8250 13254	28	23	0
4665	YQ2ORD	INCREASE IN FORCE EFFECTS FROM SECOND ORDER EFFECTS	4660 4655	4010	29	22	0
5001	MAR	MODAL ANALYSIS REQUIREMENT	3520 5002 5210 5310 5410	1345 1365	4	3	44
5002		SPECIFIED MODAL ANALYSIS PROCEDURES FOLLOWED		5001	0	4	47
5210	MR	MODELING REQUIREMENT	5220 5230	5001	1	4	46
5220		BUILDING MODELED AS A SYSTEM OF MASSES LUMPED AT FLOORS		5210	0	5	46
5230		EACH MASS HAS ONE DEGREE OF FREEDOM IN LATERAL DISPLACEMENT		5210	0	5	46
5310	NMR	MODES REQUIREMENT	5320 5330 2243 5340	5001	3	4	44
5320		NUMBER OF MODES INCLUDED IN ANALYSIS		5310 5810 5820 5830 5840 5850	0	30	21
5330	YTM	MODAL PERIOD	5410	5310 5520 5640 6211	2	45	4
5340		MODES ANALYZED ON EACH OF TWO PERPENDICULAR AXES		5310	0	5	46
5410	PMSAR	PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT	5420 5430 5440	5001 5330 5540	1	47	3
5420		PERIODS AND SHAPES CALCULATED WITH ESTABLISHED METHODS		5410	0	48	3
5430		PERIODS AND SHAPES BASED ON FIXED BASE BUILDING		5410	0	48	3
5440		PERIODS AND MODES BASED ON ELASTIC PROPERTIES OF SRS		5410	0	48	3
5510	VM	MODAL BASE SHEAR	5520 5530 3280 5550 6300	5610 5810	18	33	0
5515	XV1NSS	MODE 1 BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION	5520 5530	6300 6340	16	35	0
5520	CSM	MODAL SEISMIC COEFFICIENT	5330 1405 1415 3210 3220 5550 3354	5510 5515 6310	15	36	0
5530	XWM	EFFECTIVE MODAL GRAVITY LOAD	2243 4340 5540	5510 5515 6208	4	45	2
5540	YPHIXM	MODAL STORY DISPLACEMENT AMPLITUDE	5410	5530 5620 6330	2	46	3
5550		MODE NUMBER		5510 5520 5630 6320	0	37	14
5610	XFXM	MODAL STORY FORCE	5620 5510	5640 5710 5720 5730 5740	19	32	0
5620	XCVXM	MODAL VERTICAL DISTRIBUTION FACTOR	2243 4340 5540	5610	4	33	14

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS			DEPENDENTS			INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
5630	MSDIS	MODAL STORY DEFLECTION	3348	5640	3280	5650	5850		23	28	0
			5550	6340							
5635	XM1SDS	MODE 1 STORY DEFLECTION WITHOUT SOIL STRUCTURE INTERACTION	3348	5640		6340			21	30	0
5640	XEMSDS	ELASTIC MODAL STORY DEFLECTION	2223	5330	5610	5630	5635		20	31	0
			4340								
5650	XMDFR1	FIRST ORDER MODAL STORY DRIFT	5630			5840			24	27	0
5710	YMVX	MODAL STORY SHEAR	5610	5750		5820			20	27	4
5720	YMOMX	MODAL STORY OVERTURNING MOMENTS	5610	5750		5830	6340		20	30	1
5730	YMVWBF	MODAL SHEAR IN WALLS OR BRACED FRAMES	5610	5750		5820			20	27	4
5740	YMOMWB	MODAL OVERTURNING MOMENTS IN WALLS OR BRACED FRAMES	5610	5750		5830			20	26	5
5750		FORCE EFFECT COMPUTED BY LINEAR STATIC METHODS				5710	5720	5730	0	31	20
						5740					
5810	XVTM	BASE SHEAR DESIGN VALUE	5320	5510		5880			19	29	3
5820	VXDV	STORY SHEAR DESIGN VALUE	2114	5320	5710	4410			21	26	4
			5730	5880							
5830	OMXDV	STORY OVERTURNING MOMENT DESIGN VALUE	2114	5320	5720	5910			21	25	5
			5740	5880							
5840	XMDRDV	FIRST ORDER STORY DRIFT DESIGN VALUE	5320	5650	5880	4605			25	26	0
5850	XMDSDV	FIRST ORDER STORY DEFLECTION DESIGN VALUE	5320	5630	5880	4610			24	27	0
5860	VBAR	COMPARITIVE ELF BASE SHEAR	3210	3220	4215	5880			15	29	7
			1405	1415	3354						
			4255								
5870		DESIGNER CHOOSES NOT TO EXCEED ELF BASE SHEAR				5880			0	29	22
5880	ELFF	ELF ADJUSTMENT FACTOR	5810	5860	5870	5820	5830	5840	20	28	3
			4205			5850					
5910	MOMX	OVERTURNING MOMENT DESIGN VALUE	5830	2275		4515			22	24	5
6001	SSIR	SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT	3280	6002		1345	1365		1	3	47
6002		SPECIFIED SOIL STRUCT INT ANALYSIS PROCEDURES FOLLOWED				6001			0	4	47
6200	VELFSS	ELF BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION	4208	6202		4205	6268		17	32	2
6202	XDVSSI	SOIL STRUCT INTERACTION REDUCTION OF ELF BASE SHEAR	4210	6204	6206	6200			16	33	2
			6208								
6204	CSBAR	ELF SEISMIC COEFFICIENT MODIFIED FOR SOIL STRUCT INT	6210	3210	3220	6202			15	34	2
			3354	1415	1405						
6206	BETA	FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYSTEM	6252			6202	6310		13	36	2
6207	WBBAR	ELF GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION	6209	4215		6208			3	45	3
6208	WBAR	GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION	3520	6207	5530	6202	6212	6242	5	44	2
						6310					
6209		GRAVITY LOAD CONCENTRATED AT A SINGLE LEVEL				6207	6217		0	46	5
6210	TBAR	PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION	6232	6234	6236	6204	6252	6254	8	41	2
			6241	6238	6240	6256	6264	6320			
6211	TNS	PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION	3520	4240	5330	6212	6238	6240	4	44	3
						6252	6256				
6212	XKBAR	STIFFNESS OF BUILDING FIXED AT BASE	2223	6208	6211	6238			6	43	2
6214	YKY	LATERAL STIFFNESS OF FOUNDATION	6220	6222	6224	6238			4	43	4
6216	YKTHET	ROCKING STIFFNESS OF FOUNDATION	6220	6222	6224	6238	6268	6340	4	43	4
6217	HBBAR	ELF HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION	6209	2227		6218			1	45	5
6218	HBAR	HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION	3520	6217	6330	6238	6240	6242	5	44	2
						6256	6258				
6220		COMPUTATIONS FOLLOW ESTABLISHED PRINCIPLES				6214	6216		0	44	7
6222	G	AVERAGE SHEAR MODULUS OF SOIL AT LARGE STRAINS	6226	1415		6214	6216		3	44	4
6224	VS	AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS	6228	1415		6214	6216	6240	2	44	5
						6254	6264				
6226	XGO	SHEAR MODULUS OF SOIL AT SMALL STRAINS	6230	6228	2223	6222			2	45	4
6228	YVSO	SHEAR WAVE VELOCITY OF SOIL AT SMALL STRAINS	6229			6224	6226		1	46	4

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
6229		STRAIN LEVEL IN SOIL		6228	0	47	4
6230		AVERAGE UNIT WEIGHT OF SOIL		6226 6242	0	46	5
6232		TYPE OF FOUNDATION		6210 6254	0	42	9
6234		MAT FOUNDATION LOCATED AT OR NEAR SURFACE		6210	0	42	9
6236		MAT FOUNDATION EMBEDDED WITHOUT EFFECTIVE WALL CONTACT		6210	0	42	9
6238	XTMOD1	EFFECTIVE PERIOD FOR TYPICAL BUILDING	6211 6212 6214 6216 6218	6210	7	42	2
6240	XTMOD2	EFFECTIVE PERIOD FOR MAT FOUNDATION BUILDING	6211 6242 6244 6218 6224 6246	6210	7	42	2
6241		USE OF ALTERNATE EFFECTIVE PERIOD DESIRED		6210	0	42	9
6242	XALPHA	RELATIVE DENSITY OF STRUCTURE AND SOIL	6208 6218 6230 6248	6240	6	43	2
6244	XRA	CHARACTERISTIC FOUNDATION LENGTH BASED ON AREA	6248	6240 6258	1	43	7
6246	XRM	CHARACTERISTIC FOUNDATION LENGTH BASED ON INERTIA	6250	6240 6258	1	43	7
6248		AREA OF FOUNDATION		6242 6244	0	44	7
6250		STATIC MOMENT OF INERTIA OF FOUNDATION		6246	0	44	7
6252	XBMODC	COMPUTED FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYS	6254 6210 6211	6206	12	37	2
6254	BZERO	FOUNDATION DAMPING FACTOR	6232 6262 6266 6210 6224 6256 6264	6252	11	38	2
6256	XFIG61	DAMPING VALUE FROM FIGURE 6-1	6211 6210 6258 6218 1415	6254 6264	9	40	2
6258	RFOUND	CHARACTERISTIC FOUNDATION LENGTH	6218 2236 6244 6246	6256	6	41	4
6262		FOUNDATION IS UNIFORM SOFT STRATUM OVER ROCK LIKE STRATUM		6254	0	39	12
6264	XBZPR	FOUNDATION DAMPING FACTOR FOR PILE FOUNDATIONS	6266 6224 6210 6256	6254	10	39	2
6266		TOTAL DEPTH OF SOFT STRATUM		6254 6264	0	40	11
6268	XDFLSS	MODIFIED ELF DEFLECTIONS FOR SOIL STRUCTURE INTERACTION	6200 4208 4522 4608 6216 2226	4610	22	27	2
6300	VM1SSI	MODE 1 BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION	6310 5515	5510 6340	17	34	0
6310	XDVMSS	SOIL STRUCTURE INTERACTION REDUCTION IN MODE 1 BASE SHEAR	5520 6320 6206 6208	6300	16	35	0
6320	YCSMSS	MODE 1 SEISMIC COEFFICIENT MODIFIED FOR SOIL STRUCT INT	6210 1405 1415 3210 3220 5550 3354	6310	15	36	0
6330	XHMHAR	MODAL HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION	4340 5540 2226 2243	6218	4	45	2
6340	XMDSSI	MODE 1 DEFLECTIONS MODIFIED FOR SOIL STRUCTURE INTERACTION	6300 5515 5720 2226 6216 5635	5630	22	29	0
7001	FDR	FOUNDATION DESIGN REQUIREMENTS	1490 7210 7230 7300 7400 7500 7600	1345 1365	48	3	0
7210	FCSR	FOUNDATION COMPONENT STRENGTH REQUIREMENT	3702 7220 7215 9001 10001 11001 12001	7001	47	4	0
7215	YSFC	STRENGTH OF FOUNDATION COMPONENTS	9210 10210 11210 12210	7210	5	5	41
7220	ZRSNS	REQUIRED STRENGTH WITHOUT SEISMIC LOAD	3707 3708 3710	7210 7230	3	5	43
7230	FSCR	FOUNDATION SOIL CAPACITY REQUIREMENT	7240 7220 7250 7260 7270 3702	7001	38	4	9
7240		SOIL CAPACITY UNDER NON-SEISMIC CONDITIONS		7230	0	5	46
7250		SETTLEMENT UNDER NON-SEISMIC CONDITIONS		7230	0	5	46
7260		MAXIMUM SETTLEMENT STRUCTURE CAN WITHSTAND		7230	0	5	46

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
7270	ZELSSC	ELASTIC LIMIT OF SOIL UNDER SEISMIC CONDITIONS	3160	7230	2	5	44
7300	ZCAFR	CATEGORY A FOUNDATION REQUIREMENT		3620 7001 7400	0	9	42
7400	CBFR	CATEGORY B FOUNDATION REQUIREMENT	7300 7404 7428 7438	3630 7001 7500	7	8	36
7404	CBSIR	CATEGORY B SOIL INVESTIGATION REQUIREMENT	7408 7410 7412 7413 7414 7416 7418 7420 7424 7426	7400 7510	1	9	41
7408		REGULATORY AGENCY REQUIRES SOIL INVESTIGATION REPORT		7404 7510	0	10	41
7410		SOIL INVESTIGATION MADE		7404	0	10	41
7412		SOIL INVEST REPORT SATISFIES NON-SEISMIC REQUIREMENTS		7404	0	10	41
7413		SOIL INVEST REPORT INCLUDES ELASTIC LIMIT UNDER SEIS COND		7404	0	10	41
7414		SOIL INVEST REPORT CONSIDERS SOIL CAPACITY UNDER SEIS COND		7404	0	10	41
7416		SOIL INVEST REPORT CONSIDERS SLOPE INSTABIL UNDER SEIS COND		7404	0	10	41
7418		SOIL INVEST REPORT CONSIDERS LIQUEFACTION UNDER SEIS COND		7404	0	10	41
7420		SOIL INVEST REPORT CONSIDERS SURFACE RUPTURE UNDER SEIS COND		7404	0	10	41
7424		POLES EMBEDDED IN EARTH USED TO RESIST AXIAL AND LAT LOAD		7404	0	10	41
7426		SOIL INVEST REPORT GIVES DESIGN CRITERIA FOR POLE EMBEDMENT		7404	0	10	41
7428	CBFTR	CATEGORY B FOUNDATION TIE REQUIREMENT	7430 3125 1415 7432 7434 7436	7400	6	9	36
7430		EA INDIVID PILE CAP, DRILLED PIER, OR CAISSON INTERCONNECTED		7428	0	10	41
7432		LARGER OF CONNECTED PILE CAP LOADS		7428	0	10	41
7434		LARGER OF CONNECTED COLUMN LOADS		7428	0	10	41
7436		EQUIVALENT FOUNDATION RESTRAINT PROVIDED AND APPROVED		7428 7520	0	10	41
7438	CBFPR	CATEGORY B FOUNDATION PILE REQUIRMENT	7440 7442 7444 7446 7452 7476 7490 7492 7494	7400	3	9	39
7440		FOUNDATION STRUCTURAL COMPONENTS		7438 7535	0	10	41
7442		EMBEDDMENT OF PILE REINFORCEMENT IN PILE CAP		7438	0	10	41
7444	MDL	MINIMUM DEVELOPMENT LENGTH	7450 7448	7438 7490 7494	1	11	39
7446		PILE TYPE		7438 7535	0	10	41
7448		REINFORCING BAR CONFIGURATION		7444	0	12	39
7450		BAR DEVELOPMENT LENGTH PER CHAPTER 11 (ACI 318)		7444	0	12	39
7452	CBUCPR	CATEGORY B UNCASED CONCRETE PILE REQUIREMENT	7454 7456 7458 7460 7462 7464 7466 7468 7470 7472 7474	7438	1	10	40
7454		LENGTH OF PILE REINFORCEMENT FROM TOP		7452 7476 7490 7492 7494 7540 7550	0	11	40
7456		PILE DIAMETER		7452 7540	0	11	40
7458		AREA OF PILE REINFORCEMENT		7452 7476 7490 7492 7494 7540	0	11	40
7460		AREA OF PILE CONCRETE		7452 7476 7490 7492 7494 7540 7550	0	11	40
7462		NUMBER OF BARS IN PILE		7452 7540	0	11	40
7464		SIZE OF BARS IN PILE		7452 7540	0	11	40
7466		TIES PROVIDED FOR FULL LENGTH OF PILE REINFORCEMENT		7452 7540	0	11	40
7468		MAXIMUM SPACING OF TIES IN PILE		7452 7540	0	11	40
7470		DIAMETER OF BARS IN PILE		7452 7540	0	11	40
7472		SPACING OF TIES AT TOP 2 FEET OF PILE		7452 7494	0	11	40
7474		SPIRAL PROVIDED EQUIVALENT TO TIES		7452 7494	0	11	40

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS			DEPENDENTS			INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
7476	CBCCPR	CATEGORY B CASED CONCRETE PILE REQUIREMENT	7454	7478	7458	7438			1	10	40
			7460	7480	7482						
			7484	7486	7488						
7478		LENGTH OF PILE				7476	7492	7540	0	11	40
						7550					
7480		SPIRAL REINFORCEMNT PROVIDED FOR FULL LENGTH OF PILE REINF				7476	7550		0	11	40
7482		DIAMETER OF SPIRAL BAR IN PILE				7476	7550		0	11	40
7484		MAXIMUM PITCH OF SPIRAL IN PILE				7476	7550		0	11	40
7486		PITCH OF SPIRAL AT TOP 2 FEET OF PILE				7476			0	11	40
7488		TIES PROVIDED EQUIVALENT TO SPIRAL				7476			0	11	40
7490	CBSPPR	CATEGORY B STEEL PIPE PILE REQUIREMENT	7454	7444	7458	7438			2	10	39
			7460								
7492	CBPCPR	CATEGORY B PRECAST CONCRETE PILE REQUIREMENT	7454	7478	7458	7438			1	10	40
			7460								
7494	CBPSPR	CATEGORY B PRESTRESSED CONCRETE PILE REQUIREMENT	7454	7444	7458	7438			2	10	39
			7460	7496	7472						
			7498	7474							
7496		TIES PROVIDED AT TOP 2 FEET OF PILE				7494			0	11	40
7498		SIZE OF TIES IN PILE				7494	7540		0	11	40
7500	CCFR	CATEGORY C FOUNDATION REQUIREMENT	7400	7510	7520	3670	7001	7600	8	7	36
			7535								
7510	CCSIR	CATEGORY C SOIL INVESTIGATION REQUIREMENT	7408	7404	7515	7500			2	8	41
7515		SOIL INVEST REPORT INCLUDES LATERAL PRESS ON WALL DUE TO EQ				7510			0	9	42
7520	CCFTR	CATEGORY C FOUNDATION TIE REQUIREMENT	7525	3125	1415	7500			6	8	37
			7530	7436							
7525		EACH INDIVIDUAL SPREAD FOOTING INTERCONNECTED				7520			0	9	42
7530		LARGER OF CONNECTED FOOTING LOADS				7520			0	9	42
7535	CCPR	CATEGORY C FOUNDATION PILE REQUIREMENT	7440	7446	7540	7500			7	8	36
			7550	7570	7595						
7540	CCUCPR	CATEGORY C UNCASED CONCRETE PILE REQUIREMENT	7454	7478	7458	7535			1	9	41
			7460	7462	7464						
			7466	7468	7470						
			7545	7456	7498						
7545		SPACING OF TIES AT TOP 4 FEET OF PILE				7540			0	10	41
7550	CCCCPR	CATEGORY C CASED CONCRETE PILE REQUIREMENT	7454	7478	7555	7535			1	9	41
			7460	7560	7480						
			7482	7484	7565						
7555		AREA OF PILE REINFORCEMENT IN UPPER 2/3 OF PILE				7550			0	10	41
7560		NUMBER OF BARS IN UPPER 2/3 OF PILE				7550			0	10	41
7565		PITCH OF SPIRAL AT TOP 4 FEET OF PILE				7550			0	10	41
7570	CCPCPR	CATEGORY C PRECAST CONCRETE PILE REQUIREMENT	7575	11662	7580	7535			3	9	39
			7585	7590							
7575		TIES PROVIDED IN TOP HALF OF PILE				7570			0	10	41
7580		PILE DESIGNED TO RESIST FLEXURE DUE TO EARTHQUAKE				7570			0	10	41
7585		PILE STRESS AT MAXIMUM SOIL DEFORMATION IN EARTHQUAKE				7570			0	10	41
7590		ELASTIC LIMIT OF PILE				7570			0	10	41
7595	CCSPR	CATEGORY C STEEL PILE REQUIREMENT	3130	3125		7535			6	9	36
7600	CDFR	CATEGORY D FOUNDATION REQUIREMENT	7500	7620		3680	7001		9	6	36
7620		PRECAST-PRESTRESSED PILES USED TO RESIST FLEX DUE TO EQ				7600			0	7	44
8001	AMEDR	ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT	8100	8110	8135	1345			49	2	0
			8165	8200	8300						
			1230	1240	13301						
8100	AMEPA	ARCHITECTURAL/MECHANICAL/ELECTRICAL PROVISIONS APPLICABLE	2114	8205	8303	8001			4	3	44
			8105	1425	1430						

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS			DEPENDENTS			INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
8105	PL	A/M/E PERFORMANCE LEVEL	2114	8106	8107	1628	8100	8190	3	20	28
						8250	8363	8369			
8106	XPLA	PERFORMANCE LEVEL FROM TABLE8-B	2114	1430	2243	8105			2	21	28
			2227	8236	8237						
			8238								
8107	XPLME	PERFORMANCE LEVEL FROM TABLE8-C	2114	1430		8105			2	21	28
8110	AMESR	A/M/E COMPONENT STRENGTH REQUIREMENT	8115	8112	8120	8001			7	3	41
			8125	2114	8130						
			8230	8235							
8112	ZAMECR	A/M/E COMPONENT RESISTANCE				8110			0	4	47
8115	FP	NONSTRUCTURAL SEISMIC FORCE	2114	8215	8309	3749	8110		6	17	28
8120		POINT OF APPLICATION OF FORCE ON A/M/E COMPONENT				8110			0	4	47
8125		DIRECTION OF APPLICATION OF FORCE ON A/M/E COMPONENT				8110			0	4	47
8130	ZFPV	VERTICAL SEISMIC FORCE	8313	8309		8110			6	4	41
8135	AMEIRR	A/M/E INTERRELATIONSHIP REQUIREMENT	8140	8145	8150	8001			1	3	47
			8155	8160							
8140		INTERRELATIONSHIP OF A/M/E SYSTEMS EXISTS				8135			0	4	47
8145		FAILURE OF A/M/E COMPONENT CAUSES FAILURE AT HIGHER PERF LEV				8135			0	4	47
8150		INTERACTION OF A/M/E SYSTEM WITH STRUCTURE EXISTS				8135			0	4	47
8155		EFFECT OF A/M/E RESPONSE ON STRUCTURE CONSIDERED				8135			0	4	47
8160		EFFECT OF A/M/E DEFORM COMPATIBILITY WITH STRUCT CONSIDERED				8135			0	4	47
8165	AMEAR	A/M/E ATTACHMENT REQUIREMENT	8170	8175	8180	8001			1	3	47
			8185								
8170		ALL A/M/E COMPONENTS ATTACHED TO STRUCTURE				8165			0	4	47
8175		ATTACHMENTS TRANSMIT SEISMIC FORCE TO STRUCTURE				8165			0	4	47
8180		FRICTION DUE TO GRAVITY CONSIDERED AS RESISTANCE				8165			0	4	47
8185		ATTACHMENT DES DOCUMENTATION SUFFICIENT TO VERIFY COMPLIANCE				8165			0	4	47
8190	P	PERFORMANCE CHARACTERISTIC FACTOR	8105			8215	8309		4	19	28
8200	ARCHDR	ARCHITECTURAL DESIGN REQUIREMENT	8210	8240	8250	8001			30	3	18
			8270								
8205		ARCHITECTURAL COMPONENT LISTED IN TABLE8-B				8100			0	4	47
8210		ARCH COMPONENT DESIGN OR CRITERIA INCLUDED IN DESIGN DOC				8200			0	4	47
8215	XFPA	SEISMIC FORCE FOR ARCHITECTURAL COMPONENTS	1415	8220	8190	8115			5	18	28
			8225								
8220	XCCA	SEISMIC COEFFICIENT FOR ARCHITECTURAL COMPONENTS	2114			8215			1	19	31
8225		WEIGHT OF A/M/E COMPONENT				8215	8309	8324	0	21	30
8230		WIND LOAD ON EXTERIOR WALL				8110			0	4	47
8235		CODE HORIZONTAL LOAD ON PARTITION				8110			0	4	47
8236		DISTANCE FROM EXT WALL TO CLOSEST POINT OF ACCESS				8106			0	22	29
8237		BUILDING LOCATED IN AN URBAN AREA				8106			0	22	29
8238		BUILDING CONTAINS HIGHLY FLAMMABLE MATERIAL				8106			0	22	29
8240	EWAR	EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT	2114	8245	4660	8200			29	4	18
8245		DUCTILITY/ROTATION CAPACITY PROVIDED				8240			0	5	46
8250	ACDR	ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT	8105	8255	4660	8200			29	4	18
			8260	8265							
8255		HORIZONTAL DRIFT PROVIDED FOR IN DESIGN OF ARCH COMPONENT				8250			0	5	46
8260		ARCH COMPONENT RELATED TO HORIZONTAL CANTILEVER				8250			0	5	46
8265		VERTICAL DEFLECTION OF CANTILEVER PROVIDED FOR IN ARCH COMP				8250			0	5	46
8270	OOPER	ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT	8275	8280	8285	8200			1	4	46
8275		MATERIAL BEHAVIOR OF ARCHITECTURAL COMPONENT				8270			0	5	46
8280		OUT OF PLANE BENDING DEFLECTION DUE TO SEISMIC FORCE				8270			0	5	46
8285		DEFLECTION CAPABILITY OF ARCHITECTURAL COMPONENT				8270			0	5	46
8300	MEDR	MECHANICAL/ELECTRICAL DESIGN REQUIREMENT	8306	8345	8360	8001			48	3	0
			8372								

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
8303		MECH/ELEC COMPONENT LISTED IN TABLE8-C		8100	0	4	47
8306		M/E COMPONENT DESIGN OR CRITERIA INCLUDED IN DESIGN DOCUMENT		8300	0	4	47
8309	FPME	SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT	8310 8311 1415 8312 8190 8315 8318 8225	8115 8130 8345	5	18	28
8310		ANALYSIS PERFORMED TO JUSTIFY REDUCED M/E FORCE		8309	0	19	32
8311		RESULT OF MECH/ELECT COMPONENT FORCE ANALYSIS		8309	0	19	32
8312	XCCME	SEISMIC COEFFICIENT FOR MECHANICAL/ELECTRICAL COMPONENT	2114 8339	8309	1	19	31
8313	XCCVME	SEISMIC COEFFICIENT FOR VERTICAL FORCE ON M/E COMPONENT	2114 8339	8130	1	5	45
8315	AC	AMPLIFICATION FACTOR FOR ATTACHMENT OF M/E COMPONENT	2160 2166 8324 4240 8327	8309	4	19	28
8318	XAX	AMPLIFICATION FACTOR FOR LOCATION OF M/E COMPONENT	2226 2227	8309	1	19	31
8321	TRMS	TYPE OF RESILIENT MOUNTING SYSTEM	2161 2162	8330 8345	1	22	28
8324	TC	NATURAL PERIOD OF VIBRATION OF COMPONENT AND ATTACHMENT	8225 8330 8340 8342	8315	3	20	28
8327		LOCATION OF MECH/ELEC MOUNTING SYSTEM		8315	0	20	31
8330	K	STIFFNESS OF M/E SUPPORT WITH RESPECT TO CENTER OF GRAVITY	2160 8321 8332 8333	8324	2	21	28
8332		SPRING CONSTANT FOR MOUNTING SYSTEM		8330	0	22	29
8333		SLOPE OF M/E SUPPORT LOAD DEFLECTION CURVE AT POINT OF LOAD		8330	0	22	29
8339		TYPE OF LIGHT FIXTURE SUPPORT		8312 8313	0	20	31
8340		USE OF OTHER SUBSTANTIATED VALUE OF PERIOD DESIRED		8324	0	21	30
8342		PROPERLY SUBSTANTIATED VALUE OF PERIOD		8324	0	21	30
8345	MEADR	MECH/ELEC ATTACHMENT DESIGN REQUIREMENT	2160 9001 10001 11001 12001 8321 8348 2166 8351 8309 8354 8357	8300	47	4	0
8348		RESTRAINING DEVICE PROVIDED FOR RESILIENT MOUNTING		8345	0	5	46
8351		RESISTANCE OF RESTRAINING DEVICE ON RESILIENT MOUNT		8345	0	5	46
8354		FORCE ON COMPONENT DUE TO DECELERATION BY RESTRAINT		8345	0	5	46
8357		RESTRAINING FORCE DETERMINED BY DYNAMIC ANALYSIS		8345	0	5	46
8360	MECDR	MECHANICAL/ELECTRICAL COMPONENT DESIGN REQUIREMENT	8363 8369 1644	8300	5	4	42
8363	MECCR	M/E COMPONENT CERTIFICATION (TESTING) REQUIRED	2160 8105 1425	1637 8360	4	5	42
8369	MEACR	M/E ATTACHMENT CERTIFICATION (TESTING) REQUIRED	2160 8105	1641 8360	4	5	42
8372	MEUSIR	M/E UTILITY SERVICE INTERFACE REQUIREMENT	1430 1425 2114 8375 8378 8381 1405	8300	2	4	45
8375		TYPE OF UTILITY SERVICE		8372	0	5	46
8378		UTILITY SHUTOFF DEVICE PROVIDED		8372	0	5	46
8381		ACTION TO TRIGGER UTILITY SHUTOFF DEVICE		8372	0	5	46
9001	WMR	WOOD MATERIALS REQUIREMENT	9110 9120 1270 1350 2243 2227 1425 9701 9200 9801 9002	1345 1370 7210 8345	40	5	6
9002	WDESCR	WOOD DESIGN CATEGORY REQUIREMENT	1490 9300 9400 9500 9600	9001	7	6	38
9110		BUILDING ELEMENTS THAT RESIST SEISMIC FORCE		9001 10001 11001 11556 12001	0	15	36
9120		REQUIREMENTS OF WOOD REFERENCE DOCUMENTS		9001	0	6	45
9130		COMPONENT COVERED BY WOOD REFERENCE DOCUMENTS		9230	0	14	37
9200	ZWSCPR	WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT	9210	9001	5	6	40
9210	XSW	STRENGTH OF WOOD COMPONENTS	9220 9230	3125 3130 3393 7215 9200 9847	4	12	35

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
9220	PBIW	CAPACITY REDUCTION FACTOR FOR WOOD	2114 9240 9250 9260 9270 9280 9290	9210	1	13	37
9230	ASW	ALLOWABLE STRENGTH OF WOOD COMPONENTS	2114 9250 9130 1490 9630 9867 9877 9886 9888 9892 9235	9210	3	13	35
9235		STRENGTH FROM REFERENCE DOCUMENTS		9230	0	14	37
9240		STRESS TYPE		9220 12220	0	14	37
9250		DIAPHRAGM STRENGTH CALCULATED FROM PRINCILES OF MECHANICS		9220 9230	0	14	37
9260		SPECIES GROUP		9220 9877	0	15	36
9270		DIAPHRAGM STRENGTH FROM THESE PROVISIONS		9220	0	14	37
9280		NUMBER OF SCREWS OR NAILS IN JOINT		9220	0	14	37
9290		WIDTH OF PANEL BOUNDARY MEMBERS		9220 9867 9877	0	15	36
9300	CAWR	CATEGORY A WOOD REQUIREMENT	1350 2243 9763 9320 9330 9340	3620 9002 9400	3	10	38
9320		PORTION OF LENGTH OF WALL WITH BRACING		9300 9739	0	11	40
9330		WALL LOCATION		9300 9535 9739	0	11	40
9340		WALL BRACING APPLIED OVER FULL HEIGHT OF STORY		9300	0	11	40
9400	CBWR	CATEGORY B WOOD REQUIREMENT	9300 9420 9450 9480	3630 9002 9500	4	9	38
9420	CBWTR	CATEGORY B WOOD TIE REQUIREMENT	9430 9440	9400	1	10	40
9430		COMPONENT PROVIDING SEISMIC TIE BETWEEN TWO PORTIONS OF BLDG		9420	0	11	40
9440		COMPONENT PROVIDING ANCHORAGE OF CONC OR MAS WALLS TO FLOORS		9420	0	11	40
9450	CBLSWR	CATEGORY B LAG SCREW WASHER REQUIREMENT	9460 9470	9400	1	10	40
9460		BEARING MATERIAL UNDER HEAD OF LAG SCREW		9450	0	11	40
9470		WASHER PROVIDED UNDER HEAD OF LAG SCREW		9450	0	11	40
9480	CBEJR	CATEGORY B ECCENTRIC JOINT REQUIREMENT	9485 9490 9495	9400	1	10	40
9485		GREATEST END DISTANCE IN ANY ECCENTRIC WOOD JOINT		9480	0	11	40
9490		DEPTH OF MEMBER		9480	0	11	40
9495		SECT 208E OF REF 9.1 MODIFIED, DELETE 50% STRESS INCREASE		9480	0	11	40
9500	CCWR	CATEGORY C WOOD REQUIREMENT	9400 9515 9535 9555	3670 9002 9600	5	8	38
9515	CCPMR	CATEGORY C PLYWOOD MATERIAL REQUIREMENT	9520 9525 9530	9500	1	9	41
9520		EXPOSURE OF STRUCTURAL PLYWOOD		9515	0	10	41
9525		STRUCTURAL PLYWOOD EXPOSURE TYPE		9515	0	10	41
9530		GLUE TYPE FOR STRUCTURAL PLYWOOD		9515	0	10	41
9535	CCWFR	CATEGORY C WOOD FRAMING REQUIREMENT	2243 9540 9545 9330	9500	1	9	41
9540		WOOD DIAPHRAGM USED TO RESIST TORSION FROM CONC/MAS WALLS		9535	0	10	41
9545		SHEAR WALL SHEATHING MATERIAL		9535 9555 9600 9763 9808 9819 9888 9893	0	16	35
9555	CCWDR	CATEGORY C WOOD ,DETAILING REQUIREMENT	9560 9545 9565 9570	9500	1	9	41
9560		REF 9.1 MODIFIED FOR RESISTANCE OF NAILS PARALLEL TO GRAIN		9555	0	10	41
9565		SHEAR PANEL TYPE		9555 9856	0	10	41
9570		PLYWOOD APPLICATION		9555 9877	0	15	36
9600	CDWR	CATEGORY D WOOD REQUIREMENT	9500 9545 9620	3680 9002	6	7	38
9620		TYPE OF DIAPHRAGM FRAMING		9600	0	8	43
9630		BUILDING CONTAINS CONCRETE OR MASONRY WALLS		9230	0	14	37
9701	CLTR	CONVENTIONAL LIGHT TIMBER REQUIREMENT	9706 9739	1345 9001	4	6	41

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
9706	CWFR	CONVENTIONAL WALL FRAMING REQUIREMENT	9709 9712 9715 9718 9721 9724 9727 9730 9733 9736	9701	1	7	43
9709		DIAMETER OF FOUNDATION SILL ANCHOR BOLTS		9706	0	8	43
9712		SPACING OF FOUNDATION SILL ANCHOR BOLTS		9706	0	8	43
9715		EMBEDDMENT OF FOUNDATION SILL ANCHOR BOLTS		9706	0	8	43
9718		DOUBLE PLATES PROVIDED AT TOP OF WALL		9706	0	8	43
9721		INDIVIDUAL TOP PLATES OVERLAP AT CORNERS AND INTERSECTIONS		9706	0	8	43
9724		SPACING BETWEEN JOINTS IN INDIVIDUAL TOP PLATES		9706	0	8	43
9727		WALL STUDS BEAR FULLY ON BOTTOM PLATES		9706	0	8	43
9730		THICKNESS OF BOTTOM PLATE		9706	0	8	43
9733		WIDTH OF BOTTOM PLATE		9706	0	8	43
9736		WIDTH OF STUD		9706	0	8	43
9739	CWDR	CONVENTIONAL WALL SHEATHING REQUIREMENT	9742 9763 9745 9748 9751 9754 9757 9760 1490 2243 9330 9320	9701	3	7	41
9742		WALLS WITH SEISMIC BRACING SECTION		9739	0	8	43
9745		LOCATION OF SEISMIC BRACING SECTIONS ON WALL		9739	0	8	43
9748		SPACING OF SEISMIC BRACING SECTIONS ON WALL		9739	0	8	43
9751		WIDTH OF SEISMIC BRACING SECTION		9739	0	8	43
9754		VERTICAL JOINTS IN SHEATHING OCCUR ONLY ON STUDS		9739	0	8	43
9757		HORIZONTAL JOINTS IN SHEATHING OCCUR ONLY ON FRAMING		9739	0	8	43
9760		THICKNESS OF FRAMING MEMBERS		9739 9809 9828 9867	0	15	36
9763	WSAR	WALL SHEATHING APPLICATION REQUIREMENT	9545 9766 9769 9772 9775 9778 9781 9784 9828	9300 9739	2	11	38
9766		SPACING OF STUDS		9763 9861 9877	0	15	36
9769		THICKNESS OF SHEATHING		9763 9828 9861 9867 9877 9886 9888 9893	0	16	35
9772		BOARDS APPLIED DIAGONAL TO FRAMING		9763	0	12	39
9775		SHEATHING PANEL SIZE		9763 9856 9893	0	16	35
9778		SHEATHING PANEL ORIENTATION		9763	0	12	39
9781		SIZE OF NAILS IN SHEATHING		9763 9828 9867 9877 9886 9888 9893	0	16	35
9784		SPACING OF NAILS IN SHEATHING		9763 9888 9893	0	16	35
9801	ETCR	ENGINEERED TIMBER CONSTRUCTION REQUIREMENT	9802 9808 9898	9001	39	6	6
9802	EWRF	ENGINEERED WOOD FRAMING REQUIREMENT	9803 9804 9806 1350 9807	9801	1	7	43
9803		ALL COLUMNS FRAMED TO TRUE END BEARING		9802	0	8	43
9804		ALL COLUMNS SUPPORTED SECURELY IN POSITION		9802	0	8	43
9806		ALL COLUMNS PROTECTED FROM DETERIORATION		9802	0	8	43
9807		POSITIVE CONN PROVIDED TO RESIST UPLIFT AND LATERAL DISPL		9802	0	8	43
9808	EWSPR	ENGINEERED WOOD SHEAR PANEL REQUIREMENT	9809 9818 9819 9545 9827 9854 9878	9801	38	7	6
9809	EWSPFR	ENGINEERED WOOD SHEAR PANEL FRAMING REQUIREMENT	9760 9811 9812 9813 9814 9816 9817	9808	1	8	42
9811		CHORDS, BOUND MEMB, COLLECTORS TRANSMIT INDUCED AXIAL FORCES		9809	0	9	42

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
9812		BOUNDARY MEMBERS TIED TOGETHER AT CORNERS		9809 9856	0	10	41
9813		SHEAR STRESS TRANSFERRED AROUND OPENINGS		9809	0	9	42
9814		OPENING MATERIALLY AFFECTS PANEL STRENGTH		9809	0	9	42
9816		OPENING FULLY DETAILED ON PLANS		9809	0	9	42
9817		CONN BETWEEN PANEL AND COMPONENT RESISTS PRESCRIBED FORCES		9809	0	9	42
9818		BUILDING HAS ONE SIDE WITHOUT SHEAR WALLS		9808	0	8	43
9819	WDTR	WOOD DIAPHRAGM TORSION REQUIREMENT	9545 9821 2243	9808	2	8	41
			9823 9826 3756				
			3758				
9821		DEPTH OF DIAPHRAGM NORMAL TO OPEN SIDE		9819 9823 9828	0	13	38
9822		WIDTH OF DIAPHRAGM		9823	0	10	41
9823	YDWRD	DEPTH TO WIDTH RATIO FOR DIAPHRAGM	9821 9822	9819	1	9	41
9826		DIAGONAL SHEATHING TYPE		9819 9827	0	9	42
9827	DSSPR	DIAGONALLY SHEATHED SHEAR PANEL REQUIREMENT	9826 9828 9841	9808	37	8	6
9828	CDSR	CONVENTIONAL DIAGONAL SHEATHING REQUIREMENT	9769 9829 9781	9763 9827	1	12	38
			9831 9821 9832				
			9833 9834 9853				
			9836 9760 9838				
			9839				
9829		BOARD WIDTH		9828	0	13	38
9831		TYPE OF NAIL		9828 9867 9877	0	16	35
				9886 9888 9893			
9832		NAILS PER BOARD AT PANEL BOUNDARDY		9828	0	13	38
9833		NAILS PER BOARD AT INTERIOR FRAMING		9828	0	13	38
9834		SPACING OF JOINTS IN ADJACENT BOARDS		9828	0	13	38
9836		SPACING OF JOINTS IN BOARDS ON ANY FRAMING MEMBER		9828	0	13	38
9838		DEPTH OF FRAMING		9828	0	13	38
9839		ANGLE BETWEEN BOARDS AND FRAMING		9828	0	13	38
9841	SDSR	SPECIAL DIAGONAL SHEATHING REQUIREMENT	9842 9843 9844	9827	36	9	6
			9846				
9842		NUMBER OF LAYERS OF CONVENTIONAL DIAGONAL SHEATHING		9841	0	10	41
9843		BOTH LAYERS ON SAME FACE OF FRAMING		9841	0	10	41
9844		ANGLE BETWEEN THE BOARDS IN THE TWO LAYERS		9841	0	10	41
9846	SDCSR	CHORD STRENGTH REQUIREMENT (SPECIAL DIAGONAL)	9847 9848 9849	9841	35	10	6
			3706 9851 9852				
			9853				
9847	YCBR	CHORD BEAM RESISTANCE	9210	9846	5	11	35
9848	YCDLE	CHORD DESIGN LOAD EFFECT	9849 9851 9852	9846	1	11	39
9849		CHORD DESIGN LOAD MAGNITUDE		9846 9848	0	12	39
9851		CHORD DESIGN LOAD DIRECTION		9846 9848	0	12	39
9852		CHORD SPAN		9846 9848	0	12	39
9853		SPACING OF FRAMING MEMBERS		9828 9846	0	13	38
9854	PSPR	PLYWOOD SHEAR PANEL REQUIREMENT	9856 9861	9808	2	8	41
9856	PSPFR	PLYWOOD SHEAR PANEL FRAMING REQUIREMENT	9775 9565 9857	9854	1	9	41
			9858 9859 9860				
			9812 9882				
9857		ARRANGEMENT OF SHEATHING PANELS		9856	0	10	41
9858		FRAMING MEMBERS PROVIDED AT ALL EDGES OF EA SHEET (BLOCKED)		9856 9867 9893	0	16	35
9859		PLYWOOD DESIGNED TO RESIST SHEAR ONLY		9856	0	10	41
9860		FRAMING MEMBERS DESIGNED TO RESIST AXIAL FORCES		9856	0	10	41
9861	PSPNR	PLYWOOD SHEAR PANEL NAILING REQUIREMENT	9862 9863 9769	9854	1	9	41
			9766 9864 9866				
9862		SIZE OF NAIL AT INTERNAL MEMBERS		9861	0	10	41
9863		PANEL LOCATION		9861	0	10	41

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
9864		DIRECTION OF FACE GRAIN		9861 9877	0	15	36
9866		SPACING OF NAILS AT INTERMEDIATE MEMBERS		9861 9886	0	15	36
9867	XWSSPD	ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD DIAPHRAGM	9868 9781 9869 9769 9760 9290 9858 9871 9872 9873 9874 9876 9831	9230	1	14	36
9868		PLYWOOD GRADE		9867 9877	0	15	36
9869		PENETRATION OF NAIL INTO FRAMING		9867 9877	0	15	36
9871		ANGLE BETWEEN LOAD AND UNBLOCKED EDGES		9867	0	15	36
9872		ANGLE BETWEEN LOAD AND CONTINUOUS SHEET EDGES		9867	0	15	36
9873		SPACING OF NAILS AT PANEL BOUNDARY		9867 9877 9886	0	15	36
9874		SPACING OF NAILS AT CONTINUOUS SHEET EDGES		9867	0	15	36
9876		SPACING OF NAILS AT OTHER SHEET EDGES		9867	0	15	36
9877	XWSPSW	ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD SHEAR WALLS	9868 9781 9869 9769 9570 9873 9290 9766 9864 9260 9831	9230	1	14	36
9878	OMSPR	OTHER MATERIAL SHEAR PANEL REQUIREMENT	9879 9883 9884	9808	2	8	41
9879		DISTANCE FROM NAIL TO EDGE OF SHEET		9878	0	9	42
9881		HEIGHT OF SHEAR PANEL		9883	0	10	41
9882		WIDTH OF SHEAR PANEL		9856 9883	0	10	41
9883	YHWR	HEIGHT TO WIDTH RATIO OF SHEAR PANEL	9881 9882	9878	1	9	41
9884		WALL RESISTS LOADS FROM CONCRETE OR MASONRY WALLS		9878	0	9	42
9886	AWSFSW	ALLOWABLE WORKING STRESS SHEAR FOR FIBERBOARD SHEAR WALLS	9769 9781 9831 9887 9896 9897 9873 9866	9230	1	14	36
9887		FIBERBOARD SHEATHING TYPE		9886	0	15	36
9888	AWSLPW	ALLOWABLE WORKING STRESS SHEAR FOR LATH AND PLASTER WALLS	9545 9769 9889 9891 9784 9781 9831 9896 9897	9230	1	14	36
9889		LATH THICKNESS		9888	0	15	36
9891		PLASTER THICKNESS		9888	0	15	36
9892	AWSGBW	ALLOWABLE WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS	9896 9897 9893	9230	2	14	35
9893	BWSGBW	BASIC WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS	9545 9769 9775 9858 9784 9781 9831 9894	9892	1	15	35
9894		2-5/8" LAYERS ON SAME FACE W/#6 AT 9" BOT AND #8 AT 7" TOP"		9893	0	16	35
9896		WALL SHEATHED WITH OTHER MATERIAL THAT IS USED FOR SHEAR RES		9886 9888 9892	0	15	36
9897		SAME MATERIAL APPLIED ON BOTH FACES OF WALL		9886 9888 9892	0	15	36
9898	EWWCR	ENGINEERED WOOD WALL CONNECTION REQUIREMENT	3786 2114 9899	9801	1	7	43
9899		ELEMENT PROVIDES RESIST TO ANCH FORCE FOR CONC/MAS WALLS		9898	0	8	43
10001	SMR	STEEL MATERIALS REQUIREMENT	9110 10100 10200 10002	1345 1370 7210 8345 11858	16	14	21
10002	SDESCR	STEEL DESIGN CATEGORY REQUIREMENT	1490 10300 10400 10500	10001	15	15	21
10100		REQUIREMENTS OF STEEL REFERENCE DOCUMENTS		10001	0	15	36
10200	ZSSCPR	STEEL STRENGTH CALCULATION PRODECURE REQUIREMENT	10210	10001	4	15	32
10210	XSS	STRENGTH OF STEEL COMPONENTS	10220 10245	3125 3130 3321 3339 3393 7215 10200 10520 10530 12738	3	42	6
10220	PHIS	CAPACITY REDUCTION FACTOR FOR STEEL	2114 10225 10290 10640	10210	1	43	7

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
10225		TYPE OF STEEL CONNECTION		10220	0	44	7
10230		STRENGTH PERMITTED BY STEEL REFERENCE DOCUMENTS		10245	0	44	7
10240	MSRDR	MODIFICATION TO STEEL REFERENCE DOCUMENTS REQUIREMENT	2115 10250 10260	10245	1	44	6
			10265 10270 10280				
10245	YRSS	MODIFIED REFERENCE STRENGTH FOR STEEL	10240 10230	10210	2	43	6
10250		MODIFICATIONS A THROUGH D OF SECTION 10.2.1 (AISC STRENGTHS)		10240	0	45	6
10260		MODIFICATION E OF SECTION 10.2.1 (AISC P-DELTA EFFECTS)		10240	0	45	6
10265		P-DELTA EFFECT INCLUDED IN ANALYSIS		10240	0	45	6
10270		MODIFICATIONS A AND E OF SECTION 10.2.2 (AISI COLD FORMED)		10240	0	45	6
10280		MODIFICATION OF SECTION 10.2.3 (CABLE STRENGTHS)		10240	0	45	6
10290		CONNECTION DESIGNED TO DEVELOP FULL STRENGTH OF MEMBER		10220	0	44	7
10300	ZCASR	CATEGORY A STEEL REQUIREMENT		3620 10002 10400	0	18	33
10400	CBSR	CATEGORY B STEEL REQUIREMENT	10300 10450 3303	3630 10002 10500	13	17	21
			2114 2115 10420				
			10430 10440				
10420		REQUIREMENTS OF PART I OF REF 10.1 (AISC ELASTIC DESIGN)		10400 10450	0	43	8
10430		REQUIREMENTS OF REFERENCE 10.2 (AISI COLD FORMED)		10400 10450	0	43	8
10440		REQUIREMENTS OF REFERENCE 10.3 (AISI STAINLESS)		10400 10450	0	43	8
10450	OSMFR	ORDINARY STEEL MOMENT FRAME REQUIREMENT	10420 10430 10440	3330 10400 10500	1	42	8
10500	CCDSR	CATEGORY C AND D STEEL REQUIREMENT	10400 3303 3309	3670 3680 10002	14	16	21
			2115 3327 10600				
			1490 2243 10450				
			10520 10530				
10520	YCSBFM	COMPRESSION STRENGTH OF BRACED FRAME MEMBER	10210	10500	4	17	30
10530	YTSBFM	TENSION STRENGTH OF BRACED FRAME MEMBER	10210	10500	4	17	30
10600	SSMFR	SPECIAL STEEL MOMENT FRAME REQUIREMENT	10620 10630	3336 10500 12736	1	42	8
10620		REQUIREMENTS OF PART II OF REF 10.1 (AISC PLASTIC DESIGN)		10600	0	43	8
10630		MODIFICATIONS 1 THRU 7 OF SECT 10.6 (SPECIAL MOMENT FRAMES)		10600	0	43	8
10640		MODIFICATION 6 OF SECTION 10.6 (BEAM COLUMN JOINT)		10220	0	44	7
11001	CMR	CONCRETE MATERIALS REQUIREMENT	9110 11100 11200	1345 1370 7210	46	5	0
			11002	8345			
11002	CDESCR	CONCRETE DESIGN CATEGORY REQUIREMENT	1490 11300 11400	11001	45	6	0
			11500				
11100		REQUIREMENT OF CONCRETE REFERENCE DOCUMENT		11001 11310	0	11	40
11200	ZCSCPR	CONCRETE STRENGTH CALCULATION PROCEDURE REQUIREMENT	11210	11001	5	6	40
11210	SC	STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS	11220 2114 11230	3125 3130 3321	4	47	0
			11240 11275	3339 3393 7215			
				11200 11620 11622			
				11624 11626 11755			
				11756 11864 11876			
				12738			
11220		TYPE OF FINAL PLACEMENT OF CONCRETE		11210	0	48	3
11230	PHIC	CAPACITY REDUCTION FACTOR FOR CONCRETE	2114 11245 11290	11210 11888	3	48	0
			11295 11250 11280				
			11765 11260 11270				
			1490 11235 11285				
11235		CAPACITY REDUCTION FACTOR FROM SEC 9.2 OF REF DOCUMENT		11230	0	49	2
11240		STRENGTH PERMITTED FROM REFERENCE DOCUMENT		11210	0	48	3
11245		TYPE OF STRESS		11230	0	49	2

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
11250		NOMINAL CONCRETE COMPRESSIVE STRENGTH		11230 11275 11514 11563 11584 11600 11700 11701 11773 11790 11812 11818 11820 11832 11835 11840 11846 11880	0	51	0
11260		WEIGHT OF CONCRETE AGGREGATE		11230 11275 11514 11790 11812	0	49	2
11270		MODE OF STRESS GOVERNING STRENGTH OF COMPONENT		11230	0	49	2
11271		DIAMETER OF ANCHOR BOLT		11275	0	49	2
11272		MINIMUM EMBEDMENT OF ANCHOR BOLT		11275	0	49	2
11275	XALAB	ALLOWABLE LOADS ON ANCHOR BOLTS	11271 11272 11250 11260 11276 11277 11278 11350 1425	11210	2	48	1
11276		ANCHOR BOLT SPECIFICATIONS		11275	0	49	2
11277		ANCHOR BOLT SPACING		11275	0	49	2
11278		ANCHOR BOLT EDGE DISTANCE		11275	0	49	2
11280		GROSS AREA OF CONCRETE		11230 11563 11584 11600 11700 11701 11773 11880	0	51	0
11285		ALL SHEAR RESISTED BY DOWELS AND SHEAR FRICTION		11230	0	49	2
11290	ZAXALL	AXIAL FORCE DUE TO ALL LOADS**		11230 11563 11600 11700 11880	0	49	2
11295	ZAXEQ	AXIAL FORCE DUE TO EARTHQUAKE**		11230 11584	0	49	2
11300	CACR	CATEGORY A CONCRETE REQUIREMENT	11310 11340	3620 11002 11400	14	9	28
11310	CACFR	CATEGORY A CONCRETE FRAMING REQUIREMENT	3303 2115 3309 3327 11320 11330 11100	11300	13	10	28
11320		TYPE OF CONCRETE BRACED FRAME		11310	0	11	40
11330		TYPE OF CONCRETE SHEAR WALL		11310	0	11	40
11340	CACABR	CATEGORY A CONCRETE ANCHOR BOLT REQUIREMENT	2114 11350 11360 11370 11380 11390	11300	1	10	40
11350		LOCATION OF ANCHOR BOLT		11275 11340 12409	0	49	2
11360		TIES PROVIDED AROUND ANCHOR BOLT		11340	0	11	40
11370		DISTANCE OF ANCHOR BOLT TIES FROM TOP		11340	0	11	40
11380		SIZE OF ANCHOR BOLT TIES		11340	0	11	40
11390		NUMBER OF ANCHOR BOLT TIES		11340	0	11	40
11400	CBCR	CATEGORY B CONCRETE REQUIREMENT	11300 3303 2115 3327 11600	3630 11002 11500	15	8	28
11500	CCDCR	CATEGORY C AND D CONCRETE REQUIREMENT	11400 11507 11556 11563 11584	3670 3680 11002	44	7	0
11507	CCDCMR	CATEGORY C AND D CONCRETE MATERIAL REQUIREMENT	11514 11521	11500	2	8	41
11514	CCDCSR	CATEGORY C AND D CONCRETE STRENGTH REQUIREMENT	2114 11260 11250	11507	1	9	41
11521	CCDCRR	CATEGORY C AND D CONCRETE REINFORCEMENT REQUIREMENT	2114 11528 11535 11542 11549 11550	11507	1	9	41
11528		MATERIAL SPECIFICATION OF REINFORCEMENT		11521	0	10	41
11535		ACTUAL MILL TEST YIELD STRESS		11521	0	10	41
11542		ACTUAL MILL RETEST YIELD STRESS		11521	0	10	41
11549		ACTUAL MILL TEST ULTIMATE STRESS		11521	0	10	41
11550		SPECIFIED YIELD STRESS		11521 11812 11888	0	13	38
11556	CCDCFL	CATEGORY C AND D CONCRETE FRAMING LIMITATION	3303 2115 3327 11700 9110 11800	11500	43	8	0

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
11563	CCDNSR	CATEGORY C AND D NON-SEISMIC RESISTING SYSTEM CONCRETE REQT	2114 11570 11577 11290 11250 11280 11732 11765 11662	3390 11500	4	8	39
11570		REQT FOR MINIMUM REINFORCEMENT OF CHAP 7, 10, 11 OF REF 11.1		11563	0	9	42
11577		NONLINEAR BEHAVIOR REQD TO SATISFY DEFORM COMPATIBILITY REQT		11563	0	9	42
11584	CCDCDR	CATEGORY C AND D CONCRETE DISCONTINUITY REQUIREMENT	2114 11591 11295 11250 11280 11765	11500	3	8	40
11591		COLUMN SUPPORTS DISCONTINUOUS STIFF ELEMENT		11584	0	9	42
11600	CBOCMF	CATEGORY B ORDINARY CONCRETE MOMENT FRAME REQUIREMENT	11602 11290 11250 11280 11662	3330 11400	8	42	1
11602	OCFMR	ORDINARY CONCRETE FLEXURAL MEMBER REQUIREMENT	11604 11618 11628 11640	11600	7	43	1
11604	OCFMRR	ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT REQUIREMENT	11606 11608 11610 11612 11614 11616	11602 11716	1	45	5
11606		TENSILE REINFORCEMENT RATIO FOR TOP REINFORCEMENT		11604	0	46	5
11608		TENSILE REINFORCEMENT RATIO FOR BOTTOM REINFORCEMENT		11604	0	46	5
11610		YIELD STRENGTH OF TENSILE REINFORCEMENT		11604	0	46	5
11612		NUMBER OF CONTINUOUS TOP BARS		11604	0	46	5
11614		NUMBER OF CONTINUOUS BOTTOM BARS		11604	0	46	5
11616		MINIMUM SIZE OF CONTINUOUS BARS		11604	0	46	5
11618	OCFMMR	ORDINARY CONCRETE FLEXURAL MEMBER MOMENT RESISTANCE REQT	11620 11622 11624 11626	11602 11716	6	45	0
11620	YPMSFJ	POSITIVE MOMENT STRENGTH AT FACE OF JOINT	11210	11618	5	46	0
11622	YNMSFJ	NEGATIVE MOMENT STRENGTH AT FACE OF JOINT	11210	11618	5	46	0
11624	YPMSSY	POSITIVE MOMENT STRENGTH AT SECTION OF POTENTIAL YIELD	11210	11618	5	46	0
11626	YMMSM	MINIMUM MOMENT STRENGTH IN MEMBER	11210	11618	5	46	0
11628	OCFMRA	ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT ANCHORAGE	11630 11632 11634 11636 11638	11602 11716	1	45	5
11630		FLEXURAL MEMBERS FRAME INTO OPPOSITE FACES OF COLUMN		11628	0	46	5
11632		FLEXURAL REINFORCEMENT IS CONTINUOUS THROUGH COLUMN		11628	0	46	5
11634		VARIATION IN BEAM CROSS SECTION PREVENTS CONTINUOUS REINF		11628	0	46	5
11636		FLEXURAL REINF EXTENDED TO FAR FACE OF COLUMN CONFINED AREA		11628	0	46	5
11638		FLEXURAL REINFORCEMENT ANCHORED TO DEVELOP YIELD STRESS		11628	0	46	5
11640	OCFMWR	ORDINARY CONCRETE FLEXURAL MEMBER WEB REINF REQUIREMENT	11642 11644 11646 11648 11650 11652 11654 11656 11658 11660 11661	11602	1	44	6
11642		WEB REINFORCEMENT PROVIDED OVER ENTIRE MEMBER		11640	0	45	6
11644		ORIENTATION OF WEB REINFORCEMENT		11640	0	45	6
11646		NUMBER OF LEGS IN EACH STIRRUP		11640	0	45	6
11648		SIZE OF WEB REINFORCEMENT		11640	0	45	6
11650		DISTANCE FROM END OF CONCRETE FLEXURAL MEMBER		11640 11743	0	47	4
11652		SPACING OF WEB REINFORCEMENT		11640 11773	0	51	0
11654		EFFECTIVE DEPTH OF FLEXURAL MEMBER		11640 11710 11719 11741 11743 11770 11789	0	51	0
11656		AREA OF WEB REINFORCEMENT		11640 11773	0	51	0
11658		AREA OF TENSION REINFORCEMENT		11640	0	45	6
11660		AREA OF COMPRESSION REINFORCEMENT		11640	0	45	6
11661		HOOPS PROVIDED FOR WEB REINFORCEMENT		11640 11741	0	46	5
11662	OCBCLR	ORDINARY CONCRETE BEAM COLUMN LATERAL REINFORCEMENT REQT	11664 11668 11670 11672 11674 11676 11678 11680 11682 11684 11686 11688	7570 11563 11600	2	43	6

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
11664		DIST FROM EA JOINT OR SEC OF YIELD WHERE LAT REINF PROVIDED		11662 11765	0	50	1
11668	XLO	MINIMUM DISTANCE FOR LATERAL REINFORCEMENT	11690 11692	11662	1	44	6
11670		ANGLE OF HOOK AT END OF TIE		11662	0	44	7
11672		EXTENSION AT END OF TIE		11662	0	44	7
11674		DIAMETER OF TIE BAR		11662 11680 11741	0	46	5
11676		CROSS TIES USED FOR LATERAL REINFORCEMENT		11662	0	44	7
11678		SPACING OF LATERAL REINFORCEMENT WITHIN LO		11662 11741	0	46	5
11680	XSH	MAXIMUM ALLOWABLE SPACING OF LATERAL REINFORCEMENT	11694 11674 11696	11662	1	44	6
11682		DISTANCE FROM FACE OF JOINT TO FIRST LATERAL REINFORCEMENT		11662 11741	0	46	5
11684		MAXIMUM SPACING OF LATERAL REINFORCEMENT IN MEMBER		11662	0	44	7
11686		TIES OR LATERAL REINFORCEMENT PROVIDED THROUGHOUT		11662	0	44	7
11688		LATERAL REINFORCEMENT PROVIDED THROUGH JOINT		11662	0	44	7
11690		CLEAR HEIGHT OF COLUMN		11668 11770	0	51	0
11692		MAXIMUM DIMENSION OF COLUMN CROSS SECTION		11668	0	45	6
11694		MINIMUM DIMENSION OF COLUMN CROSS SECTION		11680	0	45	6
11696		DIAMETER OF SMALLEST LONGITUDINAL BAR		11680 11741	0	46	5
11700	SCMFR	SPECIAL CONCRETE MOMENT FRAME REQUIREMENT	11290 11280 11250 11701 11708 11749 11786	3336 11556 12736	9	42	0
11701	SCSSR	SPECIAL CONCRETE SHEAR STRENGTH REQUIREMENT	11702 11704 11705 11280 11250 11707	11700	1	43	7
11702	ZSSEQ	SHEAR STRESS DUE TO SEISMIC FORCES**		11701	0	44	7
11704	ZSSALL	SHEAR STRESS DUE TO ALL FORCES **		11701	0	44	7
11705	ZAXEQD	AXIAL COMPRESSIVE FORCE DUE TO SEISMIC AND DEAD LOAD**		11701	0	44	7
11707		SHEAR RESIST OF CONC USED TO DETERMINE AMOUNT OF LAT REINF		11701	0	44	7
11708	SCFMR	SPECIAL CONCRETE FLEXURAL MEMBER REQUIREMENT	11710 11716 11732	11700	8	43	0
11710	SCFMPR	SPECIAL CONCRETE FLEXURAL MEMBER PROPORTIONING REQT	11654 11711 11713 11714	11708	1	44	6
11711		CLEAR SPAN OF FLEXURAL MEMBER		11710	0	45	6
11713		WIDTH OF FLEXURAL MEMBER		11710 11789	0	45	6
11714		WIDTH OF FLEXURAL MEMBER OVERHANGING SUPPORT		11710	0	45	6
11716	SCFMRR	SPECIAL CONCRETE FLEXURAL MEMBER REINFORCEMENT REQT	11604 11618 11628 11717 11719	11708	7	44	0
11717		LONGITUDINAL REINF IN SPECIAL MOMENT FRAME IS SPLICED		11716	0	45	6
11719	SFMLRS	SPECIAL CONCRETE FLEXURAL MEMBER REINFORCEMENT SPLICE REQT	11720 11722 11723 11654 11725 11726 11728 11729 11731	11716 11761	1	45	5
11720		TYPE OF REINFORCEMENT SPLICE		11719 11761	0	46	5
11722		HOOP OR SPIRAL REINFORCEMENT PROVIDED OVER THE LAP LENGTH		11719	0	46	5
11723		SPACING OF HOOP OR SPIRAL LAP REINFORCEMENT		11719	0	46	5
11725		LOCATION OF LAP SPLICE		11719 11761	0	46	5
11726		REQUIREMENT OF SECT 7.5.5.1 OF REFERENCE 11.1		11719	0	46	5
11728		REQUIREMENT OF SECT 7.5.5.2 OF REFERENCE 11.1		11719	0	46	5
11729		NOT MORE THAN ALTERNATE BARS IN A LAYER SPLICED AT A SECTION		11719	0	46	5
11731		LONGITUDINAL DISTANCE BETWEEN SPLICES OF ADJACENT BARS		11719	0	46	5
11732	SCFMLR	SPECIAL CONCRETE FLEXURAL MEMBER LATERAL REINFORCEMENT REQT	11734 11741	11563 11708	3	44	4
11734	SCFMDS	SPECIAL CONCRETE FLEXURAL MEMBER DESIGN SHEAR REQT	11735 11737 11738 11740	11732	1	45	5
11735		MEMBER END MOMENTS TAKEN AS MAX RESIST MOMENTS OF OPP SIGN		11734 11777	0	51	0
11737		MEMB ASSUMED TO LOADED WITH TRIBUTARY GRAVITY LOAD		11734	0	46	5
11738		MAX RESIST MOMENT CALCULATED WITHOUT CAPACITY REDUCT FACTOR		11734 11777 11797	0	51	0
11740		MAX RESIST MOMENT CALCULATED WITH TENSILE STRESS OF 1.25 FY		11734 11797	0	46	5

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
11741	SCFMHR	SPECIAL CONCRETE FLEXURAL MEMBER HOOP REINFORCEMENT REQT	11743 11661 11747 11682 11678 11654 11696 11674	11732	2	45	4
11743	LRHR	LOCATION REQUIRES HOOP REINFORCEMENT	11650 11744 11746 11654	11741	1	46	4
11744		DISTANCE FROM POINT OF POTENTIAL YIELD IN CONCRETE FLEX MEMB		11743	0	47	4
11746		COMPRESSION REINFORCEMENT REQUIRED TO PROVIDE RESISTANCE		11743	0	47	4
11747		REQT OF REF 11.1 FOR LATERAL SUPPORT OF LONG. BARS WITH TIES		11741	0	46	5
11749	SCBCR	SPECIAL CONCRETE BEAM COLUMN REQUIREMENT	11750 11752 11753 11761 11765	11700 11880	7	43	1
11750		MINIMUM CROSS SECTION DIMENSION THROUGH CENTROID		11749 11773	0	51	0
11752		CROSS SECTION DIMENSION ORTHOGONAL TO MINIMUM		11749	0	44	7
11753	SCBCFS	SPECIAL CONCRETE BEAM COLUMN FLEXURAL STRENGTH REQT	11755 11756 11758 11759 11765	11749	6	44	1
11755	YSFSCJ	SUM OF FLEXURAL STRENGTH OF COLUMNS AT JOINT	11210	11753	5	45	1
11756	YSFSBJ	SUM OF FLEXURAL STRENGTH OF BEAMS AT JOINT	11210	11753	5	45	1
11758		SHEAR REDISTRIB ACCOUNTING FOR OMISSION OF NONCONFORMING JTS		11753	0	45	6
11759		COLUMNS FRAMING INTO CONFORMING JOINTS RESIST ALL SEIS SHEAR		11753	0	45	6
11761	SCBCRR	SPECIAL CONCRETE BEAM COLUMN REINFORCEMENT REQT	11762 11720 11725 11764 11719	11749	2	44	5
11762		REINFORCEMENT RATIO IN BEAM COLUMN		11761	0	45	6
11764		LAP SPLICE PROPORTIONED AS A TENSION SPLICE		11761	0	45	6
11765	SCBCLR	SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT	11766 11767 11768 11664 11770 11771 11773 11774 11775 11777	11230 11563 11584 11749 11753 11858	2	49	0
11766		YEILD STRENGTH OF LATERAL REINFORCEMENT		11765 11773	0	51	0
11767		YEILD STRENGTH OF LONGITUDINAL REINFORCEMENT		11765	0	50	1
11768		POINT OF CONTRAFLEXURE LOCATED IN MIDDLE HALF OF MEMBER		11765	0	50	1
11770	XMDSLR	MINIMUM DISTANCE FOR SPECIAL LATERAL REINF	11690 11654	11765	1	50	0
11771		LATERAL REINFORCEMENT PROVIDED THROUGHOUT MEMBER		11765	0	50	1
11773	MASLRR	MINIMUM AMOUNT OF SPECIAL LATERAL REINF REQT	11778 11779 11250 11766 11280 11781 11782 11656 11652 11750	11765 11786	1	50	0
11774		CROSS SECTIONAL DISTANCE BETWEEN TIES		11765 11786	0	50	1
11775		LAP OF OVERLAPPING HOOPS		11765 11786	0	50	1
11777	SCBCDS	SPECIAL CONCRETE BEAM COLUMN DESIGN SHEAR REQT	11735 11783 11738 11785	11765	1	50	0
11778		TYPE OF LATERAL REINFORCEMENT		11773	0	51	0
11779		VOLUMETRIC RATIO OF LATERAL REINFORCEMENT		11773	0	51	0
11781		CROSS SECT AREA OF COMPONENT MEASURED TO OUTSIDE OF S L R		11773 11789	0	51	0
11782		CROSS SECT CORE DIMENSION TO OUTSIDE OF SPEC LAT REINF		11773	0	51	0
11783		MEMBER ASSUMED TO BE LOADED WITH APPLICABLE STATIC FORCES		11777	0	51	0
11785		MEMBER AXIAL FORCE ASSUMED TO BE MAX DESIGN COMPR FORCE		11777	0	51	0
11786	SCMFJR	SPECIAL CONCRETE MOMENT FRAME JOINT REQUIREMENT	11787 11773 11774 11775 11789 11790 11797	11700	3	43	5
11787		LATERAL REINFORCEMENT PROVIDED THROUGHOUT JOINT		11786	0	44	7
11788		SHEAR STRESS IN JOINT		11789	0	45	6
11789	SCJSSC	JOINT SHEAR STRESS CALCULATION REQUIREMENT	11795 11792 11713 11654 11788 11781	11786	1	44	6
11790	MAJSSR	MAXIMUM ALLOWABLE SHEAR STRESS IN JOINT REQUIREMENT	11250 11260 11791 11796	11786	2	44	5

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
11791	JTYPE	JOINT TYPE	11793 11794	11790	1	45	5
11792		JOINT DESIGN SHEAR FORCE		11789	0	45	6
11793		OPPOS FACE IN DIRECT OF SEIS FORCE CONFINED BY MONOLITH MEMB		11791	0	46	5
11794		MEMBERS COVER 75% OF WIDTH AND DEPTH		11791	0	46	5
11795		SHAPE OF CROSS SECTION		11789	0	45	6
11796		MODIFIED ALLOWABLE STRESS		11790	0	45	6
11797	JDSFR	JOINT DESIGN SHEAR FORCE REQUIREMENT	11798 11799 11738 11740	11786	1	44	6
11798		JOINT SHEAR FORCE DET FROM STATIC FORCES AND JOINT MOMENTS		11797	0	45	6
11799		JOINT MOMENTS ASSUMED TO BE MAX RESIST MOMENTS OF MEMBERS		11797	0	45	6
11800	SWEFDR	CAT C/D CONCRETE SHEAR WALL, BRACED FRAME AND DIAPHRAGM REQT	2114 11818 11835 11880 11881 11888	11556	42	9	0
11802	CSWDRR	CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM REINF REQT	11804 11806 11808 11810	11820 11835	1	12	38
11804		MINIMUM WALL OR DIAPHRAGM REINFORCEMENT RATIO		11802	0	13	38
11806		SPACING OF WALL OR DIAPHRAGM REINFORCEMENT		11802	0	13	38
11808		WALL OR DIAPHRAGM REINFORCEMENT FOR SHEAR IS CONTINUOUS		11802	0	13	38
11810		WALL OR DIAPHRAGM REINF FOR SHEAR IS UNIFORMLY DISTRIBUTED		11802	0	13	38
11812	SWDSSL	CAT C AND D CONC SHEAR WALL AND DIAPHRAGM SHEAR STRESS LIMIT	11814 11250 11550 11816 11260	11832 11835	1	12	38
11814		MAXIMUM SHEAR STRESS		11812 11820 11832	0	13	38
11816		RATIO OF HORIZONTAL SHEAR REINFORCEMENT		11812 11820	0	13	38
11818	CDCSWR	CATEGORY C AND D CONCRETE SHEAR WALL REQUIREMENT	11820 11832 3303 11833 11250 11846 11840	11800	41	10	0
11820	CCDSWD	CATEGORY C AND D CONCRETE SHEAR WALL DETAILING REQUIREMENT	11802 11816 11822 11824 11826 11828 11830 11814 11250	11818	2	11	38
11822		RATIO OF VERTICAL SHEAR REINFORCEMENT		11820	0	12	39
11824		HORIZONTAL WALL REINFORCEMENT SPLICED		11820	0	12	39
11826		LOCATION OF SPLICES STAGGERED		11820	0	12	39
11828		NUMBER OF CURTAINS OF REINFORCEMENT IN WALL		11820	0	12	39
11830		EACH CURTAIN SPLICED IN DIFFERENT LOCATION		11820	0	12	39
11831		ELASTIC ANALYSIS OF GROSS CROSS SECTION		11833 11834	0	14	37
11832	CDCSWS	CATEGORY C AND D CONCRETE SHEAR WALL STRENGTH REQUIREMENT	11812 2114 11814 11250	11818	2	11	38
11833	YCU	ACTUAL COMPRESSIVE STRESS	11831 3702	11818 11835 11840	38	12	1
11834	YCUD	ACTUAL COMPRESSIVE STRESS WHERE BOUNDARY MEMBER DISCONTINUED	11831 3702	11846	38	13	0
11835	CCDCDR	CAT C AND D CONCRETE DIAPHRAGM REQUIREMENT	11802 11812 11833 11250 11846 11836 11838 11840	11800	41	10	0
11836		CONCRETE DIAPHRAGM COMPOSITION		11835	0	11	40
11838		CAST-IN-PLACE TOPPING DESIGNED TO RESIST ALL SHEAR		11835	0	11	40
11840	CSWDOR	CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM OPENING REQT	11842 11844 11846 11833 11250	11818 11835	40	11	0
11842		SHEAR WALL OR DIAPHRAGM CONTAINS OPENING		11840	0	12	39
11844		OPENINGS PROVIDED WITH BOUNDARY MEMBERS		11840	0	12	39
11846	CDCBMR	CATEGORY C AND D CONCRETE BOUNDARY MEMBER REQUIREMENT	11858 11862 11848 11850 11851 11852 11834 11250 11856	11818 11835 11840 12566	39	12	0
11848		BOUNDARY MEMBER CONTINUOUSLY ATTACHED TO WALL OR DIAPHRAGM		11846	0	13	38
11850		LOCATION OF BOUNDARY MEMBER		11846 11862	0	14	37
11851		ORIENTATION OF BOUNDARY MEMBER		11846 11862	0	14	37
11852		BOUNDARY MEMBER DISCONTINUED		11846	0	13	38

DATA NØ.	DATA LABEL	DATA DESCRIPTIØN	INGREDIENTS	DEPENDENTS	INPUT LEVEL	ØUTPUT LEVEL	TØTAL FLØAT
11856		HØRIZ WALL REINF ANCHØRED IN BØUNDARY MEMB TØ DEVELØP YIELD		11846	0	13	38
11858	CBMMR	CATEGØRY C AND D CØNCRETE BØUNDARY MEMBER MATERIAL REQT	11860 10001 11765	11846	17	13	21
11860		TYPE ØF BØUNDARY MEMBER		11858	0	14	37
11862	CBMASR	CAT C AND D CØNCRETE BØUNDARY MEMBER AXIAL STRENGTH REQT	11850 11851 11864 11866 11868 11870 11872 11874 11876 11878	11846	36	13	2
11864	YAXRB	AXIAL RESISTANCE ØF CØNCRETE BØUNDARY MEMBER	11210	11862	5	14	32
11866	YTGL	TØTAL GRAVITY LØAD ØN WALL	3707 3708 3710	11862	3	14	34
11868	YVØM	VERTICAL FØRCES FRØM SEISMIC ØVERTURNING MØMENT	3706	11862	35	14	2
11870	ZAXD	AXIAL FØRCE IN DIAPHRAGM		11862	0	14	37
11872	YMD	SEISMIC MØMENT IN DIAPHRAGM	3706	11862	35	14	2
11874		DEPTH ØF DIAPHRAGM		11862	0	14	37
11876	YSØ	STRENGTH ØF SECTIØN REMØVED FØR ØPENING	11210	11862	5	14	32
11878		BØUND MEMB ANCHØRED TØ DEVEL YIELD STRENGTH AT EDGE ØF ØPNG		11862	0	14	37
11880	CDCBFR	CATEGØRY C AND D CØNCRETE BRACED FRAME REQUIREMENT	2114 11290 11250 11280 11749	11800	8	10	33
11881	CRSAR	CATEGØRY C AND D CØNCRETE REINF SPLICE AND ANCHØRAGE REQT	2114 11882 11884 11886	11800	1	10	40
11882		SPLICES SATISFY PRØVISIØNS ØF REF 11.1 FØR TENSIØN SPLICES		11881	0	11	40
11884		ANCHØRAGES SATISFY PRØV ØF REF 11.1 FØR TENSIØN ANCHØRAGES		11881	0	11	40
11886		DEVELØPMENT LENGTH REDUCED FØR EXCESS STEEL AREA		11881	0	11	40
11888	CDCCJR	CATEGØRY C AND D CØNCRETE CØNSTRUCTIØN JØINT REQUIREMENT	11890 11892 11893 11894 11230 11896 11550 11898	11800	4	10	37
11890		ELEMENT CØNTAINS CØNSTRUCTIØN JØINT		11888	0	11	40
11892		SURFACE ØF JØINT THØRØUGHLY RØUGHENED		11888	0	11	40
11893		SHEAR RESISTED SØLELY BY FRICTIØN AND DØWEL ACTIØN		11888	0	11	40
11894		MAXIMUM SHEAR AT JØINT		11888	0	11	40
11896		AREA ØF REINFØRCEMENT NØRMAL TØ CØNSTRUCTIØN JØINT		11888	0	11	40
11898		SUM ØF SEISMIC AND MINIMUM GRAVITY FØRCES NØRMAL TØ JØINT		11888	0	11	40
12001	MMR	MASØNRY MATERIALS REQUIREMENT	9110 12110 12200 12002	1345 1370 7210 8345	44	5	2
12002	MDESCR	MASØNRY DESIGN CATEGØRY REQUIREMENT	1490 12300 12400 12500 12600	12001	43	6	2
12110		REQUIREMENTS ØF CHAPTER 12A AND REFERENCES		12001	0	6	45
12200	ZMSCPR	MASØNRY STRENGTH CALCULATIØN PRØCEDURE REQUIREMENT	12210	12001	5	6	40
12210	XSM	STRENGTH ØF MASØNRY CØMPØNENTS	12220 12225	3125 3130 3393 7215 12200	4	12	35
12220	PHIM	CAPACITY REDUCTIØN FACTØR FØR MASØNRY	9240 2114 12240	12210	1	13	37
12225	ASM	ALLØWABLE STRENGTH ØF MASØNRY CØMPØNENT	12230 12245 12250	12210	3	13	35
12230		ALLØWABLE WØRKING STRESS FRØM CHAPTER 12A		12225 12754	0	14	37
12240		ANGLE BETWEEN TENSIØN STRESS AND BED JØINT		12220	0	14	37
12245		LEVEL ØF REINFØRCEMENT IN MASØNRY		12225 12403 12409 12430 12500 12578 12620 12700 12754	0	14	37
12250	UMDPR	UNREINFØRCED MASØNRY DESIGN PRØCEDURE REQUIREMENT	12253 12256	12225 12700	2	14	35
12253	GUMDR	GENERAL UNREINFØRCED MASØNRY DESIGN PRØCEDURE REQUIREMENT	12258 12259 12262 12265 12268 12274 12277 12280 3791	12250	1	15	35
12256	AUMDR	ALTERNATE UNREINFØRCED MASØNRY DESIGN PRØCEDURE REQUIREMENT	12283 12292 12295 12286 12289 12298 12274 3791 12277 12280	12250	1	15	35

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
12258		REQUIREMENT OF REF SECTION 12A.6.1		12253 12754	0	16	35
12259		TENSION ZONE OF UNREINFORCED MASONRY ASSUMED CRACKED		12253	0	16	35
12262		COMPRESSION STRESS DISTRIBUTED LINEARLY		12253	0	16	35
12265		COMPRESSION STRESS IN EQUILIBRIUM WITH LOADS		12253	0	16	35
12268		SOURCE OF MAXIMUM ALLOWABLE STRESS		12253 12754	0	16	35
12274		MASONRY BOND TYPE		12253 12256 12403 12578 12666 12702	0	16	35
12277		PLANE OF BENDING IS PLANE OF COMPONENT		12253 12256	0	16	35
12280		BED JOINTS CONTAIN CRACKED ZONE		12253 12256	0	16	35
12283		REQUIREMENT OF REF SECTION 12A.6.2		12256	0	16	35
12286		RATIO OF E/T (FROM CHAPTER 12A)		12256	0	16	35
12289		RATIO RE (FROM CHAPTER 12A)		12256	0	16	35
12292		BENDING IS IN ONE DIRECTION (PRINCIPAL AXIS) ONLY		12256	0	16	35
12295		BENDING IS ABOUT BOTH PRINCIPAL AXES		12256	0	16	35
12298		STIFFNESS AND STRENGTH OF MASONRY IN CRACKED ZONE IGNORED		12256	0	16	35
12300	ZCAMR	CATEGORY A MASONRY REQUIREMENT		3620 12002 12400	0	10	41
12400	CBMR	CATEGORY B MASONRY REQUIREMENT	12300 12403 12409 12430 12454 12466 12469 12472 12496 12700	3630 12002 12500	39	9	3
12403	CBMHL	CATEGORY B MASONRY HEIGHT LIMITATION	2227 12274 12245 12406 2115	12400	1	10	40
12406		COMPONENT IS A PART OF SEISMIC RESISTING SYSTEM		12403 12578 12670	0	11	40
12409	CBMCTR	CATEGORY B MASONRY ANCHOR BOLT TIE REQUIREMENT	2114 11350 12412 12415 12245 12418 12421 12424 12427	12400	1	10	40
12412		REQUIREMENT OF REF SECTION 12A.6.3(F)		12409 12560	0	12	39
12415		TIES PROVIDED AROUND ANCHOR BOLTS IN MASONRY		12409	0	11	40
12418		TIES ENGAGE AT LEAST 4 VERTICAL BARS IN MASONRY COLUMN		12409	0	11	40
12421		DISTANCE OF TIES FROM TOP OF MASONRY		12409	0	11	40
12424		SIZE OF TIES AROUND ANCHOR BOLTS IN MASONRY		12409	0	11	40
12427		NUMBER OF TIES AROUND ANCHOR BOLTS IN MASONRY		12409	0	11	40
12430	CBMCWR	CATEGORY B MASONRY SCREEN WALL REQUIREMENT	2114 12245 12433 12436 12439 12442 12445 12448 12451	12400	1	10	40
12433		JOINT REINF CONSIDERED EFFECT IN RESIST TENS AND COMPR STRES		12430	0	11	40
12436		JOINT IS CONTINUOUS WITHOUT OFFSET		12430	0	11	40
12439		AREA OF JOINT REINFORCEMENT		12430	0	11	40
12442		JOINT REINFORCEMENT EMBEDDED IN MORTAR OR GROUT		12430	0	11	40
12445		TYPE OF MASONRY JOINT REINFORCEMENT		12430	0	11	40
12448		JOINT REINFORCEMENT SPLICED		12430	0	11	40
12451		WIDTH OF JOINT REINFORCEMENT		12430	0	11	40
12454	CBNSMR	CATEGORY B NONSTRUCTURAL MASONRY REQUIREMENT	2114 12457 12460 12463	12400	1	10	40
12457		COMPONENT DESIGNED TO SUPPORT SELF WEIGHT AND SEISMIC FORCE		12454	0	11	40
12460		HOLES SUITABLY STRENGTHENED AND STIFFENED		12454	0	11	40
12463		REQUIREMENT OF REF SECTION 12A.2.6		12454	0	11	40
12466		MASONRY CONSTRUCTION TYPE		12400 12569 12578 12670	0	10	41
12469		COMPONENT IS PART OF STRUCTURAL SYSTEM		12400 12600 12620 12668 12676	0	10	41
12472	CBMML	CATEGORY B MASONRY MATERIAL LIMITATION	12475 12478 12481 12484 12487	12400	1	10	40
12475		MASONRY MATERIAL		12472 12590 12676	0	11	40

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
12478		MASONRY UNIT TYPE		12472 12590 12676	0	11	40
12481		MASONRY GRADE		12472	0	11	40
12484		CONFIGURATION OF MASONRY UNIT		12472 12569 12578 12620 12670 12676	0	11	40
12487		LOAD CLASS OF MASONRY UNIT		12472 12590 12676	0	11	40
12490		MORTAR TYPE		12496	0	11	40
12493		TYPE OF CEMENT FOR MORTAR AND GROUT		12496	0	11	40
12496	CBMMR	CATEGORY B MORTAR REQUIREMENT	12490 12493	12400	1	10	40
12500	CCMR	CATEGORY C MASONRY REQUIREMENT	12400 12245 12503 12518 12566 12569 12578 12590	3670 12002 12600	41	8	2
12503	CCMTAR	CATEGORY C MASONRY TIE ANCHORAGE REQUIREMENT	12506 12509 12512 12515	12500	1	9	41
12506		REQUIREMENT OF REF SECTION 12A.6.3(D)		12503	0	10	41
12509		TURN ANGLE AT ANCHORAGE OF MASONRY TIE		12503	0	10	41
12512		EXTENSION AT ANCHORAGE OF MASONRY TIE		12503	0	10	41
12515		DIAMETER OF MASONRY TIE BAR		12503 12563	0	12	39
12518	CCMCR	CATEGORY C MASONRY COLUMN REQUIREMENT	2114 2115 12560 12563	12500 12566	2	10	39
12524		DISTANCE FROM LONGITUDINAL BAR TO LATERALLY SUPPORTED BAR		12560	0	12	39
12527		LONGITUDNAL BAR LOCATION		12560	0	12	39
12530		CROSS TIE USED TO PROVIDE LATERAL SUPPORT FROM OPPOSITE FACE		12560	0	12	39
12533		MAS COL IS BOUNDARY MEMBER OF MAS SHEAR WALL		12563	0	12	39
12536		MAS COL RESISTS AXIAL STRESS FROM EQ OVERTURNING FORCES		12563	0	12	39
12539		DISTANCE FROM TOP AND BOT OF MAS COL WITH CLOSE TIE SPACING		12563	0	12	39
12542		MAXIMUM DIMENSION OF MASONRY COLUMN		12563	0	12	39
12545		CLEAR COLUMN HEIGHT		12563	0	12	39
12548		DIAMETER OF LONGITUDINAL REINF IN MASONRY COLUMN		12563	0	12	39
12551		SMALLEST DIMENSION OF MASONRY COLUMN		12563 12620	0	12	39
12554		SPACING OF TIES IN PORTION OF MAS COL WITH CLOSE SPACING		12563	0	12	39
12557		SPACING OF TIES IN PORTION OF MAS COL WITH WIDE SPACING		12563	0	12	39
12560	MCBSR	MASONRY COLUMN BAR SUPPORT REQUIREMENT	12412 12524 12527 12530	12518	1	11	39
12563	MCTSR	MASONRY COLUMN TIE SPACING REQUIREMENT	12533 12536 12539 12542 12545 12548 12551 12554 12557 12515	12518	1	11	39
12566	CCMSWB	CATEGORY C MASONRY SHEAR WALL BOUNDARY REQUIREMENT	2114 2115 11846 12518	12500	40	9	2
12569	CCMJRR	CATEGORY C MASONRY JOINT REINFORCEMENT REQUIREMENT	12466 12484 12572 12575	12500	1	9	41
12572		LONGITUDINAL JOINT REINF USED TO FULFILL MIN REINF REQT		12569	0	10	41
12575		LONGITUDINAL JOINT REINF USED IN DETERMINING STRENGTH		12569	0	10	41
12578	CCSBR	CATEGORY C STACKED BOND REQUIREMENT	12274 12581 12584 12406 12484 12466 12245	12500	1	9	41
12581		SPACING OF HORIZONTAL REINFORCEMENT		12578 12668 12702	0	12	39
12584		RATIO OF HORIZONTAL REINFORCEMENT IN MASONRY		12578 12668 12702	0	12	39
12590	CCMML	CATEGORY C MASONRY MATERIAL LIMITATION	12475 12478 12487	12500	1	9	41
12600	CDMR	CATEGORY D MASONRY REQUIREMENT	12500 12602 12614 12620 12666 12676 12469 1652	3680 12002	42	7	2
12602	CDMGR	CATEGORY D MORTAR AND GROUT REQUIREMENT	2114 12604 12608 12610 12612	12600	1	8	42

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
12604		SUITABLY CALIBRATED DEVICH USED TO MEASURE MATERIALS		12602	0	9	42
12608		GROUT CONTAINS APPROVED ADMIXT FOR WATER LOSS AND EXPANSION		12602	0	9	42
12610		GROUT WILL NOT DEVELOP SHRINKAGE CRACKS		12602	0	9	42
12612		THICKNESS OF GROUT BETWEEN MASONRY AND REINFORCEMENT		12602	0	9	42
12614	CDGSR	CATEGORY D GROUT SPACE REQUIREMENT	12616 12618	12600	1	8	42
12616		TYPE OF GROUT LIFT		12614 12642	0	10	41
12618		MINIMUM GROUT SPACE		12614	0	9	42
12620	CDRHMR	CATEGORY D HOLLOW UNIT MASONRY REQUIREMENT	12484 12245 12469 12622 12632 12642 12656 12664 12551	12600	2	8	41
12622	HMVCR	HOLLOW MASONRY VERTICAL CELLS REQUIREMENT	12624 12626 12628 12630	12620	1	9	41
12624		WYTHE AND ELEMENT THICKNESS		12622 12656	0	10	41
12626		ALL VERTICAL CELLS ARE CLEAR, CONTINUOUS AND NO OFFSETS		12622	0	10	41
12628		DIAMETER OF LARGEST CIRCLE ENCLOSED BY VERTICAL CELLS		12622	0	10	41
12630		AREA OF VERTICAL CELL		12622	0	10	41
12632	HMGR	HOLLOW MASONRY GROUT REQUIREMENT	12634 12636 12638 12640	12620	1	9	41
12634		TYPE OF GROUT AGGREGATE		12632	0	10	41
12636		TYPE OF CONSOLIDATION USED FOR GROUT		12632	0	10	41
12638		GROUT RECONSOLIDATION AFTTER EXCESS MOISTURE ABSORBED		12632	0	10	41
12640		GROUT RECONSOLIDATION BEFORE WORKABILITY LOST		12632	0	10	41
12642	HMRSR	HOLLOW MASONRY REINFORCEMENT SUPPORT REQUIREMENT	12644 12646 12648 12616 12650 12652 12654	12620	1	9	41
12644		LOCATIONS OF SECURE SUPPORT FOR VERTICAL REINFORCEMENT		12642	0	10	41
12646		MAXIMUM DISTANCE BETWEEN SUPPORTS OF VERTICAL REINF		12642	0	10	41
12648		DIAMETER OF VERTICAL REINFORCEMENT IN MASONRY		12642	0	10	41
12650		SUPPORTS FOR VERT BARS AT INTERMEDIATE LOCATION APPROVED		12642	0	10	41
12652		HORIZONTAL REINFORCEMENT SECURELY TIED TO VERT REINF		12642	0	10	41
12654		EQUIVALENT SUPPORT PROVIDED FOR HORIZ REINF		12642	0	10	41
12656	HMBSR	HOLLOW MASONRY BAR SIZE REQUIREMENT	12624 12658 12660 12662	12620	1	9	41
12658		SIZE OF VERTICAL REINFORCEMENT BAR		12656	0	10	41
12660		NUMBER OF VERTICAL BARS IN ONE CELL		12656	0	10	41
12662		SPLICES OF VERTICAL BARS STAGGERED		12656	0	10	41
12664		FIRST EXCEPTION OF REF SECTION 12A.6.3(F) APPLIED		12620	0	9	42
12666	CDSBR	CATEGORY D STACKED BOND REQUIREMENT	12274 12668 12670	12600	2	8	41
12668	SBRR	STACKED BOND REINFORCEMENT REQUIREMENT	12469 12584 12581	12666	1	9	41
12670	HSBR	HOLLOW STACKED BOND REQUIREMENT	12484 12406 12466	12666	1	9	41
12676	CDMML	CATEGORY D MASONRY MATERIALS LIMITATION	12484 12487 12478 12475 12469	12600	1	8	42
12700	MSWR	MASONRY SHEAR WALL REQUIREMENT	1490 12245 12250 12702 12724 12754 12764	12400	38	10	3
12702	MSWRR	MASONRY SHEAR WALL REINFORCEMENT REQUIREMENT	12584 12704 12581 12706 12708 12710 12712 12714 12716 12718 12720 12722 12274	12700	1	11	39
12704		RATIO OF VERTICAL REINFORCEMENT		12702	0	12	39
12706		SPACING OF VERTICAL REINFORCEMENT		12702	0	12	39
12708		LENGTH OF MASONRY SHEAR WALL ELEMENT		12702	0	12	39
12710		HEIGHT OF MASONRY SHEAR WALL ELEMENT		12702	0	12	39

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
12712		AREA OF SHEAR REINFORCEMENT		12702 12764	0	12	39
12714		SPACING OF SHEAR REINFORCEMENT		12702 12764	0	12	39
12716		AREA OF REINFORCEMENT PERPENDICULAR TO SHEAR REINFORCEMENT		12702 12764	0	12	39
12718		SPACING OF REINFORCEMENT PERPENDICULAR TO SHEAR REINF		12702 12764	0	12	39
12720		SHEAR REINFORCEMENT IS UNIFORMLY DISTRIBUTED		12702	0	12	39
12722		SHEAR REINF RESIST ALL SHEAR ON MAS SHEAR WALL		12702	0	12	39
12724	MSWBMR	MASONRY SHEAR WALL BOUNDARY REQUIREMENT	12726 3306 12734	12700	37	11	3
			12736 12746				
12726	MSWIR	MASONRY SHEAR WALL INTERSECTION REQUIREMENT	2114 12728 12730	12724	1	12	38
			12732				
12728		INTERSECTION CONSTRUCTION SATISFIES WALL REQUIREMENT		12726	0	13	38
12730		INTERSECTION UNITES CONCRETE WITH MAS SHEAR WALL		12726	0	13	38
12732		REQUIREMENT OF REF SECTION 12A.2.1		12726	0	13	38
12734		BOUNDARY MEMBER PROVIDED AT EACH END OF EACH WALL		12724	0	12	39
12736	BMDR	BOUNDARY MEMBER DESIGN REQUIREMENT	12738 12740 12742	12724	36	12	3
			12744 3333 3327				
			10600 11700				
12738	YSVBM	STRENGTH OF VERTICAL BOUNDARY MEMBER	11210 10210	12736	5	13	33
12740	YWVMSW	EFFECT OF VERTICAL LOAD ON MAS SHEAR WALL	2146 2148	12736	1	13	37
12742	YWEVMS	EFFECT OF VERTICAL FORCES DUE TO EQ	3706	12736	35	13	3
12744		BOUNDARY MEMBER MATERIAL		12736 12746	0	13	38
12746	BMAR	BOUNDARY MEMBER ANCHORAGE REQUIREMENT	12748 12744 12750	12724	1	12	38
			12752				
12748		HORIZ REINF IN MAS SHEAR WALL ANCHORED TO BOUND MEMB		12746	0	13	38
12750		MEANS OF ANCHORING HORIZ REINF TO BOUND MEMB		12746	0	13	38
12752		MEANS OF SHEAR TRANSFER TO BOUNDARY MEMBER		12746	0	13	38
12754	MSWCSR	MASONRY SHEAR WALL COMPRESSION STRESS REQUIREMENT	12756 12758 12230	12700	1	11	39
			12245 12258 12268				
			12760 12762 12763				
			2114				
12756		LOAD EFFECT INCLUDES SEISMIC FORCE IN PLANE		12754	0	12	39
12758		ALLOWABLE COMPRESSION STRESS IN MASONRY SHEAR WALL		12754	0	12	39
12760		ALLOWABLE WORKING STRESS REDUCED FOR SLENDERNESS, IF ANY		12754	0	12	39
12762		HORIZ UNSUPPORTED DIST CONSIDERED IN LIEU OF VERT DIST		12754	0	12	39
12763		ALLOWABLE WORKING STRESS IN FLEXURE FROM REF 12A		12754	0	12	39
12764	MSWHCR	MASONRY SHEAR WALL HORIZ COMPONENT REQUIREMENT	2114 12768 12770	12700	1	11	39
			12772 12774 12776				
			12778 12780 12782				
			12712 12714 12716				
			12718				
12768		SIESMIC LOADS REQUIRE SHEAR REINFORCEMENT		12764	0	12	39
12770		DIAGONAL SHEAR REINFORCEMENT PROVIDED		12764	0	12	39
12772		REQUIREMENT REF SECTION 12A.6.4(D)		12764	0	12	39
12774		HORIZONTAL REINFORCEMENT ANCHORED IN PIERS		12764	0	12	39
12776		HORIZONTAL REINFORCEMENT CONTINUOUS THROUGH PIERS		12764	0	12	39
12778		HORIZONTAL COMPONENT SEPARATED FROM PIER WITH JOINT		12764	0	12	39
12780		JOINT BETWEEN PIER AND HORIZ COMPONENT PROVIDES FOR MOVEMENT		12764	0	12	39
12782		HORIZONTAL COMPONENT ANCHORED TO BUILDING		12764	0	12	39
13000		CHAPTER 13 ADOPTED INTO PROVISIONS		1210 13001 13301	0	4	47
13001	SHAR	SYSTEMATIC HAZARD ABATEMENT REQUIREMENT	13000 13110 13200	1305	41	1	9
			13216 13246 13301				
13110	EXER	EXTENT OF EVALUATION REQUIRED	1425 13120 13130	13001 13200 13210	4	5	42
			13140 1490 13160				
13120		DATE OF DESIGN OF BUILDING		13110	0	6	45

DATA NO.	DATA LABEL	DATA DESCRIPTION	INGREDIENTS	DEPENDENTS	INPUT LEVEL	OUTPUT LEVEL	TOTAL FLOAT
13130		BUILDING INCLUDES FEATURES PROVEN VULERNABLE TO EARTHQUAKE		13110	0	6	45
13140		BUILDING STRUCT SYS SIGNIFICANTLY WEAKENED SINCE CONST		13110	0	6	45
13150	TER	TYPE OF EVALUATION REQUIRED	1490 13216	13200	3	3	45
13160	XOP	OCCUPANCY POTENTIAL	13180 13190	13110 13262 13360	3	7	41
13170		SQUARE FEET PER OCCUPANT ESTABLISHED BY COGNIZANT JURIS		13180	0	9	42
13180	SFPO	SQUARE FEET OF FLOOR PER OCCUPANT	13170 13185	13160	2	8	41
13185	XSFT13	SQUARE FEET PER OCCUPANT FROM TABLE 13-A	1270	13180	1	9	41
13190		TOTAL SQUARE FEET IN BUILDING		13160	0	8	43
13200	SER	SYSTEMATIC EVALUATION REQUIREMENT	13110 13150 13202 13226	13001	40	2	9
13202	QEPR	QUALITATIVE EVALUATION PROCEDURES REQUIREMENT	13204 13206 13208 13210 13212 13214	13200	6	3	42
13204		ENTITY PERFORMING EVALUATION		13202 13226	0	4	47
13206		AVAILABLE PERTINENT DOCUMENTATION EXAMINED		13202	0	4	47
13208		ON SITE INSPECTION PERFORMED		13202	0	4	47
13210	EER	ELEMENT EVALUATION REQUIRED	13110 1490 13216 2114 13218	13202 13226	5	4	42
13212		ELEMENT CLASSED AS TO HAZARD		13202 13226	0	4	47
13214	DQERR	DETAIL OF QUALITATIVE EVALUATION REPORT REQUIREMENT	13220 13222 13216 13224	13202	1	4	46
13216		RESULTS OF QUALITATIVE EVALUATION		13001 13150 13210 13214 13390	0	6	45
13218		ELEM COULD CAUSE INJURY/BLK EXIT/START FIRE/RELEASE TOXIC		13210	0	5	46
13220		SKETCHES OF STRUCTURAL SRS PROVIDED		13214	0	5	46
13222		SKETCHES OF DETAILS OF STRUCT SRS PROVIDED		13214	0	5	46
13224		REASONS PROVIDED FOR CLASSIFICATION AS CAPABLE		13214	0	5	46
13226	AEPR	ANALYTICAL EVALUATION PROCEDURES REQUIREMENT	13204 13228 13230 13210 13212	13200	39	3	9
13228	AMR	ANALYSIS METHOD REQUIREMENT	13232 13234 13236 13238	13226	1	4	46
13230	DAERR	DETAILS OF ANALYTICAL EVALUATION REPORT REQUIREMENT	13240 13242 13246 13244	13226	38	4	9
13232		ANALYSIS BASED ON RECOMMENDATIONS OF PREVIOUS CHAPTERS		13228	0	5	46
13234		RECOMMENDATIONS OF PREV CHAPS FOR ANALYSIS NOT APPLICABLE		13228	0	5	46
13236		DEVIATIONS FROM RECOMMEND FOR ANAL PERMITTED BY REG AGENCY		13228	0	5	46
13238		DEVIATIONS FROM RECOMMENDS FOR ANAL JUSTIFIED IN REPORT		13228	0	5	46
13240		DIAGRAMS OF STRUCT SRS PROVIDED		13230	0	5	46
13242		CALCULATIONS FOR DETERMINING CAPACITY RATIO PROVIDED		13230	0	5	46
13244		TIME PERMITTED FOR CORRECTION PROVIDED IN REPORT		13230	0	5	46
13246	RAE	RESULTS OF ANALYTICAL EVALUATION	13248 13262	13001 13230	37	5	9
13248	XRCG	GOVERNING EARTHQUAKE CAPACITY RATIO	13250 13256 3860 13254	13246 13390	36	6	9
13250	ZVAS	ACTUAL CAPACITY IN SEISMIC SHEAR FORCE	3125 3130	13248	6	7	38
13254	ZACTSD	ACTUAL STORY DRIFT	4660	13248	29	7	15
13256	ZVRS	REQUIRED CAPACITY IN SEISMIC SHEAR FORCE	3706	13248	35	7	9
13262	RCA	ALLOWABLE EARTHQUAKE CAPACITY RATIO	1490 2114 13160	13246	4	6	41
13301	HAR	HAZARD ABATEMENT REQUIREMENT	13000 13310 13320 13330 13340 13350 13360 13370 13380	1380 1390 8001 13001	39	3	9
13310		COMPONENTS CLASSIFIED AS HAZARDOUS		13301 13380	0	5	46
13320		TYPE OF ABATEMENT TO BE USED		13301	0	4	47
13330		BUILDING IS CLASSIFIED AS HISTORICAL		13301	0	4	47
13340		ALTERNATE ABATEMENT APPROVED		13301	0	4	47
13350		NEW EARTHQUAKE CAPACITY RATIO TO BE PROVIDED		13301	0	4	47

DATA NØ.	DATA LABEL	DATA DESCRIPTIØN	INGREDIENTS	DEPENDENTS	INPUT LEVEL	ØUTPUT LEVEL	TØTAL FLØAT
13360	MRC	REQUIRED NEW EARTHQUAKE CAPACITY RATIØ	1490 2114 13160	13301	4	4	43
13370		TIME PRØPØSED FØR ABATEMENT		13301	0	4	47
13380	TX	MAXIMUM TIME PERMITTED FØR ABATEMENT	1490 2114 13310 13385 13390	13301	38	4	9
13385		CØEFFICIENT FØR PERMISSIBLE TIME		13380	0	5	46
13390	RCT	EARTHQUAKE CAPACITY RATIØ FØR CØMPUTING TIME	13216 13248	13380	37	5	9

APPENDIX A2

DECISION TABLES AND FUNCTIONS

All derived nodes are shown in this appendix, arranged in ascending order by datum number. In addition to listing the data description, label, and number, a section reference is also included. Note that references to more than one section or to an entire chapter indicate that the datum was defined in more than one location, and in some instances the relations had to be inferred from similar names in the text or from the format of the text.

The data description, label, and datum number of each ingredient is listed above the decision table or function, except for some assumed functions. The conventions for numbering according to chapter and labeling according to type of function, as explained in chapter 2 and in appendix Al, are pertinent adis for reference in reading this appendix. It is often necessary to use symbols for data items when writing conditions, actions, or functions. For derived data items, the data label is used for such symbols. However, symbols are frequently necessary for input data items, which are not normally provided with a data label, so such symbols are shown as a label in parenthesis in the ingredients list.

Decision tables are read rule by rule (column by column) as described in chapter 3. The symbolism is as follows:

- Y means yes, or true
- N means no, or false
- \+ means true predetermined by another condition value in that rule
- \- means false predetermined by another condition value in that rule
- . means either true or false is acceptable for the condition in that rule, usually referred to as immaterial
- X means that the action in that row is to be taken for the rule

The rules, conditions, and actions are all numbered for ease of reference, particularly in interpreting the comments below the decision table. "E" stands for the "ELSE" rule, which is true if no other rule is matched. Conditions that are enclosed in parenthesis are included for ease in reading the table; they are not necessary for a strict logical evaluation because their values are either +, -, or, . in every rule. Conditions are frequently written by making use of "<u>and</u>" and "<u>or</u>" connectors. These are logical functions defined thus: a series of items connected by <u>and</u> is considered true only if each of the items is true, otherwise the series is false; a series of items connected by <u>or</u> is considered true if any of the items is true, the series is false only if each of the items is false. Two other logical functions used in writing conditions and actions are MAX and MIN; they indicate the selection of the maximum (or minimum) from among the set of quantities enclosed in the following square brackets ([ ]).

Decision trees are shown for a few of the decision tables. As described in chapter 2, "Ci" indicates test of the ith condition, "Rj" indicates identification of the jth rule, "+" indicates a branch following a true result from the test of a condition, "-" indicates a branch following a false result of the test of a condition, and "ELSE" indicates a possible rule not included among the numbered rules.

The comments included in this appendix apply to two general topics:

1) assessment of the <u>Provisions</u> based on the analysis shown
2) explanation as to how the analysis was performed.

It seemed cumbersome to create a format to distinguish between the two types of comments, and in many cases it would have been redundant. The comments are generally clear about which topic is being addressed. Careful reading of the comments is urged.

DATUM: Provisions applicable

SECTION: 1.2 LABEL: PAPPL NUMBER: 1210

INGREDIENTS

Datum	Label	Number
Structure type		1220
Building stage		1230
Proposed work on existing building		1240
Seismic force resistance before proposed activity	ZSFRB	1250
Seismic force resistance after proposed activity	ZSFRA	1260
Seismic performance category before proposed change	YSPCB	1264
Seismic performance category after proposed change	YSPCA	1266
Building use		1270
Size of dwelling		1280
Seismicity index	SI	1425
Chapter 13 adopted into provisions		13000

DECISION TABLE

	DECISION TABLE	1	2	3	4	5	6	7	8
1	Structure type = building	Y	Y	Y	Y	Y	Y	Y	N
2	Building stage = new	Y	N	N	N	N	.	.	.
3	(Building stage = existing)	–	+	+	+	+	.	.	.
4	Proposed work on existing building = alteration <u>and</u> Seismic force resistance after proposed activity < Seismic force resistance before proposed activity	.	Y	N	N	N	.	.	.
5	Proposed work on existing building = change of use <u>and</u> Seismic performance category after proposed change > Seismic performance category before proposed change	.	.	Y	N	N	.	.	.
6	Building use = agricultural and not human	N	N	N	N	N	Y	–	.
7	Building use = dwelling <u>and</u> Size of dwelling = 1 or 2 family <u>and</u> Seismicity index = 1 or 2	N	N	N	N	N	–	Y	.
8	Chapter 13 adopted into provisions	.	.	.	Y	N	.	.	.
1	PAPPL = True	X	X	X	X				
2	PAPPL = False					X	X	X	X

COMMENTS:

1. Condition 1 is strongly implied by the list of non-building structures that are excluded from application.
2. Note that section 1.3.2 (decision table 1380) includes alteration and repair, thus there is a conflict with condition 4, which is written as stated in section 1.2.
3. Condition 8 reflects the amendment on page 167 of the <u>Provisions</u>.

DATUM: Seismic force resistance before proposed activity

SECTION: 1.2 LABEL: ZSFRB NUMBER: 1250

COMMENTS:

1. This is an implicit function of the provisions for structural analysis and design. However, no specific datum can be cited as an ingredient.

DATUM: Seismic force resistance after proposed activity

SECTION: 1.2 LABEL: ZSFRA NUMBER: 1260

COMMENTS:

1. See comment for datum 1250, above.

DATUM: Seismic performance category before proposed change

SECTION: 1.2 LABEL: YSPCB NUMBER: 1264

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490

COMMENTS:

1. This datum along with datum 1266, following, are necessary to represent the potential change in seismic performance category as the use of a building is changed.

DATUM: Seismic performance category after proposed change

SECTION: 1.2 LABEL: YSPCA NUMBER: 1266

INGREDIENTS

DATUM	Label	Number
Seismic performance category	SPC	1490

COMMENTS:

1. See comment for datum 1264, above.

DATUM: Application requirement

SECTION: 1.3 LABEL: APPLR NUMBER: 1305

INGREDIENTS

Datum	Label	Number
Provisions applicable	PAPPL	1210
Design documents submitted to regulatory agency		1310
Building stage		1230
New building requirement	NBR	1345
Proposed work on existing building		1240
Alteration and repair requirement	ARR	1380
Change of use requirement	CUR	1390
Load combination requirement	LCR	1315
Systematic hazard abatement requirement	SHAR	13001

	DECISION TABLE	1	2	3	4	5	6	E
1	Provisions applicable = true	N	Y	Y	Y	Y	Y	
2	Design documents submitted to regulatory agency = true	.	Y	Y	Y	Y	Y	
3	Building stage = new	.	Y	N	N	N	N	
4	New building requirement = satisfied	.	Y	.	.	.	.	
5	Proposed work on existing building = alteration or repair	.	-	Y	N	Y	N	
6	Alteration and repair requirement = satisfied	.	.	Y	.	Y	.	
7	Proposed work on existing building = change of use	.	-	N	Y	Y	N	
8	Change of use requirement = satisfied	.	.	.	Y	Y	.	
9	Load combination requirement = satisfied	.	Y	Y	Y	Y	Y	
10	Systematic hazard abatement requirement = satisfied	.	.	.	.	.	Y	
1	APPLR = satisfied	X	X	X	X	X	X	
2	APPLR = violated							X

COMMENTS:

1. This table includes conditions from subsections 1.3.1, 1.3.2, 1.3.3, and 1.3.4, including the amendment to 1.3.4 given on page 167 of the Provisions.
2. Note that condition 5 conflicts with the decision table (1210) for section 1.2 by including the activity of repair.
3. Rule 2 shows implicitly the assumption that new buildings are not altered, repaired, or changed.
4. In rule 6, for condition 1 to be true, chapter 13 must be included in the provisions. Therefore, condition 10 applies.

DATUM: Load combination requirement

SECTION: 1.3 LABEL: LCR NUMBER: 1315

INGREDIENTS

Datum	Label	Number
Design load effects		1320
Required strength	RS	3702
Non seismic lateral load effects		1335
Gravity load effects		1340

DECISION TABLE

		1	2	E
1	Required strength > Gravity load effects + Non seismic lateral load effects	Y	N	
2	Design load effects = Required strength	Y	.	
3	Design load effects = Gravity load effects + Non seismic lateral load effects	.	Y	
1	LCR = satisfied	X	X	
2	LCR = violated			X

COMMENTS:

1. The terms, " . . . gravity loads in combination with . . . the seismic forces in these provisions," were inferred to be a direct reference to the controlling load combinations and required strengths of chapter 3.
2. Rule 2 seems to have little impact. The implication of sections 1.2 and 1.3 is that all the applicable provisions for seismic resistant design must be followed even if other lateral load effects are larger.

DATUM: New building requirement

SECTION: 1.3.1 LABEL: NBR NUMBER: 1345

INGREDIENTS

Datum	Label	Number
Requirements of Chapter 2		2001
Structural design requirement	SDR	3001
Equivalent lateral force analysis requirement	ELFAR	4001
Modal analysis requirement	MAR	5001
Soil structure interaction analysis requirement	SSIR	6001
Foundation design requirements	FDR	7001
Architectural/mechanical/electrical design requirement	AMEDR	8001
Wood materials requirement	WMR	9001
Steel materials requirement	SMR	10001
Concrete materials requirement	CMR	11001
Masonry materials requirement	MMR	12001
Quality assurance requirement	QAR	1601
Building use		1270
Construction type		1350
Number of levels (stories)		2243
Total height		2227
Seismicity index	SI	1425
Conventional light timber requirement	CLTR	9701
Structural analysis and design requirements	SADR	1365
Material design and construction requirements	MDCR	1370

DECISION TABLE

		1	2	E
1	Requirements of chapter 2 = satisfied and Structrual design requirement = satisfied and Equivalent lateral force analysis requirement = satisfied and Modal analysis requirement = satisfied and Soil structure interaction analysis requirement = satisfied and Foundation design requirements = satisfied and Architectural/mechanical/electrical design requirement = satisfied and Wood materials requirement = satisfied and Steel materials requirement = satisfied and Concrete materials requirement = satisfied and Quality assurance requirement = satisfied	Y	N	
2	Building use = dwelling and Constructionl type = wood frame and Number of levels (stories) < 3 and Total height $\leq$ 35' and Seismicity index = 3 or 4	.	Y	
3	Conventional light timber requirement = satisfied	.	Y	
4	Structural analysis and design requirements = satisfied	+	.	
5	Material design and construction requirements = satisfied	+	.	
6	Architectural/mechanical/electrical design requirement = satisfied	+	.	
1	NBR = satisfied	X	X	
2	NBR = violated			X

COMMENTS:

1. Conditions 4, 5 and 6 are redundant, because condition 1 determines their value for the rule of interest.
2. The text reference to the requirements of chapter 2, is unnecessary, as chapter 2 contains definitions only.

DATUM: Structural analysis and design requirement

SECTION: 1.3.1 LABEL: SADR NUMBER: 1365

INGREDIENTS

Datum	Label	Number
Structural design requirement	SDR	3001
Equivalent lateral force analysis requirement	ELFAR	4001
Modal analysis requirement	MAR	5001
Soil structure interaction analysis requirement	SSIR	6001
Foundation design requirements	FDR	7001

DECISION TABLE

			1	E
		*		
1	Structural design requirement = satisfied	*	Y	
2	Equivalent lateral force analysis requirement = satisfied	*	Y	
3	Modal analysis requirement = satisfied	*	Y	
4	Soil structure interaction analysis requirement = satisfied	*	Y	
5	Foundation design requirements = satisfied	*	Y	
		*		
	**			
		*		
1	SADR = satisfied	*	X	
2	SADR = violated	*		X
		*		

COMMENT:

1. See comment 1 on datum 1345.

DATUM: Material design and construction requirement

SECTION: 1.3.1 LABEL: MDCR NUMBER: 1370

INGREDIENTS

Datum	Label	Number
Wood materials requirement	WMR	9001
Steel materials requirement	SMR	10001
Concrete materials requirement	CMR	11001
Masonry materials requirement	MMR	12001

DECISION TABLE

		1	E
1	Wood materials requirement = satisfied	Y	
2	Steel materials requirement = satisfied	Y	
3	Concrete materials requirement = satisfied	Y	
4	Masonry requirement = satisfied	Y	
1	MDCR = satisfied	X	
2	MDCR = violated		X

COMMENT:

1. See comment 1 on datum 1345.

DATUM: Alteration and repair requirement

SECTION: 1.3.2 LABEL: ARR NUMBER: 1380

INGREDIENTS

Datum	Label	Number
Seismic force resistance before proposed activity	ZSFRB	1250
Seismic force resistance after proposed activity	ZSFRA	1260
Seismic force resistance required by these provisions	ZSFRRP	1385
Hazard abatement requirement	HAR	13301

DECISION TABLE

			1	2	3	4
1	Seismic force resistance before proposed activity $\leq$ Seismic force resistance after proposed activity	*	Y	N	N	N
2	Seismic force resistance after proposed activity $\geq$ Seismic force resistance required by these provisions	*	.	Y	N	N
3	Hazard abatement requirement = satisfied	*	.	.	Y	N
	**					
1	ARR = satisfied	*	X	X	X	
2	ARR = violated	*				X

COMMENTS:

1. The text of section 1.3.2 refers to lateral forces, not seismic forces for the first three ingredients. It was assumed that the intent was to deal with seismic forces. It was also assumed that these were the same seismic force resistances introduced in section 1.2.
2. The text of section 1.3.2 apparently assumes that chapter 13 is adopted by its reference to section 13.3.
3. Examination of section 13.3 raises a question as to what "modification" is being referred: a reduction in the required resistance or an allowable time for upgrading, or both.
4. The early portions of chapter 13 restrict its applicability to buildings of seismic performance category C or D, yet the reference from this section is apparently for buildings of all categories.
5. It is possible to interpret the text of section 1.3.2 so that condition 2 and rule 2 are deleted from the decision table.

DATUM: Seismic force resistance required by these provisions

SECTION: 1.3.2 LABEL: ZSFRRP NUMBER: 1385

COMMENTS:

It is implied that this datum is a function of all of the provisions, but no specific guidance is given. Reasonable assumptions might be that some or all of the following be considered as ingredients: the load combinations of section 3.7 (datum 3702), the minimum forces of sections 3.7.5 and 3.7.6, the non-structural forces of chapter 8, or the new building requirement (datum 1345), which would include essentially all of the provisions.

DATUM: Change of use requirement

SECTION: 1.3.3 LABEL: CUR NUMBER: 1390

INGREDIENTS

Datum	Label	Number
Seismic force resistance after proposed activity	ZSFRA	1260
Seismic force resistance required by these provisions	ZSFRRP	1385
Hazard abatement requirement	HAR	13301

DECISION TABLE

		1	2	3
1	Seismic force resistance after proposed activity ≥ Seismic force resistance required by these provisions	Y	N	N
2	Hazard abatement requirement = satisfied	.	Y	N
1	CUR = satisfied	X	X	
2	CUR = violated			X

COMMENTS:

1. This requirement only applies to those buildings in which the change results in assignment to a higher seismic performance category, as stated in section 1.2 (datum 1210).
2. Comments 2, 3 and 4 on datum 1380, regarding chapter 13, are also applicable to this datum.

DATUM: Effective peak acceleration

SECTION: 1.4.1 LABEL: EPA NUMBER: 1405

INGREDIENTS

Datum	Label	Number
Map area from figure 1-1		1410

DECISION TABLE

		*	1	2	3	4	5	6	7
1	Map area from figure 1-1 = 7	*	Y	-	-	-	-	-	N
2	Map area from figure 1-1 = 6	*	-	Y	-	-	-	-	N
3	Map area from figure 1-1 = 5	*	-	-	Y	-	-	-	N
4	Map area from figure 1-1 = 4	*	-	-	-	Y	-	-	N
5	Map area from figure 1-1 = 3	*	-	-	-	-	Y	-	N
6	Map area from figure 1-1 = 2	*	-	-	-	-	-	Y	N
7	(Map area from figure 1-1 = 1)	*	-	-	-	-	-	-	+
	************								
1	EPA = 0.40	*	X						
2	EPA = 0.30	*		X					
3	EPA = 0.20	*			X				
4	EPA = 0.15	*				X			
5	EPA = 0.10	*					X		
6	EPA = 0.05	*						X	X

COMMENTS:

1. This decision table is a direct translation of Table 1-B from the Provisions. A simpler decision table can be written by creating some functions in the actions: (This simple table is shown for illustrative purposes only.)

		*	1	2	3
1	Map area from figure 1-1 = 1	*	Y	N	-
2	Map area from figure 1-1 > 4	*	-	N	Y
	************				
1	EPA = 0.05	*	X		
2	EPA = 0.05 times [(Map area from figure 1-1) - 1]	*		X	
3	EPA = 0.10 times [(Map area from figure 1-1) - 3]	*			X

DATUM: Effective peak velocity-related acceleration

SECTION: 1.4.1 LABEL: EPV NUMBER: 1415

INGREDIENTS

Datum	Label	Number
Map area from figure 1-2		1420

DECISION TABLE

		*	1	2	3	4	5	6	7
1	Map area from figure 1-2 = 7	*	Y	-	-	-	-	-	N
2	Map area from figure 1-2 = 6	*	-	Y	-	-	-	-	N
3	Map area from figure 1-2 = 5	*	-	-	Y	-	-	-	N
4	Map area from figure 1-2 = 4	*	-	-	-	Y	-	-	N
5	Map area from figure 1-2 = 3	*	-	-	-	-	Y	-	N
6	Map area from figure 1-2 = 2	*	-	-	-	-	-	Y	N
7	(Map area from figure 1-2 = 1)	*	-	-	-	-	-	-	+
1	EPV = 0.40	*	X						
2	EPV = 0.30	*		X					
3	EPV = 0.20	*			X				
4	EPV = 0.15	*				X			
5	EPV = 0.10	*					X		
6	EPV = 0.05	*						X	X

COMMENTS:

1. See comments for datum 1405.

DATUM: Seismicity index

SECTION: 1.4.1 LABEL: SI NUMBER: 1425

INGREDIENTS

Datum	Label	Number
Map area from figure 1-2		1420

DECISION TABLE

			1	2	3	4	5	6	7
1	Map area from figure 1-2 = 7	*	Y	-	-	-	-	-	N
2	Map area from figure 1-2 = 6	*	-	Y	-	-	-	-	N
3	Map area from figure 1-2 = 5	*	-	-	Y	-	-	-	N
4	Map area from figure 1-2 = 4	*	-	-	-	Y	-	-	N
5	Map area from figure 1-2 = 3	*	-	-	-	-	Y	-	N
6	Map area from figure 1-2 = 2	*	-	-	-	-	-	Y	N
7	(Map area from figure 1-2 = 1)	*	-	-	-	-	-	-	+
	********************	*							
1	SI = 4	*	X	X	X				
2	SI = 3	*				X			
3	SI = 2	*					X	X	
4	SI = 1	*							X

COMMENTS:

1. See the comments for datum 1405.

DATUM: Seismic hazard exposure group

SECTION: 1.4.2 LABEL: SHEG NUMBER: 1430

INGREDIENTS

Datum	Label	Number
Facility designated essential by cognizant jurisdiction		1433
Number of occupants in building is large		1436
Movement of occupants is restricted		1439
Mobility of occupants is impaired		1442
Number of use classes in building		1445
Portion of area designated as essential by cognizant jurisdiction		1448
Portion of area with large number of occupants		1451
Portion of area with occupants' free movement restricted		1454
Portion of area with occupants with impaired mobility		1457
Building provides access to another with SHEG = III		1460

DECISION TABLE

	DECISION TABLE	1	2	3	4	5	6	7
1	Facility designated essential by cognizant jurisdiction = true	Y	N	N	.	.	.	.
2	Number of occupants in building is large = true <u>or</u> Movement of occupants is restricted = true <u>or</u> Mobility of occupants is impaired = true	.	Y	N	.	.	.	.
3	Number of use classes in building > 1	N	N	N	Y	Y	Y	.
4	Portion of area designated as essential by cognizant jurisdiction ≥ 15% of building area	+	−	−	Y	N	N	.
5	Portion of area with large number of occupants ≥ 15% of building area <u>or</u> Portion of area with occupants free movement restricted ≥ 15% of building area <u>or</u> Portion of area with occupants with impaired mobility ≥ 15% of building area	.	+	−	.	Y	N	.
6	Building provides access to another with SHEG = III = true	N	N	N	N	N	N	Y
1	SHEG = III	X			X			X
2	SHEG = II		X			X		
3	SHEG = I			X			X	

COMMENTS:

1. Conditions 1 and 2 and rules 1, 2 and 3 are included in this table because they are an accurate representation of the text, although they are redundant in light of conditions 4 and 5.
2. Note that the cognizant jurisdiction determines what is an essential facility, but that no responsibility is assigned nor are any quantitative measures given for determining the value of ingredients 1436, 1439 or 1442.

DATUM: Group III functional requirement

SECTION: 1.4.2(A) LABEL: G3FR NUMBER: 1469

INGREDIENTS

Datum	Label	Number
Seismic hazard exposure group	SHEG	1430
Building has capacity to function immediately after EQ		1463
Designated systems have capacity to function immediately after EQ		1466

DECISION TABLE

			1	2	E
1	Seismic hazard exposure group = III	*	N	Y	
2	Building has capacity to function immediately after EQ = true	*	.	Y	
3	Designated systems have capacity to function immediately after EQ = true	*	.	Y	
	***				
1	G3FR = satisfied	*	X	X	
2	G3FR = violated	*			X

COMMENTS:

1. "Capacity to function" is undefined. Apparently the provisions of chapters 3 and 8 are sufficient, for no other information is available.
2. Designated systems are specified in the quality assurance plan, however, no such plan is required for group III buildings where the seismicity index is 1.

DATUM: Group III access requirement

SECTION: 1.4.2(E) LABEL: G3AR NUMBER: 1472

INGREDIENTS

Datum	Label	Number
Seismic hazard exposure group	SHEG	1430
Building is accessible during and after earthquake		1475
Access provided by adjacent structure		1478
Seismic hazard exposure group of adjacent structure		1481
Distance from access point to side property line		1484
Protection provided against potential adjacent hazards		1487

DECISION TABLE

		1	2	3	4	5	E
1	Seismic Hazard Exposure Group = III	N	Y	Y	Y	Y	
2	Building is accessible during and after earthquake = true	.	Y	Y	Y	Y	
3	Access provided by adjacent structure = true	.	N	Y	N	Y	
4	Seismic hazard exposure group of adjacent structure = III	.	.	Y	.	Y	
5	Distance from access point to side property line < 10 feet	.	N	N	Y	Y	
6	Protection provided against potential adjacent hazards = true	.	.	.	Y	Y	
1	G3AR = satisfied	X	X	X	X	X	
2	G3AR = violated						X

COMMENTS:

1. "Accessible" in condition 2 is undefined.
2. Condition 6 is probably not independent of condition 2.

DATUM: Seismic performance category

SECTION: 1.4.3 LABEL: SPC NUMBER: 1490

INGREDIENTS

Datum	Label	Number
Seismicity index	SI	1425
Seismic hazard exposure group	SHEG	1430

DECISION TABLE

			1	2	3	4	5	6
1	Seismicity index = 1	*	Y	-	-	-	N	N
2	Seismicity index = 2	*	-	Y	-	-	N	N
3	Seismicity index = 3	*	-	-	Y	Y	N	N
4	(Seismicity index = 4)	*	-	-	-	-	+	+
5	Seismic hazard exposure group = I	*	.	.	Y	N	.	-
6	(Seismic hazard exposure group = II)	*	.	.	-	.	.	-
7	Seismic hazard exposure group = III	*	.	.	-	.	N	Y
1	SPC = A	*	X					
2	SPC = B	*		X	X			
3	SPC = C	*				X	X	
4	SPC = D	*						X

COMMENTS:

1. Note that the text gives this information in tabular form; this table is simply a conversion.

DATUM: Category D site limitation requirement

SECTION: 1.4.4 LABEL: CDSLR NUMBER: 1493

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Building stage		1230
Proposed work on existing building		1240
Seismic performance category before proposed change	YSPCB	1264
Potential exists for ground rupture from active fault		1496

DECISION TABLE

		1	2	3	4	E
1	Seismic performance category = D	N	Y	Y	Y	
2	Building stage = new	.	Y	-	N	
3	Proposed work on existing building = change of use and Seismic performance category before proposed work ≠ D	.	-	Y	N	
4	Potential exists for ground rupture from active fault = true	.	N	N	.	
	************					
1	CDSLR = satisfied	X	X	X	X	
2	CDSLR = violated					X

COMMENTS:

1. No responsibility or quantitative measures are given to determine the value of ingredient datum 1496.

DATUM: Alternate acceptable

SECTION: 1.5 LABEL: AA NUMBER: 1510

INGREDIENTS

Datum	Label	Number
Use of alternate material or method desired		1520
Regulatory agency approves alternate		1530
Alternate is equal in strength, durability, seismic resistance		1540
Substantiating evidence submitted to regulatory agency		1550

DECISION TABLE

		1	E
1	Use of alternte material or method desired = true	Y	
2	Regulatory agency approves alternate = true	Y	
3	Alternate is equal in strength, durability, seismic resistance = true	Y	
4	Substantiating evidence submitted to regulatory agency = true	Y	
1	AA = satisfied	X	
2	AA = violated		X

COMMENTS:

1. The text states that this provision is applicable to materials and methods of construction. The implication is that it does not apply to methods of analysis and design.
2. This datum is left unreferenced in this analysis; it is understood to be an ingredient of nearly all decisions.
3. Condition 3 apparently refers to all the other provisions.

DATUM: Quality assurance requirement

SECTION: 1.6 LABEL: QAR NUMBER: 1601

INGREDIENTS

Datum	Label	Number
Quality assurance plan required	QAPR	1602
Quality assurance plan acceptance requirement	QAPAR	1604
Quality assurance plan compliance requirement	QAPC	1651
Mechanical/electrical equipment testing required	MEETR	1637
Mechanical/electrical testing plan acceptance requirement	MEETPA	1640
Mechanical/electrical test compliance requirement	MEETC	1644

DECISION TABLE

		1	2	3	4	E
1	Quality assurance plan required = true	Y	Y	N	N	
2	Quality assurance plan acceptance requirement = satisfied	Y	Y	.	.	
3	Quality assurance plan compliance requirement = satisfied	Y	Y	.	.	
4	Mechanical/electrical equipment testing required = true	Y	N	Y	N	
5	Mechanical/electrical testing plan acceptance requirement = satisfied	Y	.	Y	.	
6	Mechanical/electrical test compliance requirement = satisfied	Y	.	Y	.	
1	QAR = satisfied	X	X	X	X	
2	QAR = violated					X

COMMENTS:

1. The applicability of the provisions of section 1.6 are not clearly stated. Several comments on this and other decision tables will point out the problem areas.
2. It was assumed that the bulk of the provisions for quality assurance are applicable only if a quality assurance plan is required. However, section 1.6.3(E) and section 8.3.4 indicate that testing of mechanical/electrical equipment is called for in explicitly different situations. Thus, conditions 4, 5, and 6 are added to this table.

DATUM: Quality assurance plan required

SECTION: 1.6.1 LABEL: QAPR NUMBER: 1602

INGREDIENTS

Datum	Label	Number
Seismicity index	SI	1425
Seismic hazard exposure group	SHEG	1430

DECISION TABLE

		*	1	2	E
1	Seismic hazard exposure group = III	*	Y	-	
2	Seismic hazard exposure group = II	*	-	Y	
3	Seismicity index = 4	*	.	Y	
4	Seismicity index = 1	*	N	-	
	**				
1	QAPR = true	*	X	X	
2	QAPR = false	*			X

DATUM: Quality assurance plan acceptance requirement

SECTION: 1.6.1 LABEL: QAPAR NUMBER: 1604

INGREDIENTS

Datum	Label	Number
Details of quality assurance plan	DQAP	1605
Statement of contractor on quality assurance plan	SCQAP	1613

DECISION TABLE

			1	E
1	Details of quality assurance plan = satisfied	*	Y	
2	Statement of contractor on quality assurance plan = satisfied (for each contractor)	*	Y	
	**			
1	QAPAR = satisfied	*	X	
2	QAPAR = violated	*		X

COMMENTS:

1. Although the contractor's statement is apparently not a part of the quality assurance plan, it is included in this decision table because it is placed in the section of text devoted to the quality assurance plan.

DATUM: Details of quality assurance plan

SECTION: 1.6.1(A) LABEL: DQAP NUMBER: 1605

INGREDIENTS

Datum	Label	Number
Plan specifies those DSS which require special performance		1607
Plan for each DSS prepared by designer of that DSS		1608
Planned special inspection		1610
Minimum special inspection	MSI	1628
Planned special testing		1611
Minimum special testing	MST	1635

DECISION TABLE

		1	E
1	Plan specifies those DSS which require special performance = true	Y	
2	Plan for each DSS prepared by designer of that DSS = true	Y	
3	Planned special inspection $\geqq$ Minimum special inspection (for each component)	Y	
4	Planned special testing $\geqq$ Minimum special testing (for each component)	Y	
1	DQAP = satisfied	X	
2	DQAP = violated		X

COMMENTS:

1. DSS stands for "designated seismic system."

DATUM: Statement of contractor on quality assurance plan

SECTION: 1.6.1(B) LABEL: SCQAP NUMBER: 1613

INGREDIENTS

Datum	Label	Number
Statement is written		1614
Statement is submitted prior to start of work on DSS		1616
Statement acknowledges awareness of reqts of Q A plan		1617
Statement acknowledges that control will be exercised		1618
Statement contains procedures for control		1619
Statement contains method, freq, and distr of reports		1620
Statement names person responsible for control		1622
Statement shows position within mgt of responsible person		1623

DECISION TABLE

			1	E
1	Statement is written = true	*	Y	
2	Statement is submitted prior to start of work on DSS = true	*	Y	
3	Statement acknowledges awareness of reqts of Q A plan = true	*	Y	
4	Statement acknowledges that control will exercised = true	*	Y	
5	Statement contains procedures for control = true	*	Y	
6	Statement contains method, freq, and distr of reports = true	*	Y	
7	Statement names person responsible for control = true	*	Y	
8	Statement names person responsible for control = true	*	Y	
	***	*		
1	SCQAP = satisfied	*	X	
2	SCQAP = violated	*		X

DATUM: Quality assurance personnel arrangements

SECTION: 1.6.2, 1.6.3, and 2.1 LABEL: QAPA NUMBER: 1625

INGREDIENTS

Datum	Label	Number
Special inspector employed by building owner		1626
Special inspector approved by regulatory agency		1632
Special testing agency approved by regulatory agency		1634
Qualification of person with respons charge of test/inspec		2192

DECISION TABLE

			1	E
		*		
1	Special inspector employed by building owner = true	*	Y	
2	Special inspector approved by regulatory agency = true	*	Y	
3	Special testing agency approved by regulatory agency = true	*	Y	
4	Qualification of person with respons charge of test/inspec = engineer licensed by the State to practice in the applicable discipline	*	Y	
		*		
	**			
		*		
1	QAPA = satisfied	*	X	
2	QAPA = violated	*		X
		*		

COMMENTS:

1. Condition 4 is not located in the section on quality assurance, but is found in the definition of "Testing Agency" in chapter 2. The condition is not referenced from section 1.6, but it was inferred to apply to this provision.

DATUM: Minimum special inspection

SECTION: 1.6.2 LABEL: MSI NUMBER: 1628

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Construction activity		1631
A/M/E performance level	PL	8105
Seismic performance category	SPC	1490

DECISION TABLE

	Condition			1	2	3
1	Element = foundation pile and activity = driving or drilling	or	*	Y	-	N
	Element = foundation caisson and activity = work (any?)	or	*			
	Element = reinforcing steel in special moment frames and activity = placement	or	*			
	Element = reinforcing steel and activity = welding	or	*			
	Element = prestressing steel and activity = placement, stressing or grouting	or	*			
	Element = prestressed concrete and activity = placement	or	*			
	Element = structural masonry and seismic performance category = C or D and activity = placement of units	or	*			
	Element = structural masonry in the seismic resisting system and activity = grouting	or	*			
	Element = multiple pass welded connections in structural steel and activity = shop or field welding	or	*			
	Element = structural wood and activity = field gluing		*			
2	Element = reinforcing steel in concrete or masonry shear walls or ordinary reinforced concrete moment frames and activity = placement	or	*	-	Y	N
	Element = structural concrete in drilled piers, caissons, frames or shear walls and activity = placement	or	*			
	Element = structural steel high strength bolts and activity = bolting	or	*			
	Element = structural wood and activity = fastening other than field gluing	or	*			
	Element = interior or exterior panels and performance level = S or G and activity = erection or fastening	or	*			
	Element = veneers and performance level = S or G and activity = adhesion or anchorage	or	*			
	Element = M/E equipment using combustible energy, or electrical motors, transformers, switchgear unit substations or motor control centers, or reciprocating or rotating machinery, or pipe systems over 3" in diameter, or tanks, heat exchangers or pressure vessels and performance level = S or G and activity = installation or anchorage		*			
1	MSI = continuous		*	X		
2	MSI = periodic		*		X	
3	MSI = none		*			X

COMMENTS:

1. This table is to be repeated for each element of the building.
2. It is assumed that the special inspection for architectural/mechanical/electrical components with S or G performance levels is only applied to buildings for which a quality assurance plan is required, unlike the testing of mechanical/electrical equipment.

DATUM: Minimum special testing

SECTION: 1.6.3 LABEL: MST NUMBER: 1635

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114

DECISION TABLE

		1	2	3	4	5	6	7	8	9	10	11
1	Element = reinforcement for special moment frames or boundary members of concrete or masonry shear walls	Y	-	-	-	-	-	-	-	-	-	N
2	Element = prestressing steel	-	Y	-	-	-	-	-	-	-	-	N
3	Element = structural concrete	-	-	Y	-	-	-	-	-	-	-	N
4	Element = mortar or grout for structural masonry	-	-	-	Y	-	-	-	-	-	-	N
5	Element = structural masonry designed for field tested f'_m	-	-	-	-	Y	-	-	-	-	-	N
6	Element = masonry units for structural masonry	-	-	-	-	-	Y	-	-	-	-	N
7	Element = welded connection in steel special moment frames	-	-	-	-	-	-	Y	+	.	-	N
8	Element = complete penetration groove weld in special moment frames	-	-	-	-	-	-	N	Y	-	-	N
9	Element = partial penetration groove weld in column splice	-	-	-	-	-	-	N	-	Y	-	N
10	Element = welded base metal over 1-1/2" thick, if weld shrinkage is across thickness	-	-	-	-	-	-	-	-	-	Y	N

		1	2	3	4	5	6	7	8	9	10	11
1	MST = samples a fabricators and test for weldability, elongation, and strength ratios <u>or</u> accept mill test certificates if ASTM A706	X										
2	MST = examine certified mill test reports for compliance		X									
3	MST = per ACI 318, with at least one sample per day per class			X								
4	MST = test at least one per day and one per 2000 ft^2 of wall				X							
5	MST = test at least 5 prisms before work and one prism per day and one per 5000 ft^2 of wall and at least 5 per job					X						
6	MST = test compressive strength per ASTM: at least 5 units per lot and one per 5000 ft^2 of wall						X					
7	MST = follow AWS D1.1-75 for non-destructive tests							X				
8	MST = follow AWS D1.1-75, testing 100% by ultrasonic. Can be reduced to 25% if welder's reject rate is less than 5%								X			
9	MST = Ultrasonic testing, 100% if resists tension from seismic									X		
10	MST = Ultrasonic testing after completion. Criteria acceptable to regulatory agency and structural engineer										X	
11	MST = none											X

COMMENTS: (for datum 1635, previous page)

1. This table is to be repeated for each element of the building.
2. Note that a significant amount of logic is contained in the action stubs. A more detailed analysis would probably make use of a separate decision table for many of the action stubs.
3. Note that this table does not contain tests for mechanical/electrical equipment. That is shown in the table for datum 1641.

DATUM: Mechanical/electrical equipment testing required

SECTION: 1.6.5(E), 8.3.4 LABEL: MEETR NUMBER: 1637

INGREDIENTS

Datum	Label	Number
Component is a part of a designated seismic system		1638
M/E component certification (testing) required	MECCR	8363

DECISION TABLE

		*	1	2	E
1	Component is a part of a designated seismic system = true	*	Y	N	
2	M/E component certification (testing) required = true	*	.	Y	
	**	*			
1	MEETR = true	*	X	X	
2	MEETR = false	*			X

COMMENTS:

1. This table is repeated for each mechanical and electrical component.
2. The wording "For designated seismic systems or components requiring S or G performance ratings in chapter 8 . . . . The basis of the certification required in section 8.3.4 . . ." brings in the provisions of chapter 8, which define the additional situations in which special testing is required. It was assumed that the "certification" referred to in section 8.3.4 is the same thing as the "testing" referred to in section 1.6.3.

DATUM: Mechanical/electrical equipment testing plan acceptance requirement

SECTION: 1.6.3(E), 1.6.5 LABEL: MEETPA NUMBER: 1640

INGREDIENTS

Datum	Label	Number
Planned special testing for mech/elect equipment		1643
Minimum special testing for mech/elect equipment	MSTMEE	1641
Mech/elect equip manufacturer certification program reqt	MEEMCP	1674

DECISION TABLE

		1	E
1	Planned special testing for mech/elect equipment ≥ Minimum special testing for mech/elect equipment (for each component)	Y	
2	Mech/elect equip manufacturer certification program reqt = satisfied	Y	
1	MEETPA = satisfied	X	
2	MEETPA = violated		X

COMMENTS:

1. Section 1.6.5 is not clearly referenced from the remainder of section 1.6. Because it deals with certification, and because section 1.6.3(E) does mention certification, it is assumed that section 1.6.5 applies in the same situations as section 1.6.3(E). Thus, condition 2 is included in this table.

DATUM: Minimum special testing for mechanical/electrical equipment

SECTION: 1.6.3(E), 8.3.4 LABEL: MSTMEE NUMBER: 1641

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
M/E attachment certification (testing) required	MEACR	8369

	DECISION TABLE		1	2	3	E
1	Element of building = mechanical/electrical equipment	*	Y	-	-	
2	Element of building = attachment of mechanical/electrical equipment	*	-	Y	Y	
3	M/E attachment certification (testing) required = true	*	.	Y	N	
	**					
1	MSTMEE = shaking table or 3-D shock test or dynamic analytic methods using the forces of formula 8-2 <u>or</u> by a more rigorous analysis	*	X	X		
2	MSTMEE = none	*			X	X

COMMENTS:

1. Section 8.3.4 requires testing of attachments only if they are of the resilient type.

DATUM: Mechanical/electrical test compliance requirement

SECTION: 1.6.3(E) LABEL: MEETC NUMBER: 1644

INGREDIENTS

Datum	Label	Number
Actual special testing for mech/elect equipment		1646
Planned special testing for mech/elect equipment		1643
Manufacturer submits certificate of compliance		1647
Regulatory agency approves certificate		1649
Component is a part of a designated seismic system		1638
Special inspector verifies that equipment conforms to certificate		1650

DECISION TABLE

		1	2	E
1	Actual special testing for mech/elect equipment ≥ Planned special testing for mech/elect equipment (for each component)	Y	Y	
2	Manufacturer submits certificate of compliance = true	Y	Y	
3	Regulatory agency approves certificate = true	Y	Y	
4	Component is a part of a designated seismic system = true	Y	N	
5	Special inspector verifies that equipment conforms to cert = true	Y	.	
1	MEETC = satisfied	X	X	
2	MEETC = violated			X

COMMENTS:

1. The wording of 1.6.3(E) clearly states that the special inspector is to verify the certification of M/E equipment that is a part of a designated seismic system, although as discussed under datum number 1637, other M/E equipment will require certification. This is appropriate, since equipment requiring certification that is not a part of a DSS would in all likelihood be in buildings for which no quality assurance plan would be required, and thus no special inspector would be engaged.

DATUM: Quality assurance plan compliance requirement

SECTION: 1.6.4 LABEL: QAPC NUMBER: 1651

INGREDIENTS

Datum	Label	Number
Actual special inspection		1652
Planned special inspection		1610
Actual special testing		1653
Planned special testing		1611
Quality assurance personnel arrangements	QAPA	1625
Quality assurance reporting requirement	QARR	1654

DECISION TABLE

		1	E
1	Actual special inspection $\geq$ Planned special inspection (for each component)	Y	
2	Actual special testing $\geq$ Planned special testing (for each component)	Y	
3	Quality assurance personnel arrangements = satisfied	Y	
4	Quality assurance reporting requirement = satisfied	Y	
	**		
1	QAPC = satisfied	X	
2	QAPC = violated		X

COMMENTS:

1. Conditions 1 and 2 are repeated for each element of the building.

DATUM: Quality assurance reporting requirement

SECTION: 1.6.4 LABEL: QARR NUMBER: 1654

INGREDIENTS

Datum	Label	Number
Special inspector's weekly report requirement	SIWRR	1655
Special inspector's final report requirement	SIFRR	1662
Contractor's final report requirement	CFRR	1668

DECISION TABLE

		*	1	E
1	Special inspector's weekly report requirement = satisfied	*	Y	
2	Special inspector's final report requirement = satisfied	*	Y	
3	Contractor's final report requirement = satisfied	*	Y	
	**********			
1	QARR = satisfied	*	X	
2	QARR = violated	*		X

DATUM: Special inspector's weekly report requirement

SECTION: 1.6.4 LABEL: SIWRR NUMBER: 1655

INGREDIENTS

Datum	Label	Number
Special inspector prepares progress reports each week		1656
SIW report to reg agency, owner, Q A plan author, contractor		1657
SIW report notes any deficiencies		1659
SIW report notes any corrections of past deficiencies		1661

DECISION TABLE

		*	1	E
1	Special inspector prepares progress reports each week = true	*	Y	
2	SIW report to reg agency, owner, Q A plan author, contr = true	*	Y	
3	SIW report notes any deficiencies = true	*	Y	
4	SIW report notes any corrections of past deficiencies = true	*	Y	
	**********			
1	SIWRR = satisfied	*	X	
2	SIWRR = violated	*		X

DATUM: Special inspector's final report requirement

SECTION: 1.6.4 LABEL: SIFRR NUMBER: 1662

INGREDIENTS

Datum	Label	Number
SIF report submitted to regulatory agency at completion		1664
SIF report certifies inspected work substantially in compliance		1665
SIF report notes any work not in compliance		1667

DECISION TABLE

		1	E
1	SIF report submitted to regulatory agency at completion = true	Y	
2	SIF report certifies inspected work substantially in compliance = true	Y	
3	SIF report notes any work not in compliance = true	Y	
1	SIFRR = satisfied	X	
2	SIFRR = violated		X

DATUM: Contractor's final report requirement

SECTION: 1.6.4 LABEL: CFRR NUMBER: 1668

INGREDIENTS

Datum	Label	Number
CF report submitted to reg agency at completion		1670
CF report certifies all DSS substantially in compliance		1671
CF report notes any deficiencies		1673

DECISION TABLE

		1	E
1	CF report submitted to reg agency at completion = true	Y	
2	CF report certifies all DSS substantially in compliance = true	Y	
3	CF report notes any deficiencies = true	Y	
1	CFRR = satisfied	X	
2	CFRR = violated		X

DATUM: Mechanical/electrical equipment manufacturers certification program requirement

SECTION: 1.6.5 LABEL: MEEMCP NUMBER: 1674

INGREDIENTS

Datum	Label	Number
Manufacturer maintains a quality assurance program		1685
Quality control program approved by reg agency		1686
Each component marked with reg agency approval		1688

DECISION TABLE

			1	E
1	Manufacturer maintains a quality assurance program = true	*	Y	
2	Quality control program approved by reg agency = true	*	Y	
3	Each component marked with reg agency approval = true	*	Y	
*****				
1	MEEMCP = satisfied	*	X	
2	MEEMCP = violated	*		X

COMMENTS:

1. See comment 1 under datum 1640.

DATUM: Structural design requirement

SECTION: 3.1, 3.3, and 3.6 LABEL: SDR NUMBER: 3001

INGREDIENTS

Datum	Label	Number
Structural analysis requirement	SAR	3105
Strength requirement	SR	3120
Deformation requirement	DR	3140
Seismic performance category	SPC	1490
Load path requirement	LPR	3145
Foundation design criteria requirement	FDCR	3160
General framing requirement	GFR	3369
Structural design and detailing requirement	SDDR	3610

DECISION TABLE

		1	2	E
1	Structural analysis requirement = satisfied	Y	Y	
2	Strength requirement = satisfied	Y	Y	
3	Deformation requirement = satisfied	Y	N	
4	Seismic performance category = A	.	Y	
5	Load path requirement = satisfied	Y	Y	
6	Foundation design criteria requirement = satisfied	Y	Y	
7	General framing requirement = satisfied	Y	Y	
8	Structural design and detailing requirement = satisfied	Y	Y	
	******************************			
1	SDR = satisfied	X	X	
2	SDR = violated			X

COMMENTS:

1. At no place in chapter 3 is this complete set of conditions brought together. This decision table was created for use as a convenient reference to all the requirements of chapter 3, because such a reference is called for in chapter 1. (See datum 1345, for example.) Note that there are some provisions in chapter 3 that are not directly covered by this requirement. (The response modification factor, datum 3345, for example.) These datums are all referenced in other chapters, however.
2. Rule 2 was added to demonstrate a potential problem: all the requirements except the deformation requirements are either directly applicable to category A buildings or make exceptions for such buildings. The information needed to satisfy the deformation requirements for category A would require an analysis of seismic loads that would otherwise not be required.

DATUM: Structural analysis requirement

SECTION: 3.1 LABEL: SAR NUMBER: 3105

INGREDIENTS

Datum	Label	Number
Seismic load analysis requirement	SLAR	3510
Internal member forces determined with linear elastic model		3115

DECISION TABLE

			1	E
1	Seismic load analysis requirement = satisfied	*	Y	
2	Internal member forces determined with linear elastic model = true	*	Y	
	******************************			
1	SAR = satisfied	*	X	
2	SAR = violated	*		X

DATUM: Strength requirement

SECTION: 3.1 LABEL: SR NUMBER: 3120

INGREDIENTS

Datum	Label	Number
Member strength	YMS	3125
Connection strength	YCS	3130
Required strength	RS	3702

DECISION TABLE

		1	2	3	4	5
1	Member strength ≧ Required strength (for each member)	Y	Y	Y	Y	N
2	Connection strength ≧ Member strength (for each connection)	Y	N	Y	N	.
3	Connection strength ≧ Required strength (for each connection)	Y	Y	N	N	.
1	SR = satisfied	X	X	X		
2	SR = violated				X	X

COMMENTS:

1. Note that the table is repeated for each member and connection.
2. The "or" in the text of section 3.1, "... connections shall develop the strength of the member or the forces indicated above," leads to the improbable, but dangerous, situation shown in rule 3.
3. It is possible that systems designed with a large response modification factor (R) would not behave as designed if rule 2 were true.
4. Note that Category A buildings apparently are to follow the same procedures for strength evaluation as all others. The "Required strength" for Category A buildings is determined only from the minimum forces of section 3.7, not from a seismic load analysis.

DATUM: Member strength

SECTION: 3.1 LABEL: YMS NUMBER: 3125

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210
Strength of masonry components	XSM	12210

COMMENTS:

1. The strength is to be taken from the applicable chapter (or chapters). No provisions exist for the strength of any other materials.

DATUM: Connection strength

SECTION: 3.1 LABEL: YCS NUMBER: 3130

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210
Strength of masonry components	XSM	12210

COMMENTS:

1. See comment on datum 3125 above.

DATUM: Deformation requirement

SECTION: 3.1 and 3.8 LABEL: DR NUMBER: 3140

INGREDIENTS

Datum	Label	Number
Drift limit	DL	3850
Separation requirement	SEPR	3810

DECISION TABLE

			1	E
1	Drift limit = satisfied	*	Y	
2	Separation requirement = satisfied	*	Y	
1	DR = satisfied	*	X	
2	DR = violated	*		X

DATUM: Load path requirement

SECTION: 3.1 LABEL: LPR NUMBER: 3145

INGREDIENTS

Datum	Label	Number
Continuous load path exists to transfer all forces		3150
Load path has adequate strength and stiffness		3155

DECISION TABLE

			1	E
1	Continuous load path exists to transfer all forces = true	*	Y	
2	Load path has adequate strength and stiffness = true	*	Y	
1	LPR = satisfied	*	X	
2	LPR = violated	*		X

COMMENTS:

1. The relation between this and other provisions is not clear. For example, it might be possible to reference the strength requirement (datum 3120) in condition 2, but that did not seem to be the intent. The collector requirement (datum 3752), and to a lesser extent, the interconnection requirement (datum 3737) are two other examples of provisions that might be related to this provision.

DATUM: Foundation design criteria requirement

SECTION: 3.1 LABEL: FDCR NUMBER: 3160

INGREDIENTS

Datum	Label	Number
Foundation designed to accommodate design ground motions		3165
Foundation des criteria based on dynamics and structural des philosophy		3170

DECISION TABLE

			1	E
1	Foundation designed to accommodate design ground motions = true	*	Y	
2	Foundation design criteria based on dynamics and structural design philosophy = true	*	Y	
	**	*		
1	FDCR = satisfied	*	X	
2	FDCR = violated	*		X

COMMENTS:

1. No measurable criteria are included for use in judging the values in this requirement.

DATUM: Soil profile type

SECTION: 3.2 LABEL: SPT NUMBER: 3210

and

DATUM: Seismic soil coefficient

SECTION: 3.2 LABEL: SSC NUMBER: 3220

(both have the same ingredients and decision table)

INGREDIENTS

Datum	Label	Number
Soil type		3230
Depth of soil to rock		3240
Depth of soft to medium clay		3250
Soil type known		3260

DECISION TABLE

		1	2	3	4	5	E
1	Soil type = rock	Y	-	-	-	.	
2	Soil type = stiff clay and/or stable sand and/or gravel	-	Y	Y	-	.	
3	Depth of soil to rock < 200'	+	Y	N	.	.	
4	Soil type = soft to medium clay	-	-	-	Y	.	
5	Depth of soft to medium clay > 30'	.	.	.	Y	.	
6	Soil type known = true	+	+	+	+	N	
1	SPT = S1 and SSC = 1.0	X	X				
2	SPT = S2 and SSC = 1.2			X		X	X
3	SPT = S3 and SSC = 1.5				X		

COMMENTS:

1. Both of these datums are ingredients of the analysis procedures in chapters 4 and 5. It would fit better if the provisions were actually placed there.

DATUM: Soil structure interaction use requirement

SECTION: 3.2 LABEL: SSIUR NUMBER: 3270

INGREDIENTS

Datum	Label	Number
Designer wishes to use soil structure interaction		3280
Seismic load analysis used		3520

DECISION TABLE

			1	2	3	4
1	Designer wishes to use soil structure interaction = true	*	N	Y	Y	Y
2	Seismic load analysis used = Equivalent lateral force method (chapter 4)	*	.	Y	-	N
3	Seismic load analysis used = Modal analysis method (chapter 5)	*	.	-	Y	N
1	SSIUR = satisfied	*	X	X	X	
2	SSIUR = violated	*				X

COMMENTS:

1. A strict interpretation of the text implies that soil structure interaction may not be used for analysis procedures other than the ELF method or the modal method; thus it may not be used in a special dynamic analysis.
2. This provision is not an ingredient of any provision in sections 3.1 through 3.4., but it is inferred to be an ingredient of the seismic load analysis requirement (datum 3510) of section 3.5.

DATUM: General framing class

SECTION: 3.3.1 (Table 3-B) LABEL: GFC NUMBER: 3303

INGREDIENTS

Datum	Label	Number
Vertical load system		3306
Seismic resisting system		3309
Structure is characterized as an inverted pendulum		3312
Moment frame requirement	MFR	3315
Dual system requirement	DSR	3318

DECISION TABLE

		1	2	3	4	5	6	7	8	9	10	11	E
1	Vertical load system = essentially complete frame	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	
2	(Vertical load system includes bearing walls)	+	+	+	-	-	-	-	-	-	-	-	
3	Seismic resisting system includes shear wall	Y	N	Y	Y	N	Y	N	Y	N	Y	N	
4	Seismic resisting system includes braced frame	N	Y	Y	N	Y	Y	N	N	Y	Y	N	
5	Seismic resisting system includes moment frame (unbraced frame)	N	N	N	N	N	N	Y	Y	Y	Y	Y	
6	Structure is characterized as an inverted pendulum = true	N	N	N	N	N	N	N	N	N	N	Y	
7	Moment frame requirement = satisfied	.	.	.	.	.	.	Y	.	.	.	.	
8	Dual system requirement = satisfied	.	.	.	.	.	.	.	Y	Y	Y	.	
1	GFC = Bearing Wall	X	X	X									
2	GFC = Building Frame				X	X	X						
3	GFC = Moment Frame							X					
4	GFC = Dual System								X	X	X		
5	GFC = Inverted Pendulum											X	
E	GFC = not defined												X

COMMENTS:

1. It was assumed that the first two conditions are logical opposites.
2. The phrase "shear walls or braced frames" was assumed to mean shear walls "and/or" braced frames (a logical <u>or</u>).
3. Condition 6 apparently <u>only</u> applies to inverted pendulum structures that are buildings, because chapter 1 excludes non-building structures from the coverage of the provisions.
4. There are several significant ELSE rules that represent possible omissions. The following page shows the decision tree generated to identify else rules, and the discussion of the ELSE rules continues on the next page.

```
C6  + +  C1  + +  C3  + ELSE
-        -        -
-        -        -  - -  C4  + ELSE
-        -                 -
-        -                 -  - -  C5  + +  R11
-        -                          -
-        -                          -  - ELSE
-        -
-        -  - ELSE
-
-  - -  C1  + +  C3  + +  C4  + +  C5  + +  C8  + +  R10
         -        -        -        -        -
         -        -        -        -        -  - ELSE
         -        -        -        -
         -        -        -        -  - -  R6
         -        -        -
         -        -        -  - -  C5  + +  C8  + +  R8
         -        -                 -        -
         -        -                 -        -  - ELSE
         -        -                 -
         -        -                 -  - -  R4
         -        -
         -        -  - -  C4  + +  C5  + +  C8  + +  R9
         -                 -        -        -
         -                 -        -        -  - ELSE
         -                 -        -
         -                 -        -  - -  R5
         -                 -
         -                 -  - -  C5  + +  C7  + +  R7
         -                          -        -
         -                          -        -  - ELSE
         -                          -
         -                          -  - ELSE
         -
         -  - -  C5  + ELSE
                  -
                  -  - -  C3  + +  C4  + +  R3
                           -        -
                           -        -  - -  R1
                           -
                           -  - -  C4  + +  R2
                                    -
                                    -  - ELSE
```

DATUM: General framing class - discussion continued

The following table of rules is taken from the above decision tree analysis. The rule number corresponds to the order in which the else rules are printed down the page.

	TABLE OF ELSE RULES	1	2	3	4	5	6	7	8	9	10	11
1	Vertical load system = essentially complete frame	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N
2	(Vertical load system includes bearing walls)	.	.	.	.	.	.	.	.	.	.	.
3	Seismic resisting system includes shear wall	Y	N	N	.	Y	Y	N	N	N	.	N
4	Seismic resisting system includes braced frame	.	Y	N	.	Y	N	Y	N	N	.	N
5	Seismic resisting system includes moment frame (unbraced frame)	.	.	N	.	Y	Y	Y	Y	N	Y	N
6	Structure is characterized as an inverted pendulum = true	Y	Y	Y	Y	N	N	N	N	N	N	N
7	Moment frame requirement = satisfied	.	.	.	.	.	.	.	N	.	.	.
8	Dual system requirement = satisfied	.	.	.	.	N	N	N	.	.	.	.
	Appropriate comment below	A	A	B	C	D	D	D	D	B	E	B

A. These rules describe inverted pendulums that use shear walls or braced frames for seismic resistance.

B. These rules describe buildings in which the seismic resisting system is not one of the three choices: shear wall, braced frame or unbraced frame. This does not appear to be a serious omission.

C. This rule describes an inverted pendulum that uses bearing walls for vertical support.

D. These rules describe buildings with characteristics of moment frames or dual systems that do not meet the special requirements given for such systems. (Note that these special requirements create serious problems in the information network, as is discussed in appendix A3.)

E. This rule describes buildings in which bearing walls support some of the vertical load and moment frames provide some of the resistance to seismic load.

Note that these ELSE rules are not the only possible omissions in Table 3-B. See datum 3330 for an additional possibility regarding the material used for moment frame construction.

DATUM: Moment frame requirement

SECTION: 3.3.1 (table 3-B) LABEL: MFR NUMBER: 3315

INGREDIENTS

Datum	Label	Number
Strength of moment frame system	YSMFS	3321
Total required strength	ZRS	3324
Frame response type		3327
Ordinary moment frame requirement		3330
Special moment frame requirement	SMFR	3336

DECISION TABLE

			1	2	E
1	Strength of moment frame system $\geq$ Total required strength	*	Y	Y	
2	Frame response type = ordinary	*	Y	N	
3	(Frame response type = special)	*	-	+	
4	Ordinary moment frame requirement = satisfied	*	Y	.	
5	Special moment frame requirement = satisfied	*	.	Y	
	**				
1	MFR = satisfied	*	X	X	
2	MFR = violated	*			X

COMMENTS:

1. Condition 1 is very similar to the strength requirement for components. See the comments on datum 3324 regarding a potential problem with this provision.
2. Condition 3 is implicitly determined by condition 2, because only two types of moment frames are defined by the provisions.

DATUM: Dual system requirement

SECTION: 3.3.1 (table 3-B) LABEL: DSR NUMBER: 3318

INGREDIENTS

Datum	Label	Number
Special moment frame requirement	SMFR	3336
Strength of special moment frame system alone	YSSMFS	3339
Total required strength with 25% of the seismic force	ZRS25	3342

DECISION TABLE

			1	E
1	Special moment frame requirement = satisfied	*	Y	
2	Strength of special moment frame systems alone ≥ Total required strength with 25% of the seismic force	*	Y	
	**			
1	DSR = satisfied	*	X	
2	DSR = violated	*		X

COMMENTS:

1. The wording in table 3-B could be interpreted to require an additional analysis with 25% of the seismic forces or to only require one-fourth of the strength required from the initial analysis with 100% of the seismic forces.
2. Table 3-B includes the provision, "The total seismic force resistance is provided by ... in proportion to their relative rigidities." Since that provision is automatically satisfied for all buildings by the strength and analysis requirements, it was decided not to duplicate it in this decision table.
3. Condition 2 is very similar to the strength requirement for components. See the comment on datum 3342 regarding a potential problem with this provision.

DATUM: Strength of moment frame system

SECTION: 3.3.1 (table 3-B) LABEL: YSMFS NUMBER: 3321

INGREDIENTS

Datum	Label	Number
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210

COMMENTS:

1. The strength is to be taken from the applicable chapter (or chapters).

DATUM: Total required strength

SECTION: 3.3.1 (Table 3-B) LABEL: ZRS NUMBER: 3324

COMMENTS:

1. It is implied that this is simply a sum of the required component strengths that are defined in section 3.7. No direct connection is made in this representation, however, because analysis of the information network (as described in appendix A3) indicated that doing so would create a complete loop in the precedence of evaluating the strength required. See appendix A3 for a more complete description of the loop and a potential solution for the problem.

DATUM: Ordinary moment frame requirement

SECTION: 3.3.1 (table 3-B) LABEL: OMFR NUMBER: 3330

INGREDIENTS

Datum	Label	Number
Frame material		3333
Ordinary steel moment frame requirement	OSMFR	10450
Category B ordinary concrete moment frame requirement	CBOCMF	11600

DECISION TABLE

			1	2	E
1	Frame material = steel	*	Y	-	
2	Frame material = reinforced concrete	*	-	Y	
3	Ordinary steel moment frame requirement = satisfied	*	Y	.	
4	Category B ordinary concrete moment frame requirement = satisfied	*	.	Y	
	**				
1	OMFR = satisfied	*	X	X	
2	OMFR = violated	*			X

COMMENTS:

1. This decision table effectively brings in the implied limitation of table 3-B that all moment frames must be either steel or concrete. (Note the last ELSE rule in the decision tree printed below.) Frames of other materials cannot satisfy this provision.

```
C1  + + C3  + + R1
-       -
-       -  - ELSE
-
-  - - C2  + + C4  + + R2
        -       -
        -       -  - ELSE
        -
        -  - ELSE
```

DATUM: Special moment frame requirement

SECTION: 3.3.1 (table 3-B) LABEL: SMFR NUMBER: 3336

INGREDIENTS

Datum	Label	Number
Frame material		3333
Special steel moment frame requirement	SSMFR	10600
Special concrete moment frame requirement	SCMFR	11700

DECISION TABLE

			1	2	E
1	Frame material = steel	*	Y	-	
2	Frame material = reinforced concrete	*	-	Y	
3	Special steel moment frame requirement = satisfied	*	Y	.	
4	Special concrete moment frame requirement = satisfied	*	.	Y	
	**				
1	SMFR = satisfied	*	X	X	
2	SMFR = violated	*			X

COMMENTS:

1. See comment 1 on datum 3330.

DATUM: Strength of special moment frame system alone

SECTION: 3.3.1 (table 3-B) LABEL: YSSMFS NUMBER: 3339

INGREDIENTS

Datum	Label	Number
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210

COMMENTS:

1. The strength is to be taken from the applicable chapter (or chapters).

DATUM: Total required strength with 25% of the seismic force

SECTION: 3.3.1 (table 3-B) LABEL: ZRS25 NUMBER: 3342

COMMENTS:

1. This datum would depend on the analyzed seismic force effect, however, the explicit connection is not clear. Comment 1 on datum 3318 and comment 1 on datum 3324 are both pertinent to this datum.

DATUM: Single system response modification factor

SECTION: 3.3.1 (table 3-B) LABEL: RX NUMBER: 3345

and

DATUM: Deflection amplication factor

SECTION: 3.3.1 (table 3-B) LABEL: CD NUMBER: 3348

(both have the same ingredients and decision table)

INGREDIENTS

Datum	Label	Number
General framing class	GFC	3303
Seismic resisting system	(SRS)	3309
Shear wall type	(SWT)	3351
Frame response type	(FRT)	3327
Frame material	(FM)	3333

	DECISION TABLE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	E
1	GFC = Bearing Wall	Y	Y	Y	Y	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	GFC = Building Frame	-	-	-	-	-	Y	Y	Y	Y	Y	-	-	-	-	-	-	-	-	-	-	-	
3	GFC = Moment Frame	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	-	-	-	-	-	-	-	
4	GFC = Dual System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	-	-	-	
5	GFC = Inverted Pendulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	
6	SRS = braced frame	-	-	-	Y	-	-	-	-	Y	-	-	-	-	-	-	-	-	Y	-	-	-	
7	SWT = light framed	Y	-	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	Y	-	-	-	-	
8	SWT = wood sheathing	.	-	-	-	-	.	-	-	-	-	-	-	-	-	-	-	Y	-	-	-	-	
9	SWT = reinforced concrete	-	Y	-	-	-	-	Y	-	-	-	-	-	-	-	Y	-	-	-	-	-	-	
10	SWT = reinforced masonry	-	-	Y	-	-	-	-	Y	-	-	-	-	-	-	-	Y	-	-	-	-	-	
11	SWT = part. reinf. or unreinf. masonry	-	-	-	-	Y	-	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	-	
12	FRT = ordinary	.	.	.	.	.	.	.	.	.	.	N	N	Y	Y	-	-	-	-	N	N	Y	
13	(FRT = special)	.	.	.	.	.	.	.	.	.	.	+	+	-	-	+	+	+	+	+	+	-	
14	FM = steel	.	.	.	.	.	.	.	.	.	.	Y	-	Y	-	.	.	.	.	Y	-	Y	
15	FM = reinforced concrete	.	.	.	.	.	.	.	.	.	.	-	Y	-	Y	.	.	.	.	-	Y	-	
1	RX = 8, CD = 5																	X					
2	RX = 8, CD = 5 1/2											X											
3	RX = 8, CD = 6 1/2															X							
4	RX = 7, CD = 4 1/2						X																
5	RX = 7, CD = 6												X										
6	RX = 6 1/2, CD = 4	X																					
7	RX = 6 1/2, CD = 5 1/2																X						
8	RX = 6, CD = 5																		X				
9	RX = 5 1/2, CD = 5							X															
10	RX = 5, CD = 4 1/2									X													
11	RX = 4 1/2, CD = 4		X						X					X									
12	RX = 4, CD = 3 1/2				X																		
13	RX = 3 1/2, CD = 3			X																			
14	RX = 2 1/2, CD = 2 1/2																			X	X		
15	RX = 2, CD = 2														X								
16	RX = 1 1/2, CD = 1 1/2										X												
17	RX = 1 1/4, CD = 1 1/4					X																X	
E	RX = ?, CD = ?																						X

There are several significant ELSE rules that represent possible omissions. The following table of rules is taken from the decision tree analysis (see the following page for the decision tree). The rule number corresponds to the order in which the rules are printed in the decision tree.

	TABLE OF ELSE RULES	1	2	3	4	5	6	7	8	9	10
1	General framing class = Bearing Wall	Y	N	N	N	N	N	N	N	N	N
2	General framing class = Building Frame	.	Y	N	N	N	N	N	N	N	N
3	General framing class = Moment Frame	.	.	Y	N	N	.	.	Y	N	N
4	General framing class = Dual System	.	.	.	.	.	Y	Y	N	N	N
5	General framing class = Inverted Pendulm	.	.	.	Y	N	.	.	.	Y	N
6	Seismic resisting system = braced frame	N	N	.	.	.	N	N	.	.	.
7	Shear wall type = light framed	N	N	.	.	.	Y	N	.	.	.
8	Shear wall type = wood sheathing	.	.	.	.	.	N	.	.	.	.
9	Shear wall type = reinf. concrete	N	N	.	.	.	.	N	.	.	.
10	Shear wall type = reinf. masonry	N	N	.	.	.	.	N	.	.	.
11	Shear wall type = part. reinf. <u>or</u> unreinf. masonry	N	N	.	.	.	.	.	.	.	.
12	Frame response type = ordinary	.	.	Y	Y	Y	N	N	N	N	N
13	(Frame response type = special)	.	.	.	.	.	.	.	.	.	.
14	Frame material = steel	.	.	N	N	.	.	.	N	N	.
15	Frame material = reinf. concrete	.	.	N	.	.	.	.	N	N	.
	Appropriate comment below	A	A	B	C	D	E	F	B	C	G

A. These rules describe bearing wall and building frame systems that have a shear wall other than one of those types listed.
B. These rules describe moment frame systems that are not composed of either steel or reinforced concrete.
C. These rules describe inverted pendulum buildings that use an ordinary moment frame composed of some material other than steel, or a special moment frame composed of a material other than steel or reinforced concrete.
D. This rule describes a dual system without a special moment frame.
E. This rule describes a dual system with a light framed shear wall that is sheathed with some material other than wood.
F. This rule describes a dual system with a shear wall other than wood sheathed, reinforced concrete, or reinforced masonry.
G. This rule describes a building that is not classified as one of the five general framing classes. See the comments on datum 3303 for further discussion of such buildings.

DATUM 3345: Derived decision tree

```
C1   + +  C6   + +  R4
-         -
-         -    - -  C7   + +  R1
-                   -
-                   -    - -  C9   + +  R2
-                             -
-                             -    - -  C10  + +  R3
-                                       -
-                                       -    - -  C11  + +  R5
-                                                 -
-                                                 -    - ELSE
-
-    - -  C2   + +  C6   + +  R9
          -         -
          -         -    - -  C7   + +  R6
          -                   -
          -                   -    - -  C9   + +  R7
          -                             -
          -                             -    - -  C10  + +  R8
          -                                       -
          -                                       -    - -  C11  + +  R10
          -                                                 -
          -                                                 -    - ELSE
          -
          -    - -  C12  + +  C3   + +  C14  + +  R13
                    -         -         -
                    -         -         -    - -  C15  + +  R14
                    -         -                   -
                    -         -                   -    - ELSE
                    -         -
                    -         -    - -  C5   + +  C14  + +  R21
                    -                   -         -
                    -                   -         -    - ELSE
                    -                   -
                    -                   -    - ELSE
                    -
                    -    - -  C4   + +  C6   + +  R18
                              -         -
                              -         -    - -  C7   + +  C8   + +  R17
                              -                   -         -
                              -                   -         -    - ELSE
                              -                   -
                              -                   -    - -  C9   + +  R15
                              -                             -
                              -                             -    - -  C10  + +  R16
                              -                                       -
                              -                                       -    - ELSE
                              -
                              -    - -  C3   + +  C14  + +  R11
                                        -         -
                                        -         -    - -  C15  + +  R12
                                        -                   -
                                        -                   -    - ELSE
                                        -
                                        -    - -  C5   + +  C14  + +  R19
                                                  -         -
                                                  -         -    - -  C15  + +  R20
                                                  -                   -
                                                  -                   -    - ELSE
                                                  -
                                                  -    - -                      ELSE
```

DATUM: Response modification factor

SECTION: 3.3.2 (A) LABEL: R NUMBER: 3354

INGREDIENTS

Datum	Label	Number
Number of different framing systems in the building		3357
Weight supported by individual framing system	YWRX	3360
Total gravity weight of building	W	4215
Single system response modification factor	RX	3345

DECISION TABLE

		1	2	3	4
1	Number of different framing systems in the building > 1	N	Y	Y	Y
2	Weight supported by individual framing system ≦ 10% of Total gravity weight of building	.	Y	N	N
3	Single system response modification factor (for the framing system) ≦ Single system response modification factor (for all systems above)	.	.	Y	N
1	R = Single system response modification factor	X	X	X	
2	R = (lowest) single system response modification factor (for all systems above)				X

DATUM: Weight supported by individual framing system

SECTION: 3.3.2 (A) LABEL: YWRX NUMBER: 3360

INGREDIENTS

Datum	Label	Number
Total gravity weight of building	W	4215

COMMENTS:

1. This datum is used in evaluating datum 3354. It was assumed that the weight supported by any framing system should be determined following the same provisions that are used in determining the total weight of the building.

DATUM: Combined framing requirement

SECTION: 3.3.2 (B) LABEL: CFR NUMBER: 3363

INGREDIENTS

Datum	Label	Number
Number of different framing systems in the building		3357
Component detailed to requirements for system with highest RX		3366

DECISION TABLE

		*	1	2	E
1	Number of different framing systems in the building > 1	*	N	Y	
2	Component detailed to req for system with highest RX = true for each component common to different system	*	.	Y	
	***************	*			
1	CFR = satisfied	*	X	X	
2	CFR = violated	*			X

COMMENTS:

1. The detailing requirements are not directly affected by the value of R, however, they do depend on the same ingredients as the value of R (and some others in addition). For example, the value of R for a reinforced concrete frame depends on whether it is an "ordinary" or a "special" moment frame as do the detailing requirements for reinforced concrete frames (data numbers 11600 and 11700).

DATUM: General framing requirement

SECTION: 3.3.3, 3.3.4, and 3.3.5 LABEL: GFR NUMBER: 3369

INGREDIENTS

Datum	Label	Number
General framing class	GFC	3303
Seismic performance category	SPC	1490
Category C and D seismic resisting system limitation	CCDSRS	3372
Category C and D interaction requirement	CCDIR	3381
Category C and D deformation compatibility requirement	CCDDCR	3390

DECISION TABLE

			1	2	E
1	General framing class = not defined	*	N	N	
2	Seismic performance category = C or D	*	N	Y	
3	Category C and D seismic resisting system limitation = satisfied	*	.	Y	
4	Category C and D interaction requirement = satisfied	*	.	Y	
5	Category C and D deformation compability requirement = satisfied	*	.	Y	
	***	*			
1	GFR = satisfied	*	X	X	
2	GFR = violated	*			X

COMMENTS:

1. Condition 1 was introduced into this decision table to point out one of the consequences of the ELSE rules that were disucssed for datum 3303.

DATUM: Category C and D seismic resisting system limitation

SECTION: 3.3.4 (A) and 3.3.4 (D) LABEL: CCDSRS NUMBER: 3372

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
General framing class	GFC	3303
Frame response type		3327
Seismic resisting system material		3375
Earthquake force effect	QE	3706
Total height		2227
Special moment frame extends down to foundation		3378

DECISION TABLE

		1	2	3	4	5	6	7	8	E
1	Seismic performance category = C	Y	Y	Y	Y	N	N	N	N	
2	(Seismic performance category = D)	–	–	–	–	+	+	+	+	
3	General framing class = Moment frame	.	–	Y	–	.	–	Y	–	
4	General framing class = Dual system	.	–	–	Y	.	–	–	Y	
5	General framing class = Bearing wall <u>or</u> Braced frame	.	Y	–	–	.	Y	–	–	
6	Frame response type = special	.	.	Y	+	.	.	Y	+	
7	Seismic resisting system material = steel or reinforced concrete	.	Y	+	+	.	Y	+	+	
8	Earthquake force effect (in any walls or frame in one plane) ≦ 33% of total earthquake force effect	.	Y	.	.	.	Y	.	.	
9	Total height ≦ 100'	.	–	–	–	Y	N	N	N	
10	Total height ≦ 160'	Y	N	N	N	+	Y	.	.	
11	Total height ≦ 240'	+	Y	.	.	+	+	.	.	
12	Special moment frame extends down to foundation = true	.	.	Y	Y	.	.	Y	Y	
1	CCDSRS = satisfied	X	X	X	X	X	X	X	X	
2	CCDSRS = violated									X

COMMENTS:

1. This decision table is called for only if the seismic performance category is C or D.
2. Condition 8 concerning walls in one plane is ambiguous. It can be interpreted as not permitting any single wall (or frame) to resist over 1/3 the total without considering other walls in its same plane or as not permitting all the walls (or frames) in a given plane to collectively resist over 1/3 the total. The commentary seems to imply the former.
3. The height limits imposed by this decision table are effectively modified by provisions for category C and D buildings in chapters 10 and 11. See datums 10500 and 11556.

DATUM: Category C and D interaction requirement

SECTION: 3.3.4 (B) LABEL: CCDIR NUMBER: 3381

INGREDIENTS

Datum	Label	Number
Seismic resisting system		3309
SRS enclosed or adjoined by more rigid elements		3384
SRS design provides for reaction of rigid elements to drift	ZSRSID	3387

DECISION TABLE

		*	1	2	3	4
1	Seismic resisting system = unbraced frame	*	N	Y	Y	Y
2	SRS enclosed or adjoined by more rigid elements = true	*	.	N	Y	Y
3	SRS design provides for reaction of rigid elements to drift = true	*	.	.	Y	N
	**					
1	CCDIR = satisfied	*	X	X	X	
2	CCDIR = violated	*				X

DATUM: SRS design provides for reaction of rigid elements to drift

SECTION: 3.3.4 (B) LABEL: ZSRSID NUMBER: 3387

INGREDIENTS

Datum	Label	Number
Design story drift	DRIFT	4660

COMMENTS:

1. The method of evaluating the effect of drift on the interaction of the SRS frame and surrounding rigid elements and the method of accounting for the effect are not specified beyond making reference to the design story drift.

DATUM: Category C and D deformation compatibility requirement

SECTION: 3.3.4 (C) LABEL: CCDDCR NUMBER: 3390

INGREDIENTS

Datum	Label	Number
Strength of structural components not a part of SRS	ZSNSRS	3393
Effect of vertical loads and design story drift	YQVD	3396
Material of component or system		2115
Category C and D non-seismic resisting system concrete requirement	CCDNSR	11563

DECISION TABLE

		1	2	E
1	Strength of structural components not a part of SRS ≥ Effect of vertical loads and design story drift	Y	Y	
2	Material of component or system = concrete	N	Y	
3	Category C and D non-seismic existing system concrete requirement = satisfied	.	Y	
1	CCDDCR = satisfied	X	X	
2	CCDDCR = violated			X

COMMENTS:

1. This provision effectively is a strength requirement for structural components that are not a part of the seismic resisting system.
2. Datum 11563 contains several detailing requirements for concrete components. It is not explicitly referenced in section 3.3.4 (C). See that datum for further comment.

DATUM: Strength of structural components not a part of the SRS

SECTION: 3.3.4 (C) LABEL: ZSNSRS NUMBER: 3393

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210
Strength of masonry components	XSM	12210

COMMENTS:

1. The text is not clear as to how one determines the resistance of structural components not a part of the seismic resisting system. It was assumed that the intent is to use the increased strengths provided in chapters 9 through 12, although it is also not clear that these chapters would be applicable to such components.

DATUM: Effect of vertical loads and design story drift

SECTION: 3.3.4 (C) LABEL: YQVD NUMBER: 3396

INGREDIENTS

Datum	Label	Number
Dead load effect	YQD	3707
Live load effect	YQL	3708
Snow load effect	YQS	3710
Design story drfit	DRIFT	4660

COMMENTS:

1. It was assumed that the same gravity loads specified in section 3.7 for component design should be used for evaluating the effects of gravity load and drift on structural components that are not a part of the seismic resisting system.

DATUM: Building configuration

SECTION: 3.4 LABEL: BC NUMBER: 3405

INGREDIENTS

Datum	Label	Number
Plan configuration	PC	3410
Vertical configuration	VC	3415
Geometric configuration of building		3420
Location of center of building mass		3425
Location of center of seismic resisting system		3430

	DECISION TABLE	1	2	3	4	5
1	Geometric configuration of building is approximately symmetrical <u>and</u> Location of center of building mass is approximately at Location of center of seismic resisting system	Y	N	N	N	N
2	Plan configuration = regular	+	Y	Y	N	N
3	Vertical configuration = regular	+	Y	N	Y	N
1	BC = regular	X				
2	BC = irregular		X	X	X	X

COMMENTS:

1. Condition 1 will be difficult to evaluate.
2. Conditions 2 and 3 are strongly implied by the format of the section.
3. Rules 2 through 5 are shown here, rather than being grouped and labeled ELSE, to show that it is possible for a building to be irregular even though conditions 2 and 3 are both regular.

DATUM: Plan configuration

SECTION: 3.4.1 LABEL: PC NUMBER: 3410

INGREDIENTS

Datum	Label	Number
Geometric configuration of building		3420
Building has re-entrant corners with significant dimensions		3435
Location of center of building mass		3425
Location of center of seismic resisting system		3430
Any diaphragm has significant changes in strength or stiffness		3445

DECISION TABLE

		1	2
1	Geometric configuration of building = not approximately symmetrical <u>or</u> Building has re-entrant corners with significant dimensions = true <u>or</u> Location of Center of building mass is significantly different than Location of center of seismic resisting system at any level <u>or</u> Any diaphragm has significant changes in strength or stiffness = true	Y	N
1	PC = regular		X
2	PC = irregular	X	

COMMENTS:

1. "Approximately" and "significant" make this provision difficult to evaluate.
2. The text indicates that the plan configuration is to be classified as regular or irregular "for purposes of determining diaphragm component forces and distribution of seismic forces to the vertical components ...," yet no provisions make use of this classification (except, by implication, the overall building configuration, datum 3405). The indicated cross reference is never fulfilled.

DATUM: Vertical configuration

SECTION: 3.4.2 LABEL: VC NUMBER: 3415

INGREDIENTS

Datum	Label	Number
Geometric configuration of building with respect to vertical axis		3450
Building has horizontal offsets with significant dimensions		3455
Total weight at level X	YWX	4340
Story stiffness		3465

DECISION TABLE

		1	2
1	Geometric configuration of building with respect to vertical axis = not symmetrical <u>or</u> Building has horizontal offsets with significant dimensions = true <u>or</u> Ratio of story weight to Story stiffness varies significantly between adjacent stories	Y	N
1	VC = regular		X
2	VC = irregular	X	

COMMENTS:

1. "Approximately" and "significant" make this provision difficult to evaluate.
2. The text refers to the "story mass," and it was assumed that this is the same quantity as the story weight defined in chapter 4 (datum 4340).

DATUM: Seismic load analysis requirement

SECTION: 3.5 and 3.2.3 LABEL: SLAR NUMBER: 3510

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Required seismic load analysis	RSLA	3530
Fundamental period of building used in analysis		3540
Approximate building period	TA	4255
Soil structure interaction use requirement	SSIUR	3270

DECISION TABLE

		1	2	E
1	Seismic load analysis used ≥ Required seismic load analysis	Y	Y	
2	Seismic load analysis used > Required seismic load analysis <u>or</u> Required seismic load analysis > level 3 (Modal analysis)	N	Y	
3	Fundamental period of building used in analysis ≤ 1.4 Approximate building period	.	Y	
4	Soil structure interaction use requirement = satisfied	Y	Y	
1	SLAR = satisfied	X	X	
2	SLAR = violated			X

COMMENTS:

1. Condition 2 contains an <u>or</u> because the limitation on period applies whether the advanced analysis is required or used at the option of the designer.
2. The text limits the period to those periods permitted in chapters 4 or 5. However, since chapter 5 places no limit explicitly on the period, but does place a limit on base shear equal to what chapter 4 would give if 1.4 TA were used, the assumption was made that condition 3 as shown above actually reflects the intent.
3. Condition 4 is found in section 3.2.3. It was placed in this decision table because it was assumed that this provided the most appropriate place for it.

DATUM: Required seismic load analysis

SECTION: 3.5.1, 3.5.2, and 3.5.3 LABEL: RSLA NUMBER: 3530

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Building configuration	BC	3405
Plan configuration	PC	3410
Vertical configuration	VC	3415

DECISION TABLE

		*	1	2	3	4	5
1	Seismic performance category = A	*	Y	-	N	N	N
2	Seismic performance category = B	*	-	Y	N	N	N
3	(Seismic performance category = C or D)	*	-	-	+	+	+
4	Building configuration = regular	*	.	.	Y	N	N
5	Plan configuration = regular <u>and</u> Vertical configuration = irregular	*	.	.	.	Y	N
	************************	*					
1	RSLA = level 1 (ties and continuity) (no seismic load analysis)	*	X				
2	RSLA = level 2 (Equivalent Lateral Force)	*		X	X		
3	RSLA = level 3 (Modal)	*				X	
4	RSLA = level 4 (special dynamic)	*					X

DATUM: Analyzed earthquake force effect

SECTION: 3.5 LABEL: QANAL NUMBER: 3560

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Earthquake load effect from ELF/Modal analysis	QELFMD	4010
Earthquake force effect from more rigorous analysis		3550

DECISION TABLE

			1	2
1	Seismic load analysis used = level 2 (ELF) or level 3 (Modal)	*	Y	N
	***			
1	QANAL = Earthquake load effect from ELF/Modal analysis	*	X	
2	QANAL = Earthquake force effect from more rigorous analysis	*		X

COMMENTS:

1. This datum is only called for buildings that require a seismic load analysis of level 2 or higher. It is called for in section 3.7.

DATUM: Structural design and detailing requirement

SECTION: 3.6 and 3.3.2 (B) LABEL: SDDR NUMBER: 3610

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Category A design and detailing requirement	CADDR	3620
Category B design and detailing requirement	CBDDR	3630
Category C design and detailing requirement	CCDDR	3670
Category D design and detailing requirement	CDDDR	3680
Combined framing requirement	CFR	3363

DECISION TABLE

		1	2	3	4	E
1	Seismic performance category = A	Y	-	-	N	
2	Seismic performance category = B	-	Y	-	N	
3	Seismic performance category = C	-	-	Y	N	
4	(Seismic performance category = D)	-	-	-	+	
5	Category A design and detailing requirement = satisfied	Y	+	+	+	
6	Category B design and detailing requirement = satisfied	.	Y	+	+	
7	Category C design and detailing requirement = satisfied	.	.	Y	+	
8	Category D design and detailing requirement = satisfied	.	.	.	Y	
9	Combined framing requirement = satisfied	Y	Y	Y	Y	
1	SDDR = satisfied	X	X	X	X	
2	SDDR = violated					X

COMMENTS:

1. Section 3.6 contains requirements with many cross-references to other sections of the provisions. In a sense, it is a directory that controls the organization of large portions of the remaining provisions.
2. Condition 9 is not actually mentioned in section 3.6. It was assumed that this was the most appropriate datum to include it in.

DATUM: Category A design and detailing requirement

SECTION: 3.6.1 LABEL: CADDR NUMBER: 3620

INGREDIENTS

Datum	Label	Number
Interconnection requirement	IR	3737
Concrete/masonry wall anchorage requirement	CMWAR	3741
Nonstructural anchorage requirement	NSAR	3747
Category A foundation requirement	ZCAFR	7300
Category A wood requirement	CAWR	9300
Category A steel requirement	ZCASR	10300
Category A concrete requirement	CACR	11300
Category A masonry requirement	ZCAMR	12300

DECISION TABLE

		1	E
1	Interconnection requirement = satisfied	Y	
2	Concrete/masonry wall anchorage requirement = satisfied	Y	
3	Nonstructural anchorage requirement = satisfied	Y	
4	Category A foundation requirement = satisfied	Y	
5	Category A wood requirement = satisfied	Y	
6	Category A steel requirement = satisfied	Y	
7	Category A concrete requirement = satisfied	Y	
8	Category A masonry requirement = satisfied	Y	
1	CADDR = satisfied	X	
2	CADDR = violated		X

COMMENTS:

1. This provision specifies which portions of section 3.7 are applicable to category A buildings.

DATUM: Category B design and detailing requirement

SECTION: 3.6.2 LABEL: CBDDR NUMBER: 3630

INGREDIENTS

Datum	Label	Number
Category A design and detailing requirement	CADDR	3620
Component design requirement	CDR	3700
Category B openings requirement	CBOR	3640
Category B foundation requirement	CBFR	7400
Category B wood requirement	CBWR	9400
Category B steel requirement	CBSR	10400
Category B concrete requirement	CBCR	11400
Category B masonry requirement	CBMR	12400

DECISION TABLE

	DECISION TABLE	1	E
1	Category A design and detailing requirement = satisfied	Y	
2	Component design requirement = satisfied	Y	
3	Category B openings requirement = satisfied	Y	
4	Category B foundation requirement = satisfied	Y	
5	Category B wood requirement = satisfied	Y	
6	Category B steel requirement = satisfied	Y	
7	Category B concrete requirement = satisfied	Y	
8	Category B masonry requirement = satisfied	Y	
1	CBDDR = satisfied	X	
2	CBDDR = violated		X

COMMENTS:

1. Even though condition 2 refers to the design requirements of section 3.7, note that datum 3700 does not include all of the design requirements of section 3.7 because the text of this section (3.6.2) excludes one portion of section 3.7.

DATUM: Category B openings requirement

SECTION: 3.6.2 (C) LABEL: CBOR NUMBER: 3640

INGREDIENTS

Datum	Label	Number
Openings present in shear walls, diaphragms, or plate elements		3645
Chords provided at edges of each opening		3650
Chords resist local stresses caused by opening		3655
Chords extend beyond opening to develop and distribute chord stress		3660

DECISION TABLE

		1	2	E
1	Openings present in shear walls, diaphragms, or plate elements = true	N	Y	
2	Chords provided at edges of each opening = true	.	Y	
3	Chords resist local stresses caused by opening = true	.	Y	
4	Chords extend beyond opening to develop and distribute chord stress = true	.	Y	
1	CBOR = satisfied	X	X	
2	CBOR = violated			X

COMMENTS:

1. Condition 3 is a strength requirement; as such it may be redundant.
2. Condition 4 is a detailing requirement that may also be redundant because of the strength requirement.

DATUM: Category C design and detailing requirement

SECTION: 3.6.3 LABEL: CCDDR NUMBER: 3670

INGREDIENTS

Datum	Label	Number
Category B design and detailing requirement	CBDDR	3630
Category C and D vertical motion requirement	CCDVMR	3790
Category C foundation requirement	CCFR	7500
Category C wood requirement	CCWR	9500
Category C and D steel requirement	CCDSR	10500
Category C and D concrete requirement	CCDCR	11500
Category C masonry requirement	CCMR	12500

DECISION TABLE

		1	E
1	Category B design and detailing requirement = satisfied	Y	
2	Category C and D vertical motion requirement = satisfied	Y	
3	Category C foundation requirement = satisfied	Y	
4	Category C wood requirement = satisfied	Y	
5	Category C and D steel requirement = satisfied	Y	
6	Category C and D concrete requirement = satisfied	Y	
7	Category C masonry requirement = satisfied	Y	
1	CCDDR = satisfied	X	
2	CCDDR = violated		X

DATUM: Category D design and detailing requirement

SECTION: 3.6.4 LABEL: CDDDR NUMBER: 3680

INGREDIENTS

Datum	Label	Number
Category C design and detailing requirement	CCDDR	3670
Category D foundation requirement	CDFR	7600
Category D wood requirement	CDWR	9600
Category C and D steel requirement	CCDSR	10500
Category C and D concrete requirement	CCDCR	11500
Category D masonry requirement	CDMR	12600

DECISION TABLE

			1	E
1	Category C design and detailing requirement = satisfied	*	Y	
2	Category D foundation requirement = satisfied	*	Y	
3	Category D wood requirement = satisfied	*	Y	
4	Category C and D steel requirement = satisfied	*	+	
5	Category C and D concrete requirement = satisfied	*	+	
6	Category D masonry requirement = satisfied	*	Y	
	**	*		
1	CDDDR = satisfied	*	X	
2	CDDDR = violated	*		X

COMMENTS:

1. Condition 1 is not stated in the text. It was put in the table because it is consistent with all other chapters to do so. It appears to be a simple omission.

2. Conditions 4 and 5 are implicitly determined by condition 1.

DATUM: Component design requirement

SECTION: 3.7 LABEL: CDR NUMBER: 3700

INGREDIENTS

Datum	Label	Number
Critical earthquake force direction requirement	CEQFDR	3701
Discontinuity requirement	DISR	3719
Redundancy requirement	RR	3725
Interconnection requirement	IR	3737
Concrete/masonry wall anchorage requirement	CMWAR	3741
Nonstructural anchorage requirement	NSAR	3747
Collector requirement	CR	3752
Diaphragm requirement	DIAPR	3755
Bearing wall requirement	BWR	3770

DECISION TABLE

		1	E
1	Critical earthquake force direction requirement = satisfied	Y	
2	Discontinuity requirement = satisfied	Y	
3	Redundancy requirement = satisfied	Y	
4	Interconnection requirement = satisfied	Y	
5	Concrete/masonry wall anchorage requirement = satisfied	Y	
6	Nonstructural anchorage requirement = satisfied	Y	
7	Collector requirement = satisfied	Y	
8	Diaphragm requirement = satisfied	Y	
9	Bearing wall requirement = satisfied	Y	
1	CDR = satisfied	X	
2	CDR = violated		X

COMMENTS:

1. Section 3.7 contains some provisions that are ingredients to the strength requirement (datum 3120) and others that are ingredients to the design and detailing requirements of section 3.6. The split between the two may seem arbitrary. This datum sums up those provisions that are ingredients to the design and detailing requirements, with the exception of section 3.7.12. This datum could well be called "Category B component design requirement," since that is where it is directly used.

DATUM: Critical earthquake force direction requirement

SECTION: 3.7 and 3.7.2 LABEL: CEQFDR NUMBER: 3701

INGREDIENTS

Datum	Label	Number
Direction of seis force produces most critical effect in each comp		3715
Combination of orthogonal directions used for critical direction		3716

DECISION TABLE

		1	2	E
1	Direction of seis force produces most critical effect in each comp = true	Y	+	
2	Combination of orthogonal directions used for critical direction = true	N	Y	
1	CEQFDR = satisfied	X	X	
2	CEQFDR = violated			X

DATUM: Required strength

SECTION: 3.7 and 3.6.1 LABEL: RS NUMBER: 3702

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Minimum Seismic force	MFP	3731
Combined load effect	QTOT	3704

DECISION TABLE

			1	2	3
1	Seismic performance category = A	*	Y	N	N
2	Minimum seismic force > Combined load effect	*	.	Y	N
	************				
1	RS = Minimum seismic force	*	X	X	
2	RS = Combined load effect	*			X

COMMENTS:

1. The comparison in condition 2 which is used to develop rule 2 is the manifestation of the minimum forces introduced in sections 3.7.5, 3.7.6 and 3.7.7. It doesn't seem particularly valid to compare a minimum seismic force to a total combined load, but that is what those sections imply. It would appear to be more consistent to compare the minimum to the seismic force before developing the combined load, as is done for diaphragms in section 3.7.9, for example.
2. The text of section 3.7 could also be read to require resistance to gravity loads alone, but that was assumed to be outside the scope of these provisions, as directed by chapter 1.

DATUM: Combined load effect

SECTION: 3.7.1, 3.7.12 LABEL: QTOT NUMBER: 3704

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Altered load combination used to satisfy vertical motion requirement		3796
Additive load combination	XQADD	3705
Counteracting load combination	QOPPOS	3713
Altered load combination for effects of vertical motion	QV	3797

DECISION TABLE

		1	2	3
1	Seismic performance category = C or D	N	Y	Y
2	Altered load combination used to satisfy vertical motion requirement = true	.	N	Y
1	QTOT = MAX[XQADD, QOPPOS]	X	X	
2	QTOT = MAX[XQADD, QOPPOS, QV]			X

COMMENTS:

1. The permissive "may" in section 3.7.12 is the reason that condition 2 and rule 2 appear in this decision table.

DATUM: Additive load combination

SECTION: 3.7.1 LABEL: XQADD NUMBER: 3705

INGREDIENTS

Datum	Label	Number
Dead load effect	YQD	3707
Live load effect	YQL	3708
Snow load effect	YQS	3710
Earthquake force effect	QE	3706

FUNCTION:

XQADD = 1.2 YQD + 1.0 YQL + 1.0 YQS ± 1.0 QE

DATUM: Earthquake force effect

SECTION: 3.7, 3.7.9, 3.7.10, 3.7.11 LABEL: QE NUMBER: 3706

INGREDIENTS

Datum	Label	Number
Critical earthquake load effect	QCRIT	3711
Element of building (component)		2114
Minimum diaphragm seismic force effect	XQDIAP	3765
Minimum bearing wall seismic force	XQBW	3771
Type of seismic force effect		3786
Adjustment to overturning moment of inverted pendulum	XAOMIP	3788

DECISION TABLE

		1	2	3	4
1	Element of building (component) = floor or roof diaphragm	N	Y	-	-
2	Element of building (component) = bearing wall	N	-	Y	-
3	Element of building (component) = column of an inverted pendulum <u>and</u> Type of seismic force effect = overturning moment	N	-	-	Y
1	QE = QCRIT	X			
2	QE = MAX [QCRIT, XQDIAP]		X		
3	QE = MAX [QCRIT, XQBW]			X	
4	QE = QCRIT + XAOMIP				X

COMMENTS:

1. The modified seismic force effects for diaphragms, bearing walls and inverted pendulums are described in sections 3.7.9, 3.7.10, and 3.7.11.

DATUM: Dead load effect

SECTION: 3.7.1 LABEL: YQD NUMBER: 3707

INGREDIENTS

Datum	Label	Number
Dead load		2146

COMMENTS:

1. Dead load is defined in chapter 2, so it was assumed that this definition is to be used in determining the dead load effect.

DATUM: Live load effect

SECTION: 3.7.1 LABEL: YQL NUMBER: 3708

INGREDIENTS

Datum	Label	Number
Live load		2148

COMMENTS:

1. Live load is defined in chapter 2, so it was assumed that this definition is to be used in determining the live load effect.

DATUM: Snow load effect

SECTION: 3.7.1 LABEL: YQS NUMBER: 3710

INGREDIENTS

Datum	Label	Number
Effective snow load	ESL	4230

COMMENTS:

1. The effective snow load is defined in chapter 4 (by way of reference to chapter 2), so it was assumed that this definition is to be used in determining the snow load effect.

DATUM: Critical earthquake load effect

SECTION: 3.7.2 LABEL: QCRIT NUMBER: 3711

INGREDIENTS

Datum	Label	Number
Combination of orthogonal directions used for critical direction		3716
Orthogonal combination earthquake force effect	QORTHO	3717
Analyzed earthquake force effect	QANAL	3560

DECISION TABLE

		1	2
1	Combination of orthogonal directions used for critical direction = true	Y	N
1	QCRIT = QORTHO	X	
2	QCRIT = QANAL		X

COMMENTS:

1. The permissive "may" in section 3.7.2 is the reason for the choice in the manner of determining the critical earthquake force effect.

DATUM: Counteracting load combination

SECTION: 3.7.1 LABEL: QOPPOS NUMBER: 3713

INGREDIENTS

Datum	Label	Number
Component behavior		3714
Dead load effect	YQD	3707
Earthquake force effect	QE	3706

DECISION TABLE

			1	2
1	Component behavior = brittle	*	N	Y
	************************************			
1	QOPPOS = 0.8 YQD ± 1.0 QE	*	X	
2	QOPPOS = 0.5 YQD ± 1.0 QE	*		X

COMMENTS:

1. Components with brittle behavior specifically include steel columns that have splices with partial penetration welds and unreinforced masonry components. Otherwise, brittle behavior is not clearly defined.

DATUM: Orthogonal combination earthquake force effect

SECTION: 3.7.2 LABEL: QORTHO NUMBER: 3717

INGREDIENTS

Datum	Label	Number
Analyzed earthquake force effect	QANAL	3560

DECISION TABLE

			1	2
1	QANAL (1) + 0.3 QANAL (2) ≧ 0.3 QANAL (1) + QANAL (2)	*	Y	N
	************************************			
1	QORTHO = QANAL (1) + 0.3 QANAL (2)	*	X	
2	QORTHO = 0.3 QANAL (1) + QANAL (2)	*		X

COMMENTS:

1. Subscripts (1) and (2) refer to two orthogonal axes about which QANAL is determined.
2. This decision table is written in vector notation, which seems to be the correct interpretation of the text, although other interpretations are possible.

DATUM: Discontinuity requirement

SECTION: 3.7.3 LABEL: DISR NUMBER: 3719

INGREDIENTS

Datum	Label	Number
Story strength ratio	YSSR	3720
Design considers potential effect of strength ratio		3722
Strengths adjusted to compensate for strength ratio		3723

DECISION TABLE

		1	2	E
1	Story strength ratio in any story is significantly less than that for the story above	N	Y	
2	Design considers potential effects of strength ratio = true	.	Y	
3	Strengths adjusted to compensate for strength ratio = true	.	Y	
1	DISR = satisfied	X	X	
2	DISR = violated			X

COMMENTS:

1. Condition 1 will be difficult to evaluate because of the word "significantly".
2. No direction is given for how the strengths should be adjusted in condition 3.

DATUM: Story strength ratio

SECTION: 3.7.3 LABEL: YSSR NUMBER: 3720

INGREDIENTS

Datum	Label	Number
Required strength	RS	3702
Member strength	YMS	3125
Connection strength	YCS	3130

COMMENTS:

1. The story strength ratio is the ratio of the strength provided to the strength required for a given story. It is not clear if this should be taken as the lowest such ratio for all the components in a given story, or if some other method should be used.

DATUM: Redundancy requirement

SECTION: 3.7.4 LABEL: RR NUMBER: 3725

INGREDIENTS

Datum	Label	Number
Stability of building endangered by failure of single component		3726
Design considers potentially adverse effect of instability		3728
Building modified to mitigate effects of component failure		3729

DECISION TABLE

		1	2	E
1	Stability of building endangered by failure of single component = true	N	Y	
2	Design considers potentially adverse effect of instability = true	.	Y	
3	Building modified to mitigate effects of component failure = true	.	Y	
1	RR = satisfied	X	X	
2	RR = violated			X

COMMENTS:

1. All of the conditions in this table are of a qualitative nature.

DATUM: Minimum seismic force

SECTION: 3.7.5, 3.7.6, and 3.7.7 LABEL: MFP NUMBER: 3731

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Effective peak velocity-related acceleration	EPV	1415
Weight of smaller portion of building	YWSP	3732
Beam, girder, or truss reaction	YBGTR	3734
Effect of nonstructural seismic force	YQFP	3749

DECISION TABLE

			1	2	3	4	5
1	Element of building = seismic tie between any two portions of the building	*	Y	-	-	-	N
2	Element of building = any beam, girder, or truss support	*	-	Y	-	-	N
3	Element of building = any concrete wall or masonry wall	*	-	-	Y	-	N
4	Element of building = anchorage for any nonstructural component covered in chapter 8	*	-	-	-	Y	N
	******	*					
1	MFP = MAX [EPV/3, 0.05] * YWSP	*	X				
2	MFP = 5% of Beam, girder, or truss reaction (horizontally)	*		X			
3	MFP = 1000 EPV (pounds per foot) at each connected floor and roof	*			X		
4	MFP = Effect of nonstructural seismic force	*				X	
5	MFP = 0	*					X

COMMENTS:

1. Action 5 is assumed.

DATUM: Weight of smaller portion of building

SECTION: 3.7.5 LABEL: YWSP NUMBER: 3732

INGREDIENTS

Datum	Label	Number
Total gravity weight of building	W	4215

COMMENTS:

1. It is assumed that the weight of the smaller portion of the building should be evaluated in the same manner as specified for the total weight in chapter 4.

DATUM: Beam, girder, or truss reaction

SECTION: 3.7.5 LABEL: YBGTR NUMBER: 3734

INGREDIENTS

Datum	Label	Number
Dead load effect	YQD	3707
Live load effect	YQL	3708

FUNCTION:

YBGTR = YQD + YQL

DATUM: Interconnection requirement

SECTION: 3.7.5 LABEL: IR NUMBER: 3737

INGREDIENTS

Datum	Label	Number
All parts of the building are interconnected		3740

	DECISION TABLE		1	2
1	All parts of the building are interconnected = true	*	Y	N
	**			
1	IR = satisfied	*	X	
2	IR = violated	*		X

COMMENTS:

1. Note that this requirement is related to the load path requirement (datum 3145), but it does not duplicate it. This requirement is intended to cover elements and connections that are not on the "designed load path."
2. The text is somewhat unclear in that "each part ... interconnected" could mean that each part should be connected to one other part or to all other parts.
3. The text of section 3.7.5 contains a somewhat awkward combination of minimum force requirements and this design requirement.

DATUM: Concrete/masonry wall anchorage requirement

SECTION: 3.7.6 LABEL: CMWAR NUMBER: 3741

INGREDIENTS

Datum	Label	Number
Direct connection provided between each conc/mas wall and ea floor/roof		3743
Spacing of wall anchorage connectors		3744
Wall designed to resist bending between connectors		3746

DECISION TABLE

			1	2	E
1	Direct connection provided between each concrete/masonry wall and each floor/roof = true	*	Y	Y	
2	Spacing of wall anchorage connectors > 4 feet	*	N	Y	
3	Wall designed to resist bending between connectors = true	*	.	Y	
1	CMWAR = satisfied	*	X	X	
2	CMWAR = violated	*			X

COMMENTS:

1. The text of section 3.7.6 contains a somewhat awkward combination of a minimum seismic force and this design requirement.

DATUM: Nonstructural anchorage requirement

SECTION: 3.7.7 LABEL: NSAR NUMBER: 3747

INGREDIENTS

Datum	Label	Number
Effect of nonstructural seismic force	YQFP	3749
Anchorage provided for nonstructural component		3750

DECISION TABLE

			1	2	3
1	Effect of nonstructural seismic force = 0	*	Y	N	N
2	Anchorage provided for nonstructural component = true	*	.	Y	N
	**				
1	NSAR = satisfied	*	X	X	
2	NSAR = violated	*			X

COMMENTS:

1. Note that this applies to all buildings, and thus even category A buildings will require a seismic analysis of some nonstructural components in accordance with Chapter 8.

DATUM: Effect of nonstructural seismic force

SECTION: 3.7.7 LABEL: YQFP NUMBER: 3749

INGREDIENTS

Datum	Label	Number
Nonstructural seismic force	FP	8115

COMMENTS:

1. The effect of the non structural seismic force is a function of the force itself plus geometric factors.

DATUM: Collector requirement

SECTION: 3.7.8 LABEL: CR NUMBER: 3752

INGREDIENTS

Datum	Label	Number
Collector elements provided		3753

DECISION TABLE		1	2
1 Collector elements provided to transfer seismic forces from origin to resistance = true	*	Y	N
******************************			
1 CR = satisfied	*	X	
2 CR = violated	*		X

COMMENTS:

1. This requirement seems to be redundant when considering the load path requirement.

DATUM: Diaphragm requirement

SECTION: 3.7.9 LABEL: DIAPR NUMBER: 3755

INGREDIENTS

Datum	Label	Number
Deflection in plane of diaphragm		3756
Permissible deflection of elements attached to diaphragm		3758
Diaphragm design provides for both shear and bending stress		3761
Diaphragm provides anchorage for seismic wall forces		3762
Ties or struts provided to distribute seismic wall forces		3764

DECISION TABLE

		1	2	E
1	Deflection in plate of diaphragm $\leq$ Permissible deflection of elements attached to diaphragm	Y	Y	
2	Diaphragm design provides for both shear and bending stress = true	Y	Y	
3	Diaphragm provides anchorage for seismic wall forces = true	N	Y	
4	Ties or struts provided to distribute seismic wall forces = true	.	Y	
1	DIAPR = satisfied	X	X	
2	DIAPR = violated			X

COMMENTS:

1. The text of section 3.4.1 indicates that the classification of the plan configuration will be used "For purposes of determining diaphragm component forces ..." It seems that this section would be an appropriate place to make use of such a classification, but no such reference is included in section 3.7.9 (also see comment 2 on datum 3410).
2. Permissible deflection is defined as that which allows all attached components to retain structural integrity and support.

DATUM: Minimum diaphragm seismic force effect

SECTION: 3.7.9 LABEL: XQDIAP NUMBER: 3765

INGREDIENTS

Datum	Label	Number
Effective peak velocity-related acceleration	EPV	1415
Weight of diaphragm and attached components	YWD	3767
Portion of story shear transferred by the diaphragm	YVX	3768

FUNCTION:

XQDIAP = 0.5 (EPA)(YMD) + YVX

DATUM: Weight of diaphragm and attached components

SECTION: 3.7.9 LABEL: YWD NUMBER: 3767

INGREDIENTS

Datum	Label	Number
Total gravity weight of building	W	4215

COMMENTS:

1. It was assumed that the weight of the diaphragm should be evaluated following the same provisions that are used to determine the total gravity weight of the building.

DATUM: Portion of story shear transferred by the diaphragm

SECTION: 3.7.9 LABEL: YVX NUMBER: 3768

INGREDIENTS

Datum	Label	Number
Story shear force effect	YQVX	4420

COMMENT:

1. The portion of the story shear transferred by the diaphragm can be determined as the story shear effects are determined from the distribution of the story shear.

DATUM: Bearing wall requirement

SECTION: 3.7.10 LABEL: BWR NUMBER: 3770

INGREDIENTS

Datum	Label	Number
Combined load effect on wall connections	YQBWC	3780
Element of building (component)		2114
Connection strength	YCS	3130
Ductility		3776
Rotation capacity		3777

DECISION TABLE

		*	1	2	3
1	Element of building = connection between wall elements <u>or</u> Element of building = connection from wall to supporting framework	*	N	Y	Y
2	Connection strength > Combined load effect on wall connections <u>or</u> Ductility > Combined load effect on wall connections <u>or</u> Rotation capacity > Combined load effect on wall connections	*	.	Y	N
	**				
1	BWR = satisfied	*	X	X	
2	BWR = violated	*			X

COMMENTS:

1. The full meaning of condition 2 does not appear to be clear.

DATUM: Minimum bearing wall seismic force

SECTION: 3.7.10 LABEL: XQBW NUMBER: 3771

INGREDIENTS

Datum	Label	Number
Effective peak velocity-related acceleration	EPV	1415
Weight of component	(WC)	2273

FUNCTION:

XQBW = MAX [EPV (WC), 0.10 WC]

COMMENTS:

1. The weight of the component is apparently the self weight of the bearing wall.

DATUM: Combined load effect on wall connections

SECTION: 3.7.10 LABEL: YQBWC NUMBER: 3780

INGREDIENTS

Datum	Label	Number
Thermal changes effect		3783
Shrinkage effect		3782
Settlement effect		3785
Earthquake force effect	QE	3706

COMMENTS:

1. The text lists the above ingredients, but does not indicate how they are to be combined. The most conventional assumption would simply be to use the sum of them.

DATUM: Adjustment to overturning moment of inverted pendulum

SECTION: 3.7.11 LABEL: XAOMIP NUMBER: 3788

INGREDIENTS		
Datum	Label	Number
ELF Overturning moment at level X	ELFOMX	4520
Total height	(H)	2227
Height to point along inverted pendulum	(h)	3789

FUNCTION:

$$XAOMIP = ELFOMX \frac{h}{2H}$$

DATUM: Category C and D vertical motion requirement

SECTION: 3.7.12 LABEL: CCDVMR NUMBER: 3790

INGREDIENTS		
Datum	Label	Number
Member position		3791
Member support		3792
Member is prestressed		3794
Vertical motions considered in determination of EQ effect		3795
Altered load combination used to satisfy vertical motion requirement		3796

	DECISION TABLE	1	2	3	4	E
1	Member position = horizontal	N	Y	Y	Y	
2	Member support = cantilever <u>or</u> Member is prestressed = true	.	N	Y	Y	
3	Vertical motions considered in determination of EQ effect = true	.	.	Y	N	
4	Altered load combination used to satisfy vertical motion requirement = true	.	.	-	Y	
1	CCDVMR = satisfied	X	X	X	X	
2	CCDVMR = violated					X

COMMENTS:

1. Condition 4 and rule 4 occur because of the permissive "may" in section 3.7.12.

DATUM: Altered load combination for effects of vertical motion

SECTION: 3.7.12 LABEL: QV NUMBER: 3797

INGREDIENTS

Datum	Label	Number
Member position		3791
Member support		3792
Member is prestressed		3794
Earthquake force effect	QE	3706
Dead load effect	YQD	3707

DECISION TABLE

			1	2
1	(Member position = horizontal)	*	+	+
2	Member support = cantilever	*	Y	N
3	(Member is prestressed = true)	*	.	+
	**			
1	QV = -0.2 YQD	*	X	
2	QV = 0.5 YQD ± 1.0 QE	*		X

COMMENTS:

1. Conditions 1 and 3 are known implicitly because this table is only called for in situations in which the condition values are as shown. (See datums 3790 and 3704.)

DATUM: Separation requirement

SECTION: 3.8 LABEL: SEPR NUMBER: 3810

INGREDIENTS

Datum	Label	Number
Separation between adjacent portions of buildings		3820
Separation required to avoid damaging contact	YSEPR	3830
Adjacent portions of building act as an integral unit in EQ		3840

DECISION TABLE

		1	2	3
1	Separation between adjacent portions of buildings > Separation required to avoid damaging contact	Y	N	N
2	Adjacent portions of building act as an integral unit to in EQ = true	.	Y	N
1	SEPR = satisfied	X	X	
2	SEPR = violated			X

COMMENTS:

1. The provisions refer to portions of a building, but not to adjacent (but separate) buildings.

DATUM: Separation required to avoid damaging contact

SECTION: 3.8 LABEL: YSEPR NUMBER: 3830

INGREDIENTS

Datum	Label	Number
Deflection at story X	DEFLX	4610

COMMENTS:

1. The text refers to the story deflection and to damaging contact, but does not give guidance as to whether the required separation might be less than the sum of the applicable deflections.

DATUM: Drift limit

SECTION: 3.8 LABEL: DL NUMBER: 3850

INGREDIENTS

Datum	Label	Number
Design story drift	DRIFT	4660
Allowable story drift	ASD	3860

DECISION TABLE

		*	1	2
1	Design story drift $\leq$ allowable story drift for each story	*	Y	N
	******			
1	DL = satisfied	*	X	
2	DL = violated	*		X

COMMENTS:

1. Section 3.8 refers to both sections 4.6 and 5.8 for the design story drift, however, the drift value of section 5.8 is not checked for P-delta effects, so this table shows a reference only to the final design drift, which applies to both ELF and Modal analyses.

DATUM: Allowable story drift

SECTION: 3.8 LABEL: ASD NUMBER: 3860

INGREDIENTS

Datum	Label	Number
Seismic hazard exposure group	SHEG	1430
Number of levels (stories)		2243
Building contains brittle finishes		3870
Story height below level X		2228

DECISION TABLE

		*	1	2	3	4
1	Seismic hazard exposure group = III	*	Y	-	N	N
2	Seismic hazard exposure group = II	*	-	Y	N	N
3	(Seismic hazard exposure group = I)	*	-	-	+	+
4	Number of levels (stories) $\leq$ 3 and Building contains brittle finishes = false	*	.	.	N	Y
	************************					
1	ASD = 0.10 Story height below level X	*	X			
2	ASD = 0.15 Story height below level X	*		X	X	
3	ASD = 0.20 Story height below level X	*				X

COMMENTS:

1. Brittle finishes are not defined.

DATUM: Equivalent lateral force analysis requirement

SECTION: Chapter 4 LABEL: ELFAR NUMBER: 4001

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Specified ELF analysis procedures followed		4002
Overturning moment requirement	OMR	4560

DECISION TABLE

		1	2	E
1	Seismic load analysis used = level 2 (ELF)	N	Y	
2	Specified ELF analysis procedures followed = true	.	Y	
3	Overturning moment requirement = satisfied	.	Y	
1	ELFAR = satisfied	X	X	
2	ELFAR = violated			X

COMMENTS:

1. This datum does not reference all of the provisions in chapter 4. Most of chapter 4 deals with the evaluation of the earthquake force effect. What this datum does is to require that the procedures given for evaluation of the earthquake force effect be followed and to bring in the only other provision in chapter 4 that does not feed into the earthquake force effect. This datum is in turn referenced in chapter 1.

DATUM: Earthquake load effect from ELF/Modal analysis

SECTION: Chapters 3, 4, and 5 LABEL: QELFMD NUMBER: 4010

INGREDIENTS

Datum	Label	Number
Story shear force effect	YQVX	4420
Torsional moment effect	YQTM	4450
Overturning moment effect	ZQOM	4510
Stability coefficient	XTHETA	4640
Increase in force effects from second order effects	YQ2ORD	4665

DECISION TABLE

		1	2
1	Stability coefficient > 0.10	Y	N
1	QELFMD = YQVX + YQTM +ZQOM		X
2	QELFMD = YQVX + YQTM + ZQOM + YQ2ORD	X	

COMMENTS:

1. The actions in this table are implied by the wording of chapters 3, 4, and 5 that is used to refer to earthquake force effects. The condition comes specifically from section 4.6.
2. Note that the reason chapter 5 (Modal analysis) is brought into the title of this datum is that chapter 5 makes reference to the procedures in chapter 4 for determining forces and effects once the design values are determined. Chapter 4 does not contain a forward cross-reference.

DATUM: Seismic base shear

SECTION: 4.2 and 4.2.1 LABEL: V NUMBER: 4205

INGREDIENTS

Datum	Label	Number
Designer wishes to use soil structure interaction		3280
ELF seismic base shear without soil structure interaction	XVELF	4208
ELF base shear modified by soil structure interaction	VELFSS	6200

DECISION TABLE

		1	2
1	Designer wishes to use soil structure interaction = true	N	Y
1	V = ELF seismic base shear without soil structure interaction	X	
2	V = ELF base shear modified by soil structure interaction		X

DATUM: ELF seismic base shear without soil structure interaction

SECTION: 4.2 LABEL: XVELF NUMBER: 4208

INGREDIENTS

Datum	Label	Number
Seismic design coefficient	CS	4210
Total gravity weight of building	W	4215

FUNCTION:

XVELF = (CS)(W)

DATUM: Seismic design coefficient

SECTION: 4.2, 4.2.1 LABEL: CS NUMBER: 4210

INGREDIENTS

Datum	Label	Number
Effective peak acceleration	EPA	1405
Effective peak velocity-related acceleration	EPV	1415
Soil profile type	SPT	3210
Seismic soil coefficient	SSC	3220
Building period calculated		4235
Building period	T	4240
Response modification factor	R	3354

DECISION TABLE

		1	2	3	4	5	6
1	Building period calculated = true	N	N	N	Y	Y	Y
2	Effective peak acceleration $\geq$ 0.30	N	Y	Y	N	Y	Y
3	Soil profile type = S3	.	N	Y	.	N	Y
1	CS = 2.5 EPA/R	X	X				
2	CS = 2.0 EPA/R			X			
3	CS = MIN [2.5 EPA/R, 1.2 EPV(SSC)/R(T)$^{2/3}$]				X	X	
4	CS = MIN [2.0 EPA/R, 1.2 EPV(SSC)/R(T)$^{2/3}$]						X

COMMENTS:

1. Even if the period is not calculated for determination of CS, it apparently is needed later. (See datum 4330.)

DATUM: Total gravity weight of building

SECTION: 4.2 LABEL: W NUMBER: 4215

INGREDIENTS

Datum	Label	Number
Building use		1270
Dead load		2146
Live load		2148
Effective snow load	ESL	4230

DECISION TABLE

			1	2
1	Building use = storage or warehouse	*	N	Y
	********************************			
1	W = Dead load + Effective snow load	*	X	
2	W = Dead load + Effective snow load + 25% Live load (on floors)	*		X

DATUM: Effective snow load

SECTION: 4.2, 2.1 LABEL: ESL NUMBER: 4230

INGREDIENTS

Datum	Label	Number
Basic snow load		2151
Conditions warrant reduction of snow load		2152
Reduction of snow load approved by regulatory agency		2153
Snow load reduction coefficient		2154

DECISION TABLE

			1	E
1	Conditions warrant reduction of snow load = true	*	Y	
2	Reduction of snow load approved by regulatory agency = true	*	Y	
3	Snow load reduction coefficient $\geq$ 0.20	*	Y	
	********************************			
1	ESL = (Snow load reduction coefficient)(Basic snow load)	*	X	
2	ESL = 70% of Basic snow load	*		X

COMMENTS:

1. The effective snow load is completely defined in chapter 2. The datum was assigned to chapter 4 because section 4.2 is the location where the most clear reference to the definition of chapter 2 is made.

DATUM: Building period

SECTION: 4.2.2 LABEL: T NUMBER: 4240

INGREDIENTS

Datum	Label	Number
Fundamental building period calculated by designer		4245
Calculated fundamental building period	YTF	4250
Approximate building period	TA	4255

DECISION TABLE

			1	2	3
1	Fundamental building period calculated by designer = true	*	N	Y	Y
2	Calculated fundamental building period > 1.2 (Approximate building period)	*	.	N	Y
	******	*			
1	T = TA	*	X		
2	T = YTF	*		X	
3	T = 1.2 TA	*			X

DATUM: Calculated fundamental building period

SECTION: 4.2.2 LABEL: YTF NUMBER: 4250

INGREDIENTS

Datum	Label	Number
Period calculated using established methods		4251
Properties of SRS in direction being analyzed		4252
Building assumed to be fixed at base		4253

COMMENTS:

1. It might be possible to develop two datums here: one would be a decision table using the first and third ingredients as conditions, the result of which would be a requirement for the procedure of calculating the period; the other would be the datum for the period itself which would only depend on the second ingredient. That did not seem to be the intent of the text, however.

DATUM: Approximate building period

SECTION: 4.2.2 LABEL: TA NUMBER: 4255

INGREDIENTS

Datum	Label	Number
Seismic resisting system		3309
SRS enclosed or adjoined by more rigid elements		3384
Coefficient for approximate period	CT	4260
Total height	(H)	2227
Overall length of bldg at base parallel to seismic force	(L)	2235

DECISION TABLE

			1	2
1	Seismic resisting system = moment frame and SRS enclosed or adjoined by more rigid elements = false	*	Y	N
	******************************			
1	$TA = (CT)(H)^{3/4}$	*	X	
2	$TA = 0.05\ H / \sqrt{L}$	*		X

COMMENTS:

1. The wording "For moment resisting structures where the frames ..." was assumed to be equivalent to saying that the seismic resisting system is a moment frame.

DATUM: Coefficient for approximate period

SECTION: 4.2.2 LABEL: CT NUMBER: 4260

INGREDIENTS

Datum	Label	Number
Frame material		3333

DECISION TABLE

			1	2
1	Frame material = steel	*	Y	N
2	(Frame material = reinforced concrete)	*	-	+
	******************************			
1	CT = 0.035	*	X	
2	CT = 0.025	*		X

COMMENTS:

1. Chapter 3 effectively limits frame materials to steel or reinforced concrete.

DATUM: Seismic story force

SECTION: 4.3 LABEL: XFX NUMBER: 4310

INGREDIENTS

Datum	Label	Number
Seismic base shear	V	4205
Vertical distribution factor	XCVX	4320

FUNCTION:

XFX = (V) (XCVX) for each level X.

DATUM: Vertical distribution factor

SECTION: 4.3 LABEL: XCVX NUMBER: 4320

INGREDIENTS

Datum	Label	Number
Total weight at level X	YWX	4340
Height to level X	(HX)	2226
Vertical distribution exponent	K	4330
Number of levels (stories)	(N)	2243

FUNCTION:

$$XCVX = \frac{(YWX)(HX)^K}{\sum_{i=1}^{N} (YWX_i)(HX_i)^K} \quad \text{for each level, X}$$

DATUM: Vertical distribution exponent

SECTION: 4.3 LABEL: K NUMBER: 4330

INGREDIENTS

Datum	Label	Number
Building period	T	4240
Interpolation used for vertical distribution exponent		4360

DECISION TABLE

		1	2	3	4
1	Building period ≦ 0.5 seconds	Y	-	N	N
2	Building period ≧ 2.5 seconds	-	Y	N	N
3	Interpolation used for vertical distribution exponent = true	.	.	N	Y
1	K = 1	X			
2	K = 2		X	X	
3	K = 1 + (T - 0.5)/2				X

COMMENTS:

1. Note that no provision is given for K if the building period is not calculated.

DATUM: Total weight at level X

SECTION: 4.3 LABEL: YWX NUMBER: 4340

INGREDIENTS

Datum	Label	Number
Total gravity weight of building	W	4215

COMMENT:

1. The determination of the weight at any level is to be made in the same fashion as the determination of the total weight.

DATUM: Seismic story shear

SECTION: 4.4 LABEL: VX NUMBER: 4410

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Number of levels (stories)	(N)	2243
Seismic story force	XFX	4310
Story shear design value	VXDV	5820
Earthquake force effect from more rigorous analysis		3550

DECISION TABLE

			1	2	3
1	Seismic load analysis used = level 2 (ELF)	*	Y	-	N
2	Seismic load analysis used = level 3 (Modal)	*	-	Y	N
	******				
1	$VX = \sum_{i=X}^{N} XFX_i$ (for each level X)	*	X		
2	VX = VXDV (for each level X)	*		X	
3	VX = Earthquake force effect from more rigorous analysis	*			X

COMMENTS:

1. Chapter 5 makes reference to use of the procedures of chapter 4 for determining forces and effects from the design values from modal analysis. Therefore the values of modal analysis are brought into this section.
2. This datum is referenced from chapter 3 in a context that would not preclude the use of any analysis. Therefore the rule and action dealing with a more rigorous analysis was added to this table, even though no such possiblity is mentioned in this section.

DATUM: Story shear force effect

SECTION: 4.4 LABEL: YQVX NUMBER: 4420

INGREDIENTS

Datum	Label	Number
Seismic story shear	VX	4410
Stiffness of vertical components		4430
Stiffness of diaphragm		4440

COMMENTS:

1. The text says that the story shear "...shall be distributed...with due consideration given to the relative stiffnesses of the vertical components and the diaphragm."
2. The text of section 3.4.1 makes reference to the use of the classification of plan configuration for determining diaphragm component forces. Section 4.4 seems like a possible place for such a use to be made, but it is not. Also see comment 2 on datum 3410 and comment 1 on datum 3755.

DATUM: Torsional moment effect

SECTION: 4.4 LABEL: YQTM NUMBER: 4450

INGREDIENTS

Datum	Label	Number
Torsional moment	XTM	4460
Stiffness of vertical components		4430
Stiffness of diaphragm		4440

COMMENTS:

1. See both comments on datum 4420, above.

DATUM: Torsional moment

SECTION: 4.4 LABEL: XTM NUMBER: 4460

INGREDIENTS		
Datum	Label	Number
Seismic story shear	VX	4410
Eccentricity between center of mass and center of stiffness	(E)	4470
Accidental torsional moment	XTMA	4480

FUNCTION:

XTM = (VX)(E) $\pm$ XMTA (at each level X)

DATUM: Accidental torsional moment

SECTION: 4.4 LABEL: XTMA NUMBER: 4480

INGREDIENTS		
Datum	Label	Number
Seismic story shear	VX	4410
Length of building perpendicular to seismic force	(D)	4490

FUNCTION:

XTMA = 0.05 (VX)(D) (at each level X)

DATUM: Overturning moment effect

SECTION: 4.5 LABEL: ZQOM NUMBER: 4510

INGREDIENTS

Datum	Label	Number
Overturning moment at level X	OMX	4515
Seismic story shear	VX	4410
Story shear force effect	YQVX	4420

COMMENTS:

1. The text requires that "the increment of overturning moment in the story under consideration shall be distributed ... in the same proportion ... as the horizontal shears." Thus, this would suggest a simple ratio of the appropriate ingredients listed above. The apparent reason for determining the overturning moment effects in such a fashion is that the overturning moments may not be statically compatible with the story forces and thus one could not determine the overturning moment effects directly from the lateral forces on an element. It appears that the suggested procedure leads to erroneous and possibly unconservative results in buildings with vertical resisting walls or frames that terminate at intermediate heights. It also appears that it would be more consistent to calculate the overturning moment effects in an element by first using the static lateral forces, then distributing the effects to the various components, and lastly applying the reduction factor based upon the number of stories (for the ELF method) or upon the difference between the design overturning moment and the static moment from the design forces (for the modal method). This problem should be studied further; it is not within the domain of the analytical procedures used in this study.

DATUM: Overturning moment at level X

SECTION: 4.5 LABEL: OMX NUMBER: 4515

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
ELF overturning moment at level X	ELFOMX	4520
Overturning moment design value	MOMX	5910
Earthquake force effect from more rigorous analysis		3550

DECISION TABLE

		1	2	3
1	Seismic load analysis used = level 2 (ELF)	Y	-	N
2	Seismic load analysis used = level 3 (Modal)	-	Y	N
1	OMX = ELF overturning moment at level X	X		
2	OMX = Overturning moment design value		X	
3	OMX = Earthquake force effect from more rigorous analysis			X

COMMENT:

1. See the comments on datum 4410.

DATUM: ELF overturning moment at level X

SECTION: 4.5 LABEL: ELFOMX NUMBER: 4520

INGREDIENTS

Datum	Label	Number
Number of the level X	(X)	2275
Structure is characterized as an inverted pendulum		3312
Overturning moment reduction factor	KAPPA	4530
Seismic story force	XFX	4310
Height to level X	(h)	2226
Number of levels (stories)	(N)	2243

DECISION TABLE

		1	2	3
1	X = 0 (at foundation-soil interface)	N	Y	Y
2	Structure is characterized as an inverted pendulum = true	.	Y	N
1	$ELFOMX = KAPPA \sum_{i=x}^{N} XFX_i(h_i - h_X)$	X	X	
2	$ELFOMX = 0.75 \sum_{i=x}^{N} XFX_i(h_i)$			X

COMMENTS:

1. Note that section 3.7.11 modifies the overturning moment for inverted pendulums. (See datum 3788.)

DATUM: ELF overturning moment at foundation without reduction

SECTION: 4.5 LABEL: XOMO NUMBER: 4522

INGREDIENTS

Datum	Label	Number
Overturning moment reduction factor	KAPPA	4530
Seismic story force	XFX	4310
Number of the level X	(X)	2275
Height to level X	(h)	2226
Number of levels (stories)	(N)	2243

FUNCTION:

$$XOMO = KAPPA \sum_{i=x}^{N} (XFX_i)(h_i)$$

COMMENT:

1. This value is used in chapter 6 to calculate the modified deflections when considering soil structure interaction.

DATUM: Overturning moment reduction factor

SECTION: 4.5 LABEL: KAPPA NUMBER: 4530

INGREDIENTS

Datum	Label	Number
Number of levels (stories)	(N)	2243
Number of the level X	(X)	2275

DECISION TABLE

		1	2	3
1	$N - X \leq 10$	Y	-	N
2	$N - X \geq 20$	-	Y	N
1	KAPPA = 1.0	X		
2	KAPPA = 0.8		X	
3	KAPPA = 1.0 - (N - X - 10)/50			X

DATUM: Overturning moment requirement

SECTION: 4.5 LABEL: OMR NUMBER: 4560

INGREDIENTS

Datum	Label	Number
Location of resultant of forces at foundation-soil interface		4550

	DECISION TABLE		1	2
1	Location of resultant of forces at foundation-soil interface falls inside middle one half of the base of components resisting the overturning	*	Y	N
	********************			
1	OMR = satisfied	*	X	
2	OMR = violated	*		X

COMMENTS:

1. Apparently this requirement applies only to buildings analyzed with the ELF method.

DATUM: First order design story drift

SECTION: 4.6.1 LABEL: DRIFT1 NUMBER: 4605

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
First order story drift design value	XMDRDV	5840
Deflection at story X	DEFLX	4610
Earthquake force effect from more rigorous analysis		3550

DECISION TABLE

		1	2	3
1	Seismic load analysis used = level 2 (ELF)	Y	-	N
2	Seismic load analysis used = level 3 (Modal)	-	Y	N
1	DRIFT1 = Deflection at story X - Deflection at story (X - 1)	X		
2	DRIFT1 = First order story drift design value		X	
3	DRIFT1 = Earthquake force effect from more rigorous analysis			X

COMMENTS:

1. See the comments on datum 4410.

DATUM: ELF deflections without soil structure interaction

SECTION: 4.6.1 LABEL: XDXNSS NUMBER: 4608

INGREDIENTS

Datum	Label	Number
Elastic deflection at story X	EDFLX	4615
Deflection amplification factor	CD	3348

FUNCTION:

XDXNSS = (EDFLX)(CD)

DATUM: Deflection at story X

SECTION: 4.6.1 LABEL: DEFLX NUMBER: 4610

INGREDIENTS

Datum	Label	Number
Designer wishes to use soil structure interaction		3280
Seismic load analysis used		3520
Modified ELF deflections for soil structure interaction	XDFLSS	6268
First order story deflection design value	XMDSDV	5850
ELF deflections without soil structure interaction	XDXNSS	4608
Earthquake force effect from more rigorous analysis		3550

DECISION TABLE

		1	2	3	4
1	Seismic load analysis used = level 2 (ELF)	Y	Y	-	N
2	Seismic load analysis used = level 3 (Modal)	-	-	Y	N
3	Designer wishes to use soil structure interaction = true	N	Y	.	.
1	DEFLX = ELF deflections without soil structure interaction	X			
2	DEFLX = Modified ELF deflections for soil structure interaction		X		
3	DEFLX = First order story deflection design value			X	
4	DEFLX = Earthquake force effect from more rigorous analysis				X

COMMENTS:

1. See the comments on datum 4410.

DATUM: Elastic deflection at story X

SECTION: 4.6.1 LABEL: EDFLX NUMBER: 4615

INGREDIENTS

Datum	Label	Number
Deflection to be used only for checking drift requirement		4617
Fundamental bulding period calculated by designer		4245
Deflection to be based on calculated fundamental period		4620
Calculated fundamental building period	YTF	4250
Approximate building period	TA	4255
Seismic story force	XFX	4310
Reduced seismic forces corresponding to calculated periods	ZFX	4630
Elastic analysis		4635
Building assumed fixed at base		4253

DECISION TABLE

		1	E
1	Deflection to be used only for checking drift requirement = true	Y	
2	Fundamental building period calculated by designer = true	Y	
3	YTF > 1.2 TA	Y	
4	Deflection to be based on calculated fundamental period = true	Y	
1	EDFLX = function of (Seismic story force, Elastic analysis, Building assumed fixed at base)		X
2	EDFLX = function of (Reduced seismic forces corresponding to calculated periods, Elastic analysis, Building assumed fixed at base)	X	

DATUM: Reduced seismic forces corresponding to calculated periods

SECTION: 4.6 LABEL: ZFX NUMBER: 4630

INGREDIENTS

Datum	Label	Number
Calculated fundamental building period	YTF	4250
Seismic base shear	V	4205
Vertical distribution factor	CVX	4320

COMMENTS:

This datum is only called for when one calculates deflections to check the drift requirement and the calculated fundamental period exceeds the limits of datum 4240. In this case, a new base shear would be recalculated using the calculated fundamental period and then the story forces would be recalculated from the new base shear, just as done for datum 4310.

DATUM: Stability coefficient

SECTION: 4.6.2 LABEL: XTHETA NUMBER: 4640

INGREDIENTS

Datum	Label	Number
Total gravity load above level X	YPX	4645
First order design story drift	DRIFT1	4605
Seismic story shear	VX	4410
Story height below level X	(HSX)	2228
Deflection amplification factor	CD	3348

FUNCTION:

$$XTHETA = \frac{(YPX)(DRIFT1)}{(VX)(HSX)(CD)}$$

DATUM: Total gravity load above level X

SECTION: 4.6.2 LABEL: YPX NUMBER: 4645

INGREDIENTS

Datum	Label	Number
Total gravity weight of building	W	4215

COMMENT:

1. This datum could be expressed as a simple formula,

$$YPX = \sum_{i=X+1}^{N} YWX$$

where YWX is the story weight.

DATUM: Incremental factor for second order effects

SECTION: 4.6.2 LABEL: YAD NUMBER: 4650

INGREDIENTS

Datum	Label	Number
Rational analysis		4655

COMMENT:

1. The commentary indicates that there are several rational analyses that can be used. One is to compute YAD as follows: $YAD = \frac{XTHETA}{1 - XTHETA}$

DATUM: Design story drift

SECTION: 4.6.2 LABEL: DRIFT NUMBER: 4660

INGREDIENTS

Datum	Label	Number
Stability coefficient	XTHETA	4640
First order design story drift	DRIFT1	4605
Incremental factor for second order effects	YAD	4650

DECISION TABLE

		1	2
1	Stability coefficient > 0.10 for any story	N	Y
	**********		
1	DRIFT = DRIFT1	X	
2	DRIFT = DRIFT1 (1 + YAD)		X

DATUM: Increase in force effects from second order effects

SECTION: 4.6.2 LABEL: YQ2ORD NUMBER: 4665

INGREDIENTS

Datum	Label	Number
Rational analysis		4655
Design story drift	DRIFT	4660

COMMENT:

1. The text states that "the increase in story shears and moments resulting from the increase (emphasis added) in story drift shall be added to the corresponding quantities..." It was assumed that the increase in story shears and moments are actually to be based on the entire drift, not just the second order increase.

DATUM: Modal analysis requirement

SECTION: Chapter 5 LABEL: MAR NUMBER: 5001

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Specified modal analysis procedures followed		5002
Modeling requirement	MR	5210
Modes requirement	NMR	5310
Period and mode shape analysis requirement	PMSAR	5410

DECISION TABLE

			1	2	E
1	Seismic load analysis used = level 3 (Modal)	*	N	Y	
2	Specified modal analysis procedures followed = true	*	.	Y	
3	Modeling requirement = satisfied	*	.	Y	
4	Modes requirement = satisfied	*	.	Y	
5	Period and mode shape analysis requirement = satisfied	*	.	Y	
	******************	*			
1	MAR = satisfied	*	X	X	
2	MAR = violated	*			X

COMMENTS:

1. This datum does not reference all of the provisions in chapter 5. Most of chapter 5 deals with the evaluation of the earthquake forces. What this datum does is to require that the procedures given for evaluation of the earthquake forces be followed and to bring in the only other provisions in chapter 5 that do not feed into the earthquake force effect. This datum is in turn referenced in chapter 1.

DATUM: Modeling requirement

SECTION: 5.2 LABEL: MR NUMBER: 5210

INGREDIENTS

Datum	Label	Number
Building modeled as a system of masses lumped at floors		5220
Each mass has one degree of freedom in lateral displacement		5230

DECISION TABLE

			1	E
1	Building modeled as a system of masses lumped at floors = true	*	Y	
2	Each mass has one degree of freedom in lateral displacement = true	*	Y	
	**	*		
1	MR = satisfied	*	X	
2	MR = violated	*		X

COMMENTS:

1. The text uses the word "may," not "shall," so the entire section may really only be commentary.

DATUM: Modes requirement

SECTION: 5.3 LABEL: NMR NUMBER: 5310

INGREDIENTS

Datum	Label	Number
Number of modes included in analysis		5320
Modal period	YTM	5330
Number of levels (stories)		2243
Modes analyzed on each of two perpendicular axes		5340

DECISION TABLE

			1	2	E
1	Number of levels (stories) $\geqq 3$	*	Y	N	
2	Number of modes included in analysis = Number of levels (stories)	*	.	Y	
3	Number of modes included in analysis = at least the lowest 3 modes	*	Y	.	
4	Number of modes included in analysis = all modes with YTM > 0.40 seconds	*	Y	.	
5	Modes analyzed on each of two perpendicular axes = true	*	Y	Y	
*****	*****	*	*****	*****	*****
1	NMR = satisfied	*	X	X	
2	NMR = violated	*			X

DATUM: Modal period

SECTION: 5.3 LABEL: YTM NUMBER: 5330

INGREDIENTS

Datum	Label	Number
Period and mode shape analysis requirement	PMSAR	5410

COMMENT:

1. The ingredient datum gives requirements on the methods to be used in determining the modal period.

DATUM: Period and mode shape analysis requirement

SECTION: 5.4 LABEL: PMSAR NUMBER: 5410

INGREDIENTS

Datum	Label	Number
Periods and shapes calculated with established methods		5420
Periods and shapes based on fixed base building		5430
Periods and modes based on elastic properties of SRS		5440

DECISION TABLE

			1	E
1	Periods and shapes calculated with established methods = true	*	Y	
2	Periods and shapes based on fixed base building = true	*	Y	
3	Periods and modes based on elastic properties of SRS = true	*	Y	
1	PMSAR = satisfied	*	X	
2	PMSAR = violated	*		X

DATUM: Modal base shear

SECTION: 5.5 LABEL: VM NUMBER: 5510

INGREDIENTS

Datum	Label	Number
Modal seismic coefficient	CSM	5520
Effective modal gravity load	XWM	5530
Designer wishes to use soil structure interaction		3280
Mode number		5550
Mode 1 base shear modified by soil structure interaction	VM1SSI	6300

DECISION TABLE

			1	2	3
1	Mode number = 1	*	N	Y	Y
2	Designer wishes to use soil structure interaction = true	*	.	N	Y
1	VM = (CSM)(XWM)	*	X	X	
2	VM = Mode 1 base shear modified by soil structure interaction	*			X

DATUM: Mode 1 base shear without soil structure interaction

SECTION: 5.5 LABEL: XV1NSS NUMBER: 5515

INGREDIENTS

Datum	Label	Number
Modal seismic coefficient	CSM	5520
Effective modal gravity load	XWM	5530

FUNCTION:

XV1NSS = (CSM)(XWM)

COMMENT:

1. This datum is called for in chapter 6.

DATUM: Modal seismic coefficient

SECTION: 5.5 LABEL: CSM NUMBER: 5520

INGREDIENTS

Datum	Label	Number
Modal period	YTM	5330
Effective peak acceleration	EPA	1405
Effective peak velocity-related acceleration	EPV	1415
Soil profile type	SPT	3210
Seismic soil coefficient	SSC	3220
Mode number		5550
Response modification factor	R	3354

DECISION TABLE

			1	2	3	4	5	6	7
1	Modal period > 4 seconds	*	Y	-	-	-	N	N	N
2	Modal period < 0.3 seconds	*	-	Y	Y	Y	N	N	.
3	Soil profile type = S3	*	.	Y	Y	Y	Y	Y	N
4	Mode number = 1	*	.	Y	Y	N	.	.	.
5	Effective peak velocity-related acceleration ≧ 0.30	*	.	Y	N	.	Y	N	.
1	CSM = MIN [1.2 EPV (SSC)/R(YTM)$^{2/3}$, 2.5 EPA/R]	*			X			X	X
2	CSM = MIN [1.2 EPV (SSC)/R(YTM)$^{2/3}$, 2.0 EPA/R]	*		X			X		
3	CSM = (0.8 + YTM) EPA/R	*				X			
4	CSM = 3 EPA (SSC)/R(YTM)$^{4/3}$	*	X						

DATUM: Effective modal gravity load

SECTION: 5.5 LABEL: XWM NUMBER: 5530

INGREDIENTS

Datum	Label	Number
Total weight at level X	YWX	4340
Modal story displacement amplitude	YPHIXM	5540
Number of levels (stories)	(N)	2243

FUNCTION:

$$XWM = \frac{\left[\sum_{i=1}^{N} (YWX_i)(YPHIXM_i) \right]^2}{\sum_{i=1}^{N} (YWX_i)(YPHIXM_i)^2} \quad \text{for each mode}$$

DATUM: Modal story displacement amplitude

SECTION: 5.5 LABEL: YPHIXM NUMBER: 5540

INGREDIENTS

Datum	Label	Number
Period and mode shape analysis requirement	PMSAR	5410

COMMENT:

1. The ingredient datum gives requirements on the methods to be used in establishing the modal story displacement amplitudes (mode shapes).

DATUM: Modal story force

SECTION: 5.6 LABEL: XFXM NUMBER: 5610

INGREDIENTS

Datum	Label	Number
Modal vertical distribution factor	XCVXM	5620
Modal base shear	VM	5510

FUNCTION:

XFSM = (VM)(XCVXM) for each level in each mode.

DATUM: Modal vertical distribution factor

SECTION: 5.6 LABEL: XCVXM NUMBER: 5620

INGREDIENTS

Datum	Label	Number
Total weight at level X	YWX	4340
Modal story displacement amplitude	YPHIXM	5540
Number of levels (stories)	(N)	2243

FUNCTION:

$$XCVXM = \frac{(YWX)(YPHIXM)}{\sum_{i=1}^{N} (YWX_i)(YPHIXM_i)}$$ for each level in each mode.

DATUM: Modal story deflection

SECTION: 5.6 LABEL: MSDIS NUMBER: 5630

INGREDIENTS

Datum	Label	Number
Deflection amplification factor	CD	3348
Elastic modal story deflection	XEMSDS	5640
Mode number		5550
Designer wishes to use soil structure interaction		3280
Mode 1 deflections modified for soil structure interaction	XMDSSI	6340

DECISION TABLE

		1	2	3
1	Mode number = 1	N	Y	Y
2	Designer wishes to use soil structure interaction = true	.	N	Y
1	MSDIS = (CD)(XEMSDS)	X	X	
2	MSDIS = (CD)(Mode 1 deflections modified for soil structure interaction)			X

COMMENTS:

1. Repeat for each level in each mode.

DATUM: Mode 1 story deflection without soil structure interaction

SECTION: 5.6 LABEL: XM1SDS NUMBER: 5635

INGREDIENTS

Datum	Label	Number
Deflection amplification factor	CD	3348
Elastic modal story deflection	XEMSDS	5640

FUNCTION:

XM1SDS = (CD)(XEMSDS) for each level

COMMENT:

1. This datum is called for in chapter 6.

DATUM: Elastic modal story deflection

SECTION: 5.6 LABEL: XEMSDS NUMBER: 5640

INGREDIENTS

Datum	Label	Number
Acceleration of gravity	(g)	2223
Modal period	YTM	5330
Modal story force	XFXM	5610
Total weight at level X	YWX	4340

FUNCTION:

$$XEMSDS = \frac{g(YTM)^2\ XFXM}{4\pi^2\ (YWX)}$$

DATUM: First order modal story drift

SECTION: 5.6 LABEL: XMDFR1 NUMBER: 5650

INGREDIENTS

Datum	Label	Number
Modal story deflection	MSDIS	5630

FUNCTION:

XMDFR1 = Modal story deflection at level X - Modal story deflection at level X-1.

DATUM: Modal Story Shear

SECTION: 5.7 LABEL: YMVX NUMBER: 5710

and

DATUM: Modal story overturning moments

SECTION: 5.7 LABEL: YMOMX NUMBER: 5720

and

DATUM: Modal shear in walls or braced frames

SECTION: 5.7 LABEL: YMVWBF NUMBER: 5730

and

DATUM: Modal overturning moments in walls or braced frames

SECTION: 5.7 LABEL: YMOMWB NUMBER: 5740

(all are evaluated from the same information)

INGREDIENTS

Datum	Label	Number
Modal story force	XFXM	5610
Force effect computed by linear static methods		5750

COMMENTS:

1. Each of these datums is evaluated in the same way.
2. Datums 5730 and 5740 are mentioned in section 5.7, but not again. It was assumed that they are to be used when shears and moments at points other than story heights are of interest. Thus, they were made ingredients of the design values in section 5.8 even though they were not mentioned there.

DATUM: Base shear design value

SECTION: 5.8 LABEL: XVTM NUMBER: 5810

INGREDIENTS		
Datum	Label	Number
Modal base shear	VM	5510
Number of modes included in analysis	(NM)	5320

FUNCTION:

$$XVTM = \sqrt{\sum_{i=1}^{NM} (VM)^2}$$

DATUM: Story shear design value

SECTION: 5.8 LABEL: VXDV NUMBER: 5820

INGREDIENTS		
Datum	Label	Number
Element of building (component)		2114
Number of modes included in analysis	(NM)	5320
Modal story shear	YMVX	5710
Modal shear in walls or braced frames	YMVWBF	5730
ELF adjustment factor	ELFF	5880

	DECISION TABLE	1	2
1	Element of building (component) = shear wall or braced frame	Y	N
1	$VXDV = ELFF \sqrt{\sum_{i=1}^{NM} (YMVWBF)^2}$	X	
2	$VXDV = ELFF \sqrt{\sum_{i=1}^{NM} (YMVX)^2}$		X

COMMENTS:

1. See comment 2 on datum 5730.

DATUM: Story overturning moment design value

SECTION: 5.8 LABEL: OMXDV NUMBER: 5830

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Number of modes included in analysis	(NM)	5320
Modal story overturning moments	YMOMX	5720
Modal overturning moments in walls or braced frames	YMOMWB	5740
ELF adjustment factor	ELFF	5880

DECISION TABLE

			1	2
1	Element of building (component) = shear wall or braced frame	*	Y	N
1	$OMXDV = ELFF \sqrt{\sum_{i=1}^{NM} (YMOMWB)^2}$	*	X	
2	$OMXDV = ELFF \sqrt{\sum_{i=1}^{NM} (YMOMX)^2}$	*		X

COMMENTS:

1. See comment 2 on datum 5740.

DATUM: First order story drift design value

SECTION: 5.8 LABEL: XMDRDV NUMBER: 5840

INGREDIENTS

Datum	Label	Number
Number of modes included in analysis	(NM)	5320
First order modal story drift	XMDFR1	5650
ELF adjustment factor	ELFF	5880

FUNCTION:

$$XMDRDV = ELFF \sqrt{\sum_{i=1}^{NM} (XMDFR1)^2}$$

DATUM: First order story deflection design value

SECTION: 5.8 LABEL: XMDSDV NUMBER: 5850

INGREDIENTS

Datum	Label	Number
Number of modes included in analysis	(NM)	5320
Modal story deflection	MSDIS	5630
ELF adjustment factor	ELFF	5880

FUNCTION:

$$XMDSDV = ELFF \sqrt{\sum_{i=1}^{NM} (MSDIS)^2}$$

DATUM: Comparative ELF base shear

SECTION: 5.8 LABEL: VBAR NUMBER: 5860

INGREDIENTS

Datum	Label	Number
Soil profile type	SPT	3210
Seismic soil coefficient	SSC	3220
Total gravity weight of building	W	4215
Effective peak acceleration	EPA	1405
Effective peak velocity-related acceleration	EPV	1415
Response modification factor	R	3354
Approximate building period	TA	4255

DECISION TABLE

			1	2
1	Soil profile type = S3 <u>and</u> Effective peak acceleration $\geq$ 0.30	*	N	Y
******				
1	VBAR = MIN[W (2.5 EPA)/R, W (1.2 EPV) SSC / R(1.4 TA)$^{2/3}$]	*	X	
2	VBAR = MIN[W (2.0 EPA)/R, W (1.2 EPV) SSC / R(1.4 TA)$^{2/3}$]	*		X

COMMENTS:

1. The text says that this datum is to be calculated using formula 4-2, however formula 4-2 is for the seismic design coefficient, not the base shear itself. It was assumed that formula 4-2 should also be multiplied by the weight for this datum. In addition, it was assumed that the limits of formulas 4-3 and 4-3a also applied. This latter assumption affects the logic of the decision table for datum 5880 (see comment 1 for that datum).

DATUM: ELF adjustment factor

SECTION: 5.8 LABEL: ELFF NUMBER: 5880

INGREDIENTS

Datum	Label	Number
Base shear design value	XVTM	5810
Comparative ELF base shear	YBAR	5860
Seismic base shear	V	4205
Designer chooses not to exceed ELF base shear		5870

DECISION TABLE

		*	1	2	3	4
1	Base shear design value < Comparative ELF base shear	*	Y	N	-	-
2	Base shear design value < Seismic base shear	*	+	Y	N	N
3	Designer chooses not to exceed ELF base shear = true	*	.	.	N	Y
	**					
1	ELFF = 1.0	*		X	X	
2	ELFF = VBA./XVTM	*	X			
3	ELFF = V/XVTM	*				X

COMMENTS:

1. Because of the assumption made concerning the comparitive ELF base shear, it can never be greater than the seismic base shear normally calculated in chapter 4. Thus, the first two conditions are related as shown by the implicit entries.
2. Giving the designer the option of scaling the result of modal analysis down to the ELF values seems to defeat some of the rationale behind requiring modal analysis for buildings with vertical irregularities.

DATUM: Overturning moment design value

SECTION: 5.10 LABEL: MOMX NUMBER: 5910

INGREDIENTS

Datum	Label	Number
Story overturning moment design value	OMXDV	5830
Number of the level X	(X)	2275

DECISION TABLE

			1	2
1	X = 0 (at foundation - soil interface)	*	N	Y
	*****************			
1	MOMX = OMXDV	*	X	
2	MOMX = 0.9 (OMXDV)	*		X

DATUM: Soil structure interaction analysis requirement

SECTION: Chapter 6 LABEL: SSIR NUMBER: 6001

INGREDIENTS

Datum	Label	Number
Designer wishes to use soil structure interaction		3280
Specified soil struct int analysis procedures followed		6002

DECISION TABLE

			1	2	3
1	Designer wishes to use soil structure interaction = true	*	N	Y	Y
2	Specified soil struct int analysis procedures followed = true	*	.	Y	N
	**************************************				
1	SSIR = satisfied	*	X	X	
2	SSIR = violated	*			X

COMMENTS:

1. This datum does not reference all of the provisions in Chapter 6. Nearly all of Chapter 6 deals with the evaluation of the earthquake forces. What this datum does is to require that the procedures given for evaluation of the earthquake forces be followed. This datum is in turn referenced in Chapter 1.

DATUM: ELF base shear modified by soil structure interaction

SECTION: 6.2.1 LABEL: VELFSS NUMBER: 6200

INGREDIENTS

Datum	Label	Number
ELF seismic base shear without soil structure interaction	XVELF	4208
Soil struct interaction reduction of ELF base shear	XDVSSI	6202

DECISION TABLE

		1	2
1	Soil struct interaction reduction of ELF base shear > 30% ELF seismic base shear without soil structure interaction	N	Y
1	VELFSS = XVELF - XDVSSI	X	
2	VELFSS = 0.7 (XVELEF)		X

DATUM: Soil structure interaction reduction of ELF base shear

SECTION: 6.2.1 LABEL: XDVSSI NUMBER: 6202

INGREDIENTS

Datum	Label	Number
Seismic design coefficient	CS	4210
ELF seismic coefficient modified soil struct interaction	CSBAR	6204
Fraction of critical damping in struct found system	BETA	6206
Gravity load effective for soil structure interaction	WBAR	6208

FUNCTION:

$$XDVSSI = [CS - CSBAR \left(\frac{0.05}{BETA}\right)^{0.4}] \; WBAR$$

COMMENTS:

1. It was assumed that the reference to "T or Ta" in the definition of $\overline{CS}$ in the text meant "T" where T is the building period, whether it is taken from the calculated fundamental period or the approximate period.

DATUM: ELF seismic coefficient modified for soil structure interaction

SECTION: 6.2.1 LABEL: CSBAR NUMBER: 6204

INGREDIENTS

Datum	Label	Number
Period effective for soil structure interaction	TBAR	6210
Soil profile type	SPT	3210
Seismic soil coefficient	SSC	3220
Response modification factor	R	3354
Effective peak velocity-related acceleration	EPV	1415
Effective peak acceleration	EPA	1405

DECISION TABLE

		1	2
1	Soil profile type = S3 and Effective peak acceleration ≥ 0.30	N	Y
1	CSBAR = MIN [2.5 EPA/R, 1.2 EPV (SSC)/R $(TBAR)^{2/3}$]	X	
2	CSBAR = MIN [2.0 EPA/R, 1.2 EPV (SSC)/R $(TBAR)^{2/3}$]		X

COMMENTS:

1. The text refers only to formula 4-2 for the determination of this datum. It was assumed that the limitations of formula 4-3 and 4-3a also apply.

DATUM: Fraction of critical damping in structure-foundation system

SECTION: 6.2.1 (B) LABEL: BETA NUMBER: 6206

INGREDIENTS

Datum	Label	Number
Computed fraction of critical damping in struct-found system	XBMODC	6252

DECISION TABLE

			1	2
1	Computed fraction of critical damping in struct found system < 0.05	*	N	Y
	******			
1	BETA = computed fraction of critical damping in struct-found system	*	X	
2	BETA = 0.05	*		X

DATUM: ELF gravity load effective for soil structure interaction

SECTION: 6.2.1 LABEL: WEBAR NUMBER: 6207

INGREDIENTS

Datum	Label	Number
Gravity load concentrated at a single level		6209
Total gravity weight of building	W	4215

DECISION TABLE

			1	2
1	Gravity load concentrated at a single level = true	*	N	Y
	******			
1	WEBAR = 0.7 W	*	X	
2	WEBAR = W	*		X

DATUM: Gravity load effective for soil structure interaction

SECTION: 6.2.1 LABEL: WBAR NUMBER: 6208

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
ELF gravity load effective for soil structure interaction	WEBAR	6207
Effective modal gravity load	XWM	5530

DECISION TABLE

		*	1	2
1	Seismic load analysis used = level 2 (ELF)	*	Y	N
2	(Seismic load analysis used = level 3 (modal))	*	-	+
	**			
1	WBAR = WEBAR	*	X	
2	WBAR = XWM	*		X

1. This decision table is necessary to integrate the two sections of Chapter 5 that deal with the two different analysis methods.

DATUM: Period effective for soil structure interaction

SECTION: 6.2.1 (A) LABEL: TBAR NUMBER: 6210

INGREDIENTS

Datum	Label	Number
Type of foundation		6232
Mat foundation located at or near surface		6234
Mat foundation embedded without effective wall contact		6236
Effective period for typical building	XTMOD1	6238
Effective period for mat foundation building	XTMQD2	6240
Use of alternate effective period desired		6241

DECISION TABLE

		1	2	3	4
1	Type of foundation = mat	N	Y	Y	Y
2	Mat foundation located at or near surface = true or Mat foundation embedded without effective wall contact	.	Y	Y	N
3	Use of alternate effective period is desired = true	.	Y	N	.
	******************************				
1	TBAR = XTMOL1	X		X	X
2	TBAR = XTMOD2		X		

COMMENTS:

1. The use of formula 6.5 which defines datum 6240 was assumed to be optional because of the wording in the text, "alternatively, for buildings supported on mat foundations ... the effective period may be determined..." This may create a conflict with section 6.3.1 which refers to the period from formula 6-5, "...when applicable..."

DATUM: Period without modification for soil structure interaction

SECTION: 6.2.1 LABEL: TNS NUMBER: 6211

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
Building period	T	4240
Modal period	YTM	5330

DECISION TABLE

			1	2
1	Seismic load analysis used = level 2 (ELF)	*	Y	N
2	(Seismic load analysis used = level 3 (Modal))	*	-	+
	**************************************	*		
1	TNS = Building period	*	X	
2	TNS = Modal period for mode 1	*		X

COMMENTS:

1. This decision table is necessary to integrate the two sections of Chapter 6 that deal with the two different analysis methods.

DATUM: Stiffness of building fixed at base

SECTION: 6.2.1 (A) LABEL: XKBAR NUMBER: 6212

INGREDIENTS

Datum	Label	Number
Acceleration of gravity	(g)	?223
Gravity load effective for soil structure interaction	WBAR	?208
Period without modification for soil structure interaction	TNS	6211

FUNCTION:

$$XKBAR = 4\pi^2 \frac{WBAR}{g(TNS)^2}$$

DATUM: Lateral stiffness of foundation

SECTION: 6.2.1 (A) LABEL: YKY NUMBER: 6214

and

DATUM: Rocking stiffness of foundation

SECTION: 6.2.1 (A) LABEL: YKTHET NUMBER: 6216

INGREDIENTS

Datum	Label	Number
Computations follow established principles		6220
Average shear modulus of soil at large strains	G	6222
Average shear wave velocity of soil at large strains	VS	6224

COMMENTS:

1. The text defines the meaning of these datums and lists the above ingredients for use in their evaluation.

DATUM: ELF height effective for soil structure interaction

SECTION: 6.2.1 (A) LABEL: HEBAR NUMBER: 6217

INGREDIENTS

Datum	Label	Number
Gravity load concentrated at a single level		6209
Total height	(H)	2227

DECISION TABLE

			1	2
1	Gravity load concentrated at a single level = true	*	N	Y
	********************************			
1	HEBAR = 0.7 H	*	X	
2	HEBAR = H	*		X

COMMENTS:

1. The logic involved in this decision table is exactly the same as for datum 6208.

DATUM: Height effective for soil structure interaction

SECTION: 6.2.1 (A) LABEL: HBAR NUMBER: 6218

INGREDIENTS

Datum	Label	Number
Seismic load analysis used		3520
ELF height effective for soil structure interaction	HEBAR	6217
Modal height effective for soil structure interaction	XHMBAR	6330

DECISION TABLE

		1	2
1	Seismic load analysis used = level 2 (ELF)	Y	N
2	(Seismic load analysis used = level 3 (Modal))	-	+
	********************************		
1	HBAR = HEBAR	X	
2	HBAR = XHMBAR		X

COMMENTS:

1. This decision table is necessary to integrate the two sections of Chapter 6 that deal with the two different analysis methods.

DATUM: Average shear modulus of soil at large strains

SECTION: 6.2.1 (A) (table 6-A) LABEL: G NUMBER: 6222

INGREDIENTS

Datum	Label	Number
Shear modulus of soil at small strains	XGO	6226
Effective peak velocity-related acceleration	EPV	1415

DECISION TABLE

		1	2	3	4
1	Effective peak velocity-related acceleration ≦ 0.10	Y	-	-	N
2	Effective peak velocity-related acceleration = 0.15	-	Y	-	N
3	Effective peak velocity-related acceleration = 0.20	-	-	Y	N
4	(Effective peak velocity-related acceleration ≧ 0.30)	-	-	-	+
1	G = 0.81 XGO	X			
2	G = 0.64 XGO		X		
3	G = 0.49 XGO			X	
4	G = 0.42 XGO				X

COMMENTS:

1. The logic in this decision table is identical to that for datum 6224.

DATUM: Average shear wave velocity of soil at large strains

SECTION: 6.2.1 (A) LABEL: VS NUMBER: 6224

INGREDIENTS

Datum	Label	Number
Shear wave velocity of soil at small strains	YVSO	6228
Effective peak velocity-related acceleration	EPV	1415

DECISION TABLE

		1	2	3	4
1	Effective peak velocity-related acceleration ≦ 0.10	Y	-	-	N
2	Effective peak velocity-related acceleration = 0.15	-	Y	-	N
3	Effective peak velocity-related acceleration = 0.20	-	-	Y	N
4	(Effective peak velocity-related acceleration ≧ 0.30)	-	-	-	+
1	VS = 0.9 YVSO	X			
2	VS = 0.8 YVSO		X		
3	VS = 0.7 YVSO			X	
4	VS = 0.65 YVSO				X

COMMENTS:

1. The logic in this decision table is identical to that for datum 6222.

DATUM: Shear modulus of soil at small strains

SECTION: 6.2.1 (A) LABEL: XGO NUMBER: 6226

INGREDIENTS

Datum	Label	Number
Acceleration of gravity	(g)	2223
Shear wave velocity of soil at small strains	YVSO	6228
Average unit weight of soil	(d)	6230

FUNCTION:

$$XGO = \frac{d}{g} (YVSO)^2$$

DATUM: Shear wave velocity of soil at small strains

SECTION: 6.2.1 (A) LABEL: YVSO NUMBER: 6228

INGREDIENTS

Datum	Label	Number
Strain level in soil		6229

COMMENTS:

1. The text requires that the shear wave velocity be detemined at "small strain levels (10^{-3} percent or less)." The text would be more clear if it simply specified the strain level as 10^{-5} or less. The added term "percent" can possibly cause confusion.

DATUM: Effective period for typical building

SECTION: 6.2.1 (A) LABEL: XTMOD1 NUMBER: 6238

INGREDIENTS

Datum	Label	Number
Period without modification for soil structure interaction	TNS	6211
Stiffness of building fixed at base	XKBAR	6212
Lateral stiffness of foundation	YKY	6214
Rocking stiffness of foundation	YKTHET	6216
Height effective for soil structure interaction	HBAR	6218

FUNCTION:

$$XTMOD1 = TNS \sqrt{1 + \frac{XKBAR}{XKY} \left(1 + \frac{XKY\ (HBAR)^2}{YKTHET}\right)}$$

DATUM: Effective period for mat foundation building

SECTION: 6.2.1 (A) LABEL: XTMOD2 NUMBER: 6240

INGREDIENTS

Datum	Label	Number
Period without modification for soil structure interaction	TNS	6211
Relative density of structure and soil	XALPHA	6242
Characteristic foundation length based on area	XRA	6244
Height effective for soil structure interaction	HBAR	6218
Average shear wave velocity of soil at large strains	VS	6224
Characteristic foundation length based on inertia	XRM	6246

FUNCTION:

$$XTMOD2 = TNS \sqrt{1 + 25\ (XALPHA) \frac{XRA\ (HBAR)}{(VS(TNS))^2} \left(1 + 1.12 \frac{XRA\ (HBAR)^2}{(XRM)^3}\right)}$$

DATUM: Relative density of structure and soil

SECTION: 6.2.1 (A) LABEL: XALPHA NUMBER: 6242

INGREDIENTS

Datum	Label	Number
Gravity load effective for soil structure interaction	WBAR	6208
Height effective for soil structure interaction	HBAR	6218
Average unit weight of soil	(d)	6230
Area of foundation	(AO)	6248

FUNCTION:

$$XALPHA = \frac{WBAR}{d\ (AO)\ HBAR}$$

DATUM: Characteristic foundation length based on area

SECTION: 6.2.1 (A) LABEL: XRA NUMBER: 6244

INGREDIENTS

Datum	Label	Number
Area of foundation	(AO)	6248

FUNCTION:

$$XRA = \sqrt{\frac{AO}{\pi}}$$

DATUM: Characteristic foundation length based on inertia

SECTION: 6.2.1 (A) LABEL: XRM NUMBER: 6246

INGREDIENTS

Datum	Label	Number
Static moment of inertia of foundation	(IO)	6250

FUNCTION:

$$XRM = \sqrt[4]{\frac{4IO}{\pi}}$$

DATUM: Computed fraction of critical damping in structure-foundation system

SECTION: 6.2.1 (B) LABEL: XBMODC NUMBER: 6252

INGREDIENTS

Datum	Label	Number
Foundation damping factor	BZERO	6254
Period effective for soil structure interaction	TBAR	6210
Period without modification for soil structure interaction	TNS	6211

FUNCTION:

$$XBMODC = BZERO + \frac{0.05}{(TBAR/TNS)^3}$$

DATUM: Foundation damping factor

SECTION: 6.2.1 (B) LABEL: BZERO NUMBER: 6254

INGREDIENTS

Datum	Label	Number
Type of foundation		6232
Foundation is uniform soft stratum over rock like stratum		6262
Total depth of soft stratum	(DS)	6266
Period effective for soil structure interaction	TBAR	6210
Average shear wave velocity of soil at large strains	VS	6224
Damping value from Figure 6-1	XFIG61	6256
Foundation damping factor for pile foundations	XBZPR	6264

DECISION TABLE

			1	2	3
1	Type of foundation = point bearing piles <u>or</u> Foundation is uniform soft stratum over rock like stratum = true	*	N	Y	Y
2	$\frac{4\ DS}{VS(TBAR)} < 1$	*	.	Y	N
	***				
1	BZERO = XFIG61	*	X		
2	BZERO = XBZPR	*		X	
E	BZERO = ?	*			X

COMMENTS:

1. The text is unclear as to what BZERO should be in the situation represented here by rule 3. A probable assumption appears to be that action 1 would be correct.

DATUM: Damping value from Figure 6-1

SECTION: 6.2.1 (B) (figure 6-1) LABEL: XFIG61 NUMBER: 6256

INGREDIENTS

Datum	Label	Number
Period without modification for soil structure interaction	TNS	6211
Period effective for soil structure interaction	TBAR	6210
Characteristic foundation length	RFOUND	6258
Height effective for soil structure interaction	HBAR	6218
Effective peak velocity-related acceleration	EPV	1415

COMMENTS:

1. Figure 6-1 graphically produces a value of foundation damping based on three generalized variables: TBAR/TNS, HBAR/RFOUND, and EPV. Interpolation is required if EPV = 0.15.

DATUM: Characteristic foundation length

SECTION: 6.2.1 (B) LABEL: RFOUND NUMBER: 6258

INGREDIENTS

Datum	Label	Number
Height effective for soil structure interaction	HBAR	6218
Overall length of foundation parallel to seismic force	(LO)	2236
Characteristic foundation length based on area	XRA	6244
Characteristic foundation length based on inertia	XRM	6246

DECISION TABLE

		1	2	3
1	HBAR/LO $\leq$ 0.5	Y	N	-
2	HBAR/LO $\geq$ 1	-	N	Y
1	RFOUND = XRA	X		
2	RFOUND = XRA + $\left(\frac{HBAR/LO - 0.5}{0.5}\right)$ (XRM - XRA)			
3	RFOUND = XRM			

COMMENTS:

1. Action 2 is a mathematical expression of the instruction in text to interpolate between XRA and XRM.

DATUM: Foundation damping factor for pile foundations

SECTION: 6.2.1 (B) LABEL: XBZPR NUMBER: 6264

INGREDIENTS

Datum	Label	Number
Total depth of soft stratum	(DS)	6266
Average shear wave velocity of soil at large strains	VS	6224
Period effective for soil structure interaction	TBAR	6210
Damping value from figure 6-1	XFIG61	6256

FUNCTION:

$$XBEPR = \left(\frac{4\ DS}{VS\ (TBAR}\right)^2\ XFIG61$$

DATUM: Modified ELF deflections for soil structure interaction

SECTION: 6.2.3 LABEL: XDFLSS NUMBER: 6268

INGREDIENTS

Datum	Label	Number
ELF base shear modified by soil structure interaction	VELFSS	6200
ELF seismic base shear without soil structure interaction	XVELF	4208
Overturning moment at foundation without reduction	XOMO	4522
ELF deflections without soil structure interaction	XDXNSS	4608
Rocking stiffness of foundation	YKTHET	6216
Height to level X	(HX)	2226

FUNCTION:

$$XDFLSS = \frac{VELFSS}{XVELF}\ \left(\frac{XOMO\ (HX)}{YKTHET} + XDXNSS\right)$$

DATUM: Mode 1 base shear modified by soil structure interaction

SECTION: 6.3.1 LABEL: VM1SSI NUMBER: 6300

INGREDIENTS

Datum	Label	Number
Soil structure interaction reduction in mode 1 base shear	XDVMSS	6310
Mode 1 base shear without soil structure interaction	XV1NSS	5515

DECISION TABLE

		1	2
1	Soil structure interaction reduction in mode 1 base shear > 30% Mode 1 base shear without soil structure interaction	N	Y
1	VM1SSI = XV1NSS - XDVMSS	X	
2	VM1SSI = 0.7 (XV1NSS)		X

DATUM: Soil structure interaction reduction in mode 1 shear

SECTION: 6.3.1 LABEL: XDVMSS NUMBER: 6310

INGREDIENTS

Datum	Label	Number
Modal seismic coefficient	CSM	5520
Mode 1 seismic coefficient modified for soil struct interaction	YCSMSS	6320
Fraction of critical damping in struct found system	BETA	6206
Gravity load effective for soil structure interaction	WBAR	6208

FUNCTION:

$$XDVMSS = [CSM - YCSMSS \left(\frac{0.05}{BETA}\right)^{0.4}] \, WBAR$$

DATUM: Mode 1 seismic coefficient modified for soil structure interaction

SECTION: 6.3.1 LABEL: YCSMSS NUMBER: 6320

INGREDIENTS

Datum	Label	Number
Period effective for soil structure interaction	TBAR	6210
Effective peak acceleration	EPA	1405
Effective peak velocity-related acceleration	EPV	1415
Soil profile type	SPT	3210
Seismic soil coefficient	SSC	3220
Mode number		5550
Response modification factor	R	3354

COMMENTS:

1. The text refers to formula 5-3 for the evaluation of this datum. It was assumed that the limits on that formula in the text of section 5.5 and in formulas 5-3a and 5-3b are also applicable.
2. With the above assumptions, this datum can be evaluated with a decision table that is identical to that for datum 5520 with one exception: the ingredient, "modal period" (5330), is to be replaced by the ingredient, "period effective for soil structure interaction" (6210).

DATUM: Modal height effective for soil structure interaction

SECTION: 6.3.1 LABEL: XHMBAR NUMBER: 6330

INGREDIENTS

Datum	Label	Number
Total weight at level X	YWX	4340
Modal story displacement amplitude	YPHIXM	5540
Height to level X	(HX)	2226
Number of levels (stories)	(N)	2243

FUNCTION:

$$XHMBAR = \frac{\sum_{i=1}^{N} YWX_i \, (YPHIXM_i) \, HX_i}{\sum_{i=1}^{N} YWX_i \, (YPHIXM_i)} \qquad \text{(for mode 1)}$$

DATUM: Mode 1 deflections modified for soil structure interaction

SECTION: 6.3.2 LABEL: XMDSSI NUMBER: 6340

INGREDIENTS

Datum	Label	Number
Mode 1 base shear modified by soil structure interaction	VM1SSI	6300
Mode 1 base shear without soil structure interaction	XV1NSS	5515
Modal story overturning moments	YMOMX	5720
Height to level X	(HX)	2226
Rocking stiffness of foundation	YKTHET	6216
Mode 1 story deflection without soil structure interaction	XM1SDS	5635

FUNCTION:

$$XMDSSI = \frac{VM1SSI}{XV1NSS} \left[\frac{YMOMX \, (HX)}{YKTHET} + XM1SDS \right] \qquad \text{(for each level)}$$

COMMENTS:

1. Note that the overturning moment, YMOMX, is evaluated at level zero in each case, although HX and XM1SDS change with each level.

DATUM: Foundation design requirements

SECTION: Chapter 7 LABEL: FDR NUMBER: 7001

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Foundation component strength requirement	FCSR	7210
Foundation soil capacity requirement	FSCR	7230
Category A foundation requirement	ZCAFR	7300
Category B foundation requirement	CBFR	7400
Category C foundation requirement	CCFR	7500
Category D foundation requirement	CDFR	7600

DECISION TABLE

	DECISION TABLE	1	2	3	4	E
1	Foundation component strength requirement = satisfied	Y	Y	Y	Y	
2	Foundation soil capacity requirement = satisfied	Y	Y	Y	Y	
3	Seismic performance category = A	Y	-	-	N	
4	Seismic performance category = B	-	Y	-	N	
5	Seismic performance category = C	-	-	Y	N	
6	(Seismic performance category = D)	-	-	-	+	
7	Category A foundation requirement = satisfied	+	+	+	+	
8	Category B foundation requirement = satisfied	.	Y	+	+	
9	Category C foundation requirement = satisfied	.	.	Y	+	
10	Category D foundation requirement = satisfied	.	.	.	Y	
1	FDR = satisfied	X	X	X	X	
2	FDR = violated					X

COMMENTS:

1. Conditions 1 and 2 are strength requirements, and they must be satisfied for all buildings, including category A buildings. Although the determination of the required strengths for category A buildings is clear (they are simply nominal forces, see datums 3702 and 3731), the determination of the soil capacity to compare with the required strength for category A buildings is not necessarily clear. This is related to the comment made about strength of members and connections, datums 3125 and 3130.
2. See datum 7300 for a comment about condition 7.

DATUM: Foundation component strength requirement

SECTION: 7.2, 7.2.1 LABEL: FCSR NUMBER: 7210

INGREDIENTS

Datum	Label	Number
Required strength	RS	3702
Required strength without seismic load	ZRSNS	7220
Strength of foundation components	YSFC	7215
Wood materials requirement	WMR	9001
Steel materials requirement	SMR	10001
Concrete materials requirement	CMR	11001
Masonry materials requirement	MMR	12001

DECISION TABLE

		1	E
1	Strength of foundation components $\geq$ required strength (for each foundation component)	Y	
2	Strength of foundation components $\geq$ required strength without seismic load (for each foundation component)	Y	
3	Wood materials requirement = satisfied	Y	
4	Steel materials requirement = satisfied	Y	
5	Concrete materials requirement = satisfied	Y	
6	Masonry materials requirement = satisfied	Y	
	********		
1	FCSR = satisfied		
2	FCSR = violated		

COMMENTS:

1. Unless chapter 3 does not apply to foundation components, this requirement is nearly redundant, duplicating datums 3120 and 3610. The only difference is that condition 2 of this decision table is unique.

DATUM: Strength of foundation components

SECTION: 7.2.1 LABEL: YSFC NUMBER: 7215

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210
Strength of steel components	XSS	10210
Strength of concrete components and systems	SC	11210
Strength of masonry components	XSM	12210

COMMENTS:

1. The strength should be taken from the datum for the appropriate material.
2. This datum is identical to member strength, datum 3125.

DATUM: Required strength without seismic load

SECTION: 7.2.1 LABEL: ZRSNS NUMBER: 7220

INGREDIENTS

Datum	Label	Number
Dead load effect	YQD	3707
Live load effect	YQL	3708
Snow load effect	YQS	3710

COMMENT:

1. The text of section 7.2.1 requires a comparison of strength with non-seismic loads. The listed ingredients are the only load effects included in the provisions that are not seismic. No guidance is given for combining them, or for including other non-seismic loads, such as wind.

DATUM: Foundation soil capacity requirement

SECTION: 7.2.2 LABEL: FSCR NUMBER: 7230

INGREDIENTS

Datum	Label	Number
Soil capacity under non-seismic conditions		7240
Required strength without seismic load	ZRSNS	7220
Settlement under non-seismic conditions		7250
Maximum settlement structure can withstand		7260
Elastic limit of soil under seismic conditions	ZELSSC	7270
Required strength	RS	3702

DECISION TABLE

	DECISION TABLE	1	E
1	Soil capacity under non-seimsic conditions ≧ required strength without seismic load and Settlement under non-seismic conditions ≦ Maximum settlement structure can withstand	Y	
2	Elastic limit of soil under seismic conditions ≧ Required strength	Y	
1	FSCR = satisfied	X	
2	FSCR = violated		X

COMMENTS:

1. The loads that cause settlement under non-seismic conditions are not defined, nor is the maximum settlement that the structure can withstand.

DATUM: Elastic limit of soil under seismic conditions

SECTION: 7.2.2 LABEL: ZELSSC NUMBER: 7270

INGREDIENTS

Datum	Label	Number
Foundation design criteria requirement	FDCR	3160

COMMENTS:

1. Although the wording in section 7.2.2 is not precisely the same as that in section 3.1, it was assumed that the intent was to consider those factors unique to seismic design that influence the capacity of soils.

DATUM: Category A foundation requirement

SECTION: 7.3 LABEL: ZCAFR NUMBER: 7300

COMMENTS:

1. This datum only references section 7.2, which is already an ingredient of datum 7001. As shown in the decision table for datum 7001, then, this datum is always satisfied. It is only included because it is specifically called out in the text of chapters 3 and 7.

DATUM: Category B foundation requirement

SECTION: 7.4 LABEL: CBFR NUMBER: 7400

INGREDIENTS

Datum	Label	Number
Category A foundation requirement	ZCAFR	7300
Category B soil investigation requirement	CBSIR	7404
Category B foundation tie requirement	CBFTR	7428
Category B foundation pile requirement	CBFPR	7438

DECISION TABLE

		1	E
1	Category A foundation requirement = satisfied	+	
2	Category B soil investigation requirement = satisfied	Y	
3	Category B foundation tie requirement = satisfied	Y	
4	Category B foundation pile requirement = satisfied	Y	
1	CBFR = satisfied	X	
2	CBFR = violated		X

COMMENT:

1. See datum 7300 for a comment about condition 1.

DATUM: Category B soil investigation requirement

SECTION: 7.4.1 and 7.4.2 LABEL: CBSIR NUMBER: 7404

INGREDIENTS

Datum	Label	Number
Regulatory agency requires soil investigation report		7408
Soil investigation made		7410
Soil invest report satisfies non-seismic requirements		7412
Soil invest report includes elastic limit under seis cond		7413
Soil invest report considers soil capacity under seis cond		7414
Soil invest report considers slope instabil under seis cond		7416
Soil invest report considers liquefaction under seis cond		7418
Soil invest report considers surface rupture under seis cond		7420
Poles embedded in earth used to resist axial and lat load		7424
Soil invest report gives design criteria for pole embedment		7426

DECISION TABLE

	DECISION TABLE	1	2	3	4	E
1	Regulatory agency requires soil investigation report = true	Y	Y	N	N	
2	Soil investigation made = true	Y	Y	Y	.	
3	Soil invest report satisfies non-seismic requirements = true and Soil invest report includes elastic limit under seis cond = true and Soil invest report considers soil capacity under seis cond = true and Soil invest report considers slope instabil under seis cond = true and Soil invest report considers liquefaction under seis cond = true and Soil invest report considers surface rupture under seis cond = true	Y	Y	.	.	
4	Poles embedded in earth used to resist axial and lat load = true	Y	N	Y	N	
5	Soil invest report gives design criteria for pole embedment = true	Y	.	Y	.	
1	CBSIR = satisfied	X	X	X	X	
2	CBSIR = violated					X

COMMENTS:

1. It was assumed that the situation described in rule 3 is possible, that is, that a regulatory agency might not require a general soil report for a pole type structure, and that condition 3 would not matter in that situation. Another possible assumption is that the intent of section 7.4.2 is to require a full soil report for all pole type structures, in which case rule 3 would be deleted from the table.

DATUM: Category B foundation tie requirement

SECTION: 7.4.3 LABEL: CBFTR NUMBER: 7428

INGREDIENTS

Datum	Label	Number
Each individ pile cap, drilled pier, or caisson interconnected		7430
Member strength	YMS	3125
Effective peak velocity-related acceleration	EPV	1415
Larger of connected pile cap loads	(PCL)	7432
Larger of connected column loads	(CL)	7434
Equivalent foundation restraint provided and approved		7436

DECISION TABLE

		1	2	E
1	Ea individ pile cap, drilled pier, or caisson interconnected = true	Y	Y	
2	Member strength of interconnecting tie $\geqq$ PCL (EPV/4) <u>or</u> Member strength of interconnecting tie $\geqq$ CL (EPV/4)	Y	N	
3	Equivalent foundation restraint provided and approved = true	.	Y	
1	CBFTR = satisfied	X	X	
2	CBFTR = violated			X

COMMENTS:

1. The text does not say what the tie must connect a pile cap (or pier or caisson) to. It might be one, two, three or more adjacent pile caps.
2. The text creates some ambiguity with the wording ". . . pile cap or column load . . ." It implies that drilled piers and caissons always support columns. A better wording might be ". . . vertical pile cap, pier, or caisson load . . ."

DATUM: Category B foundation pile requirement

SECTION: 7.4.4 LABEL: CBFPR NUMBER: 7438

INGREDIENTS

Datum	Label	Number
Foundation structural components		7440
Embedment of pile reinforcement in pile cap		7442
Minimum development length	MDL	7444
Pile type		7446
Category B uncased concrete pile requirement	CBUCPR	7452
Category B cased concrete pile requirement	CBCCPR	7476
Category B steel pipe pile requirement	CBSPPR	7490
Category B precast concrete pile requirement	CBPCPR	7492
Category B prestressed concrete pile requirement	CBPSPR	7494

DECISION TABLE

	DECISION TABLE	1	2	3	4	5	6	7	E
1	Foundation structural components include concrete or composite concrete and steel piles	N	Y	Y	Y	Y	Y	Y	
2	Embedment of pile reinforcement in pile cap ≥ Minimum development length	.	Y	Y	Y	Y	Y	Y	
3	Pile type = uncased concrete	.	Y	–	–	–	–	N	
4	Pile type = metal cased concrete	.	–	Y	+	–	–	N	
5	Pile type = filled steel pipe	.	–	N	Y	–	–	N	
6	Pile type = precast concrete	.	–	–	–	Y	–	N	
7	Pile type = precast prestressed concrete	.	–	–	–	–	Y	N	
8	Category B uncased concrete pile requirement = satisfied	.	Y	.	.	.	.	.	
9	Category B cased concrete pile requirement = satisfied	.	.	Y	.	.	.	.	
10	Category B steel pipe pile requirement = satisfied	.	.	.	Y	.	.	.	
11	Category B precast concrete pile requirement = satisfied	.	.	.	.	Y	.	.	
12	Category B prestressed concrete pile requirement = satisfied	.	.	.	.	.	Y	.	
1	CBFPR = satisfied	X	X	X	X	X	X	X	
2	CBFPR =violated								X

COMMENTS:

1. Apparently it should be assumed that drilled piers and caissons are piles when evaluating conditions 1, 2 and 3.

DATUM: Minimum development length

SECTION: 7.4.4 LABEL: MDL NUMBER: 7444

INGREDIENTS

Datum	Label	Number
Bar development length per chapter 11 (ACI 318)		7450
Reinforcing bar configuration		7448

DECISION TABLE

			1	2
1	Reinforcing bar configuration = deformed	*	Y	N
1	MDL = Bar development length per chapter 11 (ACI 318)	*	X	
2	MDL = ?	*		X

COMMENTS:

1. The text does not require deformed bars, but does not give development length for other types of reinforcement (for example, presstressing strands, plain bars, rolled structural shapes, etc.).

DATUM: Category B uncased concrete pile requirement

SECTION: 7.4.4(A) LABEL: CBUCPR NUMBER: 7452

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Pile diameter		7456
Area of pile reinforcement		7458
Area of pile concrete		7460
Number of bars in pile		7462
Size of bars in pile		7464
Ties provided for full length of pile reinforcement		7466
Maximum spacing of ties in pile		7468
Diameter of bars in pile		7470
Spacing of ties at top 2 feet of pile		7472
Spiral provided equivalent to ties		7474

DECISION TABLE

			1	2	E
1	Length of pile reinforcement from top ≧ 10 (Pile diameter)	*	Y	Y	
2	Area of pile reinforcement ≧ 0.0025 (Area of pile concrete)	*	Y	Y	
3	Number of bars in pile ≧ 4	*	Y	Y	
4	Size of bars in pile ≧ #5	*	Y	Y	
5	Ties provided for full length of pile reinforcement = true	*	Y	N	
6	Maximum spacing of ties in pile ≦ 16 (Diameter of bars in pile)	*	Y	.	
7	Spacing of ties at top 2 feet of pile ≦ 4"	*	Y	.	
8	Spiral provided equivalent to ties = true	*	-	Y	
	**				
1	CBUCPR = satisfied	*	X	X	
2	CBUCPR = violated	*			X

COMMENTS:

1. The text does not specify the length over which ties are to be provided. Condition 5 is based on an assumption.

DATUM: Category B cased concrete pile requirement

SECTION: 7.4.4(B) LABEL: CBCCPR NUMBER: 7476

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Length of pile		7478
Area of pile reinforcement		7458
Area of pile concrete		7460
Spiral reinforcement provided for full length of pile reinf		7480
Diameter of spiral bar in pile		7482
Maximum pitch of spiral in pile		7484
Pitch of spiral at top 2 feet of pile		7486
Ties provided equivalent to spiral		7488

DECISION TABLE

			1	2	E
1	Length of pile reinforcement from top $\geq$ 1/3 of Length of pile	*	Y	Y	
2	Length of pile reinforcement from top $\geq$ 8'	*	Y	Y	
3	Area of pile reinforcement $\geq$ 0.005 (Area of pile concrete)	*	Y	Y	
4	Spiral reinforcement provided for full length of pile reinf = true	*	Y	N	
5	Diameter of spiral bar in pile $\geq$ 1/4"	*	Y	.	
6	Maximum pitch of spiral in pile $\leq$ 9"	*	Y	.	
7	Pitch of spiral at top 2 feet of pile $\leq$ 3"	*	Y	.	
8	Ties provided equivalent to spiral = true	*	-	Y	
	***				
1	CBCCPR = satisfied	*	X	X	
2	CBCCPR = violated	*			X

COMMENTS:

1. No allowance is made for piles less than eight feet long. (This may be reasonable).
2. The text does not specify the length over which a spiral is to be provided. Condition 4 is based on an assumption.

DATUM: Catgegory B steel pipe pile requirement

SECTION: 7.4.4(C) LABEL: CBSPPR NUMBER: 7490

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Minimum development length	MDL	7444
Area of pile reinforcement		7458
Area of pile concrete		7460

DECISION TABLE

		1	E
1	Length of pile reinforcement from top ≧ 2 (Minimum development length)	Y	
2	Area of pile reinforcement ≧ 0.010 (Area of pile concrete)	Y	
1	CBSPPR = satisfied	X	
2	CBSPPR = violated		X

DATUM: Category B precast concrete pile requirement

SECTION: 7.4.4(D) LABEL: CBPCPR NUMBER: 7492

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Length of pile		7478
Area of pile reinforcement		7458
Area of pile concrete		7460

DECISION TABLE

		1	E
1	Length of pile reinforcement from top = Length of pile	Y	
2	Area of pile reinforcement ≧ 0.010 (Area of pile concrete)	Y	
1	CBPCPR = satisfied	X	
2	CBPCPR = violated		X

COMMENTS:

1. The text calls for reinforcement, but does not specify a length, so the implication is the full length, as shown in condition 1.
2. No requirements for ties are stated. Most building codes probably do require ties in precast concrete piles in any case.

DATUM: Category B prestressed concrete pile requirement

SECTION: 7.4.4(E) LABEL: CBPSPR NUMBER: 7494

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Minimum development length	MDL	7444
Area of pile reinforcement		7458
Area of pile concrete		7460
Ties provided at top 2 feet of pile		7496
Spacing of ties at top 2 feet of pile		7472
Size of ties in pile		7498
Spiral provided equivalent to ties		7474

DECISION TABLE

		1	2	E
1	Length of pile reinforcement from top (nonprestressed) ≧ 2 (Minimum development length)	Y	Y	
2	Area of pile reinforcement (nonprestressed) ≧ 0.01 (Area of pile concrete)	Y	Y	
3	Ties provided at top 2 feet of pile = true	Y	N	
4	Spacing of ties at top 2 feet of pile ≦ 4"	Y	.	
5	Size of ties in pile ≧ #3	Y	.	
6	Spiral provided equivalent to ties = true	-	Y	
1	CBPSPR = satisfied	X	X	
2	CBPSPR = violated			X

COMMENTS:

1. The text uses the word "may" in referring to the pile cap connection, so the first two conditions might be optional.

DATUM: Category C foundation requirement

SECTION: 7.5 LABEL: CCFR NUMBER: 7500

INGREDIENTS

Datum	Label	Number
Category B foundation requirement	CBFR	7400
Category C soil investigation requirement	CCSIR	7510
Category C foundation tie requirement	CCFTR	7520
Category C foundation pile requirement	CCPR	7535

DECISION TABLE

	DECISION TABLE		1	E
1	Category B foundation requirement = satisfied	*	Y	
2	Category C soil investigation requirement = satisfied	*	Y	
3	Category C foundation tie requirement = satisfied	*	Y	
4	Category C foundation pile requirement = satisfied	*	Y	
	********			
1	CCFR = satisfied	*	X	
2	CCFR = violated	*		X

DATUM: Category C soil investigation requirement

SECTION: 7.5.1 LABEL: CCSIR NUMBER: 7510

INGREDIENTS

Datum	Label	Number
Regulatory agency requires soil investigation report		7408
Category B soil investigation requirement	CBSIR	7404
Soil invest report includes lateral pressure on wall due to EQ		7515

DECISION TABLE

	DECISION TABLE		1	2	E
1	Regulatory agency requires soil investigation report = true	*	N	Y	
2	(Category B soil investigation requirement = satisfied)	*	.	+	
3	Soil invest report includes lateral pressure on wall due to EQ = true	*	.	Y	
	********				
1	CCSIR = satisfied	*	X	X	
2	CCSIR = violated	*			X

DATUM: Category C foundation tie requirement

SECTION: 7.5.2 LABEL: CCFTR NUMBER: 7520

INGREDIENTS

Datum	Label	Number
Each individual spread footing interconnected		7525
Member strength	YMS	3125
Effective peak velocity-related acceleration	EPV	1415
Larger of connected footing loads	(FL)	7530
Equivalent foundation restraint provided and approved		7436

DECISION TABLE

		*	1	2	E
1	Each individual spread footing interconnected = true	*	Y	Y	
2	Member strength of interconnecting tie ≧ FL (EPV/4)	*	Y	N	
3	Equivalent foundation restraint provided and approved = true	*	.	Y	
	**				
1	CCFTR = satisfied	*	X	X	
2	CCFTR = violated	*			X

COMMENTS:

1. See comment 1 on datum 7428.

DATUM: Category C foundation pile requirement

SECTION: 7.5.3 LABEL: CCPR NUMBER: 7535

INGREDIENTS

Datum	Label	Number
Foundation structural components		7440
Pile type		7446
Category C uncased concrete pile requirement	CCUCPR	7540
Category C cased concrete pile requirement	CCCCPR	7550
Category C precast concrete pile requirement	CCPCPR	7570
Category C steel pile requirement	CCSPR	7595

DECISION TABLE

		1	2	3	4	5	6	E
1	Foundation structural components includes concrete or steel piles	N	Y	Y	Y	Y	Y	
2	Pile type = uncased concrete	.	Y	-	-	-	N	
3	Pile type = metal cased concrete	.	-	Y	-	-	N	
4	Pile type = precast concrete	.	-	-	Y	-	N	
5	Pile type = steel	.	-	-	-	Y	N	
6	Category C uncased concrete pile requirement = satisfied	.	Y	.	.	.	.	
7	Category C cased concrete pile requirement = satisfied	.	.	Y	.	.	.	
8	Category C precast concrete pile requirement = satisfied	.	.	.	Y	.	.	
9	Category C steel pile requirement = satisfied	.	.	.	.	Y	.	
1	CCPR = satisfied	X	X	X	X	X	X	
2	CCPR = violated							X

DATUM: Category C uncased concrete pile requirement

SECTION: 7.5.3(A) LABEL: CCUCPR NUMBER: 7540

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Length of pile		7478
Area of pile reinforcement		7458
Area of pile concrete		7460
Number of bars in pile		7462
Size of bars in pile		7464
Ties provided for full length of pile reinforcement		7466
Maximum spacing of ties in pile		7468
Diameter of bars in pile		7470
Spacing of ties at top 4 feet of pile		7545
Pile diameter		7456
Size of ties in pile		7498

DECISION TABLE

		1	2	E
1	Length of pile reinforcement from top = Length of pile	Y	Y	
2	Area of pile reinforcement ≧ 0.0050 (Area of pile concrete)	Y	Y	
3	Number of bars in pile ≧ 4	Y	Y	
4	Size of bars in pile ≧ #6	Y	Y	
5	Ties provided for full length of pile reinforcement = true	Y	Y	
6	Maximum spacing of ties in pile ≦ 8 (Diameter of bars in pile)	Y	Y	
7	Spacing of ties at top 4 feet of pile ≦ 3"	Y	Y	
8	Pile diameter > 20"	N	Y	
9	Size of ties in pile ≧ #3	Y	+	
10	Size of ties in pile ≧ #4	.	Y	
1	CCUCPR = satisfied	X	X	
2	CCUCPR = violated			X

COMMENTS:

1. Because the lengths are unspecified, the implication is that reinforcement and ties must be provided over the full length. Thus conditions 1 and 5 are shown as they are.
2. Note that equivalent spiral reinforcement is not permitted, although it is in the provisions for the similar datum 7452.

DATUM: Category C cased concrete pile requirement

SECTION: 7.5.5(B) LABEL: CCCCPR NUMBER: 7550

INGREDIENTS

Datum	Label	Number
Length of pile reinforcement from top		7454
Length of pile		7478
Area of pile reinforcement in upper 2/3 of pile		7555
Area of pile concrete		7460
Number of bars in upper 2/3 of pile		7560
Spiral reinforcement provided for full length of pile reinf		7480
Diameter of spiral bar in pile		7482
Maximum pitch of spiral in pile		7484
Pitch of spiral at top 4 feet of pile		7565

DECISION TABLE

		1	E
1	Length of pile reinforcement from top = Length of pile	Y	
2	Area of pile reinforcement in upper 2/3 of pile $\geq$ 0.0075 (Area of pile concrete)	Y	
3	Number of bars in upper 2/3 of pile $\geq$ 4	Y	
4	Spiral reinforcement provided for full length of pile reinf = true	Y	
5	Diameter of spiral bar in pile $\geq$ 1/4"	Y	
6	Maximum pitch of spiral in pile $\leq$ 9"	Y	
7	Pitch of spiral at top 4 feet of pile $\leq$ 3"	Y	
1	CCCCPR = satisfied	X	
2	CCCCPR = violated		X

COMMENTS:

1. Unlike several of the other provisions for piles, this provision explicitly calls for reinforcement over the full length of the pile.
2. Note that no provision for providing ties in lieu of spiral reinforcement is given.

DATUM: Category C precast concrete pile requirement

SECTION: 7.5.3(C) LABEL: CCPCPR NUMBER: 7570

INGREDIENTS

Datum	Label	Number
Ties provided in top half of pile		7575
Ordinary concrete beam column lateral reinforcement reqt	OCBCLR	11662
Pile designed to resist flexure due to earthquake		7580
Pile stress at maximum soil deformation in earthquake		7585
Elastic limit of pile		7590

DECISION TABLE

	DECISION TABLE	1	2	E
1	Ties provided in top half of pile = true <u>and</u> Ordinary concrete beam column lateral reinforcement reqt = satisfied (for those ties)	Y	Y	
2	Pile designed to resist flexure due to earthquake = true	N	Y	
3	Pile stress at maximum soil deformation in earthquake ≦ Elastic limit of pile	.	Y	
1	CCPCPR = satisfied	X	X	
2	CCPCPR = violated			X

DATUM: Category C steel pile requirement

SECTION: 7.5.3(D) LABEL: CCSPR NUMBER: 7595

INGREDIENTS

Datum	Label	Number
Connection strength	YCS	3130
Member strength	YMS	3125

DECISION TABLE

			1	2
1	Connection strength (between pile and cap) ≥ 10% Member strength (of pile in compression)	*	Y	N
	************			
1	CCSPR = satisfied	*	X	
2	CCSPR = violated	*		X

DATUM: Category D foundation requirement

SECTION: 7.6, 7.6.1 LABEL: CDFR NUMBER: 7600

INGREDIENTS

Datum	Label	Number
Category C foundation requirement	CCFR	7500
Precast-prestressed piles used to resist flexure due to EQ		7620

DECISION TABLE

			1	E
1	Category C foundation requirement = satisfied	*	Y	
2	Precast-prestressed piles used to resist flexure due to EQ = true	*	N	
	************			
1	CDFR = satisfied	*	X	
2	CDFR = violated	*		X

DATUM: Architectural/mechanical/electrical design requirement

SECTION: Chapter 8 LABEL: AMEDR NUMBER: 8001

INGREDIENTS

Datum	Label	Number
Architectural/mechanical/electrical provisions applicable	AMEPA	8100
A/M/E component strength requirement	AMESR	8110
A/M/E interrelationship requirement	AMEIRR	8135
A/M/E attachment requirement	AMEAR	8165
Architectural design requirement	ARCHDR	8200
Mechanical/electrical design requirement	MEDR	8300
Building Stage		1230
Proposed work on existing building		1240
Hazard abatement requirement	HAR	13301

DECISION TABLE

		1	2	3	E
1	Architectural/mechanical/electrical provisions applicable = true	N	Y	Y	
2	A/M/E component strength requirement = satisfied	.	Y	N	
3	A/M/E interrelationship requirement = satisfied	.	Y	Y	
4	A/M/E attachment requirement = satisfied	.	Y	Y	
5	Architectural design requirement = satisfied	.	Y	Y	
6	Mechanical/electrical design requirement = satisfied	.	Y	Y	
7	Building stage = existing <u>and</u> Proposed work on existing building = alteration or repair <u>and</u> Hazard abatement requirement = satisfied	.	.	Y	
1	AMEDR = satisfied	X	X	X	
2	AMEDR = violated				X

COMMENT:

1. It was assumed that exception 2 of section 8.1 applied only to the strength requirement (condition 2). The provisions of Chapter 1 make this issue somewhat academic, since section 1.3 controls the application of these provisions in any case.

DATUM: Architectural/mechanical/electrical provisions applicable

SECTION: 8.1 LABEL: AMEPA NUMBER: 8100

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Architectural component listed in Table 8-B		8205
Mechanical/electrical component listed in Table 8-C		8303
A/M/E performance level	PL	8105
Seismicity index	SI	1425
Seismic hazard exposure group	SHEG	1430

	DECISION TABLE	1	2	3	4	5	6	7	8	9	10
1	Element of building = architectural, mechanical or electrical system or component	+	+	+	+	+	+	+	N	+	Y
2	Architectural component listed in Table 8-B = true <u>or</u> Mechanical/electrical component listed in Table 8-C = true	Y	Y	Y	Y	Y	Y	Y	-	Y	N
3	A/M/E performance level = L	N	Y	Y	Y	Y	Y	Y	.	-	.
4	A/M/E performance level = NR	N	-	-	-	-	-	-	.	Y	.
5	Seismicity index = 1	.	N	-	Y	-	Y	Y	.	.	.
6	Seismicity index = 2	.	N	Y	-	Y	-	-	.	.	.
7	(Seismicity index = 3 or 4)	.	+	-	-	-	-	-	.	.	.
8	Seismic hazard exposure group = I	.	.	N	N	Y	Y	-	.	.	.
9	Seismic hazard exposure group = II	.	.	.	N	-	-	Y	.	.	.
10	(Seismic hazard exposure group = III)	.	.	.	+	-	-	-	.	.	.
1	AMEPA = true	X	X	X	X						
2	AMEPA = false					X	X	X	X	X	
E	AMEPA = ?										X

COMMENTS:

1. Rule 10 was found in a decision tree analysis. It reflects a problem in determining the applicability. It will not be possible to determine the performance level or the seismic coefficients for A/M/E components that are not listed in the tables, even through Section 8.1 indicates that the provisions are applicable to all A/M/E components. Table 8-C has a footnote that provides for this contingency, but Table 8-B does not.
2. Condition 4 and rule 9 are not found in Section 8.1. It was assumed that they should be added to this decision table because performance level NR (= "not required") is introduced in Tables 8-B and 8-C.

DATUM: A/M/E performance level

SECTION: 8.1, 8.1.3 LABEL: PL NUMBER: 8105

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Performance level from Table 8-B	XPLA	8106
Performance level from Table 8-C	XPLME	8107

DECISION TABLE

			1	2
1	Element of building = architectural system or component	*	Y	N
2	(Element of building = mechanical or electrical system or component)	*	-	+
	**************************************			
1	PL = XPLA	*	X	
2	PL = XPLME	*		X

COMMENT:

1. Datum 8100 restricts the applicability such that condition 1 predetermines condition 2.

DATUM: Performance level from Table 8-B

SECTION: Table 8-B LABEL: XPLA NUMBER: 8106

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Seismic hazard exposure group	SHEG	1430
Number of levels (stories)		2243
Total height		2227
Distance from exterior wall to closest point of access		8236
Building located in an urban area		8237
Building contains highly flammable material		8238

COMMENT:

1. Note that the footnotes to Table 8-B play an important role in determining the performance level. Many of the ingredients listed above are introduced in the footnotes.

DATUM: Performance level from Table 8-C

SECTION: Table 8-C LABEL: XPLME NUMBER: 8107

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Seismic hazard exposure group	SHEG	1430

COMMENTS:

1. Although there are many footnotes below Table 8-C, they do not effect the performance level.

DATUM: A/M/E component strength requirement

SECTION: 8.1, 8.1.2, 8.2.1, 8.3.1 LABEL: AMESR NUMBER: 8110

INGREDIENTS

Datum	Label	Number
Nonstructural seismic force	EP	8115
A/M/E component resistance	ZAMECR	8112
Point of application of force on A/M/E component		8120
Direction of application of force on A/M/E component		8125
Element of building (component)		2114
Vertical seismic force	ZFPV	8130
Wind load on exterior wall		8230
Code horizontal load on partition		8235

DECISION TABLE

		1	2	3	4	E
1	A/M/E component resistance ≧ Nonstructural seismic force	Y	+	.	.	
2	Point of application of force on A/M/E component = center of gravity and Direction of application of force on A/M/E component = any horizontal direction	Y	Y	.	.	
3	Element of building = architectural component or system	Y	N	Y	Y	
4	(Element of building = mechanical or electrical component or system)	-	+	-	-	
5	A/M/E component resistance ≧ Nonstructural seismic force + Vertical seismic force	.	Y	.	.	
6	Wind load on exterior wall > Nonstructural seismic force	N	.	Y	-	
7	Code horizontal load on partition > Nonstructural seismic force	N	.	-	Y	
1	AMESR = satisfied	X	X	X	X	
2	AMESR = violated					X

COMMENT:

1. It was assumed that the exception given in section 8.2.1 regarding wind and other horizontal loads and as shown in this table by rules 3 and 4 applies to the strength requirement and not to the other provisions of Chapter 8.

DATUM: A/M/E component resistance

SECTION: 8.1 LABEL: ZAMECR NUMBER: 8112

COMMENT:

1. No definitive guidance is given for evaluating the resistance of architectural, mechanical, or electrical components. Should the component be of wood, steel, concrete, or masonry, it might seem appropriate to use the applicable provisions of Chapters 9 through 12, but this is not mentioned, except for attachments of M/E components. However, many such components are made of materials that would preclude the use of those chapters. One exception to this problem of strength evaluation is the provisions for testing and certification of mechanical and electrical equipment.

DATUM: Nonstructural seismic force

SECTION: 8.1 LABEL: FP NUMBER: 8115

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Seismic force for architectural components	XFPA	8215
Seismic force for mechanical/electrical component	FPME	8309

DECISION TABLE

		1	2
1	Element of building = architectural system or component	Y	N
2	(Element of building = mechanical or electrical system or component)	-	+
1	FP = XFPA	X	
2	FP = FPME		X

COMMENT:

1. Datum 8100 restricts the applicability such that condition 1 predetermines condition 2.

DATUM: Vertical seismic force

SECTION: 8.1, Table 8-C LABEL: ZFPV NUMBER: 8130

INGREDIENTS

Datum	Label	Number
Seismic coefficient for vertical force on M/E component	XCCVME	8313
Seismic force for mechanical/electrical component	FPME	8309

COMMENT:

1. The vertical seismic force applies only to mechanical and electrical components. It is to be determined in the same fashion as the horizontal forces (datum 8309), except that the seismic coefficient from Table 8-C is to be reduced to 1/3 of the value for horizontal forces.

DATUM: A/M/E interrelationship requirement

SECTION: 8.1.1 LABEL: AMEIRR NUMBER: 8135

INGREDIENTS

Datum	Label	Number
Interrelationship of A/M/E systems exists		8140
Failure of A/M/E component causes failure at higher performance level		8145
Interaction of A/M/E system with structure exists		8150
Effect of A/M/E response on structure considered		8155
Effect of A/M/E deform compatibility with struct considered		8160

DECISION TABLE

		1	2	3	4	E
1	Interrelationship of A/M/E systems exists = true	Y	Y	N	N	
2	Failure of A/M/E component causes failure at higher performance level = true	N	N	-	-	
3	Interaction of A/M/E system with structure exists = true	Y	N	Y	N	
4	Effect of A/M/E response on structure considered = true	Y	.	Y	.	
5	Effect of A/M/E deform compatibility with struct considered = true	Y	.	Y	.	
1	AMEIRR = satisfied	X	X	X	X	
2	AMEIRR = violated					X

DATUM: A/M/E attachment requirement

SECTION: 8.1.2 LABEL: AMEAR NUMBER: 8165

INGREDIENTS

Datum	Label	Number
All A/M/E components attached to structure		8170
Attachments transmit seismic force to structure		8175
Friction due to gravity considered as resistance		8180
Attachment design documentation sufficient to verify compliance		8185

DECISION TABLE

		1	E
1	All A/M/E components attached to structure = true	Y	
2	Attachments transmit seismic force to structure = true	Y	
3	Friction due to gravity considered as resistance = true	N	
4	Attachment design documentation sufficient to verify compliance = true	Y	
1	AMEAR = satisfied	X	
2	AMEAR = violated		X

DATUM: Performance characteristic factor

SECTION: 8.1.3, table 8-A LABEL: P NUMBER: 8190

INGREDIENTS		
Datum	Label	Number
A/M/E performance level	PL	8105

	DECISION TABLE	1	2	3	4
1	A/M/E performance level = S	Y	-	-	N
2	A/M/E performance level = G	-	Y	-	N
3	A/M/E performance level = L	-	-	Y	N
4	(A/M/E performance level = NR)	-	-	-	+
	************				
1	P = 1.5	X			
2	P = 1.0		X		
3	P = 0.5			X	
4	P = ?				X

COMMENT:

1. This decision table is based on table 8-A, except that condition 4, rule 4, and action 4 have been added, because "NR" is a permissible value of the performance level. Presumably the intended value of P in action 4 should be zero.

DATUM: Architectural design requirement

SECTION: 8.2.1, 8.2.3, 8.2.4, 8.2.5 LABEL: ARCHDR NUMBER: 8200

INGREDIENTS

Datum	Label	Number
Arch component design or criteria included in design document		8210
Exterior wall panel attachment requirement	EWAR	8240
Architectural component deformation requirement	ACDR	8250
Arch component out of plane bending requirement	OOPBR	8270

DECISION TABLE

			1	E
1	Arch component design or criteria included in design document = true	*	Y	
2	Exterior wall panel attachment requirement = satisfied	*	Y	
3	Architectural component deformation requirement = satisfied	*	Y	
4	Arch component out of plane bending requirement = satisfied	*	Y	
1	ARCHDR = satisfied	*	X	
2	ARCHDR = violated	*		X

DATUM: Seismic force for architectural components

SECTION: 8.2.2 LABEL: XFPA NUMBER: 8215

INGREDIENTS

Datum	Label	Number
Effective peak velocity-related acceleration	EPV	1415
Seismic coefficient for architectural components	XCCA	8220
Performance characteristic factor	P	8190
Weight of A/M/E component	(WC)	8225

FUNCTION:

XFPA = EPV(XCCA)(P)(WC)

DATUM: Seismic coefficient for architectural components

SECTION: 8.2.2, Table 8-B LABEL: XCCA NUMBER: 8220

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114

COMMENT:

1. Just as datum 8106 is, this datum is evaluated from table 8-B. Unlike datum 8106 however, the footnotes to the table do not affect the seismic coefficient. Therefore, the only ingredient necessary is the type of component.

DATUM: Exterior wall panel attachment requirement

SECTION: 8.2.3 LABEL: EWAR NUMBER: 8240

INGREDIENTS

Datum	Label	Number
Element of building		2114
Ductility/rotation capacity provided		8245
Design story drift	DRIFT	4660

DECISION TABLE

		1	2	E
1	Element of building = exterior wall panel	N	Y	
2	Ductility/rotation capacity provided sufficient to accommodate design story drift	.	Y	
1	EWAR = satisfied	X	X	
2	EWAR = violated			X

DATUM: Architectural component deformation requirement

SECTION: 8.2.4 LABEL: ACDR NUMBER: 8250

INGREDIENTS

Datum	Label	Number
A/M/E performance level	PL	8105
Horizontal drift provided for in design of arch component		8255
Design story drift	DRIFT	4660
Arch component related to horizontal cantilever		8260
Vertical deflection of cantilever provided for in arch component		8265

	DECISION TABLE	1	2	3	4	5	E
1	A/M/E performance level = L	N	N	Y	Y	-	
2	A/M/E performance level = NR	N	N	-	-	Y	
3	Horizontal drift provided for in design of arch component ≧ Design story drift	Y	Y	.	.	.	
4	Horizontal drift provided for in design of arch component ≧ 50% of Design story drift	+	+	Y	Y	.	
5	Arch component related to horizontal cantilever = true	Y	N	Y	N	.	
6	Vertical deflection of cantilever provided for in arch component = true	Y	.	Y	.	.	
1	ACDR = satisfied	X	X	X	X	X	
2	ACDR = violated						X

COMMENT:

1. Condition 2 and rule 5 are not found in section 8.2.4. It was assumed that they should be added to this decision table.

DATUM: Architectural component out of plane bending requirement

SECTION: 8.2.5 LABEL: OOPBR NUMBER: 8270

INGREDIENTS

Datum	Label	Number
Material behavior of architectural component		8275
Out of plane bending deflection due to seismic force		8280
Deflection capability of architectural component		8285

DECISION TABLE

			1	2	E
1	Material behavior of architectural component = basically brittle	*	N	Y	
2	Out of plane bending deflection due to seismic force ≦ Deflection capability of architectural component	*	.	Y	
	******************************				
1	OOPBR = satisfied	*	X	X	
2	OOPBR = violated	*			X

COMMENT:

1. Ingredients 8275 and 8285 both lack any explanation as to how they should be evaluated.

DATUM: Mechanical/electrical design requirement

SECTION: 8.3.1, 8.3.3, 8.3.4, 8.3.5 LABEL: MEDR NUMBER: 8300

INGREDIENTS

Datum	Label	Number
M/E component design or criteria included in design document		8306
Mechancial/electrical attachment design requirement	MEADR	8345
Mechanical/electrical component design requirement	MECDR	8360
M/E utility service interface requirement	MEUSIR	8372

DECISION TABLE

			1	E
1	M/E component design or criteria included in design document = true	*	Y	
2	Mechancial/electrical attachment design requirement = satisfied	*	Y	
3	Mechanical/electrical component design requirement = satisfied	*	Y	
4	M/E utility service interface requirement = satisfied	*	Y	
1	MEDR = satisfied	*	X	
2	MEDR = violated	*		X

DATUM: Seismic force for mechanical/electrical component

SECTION: 8.3.1, 8.3.2 LABEL: FPME NUMBER: 8309

INGREDIENTS

Datum	Label	Number
Analysis performed to justify reduced M/E force		8310
Results of M/E component force analysis		8311
Effective peak velocity-related acceleration	EPV	1415
Seismic coefficient for mechancial/electrical component	XCCME	8312
Performance characteristic factor	P	8190
Amplification factor for attachment of M/E component	AC	8315
Amplification factor for location of M/E component	XAX	8318
Weight of A/M/E component	(WC)	8225

DECISION TABLE

			1	2
1	Analysis performed to justify reduced M/E force = true	*	N	Y
	**			
1	FPME = EPV(XCCME)(P)(AC)(XAX)(WC)	*	X	
2	FPME = results of M/E component force analysis	*		X

DATUM: Seismic coefficient for mechanical/electrical component

SECTION: 8.3.2, Table 8-C LABEL: XCCME NUMBER: 8312

and

DATUM: Seismic coefficient for vertical force on M/E component

SECTION: 8.3.2, Table 8-C LABEL: XCCVME NUMBER: 8313

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Type of light fixture support		8339

COMMENT:

1. These data items are determined from table 8-B. Note that the footnotes have a bearing on the value. The vertical coefficient is simply 1/3 of the horizontal coefficient.

DATUM: Amplification factor for attachment of M/E component

SECTION: 8.3.2 (A) LABEL: AC NUMBER: 8315

INGREDIENTS

Datum	Label	Number
Type of mounting system for mech/elec equipment		2160
Type of restraining device		2166
Natural period of vibration of component and attachment	TC	8324
Building period	T	4240
Location of mech/elec mounting system		8327

DECISION TABLE

	DECISION TABLE	1	2	3	4	5	6	E
1	Type of mounting system for mech/elec equipment = fixed <u>or</u> direct	Y	-	-	-	-	-	
2	Type of mounting system for mech/elec equipment = resilient	-	Y	Y	Y	Y	Y	
3	Type of restraining device = seismic activated	.	Y	-	-	-	-	
4	Type of restraining device = elastic	.	-	Y	Y	Y	Y	
5	$TC/T < 0.6$	.	.	Y	N	-	.	
6	$TC/T \geq 1.4$	.	.	-	N	Y	.	
7	Location of mech/elec mounting system = directly on ground <u>or</u> on slab in direct contact with ground	.	.	N	N	N	Y	
1	AC = 1	X	X	X		X		
2	AC = 2 minimum				X			
3	AC = 2						X	
E	AC = ?							X

COMMENT:

1. The decision tree analysis shows two ELSE rules that represent possible ommissions: 1) for the case of a mounting system that is not classified is fixed, direct, or resilient, and 2) for the case of a resilient mounting system with a restraint that is not seismic activated or elastic. Chapter 2 actually defines a third type of restraint for resilient mounting, a fixed restraining device.

```
C2  + + C4  + + C7  + + R6
 -       -       -
 -       -       -  - - C5  + + R3
 -       -               -
 -       -               -  - - C6  + + R5
 -       -                       -
 -       -                       -  - - R4
 -       -
 -       -  - - C3  + + R2
 -               -
 -               -  - ELSE
 -
 -  - - C1  + + R1
         -
         -  - ELSE
```

DATUM: Amplification factor for location of M/E component

SECTION: 8.3.1 LABEL: XAX NUMBER: 8318

INGREDIENTS

Datum	Label	Number
Height to level X	(hx)	2226
Total height	(H)	2227

FUNCTION:

XAX = 1.0 + hx/H

DATUM: Type of resilient mounting system

SECTION: 8.3.3, 2.1 LABEL: TRMS NUMBER: 8321

INGREDIENTS

Datum	Label	Number
Horiz force displacement ratio of resilient mounting system		2161
Vert force displacement ratio of resilient mounting system		2162

DECISION TABLE

		1	2
1	Horiz force displacement ratio of resilient mounting system = vert force displacement ratio of resilient mounting system	Y	N
1	TRMS = stable	X	
2	TRMS = not stable		X

COMMENT:

1. The provision represented here is actually found in chapter 2, but section 8.3.3 is the place where it is used.

DATUM: Natural period of vibration of component and attachment

SECTION: 8.3.2 (A) LABEL: TC NUMBER: 8324

INGREDIENTS

Datum	Label	Number
Weight of A/M/E component	(WC)	8225
Stiffness of M/E support with respect to center of gravity	K	8330
Use of other substantiated value of period desired		8340
Properly substantiated value of period		8342

DECISION TABLE

			1	2
1	Use of other substantiated value of period desired = true	*	N	Y
	*****			
1	$TC = 0.32 \sqrt{WC/K}$	*	X	
2	TC = properly substantiated value of period	*		X

DATUM: Stiffness of M/E support with respect to center of gravity

SECTION: 8.3.2 (A) LABEL: K NUMBER: 8330

INGREDIENTS

Datum	Label	Number
Type of mounting system for mech/elect equipment		2160
Type of resilient mounting system	TRMS	8321
Spring constant for mounting system		8332
Slope of M/E support load deflection curve at point of load		8333

DECISION TABLE

		1	2	E
1	Type of mounting system for mech/elect equipment = resilient	Y	Y	
2	Type of resilient mounting system = stable	Y	N	
1	K = spring constant for mounting system	X		
2	K = slope of M/E support load deflection curve at point of load		X	
E	K = ?			X

COMMENT:

1. Although this table shows an else rule with no specified action for non-resilient mounting systems, the omission is not significant because K is only called for when the mounting system is resilient.

DATUM: Mechanical/electrical attachment design requirement

SECTION: 8.3.3 LABEL: MEADR NUMBER: 8345

INGREDIENTS

Datum	Label	Number
Type of mounting system for mech/elect equipment		2160
Wood materials requirement	WMR	9001
Steel materials requirement	SMR	10001
Concrete materials requirement	CMR	11001
Masonry materials requirement	MMR	12001
Type of resilient mounting system	TRMS	8321
Restraining device provided for resilient mounting		8348
Type of restraining device		2166
Resistance of restraining device on resilient mount		8351
Force on component due to deceleration by restraint		8354
Restraining force determined by dynamic analysis		8357
Seismic force for mechanical/electrical component	FPME	8309

DECISION TABLE

	DECISION TABLE	1	2	3	E
1	Type of mounting system for mech/elect equipment = fixed <u>or</u> direct	Y	-	-	
2	Type of mounting system for mech/elect equipment = resilient	-	Y	Y	
3	Wood materials requirement = satisfied <u>and</u> Steel materials requirement = satisfied <u>and</u> Concrete materials requirement = satisfied <u>and</u> Masonry materials requirement = satisfied	Y	.	.	
4	Type of resilient mounting system = stable	.	Y	Y	
5	Restraining device provided for resilient mounting = true	.	Y	Y	
6	Type of restraining device = elastic	.	Y	N	
7	Resistance of restraining device on resilient mount ≧ Seismic force for mechanical/electrical component <u>or</u> Resistance of restraining device on resilient mount ≧ Restraining force determined by dynamic analysis	.	Y	.	
8	Force on component due to deceleration by restraint ≦ Seismic force for mechanical/electrical component	.	Y	.	
	MEADR = satisfied	X	X	X	
	MEADR = violated				X

COMMENTS:

1. Condition 3 is somewhat redundant because chapters 1 and 3 already require it.
2. It was assumed that resilient mounting systems with restraining devices other than elastic are permitted, because other sections of the chapter make specific reference to other types. As section 8.3. is written, however, neither conditions 7 nor 8 apply to such mounting systems.
3. The commentary to the <u>Provisions</u> indicate that the logical <u>or</u> in condition 7 may not be strictly correct.

DATUM: Mechanical/electrical component design requirement

SECTION: 8.3.4 LABEL: MECDR NUMBER: 8360

INGREDIENTS

Datum	Label	Number
M/E component certification (testing) required	MECCR	8363
M/E attachment certification (testing) required	MEACR	8369
Mechanical/electrical test compliance requirement	MEETC	1644

DECISION TABLE

		1	2	E
1	M/E component certification (testing) required = true or M/E attachment certification (testing) required = true	N	Y	
2	Mechanical/electrical test compliance requirement = satisfied	.	Y	
1	MECDR = satisfied	X	X	
2	MECDR = violated			X

COMMENT:

1. The text of section 8.3.4 refers to "certification" in many places, whereas the text of section 1.6.3 refers to "testing." Section 1.6.5, which is not referenced by either section 8.3.4 or 1.6.3 refers to "certification." This mixture of terms is somewhat confusing. The confusion even extends to the title of section 8.3.4, (and consequently, the name of this datum) which does not accurately represent the provisions within section 8.3.4.

DATUM: M/E component certification (testing) required

SECTION: 8.3.4 LABEL: MECCR NUMBER: 8363

INGREDIENTS

Datum	Label	Number
Type of mounting system for mech/elect equipment		2160
A/M/E performance level	PL	8105
Seismicity index	SI	1425

DECISION TABLE

		1	2	E
1	Type of mounting system for mech/elect equipment = fixed or direct	Y	-	
2	Type of mounting system for mech/elect equipment = resilient	-	Y	
3	A/M/E performance level = S or G	Y	Y	
4	Seismicity index = 3 or 4	Y	.	
1	MECCR = true	X	X	
2	MECCR = false			X

DATUM: M/E attachment certification (testing) required

SECTION: 8.3.4 LABEL: MEACR NUMBER: 8369

INGREDIENTS

Datum	Label	Number
Type of mounting system for mech/elect equipment		2160
A/M/E performance level	PL	8105

DECISION TABLE

		1	E
1	Type of mounting system for mech/elect equipment = resilient	Y	
2	A/M/E performance level = S or G	Y	
1	MEACR = true	X	
2	MEACR = false		X

DATUM: M/E utility service interface requirement

SECTION: 8.3.5 LABEL: MEUSIR NUMBER: 8372

INGREDIENTS

Datum	Label	Number
Seismic hazard exposure group	SHEG	1430
Seismicity index	SI	1425
Element of building (component)		2114
Type of utility service		8375
Utility shutoff device provided		8378
Action to trigger utility shutoff device		8381
Effective peak acceleration	EPA	1405

DECISION TABLE

		1	2	3	4	E
1	Element of building = utility interface for gas, high temperature fluids or electricity	N	Y	Y	Y	
2	Seismic hazard exposure group = II or III	.	Y	Y	N	
3	Seismicity index = 3 or 4	.	Y	N	.	
4	Utility shutoff device provided = true	.	Y	.	.	
5	Action to trigger utility shutoff device = failure within service system and Action to trigger utility shutoff device = ground motion above 0.5 EPA (gravity)	.	Y	.	.	
1	MEUSIR = satisified	X	X	X	X	
2	MEUSIR = violated					X

COMMENT:

1. Condition 5 states that the shutoff device shall be triggered by either, or both, of the two actions specified. There is one other possible assumption for the meaning of the provisions: that the shutoff device can be designed to trigger on either one of the two actions and ignore the other.

DATUM: Wood materials requirement

SECTION: Chapter 9 LABEL: WMR NUMBER: 9001

INGREDIENTS

Datum	Label	Number
Building elements that resist seismic force		9110
Requirements of wood reference documents		9120
Building use		1270
Construction type		1350
Number of levels (stories)		2243
Total height		2227
Seismicity index	SI	1425
Conventional light timber requirement	CLTR	9701
Wood strength calculation procedure requirement	ZWSCPR	9200
Engineered timber construction requirement	ETCR	9801
Wood design category requirement	WDESCR	9002

DECISION TABLE

		1	2	3	E
1	Building elements that resist seismic force include wood systems	N	Y	Y	
2	Requirements of wood reference documents = true (as modified by conditions 3 through 7)	.	Y	Y	
3	Building use = dwelling <u>and</u> Construction type = wood frame <u>and</u> Number of levels (stories) < 3 <u>and</u> Total height < 35 feet <u>and</u> Seismicity index = 3 <u>or</u> 4	.	Y	N	
4	Conventional light timber requirement = satisfied	.	Y	.	
5	Wood strength calculation procedure requirement = satisfied	.	.	Y	
6	Engineered timber construction requirement = satisfied	.	.	Y	
7	Wood design category requirement = satisfied	.	.	Y	
1	WMR = satisfied	X	X	X	
2	WMR = violated				X

COMMENTS:

1. The third condition is found in section 1.3.1, which is referenced in section 9.7. Chapter 1 states that buildings for which that condition is true need only satisfy the provisions of section 9.7, which is the fourth condition. Thus the second rule is independent of the seismic performance category. In fact, chapter 1 strongly implies that such buildings need not be classified according to seismic performance category. Section 9.5, which contains the category C wood requirement, modifies the provisions of section 9.7, thus implying that such buildings are classified according to seismic performance category (they all fall into category B or category C). This inconsistency is treated in these decision tables by including the pertinent provision from section 9.5 in the decision table for section 9.7 and by assuming that such buildings are classified only for the purpose of determining the applicable provisions in that decision table and that no other seismic performance category requirements apply.
2. Although category A buildings require very little analysis of seismic forces, the wording of section 9.7 only allows the conventional light timber design rules for those buildings meeting the exception of section 1.3.1. Thus this table shows that category A buildings (which do not meet the exception of section 1.3.1) must meet the requirement for engineered construction, which does not seem to be fully applicable.

COMMENT (for datum 9001, previous page)

3. There are several possible ELSE rules for this table (see decision tree), and for most of them the implied action seems appropriate. There is one exception, however. (It is marked with an *.) Buildings for which the third condition is true (i.e., buildings falling within the exception of section 1.3.1) and the fourth condition is false (i.e., buildings not satisfying the requirements of section 9.7, the conventional light timber construction requirement) are apparently unacceptable, even if conditions 5, 6, and 7 are true. It would seem technically acceptable for the conventional light timber construction requirement to be violated if the engineered timber construction requirement were satisfied.

```
C1 + + C2 + + C3 + + C4 + + R2
 -      -      -      -
 -      -      -      - - ELSE*
 -      -      -
 -      -      - - - C5 + + C6 + + C7 + + R3
 -      -             -      -      -
 -      -             -      -      - - ELSE
 -      -             -      -
 -      -             -      - - ELSE
 -      -             -
 -      -             - - ELSE
 -      -
 -      - - ELSE
 -
 - - - R1
```

DATUM: Wood design category requirement

SECTION: Chapter 9 LABEL: WDESCR NUMBER: 9002

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Category A wood requirement	CAWR	9300
Category B wood requirement	CBWR	9400
Category C wood requirement	CCWR	9500
Category D wood requirement	CDWR	9600

DECISION TABLE

		1	2	3	4	E
1	Seismic performance category = A	Y	-	-	N	
2	Seismic performance category = B	-	Y	-	N	
3	Seismic performance category = C	-	-	Y	N	
4	(Seismic performance category = D)	-	-	-	+	
5	Category A wood requirement = satisfied	Y	+	+	+	
6	Category B wood requirement = satisfied	.	Y	+	+	
7	Category C wood requirement = satisfied	.	.	Y	+	
8	Category D wood requirement = satisfied	.	.	.	Y	
1	WDESCR = satisfied	X	X	X	X	
2	WDESCR = violated					X

DATUM: Wood strength calculation procedure requirement

SECTION: 9.2 LABEL: ZWSCPR NUMBER: 9200

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210

COMMENTS:

1. This particular datum is not absolutely necessary to represent the Provisions, and the relation to its ingredient is somewhat less clear than in the general case. It is used in this analysis to emphasize that the strengths of structural components found in reference documents are modified by the Provisions for use in earthquake resistant design and to facilitate the clear reference of the datum from other chapters independently from the design category datum.
2. Note that this requirement applies for all seismic performance categories, including category A, even though no seismic load analysis is specified for category A, only minimum seismic forces.

DATUM: Strength of wood components

SECTION: 9.2 LABEL: XSW NUMBER: 9210

INGREDIENTS

Datum	Label	Number
Capacity reduction factor for wood	PHIW	9220
Allowable strength of wood components	ASW	9230

FUNCTION:

XSW = 2(PHIW)(ASW)

DATUM: Capacity reduction factor for wood

SECTION: 9.2, 9.5.3, Table 9-1 LABEL: PHIW NUMBER: 9220

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Stress type		9240
Diaphragm strength calculated from principles of mechanics		9250
Species group		9260
Diaphragm strength from these provisions		9270
Number of screws or nails in joint	(N)	9280
Width of panel boundary members		9290

DECISION TABLE

		1	2	3	4	5	6	7	8	9	10	11	E
1	Element = wood member and Stress type = bending, bearing, compression or tension	Y	-	-	-	-	-	-	-	-	-	-	
2	Element = plywood diaphragm and Diaphragm strength calculated from principles of mechanics = true	-	Y	Y	-	-	-	-	-	-	-	-	
3	Species group of diaphragm framing = III	.	Y	-	.	.	.	.	.	.	.	.	
4	Species group of diaphragm framing = IV	.	-	Y	.	.	.	.	.	.	.	.	
5	Element = diaphragm or shear wall and Diaphragm strength from these provisions = true	-	-	-	Y	Y	-	-	-	-	-	-	
6	Element = carriage bolt without washer	-	-	-	-	-	Y	-	-	-	-	-	
7	Element = lag screws or wood screws	-	-	-	-	-	-	Y	Y	-	-	-	
8	Number of screws or nails in joint > 4	.	.	.	.	.	.	N	Y	.	N	Y	
9	Element = bolt or other timber connector	-	-	-	-	-	-	-	-	Y	-	-	
10	Element = nail perpendicular to grain in withdrawal	-	-	-	-	-	-	-	-	-	Y	Y	
11	Element = plywood diaphragm and Width of panel boundary members < 3" nominal	-	-	-	N	Y	-	-	-	-	-	-	
1	PHIW = 1.0	X								X			
2	PHIW = 0.82		X										
3	PHIW = 0.65			X									
4	PHIW = 0.75				X								
5	PHIW = 0.67					X	X						
6	PHIW = 0.90							X			X		
7	PHIW = 3.6/N								X			X	
E	PHIW = ?												X

COMMENTS:

1. There are several ELSE rules for which no action is specified. (See the decision tree.) For example:
   i) Shear stress in a wood member (marked *).
   ii) Plywood diaphragms with strength calculated on the principles of mechanics where the species group of the framing members is I or II (marked #.). Note that Douglas Fir and Southern Pine are both Group II.
   iii) Lateral resistance of nails (marked $).
   iv) etc.

DATUM 9220: Derived decision tree

```
C2  + + C3  + + R2
-       -
-       -   - - C4  + + R3
-               -
-               -   - ELSE#
-
-   - - C5  + + C11 + + R5
        -       -
        -       -   - - R4
        -
        -   - - C7  + + C8  + + R8
                -       -
                -       -   - - R7
                -
                -   - - C10 + + C8  + + R11
                        -       -
                        -       -   - - R10
                        -
                        -   - - C1  + + R1
                                -
                                -   - - C6  + + R6
                                        -
                                        -   - - C9  + + R9
                                                -
                                                -   - ELSE *$
```

DATUM: Allowable strength of wood components

SECTION: 9.2, 9.6.3, 9.8 LABEL: ASW NUMBER: 9230

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Diaphragm strength calculated from principles of mechanics		9250
Seismic performance category	SPC	1490
Building contains concrete or masonry walls		9630
Component covered by wood reference documents		9130
Allowable working stress shear in plywood diaphragm	XWSSPD	9867
Allowable working stress shear in plywood shear walls	XWSPSW	9877
Allowable working stress shear for fiberboard shear walls	AWSFSW	9886
Allowable working stress shear for lath and plaster walls	AWSLPW	9888
Allowable working stress shear for gypsum board walls	AWSGBW	9892
Strength from reference documents		9235

	DECISION TABLE	1	2	3	4	5	6	7	8	9	10	11	E
1	Component = plywood diaphragm	Y	Y	-	-	-	-	-	-	-	-	N	
2	Component = plywood shear wall	-	-	Y	Y	Y	-	-	-	-	-	N	
3	Component = conventional diagonlly sheathed shear wall	-	-	-	-	-	Y	-	-	-	-	N	
4	Component = special diagonally sheathed shear wall	-	-	-	-	-	-	Y	-	-	-	N	
5	Component = fiberboard shear panel	-	-	-	-	-	-	-	Y	-	-	N	
6	Component = lath and plaster shear panel	-	-	-	-	-	-	-	-	Y	-	N	
7	Component = gypsum board shear panel	-	-	-	-	-	-	-	-	-	Y	N	
8	Diaphragm strength calculated from principles of mechanics = true	N	Y	N	Y	.	.	.	.	.	.	.	
9	Seismic performance category = D and Building contains concrete or masonry walls = true	.	.	N	N	Y	.	.	.	.	.	.	
10	Component covered by wood reference documents = true	.	.	.	.	.	.	.	.	.	.	Y	
1	ASW = XWSSPD (table 9-1 of Provisions)	X											
2	ASW = XWSPSW (table 9-2 of Provisions)			X									
3	ASW = XWSPSW/2					X							
4	ASW = Strength from reference documents		X		X							X	
5	ASW = 200 pounds/foot						X						
6	ASW = 600 pounds/foot							X					
7	ASW = AWSFSW (tabel 9-3 of Provisions)								X				
8	ASW = AWSLPW (table 9-4a of Provisions)									X			
9	ASW = AWSGBW (table 9-4b of Provisions)										X		
E	ASW = ?												X

COMMENTS:

1. The "allowable" strength of a large number of wood components is specified in the tables referenced from section 9.8. This is in contrast to the other chapters on materials of construction, where reference documents are used almost exclusively for "allowable" strengths.
2. Rule 5 is found in section 9.6.3. It was assumed that condition 8 should be immaterial for that rule.
3. The only ELSE rule is for components that would give false values for conditions 1 through 7 and 10.

DATUM: Category A wood requirement

SECTION: 9.3 LABEL: CAWR NUMBER: 9300

INGREDIENTS

Datum	Label	Number
Construction type		1350
Number of levels (stories)		2243
Wall sheathing application requirement	WSAR	9763
Portion of length of wall with bracing		9320
Wall location		9330
Wall bracing applied over full height of story		9340

DECISION TABLE

		1	2	3	E
1	Construction type = wood frame <u>and</u> Number of levels (stories) = 3	N	Y	Y	
2	Wall location = first story exterior	.	N	Y	
3	Wall sheathing application requirement = satisfied	.	.	Y	
4	Portion of length of wall with bracing $\geq$ 25%	.	.	Y	
5	Wall bracing applied over full height of story = true	.	.	Y	
1	CAWR = satisfied	X	X	X	
2	CAWR = violated				X

COMMENTS:

1. Note that the wall bracing provisions apply only to three-story buildings. It might be more plausible if they applied to all buildings over 2 stories high.
2. The provisions for wall bracing apparently override any calculated strength requirements.

DATUM: Category B wood requirement

SECTION: 9.4 LABEL: CBWR NUMBER: 9400

INGREDIENTS

Datum	Label	Number
Category A wood requirement	CAWR	9300
Category B wood tie requirement	CBWTR	9420
Category B lag screw washer requirement	CBLSWR	9450
Category B eccentric joint requirement	CBEJR	9480

DECISION TABLE

		1	E
1	Category A wood requirement = satisfied	Y	
2	Category B wood tie requirement = satisfied	Y	
3	Category B lag screw washer requirement = satisfied	Y	
4	Category B eccentric joint requirement = satisfied	Y	
1	CBWR = satisfied	X	
2	CBWR = violated		X

DATUM: Category B wood tie requirement

SECTION: 9.4.1(A) LABEL: CBWTR NUMBER: 9420

INGREDIENTS

Datum	Label	Number
Component providing seismic tie between two portions of bldg		9430
Component providing anchorage of concrete or masonry walls to floors		9440

DECISION TABLE

			1	E
1	Component providing seismic tie between two portions of bldg = diaphragm sheathing	*	N	
2	Component providing anchorage of concrete or masonry walls to floors = diaphragm sheathing	*	N	
	***			
1	CBWTR = satisfied	*	X	
2	CBWTR = violated	*		X

COMMENTS:

1. Section 9.4.1(A) is headed "Anchorage of Concrete or Masonry Walls," but the text of the section also includes reference to the minimum tie requirement of section 3.7.5.

DATUM: Category B lag screw washer requirement

SECTION: 9.4.1(B) LABEL: CBLSWR NUMBER: 9450

INGREDIENTS

Datum	Label	Number
Bearing material under head of lag screw		9460
Washer provided under head of lag screw		9470

DECISION TABLE

		1	2	E
1	Bearing material under head of lag screw = wood	N	Y	
2	Washer provided under head of lag screw = true	.	Y	
	********************************			
1	CBLSWR = satisfied	X	X	
2	CBLSWR = violated			X

DATUM: Category B eccentric joint requirement

SECTION: 9.4.1(C) LABEL: CBEJR NUMBER: 9480

INGREDIENTS

Datum	Label	Number
Greatest end distance in any eccentric wood joint		9485
Depth of member		9490
Sect 208B of Ref 9.1 modified, delete 50% stress increase		9495

DECISION TABLE

		1	2	E
1	Greatest end distance in any eccentric wood joint > 5(Depth of member)	N	Y	
2	Sect 208B of Ref 9.1 modified, delete 50% stress increase = true	.	Y	
	********************************			
1	CBEJR = satisfied	X	X	
2	CBEJR = violated			X

DATUM: Category C wood requirement

SECTION: 9.5 LABEL: CCWR NUMBER: 9500

INGREDIENTS

Datum	Label	Number
Category B wood requirement	CBWR	9400
Category C plywood material requirement	CCPMR	9515
Category C wood framing requirement	CCWFR	9535
Category C wood detailing requirement	CCWDR	9555

DECISION TABLE

		1	E
1	Category B wood requirement = satisfied	Y	
2	Category C plywood material requirement = satisfied	Y	
3	Category C wood framing requirement = satisfied	Y	
4	Category C wood detailing requirement = satisfied	Y	
1	CCWR = satisfied	X	
2	CCWR = violated		X

COMMENTS:

1. Section 9.5.2(C) is not contained in this decision table as explained in comment 1 on datum 9001, it is included in the decision tables for section 9.7 (specifically, datum 9739).

DATUM: Category C plywood material requirement

SECTION: 9.5.1 LABEL: CCPMR NUMBER: 9515

INGREDIENTS

Datum	Label	Number
Exposure of structural plywood		9520
Structural plywood exposure type		9525
Glue type for structural plywood		9530

DECISION TABLE

		*	1	2	E
1	Exposure of structural plywood = exterior surface of exterior walls	*	Y	N	
2	Structural plywood exposure type = "Exterior"	*	Y	.	
3	Glue type for structural plywood = "Intermediate" or "Exterior"	*	+	Y	
1	CCPMR = satisfied	*	X	X	
2	CCPMR = violated	*			X

DATUM: Category C wood framing requirement

SECTION: 9.5.2(A) and (B) LABEL: CCWFR NUMBER: 9535

INGREDIENTS

Datum	Label	Number
Number of stories (levels)		2243
Wood diaphragm used to resist torsion from conc/mas walls		9540
Shear wall sheathing material		9545
Wall location		9330

DECISION TABLE

		1	2	3	4	5	E
1	Number of stories (levels) > 2	-	N	N	Y	Y	
2	Number of stories (levels) > 1	N	Y	Y	+	+	
3	Wood diaphragm used to resist torsion from conc/mas walls = true	.	.	.	N	N	
4	Shear wall material = fiberboard on any wall	N	N	N	N	N	
5	Wall location = top story	.	Y	N	Y	N	
6	Shear wall sheathing material = gypsum sheathing or gypsum wall-board or particle board or wire lath and plaster	.	.	N	.	N	
1	CCWFR = satisfied	X	X	X	X	X	
2	CCWFR = violated						X

COMMENTS:

1. The sheathing types that are prohibited by conditions 4 and 6 include all the types listed in section 9.7.3 except plywood and diagonal boards. However, section 9.8.5 includes gypsum lath and plaster, which would not be prohibited by this decision table. It appears that the ambiguity regarding engineered versus conventional timber construction discussed in the comments on datum 9001 may also affect this provision.

DATUM: Category C wood detailing requirement

SECTION: 9.5.3 LABEL: CCWDR NUMBER: 9555

INGREDIENTS

Datum	Label	Number
Ref 9.1 modified for resistance of nails parallel to grain		9560
Shear wall sheathing material		9545
Shear panel type		9565
Plywood application		9570

DECISION TABLE

		1	2	3	4	E
1	Ref 9.1 modified for resistance of nails parallel to grain = true	Y	Y	Y	Y	
2	Shear wall sheathing material = plywood	N	Y	Y	Y	
3	Shear panel type = diaphragm	.	N	Y	Y	
4	Plywood application = directly on framing	.	Y	Y	-	
5	Plywood application = over solid lumber planking or laminated deck	.	-	-	Y	
1	CCWDR = satisfied	X	X	X	X	
2	CCWDR = violated					X

COMMENTS:

1. The text is ambiguous as to whether the resistance of nails driven parallel to grain called out in condition 1 is to be taken as an allowable working strength value or yield strength value.
2. The second rule apparently prohibits applying plywood sheathing over gypsum sheathing for use as a seismic shear wall, although it is permitted in table 9-2.
3. The second paragraph of section 9.5.3(A) is not in this table; it is in the table for the capacity reduction factor, datum 9220.

DATUM: Category D wood requirement

SECTION: 9.6, 9.6.1, 9.6.2 LABEL: CDWR NUMBER: 9600

INGREDIENTS

Datum	Label	Number
Category C wood requirement	CCWR	9500
Shear wall sheathing material		9545
Type of diaphragm framing		9620

DECISION TABLE

		1	E
1	Category C wood requirement = satisfied	Y	
2	Shear wall sheathing material = gypsum sheathing or gypsum wallboard or fiberboard or particle board or wire lath and plaster	N	
3	Type of diaphragm framing = unblocked (for seismic resistance)	N	
1	CDWR = satisfied	X	
2	CDWR = violated		X

COMMENTS:

1. Section 9.6.3 is not included in this decision table. It is included in datum 9230.
2. The comment on datum 9535 pertains to the second condition in this decision table.

DATUM: Conventional light timber requirement

SECTION: 9.7 LABEL: CLTR NUMBER: 9701

INGREDIENTS

Datum	Label	Number
Conventional wall framing requirement	CWFR	9706
Conventional wall sheathing requirement	CWDR	9739

DECISION TABLE

		1	E
1	Conventional wall framing requirement = satisfied	Y	
2	Conventional wall sheathing requirement = satisfied	Y	
1	CLTR = satisfied	X	
2	CLTR = violated		X

DATUM: Conventional wall framing requirement

SECTION: 9.7.1 LABEL: CWFR NUMBER: 9706

INGREDIENTS

Datum	Label	Number
Diameter of foundation sill anchor bolts		9709
Spacing of foundation sill anchor bolts		9712
Embedment of foundation sill anchor bolts		9715
Double plates provided at top of wall		9718
Individual top plates overlap at corners and intersections		9721
Spacing between joints in individual top plates		9724
Wall studs bear fully on bottom plates		9727
Thickness of bottom plate		9730
Width of bottom plate		9733
Width of stud		9736

DECISION TABLE

		1	E
1	Diameter of foundation sill anchor bolts ≧ 1/2" and Spacing of foundation sill anchor bolts ≦ 4' and Embedment of foundation sill anchor bolts ≧ 7 (Diameter of foundation sill anchor bolts)	Y	
2	Double plates provided at top of wall = true and Individual top plates overlap at corners and intersections = true and Spacing between joints in individual top plates ≧ 4'	Y	
3	Wall studs bear fully on bottom plates = true and Thickness of bottom plate ≧ 2" (nominal) and Width of bottom plate ≧ Width of stud	Y	
1	CWFR = satisfied	X	
2	CWFR = violated		X

DATUM: Conventional wall sheathing requirement

SECTION: 9.7.2 and 9.5.2(C) LABEL: CWDR NUMBER: 9739

INGREDIENTS

Datum	Label	Number
Walls with seismic bracing section		9742
Wall sheathing application requirement	WSAR	9763
Location of seismic bracing sections on wall		9745
Spacing of seismic bracing sections on wall		9748
Width of seismic bracing section		9751
Vertical joints in sheathing occur only on studs		9754
Horizontal joints in sheathing occur only on framing		9757
Thickness of framing members		9760
Seismic performance category	SPC	1490
Number of levels (stories)		2243
Wall location		9330
Portion of length of wall with bracing		9320

DECISION TABLE

		1	2	3	E
1	Walls with seismic bracing section include all exterior walls and main interior partitions	Y	Y	Y	
2	Wall sheathing application requirement = satisfied	Y	Y	Y	
3	Location of seismic bracing sections on wall = at least each end of wall	Y	Y	Y	
4	Spacing of seismic bracing sections on wall ≦ 25'	Y	Y	Y	
5	Width of seismic bracing section ≧ 4'	Y	Y	Y	
6	Vertical joints in sheathing occur only on studs = true	Y	Y	Y	
7	Horizontal joints in sheathing occur only on framing = true	Y	Y	Y	
8	Thickness of framing members ≧ 2" (nominal)	Y	Y	Y	
9	Seismic performance category = C or D <u>and</u> Number of levels > 1	N	Y	Y	
10	Wall location = top story	.	Y	N	
11	Portion of length of wall with bracing ≧ 40%	.	.	Y	
1	CWDR = satisfied	X	X	X	
2	CWDR = violated				X

COMMENTS:

1. Conditions 9, 10, and 11 are from section 9.5.2(C). See comment 1 on datum 9001.

DATUM: Wall sheathing application requirement

SECTION: 9.7.3 LABEL: WSAR NUMBER: 9763

INGREDIENTS

Datum	Label	Number
Shear wall sheathing material		9545
Spacing of studs		9766
Thickness of sheathing		9769
Boards applied diagonal to framing		9772
Sheathing panel size		9775
Sheathing panel orientation		9778
Size of nails in sheathing		9781
Spacing of nails in sheathing		9784
Conventional diagonal sheathing requirement	CDSR	9828

DECISION TABLE

		1	2	3	4	5	6	7	E
1	Shear wall sheathing material = wood boards	Y	-	-	-	-	-	-	
2	Shear wall sheathing material = plywood	-	Y	Y	-	-	-	-	
3	Shear wall sheathing material = fiberboard	-	-	-	Y	-	-	-	
4	Shear wall sheathing material = gypsum sheathing	-	-	-	-	Y	-	-	
5	Shear wall sheathing material = gypsum wallboard	-	-	-	-	-	Y	-	
6	Shear wall sheathing material = exterior type 2-B-1 particle board	-	-	-	-	-	-	Y	
7	Spacing of studs ≦ 24"	Y	+	Y	+	+	Y	+	
8	Spacing of studs ≦ 16"	.	Y	N	Y	Y	.	Y	
9	Thickness of sheathing ≧ 5/16"	+	Y	+	+	+	+	+	
10	Thickness of sheathing ≧ 3/8"	+	.	Y	+	+	+	Y	
11	Thickness of sheathing ≧ 7/16"	+	.	.	Y	+	+	.	
12	Thickness of sheathing ≧ 1/2" (nominal)	+	.	.	.	Y	Y	.	
13	Thickness of sheathing ≧ 5/8" (net)	Y	.	.	.	.	.	.	
14	Boards applied diagonal to framing = true	Y	-	-	-	-	-	-	
15	Sheathing panel size = 4' x 8' <u>and</u> Sheathing panel orientation = long side vertical	-	.	.	Y	.	.	.	
16	Size and Spacing of nails in sheathing per table 9-2	-	Y	Y	-	-	-	-	
17	Size and Spacing of nails in sheathing per table 9-3	-	-	-	Y	-	-	Y	
18	Size and Spacing of nails in sheathing per table 9-4	-	-	-	-	Y	Y	-	
19	Conventional diagonal sheathing requirement = satisfied	Y	-	-	-	-	-	-	
1	WSAR = satisfied	X	X	X	X	X	X	X	
2	WSAR = violated								X

COMMENTS:

1. The textual reference to tables 9-1 through 9-4 is somewhat ambiguous. Table 9-1 does not apply to walls. Tables 9-2 through 9-4 specify allowable shears, not minimum nailings. It must be assumed that the nailing required would be the minimum of the different possibilities in each table.
2. The reference to section 9.8.3 (datum 9828) for nailing of diagonally sheathed panels unavoidably brings in other provisions for board size and joints.

DATUM: Engineered timber construction requirement

SECTION: 9.8 LABEL: ETCR NUMBER: 9801

INGREDIENTS

Datum	Label	Number
Engineered wood framing requirement	EWRF	9802
Engineered wood shear panel requirement	EWSPR	9808
Engineered wood wall connection requirement	EWWCR	9898

DECISION TABLE

		1	E
1	Engineered wood framing requirement = satisfied	Y	
2	Engineered wood shear panel requirement = satisfied	Y	
3	Engineered wood wall connection requirement = satisfied	Y	
	************		
1	ETCR = satisfied	X	
2	ETCR = violated		X

DATUM: Engineered wood framing requirement

SECTION: 9.8.1 LABEL: EWFR NUMBER: 9802

INGREDIENTS

Datum	Label	Number
All columns framed to true end bearing		9803
All columns supported securely in position		9804
All columns protected from deterioration		9806
Construction type		1350
Positive conn provided to resist uplift and lateral displ		9807

DECISION TABLE

		1	2	E
1	All columns framed to true end bearing = true	Y	Y	
2	All columns supported securely in position = true	Y	Y	
3	All columns protected from deterioration = true	Y	Y	
4	Construction type = post and beam	N	Y	
5	Positive conn provided to resist uplift and lateral displ = true	.	Y	
1	EWFR = satisfied	X	X	
2	EWFR = violated			X

COMMENTS:

1 Several of the conditions in this table are difficult to evaluate because no measurable criteria are given.

DATUM: Engineered wood shear panel requirement

SECTION: 9.8.2, 9.8.3, 9.8.4, 9.8.5 LABEL: EWSPR NUMBER: 9808

INGREDIENTS

Datum	Label	Number
Engineered wood shear panel framing requirement	EWSPFR	9809
Building has one side without shear walls		9818
Wood diaphragm torsion requirement	WDTR	9819
Shear wall sheathing material		9545
Diagonally sheathed shear panel requirement	DSSPR	9827
Plywood shear panel requirement	PSPR	9854
Other material shear panel requirement	OMSPR	9878

DECISION TABLE

		1	2	3	4	5	6	E
1	Engineered wood shear panel framing requirement = satisfied	Y	Y	Y	Y	Y	Y	
2	Building has one side without shear walls = true	N	N	N	Y	Y	Y	
3	Wood diaphragm torsion requirement = satisfied	.	.	.	Y	Y	Y	
4	Shear wall sheathing material = wood boards	Y	-	N	Y	-	N	
5	Shear wall sheathing material = plywood	-	Y	N	-	Y	N	
6	Diagonally sheathed shear panel requirement = satisfied	Y	.	.	Y	.	.	
7	Plywood shear panel requirement = satisfied	.	Y	.	.	Y	.	
8	Other material shear panel requirement = satisfied	.	.	Y	.	.	Y	
1	EWSPR = satisfied	X	X	X	X	X	X	
2	EWSPR = violated							X

COMMENTS:

1. The wording from which condition 2 was drawn implies that engineered wood buildings may only use shear walls for the vertical elements of the seismic resisting system. The provision is probably intended to apply when a wood building has shear walls on 3 sides.

DATUM: Engineered wood shear panel framing requirement

SECTION: 9.8.2(A) LABEL: EWSPFR NUMBER: 9809

INGREDIENTS

Datum	Label	Number
Thickness of framing members		9760
Chords, bound memb, collectors transmit induced axial forces		9811
Boundary members tied together at corners		9812
Shear stress transferred around openings		9813
Opening materially affects panel strength		9814
Opening fully detailed on plans		9816
Conn between panel and component resists prescribed forces		9817

DECISION TABLE

		1	2	E
1	Thickness of framing members ≥ 2" (nominal)	Y	Y	
2	Chords, bound memb, collectors transmit induced axial forces = true	Y	Y	
3	Boundary members tied together at corners = true	Y	Y	
4	Shear stress transferred around openings = true	Y	Y	
5	Opening materially affects panel strength = true	N	Y	
6	Opening fully detailed on plans = true	.	Y	
7	Conn between panel and component resists prescribed forces = true	Y	Y	
1	EWSPFR = satisfied	X	X	
2	EWSPFR = violated			X

COMMENTS:

1. Conditions 2, 3, 4, 5 and 7 will be difficult to evaluate. Conditions 2 and 7 are somewhat redundant with the strength requirement.

DATUM: Wood diaphragm torsion requirement

SECTION: 9.8.2(B) LABEL: WDTR NUMBER: 9819

INGREDIENTS

Datum	Label	Number
Shear wall sheathing material		9545
Depth of diaphragm normal to open side		9821
Number of levels (stories)		2243
Depth to width ratio for diaphragm	YDWRD	9823
Diagonal sheathing type		9826
Deflection in plane of diaphragm		3756
Permissible deflection of elements attached to diaphragm		3758

	DECISION TABLE	1	2	3	4	5	6	7	E
1	Shear wall sheathing material = diagonal boards	Y	-	Y	-	Y	Y	-	
2	Shear wall sheathing material = plywood	-	Y	-	Y	-	-	Y	
3	Depth of diaphragm normal to open side ≦ 25'	Y	Y	Y	Y	.	.	.	
4	Number of levels (stories) = 1	N	N	Y	Y	.	.	.	
5	Depth to width ratio for diaphragm ≦ 0.67	Y	Y	.	.	-	-	-	
6	Depth to width ratio for diaphragm ≦ 1.0	+	+	Y	Y	N	N	N	
7	Depth to width ratio for diaphragm ≦ 1.5	+	+	+	+	Y	.	.	
8	Depth to width ratio for diaphragm ≦ 2.0	+	+	+	+	+	Y	Y	
9	Diagonal sheathing type = conventional	.	.	.	.	Y	N	.	
10	(Diagonal sheathing type = special)	.	.	.	.	-	+	.	
11	Deflection in plane of diaphragm ≦ Permissible deflection of elements attached to diaphragm	.	.	.	.	Y	Y	Y	
1	WDTR = satisfied	X	X	X	X	X	X	X	
2	WDTR = violated								X

COMMENTS:

1. Rules 1 through 4 are covered in the initial portion of section 9.8.2(B). In interpreting the remainder of the section to obtain rules 5, 6, and 7, it was assumed that conditions 3 and 4 are immaterial.

DATUM: Depth to width ratio for diaphragm

SECTION: 9.8.2(B) LABEL: YDWRD NUMBER: 9823

INGREDIENTS

Datum	Label	Number
Depth of diaphragm normal to open side		9821
Width of diaphragm		9822

COMMENTS:

1. It is assumed that the depth referred to by the phrase "ratio of depth to width" is the depth normal to the open side. The function would then be:

   YDWRD = Depth/width

DATUM: Diagonally sheathed shear panel requirement

SECTION: 9.8.3 LABEL: DSSPR NUMBER: 9827

INGREDIENTS

Datum	Label	Number
Diagonal sheathing type		9826
Conventional diagonal sheathing requirement	CDSR	9828
Special diagonal sheathing requirement	SDSR	9841

DECISION TABLE

		1	2	E
1	Diagonal sheathing type = conventional	Y	N	
2	(Diagonal sheathing type = special)	-	+	
3	Conventional diagonal sheathing requirement = satisfied	Y	Y	
4	Special diagonal sheathing requirement = satisfied	.	Y	
1	DSSPR = satisfied	X	X	
2	DSSPR = violated			X

DATUM: Conventional diagonal sheathing requirement

SECTION: 9.8.3(A) LABEL: CDSR NUMBER: 9828

INGREDIENTS

Datum	Label	Number
Thickness of sheathing		9769
Board width		9829
Size of nails in sheathing		9781
Type of nail		9831
Depth of diaphragm normal to open side		9821
Nails per board at panel boundary		9832
Nails per board at interior framing		9833
Spacing of joints in adjacent boards		9834
Spacing of framing members		9853
Spacing of joints in boards on any framing member		9836
Thickness of framing members		9760
Depth of framing		9838
Angle between boards and framing		9839

	DECISION TABLE	1	2	3	4	5	6	7	8	E
1	Thickness of sheathing = 1" (nominal)	Y	Y	Y	Y	-	-	-	-	
2	Thickness of sheathing = 2" (nominal)	-	-	-	-	Y	Y	Y	Y	
3	Board width = 6" (nominal)	Y	Y	-	-	Y	Y	-	-	
4	Board width ≥ 8" (nominal)	-	-	Y	Y	-	-	Y	Y	
5	Size of nails in sheathing = 8d	Y	Y	Y	Y	-	-	-	-	
6	Size of nails in sheathing = 16d	-	-	-	-	Y	Y	Y	Y	
7	Type of nail = box	N	Y	N	Y	N	Y	N	Y	
8	Nails per board at panel boundary ≥ 3	Y	+	+	+	Y	+	+	+	
9	Nails per board at panel boundary ≥ 4	.	+	Y	+	.	+	Y	+	
10	Nails per board at panel boundary ≥ 5	.	Y	.	+	.	Y	.	+	
11	Nails per board at panel boundary ≥ 6	.	.	.	Y	.	.	.	Y	
12	Nails per board at interior framing ≥ 2	Y	+	+	+	Y	+	+	+	
13	Nails per board at interior framing ≥ 3	.	Y	Y	+	.	Y	Y	+	
14	Nails per board at interior framing ≥ 4	.	.	.	Y	.	.	.	Y	
15	Spacing of joints in adjacent boards ≥ Spacing of framing members	Y	Y	Y	Y	Y	Y	Y	Y	
16	Spacing of joints in boards on any framing member ≥ 2 Board width	Y	Y	Y	Y	.	.	.	.	
17	Thickness of framing members ≥ 3" (nominal) <u>and</u> Depth of framing ≥ 4" (nominal)	.	.	.	.	Y	Y	Y	Y	
18	Angle between boards and framing = 45° approximately	Y	Y	Y	Y	Y	Y	Y	Y	
1	CDSR = satisfied	X	X	X	X	X	X	X	X	
2	CDSR = violated									X

COMMENTS:

1. Note that the operator in conditions 5 and 6 is "=", not "≥".
2. According to the text, condition 16 does not apply to diaphragms of 2 inch thick boards.

DATUM: Special diagonal sheathing requirement

SECTION: 9.8.3(B) LABEL: SDSR NUMBER: 9841

INGREDIENTS

Datum	Label	Number
Number of layers of conventional diagonal sheathing		9842
Both layers on same face of framing		9843
Angle between the boards in the two layers		9844
Chord strength requirement (special diagonal)	SDCSR	9846

DECISION TABLE

		1	E
1	Number of layers of conventional diagonal sheathing = 2	Y	
2	Both layers on same face of framing = true	Y	
3	Angle between the boards in the two layers = 90°	Y	
4	Chord strength requirement (special diagonal) = satisfied	Y	
1	SDSR = satisfied	X	
2	SDSR = violated		X

DATUM: Chord strength requirement (special diagonal)

SECTION: 9.8.3(B) LABEL: SDCSR NUMBER: 9846

INGREDIENTS

Datum	Label	Number
Chord beam resistance	YCBR	9847
Chord design load effect	YCDLE	9848
Chord design load magnitude		9849
Earthquake force effect	QE	3706
Chord design load direction		9851
Chord span		9852
Spacing of framing members		9853

DECISION TABLE

		1	E
1	Chord design load magnitude = 50% Earthquake force effect (diaphragm unit shear)	Y	
2	Chord design load direction = normal to chord in plane of diaphragm (either direction)	Y	
3	Chord span = Spacing of framing members	Y	
4	Chord beam resistance ≧ Chord design load effect	Y	
1	SDCSR = satisfied	X	
2	SDCSR = violated		X

COMMENTS:

1. This is a strength requirement that is contained within detailing requirements.

DATUM: Chord beam resistance

SECTION: 9.8.3(B) LABEL: YCBR NUMBER: 9847

INGREDIENTS

Datum	Label	Number
Strength of wood components	XSW	9210

COMMENTS:

1. For the use of this datum (see datum 9846), only the beam resistance of the chord is to be considered (apparently interaction with axial forces are to be ignored in this calculation).

DATUM: Chord design load effect

SECTION: 9.8.3(B) LABEL: YCDLE NUMBER: 9848

INGREDIENTS

Datum	Label	Number
Chord design load magnitude		9849
Chord design load direction		9851
Chord span		9852

COMMENT:

1. The load effect is to be calculated as a function of the ingredients. Note that limits exist on the ingredients in the decision table for datum 9846.

DATUM: Plywood shear panel requirement

SECTION: 9.8.4 LABEL: PSPR NUMBER: 9854

INGREDIENTS

Datum	Label	Number
Plywood shear panel framing requirement	PSPFR	9856
Plywood shear panel nailing requirement	PSPNR	9861

DECISION TABLE

		*	1	E
1	Plywood shear panel framing requirement = satisfied	*	Y	
2	Plywood shear panel nailing requirement = satisfied	*	Y	
	**	*		
1	PSPR = satisfied	*	X	
2	PSPR = violated	*		X

DATUM: Plywood shear panel framing requirement

SECTION: 9.8.4(A) LABEL: PSPFR NUMBER: 9856

INGREDIENTS

Datum	Label	Number
Sheathing panel size		9775
Shear panel type		9565
Arrangement of sheathing panels		9857
Framing members provided at all edges of each sheet (blocked)		9858
Plywood designed to resist shear only		9859
Framing members designed to resist axial forces		9860
Boundary members tied together at corners		9812
Width of shear panel		9882

DECISION TABLE

	DECISION TABLE	1	2	3	E
1	Sheathing panel size ≧ 4' by 8', except at boundaries	Y	Y	Y	
2	Shear panel type = diaphragm	Y	Y	N	
3	(Shear panel type = shear wall)	-	-	+	
4	Arrangement of sheathing panels matches one from table 9-1	Y	Y	.	
5	Width of shear panel ≧ 12"	N	Y	.	
6	Framing members provided at all edges of each sheet (blocked) = true	.	Y	Y	
7	Plywood designed to resist shear only = true	Y	Y	Y	
8	Framing members designed to resist axial forces = true	Y	Y	Y	
9	Boundary members tied together at corners = true	Y	Y	Y	
1	PSPFR = satisfied	X	X	X	
2	PSPFR = violated				X

COMMENTS:

1. Condition 3 shows the assumption implied by the text that all shear panels are either diaphragms or shear walls. Note that the text refers to horizontal diaphragms in some sections, thereby implying that not all diaphragms are horizontal.
2. Condition 9 is redundant; it is also in the decision table for datum 9809, which covers all shear panels used in engineered wood construction, including plywood.
3. The exception included in condition 1 allows condition 5 to be independent of condition 1.

DATUM: Plywood shear panel nailing requirement

SECTION: 9.8.4(B) LABEL: PSPNR NUMBER: 9861

INGREDIENTS

Datum	Label	Number
Size of nail at internal members		9862
Panel location		9863
Thickness of sheathing		9769
Spacing of studs		9766
Direction of face grain		9864
Spacing of nails at intermediate members		9866

DECISION TABLE

		1	2	3	4	E
1	Size of nail at internal members = nail size specified for edges and boundaries in table 9-1 or 9-2	Y	Y	Y	Y	
2	Panel location = floor	Y	-	-	-	
3	Panel location = roof	-	Y	-	-	
4	Panel location = wall	-	-	Y	Y	
5	Thickness of sheathing = 3/8" and Spacing of studs = 24" and Direction of face grain = parallel to studs	.	.	N	Y	
6	Spacing of nails at intermediate members $\leqq$ 6"	.	.	.	Y	
7	Spacing of nails at intermediate members $\leqq$ 10"	Y	.	.	+	
8	Spacing of nails at intermediate members $\leqq$ 12"	+	Y	Y	+	
1	PSPNR = satisfied	X	X	X	X	
2	PSPNR = violated					X

COMMENTS:

1. Although strict interpretation of the text would replace the "$\leqq$" in conditions 6, 7, and 8 with "=", it was assumed that the intent is as shown here.

DATUM: Allowable working stress shear in plywood diaphragms

SECTION: 9.8.4, table 9-1 LABEL: XWSSPD NUMBER: 9867

INGREDIENTS

Datum	Label	Number
Plywood grade		9868
Size of nails in sheathing		9781
Penetration of nail into framing		9869
Thickness of sheathing		9769
Thickness of framing members		9760
Width of panel boundary members		9290
Framing members provided at all edges of each sheet (blocked)		9858
Angle between load and unblocked edges		9871
Angle between load and continuous sheet edges		9872
Spacing of nails at panel boundary		9873
Spacing of nails at continuous sheet edges		9874
Spacing of nails at other sheet edges		9876
Type of nail		9831

DECISION TABLE

No table will be shown, since table 9-1 presents all the decisions clearly and concisely (excepting the item noted in the second comment below).

COMMENTS:

1. The table effectively places several restrictions on the design of plywood diaphragms by omission. These omissions would be shown as "ELSE rules" in a decision table analysis and would include: i) plywood grade other than specified, ii) nail size other than 6, 8, or 10 penny common, iii) nail penetration less than 1-1/4", iv) plywood thickness less than 5/16", v) framing members thinner than 2", and vi) nail spacings over 6".
2. Table 9-1 apparently contains a typographical error; the figure in the bottom row of the column for plywood thickness should probably be 5/8".
3. The first footnote to table 9-1 is really a condition in the decision table for the capacity reduction factor (datum 9220).
4. The figures below table 9-1 are generally for illustration only. However, they imply a hidden design provision: that cases 5 and 6 must be fully blocked panels.

DATUM: Allowable working stress shear in plywood shear walls

SECTION: 9.8.4, Table 9-2 LABEL: XWSPSW NUMBER: 9877

INGREDIENTS

Datum	Label	Number
Plywood grade		9868
Size of nails in sheathing		9781
Penetration of nail into framing		9869
Thickness of sheathing		9769
Plywood application		9570
Spacing of nails at panel boundary		9873
Width of panel boundary members		9290
Spacing of studs		9766
Direction of face grain		9864
Type of nail		9831
Species group		9260

DECISION TABLE

No table will be shown, since table 9-2 presents all the decisions clearly and concisely, except as noted in the second and third comments below.

COMMENTS:

1. Just as table 9-1 does, this table places several restrictions on the design of plywood shear walls.
2. Table 9-2 apparently contains a typographical error. The corresponding table in the Uniform Building Code, which appears to be the source, contains a value of 200 where the blank space occurs in the bottom row of table 9-2.
3. The first footnote to the table contains two design restrictions that are addressed in the decision table for datums 9809 and 9861. Note that the second paragraph appears to be ambiguous in that it refers to "other species," apparently for the framing members when no species has been specified.
4. The title for table 9-2 refers to wind forces.

DATUM: Other material shear panel requirement

SECTION: 9.8.5 LABEL: OMSPR NUMBER: 9878

INGREDIENTS

Datum	Label	Number
Distance from nail to edge of sheet		9879
Height to width ratio of shear panel	YHWR	9883
Wall resists loads from concrete or masonry walls		9884

DECISION TABLE

	DECISION TABLE		1	E
1	Distance from nail to edge of sheet ≥ 3/8"	*	Y	
2	Height to width ratio of shear panel ≤ 1.5	*	Y	
3	Wall resists loads from concrete or masonry walls = true	*	N	
	**			
1	OMSPR = satisfied	*	X	
2	OMSPR = violated	*		X

COMMENTS:

1. Condition 3 is found in a footnote to tables 9-3 and 9-4, which are referenced from section 9.8.5.

DATUM: Height to width ratio of shear panel

SECTION: 9.8.5 LABEL: YHWR NUMBER: 9883

INGREDIENTS

Datum	Label	Number
Height of shear panel		9881
Width of shear panel		9882

COMMENTS:

1. The implied function is simply:

   YHWR = Height/Width

DATUM: Allowable working stress shear for fiberboard shear walls

SECTION: 9.8.5, Table 9-3 LABEL: AWSFSW NUMBER: 9886

INGREDIENTS

Datum	Label	Number
Thickness of sheathing		9769
Size of nails in sheathing		9781
Type of nail		9831
Fiberboard sheathing type		9887
Wall sheathed with other material that is used for shear resistance		9896
Same material applied on both faces of wall		9897
Spacing of nails at panel boundary		9873
Spacing of nails at intermediate members		9866

DECISION TABLE

		1	2	3	4	5	6	7	E
1	Thickness of sheathing = 7/16"	.	Y	Y	-	-	-	-	
2	Thickness of sheathing = 1/2"	.	-	-	Y	Y	-	-	
3	Thickness of sheathing = 25/32"	.	-	-	-	-	Y	Y	
4	Size and Type of nail = 11 gage galvanized roofing nail 1-1/2" long with 7/16" head	.	Y	Y	Y	Y	-	-	
5	Size and Type of nail = 11 gage galvanized roofing nail 1-3/4" long with 5/16" head	.	-	-	-	-	Y	Y	
6	Fiberboard sheathing type = "nail base"	.	.	.	Y	Y	.	.	
7	Wall sheathed with other material that is used for shear resistance = true	Y	N	N	N	N	N	N	
8	Same material applied on both faces of wall = true	.	N	Y	N	Y	N	Y	
9	Spacing of nails at panel boundary ≦ 3"	.	Y	Y	Y	Y	Y	Y	
10	Spacing of nails at intermediate members ≦ 6"	.	Y	Y	Y	Y	Y	Y	
1	AWSFSW = 0	X							X
2	AWSFSW = 125 lbs./ft.		X						
3	AWSFSW = 175 lbs./ft.				X		X		
4	AWSFSW = 250 lbs./ft.			X					
5	AWSFSW = 350 lbs./ft.					X		X	

COMMENTS:

1. A comparable table in the Uniform Building Code gives 7/16 inch for the head size of the nail in condition 5.

DATUM: Allowable working stress shear for lath and plaster walls

SECTION: 9.8.5, Table 9-4 LABEL: AWSLPW NUMBER: 9888

INGREDIENTS

Datum	Label	Number
Shear wall sheathing material		9545
Thickness of sheathing		9769
Lath thickness		9889
Plaster thickness		9891
Spacing of nails in sheathing		9784
Size of nails in sheathing		9781
Type of nail		9831
Wall sheathed with other material that is used for shear resistance		9896
Same material applied on both faces of wall		9897

DECISION TABLE

			1	2	3	4	5	E
1	Shear wall sheathing material = woven or welded wire lath and portland cement plaster	*	.	Y	Y	-	-	
2	Shear wall sheathing material = plain or perforated gypsum lath and plaster	*	.	-	-	Y	Y	
3	Thickness of sheathing = 7/8"	*	.	Y	Y	+	+	
4	Lath thickness = 3/8"	*	.	.	.	Y	Y	
5	Plaster thickness = 1/2"	*	.	.	.	Y	Y	
6	Spacing of nails in sheathing ≦ 6" (at all framing)	*	.	Y	Y	+	+	
7	Spacing of nails in sheathing ≦ 5" (at all framing)	*	.	.	.	Y	Y	
8	Size and Type of nail = 11 gage 1-1/2" long with 7/16" head <u>or</u> 16 gage staples with 7/8" long legs	*	.	Y	Y	-	-	
9	Size and Type of Nail = 13 gage 1-1/8" long plaster board blued nail with 7/16" head	*	.	-	-	Y	Y	
10	Wall sheathed with other material that is used for shear resistance = true	*	Y	N	N	N	N	
11	Same material applied on both faces of wall = true	*	.	N	Y	N	Y	
	**							
1	AWSLPW = 0	*	X					X
2	AWSLPW = 100 lbs./ft.	*				X		
3	AWSLPW = 180 lbs./ft.	*		X				
4	AWSLPW = 200 lbs./ft.	*					X	
5	AWSLPW = 360 lbs./ft.	*			X			

DATUM: Allowable working stress shear for gypsum board walls

SECTION: 9.8.5 LABEL: AWSGBW NUMBER: 9892

INGREDIENTS

Datum	Label	Number
Wall sheathed with other material that is used for shear resistance		9896
Same material applied on both faces of wall		9897
Basic working stress shear for gypsum board walls	BWSGBW	9893

DECISION TABLE

		*	1	2	3
1	Wall sheathed with other material that is used for shear res = true	*	Y	N	N
2	Same material applied on both faces of wall = true	*	.	N	Y
		*			
	**				
		*			
1	AWSGBW = 0	*	X		
2	AWSGBW = BWSGBW	*		X	
3	AWSBGW = 2 (BWSGBW)	*			X
		*			

COMMENTS:

1. Inclusion of these conditions in the decision table for datum 9893 made that table unnecessarily unwieldy; therefore, the information was divided into two decision tables.

DATUM: Basic working stress shear for gypsum board walls

SECTION: 9.8.5, Table 9-4 LABEL: BWSGBW NUMBER: 9893

INGREDIENTS

Datum	Label	Number
Shear wall sheathing material		9545
Thickness of sheathing		9769
Sheathing panel size		9775
Framing members provided at all edges of each sheet (blocked)		9858
Spacing of nails in sheathing		9784
Size of nails in sheathing		9781
Type of nail		9831
2-5/8" layers on same face with 6d at 9" bot and 8d at 7" top		9894

	DECISION TABLE	1	2	3	4	5	6	7	8	9	E
1	Shear wall sheathing material = gypsum sheathing board	Y	Y	Y	-	-	-	-	-	-	
2	Shear wall sheathing material = gypsum wallboard	-	-	-	Y	Y	Y	Y	Y	Y	
3	Thickness of sheathing = 1/2"	Y	Y	Y	Y	Y	Y	Y	-	-	
4	Thickness of sheathing = 5/8"	-	-	-	-	-	-	-	Y	-	
5	Sheathing panel size = 2' wide	Y	-	-	.	.	.	.	.	.	
6	Sheathing panel size = 4' wide	-	Y	Y	.	.	.	.	.	.	
7	Framing members provided at all edges of ea sheet (blocked) = true	N	N	Y	N	N	Y	Y	Y	Y	
8	Spacing of nails in sheathing $\leq$ 7" (at all framing)	+	+	Y	Y	+	Y	+	+	.	
9	Spacing of nails in sheathing $\leq$ 4" (at all framing)	Y	Y	.	N	Y	N	Y	Y	.	
10	Size and Type of nail = 11 gage 1-3/4" diamond point, galvanized with 7/16" head	Y	Y	Y	-	-	-	-	-	-	
11	Size and Type of nail = 5d cooler	-	-	-	Y	Y	Y	Y	-	-	
12	Size and Type of nail = 6d cooler	-	-	-	-	-	-	-	Y	-	
13	2-5/8" layers on same face with 6d at 9" bot and 8d at 7" top = true <u>and</u> Type of nail = cooler	-	-	-	-	-	-	-	-	Y	
1	BSWGBW = 0 lbs./ft.										X
2	BSWGBW = 75 lbs./ft.	X									
3	BSWGBW = 100 lbs./ft.		X		X						
4	BSWGBW = 125 lbs./ft.					X	X				
5	BSWGBW = 150 lbs./ft.							X			
6	BSWGBW = 175 lbs./ft.			X					X		
7	BSWGBW = 250 lbs./ft.									X	

DATUM: Engineered wood wall connection requirement

SECTION: 9.8.6 LABEL: EWWCR NUMBER: 9898

INGREDIENTS

Datum	Label	Number
Element provides resist to anch force for conc/mas walls		9899
Element of building (component)		2114
Type of seismic force effect		3786

DECISION TABLE

			1	2	E
1	Element provides resist to anch force for conc/mas walls = true	*	N	Y	
2	Component (used for connection) = toe nails	*	.	N	
3	Component (used for connection) = nails in withdrawal	*	.	N	
4	Component (used for connection) = wood ledger and Type of seismic force effect = cross grain bending or tension	*	.	N	
	**				
1	EWWCR = satisfied	*	X	X	
2	EWWCR = violated	*			X

DATUM: Steel materials requirement

SECTION: Chapter 10 LABEL: SMR NUMBER: 10001

INGREDIENTS

Datum	Label	Number
Building elements that resist seismic force		9110
Requirements of steel reference documents		10100
Steel strength calculation procedure requirement	ZSSCPR	10200
Steel design category requirement	SDESCR	10002

DECISION TABLE

	DECISION TABLE	1	2	E
1	Building elements that resist seismic force include steel materials	N	Y	
2	Requirements of steel reference documents = satisfied (except as modified by condition 3 and 4)	.	Y	
3	Steel strength calculation procedure requirement = satisfied	.	Y	
4	Steel design category requirement = satisfied	.	Y	
1	SMR = satisfied	X	X	
2	SMR = violated			X

COMMENTS:

1. Note that there are several modifications in chapter 11 that affect condition 2, particularly in datums 10240 and 10630.

DATUM: Steel design category requirement

SECTION: Chapter 10 LABEL: SDESCR NUMBER: 10002

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Category A steel requirement	ZCASR	10300
Category B steel requirement	CBSR	10400
Category C and D steel requirement	CCDSR	10500

DECISION TABLE

	DECISION TABLE	1	2	3	4	E
1	Seismic performance category = A	Y	-	-	N	
2	Seismic performance category = B	-	Y	-	N	
3	Seismic performance category = C	-	-	Y	N	
4	(Seismic performance category = D)	-	-	-	+	
5	Category A steel requirement = satisfied	+	+	+	+	
6	Category B steel requirement = satisfied	.	Y	+	+	
7	Category C and D steel requirement = satisfied	.	.	Y	Y	
	***					
1	SDESCR = satisfied	X	X	X	X	
2	DSESCR = violated					X

COMMENTS:

1. See datum 10300 for a comment about condition 5.

DATUM: Steel strength calculation procedure requirement

SECTION: 10.2 LABEL: ZSSCPR NUMBER: 10200

INGREDIENTS

Datum	Label	Number
Strength of steel components	XSS	10210

COMMENTS:

1. See the comments on datum 9200. Note that several modifications to the steel reference documents are introduced by datums 10240 and 10245 which are part of the global ingredience of this datum.

DATUM: Strength of steel components

SECTION: 10.2 LABEL: XSS NUMBER: 10210

INGREDIENTS

Datum	Label	Number
Capacity reduction factor for steel	PHIS	10220
Modified reference strength for steel	YRSS	10245

FUNCTION:

XSS = (PHIS)(YRSS)

DATUM: Capacity reduction factor for steel

SECTION: 10.2 LABEL: PHIS NUMBER: 10220

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Type of steel connection		10225
Connection designed to develop full strength of member		10290
Modification 6 of Section 10.6 (beam column joint)		10640

DECISION TABLE

			1	2	3	4	E
1	Component = member	*	Y	N	N	N	
2	(Component = connection)	*	-	+	+	+	
3	Type of steel connection = partial penetration weld in steel column	*	-	N	N	Y	
4	Connection designed to develop full strength of member = true	*	.	Y	-	.	
5	Modification 6 of section 10.6 (beam column joint) = true	*	.	+	N	.	
1	PHIS = 0.90	*	X	X			
2	PHIS = 0.67	*			X		
3	PHIS = 0.80	*				X	
E	PHIS = ?	*					X

COMMENTS:

1. For the purpose of this decision table, all steel components may be thought of as members or connections.
2. It was assumed that the reference to section 10.6.1(A)6 meant modification 6 of section 10.6
3. The decision tree shows one ELSE rule, a steel connection for which condition 4 is false and condition 5 is true. This is possible if the strength of the connection is less than the full strength of the member, but the rotation capacity of the connection is adequate to satisfy modification 6 of section 10.6.

```
C1   + + R1
-
-   - - C3   + + R4
        -
        -   - - C4   + + R2
                -
                -   - - C5   + ELSE
                        -
                        -   - - R3
```

DATUM: Modification to steel reference documents requirement

SECTION: 10.2.1 LABEL: MSRDR NUMBER: 10240

INGREDIENTS

Datum	Label	Number
Material of component or system		2115
Modifications A through D of section 10.2.1 (AISC strength)		10250
Modification E of section 10.2.1 (AISC P-delta effect)		10260
P-delta effect included in analysis		10265
Modifications A and B of section 10.2.2 (AISI cold formed steel)		10270
Modification of section 10.2.3 (cable strengths)		10280

DECISION TABLE

	DECISION TABLE	1	2	3	4	5	E
1	Material of component or system = structural steel	Y	Y	-	-	N	
2	Material of component or system = cold formed steel	-	-	Y	-	N	
3	Material of component or system = steel cables	-	-	-	Y	N	
4	P-delta effect included in analysis	N	Y	.	.	.	
5	Modifications A through D of section 10.2.1 (AISC strength) = true	Y	Y	.	.	.	
6	Modification E of section 10.2.1 (AISC P-delta effect) = true	N	Y	.	.	.	
7	Modification A and B of section 10.2.2 (AISI cold formed) = true	.	.	Y	.	.	
8	Modification of section 10.2.3 (cable strengths) = true	.	.	.	Y	.	
1	MSRDR = satisfied	X	X	X	X	X	
2	MSRDR = violated						X

COMMENTS:

1. Note that there are no modifications for steel joists, so that the strength used in seismic design is the same as in all other design.
2. Modification 6 of section 10.2.1 removes the 23/12 factor from the definition of the Euler load in section 1.6.1 of AISC; however, a cross-reference to this from section 2.3 of AISC contains the factor. This may not be consistent.
3. For the ELF and Modal analysis, condition 4 may be determined by checking the value of datum 4665. Datum 10265 was created to account for the general case where other analysis might be used.

DATUM: Modified reference strength for steel

SECTION: 10.2.1 LABEL: YRSS NUMBER: 10245

INGREDIENTS

Datum	Label	Number
Strength permitted by steel reference documents		10230
Modification to steel reference documents requirement	MSRDR	10240

COMMENTS:

1. See the comment on datum 10240.

DATUM: Category A steel requirement

SECTION: 10.3 LABEL: ZCASR NUMBER: 10300

COMMENTS:

1. This datum only makes reference to the steel reference documents, which is already referenced (for all situations) by the root datum of this chapter. In all situations, this datum would be satisfied by conformance to datum 10001. It is only included because it is specifically called out in the text of chapters 3 and 10.

DATUM: Category B steel requirement

SECTION: 10.4 LABEL: CBSR NUMBER: 10400

INGREDIENTS

Datum	Label	Number
Category A steel requirement	ZCASR	10300
Ordinary steel moment frame requirement	OSMFR	10450
General framing class	GFC	3303
Element of building (component)		2114
Material of component or system		2115
Requirements of Part I of Reference 10.1 (AISC elastic design)		10420
Requirements of Reference 10.2 (AISI Cold Formed)		10430
Requirements of Reference 10.3 (AISI Stainless)		10440

DECISION TABLE

		1	2	3	E
1	Category A steel requirement = satisfied	+	+	+	
2	General framing class = Moment Frame and Material = steel	N	Y	-	
3	General framing class = Building Frame or Bearing Wall and Element of building = space frame and Material = steel	N	-	Y	
4	Ordinary steel moment frame requirement = satisfied	.	Y	+	
5	Requirements of Part I of Reference 10.1 (AISC) = satisfied or Requirements of Reference 10.2 (AISI Cold Formed) = satisfied or Requirements of Reference 10.3 (AISI Stainless) = satisfied	.	+	Y	
1	CBSR = satisfied	X	X	X	
2	CBSR = violated				X

COMMENTS:

1. See datum 10300 for a comment about condition 1.
2. Conditions 4 and 5 actually require the same thing: that the steel framing be designed with structural steel conforming to the AISC specification or with cold formed or stainless steel conforming to the AISI specifications. They are separated here because chapter 3 makes specific reference to datum 10450.

DATUM: Ordinary steel moment frame requirement

SECTION: 10.4.1 LABEL: OSMFR NUMBER: 10450

INGREDIENTS

Datum	Label	Number
Requirements of Part I of Reference 10.1 (AISC elastic design)		10420
Requirements of Reference 10.2 (AISI Cold Formed)		10430
Requirements of Reference 10.3 (AISI Stainless)		10440

DECISION TABLE

			1	2
1	Requirements of Part I of Reference 10.1 (AISC) = satisfied <u>or</u> Requirements of Reference 10.2 (AISI Cold Formed) = satisfied <u>or</u> Requirement of Reference 10.3 (AISI Stainless) = satisfied	*	Y	N
	********************************	*		
1	OSMFR = satisfied	*	X	
2	OSMFR = violated	*		X

DATUM: Category C and D steel requirement

SECTION: 10.5 LABEL: CCDSR NUMBER: 10500

INGREDIENTS

Datum	Label	Number
Category B steel requirement	CBSR	10400
General framing class	GFC	3303
Seismic resisting system		3309
Material of component or system		2115
Frame response type		3327
Special steel moment frame requirement	SSMFR	10600
Seismic performance category	SPC	1490
Number of levels (stories)		2243
Ordinary steel moment frame requirement	OSMFR	10450
Compression strength of braced frame member	YCSBFM	10520
Tension strength of braced frame member	YTSBFM	10530

DECISION TABLE

		1	2	3	4	5	E
1	Category B steel requirement = satisfied	Y	Y	Y	Y	Y	
2	General framing class = Moment Frame and Material = steel	Y	Y	-	-	N	
3	Seismic resisting system includes braced frame and Material = steel	-	-	Y	Y	N	
4	Frame response type = special	+	N	.	.	.	
5	(Frame response type = ordinary)	-	+	.	.	.	
6	Special steel moment frame requirement = satisfied	Y	N	.	.	.	
7	Seismic performance category = C	.	Y	.	.	.	
8	Number of levels (stories) < 3	.	Y	.	Y	.	
9	Ordinary steel moment frame requirement = satisfied	-	Y	.	.	.	
10	Compression strength of braced frame member $\geq$ 50% Tension strength of braced frame member	.	.	Y	N	.	
1	CCDSR = satisfied	X	X	X	X	X	
2	CCDSR = violated						X

COMMENTS:

1. The value for condition 9 is known in rule 1 because of the value stated for condition 6. Note that this technically would also imply a "-" (implicit no), for condition 1. This has not been shown, because it has been assumed throughout that the reference to requirements for lower seismic performance categories from higher ones carries with it the understood concept "except as modified by the requirements for the higher seismic performance category."
2. Rule 5 covers buildings with steel shear walls and buildings with some steel components but in which the primary seismic resisting system is composed of another material.
3. Note that condition B in rule 2 contradicts section 3.3.4 (A) (datum 3372), which permits "ordinary" moment frames in much taller buildings.

DATUM: Compression strength of braced frame member

SECTION: 10.5.2 LABEL: YCSBFM NUMBER: 10520

INGREDIENTS

Datum	Label	Number
Strength of steel components	XSS	10210

DATUM: Tension strength of braced frame member

SECTION: 10.5.2 LABEL: YTSBFM NUMBER: 10530

INGREDIENTS

Datum	Label	Number
Strength of steel components	XSS	10210

DATUM: Special steel moment frame requirement

SECTION: 10.6 LABEL: SSMFR NUMBER: 10600

INGREDIENTS

Datum	Label	Number
Requirements of Part II of Reference 10.1 (AISC plastic design)		10620
Modifications 1 through 7 of section 10.6 (special moment frames)		10630

DECISION TABLE

		1	E
1	Requirements of Part II of Reference 10.1 (AISC plastic design) = satisfied	Y	
2	Modifications 1 through 7 of section 10.6 (special moment frames) = true	Y	
1	SSMFR = satisfied	X	
2	SSMFR = violated		X

DATUM: Concrete materials requirement

SECTION: Chapter 11 LABEL: CMR NUMBER: 11001

INGREDIENTS

Datum	Label	Number
Building elements that resist seismic force		9110
Requirements of concrete reference document		11100
Concrete strength calculation procedure requirement	ZCSCPR	11200
Concrete design category requirement	CDESCR	11002

DECISION TABLE

		*	1	2	E
1	Building elements that resist seismic force include concrete materials	*	N	Y	
2	Requirements of concrete reference document = satisfied (as modified by conditions 3 and 4)	*	.	Y	
3	Concrete strength calculation procedure requirement = satisfied	*	.	Y	
4	Concrete design category requirement = satisfied	*	.	Y	
	**************************	*			
1	CMR = satisfied	*	X	X	
2	CMR = violated	*			X

DATUM: Concrete design category requirement

SECTION: Chapter 11 LABEL: CDESCR NUMBER: 11002

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Category A concrete requirement	CACR	11300
Category B concrete requirement	CBCR	11400
Category C and D concrete requirement	CCDCR	11500

DECISION TABLE

		1	2	3	4	E
1	Seismic performance category = A	Y	-	-	N	
2	Seismic performance category = B	-	Y	-	N	
3	Seismic performance category = C	-	-	Y	N	
4	(Seismic performance category = D)	-	-	-	+	
5	Category A concrete requirement = satisfied	Y	+	+	+	
6	Category B concrete requirement = satisfied	.	Y	+	+	
7	Category C and D concrete requirement = satisfied	.	.	Y	Y	
1	CDESCR = satisfied	X	X	X	X	
2	CDESCR = violated					X

DATUM: Concrete strength calculation procedure requirement

SECTION: 11.2 LABEL: ZCSCPR NUMBER: 11200

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210

COMMENTS:

1. See the comments for datum 9200.

DATUM: Strength of concrete components and systems

SECTION: 11.2 LABEL: SC NUMBER: 11210

INGREDIENTS

Datum	Label	Number
Type of final placement of concrete		11220
Element of building (component)		2114
Capacity reduction factor for concrete	PHIC	11230
Strength permitted from reference document		11240
Allowable loads on anchor bolts	XALAB	11275

DECISION TABLE

		1	2	3	E
1	Type of final placement of concrete = cast in place	Y	-	.	
2	Type of final placement of concrete = precast	-	Y	.	
3	Component = anchor bolt	N	N	Y	
1	SC = (PHIC)(Strength permitted from reference document)	X	X		
2	SC = XALAB			X	
E	SC = ?				X

COMMENTS:

1. The first two conditions are shown in this table to make a point about an ambiguity in the text. The two may represent the only ways of placing concrete, in which case no ELSE rule would exist. The ambiguity is found in these statements: "These provisions are based on the use of monolithic cast-in-place reinforced concrete construction. Precast reinforced concrete components may be used if the resulting construction complies with the requirements of Sec. 3.6 and this chapter." Since all buildings must comply with section 3.6 and since any buildings with reinforced concrete components resisting earthquake forces must comply with chapter 11, the statements do not make any difference in the provisions applicable to precast concrete when contrasted with cast-in-place concrete. Neither the reference to section 3.6 or the one to chapter 11 were included as conditions in this decision table because they are both in the global dependence of this datum; to include them would create a loop.
2. The text is not clear as to whether the "allowable" strength for anchor bolts is to be multiplied by any increase for equivalent yield level or by the capacity reduction factor. It was assumed that neither applied.

DATUM: Capacity reduction factor for concrete

SECTION: 11.2 LABEL: PHIC NUMBER: 11230

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Type of stress		11245
Axial force due to all loads	ZAXALL	11290
Axial force due to earthquake	ZAXEQ	11295
Nominal concrete compressive strength	(FC)	11250
Gross area of concrete	(AG)	11280
Special concrete beam column lateral reinforcement requirement	SCBCLR	11765
Weight of concrete aggregate		11260
Mode of stress governing strength of component		11270
Seismic performance category	SPC	1490
Capacity reduction factor from Sec. 9.2 of Ref document		11235
All shear resisted by dowels and shear-friction		11285

	DECISION TABLE	1	2	3	4	5	6	7	8	E
1	Component = connection of precast components	Y	N	N	N	N	N	N	N	
2	Type of stress = axial compression	.	Y	-	-	-	-	-	-	
3	Type of stress = shear	.	-	Y	Y	Y	Y	Y	Y	
4	Axial force due to all loads > 0.10 (FC)(AG)	.	Y	.	.	.	.	.	.	
5	Axial force due to earthquake > 0.05 (FC)(AG)	.	Y	.	.	.	.	.	.	
6	Special concrete beam column lateral reinforcement requirement = satisfied	.	N	.	.	.	.	.	.	
7	Weight of concrete aggregate = normal weight	.	.	Y	Y	-	-	-	-	
8	Weight of concrete aggregate = light weight	.	.	-	-	Y	Y	Y	Y	
9	Seismic performance category = C or D	.	.	Y	Y	Y	Y	N	Y	
10	Mode of stress governing strength of component = flexure	.	.	Y	-	Y	-	.	.	
11	Mode of stress governing strength of component = shear	.	.	-	Y	-	Y	.	.	
12	Element of building = construction joint <u>and</u> All shear resisted by dowels and shear friction = true	.	.	.	.	N	N	.	Y	
1	PHIC = 0.5	X	X							
2	PHIC = 0.85			X						
3	PHIC = 0.6				X					
4	PHIC = 0.8 (0.85) = 0.68					X				
5	PHIC = 0.8 (0.6) = 0.48						X			
6	PHIC = 0.8 (Capacity reduction factor from sec. 9.2 of Ref document)							X		
7	PHIC = 0.6 (Capacity reduction factor from sec. 9.2 of Ref document)								X	
E	PHIC = Capacity reduction factor from Sec. 9.2 of Ref document									X

COMMENTS:

1. The action for the ELSE rule is fairly clear in the text.
2. The name of datums 11290 and 11295 makes use of the term "force" rather than the term used in section 11.2 ("stress") in order to be consistent with the remainder of the chapter.
3. It was assumed that the reduction in PHIC for lightweight concrete construction joints shown in rule 8 and action 7 was applicable only to category C and D since the formula referred to (formula 11-6) is in a portion of the chapter that only applies to category C and D buildings.

DATUM: Allowable loads on anchor bolts

SECTION: 11.2, Table 11-A LABEL: XALAB NUMBER: 11275

INGREDIENTS

Datum	Label	Number
Diameter of anchor bolt		11271
Minimum embedment of anchor bolt		11272
Nominal concrete compressive strength		11250
Weight of concrete aggregate		11260
Anchor bolt specifications		11276
Anchor bolt spacing		11277
Anchor bolt edge distance		11278
Location of anchor bolt		11350
Seismicity index	SI	1425

COMMENTS:

1. This datum is determined from table 11-A in the Provisions. Note that much of the logic is contained in the footnotes to that table. The equivalent decision table would be fairly large and complex.

DATUM: Axial force due to all loads

SECTION: 11.2 LABEL: ZAXALL NUMBER: 11290

COMMENTS:

1. The normal ingredient for this datum would be datum 3702. It is not shown here, however, for reasons similar to those discussed in the comment on datum 3324. That is, a complete loop in precedence exists through the imposition of a strength requirement on the framing classification. See datum 3324, and appendix A3.

DATUM: Axial force due to earthquake

SECTION: 11.2 LABEL: ZAXEQ NUMBER: 11295

COMMENTS:

1. The normal ingredient for this datum would be datum 3706. It is not shown for the same reason as discussed on the previous datum, number 11290.

DATUM: Category A concrete requirement

SECTION: 11.3 LABEL: CACR NUMBER: 11300

INGREDIENTS

Datum	Label	Number
Category A concrete framing requirement	CACFR	11310
Category A concrete anchor bolt requirement	CACABR	11340

DECISION TABLE

		1	E
1	Category A concrete framing requirement = satisfied	Y	
2	Category A concrete anchor bolt requirement = satisfied	Y	
1	CACR = satisfied	X	
2	CACR = violated		X

DATUM: Category A concrete framing requirement

SECTION: 11.3 LABEL: CACFR NUMBER: 11310

INGREDIENTS

Datum	Label	Number
General framing class	GFC	3303
Material of component or system		2115
Seismic resisting system		3309
Frame response type		3327
Type of concrete braced frame		11320
Type of concrete shear wall		11330
Requirement of concrete reference document		11100

DECISION TABLE

		1	2	3	4	E
1	General framing class = Moment Frame and Material = concrete	Y	-	-	-	
2	Seismic resisting system includes braced frame and Material = concrete	-	Y	Y	N	
3	Seismic resisting system includes shear wall and Material = concrete	-	N	Y	Y	
4	Frame response type = ordinary	Y	.	.	.	
5	Type of concrete braced frame = ordinary	.	Y	Y	.	
6	Type of concrete shear wall = ordinary	.	.	Y	Y	
7	Requirement of concrete reference document = satisfied	Y	Y	Y	Y	
1	CACFR = satisfied	X	X	X	X	
2	CACFR = violated					X

COMMENTS:

1. "Ordinary" braced frames and shear walls are not described, defined, or used at any other location in the Provisions.
2. Rule 1 directly contradicts table 3-B of chapter 3, which stipulates that ordinary moment frames of reinforced concrete must satisfy section 10.4.1, which in turn brings in section 11.6 (datum 11600).
3. The combination of shear wall and braced frame is not excluded in either chapter 3 or chapter 11, therefore it was assumed to be permitted.

DATUM: Category A concrete anchor bolt requirement

SECTION: 11.3 LABEL: CACABR NUMBER: 11340

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Location of anchor bolt		11350
Ties provided around anchor bolt		11360
Distance of anchor bolt ties from top		11370
Size of anchor bolt ties		11380
Number of anchor bolt ties		11390

DECISION TABLE

		1	2	3	4	E
1	Component = anchor bolt	N	Y	Y	Y	
2	Location of anchor bolt = column top or similar location	.	N	Y	Y	
3	Ties provided around anchor bolt = true	.	.	Y	Y	
4	Distance of anchor bolt ties from top < 4"	.	.	Y	Y	
5	Size of anchor bolt ties = #3	.	.	Y	-	
6	Size of anchor bolt ties = #4	.	.	-	Y	
7	Number of anchor bolt ties ≧ 2	.	.	+	Y	
8	Number of anchor bolt ties ≧ 3	.	.	Y	.	
1	CACABR = satisfied	X	X	X	X	
2	CACABR = violated					X

COMMENTS:

1. Note the similarity of this provision to datum 12409 for anchor bolts in masonry columns, and that datum 12409 is for seismic performance category B, not A.

DATUM: Category B concrete requirement

SECTION: 11.4 LABEL: CBCR NUMBER: 11400

INGREDIENTS

Datum	Label	Number
Category A concrete requirement	CACR	11300
General framing class	GFC	3303
Material of component or system		2115
Frame response type		3327
Category B ordinary concrete moment frame requirement	CBOCMF	11600

DECISION TABLE

		1	2	E
1	Category A concrete requirement = satisfied	Y	Y	
2	General framing class = Moment Frame and Material = concrete and Frame response type = ordinary	N	Y	
3	Category B ordinary concrete moment frame requirement = satisfied	.	Y	
1	CBCR = satisfied	X	X	
2	CBCR = violated			X

DATUM: Category C and D concrete requirement

SECTION: 11.5 LABEL: CCDCR NUMBER: 11500

INGREDIENTS

Datum	Label	Number
Category B concrete requirement	CBCR	11400
Category C and D concrete material requirement	CCDCMR	11507
Category C and D concrete framing limitation	CCDCFL	11556
Category C and D non-seismic resisting system concrete requirement	CCDNSR	11563
Category C and D concrete discontinuity requirement	CCDCDR	11584

DECISION TABLE

	DECISION TABLE	1	E
1	Category B concrete requirement = satisfied	Y	
2	Category C and D concrete material requirement = satisfied	Y	
3	Category C and D concrete framing limitation = satisfied	Y	
4	Category C and D non-seismic resisting system concrete requirement = satisfied	Y	
5	Category C and D concrete discontinuity requirement = satisfied	Y	
	******		
1	CCDCR = satisfied	X	
2	CCDCR = violated		X

DATUM: Category C and D concrete material requirement

SECTION: 11.5.1 LABEL: CCDCMR NUMBER: 11507

INGREDIENTS

Datum	Label	Number
Category C and D concrete strength requirement	CCDCSR	11514
Category C and D concrete reinforcement requirement	CCDCRR	11521

DECISION TABLE

	DECISION TABLE		1	E
1	Category C and D concrete strength requirement = satisfied	*	Y	
2	Category C and D concrete reinforcement requirement = satisfied	*	Y	
	**********			
1	CCDCMR = satisfied	*	X	
2	CCDCMR = violated	*		X

DATUM: Category C and D concrete strength requirement

SECTION: 11.5.1 LABEL: CCDCSR NUMBER: 11514

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Weight of concrete aggregate		11260
Nominal concrete compressive strength		11250

DECISION TABLE

	DECISION TABLE		1	2	3	E
1	Component = concrete for special moment frame <u>or</u> for shear wall	*	Y	.	N	
2	Weight of concrete aggregate = light weight	*	N	Y	N	
3	Nominal concrete compressive strength $\geq$ 3000 psi	*	Y	+	.	
4	Nominal concrete compressive strength $\leq$ 4000 psi	*	.	Y	.	
	**********					
1	CCDCSR = satisfied	*	X	X	X	
2	CCDCSR = violated	*				X

COMMENTS:

1. Rule 3 is strongly implied.

DATUM: Category C and D concrete reinforcement requirement

SECTION: 11.5.1 LABEL: CCDCRR NUMBER: 11521

INGREDIENTS		
Datum	Label	Number
Element of building (component)		2114
Material specification of reinforcement		11528
Actual mill test yield stress		11535
Actual mill retest yield stress		11542
Actual mill test ultimate stress		11549
Specified yield stress		11550

	DECISION TABLE	1	2	3	E
1	Component = reinforcement in special moment frames <u>or</u> in shear wall boundary members	N	Y	Y	
2	Material specification of reinforcement = ASTM A706	.	Y	-	
3	Material specification of reinforcement = ASTM A615 Grade 40	.	-	Y	
4	Actual mill test yield stress ≦ Specified yield stress + 18,000 psi	.			
5	Actual mill retest yield stress ≦ Specified yield stress + 21,000 psi	.	.	Y	
6	Actual mill test ultimate stress ≦ 1.25 (Actual mill test yield stress)	.	+	Y	
	******************************				
1	CCDCRR = satisfied	X	X	X	
2	CCDCRR = violated				X

COMMENTS:

1. Section 11.5.1 states "... actual yield stress based on mill tests does not exceed the specified yield stress by more than 18,000 psi (retests shall not exceed this value by more than an additional 3000 psi) ..." In writing condition 4, it was assumed that "this value" was the specified yield stress plus 18,000 psi. Also note that it is not clear whether retests must be performed on all specimens or only on those that fail condition 4.
2. The implicit entries shown for conditions 4 and 6 in rule 2 are there because those conditions are also within ASTM A706.

DATUM: Category C and D concrete framing limitation

SECTION: 11.5.2 LABEL: CCDCFL NUMBER: 11556

INGREDIENTS

Datum	Label	Number
General framing class	GFC	3303
Material of component or system		2115
Frame response type		3327
Special concrete moment frame requirement	SCMFR	11700
Building elements that resist seismic force		9110
CAT C/D concrete shear wall, braced frame and diaphragm reqts	SWBFDR	11800

DECISION TABLE

		1	2	3	4	5	E
1	General framing class = Moment Frame and Material = concrete	N	Y	Y	N	N	
2	Frame response type = special and Special concrete moment frame requirement = satisfied	.	Y	Y	.	.	
3	Building elements that resist seismic force include shear walls, braced frames or diaphragms and Material = concrete	N	Y	N	Y	N	
4	Cat C/D concrete shear wall, braced frame and diaphragm reqts = satisfied	.	Y	.	Y	.	
1	CCDCFL = satisfied	X	X	X	X	X	
2	CCDCFL = violated						X

COMMENTS:

1. Note that rules 2 and 3 contradict section 3.3.4 (A) (datum 3372) which permits the use of "ordinary" moment frames in certain category C buildings depending on height.
2. Conditions 1 and 3 are not mutually exclusive because moment frame buildings frequently include diaphragms.

DATUM: Category C and D non-seismic resisting system concrete requirement

SECTION: 11.5.3 LABEL: CCDNSR NUMBER: 11563

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Reqt for minimum reinforcement of chap 7, 10, 11 of Ref 11.1		11570
Nonlinear behavior required to satisfy deform compatibility reqt		11577
Axial force due to all loads	ZAXALL	11290
Nominal concrete compressive strength	(FC)	11250
Gross area of concrete	(AG)	11280
Special concrete flexural member lateral reinforcement reqt	SCFMLR	11732
Special concrete beam column lateral reinforcement reqt	SCBCLR	11765
Ordinary concrete beam column lateral reinforcement reqt	OCBCLR	11662

DECISION TABLE

		1	2	3	4	5	E
1	Component = concrete frame component that is not part of SRS	N	Y	Y	Y	Y	
2	Reqt for minimum reinforcement of chap 7, 10, 11 of Ref 11.1 = satisfied	.	Y	Y	Y	Y	
3	Nonlinear behavior required to satisfy deform compatibility reqt = true	.	N	Y	N	Y	
4	Axial force due to all loads > 0.10 (FC)(AG)	.	N	N	Y	Y	
5	Special concrete flexural member lateral reinforcement reqt = satisfied	.	.	Y	.	.	
6	Special concrete beam column lateral reinforcement reqt = satisfied	.	.	.	.	Y	
7	Ordinary concrete beam column lateral reinforcement reqt = satisfied	.	.	.	Y	Y	
1	CCDNSR = satisfied	X	X	X	X	X	
2	CCDNSR = violated						X

COMMENTS:

1. Section 11.5.3 actually makes reference to the requirements of section 3.3.4 (C), which are not shown in this table. That section is represented as datum 3390, and it was decided to make this datum an ingredient of 3390 rather than having 3390 be an ingredient of this datum as section 11.5.3 would imply. There are two reasons: 1) section 3.3.4 (C) represents the general case, covering all category C and D buildings, whereas section 11.5.3 applies only to concrete components; and 2) referring to this datum from datum 3390 makes it clear that this datum applies to concrete components in buildings that do not have concrete components in the seismic resisting system. Thus, this datum could apply to a building when little else in chapter 11 applies.

DATUM: Category C and D concrete discontinuity requirement

SECTION: 11.5.4 LABEL: CCDCDR NUMBER: 11584

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Column supports discontinuous stiff element		11591
Axial force due to earthquake	ZAXEQ	11295
Nominal concrete compressive strength	(FC)	11250
Gross area of concrete	(AG)	11280
Special concrete beam column lateral reinforcement requirement	SCBCLR	11765

DECISION TABLE

		1	2	3	4	E
1	Component = concrete column	N	Y	Y	Y	
2	Column supports discontinuous stiff element = true	.	N	Y	Y	
3	Axial force due to earthquake > 0.05 (FC)(AG)	.	.	N	Y	
4	Special concrete beam column lateral reinforcement requirement = satisfied (for full height of column)	.	.	.	Y	
1	CCDCDR = satisfied	X	X	X	X	
2	CCDCDR = violated					X

DATUM: Category B ordinary concrete moment frame requirement

SECTION: 11.6 LABEL: CBOCMF NUMBER: 11600

INGREDIENTS

Datum	Label	Number
Ordinary concrete flexural member requirement	OCFMR	11602
Axial force due to all loads	ZAXALL	11290
Nominal concrete compressive strength	(FC)	11250
Gross area of concrete	(AG)	11280
Ordinary concrete beam column lateral reinforcement requirement	OCBCLR	11662

DECISION TABLE

		1	2	E
1	Axial force due to all loads > 0.10 (FC)(AG)	N	Y	
2	Ordinary concrete flexural member requirement = satisfied	Y	Y	
3	Ordinary concrete beam column lateral reinforcement requirement = satisfied	.	Y	
1	CBOCMF = satisfied	X	X	
2	CBOCMF = violated			X

COMMENTS:

1. The text is not explicitly clear on the applicability of the flexural member requirement (condition 2). It was assumed that it does apply to beam-columns.

DATUM: Ordinary concrete flexural member requirement

SECTION: 11.6.1 LABEL: OCFMR NUMBER: 11602

INGREDIENTS

Datum	Label	Number
Ordinary concrete flexural member reinforcement requirement	OCFMRR	11604
Ordinary concrete flexural member moment resistance requirement	OCFMMR	11618
Ordinary concrete flexural member reinforcement anchorage	OCFMRA	11628
Ordinary concrete flexural member web reinf requirement	OCFMWR	11640

DECISION TABLE

		1	E
1	Ordinary concrete flexural member reinforcement requirement = satisfied	Y	
2	Ordinary concrete flexural member moment resistance requirement = satisfied	Y	
3	Ordinary concrete flexural member reinforcement anchorage = satisfied	Y	
4	Ordinary concrete flexural member web reinf requirement = satisfied	Y	
1	OCFMR = satisfied	X	
2	OCFMR = violated		X

DATUM: Ordinary concrete flexural member reinforcement requirement

SECTION: 11.6.1 LABEL: OCFMRR NUMBER: 11604

INGREDIENTS

Datum	Label	Number
Tensile reinforcement ratio for top reinforcement		11606
Tensile reinforcement ratio for bottom reinforcement		11608
Yield strength of tensile reinforcement	(FY)	11610
Number of continuous top bars		11612
Number of continuous bottom bars		11614
Minimum size of continuous bars		11616

DECISION TABLE

		1	E
1	Tensile reinforcement ratio for top reinforcement ≥ 200/FY (for all sections)	Y	
2	Tensile reinforcement ratio for bottom reinforcement ≥ 200/FY (for all sections)	Y	
3	Tensile reinforcement ratio for top reinforcement ≥ 0.025 (for all sections)	Y	
4	Tensile reinforcement ratio for bottom reinforcement ≥ 0.025 (for all sections)	Y	
5	Number of continuous top bars ≥ 2	Y	
6	Number of continuous bottom bars ≥ 2	Y	
7	Minimum size of continuous bars ≥ #5	Y	
1	OCFMRR = satisfied	X	
2	OCFMRR = violated		X

DATUM: Ordinary concrete flexural member moment resistance requirement

SECTION: 11.6.1 LABEL: OCFMMR NUMBER: 11618

INGREDIENTS

Datum	Label	Number
Positive moment strength at face of joint	YPMSFJ	11620
Negative moment strength at face of joint	YNMSFJ	11622
Positive moment strength at section of potential yield	YPMSSY	11624
Minimum moment strength in member	YMMSM	11626

DECISION TABLE

		1	E
1	Positive moment strength at face of joint ≧ 50% of Negative moment strength at face of joint	Y	
2	Positive moment strength at section of potential yield ≧ 50% of Negative moment strength at face of joint	Y	
3	Minimum moment strength in member ≧ 25% of MAX [Positive moment strength at at face of joint, Negative moment strength at face of joint]	Y	
1	OCFMMR = satisfied	X	
2	OCFMMR = violated		X

DATUM: Positive moment strength at face of joint

SECTION: 11.6.1 LABEL: YPMSFJ NUMBER: 11620

(and)

DATUM: Negative moment strength at face of joint

SECTION: 11.6.1 LABEL: YNMSFJ NUMBER: 11622

(and)

DATUM: Positive moment strength at section of potential yield

SECTION: 11.6.1 LABEL: YPMSSY NUMBER: 11624

(and)

DATUM: Minimum moment strength in member

SECTION: 11.6.1 LABEL: YMMSM NUMBER: 11626

(they are all evaluated in the same manner)

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210

DATUM: Ordinary concrete flexural member reinforcement anchorage

SECTION: 11.6.1 LABEL: OCFMRA NUMBER: 11628

INGREDIENTS

Datum	Label	Number
Flexural members frame into opposite faces of column		11630
Flexural reinforcement is continuous through column		11632
Variation in beam cross section prevents continuous reinforcement		11634
Flexural reinforcement extended to far face of column confined area		11636
Flexural reinforcement anchored to develop yield stress		11638

DECISION TABLE

		1	2	3	E
1	Flexural members frame into opposite faces of column = true	Y	Y	N	
2	Flexural reinforcement is continuous through column = true	Y	-	.	
3	Variation in beam cross section prevents continuous reinforcement = true	-	Y	.	
4	Flexural reinforcement extended to far face of column confined area = true	-	Y	Y	
5	Flexural reinforcement anchored to develop yield stress = true	-	Y	Y	
	************				
1	OCFMRA = satisfied	X	X	X	
2	OCFMRA = violated				X

COMMENTS:

1. The text is not specific about the location where the yield strength referred to in condition 5 is to be measured. It could logically be the face of the joint.
2. The text apparently assumes that flexural members are always supported by columns.
3. The decision tree shows one ELSE rule that might be troublesome: the case where reinforcement is not continuous through the column for some reason other than a change in beam cross section.

```
C1  + + C2  + + R1
-       -
-       - - - C3  + + C4  + + C5  + + R2
-             -       -       -
-             -       -       - - ELSE
-             -       -
-             -       - - ELSE
-             -
-             - - ELSE *
-
- - - C4  + + C5  + + R3
      -       -
      -       - - ELSE
      -
      - - ELSE
```

DATUM: Ordinary concrete flexural member web reinforcement requirement

SECTION: 11.6.1 LABEL: OCFMWR NUMBER: 11640

INGREDIENTS

Datum	Label	Number
Web reinforcement provided over entire member		11642
Orientation of web reinforcement		11644
Number of legs in each stirrup		11646
Size of web reinforcement		11648
Distance from end of concrete flexural member		11650
Spacing of web reinforcement	(s)	11652
Effective depth of flexural member	(d)	11654
Area of web reinforcement	(Aw)	11656
Area of tension reinforcement	(At)	11658
Area of compression reinforcement	(Ac)	11660
Hoops provided for web reinforcement		11661

DECISION TABLE

		1	2	3	E
1	Web reinforcement provided over entire member = true	Y	Y	Y	
2	Orientation of web reinforcement = perpendicular to longitudinal reinforcement	Y	Y	Y	
3	Number of legs in each stirrup ≧ 2	Y	Y	Y	
4	Size of web reinforcement ≧ #3	Y	Y	Y	
5	Distance from end of concrete flexural member > 2 d	Y	N	-	
6	Distance from end of concrete flexural member > d	+	Y	N	
7	Spacing of web reinforcement ≦ d/2	Y	+	+	
8	Spacing of web reinforcement ≦ d/4	.	Y	Y	
9	Aw/s ≧ 0.15 MAX [At, Ac]	.	Y	Y	
10	Hoops provided for web reinforcement = true	.	.	Y	
1	OCFMWR = satisfied	X	X	X	
2	OCFMWR = violated				X

DATUM: Ordinary concrete beam column lateral reinforcement requirement

SECTION: 11.6.2 LABEL: OCBCLR NUMBER: 11662

INGREDIENTS

Datum	Label	Number
Dist from each joint or sec of yield where lat reinf provided		11664
Minimum distance for lateral reinforcement	XLO	11668
Angle of hook at end of tie		11670
Extension at end of tie		11672
Diameter of tie bar		11674
Cross ties used for lateral reinforcement		11676
Spacing of lateral reinforcement within LO		11678
Maximum allowable spacing of lateral reinforcement	XSH	11680
Distance from face of joint to first lateral reinforcement		11682
Maximum spacing of lateral reinforcement in member		11684
Ties or lateral reinforcement provided throughout		11686
Lateral reinforcement provided through joint		11688

DECISION TABLE

		1	E
1	Dist from ea joint or sec of yield where lat reinf provided ≤ Minimum distance for lateral reinforcement	Y	
2	Angle of hook at end of tie = 135°	Y	
3	Extension at end of tie ≥ MAX [6 (Diameter of tie bar), 4"]	Y	
4	Cross ties used for lateral reinforcement = true	.	
5	Spacing of lateral reinforcement within LO ≤ Maximum allowable spacing of lateral reinforcement	Y	
6	Distance from face of joint to first lateral reinforcement ≤ 50% of Maximum allowable spacing of lateral reinforcement	Y	
7	Maximum spacing of lateral reinforcement in member ≤ 2 (Maximum allowable spacing of lateral reinforcement)	Y	
8	Ties or lateral reinforcement provided throughout = true	Y	
9	Lateral reinforcement provided through joint = true	Y	
1	OCBCLR = satisfied	X	
2	OCBCLR = violated		X

COMMENTS:

1. Condition 4 is stated in a permissive fashion, thus the entry in the rule is immaterial.
2. Condition 7 is explicitly stated and thereby implies condition 8, so it was added to this table.

DATUM: Minimum distance for lateral reinforcement

SECTION: 11.6.2 LABEL: XLO NUMBER: 11668

INGREDIENTS

Datum	Label	Number
Clear height of column	(HC)	11690
Maximum dimension of column cross section	(B)	11692

FUNCTION:

XLO = MAX [HC/6, B, 18"]

COMMENTS:

1. The text makes several clear references to columns, as if columns were the only kind of member that would be subjected to these provisions. That may be the general case, but the statement of applicability is not restricted to columns. It is, "members ... having a design compressive force exceeding 0.10 $f_c A_G$ ..." Thus some confusion is likely in interpreting ingredients like "clear height of column."

DATUM: Maximum allowable spacing of lateral reinforcement

SECTION: 11.6.2 LABEL: XSH NUMBER: 11680

INGREDIENTS

Datum	Label	Number
Minimum dimension of column cross section	(b)	11694
Diameter of tie bar	(dt)	11674
Diameter of smallest longitudinal bar	(dl)	11696

FUNCTION:

XSH = MIN [8 (dl), 24 (dt), b/2]

COMMENT:

1. See comment on datum 11668.

DATUM: Special concrete moment frame requirement

SECTION: 11.7 LABEL: SCMFR NUMBER: 11700

INGREDIENTS

Datum	Label	Number
Axial force due to all loads	ZAXALL	11290
Gross area of concrete	(AG)	11280
Nominal concrete compressive strength	(FC)	11250
Special concrete shear strength requirement	SCSSR	11701
Special concrete flexural member requirement	SCFMR	11708
Special concrete beam column requirement	SCBCR	11749
Special concrete moment frame joint requirement	SCMFJR	11786

DECISION TABLE

	DECISION TABLE		1	2	E
1	Axial force due to all loads > 0.10 (FC)(AG)	*	N	Y	
2	Special concrete flexural member requirement = satisfied	*	Y	.	
3	Special concrete beam column requirement = satisfied	*	.	Y	
4	Special concrete shear strength requirement = satisfied	*	Y	Y	
5	Special concrete moment frame joint requirement = satisfied	*	Y	Y	
	**				
1	SCMFR = satisfied	*	X	X	
2	SCMFR = violated	*			X

COMMENT:

1. Rule 2 makes it clear that the flexural member requirement does not apply to beam columns. Contrast this to the situation described for ordinary frames in datum 11600.

DATUM: Special concrete shear strength requirement

SECTION: 11.7 LABEL: SCSSR NUMBER: 11701

INGREDIENTS

Datum	Label	Number
Shear stress due to seismic forces	ZSSEQ	11702
Shear stress due to all forces	ZSSALL	11704
Axial compressive force due to seismic and dead load	ZAXEQD	11705
Gross area of concrete	(AG)	11280
Nominal concrete compressive strength	(FC)	11250
Shear resist of concrete used to determine amount of lat reinf		11707

DECISION TABLE

		1	2	3	E
1	Shear stress due to seismic forces > 50% of Shear stress due to all forces	Y	Y	N	
2	Axial compressive force due to seismic and dead loads < 0.05 (FC)(AG)	Y	N	.	
3	Shear resist of conc used to determine amount of lat reinf taken as zero	Y	.	.	
1	SCSSR = satisfied	X	X	X	
2	SCSSR = violated				X

COMMENTS:

1. This provision effectively modifies the shear strength of concrete, V_c allowed by the reference document.

DATUM: Shear stress due to seismic forces

SECTION: 11.7 LABEL: ZSSEQ NUMBER: 11702

(and)

DATUM Shear stress due to all forces

SECTION: 11.7 LABEL: ZSSALL NUMBER: 11704

(and)

DATUM: Axial compressive force due to seismic and dead load

SECTION: 11.7 LABEL: ZAXEQD NUMBER: 11705

COMMENTS:

1. The normal ingredients for all three of these datums would include the earthquake force effect. The ingredients are not shown here, however, for the reasons discussed on datum 3324 and appendix A3.

DATUM: Special concrete flexural member requirement

SECTION: 11.7.1 LABEL: SCFMR NUMBER: 11708

INGREDIENTS

Datum	Label	Number
Special concrete flexural member proportioning requirement	SCFMPR	11710
Special concrete flexural member reinforcement requirement	SCFMRR	11716
Special concrete flexural member lateral reinforcement requirement	SCFMLR	11732

DECISION TABLE

		1	E
1	Special concrete flexural member proportioning requirement = satisfied	Y	
2	Special concrete flexural member reinforcement requirement = satisfied	Y	
3	Special concrete flexural member lateral reinforcement requirement = satisfied	Y	
1	SCFMR = satisfied	X	
2	SCFMR = violated		X

DATUM: Special concrete flexural member proportioning requirement

SECTION: 11.7.1 LABEL: SCFMPR NUMBER: 11710

INGREDIENTS

Datum	Label	Number
Effective depth of flexural member		11654
Clear span of flexural member		11711
Width of flexural member		11713
Width of flexural member overhanging support		11714

DECISION TABLE

		1	E
1	Effective depth of flexural member ≦ 25% of Clear span of flexural member	Y	
2	Width of flexural member ≧ 10"	Y	
3	Width of flexural member overhanging support (on either side) ≦ 75% of Effective depth of flexural member	Y	
4	Width of flexural member/Effective depth of flexural member ≧ 0.3	Y	
1	SCFMPR = satisfied	X	
2	SCFMPR = violated		X

DATUM: Special concrete flexural member reinforcement requirement

SECTION: 11.7.1 (A) LABEL: SCFMRR NUMBER: 11716

INGREDIENTS

Datum	Label	Number
Ordinary concrete flexural member reinforcement requirement	OCFMRR	11604
Ordinary concrete flexural member moment resistance requirement	OCFMMR	11618
Ordinary concrete flexural member reinforcement anchorage	OCFMRA	11628
Longitudinal reinforcement in special moment frame is spliced		11717
Special flexural member reinforcement splice requirement	SFMLRS	11719

DECISION TABLE

		1	2	E
1	Ordinary concrete flexural member reinforcement requirement = satisfied	Y	Y	
2	Ordinary concrete flexural member moment resistance requirement = satisfied	Y	Y	
3	Ordinary concrete flexural member reinforcement anchorage = satisfied	Y	Y	
4	Longitudinal reinforcement in special moment frame is spliced = true	N	Y	
5	Special flexural member reinforcement splice requirement = satisfied	.	Y	
1	SCFMRR = satisfied	X	X	
2	SCFMRR = violated			X

COMMENTS:

1. Section 11.7.1 (A) refers to section 11.6 thus: "Longitudinal reinforcement shall comply with the requirements of Sec. 11.6 and ..." That reference could be interpreted three ways: (i) the entire section, including web reinforcement provisions, (ii) all those provisions primarily related to longitudinal reinforcement, or (iii) only the limits on reinforcement ratios. Option (ii) was assumed here.
2. Section 11.7.1 (A) contains a paragraph pertaining to the anchorage of flexural member reinforcement in columns that is not shown in this decision table because condition 3 refers to essentially identical provisions.

DATUM: Special concrete flexural member reinforcement splice requirement

SECTION: 11.7.1 (A) LABEL: SFMLRS NUMBER: 11719

INGREDIENTS

Datum	Label	Number
Type of reinforcement splice		11720
Hoop or spiral reinforcement provided over the lap length		11722
Spacing of hoop or spiral lap reinforcement		11723
Effective depth of flexural member	(d)	11654
Location of lap splice		11725
Requirement of Section 7.5.5.1 of Reference 11.1		11726
Requirement of Section 7.5.5.2 of Reference 11.1		11728
Not more than alternate bars in a layer spliced at a section		11729
Longitudinal distance between splices of adjacent bars		11731

DECISION TABLE

	DECISION TABLE	1	2	3	E
1	Type of reinforcement splice = lap	Y	-	-	
2	Type of reinforcement splice = welded	-	Y	-	
3	Type of reinforcement splice = mechanical	-	-	Y	
4	Hoop or spiral reinforcement provided over the lap length = true	Y	.	.	
5	Spacing of hoop or spiral lap reinforcement ≦ MIN [d/4, 4"]	Y	.	.	
6	Location of lap splice = within a joint <u>or</u> within 2d of a joint <u>or</u> where flexual yielding may occur	N	.	.	
7	Requirement of Section 7.5.5.1 of Reference 11.1 = satisfied	.	Y	.	
8	Requirement of Section 7.5.5.2 of Reference 11.1 = satisfied	.	.	Y	
9	Not more than alternate bars in a layer spliced at a section = true	.	+	+	
10	Longitudinal distance between splices of adjacent bars ≧ 24"	.	Y	Y	
1	SFMLRS = satisfied	X	X	X	
2	SFMLRS = violated				X

COMMENTS:

1. For all the rules of interest, condition 10 predetermines the value of condition 9.

DATUM: Special concrete flexural member lateral reinforcement requirement

SECTION: 11.7.1 (B) LABEL: SCFMLR NUMBER: 11732

INGREDIENTS

Datum	Label	Number
Special concrete flexural member design shear requirement	SCFMDS	11734
Special concrete flexural member hoop reinforcement requirement	SCRMHR	11741

	DECISION TABLE	1	E
1	Special concrete flexural member design shear requirement = satisfied	Y	
2	Special concrete flexural member hoop reinforcement requirement = satisfied	Y	
	**********		
1	SCFMLR = satisfied	X	
2	SCFMLR = violated		X

DATUM: Special concrete flexural member design shear requirement

SECTION: 11.7.1 (B) LABEL: SCFMDS NUMBER: 11734

INGREDIENTS

Datum	Label	Number
Member end moments taken as max resist moments of opp sign		11735
Member assumed to loaded with tributary gravity load		11737
Max resist moment calculated without capacity reduct factor		11738
Max resist moment calculated with tensile stress of 1.25 FY		11740

	DECISION TABLE	1	E
1	Member end moments taken as max resist moments of opp sign = true	Y	
2	Member assumed to loaded with tributary gravity load = true	Y	
3	Max resist moment calculated without capacity reduct factor = true	Y	
4	Max resist moment calculated with tensile stress of 1.25 FY = true	Y	
	**********		
1	SCFMDS = satisfied	X	
2	SCFMDS = violated		X

DATUM: Special concrete flexural member hoop reinforcement requirement

SECTION: 11.7.1 (B) LABEL: SCFMHR NUMBER: 11741

INGREDIENTS

Datum	Label	Number
Location requires hoop reinforcement	LRHR	11743
Hoops provided for web reinforcement		11661
Reqt of Ref 11.1 for lateral support of long. bars with ties		11747
Distance from face of joint to first lateral reinforcement		11682
Spacing of lateral reinforcement within l_o		11678
Effective depth of flexural member	(d)	11654
Diameter of smallest longitudinal bar	(dl)	11696
Diameter of tie bar	(dt)	11674

DECISION TABLE

	DECISION TABLE	1	2	E
1	Location requires hoop reinforcement = true	N	Y	
2	Hoops provided for web reinforcement = true	.	Y	
3	Reqt of Ref. 11.1 for lateral support of long. bars with ties = satisfied	.	Y	
4	Distance from face of joint to first lateral reinforcement $\leq$ 2"	Y	Y	
5	Spacing of lateral reinforcement within $l_o \leq$ MIN [d/4, 8(dl), 24(dt), 12"]			
1	SCFMHR = satisfied	X	X	
2	SCFMHR = violated			X

DATUM: Location requires hoop reinforcement

SECTION: 11.7.1 (B) LABEL: LRHR NUMBER: 11743

INGREDIENTS

Datum	Label	Number
Distance from end of concrete flexural member		11650
Distance from point of potential yield in concrete flexural member		11744
Compression reinforcement required to provide resistance		11746
Effective depth of flexural member	(d)	11654

DECISION TABLE

		1	2	3	4
1	Distance from end of concrete flexural member $\leq$ 2d	Y	N	N	N
2	Distance from point of potential yield in concrete flexural member $\leq$ 2d	.	Y	N	N
3	Compression reinforcement required to provide resistance = true	.	.	Y	N
1	LRHR = true	X	X	X	
2	LRHR = false				X

DATUM: Special concrete beam column requirement

SECTION: 11.7.2 LABEL: SCBCR NUMBER: 11749

INGREDIENTS

Datum	Label	Number
Minimum cross section dimension through centroid		11750
Cross section dimension orthogonal to minimum		11752
Special concrete beam column flexural strength requirement	SCBCFS	11753
Special concrete beam column reinforcement requirement	SCBCRR	11761
Special concrete beam column lateral reinforcement requirement	SCBCLR	11765

DECISION TABLE

		1	E
1	Minimum cross section dimension through centroid $\geq$ 12"	Y	
2	Minimum cross section dimension through centroid ÷ Cross section dimension orthogonal to minimum $\geq$ 0.4	Y	
3	Special concrete beam column flexural strength requirement = satisfied	Y	
4	Special concrete beam column reinforcement requirement = satisfied	Y	
5	Special concrete beam column lateral reinforcement requirement = satisfied	Y	
1	SCBCR = satisfied	X	
2	SCBCR = violated		X

DATUM: Special concrete beam column flexural strength requirement

SECTION: 11.7.2 (A) LABEL: SCBCFS NUMBER: 11753

INGREDIENTS

Datum	Label	Number
Sum of flexural strength of columns at joint	YSFSCJ	11755
Sum of flexural strength of beams at joint	YSFSBJ	11756
Shear redistributed accounting for omission of non conforming joints		11758
Columns framing into conforming joints resist all seismic shear		11759
Special concrete beam column lateral reinforcement requirement	SCBCLR	11765

DECISION TABLE

		1	2	E
1	Sum of flexural strength of columns at joint > Sum of flexural strength of beams at joint (for all joints)	Y	N	
2	Shear redistributed accounting for omission of non conforming joints = true	.	Y	
3	Columns framing into conforming joints resist all seismic shear = true	.	Y	
4	Special concrete beam column lateral reinforcement requirement = satisfied (for full length of columns framing into non conforming joints)	.	Y	
1	SBCFSR = satisfied	X	X	
2	SBCFSR = violated			X

DATUM: Sum of flexural strength of columns at joint

SECTION: 11.7.2(A) LABEL: YSFSCJ NUMBER: 11755

(and)

DATUM: Sum of flexural strength of beams at joint

SECTION: 11.7.2(A) LABEL: YSFSBJ NUMBER: 11756

(both are evaluated in the same manner)

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210

DATUM: Special concrete beam column reinforcement requirement

SECTION: 11.7.2 (B) LABEL: SCBCRR NUMBER: 11761

INGREDIENTS

Datum	Label	Number
Reinforcement ratio in beam column		11762
Type of reinforcement splice		11720
Location of lap splice		11725
Lap splice proportioned as a tension splice		11764
Special flexural member reinforcement splice requirement	SFMLRS	11719

	DECISION TABLE	1	2	3	4	E
1	Reinforcement ratio in beam column ≧ 0.01	Y	Y	Y	Y	
2	Reinforcement ratio in beam column ≦ 0.06	Y	Y	Y	Y	
3	Type of reinforcement splice = lap	N	Y	-	-	
4	Type of reinforcement splice = welded	N	-	Y	-	
5	Type of reinforcement splice = mechanical	N	-	-	Y	
6	Location of lap splice = within center half of member span	.	Y	.	.	
7	Lap splice proportioned as a tension splice = true	.	Y	.	.	
8	Special flexural member reinforcement splice requirement = satisfied	.	.	Y	Y	
1	SCBCRR = satisfied	X	X	X	X	
2	SCBCRR = violated					X

COMMENTS:

1. Note that the requirements for splicing reinforcement in section 11.7.1 (A) (datum 11719) are almost the same as those in this datum.

DATUM: Special concrete beam column lateral reinforcement requirement

SECTION: 11.7.2 (C) LABEL: SCBCLR NUMBER: 11765

INGREDIENTS

Datum	Label	Number
Yield strength of lateral reinforcement		11766
Yield strength of longitudinal reinforcement		11767
Point of contraflexure located in middle half of member		11768
Dist from ea joint or sec of yield where lat reinf provided		11664
Minimum distance for special lateral reinforcement	XMDSLR	11770
Lateral reinforcement provided throughout member		11771
Minimum amount of special lateral reinforcement requirement	MASLRR	11773
Cross sectional distance between ties		11774
Lap of overlapping hoops		11775
Special concrete beam column design shear requirement	SCBCDS	11777

DECISION TABLE

		1	2	E
1	Yield strength of lateral reinforcement ≤ Yield strength of longitudinal reinforcement	Y	Y	
2	Point of contraflexure located in middle half of member = true	Y	N	
3	Dist from ea joint or sec of yield where lat reinf provided ≥ Minimum distance for special lateral reinforcement	Y	+	
4	Lateral reinforcement provided throughout member = true	.	Y	
5	Minimum amount of special lateral reinforcement requirement = satisfied	Y	Y	
6	Cross sectional distance between ties ≤ 14" <u>or</u> Lap of overlapping hoops ≤ 14"	Y	Y	
7	Special concrete beam column design shear requirement = satisfied (for lateral reinforcement)	Y	Y	
1	SCBCLR = satisfied	X	X	
2	SCBCLR = violated			X

COMMENTS:

1. Condition 6 does not seem applicable to sections with spirals or circular ties.

DATUM: Minimum distance for special lateral reinforcement

SECTION: 11.7.2 (C) LABEL: XMDSLR NUMBER: 11770

INGREDIENTS

Datum	Label	Number
Clear height of column	(HC)	11690
Effective depth of flexural member	(d)	11654

FUNCTION:

XMDSLR = MAX [d, HC/6, 18"]

DATUM: Minimum amount of special lateral reinforcement requirement

SECTION: 11.7.2 (C) LABEL: MASLRR NUMBER: 11773

INGREDIENTS

Datum	Label	Number
Type of lateral reinforcement		11778
Volumetric ratio of lateral reinforcement		11779
Nominal concrete compressive strength	(FC)	11250
Yield strength of lateral reinforcement	(FYL)	11766
Gross area of concrete	(AG)	11280
Cross sect area of component measured to outside of S.L.R.	(AC)	11781
Cross sect core dimension to outside of special lat reinforcement	(h)	11782
Area of web reinforcement	(Aw)	11656
Spacing of web reinforcement	(s)	11652
Minimum cross section dimension through centroid	(b)	11750

DECISION TABLE

		1	2	E
1	Type of lateral reinforcement = spiral or circular hoop	Y	-	
2	Type of lateral reinforcement = rectangular hoop	-	Y	
3	Volumetric ratio of lateral reinforcement $\geqq$ 0.12 FC/FYL	Y	.	
4	Area of web reinforcement $\geqq s(h)\frac{FC}{FYL}(MAX\ [0.12,\ 0.3\ (\frac{AG}{AC} - 1)])$			
5	Spacing of web reinforcement $\leqq$ MIN [4", b/4]	Y	Y	
1	MASLRR = satisfied	X	X	
2	MASLRR = violated			X

DATUM: Special concrete beam column design shear requirement

SECTION: 11.7.2 (C) LABEL: SCBCDS NUMBER: 11777

INGREDIENTS

Datum	Label	Number
Member end moments taken as max resist moments of opp sign		11735
Member assumed to be loaded with applicable static forces		11783
Max resist moment calculated without capacity reduct factor		11738
Member axial force assumed to be max design compression force		11785

DECISION TABLE

			1	E
1	Member end moments taken as max resist moments of opp sign = true	*	Y	
2	Member assumed to be loaded with applicable static forces = true	*	Y	
3	Max resist moment calculated without capacity reduct factor = true	*	Y	
4	Member axial force assumed to be max design compression force = true	*	Y	
	**			
1	SCBCDS = satisfied	*	X	
2	SCBCDS = violated	*		X

COMMENTS:

1. It is instructive to note the similarities and differences between this datum and datum 11734.

DATUM: Special concrete moment frame joint requirement

SECTION: 11.7.3 LABEL: SCMFJR NUMBER: 11786

INGREDIENTS

Datum	Label	Number
Lateral reinforcement provided throughout joint		11787
Minimum amount of special lateral reinforcement reqt	MASLRR	11773
Cross sectional distance between ties		11774
Lap of overlapping hoops		11775
Joint shear stress calculation requirement	SCJSSC	11789
Maximum allowable shear stress in joint requirement	MAJSSR	11790
Joint design shear force requirement	JDSFR	11797

DECISION TABLE

		1	E
1	Lateral reinforcement provided throughout joint = true	Y	
2	Minimum amount of special lateral reinforcement reqt = satisfied (within joint)	Y	
3	Cross sectional distance between ties $\leq$ 14" <u>or</u> Lap of overlapping hoops $\leq$ 14"	Y	
4	Joint shear stress calculation requirement = satisfied	Y	
5	Maximum allowable shear stress in joint requirement = satisfied	Y	
6	Joint design shear force requirement = satisfied	Y	
1	SCMFJR = satisfied	X	
2	SCMFJR = violated		X

COMMENTS:

1. Condition 3 does not seem applicable to sections with spirals or circular hoops.

DATUM: Joint shear stress calculation requirement

SECTION: 11.7.3 LABEL: SCJSSC NUMBER: 11789

INGREDIENTS

Datum	Label	Number
Shape of cross section		11795
Shear stress in joint		11788
Joint design shear force	(v)	11792
Width of flexural member	(b)	11713
Effective depth of flexural member	(d)	11654
Cross sect area of component measured to outside of S.L.R.	(AC)	11781

DECISION TABLE

			1	2	E
1	Shape of cross section = rectangular	*	Y	N	
2	Shear stress in joint = v/bd	*	Y	.	
3	Shear stress in joint = v/AC	*	.	Y	
	**				
1	SCJSSC = satisfied	*	X	X	
2	SCJSSC = violated	*			X

COMMENTS:

1. Ingredient datum 11792 would properly be a dependent of the total combined load effect, but it is not shown so in this analysis, for the same reason as discussed on datum 11290.

DATUM: Maximum allowable shear stress in joint requirement

SECTION: 11.7.3 LABEL: MAJSSR NUMBER: 11790

INGREDIENTS

Datum	Label	Number
Nominal concrete compressive strength	(FC)	11250
Weight of concrete aggregate		11260
Joint type	JTYPE	11791
Modified allowable stress		11796

DECISION TABLE

			1	2	3	4	E
1	Joint type = laterally confined	*	Y	Y	N	N	
2	Weight of concrete aggregate = normal	*	Y	-	Y	-	
3	Weight of concrete aggregate = light	*	-	Y	-	Y	
4	Modified allowable stress $\leq 16\sqrt{FC}$	*	Y	+	+	+	
5	Modified allowable stress $\leq 12\sqrt{FC}$	*	.	Y	Y	+	
6	Modified allowable stress $\leq 9\sqrt{FC}$	*	.	.	.	Y	
1	MAJSSR = satisfied	*	X	X	X	X	
2	MAJSSR = violated	*					X

COMMENTS:

1. This effectively modifies the strength taken from the reference document.

DATUM: Joint type

SECTION: 11.7.3 and 2.1 LABEL: JTYPE NUMBER: 11791

INGREDIENTS

Datum	Label	Number
Oppos face in direction of seis force confined by monolithic member		11793
Members cover 75% of width and depth		11794

DECISION TABLE

			1	E
1	Oppos face in direction of seis force confined by monolithic member = true	*	Y	
2	Members cover 75% of width and depth = true	*	Y	
	**			
1	JTYPE = laterally confined	*	X	
2	JTYPE = not laterally confined	*		X

DATUM: Joint design shear force requirement

SECTION: 11.7.3 LABEL: JDSFR NUMBER: 11797

INGREDIENTS

Datum	Label	Number
Joint shear force determined from static forces and joint moments		11798
Joint moments assumed to be max resist moments of members		11799
Max resist moment calculated without capacity reduction factor		11738
Max resist moment calculated with tensile stress of 1.25 FY		11740

DECISION TABLE

			1	E
1	Joint shear force determined from static forces and joint moments = true	*	Y	
2	Joint moments assumed to be max resist moments of members = true	*	Y	
3	Max resist moment calculated without capacity reduction factor = true	*	Y	
4	Max resist moment calculated with tensile stress of 1.25 FY = true	*	Y	
	**			
1	JDSFR = satisfied	*	X	
2	JDSFR = violated	*		X

DATUM: Category C and D concrete shear wall, braced frame and diaphragm requirement

SECTION: 11.8 LABEL: SWBFDR NUMBER: 11800

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Category C and D concrete shear wall requirement	CDCSWR	11818
Category C and D concrete diaphragm requirement	CCDCDR	11835
Category C and D concrete braced frame requirement	CDCBFR	11880
Category C and D concrete reinf splice and anchorage reqt	CRSAR	11881
Category C and D concrete construction joint requirement	CDCCJR	11888

DECISION TABLE

		1	2	3	4	E
1	Component = concrete shear wall	Y	-	-	N	
2	Component = concrete braced frame	-	Y	-	N	
3	Component = concrete diaphragm	-	-	Y	N	
4	Category C and D concrete shear wall requirement = satisfied	Y	.	.	.	
5	Category C and D concrete diaphragm requirement = satisfied	.	Y	.	.	
6	Category C and D concrete braced frame requirement = satisfied	.	.	Y	.	
7	Category C and D concrete reinf splice and anchorage reqt = satisifed	Y	Y	Y	.	
8	Category C and D concrete construction joint requirement = satisfied	Y	Y	Y	.	
1	SWBFDR = satisfied	X	X	X	X	
2	SWBFDR = violated					X

DATUM: Category C and D concrete shear wall and diaphragm reinforcement requirement

SECTION: 11.8 LABEL: CSWDRR NUMBER: 11802

INGREDIENTS

Datum	Label	Number
Minimum wall or diaphragm reinforcement ratio		11804
Spacing of wall or diaphragm reinforcement		11806
Wall or diaphragm reinforcement for shear is continuous		11808
Wall or diaphragm reinforcement for shear is uniformly distributed		11810

DECISION TABLE

		1	E
1	Minimum wall or diaphragm reinforcement ratio $\geq$ 0.0025	Y	
2	Spacing of wall of diaphragm reinforcement $\leq$ 18"	Y	
3	Wall or diaphragm reinforcement for shear is continuous = true	Y	
4	Wall or diaphragm reinf for shear is uniformly distributed = true	Y	
1	CSWDRR = satisfied	X	
2	CSWDRR = violated		X

COMMENTS:

1. Conditions 1 and 2 refer to the reinforcement in both directions that are within the plane of the wall or diaphragm.

DATUM: Category C and D concrete shear wall and diaphragm shear stress limit

SECTION: 11.8 LABEL: SWDSSL NUMBER: 11812

INGREDIENTS

Datum	Label	Number
Weight of concrete aggregate		11260
Maximum shear stress		11814
Nominal concrete compressive strength	(FC)	11250
Specified yield stress	(FY)	11550
Ratio of horizontal shear reinforcement	(ph)	11816

DECISION TABLE

			1	2	E
1	Weight of concrete aggregate = light	*	N	Y	
2	Maximum shear stress $\leqq 2\sqrt{FC} + (ph)(FY)$	*	Y	+	
3	Maximum sheer stress $\leqq 1.5\sqrt{FC} + 0.75\,(ph)(FY)$	*	.	Y	
	**				
1	SWDSSL = satisfied	*	X	X	
2	SWDSSL = violated	*			X

COMMENTS:

1. This provision effectively modifies the strength from the reference document.
2. The text contains an ambiguity that is reflected in datum 11816: in diaphragms, both directions of interest are normally horizontal.

DATUM: Category C and D concrete shear wall requirement

SECTION: 11.8.1 LABEL: CDCSWR NUMBER: 11818

INGREDIENTS

Datum	Label	Number
Category C and D concrete shear wall detailing requirement	CCDSWD	11820
Category C and D concrete shear wall strength requirement	CDCSWS	11832
General framing class	GFC	3303
Actual compressive stress	YCU	11833
Nominal concrete compressive strength	(FC)	11250
Category C and D concrete boundary member requirement	CDCBMR	11846
Category C and D concrete shear wall and diaphragm opening reqt	CSWDOR	11840

DECISION TABLE

	DECISION TABLE		1	2	3	E
1	Category C and D concrete shear wall detailing requirement = satisfied	*	Y	Y	Y	
2	Category C and D concrete shear wall strength requirement = satisfied	*	Y	Y	Y	
3	Category C and D concrete shear wall and diaphragm opening reqt = satisfied	*	Y	Y	Y	
4	General framing class = Dual System	*	Y	N	N	
5	(General framing class = Bearing Wall or Building Frame)	*	-	+	+	
6	Actual compressive stress > 0.2 (FC)	*	.	Y	N	
7	Category C and D concrete boundary member requirement = satisfied	*	Y	Y	.	
	**					
1	CDCSWR = satisfied	*	X	X	X	
2	CDCSWR = violated	*				X

COMMENTS:

1. The text is somewhat ambiguous: "shear walls in Dual Systems and shear walls in Building Frame or Bearing Wall systems having design compressive stresses in excess of $0.2f'_c$.. shall have boundary members." The ambiguity is in whether the condition on compressive stress applies to Dual systems or not. In preparing this decision table it was assumed that the condition does not apply to Dual Systems.
2. The fifth condition is determined by the value of the fourth condition. No systems other than those shown there may have concrete shear walls.

DATUM: Category C and D concrete shear wall detailing requirement

SECTION: 11.8.1 LABEL: CCDSWD NUMBER: 11820

INGREDIENTS

Datum	Label	Number
Category C and D concrete shear wall and diaphragm reinf reqt	CSWDRR	11802
Ratio of horizontal shear reinforcement		11816
Ratio of vertical shear reinforcement		11822
Horizontal wall reinforcement spliced		11824
Location of splices staggered		11826
Number of curtains of reinforcement in wall		11828
Each curtain spliced in different location		11830
Maximum shear stress		11814
Nominal concrete compressive strength	(FC)	11250

DECISION TABLE

		1	2	3	4	E
1	Category C and D concrete shear wall and diaphragm reinf reqt = satisfied	Y	Y	Y	Y	
2	Ratio of horizontal shear reinforcement = Ratio of vertical shear reinforcement	Y	Y	Y	Y	
3	Horizontal wall reinforcement spliced = true	N	N	Y	Y	
4	Location of splices staggered = true	.	.	Y	Y	
5	Number of curtains of reinforcement in wall > 1	Y	N	Y	N	
6	Each curtain spliced in different location = true	.	.	Y	.	
7	Maximum shear stress > 2 $\sqrt{FC}$	.	Y	.	Y	
1	CCDSWD = satisfied	X	X	X	X	
2	CCDSWD = violated					X

COMMENTS:

1. Note that condition 2 calls for reinforcement ratios that are precisely equal in two directions.
2. Condition 7 effectively modifies the strength from the reference document.

DATUM: Category C and D concrete shear wall strength requirement

SECTION: 11.8.1 LABEL: CDCSWS NUMBER: 11832

INGREDIENTS

Datum	Label	Number
Category C and D conc shear wall and diaphragm shear stress limits	SWDSSL	11812
Element of building (component)		2114
Maximum shear stress		11814
Nominal concrete compressive strength	(FC)	11250

DECISION TABLE

			1	2	E
1	Category C and D conc shear wall and diaphragm shear stress limit = satisfied	*	Y	Y	
2	Component = individual pier or horizontal component between piers	*	Y	N	
3	Component = entire wall	*	-	Y	
4	Maximum shear stress $\leq 8 \sqrt{FC}$	*	.	Y	
5	Maximum shear stress $\leq 10 \sqrt{FC}$	*	Y	+	
	**				
1	CDCSWS = satisfied	*	X	X	
2	CDCSWS = violated	*			X

COMMENTS:

1. This provision effectively modifies the strength from the reference document.

DATUM: Actual compressive stress

SECTION: 11.8.1 LABEL: YCU NUMBER: 11833

(and)

DATUM: Actual compressive stress where boundary member discontinued

SECTION: 11.8.4 LABEL: YCUD NUMBER: 11834

(both are calculated in the same manner)

INGREDIENTS

Datum	Label	Number
Required strength	RS	3702
Elastic analysis of gross cross section		11831

COMMENTS:

1. This stress is to be calculated with the ingredients shown. It is used as a switch to determine the need for boundary members in shear walls and diaphragms.

DATUM: Category C and D concrete diaphragm requirement

SECTION: 11.8.2 LABEL: CCDCDR NUMBER: 11835

INGREDIENTS

Datum	Label	Number
Category C and D concrete shear wall and diaphragm reinf reqt	CSWDRR	11802
Category C and D conc shear wall and diaphragm shear stress limit	SWDSSL	11812
Actual compressive stress	YCU	11833
Nominal concrete compressive strength	(FC)	11250
Category C and D concrete boundary member requirement	CDCBMR	11846
Concrete diaphragm composition		11836
Cast-in-place topping designed to resist all shear		11838
Category C and D concrete shear wall and diaphragm opening reqt	CSWDOR	11840

DECISION TABLE

		1	2	3	4	E
1	Category C and D concrete shear wall and diaphragm reinf reqt = satisifed	Y	Y	Y	Y	
2	Category C and D conc shear wall and diaphragm shear stress limit = satisfied	Y	Y	Y	Y	
3	Actual compressive stress > 0.2 (FC)	N	N	Y	Y	
4	Category C and D concrete boundary member requirement = satisfied	.	.	Y	Y	
5	Concrete diaphragm composition = cast-in-place topping over precast floor	N	Y	N	Y	
6	Cast-in-place topping designed to resist all shear = true	.	Y	.	Y	
7	Category C and D concrete shear wall and diaphragm opening reqt = satisfied	Y	Y	Y	Y	
1	CCDCDR = satisfied	X	X	X	X	
2	CCDCDR = violated					X

DATUM: Category C and D concrete shear wall and diaphragm opening requirement

SECTION: 11.8.3 LABEL: CSWDOR NUMBER: 11840

INGREDIENTS

Datum	Label	Number
Shear wall or diaphragm contains opening		11842
Openings provided with boundary members		11844
Category C and D concrete boundary member requirement	CDCBMR	11846
Actual compressive stress	YCU	11833
Nominal concrete compressive strength	(FC)	11250

DECISION TABLE

		1	2	3	E
1	Shear wall or diaphragm contains opening = true	N	Y	Y	
2	Openings provided with boundary members = true and Category C and D concrete boundary member requirement = satisfied	.	Y	N	
3	Actual compressive stress < 0.2 (FC)	.	.	Y	
1	CSWDOR = satisfied	X	X	X	
2	CSWDOR = violated				X

DATUM: Category C and D concrete boundary member requirement

SECTION: 11.8.4 LABEL: CDCBMR NUMBER: 11846

INGREDIENTS

Datum	Label	Number
Category C and D concrete boundary member material requirement	CBMMR	11858
Category C and D concrete boundary member axial strength requirement	CBMASR	11862
Boundary member continuously attached to wall or diaphragm		11848
Location of boundary member		11850
Orientation of boundary member		11851
Boundary member discontinued		11852
Actual compression stress at location where bound member discontinued	YCUD	11834
Nominal concrete compressive strength	(FC)	11250
Horizontal wall reinf anchored in boundary member to develop yield		11856

DECISION TABLE

		1	2	3	E
1	Category C and D concrete boundary member material requirement = satisfied	Y	Y	Y	
2	Category C and D concrete boundary member axial strength requirement = satisfied	Y	Y	Y	
3	Boundary member continuously attached to wall or diaphragm = true	Y	Y	Y	
4	Location of boundary member = edge of shear wall and Orientation of boundary member = vertical	Y	N	-	
5	Location of boundary member = edge of opening	-	N	Y	
6	Horizontal wall reinf anchored in boundary member to develop yield = true	Y	.	.	
7	Boundary member discontinued = true	.	.	N	
8	Actual compression stress at location where bound member discontinued < 0.15 (FC)	Y	Y	.	
1	CDCBMR = satisfied	X	X	X	
2	CDCBMR = violated				X

COMMENTS:

1. Condition 7 shows immaterial entries in rules 1 and 2 because it is a permissive provision.

DATUM: Category C and D concrete boundary member material requirement

SECTION: 11.8.4 LABEL: CBMMR NUMBER: 11858

INGREDIENTS

Datum	Label	Number
Type of boundary member		11860
Steel materials requirement	SMR	10001
Special concrete beam column lateral reinforcement requirement	SCBCLR	11765

DECISION TABLE

		1	2	E
1	Type of boundary member = steel encased in concrete	Y	-	
2	Type of boundary member = reinforced concrete	-	Y	
3	Steel materials requirement = satisfied	Y	.	
4	Special concrete beam column lateral reinforcement requirement = satisfied (for full length of boundary member)	.	Y	
1	CBMMR = satisfied	X	X	
2	CBMMR = violated			X

COMMENTS:

1. The requirement referenced in condition 4 requires a member to be designed for a shear force, which does not seem to be applicable to boundary members.

DATUM: Category C and D concrete boundary member axial strength requirement

SECTION: 11.8.4 LABEL: CBMASR NUMBER: 11862

INGREDIENTS

Datum	Label	Number
Location of boundary member		11850
Orientation of boundary member		11851
Axial resistance of concrete boundary member	YAXRB	11864
Total gravity load on wall	YTGL	11866
Vertical forces from seismic overturning moment	YVOM	11868
Axial force in diaphragm	ZAXD	11870
Seismic moment in diaphragm	YMD	11872
Depth of diaphragm		11874
Strength of section removed for opening	YSO	11876
Bound member anchored to develop yield strength at edge of opening		11878

DECISION TABLE

		1	2	3	4	5	E
1	Location of boundary member = edge of shear wall	Y	Y	-	-	N	
2	Location of boundary member = edge of diaphragm	-	-	Y	-	N	
3	Location of boundary member = edge of opening	-	-	-	Y	N	
4	Orientation of boundary member = vertical	N	Y	-	.	.	
5	Axial resistance of concrete boundary member > Total gravity load on wall + Vertical forces from seismic overturning moment	.	Y	.	.	.	
6	Axial resistance of concrete boundary member > Axial force in diaphragm + Seismic moment in diaphragm ÷ Depth of diaphragm	.	.	Y	.	.	
7	Axial resistance of concrete boundary member > Strength of section for opening	.	.	.	Y	.	
8	Boundary member anchored to develop yield strength at edge of opening = true	.	.	.	Y	.	
1	CBMASR = satisfied	X	X	X	X	X	
2	CBMASR = violated						X

COMMENTS:

1. This strength requirement adds significantly to the general strength requirement, datum 3120.

DATUM: Axial resistance of concrete boundary member

SECTION: 11.8.4 LABEL: YAXRB NUMBER: 11864

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210

COMMENTS:

1. Although there are special rules for determining the design load on boundary members, the strength available is apparently calculated in the standard fashion.

DATUM: Total gravity load on wall

SECTION: 11.8.4 LABEL: YTGL NUMBER: 11866

INGREDIENTS

Datum	Label	Number
Dead load effect	YQD	3707
Live load effect	YQL	3708
Snow load effect	YQS	3710

COMMENTS:

1. The normal assumption would be to simply sum the ingredients.

DATUM: Vertical forces from seismic overturning moment

SECTION: 11.8.4 LABEL: YVOM NUMBER: 11868

INGREDIENTS

Datum	Label	Number
Earthquake force effect	QE	3706

COMMENTS:

1. Apparently the boundary member design load is to include all of the vertical force from the seismic overturning moment.

DATUM: Axial force in diaphragm

SECTION: 11.8.4 LABEL: ZAXD NUMBER: 11870

COMMENTS:

1. It is not clear as to what the source of the axial force in a diaphragm would be.

DATUM: Seismic moment in diaphragm

SECTION: 11.8.4 LABEL: YMD NUMBER: 11872

INGREDIENTS

Datum	Label	Number
Earthquake force effect	QE	3706

COMMENTS:

1. The method of calculation of the seismic moment in a diaphragm which is supported by more than two lines of walls or frames is not specified.

DATUM: Strength of section removed for opening

SECTION: 11.8.4 LABEL: YSO NUMBER: 11876

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210

DATUM: Category C and D concrete braced frame requirement

SECTION: 11.8.5 LABEL: CDCBFR NUMBER: 11880

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Axial force due to all loads	ZAXALL	11290
Nominal concrete compressive strength	(FC)	11250
Gross area of concrete	(AG)	11280
Special concrete beam column requirement	SCBCR	11749

DECISION TABLE

		1	2	3	E
1	Component = member of braced frame <u>or</u> member of horizontal truss <u>or</u> tie member <u>or</u> collector member	N	Y	Y	
2	Axial force due to all loads > 0.2 (FC)(AG)	.	N	Y	
3	Special concrete beam column requirement = satisfied	.	Y	+	
4	Special concrete beam column requirement = satisfied (for full length of member)	.	.	Y	
1	CDCBFR = satisfied	X	X	X	
2	CDCBFR = violated				X

COMMENTS:

1. Sections 11.5 and 11.8, which control the applicability of this provision, make no mention of horizontal trusses, ties, or collector members; thus the application of this provision is unclear. Furthermore, the word "tie" has several different meanings: a type of lateral reinforcement, a link between two parts of a building, a link between two components of the foundation, etc.
2. It is not clear that the special concrete beam column requirement is entirely applicable to members that are not part of a "moment" frame.
3. It might be more clear to simply modify the required length for provision of special lateral reinforcement, if that is what is intended in condition 4.

DATUM: Category C and D concrete reinforcement splice and anchorage requirement

SECTION: 11.8.6 LABEL: CRSAR NUMBER: 11881

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Splices satisfy provisions of Ref 11.1 for tension splices		11882
Anchorages satisfy provisions of Ref 11.1 for tension anchorages		11884
Development length reduced for excess steel area		11886

DECISION TABLE

	DECISION TABLE	1	2	E
1	Component = continuous reinforcement in shear walls, diaphragms, trusses, struts, ties, chords, or collectors	N	Y	
2	Splices satisfy provisions of Ref 11.1 for tension splices = true	.	Y	
3	Anchorages satisfy provisions of Ref 11.1 for tension anchorages = true	.	Y	
4	Development length reduced for excess steel area = true	.	N	
	************************************			
1	CRSAR = satisfied	X	X	
2	CRSAR = violated			X

COMMENTS:

1. Comment 1 on datum 11880 is applicable to condition 1.

DATUM: Category C and D concrete construction joint requirement

SECTION: 11.8.6 LABEL: CDCCJR NUMBER: 11888

INGREDIENTS

Datum	Label	Number
Element contains construction joint		11890
Surface of joint thoroughly roughened		11892
Shear resisted solely by friction and dowel action		11893
Maximum shear at joint		11894
Capacity reduction factor for concrete	PHIC	11230
Area of reinforcement normal to construction joint	(AV)	11896
Specified yield stress	(FY)	11550
Sum of seismic and minimum gravity forces normal to joint	(PN)	11898

DECISION TABLE

		1	2	3	E
1	Element contains construction joint = true	N	Y	Y	
2	Surface of joint thoroughly roughened = true	.	Y	Y	
3	Shear resisted solely by friction and dowel action = true	.	N	Y	
4	Maximum shear at joint ≦ PHIC [AV (FY) + 0.75 PN]	.	.	Y	
1	CDCCJR = satisfied	X	X	X	
2	CDCCJR = violated				X

COMMENTS:

1. This effectively modifies the strength from the reference document.

DATUM: Masonry materials requirement

SECTION: Chapter 12 LABEL: MMR NUMBER: 12001

INGREDIENTS

Datum	Label	Number
Building elements that resist seismic force		9110
Requirements of chapter 12A and references		12110
Masonry strength calculation procedure requirement	ZMSCPR	12200
Masonry design category requirement	MDESCR	12002

DECISION TABLE

			1	2	E
1	Building elements that resist seismic force include masonry materials	*	N	Y	
2	Requirements of chapter 12A and references = satisfied (as modified by conditions 3 and 4)	*	.	Y	
3	Masonry strength calculation procedure requirement = satisfied	*	.	Y	
4	Masonry design category requirement = satisfied	*	.	Y	
1	MMR = satisfied	*	X	X	
2	MMR = violated	*			X

DATUM: Masonry design category requirement

SECTION: Chapter 12 LABEL: MDESCR NUMBER: 12002

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Category A masonry requirement	ZCAMR	12300
Category B masonry requirement	CBMR	12400
Category C masonry requirement	CCMR	12500
Category D masonry requirement	CDMR	12600

DECISION TABLE

		1	2	3	4	5
1	Seismic performance category = A	Y	-	-	N	
2	Seismic performance category = B	-	Y	-	N	
3	Seismic performance category = C	-	-	Y	N	
4	(Seismic performance category = D)	-	-	-	+	
5	Category A masonry requirement = satisfied	+	+	+	+	
6	Category B masonry requirement = satisfied	.	Y	+	+	
7	Category C masonry requirement = satisfied	.	.	Y	+	
8	Category D masonry requirement = satisfied	.	.	.	Y	

		1	2	3	4	5
1	MDESCR = satisfied	X	X	X	X	
2	MDESCR = violated					X

COMMENTS:

1. See the comment on datum 12300 concerning condition 5.

DATUM: Masonry strength calculation procedure requirement

SECTION: 12.2 LABEL: ZMSCPR NUMBER: 12200

INGREDIENTS

Datum	Label	Number
Strength of masonry components	XSM	12210

COMMENT:

1. See the comments for datum 9200.

DATUM: Strength of masonry components

SECTION: 12.2 LABEL: XSM NUMBER: 12210

INGREDIENTS

Datum	Label	Number
Capacity reduction factor for masonry	PHIM	12220
Allowable strength of masonry component	ASM	12225

FUNCTION:

XSM = 2.5 (PHIM) ASM

COMMENT:

1. It is unclear whether this same function applies to unreinforced masonry. Section 12.2.1 does give a strength, but does not specify as to whether it is an "allowable" strength or a "design" strength.

DATUM: Capacity reduction factor for masonry

SECTION: 12.2 LABEL: PHIM NUMBER: 12220

INGREDIENTS

Datum	Label	Number
Stress type		9240
Element of building (component)		2114
Angle between tension stress and bed joint		12240

DECISION TABLE

		1	2	3	4	5	6	E
1	Component = masonry	Y	-	-	Y	Y	Y	
2	Component = reinforcement or bolt	-	Y	Y	-	-	-	
3	Stress type = axial or flexural compression or bearing	Y	.	-	-	-	-	
4	Stress type = shear	-	N	Y	-	Y	-	
5	Stress type = tension	-	.	-	Y	-	Y	
6	Angle between tension stress and bed joint = 0° (parallel)	.	.	.	Y	.	-	
7	Angle between tension stress and bed joint = 90° (perpendicular)	.	.	.	-	.	Y	
1	PHIM = 1.0	X						
2	PHIM = 0.8		X					
3	PHIM = 0.6			X	X			
4	PHIM = 0.4					X		
5	PHIM = 0						X	
E	PHIM = ?							X

COMMENTS:

1. The text is not clear as to how condition 4 ("stress type = shear") should be evaluated in rules 2 and 3. The check could be on the member as a whole or only on the reinforcement and/or bolts.
2. This section of text seems to imply separate reduction factors for the masonry and the reinforcement in the same component, thus introducing a "partial factor" design approach.
3. There are three ELSE rules: 1) for components other than masonry, reinforcement, or bolts; 2) for stress types other than those listed; and 3) for an angle between the tension stress and bed joint other than 0° or 90°.

```
C1  + + C5  + + C6  + + R4
 -       -       -
 -       -       -  - - C7  + + R6
 -       -               -
 -       -               -  - ELSE
 -       -
 -       -  - - C3  + + R1
 -               -
 -               -  - - C4  + + R5
 -                       -
 -                       -  - ELSE
 -
 -  - - C2  + + C4  + + R3
         -       -
         -       -  - - R2
         -
         -  - ELSE
```

DATUM: Allowable strength of masonry component

SECTION: 12.2, 12.2.1 LABEL: ASM NUMBER: 12225

INGREDIENTS

Datum	Label	Number
Allowable working stress from chapter 12A		12230
Level of reinforcement in masonry		12245
Unreinforced masonry design procedure requirement	UMDPR	12250

DECISION TABLE

			1	2
1	Level of reinforcement in masonry = unreinforced	*	Y	N
2	Unreinforced masonry design procedure requirement = satisfied	*	Y	.
	********			
1	ASM = function of Unreinforced masonry design procedure requirement	*	X	
2	ASM = Allowable working stress from chapter 12A	*		X

COMMENTS:

1. See comment 1 on datum 12210.

DATUM: Unreinforced masonry design procedure requirement

SECTION: 12.2.1 LABEL: UMDPR NUMBER: 12250

INGREDIENTS

Datum	Label	Number
General unreinforced masonry design procedure requirement	GUMDR	12253
Alternate unreinforced masonry design procedure requirement	AUMDR	12256

DECISION TABLE

			1	2	E
1	General unreinforced masonry design procedure requirement = satisfied	*	Y	N	
2	Alternate unreinforced masonry desing procedure requirement = satisfied	*	.	Y	
	********				
1	UMDPR = satisfied	*	X	X	
2	UMDPR = violated	*			X

DATUM: General unreinforced masonry design procedure requirement

SECTION: 12.2.1(A) LABEL: GUMDR NUMBER: 12253

INGREDIENTS

Datum	Label	Number
Requirement of Ref. section 12A.6.1		12258
Tension zone of unreinforced masonry assumed cracked		12259
Compression stress distributed linearly		12262
Compression stress in equilibrium with loads		12265
Source of maximum allowable stress		12268
Masonry bond type		12274
Plane of bending is plane of component		12277
Bed joints contain cracked zone		12280
Member position		3791

DECISION TABLE

		1	2	E
1	Requirement of Ref. section 12A.6.1 = satisfied	Y	Y	
2	Tension zone of unreinforced masonry assumed cracked = true	Y	-	
3	Compression stress distributed linearly = true	Y	Y	
4	Compression stress in equilibrium with loads = true	Y	Y	
5	Source of maximum allowable stress = table 12A-3 of Ref. chapter 12A	Y	Y	
6	Masonry bond type = stacked <u>and</u> Plane of bending is plane of component = true <u>and</u> Member position = vertical	N	Y	
7	Bed joints contain cracked zone = true	.	N	
1	GUMDR = satisfied	X	X	
2	GUMDR = violated			X

COMMENTS:

1. Condition 4 is redundant when considering the strength requirement in chapter 3.

DATUM: Alternate unreinforced masonry design procedure requirement

SECTION: 12.2.1(B) LABEL: AUMDR NUMBER: 12256

INGREDIENTS

Datum	Label	Number
Requirement of Ref section 12A.6.2		12283
Bending is in one direction (principal axis) only		12292
Bending is about both principal axes		12295
Ratio of e/t (from chapter 12A)		12286
Ratio Re (from chapter 12A)		12289
Stiffness and strength of masonry in cracked zone ignored		12298
Masonry bond type		12274
Member position		3791
Plane of bending is plane of component		12277
Bed joints contain cracked zone		12280

DECISION TABLE

		1	2	3	4	E
1	Requirement of Ref section 12A.6.2 = satisfied	Y	Y	Y	Y	
2	Bending is in one direction (principal axis) only = true	Y	N	Y	N	
3	(Bending is about both principal axes = true)	−	+	−	+	
4	Ratio of e/t (from chapter 12A) $\leq$ 1/6	Y	.	Y	.	
5	Ratio Re (from chapter 12A) $\leq$ 1/6	.	Y	.	Y	
6	Stiffness and strength of masonry in cracked zone ignored = true	.	.	.	.	
7	Masonry bond type = stacked and Plane of bending is plane of component = true and Member position = vertical	N	N	Y	Y	
8	Bed joints contain cracked zone = true	.	.	N	N	
1	AUMDR = satisfied	X	X	X	X	
2	AUMDR = violated					X

COMMENTS:

1. The wording of the text from which condition 2 was drawn leaves open the possibility of bending in one direction which would cause bending about both principal axes. It was assumed that the intent was that the e/t ratio be checked when bending was on only one principal axis.
2. Condition 6 is shown with all immaterial entries because it is an option for the designers. It is unclear as to why section 12.2.1(B) uses slightly different wording than section 12.2.1(A), so a new datum was created (12298 versus 12259).

DATUM: Category A masonry requirement

SECTION: 12.3 LABEL: ZCAMR NUMBER: 12300

COMMENTS:

1. This datum only makes reference to the reference chapter for masonry, which is already referenced for all situations by the root datum of this chapter. It is only icluded because it is specifically called out in the text of chapters 3 and 12.

DATUM: Category B masonry requirement

SECTION: 12.4 LABEL: CBMR NUMBER: 12400

INGREDIENTS

Datum	Label	Number
Category A masonry requirement	ZCAMR	12300
Category B masonry height limitation	CBMHL	12403
Category B masonry anchor bolt tie requirement	CBMCTR	12409
Category B masonry screen wall requirement	CBMCWR	12430
Category B nonstructural masonry requirement	CBNSMR	12454
Masonry construction type		12466
Component is part of structural system		12469
Category B masonry material limitation	CBMML	12472
Category B mortar requirement	CBMMR	12496
Masonry shear wall requirement	MSWR	12700

DECISION TABLE

		1	E
1	Category A masonry requirement = satisfied	+	
2	Category B masonry height limitation = satisfied	Y	
3	Category B masonry anchor bolt tie requirement = satisfied	Y	
4	Category B masonry screen wall requirement = satisfied	Y	
5	Category B nonstructural masonry requirement = satisfied	Y	
6	Masonry construction type = cavity wall and Component is part of structural system = true	N	
7	Category B masonry material limitation = satisfied	Y	
8	Category B mortar requirement = satisfied	Y	
9	Masonry shear wall requirement = satisfied	Y	
1	CBMR = satisfied	X	
2	CBMR = violated		X

COMMENTS:

1. See datum 12300 for a comment about condition 1.

DATUM: Category B masonry height limitation

SECTION: 12.4.1(A) LABEL: CBMHL NUMBER: 12403

INGREDIENTS

Datum	Label	Number
Total height		2227
Masonry bond type		12274
Level of reinforcement in masonry		12245
Component is part of seismic resisting system		12406
Material of component or system		2115

	DECISION TABLE	1	2	3	4	5	E
1	Total height < 35'	Y	Y	Y	N	N	
2	Component is part of seismic resisting system = true <u>and</u> Material of component or system = masonry	N	Y	Y	.	N	
3	Masonry bond type = stacked	.	.	N	.	.	
4	(Masonry bond type = running)	.	.	+	.	.	
5	Level of reinforcement in masonry = unreinforced	.	-	-	-	-	
6	Level of reinforcement in masonry = partially reinforced	.	-	Y	-	Y	
7	Level of reinforcement in masonry = reinforced	.	Y	N	Y	N	
1	CBMHL = satisfied	X	X	X	X	X	
2	CBMHL = violated						X

COMMENTS:

1. In writing condition 4 and rule 3, it was assumed that if the bond is not stacked, then it is some type of running bond.

DATUM: Category B masonry anchor bolt tie requirement

SECTION: 12.4.1(B) LABEL: CBMCTR NUMBER: 12409

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Location of anchor bolt		11350
Requirement of Ref section 12A.6.3(F)		12412
Ties provided around anchor bolts in masonry		12415
Level of reinforcement in masonry		12245
Ties engage at least 4 vertical bars in masonry column		12418
Distance of ties from top of masonry		12421
Size of ties around anchor bolts in masonry		12424
Number of ties around anchor bolts in masonry		12427

DECISION TABLE

		1	2	3	4	5	E
1	Component = anchor bolt and Location of anchor bolt = top of masonry column or pilaster	N	Y	Y	Y	Y	
2	Requirement of Ref section 12A.6.3(F) = satisfied	.	Y	Y	Y	Y	
3	Tie provided around anchor bolts in masonry = true	.	Y	Y	Y	Y	
4	Level of reinforcement in masonry = reinforced	.	N	N	Y	Y	
5	Ties engage at least 4 vertical bars in masonry column = true	.	.	.	Y	Y	
6	Distance of ties from top of masonry $\leq$ 4"	.	Y	Y	Y	Y	
7	Size of ties around anchor bolts in masonry = #3	.	Y	-	Y	-	
8	Size of ties around anchor bolts in masonry = #4	.	-	Y	-	Y	
9	Number of ties around anchor bolts in masonry $\geq$ 2	.	+	Y	+	Y	
10	Number of ties around anchor bolts in masonry $\geq$ 3	.	Y	.	Y	.	
1	CBMCTR = satisfied	X	X	X	X	X	
2	CBMCTR = violated						X

COMMENTS:

1 Note the similarity with the category A concrete anchor bolt requirement, datum 11340.

DATUM: Category B masonry screen wall requirement

SECTION: 12.4.1(D) LABEL: CBMCWR NUMBER: 12430

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Level of reinforcement in masonry		12245
Joint reinf considered effect in resisting tens and compr stress		12433
Joint is continuous without offset		12436
Area of joint reinforcement		12439
Joint reinforcement embeded in mortar or grout		12442
Type of masonry joint reinforcement		12445
Joint reinforcement spliced		12448
Width of joint reinforcement		12451

DECISION TABLE

			1	2	3	E
1	Component = masonry screen wall	*	N	Y	Y	
2	Level of reinforcement in masonry = reinforced	*	.	Y	Y	
3	Joint reinf considered effect in resist tens and compr stress = true	*	.	Y	Y	
4	Joint is continuous without offset = true for at least one direction	*	.	Y	Y	
5	Area of joint reinforcement $\geq$ 0.03 in^2 in continuous joint	*	.	Y	Y	
6	Joint reinforcement embeded in mortar or grout = true	*	.	Y	Y	
7	Type of masonry joint reinforcement = two wires with truss	*	.	.	-	
8	Type of masonry joint reinforcement = two wires with ladder	*	.	N	Y	
9	Joint reinforcement spliced = true	*	.	.	N	
10	Width of joint reinforcement = widest that allows 1/2" cover	*	.	.	Y	
1	CBMCWR = satisfied	*	X	X	X	
2	CBMCWR = violated	*				X

COMMENTS:

1. Condition 4 is not very specific. It is not clear how many joints must be continuous or what the maximum spacing between them might be.
2. Condition 7 is taken from a permissive statement.

DATUM: Category B nonstructural masonry requirement

SECTION: 12.4.1(E) LABEL: CBNSMR NUMBER: 12454

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Component designed to support self weight and seismic force		12457
Holes suitably strengthened and stiffened		12460
Requirement of Ref section 12A.2.6		12463

DECISION TABLE

			1	2	3	
1	Component = nonstructural masonry	*	N	Y	Y	
2	Component designed to support self weight and seismic force = true	*	.	Y	Y	
3	Holes suitably strengthened and stiffened = true	*	.	Y	Y	
4	Component = wall or partition	*	.	N	Y	
5	Requirement of Ref section 12A.2.6 = satisfied	*	.	.	Y	
********	********	*	********	********	********	********
1	CBNSMR = satisfied	*	X	X	X	
2	CBNSMR = violated	*				X

COMMENTS:

1. Condition 3 is somewhat vague.

DATUM: Category B masonry material limitation

SECTION: 12.4.2 LABEL: CBMML NUMBER: 12472

INGREDIENTS

Datum	Label	Number
Masonry material		12475
Masonry unit type		12478
Masonry grade		12481
Configuration of masonry unit		12484
Load class of masonry unit		12487

	DECISION TABLE	1	2	3	4	5	6	7	E
1	Masonry material = unburned clay	Y	-	-	-	-	-	-	
2	Masonry material = clay or shale	-	Y	-	-	-	-	Y	
3	Masonry material = sand/lime	-	-	Y	-	-	-	-	
4	Masonry material = concrete	-	-	-	Y	Y	Y	-	
5	Masonry unit type = brick	.	Y	Y	Y	-	-	-	
6	Masonry unit type = tile	.	-	-	-	-	-	Y	
7	Masonry unit type = block	.	-	-	-	Y	Y	-	
8	Masonry grade = NW	.	Y	.	.	.	.	.	
9	Masonry grade = SW or MW	.	-	N	.	.	.	.	
10	Masonry grade = N	.	-	.	N	N	N	.	
11	Configuration of masonry unit = solid	.	.	.	.	Y	-	-	
12	Configuration of masonry unit = hollow	.	.	.	.	-	Y	+	
13	Load class of masonry unit = load bearing	.	.	.	.	Y	Y	Y	
1	CBMML = satisfied								X
2	CBMML = violated	X	X	X	X	X	X	X	

DATUM: Category B masonry mortar requirement

SECTION: 12.4.2 LABEL: CBMMR NUMBER: 12496

INGREDIENTS

Datum	Label	Number
Mortar type		12490
Type of cement for mortar and grout		12493

DECISION TABLE

			1	E
1	Mortar type = M or S	*	Y	
2	Type of cement for mortar and grout = masonry cement	*	N	
	**			
1	CBMMR = satisfied	*	X	
2	CBMMR = violated	*		X

DATUM: Category C masonry requirement

SECTION: 12.5 LABEL: CCMR NUMBER: 12500

INGREDIENTS

Datum	Label	Number
Category B masonry requirement	CBMR	12400
Level of reinforcement in masonry		12245
Category C masonry tie anchorage requirement	CCMTAR	12503
Category C masonry column requirement	CCMCR	12518
Category C masonry shear wall boundary requirement	CCMSWB	12566
Category C masonry joint reinforcement requirement	CCMJRR	12569
Category C stacked bond requirement	CCSBR	12578
Category C masonry material limitation	CCMML	12590

DECISION TABLE

	DECISION TABLE	1	E
1	Category B masonry requirement = satisfied	Y	
2	Level of reinforcement in masonry = reinforced for all masonry	Y	
3	Category C masonry tie anchorage requirement = satisfied	Y	
4	Category C masonry column requirement = satisfied	Y	
5	Category C masonry shear wall boundary requirement = satisfied	Y	
6	Category C masonry joint reinforcement requirement = satisfied	Y	
7	Category C stacked bond requirement = satisfied	Y	
8	Category C masonry material limitation = satisfied	Y	
1	CCMR = satisfied	X	
2	CCMR = violated		X

DATUM: Category C masonry tie anchorage requirement

SECTION: 12.5.1(B) LABEL: CCMTAR NUMBER: 12503

INGREDIENTS

Datum	Label	Number
Requirement of Ref section 12A.6.3(D)		12506
Turn angle at anchorage of masonry tie		12509
Extension at anchorage of masonry tie		12512
Diameter of masonry tie bar	(d)	12515

DECISION TABLE

			1	E
1	Requirement of Ref section 12A.6.3(D) = satisfied for all ties	*	Y	
2	Turn angle at anchorage of masonry tie ≧ 135°	*	Y	
6	Extension at anchorage of masonry tie ≧ MAX [6d, 4"]	*	Y	
1	CCMTAR = satisfied	*	X	
2	CCMTAR = violated	*		X

DATUM: Category C masonry column requirement

SECTION: 12.5.1(C) LABEL: CCMCR NUMBER: 12518

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Material of component or system		2115
Masonry column bar support requirement	MCBSR	12560
Masonry column tie spacing requirement	MCTSR	12563

DECISION TABLE

			1	2	E
1	Component = reinforced masonry column	*	N	Y	
2	Masonry column bar support requirement = satisfied	*	.	Y	
3	Masonry column tie spacing requirement = satisfied	*	.	Y	
1	CCMCR = satisfied	*	X	X	
2	CCMCR = violated	*			X

DATUM: Masonry column bar support requirement

SECTION: 12.5.1(C) LABEL: MCBSR NUMBER: 12560

INGREDIENTS

Datum	Label	Number
Requirement of Ref section 12A.6.3(F)		12412
Distance from longitudinal bar to laterally supported bar		12524
Longitudinal bar location		12527
Cross tie used to provide lateral support from opposite face		12530

DECISION TABLE

		1	2	E
1	Requirement of Ref section 12A.6.3(F) = satisfied	Y	Y	
2	Distance from longitudinal bar to laterally supported bar $\leq$ 6" for any bar	Y	Y	
3	Longitudinal bar location = corner	Y	N	
4	Cross tie used to provide lateral support from opposite face = true	N	.	
1	MCBSR = satisfied	X	X	
2	MCBSR = violated			X

COMMENTS:

1. Cross ties are defined in chapter 2 of the Provisions.

DATUM: Masonry column tie spacing requirement

SECTION: 12.5.1(C) LABEL: MCTSR NUMBER: 12563

INGREDIENTS

Datum	Label	Number
Masonry column is boundary member of masonry shear wall		12533
Masonry column resists axial stress from EQ overturning forces		12536
Distance from top and bot of mas col with close tie spacing		12539
Maximum dimension of masonry column		12542
Clear column height	(h)	12545
Diameter of longitudinal reinf in masonry column	(d)	12548
Smallest dimension of masonry column	(b)	12551
Spacing of ties in portion of mas col with close spacing		12554
Spacing of ties in portion of mas col with wide spacing		12557
Diameter of masonry tie bar	(dt)	12515

DECISION TABLE

		1	2	3	E
1	Masonry column is boundary member of masonry shear wall = true	N	Y	N	
2	Masonry column resists axial stress from EQ overturning forces = true	N	.	Y	
3	Distance from top and bot of mas col with close tie spacing = entire column	.	Y	Y	
4	Distance from top and bot of mas col with close tie spacing ≧ MAX [h/6, 18", b]	Y	+	+	
5	Spacing of ties in portion of mas col with close spacing ≦ MIN [16d, 8"]	Y	Y	Y	
6	Spacing of ties in portion of mas col with wide spacing ≦ MIN [16d, 48dt, b, 18"]	Y	.	.	
1	MCTSR = satisfied	X	X	X	
2	MCTSR = violated				X

DATUM: Category C masonry shear wall boundary requirement

SECTION: 12.5.1(D) LABEL: CCMSWB NUMBER: 12566

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Material of component or system		2115
Category C and D concrete boundary member requirement	CDCBMR	11846
Category C masonry column requirement	CCMCR	12518

DECISION TABLE

			1	2	3	E
1	Component = boundary member in masonry shear wall	*	N	Y	Y	
2	Material = steel or reinforced concrete	*	.	Y	-	
3	Material = masonry	*	.	-	Y	
4	Category C and D concrete boundary member requirement = satisfied	*	.	Y	.	
5	Category C masonry column requirement = satisfied	*	.	.	Y	
	**					
1	CCMSWB = satisfied	*	X	X	X	
2	CCMSWB = violated	*				X

DATUM: Category C masonry joint reinforcement requirement

SECTION: 12.5.1(E) LABEL: CCMJRR NUMBER: 12569

INGREDIENTS

Datum	Label	Number
Masonry construction type		12466
Configuration of masonry unit		12484
Longitudinal joint reinf used to fulfill minimum reinf reqt		12572
Longitudinal joint reinf used in determining strength		12575

DECISION TABLE

		1	2	E
1	Masonry construction type = grouted <u>or</u> Configuration of masonry unit = hollow	N	Y	
2	Longitudinal joint reinf used to fulfill minimum reinf reqt = true	.	.	
3	Longitudinal joint reinf used in determining strength = true	.	N	
1	CCMJRR = satisfied	X	X	
2	CCMJRR = violated			X

COMMENTS:

1. Condition 2 is taken from a permissive statement.

DATUM: Category C stacked bond requirement

SECTION: 12.5.1(F) LABEL: CCSBR NUMBER: 12578

INGREDIENTS

Datum	Label	Number
Masonry bond type		12274
Spacing of horizontal reinforcement		12581
Ratio of horizontal reinforcement in masonry		12584
Component is part of seismic resisting system		12406
Configuration of masonry unit		12484
Masonry construction type		12466
Level of reinforcement in masonry		12245

DECISION TABLE

	DECISION TABLE	1	2	3	E
1	Masonry bond type = stacked	N	Y	Y	
2	Spacing of horizontal reinforcement ≦ 24"	.	Y	Y	
3	Ratio of horizontal reinforcement in masonry ≧ 0.0015	.	Y	Y	
4	Component is part of seismic resisting system = true <u>and</u> Configuration of masonry unit = hollow <u>and</u> Level of reinforcement in masonry = reinforced	.	N	Y	
5	Masonry construction type = grouted solid <u>and</u> Configuration of masonry unit = open end	.	.	Y	
1	CCSBR = satisfied	X	X	X	
2	CCSBR = violated				X

DATUM: Category C masonry material limitation

SECTION: 12.5.2 LABEL: CCMML NUMBER: 12590

INGREDIENTS

Datum	Label	Number
Masonry material		12475
Masonry unit type		12478
Load class of masonry unit		12487

DECISION TABLE

			1	2	E
1	Masonry material = clay or shale	*	Y	-	
2	Masonry material = glass	*	-	Y	
3	Masonry unit type = tile	*	Y	.	
4	Load class of masonry unit = non-loadbearing	*	Y	.	
	***				
1	CCMML = satisfied	*			X
2	CCMML = violated	*	X	X	

COMMENTS:

1. The text also refers to the category B masonry materials limitation. This is not referenced in this decision table because it is already a part of the blanket reference to category B requirements made in datum 12500.

DATUM: Category D masonry requirement

SECTION: 12.6 LABEL: CDMR NUMBER: 12600

INGREDIENTS

Datum	Label	Number
Category C masonry requirement	CCMR	12500
Category D mortar and grout requirement	CDMGR	12602
Category D grout space requirement	CDGSR	12614
Category D hollow unit masonry requirement	CDRHMR	12620
Category D stacked bond requirement	CDSBR	12666
Category D masonry materials limitation	CDMML	12676
Component is part of structural system		12469
Actual special inspection		1652

DECISION TABLE

		1	2	E
1	Category C masonry requirement = satisfied	Y	Y	
2	Component is part of structural system = true	Y	N	
3	Category D mortar and grout requirement = satisfied	Y	.	
4	Category D grout space requirement = satisfied	Y	.	
5	Category D hollow unit masonry requirement = satisfied	Y	.	
6	Category D stacked bond requirement = satisfied	Y	Y	
7	Category D masonry materials limitation = satisfied	Y	Y	
8	Actual special inspection = continuous	Y	.	
1	CDMR = satisfied	X	X	
2	CDMR = violated			X

COMMENTS:

1. Condition 8 is incompletely stated in section 12.6.3. It was assumed that the statement is intended to agree with section 1.6.

DATUM: Category D mortar and grout requirement

SECTION: 12.6.1 LABEL: CDMGR NUMBER: 12602

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Suitably calibrated device used to measure materials		12604
Grout contains approved admixture for water loss and expansion		12608
Grout will not develop shrinkage cracks		12610
Thickness of grout between masonry and reinforcement		12612

DECISION TABLE

		1	2	3	4	E
1	Component = mortar for structural masonry	N	Y	-	-	
2	Component = grout for structural masonry	N	-	Y	Y	
3	Suitably calibrated device used to measure materials = true	.	Y	Y	Y	
4	Grout contains approved admixture for water loss and expansion = true	.	.	Y	N	
5	Grout will not develop shrinkage cracks = true	.	.	.	Y	
6	Thickness of grout between masonry and reinforcement $\geq$ 1/2"	.	.	Y	Y	
1	CDMGR = satisfied	X	X	X	X	
2	CDMGR = violated					X

COMMENTS:

1. Suitably calibrated devices are not defined except that shovels are explicitly excluded.

DATUM: Category D grout space requirement

SECTION: 12.6.1(A) LABEL: CDGSR NUMBER: 12614

INGREDIENTS

Datum	Label	Number
Type of grout lift		12616
Minimum grout space		12618

DECISION TABLE

		1	2	E
1	Type of grout lift = low	Y	N	
2	(Type of grout lift = high)	-	+	
3	Minimum grout space ≥ 2-1/2"	Y	+	
4	Minimum grout space ≥ 3-1/2"	.	Y	
1	CDGSR = satisfied	X	X	
2	CDGSR = violated			X

DATUM: Category D hollow unit masonry requirement

SECTION: 12.6.1(B) LABEL: CDRHMR NUMBER: 12620

INGREDIENTS

Datum	Label	Number
Configuration of masonry unit		12484
Level of reinforcement in masonry		12245
Component is part of structural system		12469
Hollow masonry vertical cells requirement	HMVCR	12622
Hollow masonry grout requirement	HMGR	12632
Hollow masonry reinforcement support requirement	HMRSR	12642
Hollow masonry bar size requirement	HMBSR	12656
First exception of Ref section 12A.6.3(F) applied		12664
Smallest dimension of masonry column		12551

DECISION TABLE

		1	2	E
1	Configuration of masonry unit = hollow <u>and</u> Level of reinforcement in masonry = reinforced <u>and</u> Component is part of structural system = true	N	Y	
2	Hollow masonry vertical cells requirement = satisfied	.	Y	
3	Hollow masonry grout requirement = satisfied	.	Y	
4	Hollow masonry reinforcement support requirement = satisfied	.	Y	
5	Hollow masonry bar size requirement = satisfied	.	Y	
6	First exception of Ref section 12A.6.3(F) applied = true	.	N	
7	Smallest dimension of masonry column ≥ 12" nominal	.	Y	
1	CDRHMR = satisfied	X	X	
2	CDRHMR = violated			X

DATUM: Hollow masonry vertical cells requirement

SECTION: 12.6.1(B)1 LABEL: HMVCR NUMBER: 12622

INGREDIENTS

Datum	Label	Number
Wythe and element thickness		12624
All vertical cells are clear, continuous and no offsets		12626
Diameter of largest circle enclosed by vertical cells		12628
Area of vertical cell		12630

DECISION TABLE

			1	E
1	Wythe and element thickness ≥ 8" nominal	*	Y	
2	All vertical cells are clear, continuous and no offsets = true	*	Y	
3	Diameter of largest circle enclosed by vertical cells ≥ 3.5"	*	Y	
4	Area of vertical cell ≥ 15 in^2	*	Y	
	********			
1	HMVCR = satisfied	*	X	
2	HMVCR = violated	*		X

DATUM: Hollow masonry grout requirement

SECTION: 12.6.1(B)2 LABEL: HMGR NUMBER: 12632

INGREDIENTS

Datum	Label	Number
Type of grout aggregate		12634
Type of consolidation used for grout		12636
Grout reconsolidation after excess moisture absorbed		12638
Grout reconsolidation before workability lost		12640

DECISION TABLE

			1	E
1	Type of grout aggregate = coarse	*	Y	
2	Type of consolidation used for grout = mechanical	*	Y	
3	Grout reconsolidation after excess moisture absorbed = true	*	Y	
4	Grout reconsolidation before workability lost = true	*	Y	
	********			
1	HMGR = satisfied	*	X	
2	HMGR = satisfied	*		X

DATUM: Hollow masonry reinforcement support requirement

SECTION: 12.6.1(B)3 LABEL: HMRSR NUMBER: 12642

INGREDIENTS

Datum	Label	Number
Locations of secure support for vertical reinforcement		12644
Maximum distance between supports of vertical reinf		12646
Diameter of vertical reinforcement in masonry	(d)	12648
Type of grout lift		12616
Supports for vertical bars at intermediate location approved		12650
Horizontal reinforcement securely tied to vertical reinf		12652
Equivalent support provided for horizontal reinf		12654

DECISION TABLE

		1	2	E
1	Locations of secure support for vertical reinforcement = at least at top, bottom, and each splice	Y	Y	
2	Maximum distance between supports of vertical reinf $\leq$ 112 (d)	Y	Y	
3	Type of grout lift = high	N	Y	
4	Supports for vertical bars at intermediate location approved = true	.	Y	
5	Horizontal reinforcement securely tied to vertical reinf = true <u>or</u> Equivalent support provided for horizontal reinf = true	Y	Y	
1	HMRSR = satisfied	X	X	
2	HMRSR = violated			X

DATUM: Hollow masonry bar size requirement

SECTION: 12.6.1(B)4 LABEL: HMBSR NUMBER: 12656

INGREDIENTS

Datum	Label	Number
Wythe and element thickness		12624
Size of vertical reinforcement bar		12658
Number of vertical bars in one cell		12660
Splices of vertical bars staggered		12662

DECISION TABLE

		1	2	3	E
1	Wythe and element thickness < 10" nominal	N	Y	Y	
2	Number of vertical bars in one cell = 1	.	Y	-	
3	Number of vertical bars in one cell = 2	.	-	Y	
4	Size of vertical reinforcement bar ≦ #10	.	Y	+	
5	Size of vertical reinforcement bar ≦ #8	.	.	Y	
6	Splices of vertical bars staggered = true	.	.	Y	
1	HMBSR = satisfied	X	X	X	
2	HMBSR = violated				X

DATUM: Category D stacked bond requirement

SECTION: 12.6.1(C) LABEL: CDSBR NUMBER: 12666

INGREDIENTS

Datum	Label	Number
Masonry bond type		12274
Stacked bond reinforcement requirement	SBRR	12668
Hollow stacked bond requirement	HSBR	12670

DECISION TABLE

		1	2	E
1	Masonry bond type = stacked	N	Y	
2	Stacked bond reinforcement requirement = satisfied	.	Y	
3	Hollow stacked bond requirement = satisfied	.	Y	
1	CDSBR = satisfied	X	X	
2	CDSBR = violated			X

DATUM: Stacked bond reinforcement requirement

SECTION: 12.6.1(C)1 LABEL: SBRR NUMBER: 12668

INGREDIENTS

Datum	Label	Number
Component is part of structural system		12469
Ratio of horizontal reinforcement in masonry		12584
Spacing of horizontal reinforcement		12581

DECISION TABLE

		1	2	E
1	Component is part of structural system = true	N	Y	
2	Ratio of horizontal reinforcement in masonry ≧ 0.0015	Y	+	
3	Ratio of horizontal reinforcement in masonry ≧ 0.0025	.	Y	
4	Spacing of horizontal reinforcement ≦ 24"	Y	+	
5	Spacing of horizontal reinforcement ≦ 16"	.	Y	
1	SBRR = satisfied	X	X	
2	SBRR = violated			X

DATUM: Hollow stacked bond requirement

SECTION: 12.6.1(C)2 and 12.6.1(C)3 LABEL: HSBR NUMBER: 12670

INGREDIENTS

Datum	Label	Number
Configuration of masonry unit		12484
Component is part of seismic resisting system		12406
Masonry construction type		12466

DECISION TABLE

		1	2	3	E
1	Configuration of masonry unit = hollow	N	Y	Y	
2	Component is part of seismic resisting system = true	.	N	Y	
3	Masonry construction type = grouted solid	.	Y	Y	
4	Configuration of masonry unit = double open end and Configuration of masonry unit = bond beam units	.	-	Y	
5	Configuration of masonry unit = open end	.	Y	-	
1	HSBR = satisfied	X	X	X	
2	HSBR = violated				X

DATUM: Category D masonry materials limitation

SECTION: 12.6.2 LABEL: CDMML NUMBER: 12676

INGREDIENTS

Datum	Label	Number
Configuration of masonry unit		12484
Load class of masonry unit		12487
Masonry unit type		12478
Masonry material		12475
Component is part of structural system		12469

DECISION TABLE

			1	2	E
1	Configuration of masonry unit = hollow	*	Y	.	
2	Load class of masonry unit = non-load bearing	*	Y	-	
3	Masonry unit type = block	*	Y	-	
4	Masonry unit type = brick	*	-	Y	
5	Masonry material = concrete	*	Y	-	
6	Masonry material = sand-lime	*	-	Y	
7	Component is part of structural system = true	*	-	Y	
	**				
1	CDMML = satisfied	*			X
2	CDMML = violated	*	X	X	

DATUM: Masonry shear wall requirement

SECTION: 12.7 and 12.4.1(C) LABEL: MSWR NUMBER: 12700

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Level of reinforcement in masonry		12245
Unreinforced masonry design procedure requirement	UMDPR	12250
Masonry shear wall reinforcement requirement	MSWRR	12702
Masonry shear wall boundary requirement	MSWBMR	12724
Masonry shear wall compression stress requirement	MSWCSR	12754
Masonry shear wall horizontal component requirement	MSWHCR	12764

DECISION TABLE

	DECISION TABLE	1	2	E
1	Seismic performance category = B and Level of reinforcement in masonry = partially reinforced and Unreinforced masonry design procedure requirement = satisfied	Y	N	
2	Masonry shear wall reinforcement requirement = satisfied	.	Y	
3	Masonry shear wall boundary requirement = satisfied	Y	Y	
4	Masonry shear wall compression stress requirement = satisfied	Y	Y	
5	Masonry shear wall horizontal component requirement = satisfied	Y	Y	
1	MSWR = satisfied	X	X	
2	MSWR = violated			X

DATUM: Masonry shear wall reinforcement requirement

SECTION: 12.7.1 LABEL: MSWRR NUMBER: 12702

INGREDIENTS

Datum	Label	Number
Ratio of horizontal reinforcement in masonry		12584
Ratio of vertical reinforcement		12704
Spacing of horizontal reinforcement		12581
Spacing of vertical reinforcement		12706
Length of masonry shear wall element	(l)	12708
Height of masonry shear wall element	(h)	12710
Area of shear reinforcement		12712
Spacing of shear reinforcement		12714
Area of reinforcement perpendicular to shear reinforcement		12716
Spacing of reinforcement perpendicular to shear reinforcement		12718
Shear reinforcement is uniformly distributed		12720
Shear reinf resists all shear on masonry shear wall		12722
Masonry bond type		12274

DECISION TABLE

	DECISION TABLE	1	2	E
1	Ratio of horizontal reinforcement in masonry ≧ 0.0015 <u>and</u> Ratio of vertical reinforcement ≧ 0.0015	Y	N	
2	Spacing of horizontal reinforcement ≦ MIN[l/3, h/3, 32"]	Y	Y	
3	Spacing of vertical reinforcement ≦ MIN[l/3, h/3, 32"]	Y	Y	
4	Area of reinforcement perpendicular to shear reinforcement ≧ Area of shear reinforcement	Y	Y	
5	Spacing of reinforcement perpendicular to shear reinf ≦ Spacing of shear reinforcement	Y	Y	
6	Shear reinforcement is uniformly distributed = true	Y	Y	
7	Shear reinf resists all shear on masonry shear wall = true	.	Y	
8	Masonry bond type = running	.	Y	
9	Ratio of horizontal reinforcement in masonry ≧ 0.0007 <u>and</u> Ratio of vertical reinforcement ≧ 0.0007	+	Y	
10	Ratio of horizontal reinforcement in masonry + Ratio of vertical reinforcement ≧ 0.0020	+	Y	
1	MSWRR = satisfied	X	X	
2	MSWRR = violated			X

COMMENTS:

1. The text refers to reinforcement "in each direction". This was asumed to mean horizontal and vertical.
2. The text sets an upper limit on the spacing of reinforcing as "one-third the length and height . . ." This was assumed to mean 1/3 of the length and 1/3 of the height in writing conditions 2 and 3.
3. The text refers to "the area and spacing . . . shall be at least equal . . ." It was assumed that the intent here was for the area to be larger and the spacing to be smaller that the object of comparison in writing conditions 4 and 5.

DATUM: Masonry shear wall boundary requirement

SECTION: 12.7.2 LABEL: MSWBMR NUMBER: 12724

INGREDIENTS

Datum	Label	Number
Masonry shear wall intersection requirement	MSWIR	12726
Vertical load system		3306
Boundary member provided at each end of each wall		12734
Boundary member design requirement	BMDR	12736
Boundary member anchorage requirement	BMAR	12746

DECISION TABLE

		1	2	E
1	Masonry shear wall intersection requirement = satisfied	Y	Y	
2	Vertical load system = essentially complete frame	N	Y	
3	Boundary member provided at each end of each wall = true	.	Y	
4	Boundary member design requirement = satisfied	.	Y	
5	Boundary member anchorage requirement = satisfied	.	Y	
1	MSWBMR = satisfied	X	X	
2	MSWBMR = violated			X

DATUM: Masonry shear wall intersection requirement

SECTION: 12.7.2 LABEL: MSWIR NUMBER: 12726

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Intersection construction satisfies wall requirement		12728
Intersection unites concrete with masonry shear wall		12730
Requirement of Ref section 12A.2.1		12732

DECISION TABLE

			1	2	3	E
1	Component = intersection of masonry shear wall with cross wall <u>or</u> boundary member	*	N	Y	Y	
2	Intersection construction satisfies wall requirement = true	*	.	Y	Y	
3	Intersection unites concrete with masonry shear wall = true	*	.	N	Y	
4	Requirement of Ref section 12A.2.1 = satisfied	*	.	.	Y	
	**					
1	MSWIR = satisfied	*	X	X	X	
2	MSWIR = violated	*				X

COMMENTS:

1. Condition 2 would introduce a loop if the text were taken literally, since this provision is a part of the shear wall requirements.

DATUM: Boundary member design requirement

SECTION: 12.7.2 LABEL: BMDR NUMBER: 12736

INGREDIENTS

Datum	Label	Number
Strength of vertical boundary member	YSVBM	12738
Effect of vertical load on masonry shear wall	YWVMSW	12740
Effect of vertical forces due to EQ	YWEVMS	12742
Boundary member material		12744
Frame material		3333
Frame response type		3327
Special steel moment frame requirement	SSMFR	10600
Special concrete moment frame requirement	SCMFR	11700

DECISION TABLE

		1	2	3	E
1	Strength of vertical boundary member ≥ Effect of vertical load on mas shear wall + Effect of vertical forces due to EQ	Y	Y	Y	
2	Boundary member mateial = Frame material	Y	Y	Y	
3	Frame response type = special	N	Y	Y	
4	Frame material = steel	.	Y	N	
5	(Frame material = concrete)	.	-	+	
6	Special steel moment frame requirement = satisfied for boundary member	.	Y	.	
7	Special concrete moment frame requirement = satisfied for boundary member	.	.	Y	
1	BMDR = satisfied	X	X	X	
2	BMDR = violated				X

COMMENTS:

1. Condition 1 effectively specifies the design load for the boundary members.
2. Previous provisions for special moment frames limit the choice to steel or concrete, thus condition 5 is predetermined by conditions 3 and 4.

DATUM: Strength of vertical boundary member

SECTION: 12.7.2 LABEL: YSVBM NUMBER: 12738

INGREDIENTS

Datum	Label	Number
Strength of concrete components and systems	SC	11210
Strength of steel components	XSS	10210

COMMENT:

1. All boundary members in masonry walls will be steel or concrete.

DATUM: Effect of vertical loads on masonry shear wall

SECTION: 12.7.2 LABEL: YWVMSW NUMBER: 12740

INGREDIENTS

Datum	Label	Number
Dead load		2146
Live load		2148

COMMENT:

1. Note that unlike datum 11866 for vertical boundary elements on concrete shear walls, this datum does not include the effect of snow load.

DATUM: Effect of vertical forces due to earthquake

SECTION: 12.7.2 LABEL: YWEVMS NUMBER: 12742

INGREDIENTS

Datum	Label	Number
Earthquake force effect	QE	3706

COMMENTS:

1. The equivalent provision in chapter 11 for concrete shear wall boundary members makes it clear that the vertical force is due to the earthquake overturning moment.

DATUM: Boundary member anchorage requirement

SECTION: 12.7.2 LABEL: BMAR NUMBER: 12746

INGREDIENTS

Datum	Label	Number
Horiz reinf in masonry shear wall anchored to boundary member		12748
Boundary member material		12744
Means of anchoring horiz reinf to boundary member		12750
Means of shear transfer to boundary member		12752

DECISION TABLE

			1	2	E
1	Horiz reinf in masonry shear wall anchored to boundary member = true	*	Y	Y	
2	Boundary member material = steel	*	N	Y	
3	(Boundary member material = concrete)	*	+	-	
4	Means of anchoring horiz reinf to boundary member = welding <u>or</u> embedment in grout encasing the boundary member	*	.	Y	
5	Means of shear transfer to boundary member = encasement in grout <u>or</u> dowels <u>or</u> bolts <u>or</u> lugs <u>or</u> other approved method	*	.	Y	
	********************************	*			
1	BMAR = satisfied	*	X	X	
2	BMAR = violated	*			X

DATUM: Masonry shear wall compression stress requirement

SECTION: 12.7.3 LABEL: MSWCSR NUMBER: 12754

INGREDIENTS

Datum	Label	Number
Load effect includes seismic force in plane		12756
Allowable compression stress in masonry shear wall		12758
Allowable working stress from chapter 12A		12230
Level of reinforcement in masonry		12245
Requirement of Ref section 12A.6.1		12258
Source of maximum allowable stress		12268
Allow working stress reduced for slenderness, if any		12760
Horiz unsupported distance considered in lieu of vert distance		12762
Element of building (component)		2114
Allowable working stress in flexure from chapter 12A		12763

DECISION TABLE

		1	2	3	4	5	E
1	Load effect includes seismic force in plane = true	N	Y	Y	Y	Y	
2	Allowable compression stress in masonry shear wall ≤ Allowable working stress from chapter 12A	.	Y	Y	N	N	
3	Component = pier that does not extend from floor to floor	.	.	.	Y	Y	
4	Level of reinforcement in masonry = unreinforced	.	Y	-	Y	-	
5	Level of reinforcement in masonry = reinforced	.	-	Y	-	Y	
6	Requirement of Ref section 12A.6.1 = satisfied	.	Y	.	Y	.	
7	Source of maximum allowable stress = Ref. table 12A-3	.	Y	-	Y	-	
8	Source of maximum allowable stress = Ref. table 12A-5	.	-	Y	-	Y	
9	Source of maximum allowable stress = Ref. formulas 12A-7	.	N	N	Y	Y	
10	Allow working stress reduced for slenderness, if any = true	.	.	Y	.	Y	
11	Horiz unsupported dist considered in lieu of vert dist = true	.	.	.	.	.	
12	Allowable compression stress in masonry shear wall ≤ Allowable working stress in flexure from chapter 12A	.	+	+	Y	Y	
1	MSWCSR = satisfied	X	X	X	X	X	
2	MSWCSR = violated						X

COMMENTS:

1. Analysis of the decision tree shows that this datum makes no provision for partially reinforced masonry.
2. Condition 11 was taken from a permissive statement.

DATUM: Masonry shear wall horizontal component requirement

SECTION: 12.7.4 LABEL: MSWHCR NUMBER: 12764

INGREDIENTS

Datum	Label	Number
Element of building (component)		2114
Seismic loads require shear reinforcement		12768
Diagonal shear reinforcement provided		12770
Requirement of Ref section 12A.6.4(D)		12772
Horizontal reinforcement anchored in piers		12774
Horizontal reinforcement continuous through piers		12776
Horizontal component separated from pier with joint		12778
Joint between pier and horiz component provides for movement		12780
Horizontal component anchored to building		12782
Area of shear reinforcement		12712
Spacing of shear reinforcement		12714
Area of reinforcement perpendicular to shear reinforcement		12716
Spacing of reinforcement perpendicular to shear reinforcement		12718

	DECISION TABLE	1	2	3	4	5	6	7	E
1	Component = horizontal element of masonry shear wall	N	Y	Y	Y	Y	Y	Y	
2	Seismic loads require shear reinforcement = true	.	N	N	Y	Y	Y	Y	
3	Diagonal shear reinforcement provided = true and Requirement of Ref section 12A.6.4(D) = satisfied	.	.	.	Y	Y	N	N	
4	Horizontal reinforcement anchored in piers = true or Horizontal reinforcement continuous through piers = true	.	Y	-	Y	-	Y	-	
5	Horizontal component separated from pier with joint = true	.	-	Y	-	Y	-	Y	
6	Joint between pier and horiz component provides for movement = true and Horizontal component anchored to building = true	.	.	Y	.	Y	.	Y	
7	Area of reinforcement perpendicular to shear reinforcement ≥ Area of shear reinforcement and Spacing of reinforcement perpendicular to shear reinf ≤ Spacing of shear reinforcement	.	.	.	.	.	Y	Y	
1	MSWHCR = satisfied	X	X	X	X	X	X	X	
2	MSWHCR = violated								X

COMMENTS:

1. This provision applies to the portions of shear walls between piers, such as below a window.
2. The text is not clear as to whether conditions 2, 3, and 4 are applicable to components separated by joints. In particular, it is difficult to see how conditions 2 and 5 can be true simultaneously.

DATUM: Systematic hazard abatement requirement

SECTION: Chapter 13 LABEL: SHAR NUMBER: 13001

and

DATUM: Hazard abatement requirement

SECTION: 13.3 LABEL: HAR NUMBER: 13301

INGREDIENTS

Datum	Label	Number
Chapter 13 adopted into provisions		13000

DECISION TABLE

			1	2
1	Chapter 13 adopted into provisions = true	*	N	Y
	**			
1	Systematic hazard abatement requirement = satisfied and Hazard abatement requirement = satisfied	*	X	
2	Systematic hazard abatement requirement and Hazard abatement requirement evaluated by following decision tables	*		X

COMMENTS:

1. This non-standard decision table is inserted simply to make the point that chapter 13 is optional. These two datums are the only ones in chapter 13 that are referenced from the other chapters.

DATUM: Systematic hazard abatement requirement

SECTION: Chapter 13 LABEL: SHAR NUMBER: 13001

INGREDIENTS

Datum	Label	Number
Chapter 13 adopted into provisions		13000
Extent of evaluation required	EXER	13110
Systematic evaluation requirement	SER	13200
Results of qualitative evaluation		13216
Results of analytical evaluation	RAE	13246
Hazard abatement requirement	HAR	13301

DECISION TABLE

	DECISION TABLE	1	2	3	4	E
1	Chapter 13 adopted into provisions = true	N	Y	Y	Y	
2	Extent of evaluation required = none	.	Y	N	N	
3	Systematic evaluation requirement = satisfied	.	.	Y	Y	
4	Results of qualitative evaluation = nonconforming <u>or</u> Results of analytical evaluation = nonconforming	.	.	N	Y	
5	Hazard abatement requirement = satisfied	.	.	.	Y	
1	SHAR = satisfied	X	X	X	X	
2	SHAR = violated					X

COMMENTS:

1. Some uncertainty exists as to what the possible results of qualitative analysis are. Section 13.2.1 lists two:
   1) ". . . capable of meeting the requirements . . .", and
   2) ". . . capacity cannot be determined . . .".

   Section 13.3.2 adds a third: "For building classified as nonconforming by Qualitative Evaluation . . ." The commentary for section 13.2.1 lists three values:
   1) "Conforming to the provisions . . .",
   2) "Not conforming to the provisions . . .", and
   3) "Conformance cannot be determined . . ."

   It was assumed that the intent was to have three possible results and those results have been named as follows:
   1) capable of meeting requirements,
   2) nonconforming, and
   3) uncertain.

DATUM: Extent of evaluation required

SECTION: 13.1 and 13.1.1 LABEL: EXER NUMBER: 13110

INGREDIENTS

Datum	Label	Number
Seismicity index	SI	1425
Date of design of building		13120
Building includes features proven vulnerable to earthquake		13130
Building struct system significantly weakened since const		13140
Seismic performance category	SPC	1490
Occupancy potential	XOP	13160

DECISION TABLE

		1	2	3	4	E
1	Seismicity index = 4	Y	Y	Y	Y	
2	Date of design of building = before 19xx	Y	Y	N	N	
3	Date of design of building = before 19yy	+	+	Y	Y	
4	Building includes features proven vulnerable to earthquake = true <u>or</u> Building struct system significantly weakened since const = true	.	.	Y	Y	
5	Seismic performance category = C <u>and</u> Occupancy potential $\leqq$ 100	N	Y	N	Y	
1	EXER = complete	X		X		
2	EXER = external		X		X	
3	EXER = none					X

COMMENTS:

1. It was assumed that 19xx is earlier than 19yy.
2. The text is not clear as to whether condition 5 applies to all buildings or only to those with seismicity index = 4 that were designed before 19xx or 19yy. The second possibility is shown in this decision table.

DATUM: Type of evaluation required

SECTION: 13.1 LABEL: TER NUMBER: 13150

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Results of qualitative evaluation		13216

DECISION TABLE

			1	2	3
1	Seismic performance category = C	*	N	Y	Y
2	(Seismic performance category = D)	*	+	-	-
3	Results of qualitative evaluation = uncertain	*	.	Y	N
	**************************************				
1	TER = analytical	*	X	X	
2	TER = qualitative	*			X

COMMENTS:

1. Note that rules 2 and 3 in this decision table imply a two step iteration: 1) a qualitative evaluation is performed, and 2) depending on the result of the qualitative evaluation, an analytical evaluation may or may not be required.

DATUM: Occupancy potential

SECTION: 13.1.1 LABEL: XOP NUMBER: 13160

INGREDIENTS

Datum	Label	Number
Square feet of floor per occupant	SFPO	13180
Total square feet in building	(A)	13190

FUNCTION:

$$XOP = \frac{A}{XSFPO}$$

DATUM: Square feet of floor per occupant

SECTION: 13.1.1 LABEL: SFPO NUMBER: 13180

INGREDIENTS

Datum	Label	Number
Square feet per occupant established by cognizant jurisdiction		13170
Square feet per occupant from table 13-A	XSFT13	13185

DECISION TABLE

			1	2
1	Square feet per occupant established by cognizant jurisdiction = true	*	Y	N
	***************			
1	SFPO = value established by cognizant jurisdiction	*	X	
2	SFPO = Square feet per occupant from table 13-A	*		X

DATUM: Square feet per occupant from table 13-A

SECTION: 13.1.1 (Table 13-A) LABEL: XSFT13 NUMBER: 13185

INGREDIENTS

Datum	Label	Number
Building use		1270

COMMENT:

1. Table 13-A in the text is quite clear in how to evaluate the square feet per occupant once the building use is known. There may be problems with fitting the use of a building into the categories of use shown in the table.

DATUM: Systematic evalution requirement

SECTION: 13.2 LABEL: SER NUMBER: 13200

INGREDIENTS

Datum	Label	Number
Extent of evaluation required	EXER	13110
Type of evaluation required	TER	13150
Qualitative evaluation procedures requirement	QEPR	13202
Analytical evaluation procedures requirement	AEPR	13226

DECISION TABLES

	DECISION TABLES		1	2	3	E
1	Extent of evaluation required = none	*	Y	N	N	
2	Type of evaluation required = qualitative	*	.	Y	N	
3	Qualitative evaluation procedures requirement = satisfied	*	.	Y	.	
4	Analytical evaluation procedures requirement = satisfied	*	.	.	Y	
	**					
1	SER = satisfied	*	X	X	X	
2	SER = violated	*				X

DATUM: Qualitative evaluation procedures requirement

SECTION: 13.2.1 LABEL: QEPR NUMBER: 13202

INGREDIENTS

Datum	Label	Number
Entity performing evaluation		13204
Available pertinent documentation examined		13206
On-site inspection performed		13208
Element evaluation required	EER	13210
Element classed as to hazard		13212
Detail of qualitative evaluation report requirement	DQERR	13214

DECISION TABLE

		1	2	E
1	Entity performing evaluation = cognizant jurisdiction or registered engineer or registered architect	Y	Y	
2	Available pertinent documentation examined = true	Y	Y	
3	On-site inspection performed = true	Y	Y	
4	Element evaluation required = true	Y	N	
5	Element classified as to hazard = true	Y	.	
6	Detail of qualitative evaluation report requirement = satisfied	Y	Y	
1	QEPR = satisfied	X	X	
2	QEPR = violated			X

COMMENTS:

1. Condition 1 is actually found in section 13.1.

DATUM: Element evaluation required

SECTION: 13.2.1 LABEL: EER NUMBER: 13210

INGREDIENTS

Datum	Label	Number
Extent of evaluation required	EXER	13110
Seismic performance category	SPC	1490
Results of qualitative evaluation		13216
Element of building (component)		2114
Element could cause injury/block exit/start fire/release toxic		13218

DECISION TABLE

		1	2	3	4	5	6	7	8	9
1	Extent of evaluation required = complete	Y	Y	Y	Y	Y	Y	-	-	N
2	Extent of evaluation required = external	-	-	-	-	-	-	Y	Y	N
3	(Extent of evaluation required = none)	-	-	-	-	-	-	-	-	+
4	Element = primary structural system	Y	-	-	-	-	N	-	.	.
5	Element = exterior non-structural	-	Y	-	-	-	N	Y	N	.
6	Element = interior non-structural	-	-	Y	Y	Y	N	-	.	.
7	Element could cause injury/block exit/start fire/release toxic = true	.	.	Y	N	.	.	.	.	.
8	Seismic performance category = C and Results of qualitative evaluation (for primary structural system) = capable of meeting requirements	.	.	N	N	Y	.	.	.	.
1	EER = true	X	X	X				X		
2	EER = false				X	X	X		X	X

DATUM: Detail of qualitative evaluation report requirement

SECTION: 13.2.1 LABEL: DQERR NUMBER: 13214

INGREDIENTS

Datum	Label	Number
Sketches of struct seismic resisting system provided		13220
Sketches of details of struct seismic resisting system provided		13222
Results of qualitative evaluation		13216
Reasons provided for classification as capable		13224

DECISION TABLE

			1	2	E
1	Sketches of struct seismic resisting system provided = true	*	Y	Y	
2	Sketches of details of struct seismic resisting system provided = true	*	Y	Y	
3	Results of qualitative evaluation = capable of meeting requirements	*	Y	N	
4	Reasons provided for classification as capable = true	*	Y	.	
	**				
1	DQERR = satisfied	*	X	X	
2	DQERR = violated	*			X

DATUM: Analytical evaluation procedures requirement

SECTION: 13.2.2 LABEL: AEPR NUMBER: 13226

INGREDIENTS

Datum	Label	Number
Entity performing evaluation		13204
Analysis method requirement	AMR	13228
Details of analytical evaluation report requirement	DAERR	13230
Element evaluation required	EER	13210
Element classified as to hazard		13212

DECISION TABLE

		1	2	E
1	Entity performing evaluation = registered structural engineer	Y	Y	
2	Analysis method requirement = satisfied	Y	Y	
3	Details of analytical evaluation report requirement = satisfied	Y	Y	
4	Element evaluation required = true	Y	N	
5	Element classified as to hazard = true	Y	.	
1	AEPR = satisfied	X		
2	AEPR = violated		X	

COMMENTS:

1. Condition 1 is from section 13.1.

DATUM: Analysis method requirement

SECTION: 13.2.2 LABEL: AMR NUMBER: 13228

INGREDIENTS

Datum	Label	Number
Analysis based on recommendations of previous chapters		13232
Recommendations of previous chaps for analysis not applicable		13234
Deviations from recommendations for analysis permitted by reg agency		13236
Deviations from recommendations for analysis justified in report		13238

DECISION TABLE

			1	2	E
1	Analysis based on recommendations of previous chapters = true	*	Y	N	
2	Recommendations of previous chaps for analysis not applicable = true	*	-	Y	
3	Deviations from recommendations for analysis permitted by reg agency = true	*	.	Y	
4	Deviations from recommendations for analysis justified in report = true	*	.	Y	
	******************************				
1	AMR = satisfied	*	X	X	
2	AMR = violated	*			X

DATUM: Details of analytical evaluation report requirement

SECTION: 13.2.2 LABEL: DAERR NUMBER: 13230

INGREDIENTS

Datum	Label	Number
Diagrams of struct seismic resisting system provided		13240
Calculations for determining capacity ratio provided		13242
Results of analytical evaluation		13246
Time permitted for correction provided in report		13244

DECISION TABLE

			1	2	E
1	Diagrams of struct seismic resisting system provided = true	*	Y	Y	
2	Calculations for determining capacity ratio provided = true	*	Y	Y	
3	Results of analytical evaluation = nonconforming	*	N	Y	
4	Time permitted for correction provided in report = true	*	.	Y	
	******************************				
1	DAERR = satisfied	*	X	X	
2	DAERR = violated	*			X

DATUM: Results of analytical evaluation

SECTION: 13.2.2 LABEL: RAE NUMBER: 13246

INGREDIENTS

Datum	Label	Number
Governing earthquake capacity ratio	XRCG	13248
Allowable earthquake capacity ratio	RCA	13262

DECISION TABLE

		*	1	2
1	Governing earthquake capacity ratio < Allowable earthquake capacity ratio	*	Y	N
	**			
1	RAE = conforming	*		X
2	RAE = nonconforming	*	X	

DATUM: Governing earthquake capacity ratio

SECTION: 13.2.2 LABEL: XRCG NUMBER: 13248

INGREDIENTS

Datum	Label	Number
Actual capacity in seismic shear force	ZVAS	13250
Required capacity in seismic shear force	ZVRS	13256
Allowable story drift	ASD	3860
Actual story drift	ZACTSD	13254

FUNCTION:

XRCG = MIN[ZVAS/ZVRS, ASD/ZACTSD]

COMMENTS:

1. The text refers to a ratio of shear forces in terms of actual capacity ÷ required capacity and then stipulates that the ratio may be governed by "shear, moment, or axial forces or by drift limitations." Since the ratio for drift is most easily obtained by using the allowable story drift and since in that case the consistent ratio has the actual value in the denominator rather than the numerator, the function shown here was modified to separate strength and drift.
2. For a given element the function is straightforward. For a system or the building, take the minimum of the values determined for all the elements of that system or building.

DATUM: Actual capacity in seismic shear force

SECTION: 13.2.2 LABEL: ZVAS NUMBER: 13250

INGREDIENTS

Datum	Label	Number
Member strength	YMS	3125
Connection strength	YCS	3130

COMMENT:

1. The text states that the capacity in seismic shear force may be governed by direct shear, bending, or axial force effects. The assumed function for this would be:

   YVAS = MIN[shear strength, bending strength, axial strength]

DATUM: Actual story drift

SECTION: 13.2.2 LABEL: ZACTSD NUMBER: 13254

INGREDIENTS

Datum	Label	Number
Design story drift	DRIFT	4660

COMMENT:

1. It is assumed that the method for obtaining the drift should be the same as specified in the earlier chapters, including secondary effects.

DATUM: Required capacity in seismic shear force

SECTION: 13.2.2 LABEL: ZVRS NUMBER: 13256

INGREDIENTS

Datum	Label	Number
Earthquake force effect	QE	3706

COMMENT:

1. The text specifically refers to the base shear determined by chapters 4 or 5. It was assumed that the requirements of section 3.7 for critical direction, minimum nominal forces, and so on were to be included. Thus, the reference here is made to the datum with the earthquake force effect that takes all those requirements into account.

DATUM: Allowable earthquake capacity ratio

SECTION: 13.2.2 LABEL: RCA NUMBER: 13262

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Element of building (component)		2114
Occupancy potential	XOP	13160

DECISION TABLE

		1	2	3	4	5	6	E
1	Seismic performance category = D	Y	Y	Y	N	N	N	
2	(Seismic performance category = C)	-	-	-	+	+	+	
3	Element = primary structural system	Y	-	-	Y	-	-	
4	Element = exterior nonstructural component	-	Y	-	-	Y	-	
5	Element = interior nonstructural component	-	-	Y	-	-	Y	
1	RCA = 0.5	X	X	X		X		
2	$RCA = MIN[0.5, 0.25(1 + \frac{XOP-100}{700})]$				X		X	
E	RCA = ?							X

COMMENTS:

1. The ELSE rule in this decision table occurs if conditions 3, 4, and 5 are all false, which should not occur because evaluation is only required for those elements listed. (See datum 13210.) However, recognition of the ELSE rule raises the questions as to what is to be done with members of the structural system that are not "primary" and which parts of the structural system should be classified as primary.

DATUM: Hazard abatement requirement

SECTION: 13.3 LABEL: HAR NUMBER: 13301

INGREDIENTS

Datum	Label	Number
Chapter 13 adopted into provisions		13000
Components classified as hazardous		13310
Type of abatement to be used		13320
Building is classified as historical		13330
Alternate abatement approved		13340
New earthquake capacity ratio to be provided		13350
Required new earthquake capacity ratio	MRC	13360
Time proposed for abatement		13370
Maximum time permitted for abatement	TX	13380

DECISION TABLE

		1	2	3	4	5	E
1	Chapter 13 adopted into provisions = true	N	Y	Y	Y	Y	
2	Type of abatement to be used = strengthening	.	Y	-	-	.	
3	Type of abatement to be used = removal of hazard	.	-	Y	-	.	
4	Type of abatement to be used = demolition	.	-	-	Y	.	
5	Components classified as hazardous include primary structural system	.	.	.	Y	.	
6	New earthquake capacity ratio to be provided ≥ Required new earthquake capacity ratio for each components classified as hazardous	.	Y	.	.	.	
7	Time proposed for abatement ≤ Maximum time permitted for abatement for each component classified as hazardous	.	Y	Y	Y	.	
8	Building is classified as historical = true <u>and</u> Alternate abatement approved = true	.	-	-	-	Y	
1	HAR = satisfied	X	X	X	X	X	
2	HAR = violated						X

COMMENTS:

1. The text specifically makes the acceptability of demolition conditional on the primary structural system being classified as hazardous, thus condition 5 is necessary in rule 4.
2. The text makes no mention of the applicability of the capacity ratio for the case of removing hazardous components, so condition 6 is shown as immaterial in rule 3.
3. Condition 6 is implicitly false in rules 2, 3, and 4, because datum 13340 would be false in those cases.
4. Section 13.3 refers to components classified as hazardous, whereas sections 13.1 and 13.2 use the term nonconforming. The two were assumed to be equivalent.

DATUM: Required new earthquake capacity ratio

SECTION: 13.3.1 LABEL: MRC NUMBER: 13360

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Element of building (component)		2114
Occupancy potential	XOP	13160

DECISION TABLE

		1	2	3
1	Seismic performance category = D	Y	N	N
2	(Seismic performance category = C)	-	+	+
3	Element = exterior nonstructural component	.	Y	N
	**			
1	MRC = 1.0	X	X	
2	$MRC = MIN[1.0, 0.5(1 + \frac{XOP - 100}{700})]$			X

DATUM: Maximum time permitted for abatement

SECTION: 13.3.2 LABEL: TX NUMBER: 13380

INGREDIENTS

Datum	Label	Number
Seismic performance category	SPC	1490
Element of building (component)		2114
Components classified as hazardous		13310
Coefficient for permissible time	(AT)	13385
Earthquake capacity ratio for computing time	RCT	13390

DECISION TABLE

			1	2	3	4
1	Element of building = exterior nonstructural	*	Y	N	N	N
2	Seismic performance category = D	*	.	Y	Y	N
3	(Seismic performance category = C)	*	.	-	-	+
4	Components classified as hazardous include primary structural system	*	.	Y	N	.
1	TX = 1.0	*	X			
2	TX = MAX[1.0, MIN(AT*RCT,15)]	*		X		
3	TX = 2.0	*			X	
4	TX = MAX[2.0, MIN(AT*RCT,15)]	*				X

COMMENT:

1. The coefficient for permissible time, AT, is to be supplied by the regulatory agency.

DATUM: Earthquake capacity ratio for computing time

SECTION: 13.3.2 LABEL: RCT NUMBER: 13390

INGREDIENTS

Datum	Label	Number
Results of qualitative evaluation		13216
Governing earthquake capacity ratio	XRCG	13248

DECISION TABLE

			1	2
1	Results of qualitative evaluation = nonconforming	*	Y	N
	**			
1	RCT = 0.1	*	X	
2	RCT = XRCG	*		X

COMMENT:

1. See comment 1 on datum 13001.

APPENDIX A3

INFORMATION NETWORKS

This appendix is divided into three major parts. Presented first are information networks for each of the 13 chapters of the Provisions, except chapter 2. The total network created by merging all of the chapters is presented on the sheet folded into the pocket attached to the back cover of the report. Comments on the networks are presented on the pages following the individual chapter networks.

The networks are computer generated printings of the global ingredience of all terminal nodes, as described in chapter 2. The printing is in the form of an indented outline that represents a spanning tree. Each node is connected to its ingredients with dotted lines, and each node is printed in a column corresponding to its level from output. Two conventions are used to represent branches that would connect upwards to nodes already printed:

1) a "-" before the data number indicates that the node has already occurred in the network;
2) a "*" following the data number indicates that the node has ingredients (is a derived node) and that the subnetwork of its ingredients is not printed at this location. To locate the subnetwork, simply proceed up the network at the same level to the point at which the node is printed without a "-" (this is the original occurrence of the node).

Two additional conventions are used in the printing of the individual chapter networks to indicate references to data items in other chapters (these references are treated as input data items in the individual chapter networks):

1) the first character of a data description for a data item from another chapter is "%".
2) if the data item is a derived data item in the chapter in which it is defined, the second character of the data description is "*".

The printout of the total merged network is quite large. To be able to reproduce it in this report, all input data items were omitted. Thus that printout shows no nodes occurring at the highest level from output.

GLØBAL INGREDIENCE ØF CHAPTER 1

EXTREME LEVEL FRØM ØUTPUT

```
0   1   2   3   4   5   6   7   8

1305  APPLICATIØN REQUIREMENT
:...1210  PRØVISIØNS APPLICABLE
:   :...1220  STRUCTURE TYPE
:   :...1230  BUILDING STAGE
:   :...1240  PRØPØSED WØRK ØN EXISTING BUILDING
:   :...1250  SEISMIC FØRCE RESISTANCE BEFØRE PRØPØSED ACTIVITY
:   :...1260  SEISMIC FØRCE RESISTANCE AFTER PRØPØSED ACTIVITY
:   :...1264  SEISMIC PERFØRMANCE CATEGØRY BEFØRE PRØPØSED CHANGE
:   :   :...............1490  SEISMIC PERFØRMANCE CATEGØRY
:   :                       :...1425  SEISMICITY INDEX
:   :                       :   :...1420  MAP AREA FRØM FIGURE 1-2
:   :                       :...1430  SEISMIC HAZARD EXPØSURE GRØUP
:   :                           :...1433  FACILITY DESIGNATED ESSENTIAL BY CØGNIZANT JURISDICTIØN
:   :                           :...1436  NUMBER ØF ØCCUPANTS IN BUILDING IS LARGE
:   :                           :...1439  MØVEMENT ØF ØCCUPANTS IS RESTRICTED
:   :                           :...1442  MØBILITY ØF ØCCUPANTS IS IMPAIRED
:   :                           :...1445  NUMBER ØF USE CLASSES IN BUILDING
:   :                           :...1448  PØRTIØN ØF AREA DESIGNATED AS ESSENTIAL BY CØGNIZANT JURIS
:   :                           :...1451  PØRTIØN ØF AREA WITH LARGE NUMBER ØF ØCCUPANTS
:   :                           :...1454  PØRTIØN ØF AREA WITH ØCCUPANTS FREE MØVEMENT RESTRICTED
:   :                           :...1457  PØRTIØN ØF AREA WITH ØCCUPANTS WITH IMPAIRED MØBILITY
:   :                           :...1460  BUILDING PRØVIDES ACCESS TØ ANØTHER WITH SHEG = III
:   :...1266  SEISMIC PERFØRMANCE CATEGØRY AFTER PRØPØSED CHANGE
:   :   :..............-1490* SEISMIC PERFØRMANCE CATEGØRY
:   :...1270  BUILDING USE
:   :...1280  SIZE ØF DWELLING
:   :.....................-1425* SEISMICITY INDEX
:   :..13000  %* CHAPTER 13 ADØPTED INTØ PRØVISIØNS
:...1310  DESIGN DØCUMENTS SUBMITTED TØ REGULATØRY AGENCY
:......-1230  BUILDING STAGE
:...1345  NEW BUILDING REQUIREMENT
:   :...2001  % REQUIREMENTS ØF CHAPTER 2
:   :.......3001  %* STRUCTURAL DESIGN REQUIREMENT
:   :.......4001  %* EQUIVALENT LATERAL FØRCE ANALYSIS REQUIREMENT
:   :.......5001  %* MØDAL ANALYSIS REQUIREMENT
:   :.......6001  %* SØIL STRUCTURE INTERACTIØN ANALYSIS REQUIREMENT
:   :.......7001  %* FØUNDATIØN DESIGN REQUIREMENT
:   :...8001  %* ARCHITECTURAL/MECHANICAL/ELECTRICAL REQUIREMENT
:   :.......9001  %* WØØD MATERIALS REQUIREMENT
:   :......10001  %* STEEL MATERIALS REQUIREMENT
:   :......11001  %* REINFØRCED CØNCRETE MATERIALS REQUIREMENT
:   :......12001  %* MASØNRY MATERIALS REQUIREMENT
:   :...1601  QUALITY ASSURANCE REQUIREMENT
:   :   :...1602  QUALITY ASSURANCE PLAN REQUIRED
:   :   :   :..............-1425* SEISMICITY INDEX
:   :   :   :..............-1430* SEISMIC HAZARD EXPØSURE GRØUP
:   :   :...1604  QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
:   :   :   :...1605  DETAILS ØF QUALITY ASSURANCE PLAN
:   :   :   :   :...1607  PLAN SPECIFIES THØSE DSS WHICH REQUIRE SPECIAL PERFØRMANCE
:   :   :   :   :...1608  PLAN FØR EACH DSS PREPARED BY DESIGNER ØF THAT DSS
```

```
:   :   :   :   :...1610  PLANNED SPECIAL INSPECTION
:   :   :   :   :...1628  MINIMUM SPECIAL INSPECTION
:   :   :   :   :   :...2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :   :   :   :...1631  CONSTRUCTION ACTIVITY
:   :   :   :   :   :...8105  %* A/M/E PERFORMANCE LEVEL
:   :   :   :   :   :..-1490* SEISMIC PERFORMANCE CATEGORY
:   :   :   :   :...1611  PLANNED SPECIAL TESTING
:   :   :   :   :...1635  MINIMUM SPECIAL TESTING
:   :   :   :       :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :   :...1613  STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
:   :   :       :...1614  STATEMENT IS WRITTEN
:   :   :       :...1616  STATEMENT IS SUBMITTED PRIOR TO START OF WORK ON DSS
:   :   :       :...1617  STATEMENT ACKNOWLEDGES AWARENESS OF REQTS OF Q A PLAN
:   :   :       :...1618  STATEMENT ACKNOWLEDGES THAT CONTROL WILL EXERCISED
:   :   :       :...1619  STATEMENT CONTAINS PROCEDURES FOR CONTROL
:   :   :       :...1620  STATEMENT CONTAINS METHOD, FREQ, AND DISTR OF REPORTS
:   :   :       :...1622  STATEMENT NAMES PERSON RESPONSIBLE FOR CONTROL
:   :   :       :...1623  STATEMENT SHOWS POSITION WITHIN MGT OF RESPONSIBLE PERSON
:   :   :...1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
:   :   :   :...1652  ACTUAL SPECIAL INSPECTION
:   :   :   :......-1610  PLANNED SPECIAL INSPECTION
:   :   :   :...1653  ACTUAL SPECIAL TESTING
:   :   :   :......-1611  PLANNED SPECIAL TESTING
:   :   :   :...1625  QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
:   :   :   :   :...1626  SPECIAL INSPECTOR EMPLOYED BY BUILDING OWNER
:   :   :   :   :...1632  SPECIAL INSPECTOR APPROVED BY REGULATORY AGENCY
:   :   :   :   :...1634  SPECIAL TESTING AGENCY APPROVED BY REGULATORY AGENCY
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:   :   :       :   :...1659  SIW REPORT NOTES ANY DEFICIENCIES
:   :   :       :   :...1661  SIW REPORT NOTES ANY CORRECTIONS OF PAST DEFICIENCIES
:   :   :       :...1662  SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
:   :   :       :   :...1664  SIF REPORT SUBMITTED TO REGULATORY AGENCY AT COMPLETION
:   :   :       :   :...1665  SIF REPORT CERTIFIES INSPECTED WORK SUBSTANTIALLY OK
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:   :   :       :...1668  CONTRACTORS FINAL REPORT REQUIREMENT
:   :   :           :...1670  CF REPORT SUBMITTED TO REG AGENCY AT COMPLETION
:   :   :           :...1671  CF REPORT CERTIFIES ALL DSS SUBSTANTIALLY IN COMPLIANCE
:   :   :           :...1673  CF REPORT NOTES ANY DEFICIENCIES
:   :   :...1637  MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
:   :   :   :...1638  COMPONENT IS A PART OF A DESIGNATED SEISMIC SYSTEM
:   :   :   :...8363  %* M/E COMPONENT CERTIFICATION (TESTING) REQUIRED
:   :   :...1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
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:   :   :   :...1641  MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
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:   :   :       :...1685  MANUFACTURER MAINTAINS A QUALITY ASSURANCE PROGRAM
:   :   :       :...1686  QUALITY CONTROL PROGRAM APPROVED BY REG AGENCY
:   :   :       :...1688  EACH COMPONENT MARKED WITH REG AGENCY APPROVAL
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:   :       :..-1643  PLANNED SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
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:   :...2227  % TOTAL HEIGHT
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:   :   :..-5001  %* MODAL ANALYSIS REQUIREMENT
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:       :.-10001  %* STEEL MATERIALS REQUIREMENT
:       :.-11001  %* REINFORCED CONCRETE MATERIALS REQUIREMENT
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:   :..13301  %* HAZARD ABATEMENT MEASURES REQUIREMENT
:...1390  CHANGE OF USE REQUIREMENT
:   :..-1260  SEISMIC FORCE RESISTANCE AFTER PROPOSED ACTIVITY
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:......-1264* SEISMIC PERFORMANCE CATEGORY BEFORE PROPOSED CHANGE
:...1456  POTENTIAL EXISTS FOR GROUND RUPTURE FROM ACTIVE FAULT
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:....1520  USE ØF ALTERNATE MATERIAL ØR METHØD DESIRED
:....1530  REGULATØRY AGENCY APPRØVES ALTERNATE
:....1540  ALTERNATE IS EQUAL IN STRENGTH, DURABILITY, SEISMIC RESIST
:....1550  SUBSTANTIATING EVIDENCE SUBMITTED TØ REG AGENCY
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GLØBAL INGREDIENCE ØF CHAPTER 3

EXTREME LEVEL FRØM ØUTPUT

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0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15

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:...3105  STRUCTURAL ANALYSIS REQUIREMENT
:   :...3510  SEISMIC LØAD ANALYSIS REQUIREMENT
:   :   :.................................................3520  SEISMIC LØAD ANALYSIS USED
:   :   :...3530  REQUIRED SEISMIC LØAD ANALYSIS
:   :   :   :.........................1490  %* SEISMIC PERFØRMANCE CATEGØRY
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:   :   :   :   :   :...3420  GEØMETRIC CØNFIGURATIØN ØF BUILDING
:   :   :   :   :   :...3435  BLDG HAS RE-ENTRANT CØRNERS WITH SIGNIFICANT DIMENSIØNS
:   :   :   :   :   :...3425  LØCATIØN ØF CENTER ØF BUILDING MASS
:   :   :   :   :   :...3430  LØCATIØN ØF CENTER ØF SEISMIC RESISTING SYSTEM
:   :   :   :   :   :...3445  ANY DIAPHRAGM HAS SIGNIFICANT CHANGES IN STRENGTH ØR STIFF
:   :   :   :   :...3415  VERTICAL CØNFIGURATIØN
:   :   :   :   :   :...3450  GEØMETRIC CØNFIG ØF BLDG WITH RESPECT TØ VERTICAL AXIS
:   :   :   :   :   :...3455  BUILDING HAS HØRIZ ØFFSETS WITH SIGNIFICANT DIMENSIØNS
:   :   :   :   :   :...4340  %* TØTAL WEIGHT AT LEVEL X
:   :   :   :   :   :...3465  STØRY STIFFNESS
:   :   :   :   :......-3420  GEØMETRIC CØNFIGURATIØN ØF BUILDING
:   :   :   :   :......-3425  LØCATIØN ØF CENTER ØF BUILDING MASS
:   :   :   :   :......-3430  LØCATIØN ØF CENTER ØF SEISMIC RESISTING SYSTEM
:   :   :   :......-3410* PLAN CØNFIGURATIØN
:   :   :   :......-3415* VERTICAL CØNFIGURATIØN
:   :   :...3270  SØIL STRUCTURE INTERACTIØN USE REQUIREMENT
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:   :   :   :.........................................-3520  SEISMIC LØAD ANALYSIS USED
:   :   :...3540  FUNDAMENTAL PERIØD ØF BUILDING USED IN ANALYSIS
:   :   :...4255  %* APPRØXIMATE BUILDING PERIØD
:   :...3115  INTERNAL MEMBER FØRCES DETERMINED WITH LINEAR ELASTIC MØDEL
:...3120  STRENGTH REQUIREMENT
:   :.........................3125  MEMBER STRENGTH
:   :                         :...9210  %* STRENGTH ØF WØØD CØMPØNENTS
:   :                         :..10210  %* STRENGTH ØF STEEL CØMPØNENTS
:   :                         :..11210  %* STRENGTH ØF CØNCRETE CØMPØNENTS AND SYSTEMS
:   :                         :..12210  %* STRENGTH ØF MASØNRY CØMPØNENTS
:   :.........................3130  CØNNECTIØN STRENGTH
:   :                         :..-9210  %* STRENGTH ØF WØØD CØMPØNENTS
:   :                         :.-10210  %* STRENGTH ØF STEEL CØMPØNENTS
:   :                         :.-11210  %* STRENGTH ØF CØNCRETE CØMPØNENTS AND SYSTEMS
:   :                         :.-12210  %* STRENGTH ØF MASØNRY CØMPØNENTS
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:                             :...3731  MINIMUM SEISMIC FØRCE
:                             :   :...........2114  % ELEMENT ØF BUILDING (CØMPØNENT)
:                             :   :...............1415  %* EFFECTIVE PEAK VELØCITY-RELATED ACCELERATIØN
:                             :   :...3732  WEIGHT ØF SMALLER PØRTIØN ØF BUILDING
:                             :   :   :..............4215  %* TØTAL GRAVITY WEIGHT ØF BUILDING
:                             :   :...3734  BEAM, GIRDER, ØR TRUSS REACTIØN
:                             :   :   :...3707  DEAD LØAD EFFECT
:                             :   :   :   :...2146  % DEAD LØAD
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:                               :   :   :...3708  LIVE LOAD EFFECT
:                               :   :       :...2148  % LIVE LOAD
:                               :   :...3749  EFFECT OF NONSTRUCTURAL SEISMIC FORCE
:                               :       :...8115  %* NONSTRUCTURAL SEISMIC FORCE
:                               :...3704  COMBINED LOAD EFFECT
:                                   :..-1490  %* SEISMIC PERFORMANCE CATEGORY
:                                   :...3796  ALTERED LOAD COMBO USED TO SATISFY VERT MOTION REQT
:                                   :...3705  ADDITIVE LOAD COMBINATION
:                                   :   :..-3707* DEAD LOAD EFFECT
:                                   :   :..-3708* LIVE LOAD EFFECT
:                                   :   :...3710  SNOW LOAD EFFECT
:                                   :   :   :...4230  %* EFFECTIVE SNOW LOAD
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:                                   :       :   :...3716  COMBO OF ORTHOGONAL DIRECTIONS USED FOR CRIT DIRECTION
:                                   :       :   :...3717  ORTHOGONAL COMBINATION EARTHQUAKE FORCE EFFECT
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:                                   :       :   :       :..-3520  SEISMIC LOAD ANALYSIS USED
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:                                   :       :   :       :...3550  EARTHQUAKE FORCE EFFECT FROM MORE RIGOROUS ANALYSIS
:                                   :       :   :.......-3560* ANALYZED EARTHQUAKE FORCE EFFECT
:                                   :       :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:                                   :       :...3765  MINIMUM DIAPHRAGM SIESMIC FORCE EFFECT
:                                   :       :   :..-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:                                   :       :   :...3767  WEIGHT OF DIAPHRAGM AND ATTACHED COMPONENTS
:                                   :       :   :   :..-4215  %* TOTAL GRAVITY WEIGHT OF BUILDING
:                                   :       :   :...3768  PORTION OF STORY SHEAR TRANSFERRED BY THE DIAPHRAGM
:                                   :       :       :...4420  %* STORY SHEAR FORCE EFFECT
:                                   :       :...3771  MINIMUM BEARING WALL SEISMIC FORCE
:                                   :       :   :..-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:                                   :       :   :...2273  % WEIGHT OF COMPONENT
:                                   :       :...3786  TYPE OF SEISMIC FORCE EFFECT
:                                   :       :...3788  ADJUSTMENT TO OVERTURNING MOMENT OF INVERTED PENDULUM
:                                   :           :...4520  %* ELF OVERTURNING MOMENT AT LEVEL X
:                                   :           :...2227  % TOTAL HEIGHT
:                                   :           :...3789  HEIGHT TO POINT ALONG INVERTED PENDULUM
:                                   :...3713  COUNTERACTING LOAD COMBINATION
:                                   :   :...3714  COMPONENT BEHAVIOUR
:                                   :   :..-3707* DEAD LOAD EFFECT
:                                   :   :..-3706* EARTHQUAKE FORCE EFFECT
:                                   :...3797  ALTERED LOAD COMBO FOR EFFECTS OF VERT MOTION
:                                       :...3791  MEMBER POSITION
:                                       :...3792  MEMBER SUPPORT
:                                       :...3794  MEMBER IS PRESTRESSED
:                                       :..-3706* EARTHQUAKE FORCE EFFECT
:                                       :..-3707* DEAD LOAD EFFECT
:...3140  DEFORMATION REQUIREMENT
:   :...3850  DRIFT LIMIT
:   :   :.......4660  %* DESIGN STORY DRIFT
:   :   :...3860  ALLOWABLE STORY DRIFT
:   :       :...1430  %* SEISMIC HAZARD EXPOSURE GROUP
:   :       :...2243  % NUMBER OF LEVELS (STORIES)
:   :       :...3870  BUILDING CONTAINS BRITTLE FINISHES
:   :       :...2228  % STORY HEIGHT BELOW LEVEL X
:   :...3810  SEPARATION REQUIREMENT
:       :...3820  SEPARATION BETWEEN ADJACENT PORTIONS OF BUILDINGS
:       :...3830  SEPARATION REQUIRED TO AVOID DAMAGING CONTACT
:       :   :...4610  %* DEFLECTION AT STORY X
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:       :...3840  ADJACENT PØRTIØNS ØF BLDG ACT AS AN INTEGRAL UNIT IN EQ
:.....................................-1490  %* SEISMIC PERFØRMANCE CATEGØRY
:...3145  LØAD PATH REQUIREMENT
:   :...3150  CØNTINUØUS LØAD PATH EXISTS TØ TRANSFER ALL FØRCES
:   :...3155  LØAD PATH HAS ADEQUATE STRENGTH AND STIFFNESS
:...3160  FØUNDATIØN DESIGN CRITERIA REQUIREMENT
:   :...3165  FØUNDATIØN DESIGNED TØ ACCØMMØDATE DESIGN GRØUND MØTIØNS
:   :...3170  FØUNDN DES CRIT BASED ØN DYNAMICS AND STRUCT DESIGN PHILØS
:...3369  GENERAL FRAMING REQUIREMENT
:   :.......3303  GENERAL FRAMING CLASS
:   :       :...3306  VERTICAL LØAD SYSTEM
:   :       :...3309  SEISMIC RESISTING SYSTEM
:   :       :...3312  STRUCTURE IS CHARACTERIZED AS AN INVERTED PENDULUM
:   :       :...3315  MØMENT FRAME REQUIREMENT
:   :       :   :...3321  STRENGTH ØF MØMENT FRAME SYSTEM
:   :       :   :   :.............-10210  %* STRENGTH ØF STEEL CØMPØNENTS
:   :       :   :   :.............-11210  %* STRENGTH ØF CØNCRETE CØMPØNENTS AND SYSTEMS
:   :       :   :...3324  TØTAL REQUIRED STRENGTH**
:   :       :   :...3327  FRAME RESPØNSE TYPE
:   :       :   :...3330  ØRDINARY MØMENT FRAME REQUIREMENT
:   :       :   :   :...3333  FRAME MATERIAL
:   :       :   :   :..10450  %* ØRDINARY STEEL MØMENT FRAME REQUIREMENT
:   :       :   :   :..11600  %* CATEGØRY B ØRDINARY CØNCRETE MØMENT FRAME REQUIREMENT
:   :       :   :...3336  SPECIAL MØMENT FRAME REQUIREMENT
:   :       :       :..-3333  FRAME MATERIAL
:   :       :       :..10600  %* SPECIAL STEEL MØMENT FRAME REQUIREMENT
:   :       :       :..11700  %* SPECIAL CØNCRETE MØMENT FRAME REQUIREMENT
:   :       :...3318  DUAL SYSTEM REQUIREMENT
:   :           :..-3336* SPECIAL MØMENT FRAME REQUIREMENT
:   :           :...3339  STRENGTH ØF SPECIAL MØMENT FRAME SYSTEM ALØNE
:   :           :   :.............-10210  %* STRENGTH ØF STEEL CØMPØNENTS
:   :           :   :.............-11210  %* STRENGTH ØF CØNCRETE CØMPØNENTS AND SYSTEMS
:   :           :...3342  TØTAL REQUIRED STRENGTH WITH 25% ØF THE SEISMIC FØRCE**
:   :.................................-1490  %* SEISMIC PERFØRMANCE CATEGØRY
:   :...3372  CATEGØRY C AND D SEISMIC RESISTING SYSTEM LIMITATIØN
:   :   :.............................-1490  %* SEISMIC PERFØRMANCE CATEGØRY
:   :   :..-3303* GENERAL FRAMING CLASS
:   :   :..........-3327  FRAME RESPØNSE TYPE
:   :   :...3375  SEISMIC RESISTING SYSTEM MATERIAL
:   :   :.................................-3706* EARTHQUAKE FØRCE EFFECT
:   :   :.........................................-2227  % TØTAL HEIGHT
:   :   :...3378  SPECIAL MØMENT FRAME EXTENDS DØWN TØ FØUNDATIØN
:   :...3381  CATEGØRY C AND D INTERACTIØN REQUIREMENT
:   :   :......-3309  SEISMIC RESISTING SYSTEM
:   :   :...3384  SRS ENCLØSED ØR ADJØINED BY MØRE RIGID ELEMENTS
:   :   :...3387  SRS DESIGN PRØVIDES FØR REACTIØN ØF RIGID ELEMENTS TØ DRIFT
:   :       :..-4660  %* DESIGN STØRY DRIFT
:   :...3390  CATEGØRY C AND D DEFØRMATIØN CØMPATIBILITY REQUIREMENT
:       :...3393  STRENGTH ØF STRUCTURAL CØMPØNENTS NØT A PART ØF SRS
:       :   :.....................-9210  %* STRENGTH ØF WØØD CØMPØNENTS
:       :   :.....................-10210  %* STRENGTH ØF STEEL CØMPØNENTS
:       :   :.....................-11210  %* STRENGTH ØF CØNCRETE CØMPØNENTS AND SYSTEMS
:       :   :.....................-12210  %* STRENGTH ØF MASØNRY CØMPØNENTS
:       :...3396  EFFECT ØF VERTICAL LØADS AND DESIGN STØRY DRIFT
:       :   :.............................-3707* DEAD LØAD EFFECT
:       :   :.............................-3708* LIVE LØAD EFFECT
:       :   :.............................-3710* SNØW LØAD EFFECT
:       :   :..-4660  %* DESIGN STØRY DRIFT
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:       :...2115  % MATERIAL OF COMPONENT OR SYSTEM
:       :..11563  %* CAT C AND D NON-SEISMIC RESISTING SYSTEM CONCRETE REQT
:...3610  STRUCTURAL DESIGN AND DETAILING REQUIREMENT
:   :.................................-1490  %* SEISMIC PERFORMANCE CATEGORY
:   :...............3620  CATEGORY A DESIGN AND DETAILING REQUIREMENT
:   :                   :...3737  INTERCONNECTION REQUIREMENT
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:   :                   :...3741  CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
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:   :                   :...3747  NONSTRUCTURAL ANCHORAGE REQUIREMENT
:   :                   :   :..............-3749* EFFECT OF NONSTRUCTURAL SEISMIC FORCE
:   :                   :   :...3750  ANCHORAGE PROVIDED FOR NONSTRUCTURAL COMPONENT
:   :                   :...7300  %* CATEGORY A FOUNDATION REQUIREMENT
:   :                   :...9300  %* CATEGORY A WOOD REQUIREMENT
:   :                   :..10300  %* CATEGORY A STEEL REQUIREMENT
:   :                   :..11300  %* CATEGORY A CONCRETE REQUIREMENT
:   :                   :..12300  %* CATEGORY A MASONRY REQUIREMENT
:   :...........3630  CATEGORY B DESIGN AND DETAILING REQUIREMENT
:   :               :..-3620* CATEGORY A DESIGN AND DETAILING REQUIREMENT
:   :               :...3700  COMPONENT DESIGN REQUIREMENT
:   :               :   :...3701  CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
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:   :               :   :   :.........................-3716  COMBO OF ORTHOGONAL DIRECTIONS USED FOR CRIT DIRECTION
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:   :               :   :   :...3720  STORY STRENGTH RATIO
:   :               :   :   :   :..-3702* REQUIRED STRENGTH
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:   :               :   :   :...3723  STRENGTHS ADJUSTED TO COMPENSATE FOR STRENGTH RATIO
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:   :               :   :   :...3728  DESIGN CONSIDERS POTFNTIALLY ADVERSE EFFECT OF INSTABILITY
:   :               :   :   :...3729  BLDG MODIFIED TO MITIGATE EFFECTS OF COMPONENT FAILURE
:   :               :   :..-3737* INTERCONNECTION REQUIREMENT
:   :               :   :..-3741* CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
:   :               :   :..-3747* NONSTRUCTURAL ANCHORAGE REQUIREMENT
:   :               :   :...3752  COLLECTOR REQUIREMENT
:   :               :   :   :...3753  COLLECTOR ELEMENTS PROVIDED
:   :               :   :...3755  DIAPHRAGM REQUIREMENT
:   :               :   :   :...3756  DEFLECTION IN PLANE OF DIAPHRAGM
:   :               :   :   :...3758  PERMISSIBLE DEFLECTION OF ELEMENTS ATTACHED TO DIAPHRAGM
:   :               :   :   :...3761  DIAPHRAGM DESIGN PROVIDES FOR BOTH SHEAR & BENDING STRESS
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:   :               :       :...3780  COMBINED LOAD EFFECT ON WALL CONNECTIONS
:   :               :       :   :...3783  THERMAL CHANGES EFFECT
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:   :               :       :   :...3785  SETTLEMENT EFFECT
:   :               :       :   :..............-3706* EARTHQUAKE FORCE EFFECT
:   :               :       :......................-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :               :       :.......-3130* CONNECTION STRENGTH
:   :               :       :...3776  DUCTILITY
:   :               :       :...3777  ROTATION CAPACITY
:   :               :...3640  CATEGORY B OPENINGS REQUIREMENT
```

```
:   :           :   :...3645  OPENINGS PRESENT IN SHEAR WALLS, DIAPHRAGMS, OR PLATE ELEM
:   :           :   :...3650  CHORDS PROVIDED AT EDGES OF EACH OPENING
:   :           :   :...3655  CHORDS RESIST LOCAL STRESSES CAUSED BY OPENING
:   :           :   :...3660  CHORDS EXTEND BEYOND OPENING TO DEVEL & DISTR CHORD STRESS
:   :           :...7400  %* CATEGORY B FOUNDATION REQUIREMENT
:   :           :...9400  %* CATEGORY B WOOD REQUIREMENT
:   :           :..10400  %* CATEGORY B STEEL REQUIREMENT
:   :           :..11400  %* CATEGORY B CONCRETE REQUIREMENT
:   :           :..12400  %* CATEGORY B MASONRY REQUIREMENT
:   :.......3670  CATEGORY C DESIGN AND DETAILING REQUIREMENT
:   :       :..-3630* CATEGORY B DESIGN AND DETAILING REQUIREMENT
:   :       :...3790  CATEGORY C AND D VERTICAL MOTION REQUIREMENT
:   :       :   :.........................-3791  MEMBER POSITION
:   :       :   :.........................-3792  MEMBER SUPPORT
:   :       :   :.........................-3794  MEMBER IS PRESTRESSED
:   :       :   :...3795  VERT MOTIONS CONSIDERED IN DETERMINATION OF EQ EFFECT
:   :       :   :.....................-3796  ALTERED LOAD COMBO USED TO SATISFY VERT MOTION REQT
:   :       :...7500  %* CATEGORY C FOUNDATION REQUIREMENT
:   :       :...9500  %* CATEGORY C WOOD REQUIREMENT
:   :       :..10500  %* CATEGORY C AND D STEEL REQUIREMENT
:   :       :..11500  %* CATEGORY C AND D CONCRETE REQUIREMENT
:   :       :..12500  %* CATEGORY C MASONRY REQUIREMENT
:   :...3680  CATEGORY D DESIGN AND DETAILING REQUIREMENT
:   :   :..-3670* CATEGORY C DESIGN AND DETAILING REQUIREMENT
:   :   :...7600  %* CATEGORY D FOUNDATION REQUIREMENT
:   :   :...9600  %* CATEGORY D WOOD REQUIREMENT
:   :   :.....-10500  %* CATEGORY C AND D STEEL REQUIREMENT
:   :   :.....-11500  %* CATEGORY C AND D CONCRETE REQUIREMENT
:   :   :..12600  %* CATEGORY D MASONRY REQUIREMENT
:   :...3363  COMBINED FRAMING REQUIREMENT
:       :...3357  NUMBER OF DIFFERENT FRAMING SYSTEMS IN THE BUILDING
:       :...3366  COMPONENT DETAILED TO REQTS FOR SYSTEM WITH HIGHEST RX
3210  SOIL PROFILE TYPE
:...3230  SOIL TYPE
:...3240  DEPTH OF SOIL TO ROCK
:...3250  DEPTH OF SOFT TO MEDIUM CLAY
:...3260  SOIL TYPE KNOWN
3220  SEISMIC SOIL COEFFICIENT
:..-3230  SOIL TYPE
:..-3240  DEPTH OF SOIL TO ROCK
:..-3250  DEPTH OF SOFT TO MEDIUM CLAY
:..-3260  SOIL TYPE KNOWN
3348  DEFLECTION AMPLIFICATION FACTOR
:..........-3303* GENERAL FRAMING CLASS
:..............-3309  SEISMIC RESISTING SYSTEM
:.......3351  SHEAR WALL TYPE
:..................-3327  FRAME RESPONSE TYPE
:......................-3333  FRAME MATERIAL
3354  RESPONSE MODIFICATION FACTOR
:..........-3357  NUMBER OF DIFFERENT FRAMING SYSTEMS IN THE BUILDING
:...3360  WEIGHT SUPPORTED BY INDIVIDUAL FRAMING SYSTEM
:   :..............................................-4215  %* TOTAL GRAVITY WEIGHT OF BUILDING
:..................................................-4215  %* TOTAL GRAVITY WEIGHT OF BUILDING
:...3345  SINGLE SYSTEM RESPONSE MODIFICATION FACTOR
    :......-3303* GENERAL FRAMING CLASS
    :..........-3309  SEISMIC RESISTING SYSTEM
    :..-3351  SHEAR WALL TYPE
    :.............-3327  FRAME RESPONSE TYPE
```

:...................-3333 FRAME MATERIAL

GLØBAL INGREDIENCE ØF CHAPTER 4

EXTREME LEVEL FRØM ØUTPUT

```
0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15

4001  EQUIVALENT LATERAL FØRCE ANALYSIS REQUIREMENT
:.......................3520  % SEISMIC LØAD ANALYSIS USED
:...4002  SPECIFIED ELF ANALYSIS PRØCEDURES FØLLØWED
:...4560  ØVERTURNING MØMENT REQUIREMENT
:   :...4550  LØCATIØN ØF RESULTANT ØF FØRCES AT FØUND-SØIL INTERFACE
4010  EARTHQUAKE LØAD EFFECT FRØM ELF/MØDAL ANALYSIS
:.......4420  STØRY SHEAR FØRCE EFFECT
:       :.......4410  SEISMIC STØRY SHEAR
:       :       :......-3520  % SEISMIC LØAD ANALYSIS USED
:       :       :.......................2243  % NUMBER ØF LEVELS (STØRIES)
:       :       :...............4310  SEISMIC STØRY FØRCE
:       :       :               :...4205  SEISMIC BASE SHEAR
:       :       :               :   :...3280  % DESIGNER WISHES TØ USE SØIL STRUCTURE INTERACTIØN
:       :       :               :   :...4208  ELF SEISMIC BASE SHEAR WITHØUT SØIL STRUCTURE INTERACTIØN
:       :       :               :   :   :...4210  SEISMIC DESIGN CØEFFICIENT
:       :       :               :   :   :   :...1405  %* EFFECTIVE PEAK ACCELERATIØN
:       :       :               :   :   :   :...1415  %* EFFECTIVE PEAK VELØCITY-RELATED ACCELERATIØN
:       :       :               :   :   :   :...3210  %* SØIL PRØFILE TYPE
:       :       :               :   :   :   :...3220  %* SEISMIC SØIL CØEFFICIENT
:       :       :               :   :   :   :...4235  BUILDING PERIØD CALCULATED
:       :       :               :   :   :   :...4240  BUILDING PERIØD
:       :       :               :   :   :   :   :...4245  FUNDAMENTAL BUILDING PERIØD CALCULATED BY DESIGNER
:       :       :               :   :   :   :   :...4250  CALCULATED FUNDAMENTAL BUILDING PERIØD
:       :       :               :   :   :   :   :   :...4251  PERIØD CALCULATED USING ESTABLISHED METHØDS
:       :       :               :   :   :   :   :   :...4252  PRØPERTIES ØF SRS IN DIRECTIØN BEING ANALYZED
:       :       :               :   :   :   :   :   :...4253  BUILDING ASSUMED FIXED AT BASE
:       :       :               :   :   :   :   :...4255  APPRØXIMATE BUILDING PERIØD
:       :       :               :   :   :   :       :...3309  % SEISMIC RESISTING SYSTEM
:       :       :               :   :   :   :       :...3384  % SRS ENCLØSED ØR ADJØINED BY MØRE RIGID ELEMENTS
:       :       :               :   :   :   :       :...4260  CØEFFICIENT FØR APPRØXIMATE PERIØD
:       :       :               :   :   :   :       :   :...3333  % FRAME MATERIAL
:       :       :               :   :   :   :       :...2227  % TØTAL HEIGHT
:       :       :               :   :   :   :       :...2235  % ØVERALL LENGTH ØF BLDG AT BASE PARALLEL TØ SEISMIC FØRCE
:       :       :               :   :   :   :...3354  %* RESPØNSE MØDIFICATIØN FACTØR
:       :       :               :   :   :...4215  TØTAL GRAVITY WEIGHT ØF BUILDING
:       :       :               :   :       :...1270  % BUILDING USE
:       :       :               :   :       :...2146  % DEAD LØAD
:       :       :               :   :       :...2148  % LIVE LØAD
:       :       :               :   :       :...4230  EFFECTIVE SNØW LØAD
:       :       :               :   :           :...2151  % BASIC SNØW LØAD
:       :       :               :   :           :...2152  % CØNDITIØNS WARRENT REDUCTIØN ØF SNØW LØAD
:       :       :               :   :           :...2153  % REDUCTIØN ØF SNØW LØAD APPRØVED BY REGULATØRY AGENCY
:       :       :               :   :           :...2154  % SNØW LØAD REDUCTIØN CØEFFICIENT
:       :       :               :   :...6200  %* ELF BASE SHEAR MØDIFIED BY SØIL STRUCTURE INTERACTIØN
:       :       :               :...4320  VERTICAL DISTRIBUTIØN FACTØR
:       :       :                   :...4340  TØTAL WEIGHT AT LEVEL X
:       :       :                   :   :..-4215* TØTAL GRAVITY WEIGHT ØF BUILDING
:       :       :                   :...2226  % HEIGHT TØ LEVEL X
:       :       :                   :...4330  VERTICAL DISTRIBUTIØN EXPØNENT
:       :       :                   :   :......-4240* BUILDING PERIØD
```

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:       :       :                   :   :...4360  INTERPØLATIØN USED FØR VERTICAL DISTRIBUTIØN EXPØNENT
:       :       :                   :..-2243  % NUMBER ØF LEVELS (STØRIES)
:       :       :...5820  %* STØRY SHEAR DESIGN VALUE
:       :       :.......3550  % EARTHQUAKE FØRCE EFFECT FRØM MØRE RIGØRØUS ANALYSIS
:       :...4430  STIFFNESS ØF VERTICAL CØMPØNENTS
:       :...4440  STIFFNESS ØF DIAPHRAGM
:...4450  TØRSIØNAL MØMENT EFFECT
:   :...4460  TØRSIØNAL MØMENT
:   :   :......-4410* SEISMIC STØRY SHEAR
:   :   :...4470  ECCENTRICITY BETWEEN CENTER ØF MASS AND CENTER ØF STIFFNESS
:   :   :...4480  ACCIDENTAL TØRSIØNAL MØMENT
:   :       :..-4410* SEISMIC STØRY SHEAR
:   :       :...4490  LENGTH ØF BUILDING PERPENDICULAR TØ SEISMIC FØRCE
:   :......-4430  STIFFNESS ØF VERTICAL CØMPØNENTS
:   :......-4440  STIFFNESS ØF DIAPHRAGM
:...4510  ØVERTURNING MØMENT EFFECT
:   :...4515  ØVERTURNING MØMENT AT LEVEL X
:   :   :.............-3520  % SEISMIC LØAD ANALYSIS USED
:   :   :...4520  ELF ØVERTURNING MØMENT AT LEVEL X
:   :   :   :.......2275  % NUMBER ØF THE LEVEL X
:   :   :   :...3312  % STRUCTURE IS CHARACTERIZED AS AN INVERTED PENDULUM
:   :   :   :...4530  ØVERTURNING MØMENT REDUCTIØN FACTØR
:   :   :   :   :.....................-2243  % NUMBER ØF LEVELS (STØRIES)
:   :   :   :   :..-2275  % NUMBER ØF THE LEVEL X
:   :   :   :................-4310* SEISMIC STØRY FØRCE
:   :   :   :........................-2243  % NUMBER ØF LEVELS (STØRIES)
:   :   :   :........................-2226  % HEIGHT TØ LEVEL X
:   :   :...5910  %* ØVERTURNING MØMENT DESIGN VALUE
:   :   :.............-3550  % EARTHQUAKE FØRCE EFFECT FRØM MØRE RIGØRØUS ANALYSIS
:   :..........-4410* SEISMIC STØRY SHEAR
:   :..-4420* STØRY SHEAR FØRCE EFFECT
:...........4640  STABILITY CØEFFICIENT
:           :...4645  TØTAL GRAVITY LØAD ABØVE LEVEL X
:           :   :........................-4215* TØTAL GRAVITY WEIGHT ØF BUILDING
:           :...4605  FIRST ØRDER DESIGN STØRY DRIFT
:           :   :......-3520  % SEISMIC LØAD ANALYSIS USED
:           :   :......-3550  % EARTHQUAKE FØRCE EFFECT FRØM MØRE RIGØRØUS ANALYSIS
:           :   :...5840  %* FIRST ØRDER STØRY DRIFT DESIGN VALUE
:           :   :...4610  DEFLECTIØN AT STØRY X
:           :       :.................-3280  % DESIGNER WISHES TØ USE SØIL STRUCTURE INTERACTIØN
:           :       :..-3520  % SEISMIC LØAD ANALYSIS USED
:           :       :..-3550  % EARTHQUAKE FØRCE EFFECT FRØM MØRE RIGØRØUS ANALYSIS
:           :       :...6268  %* MØDIFIED ELF DEFLECTIØNS FØR SØIL STRUCTURE INTERACTIØN
:           :       :...5850  %* FIRST ØRDER STØRY DEFLECTIØN DESIGN VALUE
:           :       :...4608  ELF DEFLECTIØNS WITHØUT SØIL STRUCTURE INTERACTIØN
:           :           :...4615  ELASTIC DEFLECTIØN AT STØRY X
:           :           :   :...4617  DEFLECTIØN TØ BE USED ØNLY FØR CHECKING DRIFT REQT
:           :           :   :.....................-4245  FUNDAMENTAL BUILDING PERIØD CALCULATED BY DESIGNER
:           :           :   :...4620  DEFLECTIØN TØ BE BASED ØN CALCULATED FUNDAMENTAL PERIØD
:           :           :   :....................-4250* CALCULATED FUNDAMENTAL BUILDING PERIØD
:           :           :   :....................-4255* APPRØXIMATE BUILDING PERIØD
:           :           :   :..-4310* SEISMIC STØRY FØRCE
:           :           :   :...4630  REDUCED SEISMIC FØRCES CØRRESPØNDING TØ CALCULATED PERIØDS
:           :           :   :   :.................-4250* CALCULATED FUNDAMENTAL BUILDING PERIØD
:           :           :   :   :..-4205* SEISMIC BASE SHEAR
:           :           :   :   :..-4320* VERTICAL DISTRIBUTIØN FACTØR
:           :           :   :...4635  ELASTIC ANALYSIS
:           :           :   :.........................-4253  BUILDING ASSUMED FIXED AT BASE
```

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:            :            :...3348  %* DEFLECTIØN AMPLIFICATIØN FACTØR
:            :..-4410* SEISMIC STØRY SHEAR
:            :...2228  % STØRY HEIGHT BELØW LEVEL X
:            :.............-3348  %* DEFLECTIØN AMPLIFICATIØN FACTØR
:...4665  INCREASE IN FØRCE EFFECTS FRØM SECØND ØRDER EFFECTS
:   :...4660  DESIGN STØRY DRIFT
:   :   :..-4640* STABILITY CØEFFICIENT
:   :   :......-4605* FIRST ØRDER DESIGN STØRY DRIFT
:   :   :...4650  INCREMENTAL FACTØR FØR SECØND ØRDER EFFECTS
:   :       :...4655  RATIØNAL ANALYSIS
:   :..........-4655  RATIØNAL ANALYSIS
4522  ØVERTURNING MØMENT AT FØUNDATIØN WITHØUT REDUCTIØN
:.............-4530* ØVERTURNING MØMENT REDUCTIØN FACTØR
:............................-4310* SEISMIC STØRY FØRCE
:................-2275  % NUMBER ØF THE LEVEL X
:..................................-2226  % HEIGHT TØ LEVEL X
:..................................-2243  % NUMBER ØF LEVELS (STØRIES)
```

GLOBAL INGREDIENCE OF CHAPTER 5

EXTREME LEVEL FROM OUTPUT

```
0   1   2   3   4   5   6   7   8   9

5001  MODAL ANALYSIS REQUIREMENT
:...3520  % SEISMIC LOAD ANALYSIS USED
:...5002  SPECIFIED MODAL ANALYSIS PROCEDURES FOLLOWED
:...5210  MODELING REQUIREMENT
:   :...5220  BUILDING MODELED AS A SYSTEM OF MASSES LUMPED AT FLOORS
:   :...5230  EACH MASS HAS ONE DEGREE OF FREEDOM IN LATERAL DISPLACEMENT
:...5310  MODES REQUIREMENT
:   :...........5320  NUMBER OF MODES INCLUDED IN ANALYSIS
:   :.......................5330  MODAL PERIOD
:   :                       :...5410  PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
:   :                           :...5420  PERIODS AND SHAPES CALCULATED WITH ESTABLISHED METHODS
:   :                           :...5430  PERIODS AND SHAPES BASED ON FIXED BASE BUILDING
:   :                           :...5440  PERIODS AND MODES BASED ON ELASTIC PROPERTIES OF SRS
:   :.......................2243  % NUMBER OF LEVELS (STORIES)
:   :...5340  MODES ANALYZED ON EACH OF TWO PERPENDICULAR AXES
:..........................-5410* PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
5515  MODE 1 BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
:.....................5520  MODAL SEISMIC COEFFICIENT
:                     :..-5330* MODAL PERIOD
:                     :...1405  %* EFFECTIVE PEAK ACCELERATION
:                     :...1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:                     :...3210  %* SOIL PROFILE TYPE
:                     :...3220  %* SEISMIC SOIL COEFFICIENT
:                     :...5550  MODE NUMBER
:                     :...3354  %* RESPONSE MODIFICATION FACTOR
:.....................5530  EFFECTIVE MODAL GRAVITY LOAD
:                     :..-2243  % NUMBER OF LEVELS (STORIES)
:                     :...4340  %* TOTAL WEIGHT AT LEVEL X
:                     :...5540  MODAL STORY DISPLACEMENT AMPLITUDE
:                         :..-5410* PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
5635  MODE 1 STORY DEFLECTION WITHOUT SOIL STRUCTURE INTERACTION
:...........3348  %* DEFLECTION AMPLIFICATION FACTOR
:...........5640  ELASTIC MODAL STORY DEFLECTION
:           :...2223  % ACCELERATION OF GRAVITY
:           :.............-5330* MODAL PERIOD
:           :...5610  MODAL STORY FORCE
:           :   :...5620  MODAL VERTICAL DISTRIBUTION FACTOR
:           :   :   :......-2243  % NUMBER OF LEVELS (STORIES)
:           :   :   :......-4340  %* TOTAL WEIGHT AT LEVEL X
:           :   :   :......-5540* MODAL STORY DISPLACEMENT AMPLITUDE
:           :   :...5510  MODAL BASE SHEAR
:           :       :..-5520* MODAL SEISMIC COEFFICIENT
:           :       :..-5530* EFFECTIVE MODAL GRAVITY LOAD
:           :       :...3280  % DESIGNER WISHES TO USE SOIL STRUCTURE INTERACTION
:           :       :......-5550  MODE NUMBER
:           :       :...6300  %* MODE 1 BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
:           :.............-4340  %* TOTAL WEIGHT AT LEVEL X
5820  STORY SHEAR DESIGN VALUE
:.......2114  % ELEMENT OF BUILDING (COMPONENT)
:.............-5320  NUMBER OF MODES INCLUDED IN ANALYSIS
```

```
:...5710  MODAL STORY SHEAR
:   :..........-5610* MODAL STORY FORCE
:   :.......5750  FORCE EFFECT COMPUTED BY LINEAR STATIC METHODS
:...5730  MODAL SHEAR IN WALLS OR BRACED FRAMES
:   :..........-5610* MODAL STORY FORCE
:   :......-5750  FORCE EFFECT COMPUTED BY LINEAR STATIC METHODS
:.......5880  ELF ADJUSTMENT FACTOR
:       :...5810  BASE SHEAR DESIGN VALUE
:       :   :..-5320  NUMBER OF MODES INCLUDED IN ANALYSIS
:       :   :......-5510* MODAL BASE SHEAR
:       :...5860  COMPARITIVE ELF BASE SHEAR
:       :   :..............-3210  %* SOIL PROFILE TYPE
:       :   :..............-3220  %* SEISMIC SOIL COEFFICIENT
:       :   :...4215  %* TOTAL GRAVITY WEIGHT OF BUILDING
:       :   :..............-1405  %* EFFECTIVE PEAK ACCELERATION
:       :   :..............-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:       :   :..............-3354  %* RESPONSE MODIFICATION FACTOR
:       :   :...4255  %* APPROXIMATE BUILDING PERIOD
:       :...5870  DESIGNER CHOOSES NOT TO EXCEED ELF BASE SHEAR
:       :...4205  %* SEISMIC BASE SHEAR
5840  FIRST ORDER STORY DRIFT DESIGN VALUE
:..............-5320  NUMBER OF MODES INCLUDED IN ANALYSIS
:...5650  FIRST ORDER MODAL STORY DRIFT
:   :...5630  MODAL STORY DEFLECTION
:       :..-3348  %* DEFLECTION AMPLIFICATION FACTOR
:       :..-5640* ELASTIC MODAL STORY DEFLECTION
:       :.............-3280  % DESIGNER WISHES TO USE SOIL STRUCTURE INTERACTION
:       :.................-5550  MODE NUMBER
:       :...6340  %* MODE 1 DEFLECTS MODIFIED FOR SOIL STRUCTURE INTERACTION
:......-5880* ELF ADJUSTMENT FACTOR
5850  FIRST ORDER STORY DEFLECTION DESIGN VALUE
:..............-5320  NUMBER OF MODES INCLUDED IN ANALYSIS
:......-5630* MODAL STORY DEFLECTION
:......-5880* ELF ADJUSTMENT FACTOR
5910  OVERTURNING MOMENT DESIGN VALUE
:...5830  STORY OVERTURNING MOMENT DESIGN VALUE
:   :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :..........-5320  NUMBER OF MODES INCLUDED IN ANALYSIS
:   :...5720  MODAL STORY OVERTURNING MOMENTS
:   :   :......-5610* MODAL STORY FORCE
:   :   :..-5750  FORCE EFFECT COMPUTED BY LINEAR STATIC METHODS
:   :...5740  MODAL OVERTURNING MOMENTS IN WALLS OR BRACED FRAMES
:   :   :......-5610* MODAL STORY FORCE
:   :   :..-5750  FORCE EFFECT COMPUTED BY LINEAR STATIC METHODS
:   :..-5880* ELF ADJUSTMENT FACTOR
:...2275  % NUMBER OF THE LEVEL X
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GLØBAL INGREDIENCE ØF CHAPTER 6

EXTREME LEVEL FRØM ØUTPUT

```
0   1   2   3   4   5   6   7   8   9  10  11  12  13  14

6001  SØIL STRUCTURE INTERACTIØN ANALYSIS REQUIREMENT
:...3280  % DESIGNER WISHES TØ USE SØIL STRUCTURE INTERACTIØN
:...6002  SPECIFIED SØIL STRUCT INT ANALYSIS PRØCEDURES FØLLØWED
6268  MØDIFIED ELF DEFLECTIØNS FØR SØIL STRUCTURE INTERACTIØN
:...6200  ELF BASE SHEAR MØDIFIED BY SØIL STRUCTURE INTERACTIØN
:   :...4208  %* ELF SEISMIC BASE SHEAR WITHØUT SØIL STRUCTURE INTERACTIØN
:   :...6202  SØIL STRUCT INTERACTIØN REDUCTIØN ØF ELF BASE SHEAR
:       :...4210  %* SEISMIC DESIGN CØEFFICIENT
:       :...6204  ELF SEISMIC CØEFFICIENT MØDIFIED FØR SØIL STRUCT INT
:       :   :...................6210  PERIØD EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :...6232  TYPE ØF FØUNDATIØN
:       :   :                   :...6234  MAT FØUNDATIØN LØCATED AT ØR NEAR SURFACE
:       :   :                   :...6236  MAT FØUNDATIØN EMBEDDED WITHØUT EFFECTIVE WALL CØNTACT
:       :   :                   :...6241  USE ØF ALTERNATE EFFECTIVE PERIØD DESIRED
:       :   :                   :...6238  EFFECTIVE PERIØD FØR TYPICAL BUILDING
:       :   :                   :   :.......6211  PERIØD WITHØUT MØDIFICATIØN FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :   :       :...3520  % SEISMIC LØAD ANALYSIS USED
:       :   :                   :   :       :...4240  %* BUILDING PERIØD
:       :   :                   :   :       :...5330  %* MØDAL PERIØD
:       :   :                   :   :...6212  STIFFNESS ØF BUILDING FIXED AT BASE
:       :   :                   :   :   :...........2223  % ACCELERATIØN ØF GRAVITY
:       :   :                   :   :   :...6208  GRAVITY LØAD EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :   :   :   :..-3520  % SEISMIC LØAD ANALYSIS USED
:       :   :                   :   :   :   :...6207  ELF GRAVITY LØAD EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :   :   :   :   :...6209  GRAVITY LØAD CØNCENTRATED AT A SINGLE LEVEL
:       :   :                   :   :   :   :   :...4215  %* TØTAL GRAVITY WEIGHT ØF BUILDING
:       :   :                   :   :   :   :...5530  %* EFFECTIVE MØDAL GRAVITY LØAD
:       :   :                   :   :   :..-6211* PERIØD WITHØUT MØDIFICATIØN FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :   :...6214  LATERAL STIFFNESS ØF FØUNDATIØN
:       :   :                   :   :   :...6220  CØMPUTATIØNS FØLLØW ESTABLISHED PRINCIPLES
:       :   :                   :   :   :...6222  AVERAGE SHEAR MØDULUS ØF SØIL AT LARGE STRAINS
:       :   :                   :   :   :   :...6226  SHEAR MØDULUS ØF SØIL AT SMALL STRAINS
:       :   :                   :   :   :   :   :...6230  AVERAGE UNIT WEIGHT ØF SØIL
:       :   :                   :   :   :   :   :...6228  SHEAR WAVE VELØCITY ØF SØIL AT SMALL STRAINS
:       :   :                   :   :   :   :   :   :...6229  STRAIN LEVEL IN SØIL
:       :   :                   :   :   :   :   :..-2223  % ACCELERATIØN ØF GRAVITY
:       :   :                   :   :   :   :...1415  %* EFFECTIVE PEAK VELØCITY-RELATED ACCELERATIØN
:       :   :                   :   :   :...6224  AVERAGE SHEAR WAVE VELØCITY ØF SØIL AT LARGE STRAINS
:       :   :                   :   :       :......-6228* SHEAR WAVE VELØCITY ØF SØIL AT SMALL STRAINS
:       :   :                   :   :       :..-1415  %* EFFECTIVE PEAK VELØCITY-RELATED ACCELERATIØN
:       :   :                   :   :...6216  RØCKING STIFFNESS ØF FØUNDATIØN
:       :   :                   :   :   :..-6220  CØMPUTATIØNS FØLLØW ESTABLISHED PRINCIPLES
:       :   :                   :   :   :..-6222* AVERAGE SHEAR MØDULUS ØF SØIL AT LARGE STRAINS
:       :   :                   :   :   :..-6224* AVERAGE SHEAR WAVE VELØCITY ØF SØIL AT LARGE STRAINS
:       :   :                   :   :.......6218  HEIGHT EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :           :..-3520  % SEISMIC LØAD ANALYSIS USED
:       :   :                   :           :...6217  ELF HEIGHT EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:       :   :                   :           :   :..-6209  GRAVITY LØAD CØNCENTRATED AT A SINGLE LEVEL
:       :   :                   :           :   :...2227  % TØTAL HEIGHT
:       :   :                   :           :...6330  MØDAL HEIGHT EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
```

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:       :   :                   :               :...4340  %* TOTAL WEIGHT AT LEVEL X
:       :   :                   :               :...5540  %* MODAL STORY DISPLACEMENT AMPLITUDE
:       :   :                   :               :...2226  % HEIGHT TO LEVEL X
:       :   :                   :               :...2243
:       :   :                   :...6240  EFFECTIVE PERIOD FOR MAT FOUNDATION BUILDING
:       :   :                       :.......-6211* PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION
:       :   :                       :...6242  RELATIVE DENSITY OF STRUCTURE AND SOIL
:       :   :                       :   :..-6208* GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :   :                       :   :..-6218* HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :   :                       :   :..........-6230  AVERAGE UNIT WEIGHT OF SOIL
:       :   :                       :   :...6248  AREA OF FOUNDATION
:       :   :                       :...6244  CHARACTERISTIC FOUNDATION LENGTH BASED ON AREA
:       :   :                       :   :..-6248  AREA OF FOUNDATION
:       :   :                       :......-6218* HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :   :                       :......-6224* AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS
:       :   :                       :...6246  CHARACTERISTIC FOUNDATION LENGTH BASED ON INERTIA
:       :   :                           :...6250  STATIC MOMENT OF INERTIA OF FOUNDATION
:       :   :...3210  %* SOIL PROFILE TYPE
:       :   :...3220  %* SEISMIC SOIL COEFFICIENT
:       :   :...3354  %* RESPONSE MODIFICATION FACTOR
:       :   :..............................-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:       :   :...1405  %* EFFECTIVE PEAK ACCELERATION
:       :...6206  FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYSTEM
:       :   :...6252  COMPUTED FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYS
:       :       :...6254  FOUNDATION DAMPING FACTOR
:       :       :   :.............-6232  TYPE OF FOUNDATION
:       :       :   :...6262  FOUNDATION IS UNIFORM SOFT STRATUM OVER ROCK LIKE STRATUM
:       :       :   :.......6266  TOTAL DEPTH OF SOFT STRATUM
:       :       :   :..........-6210* PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :   :..................-6224* AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS
:       :       :   :.......6256  DAMPING VALUE FROM FIGURE 6-1
:       :       :   :       :.............-6211* PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION
:       :       :   :       :..-6210* PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :   :       :...6258  CHARACTERISTIC FOUNDATION LENGTH
:       :       :   :       :   :..........-6218* HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :   :       :   :...2236  % OVERALL LENGTH OF FOUNDATION PARALLEL TO SEISMIC FORCE
:       :       :   :       :   :......-6244* CHARACTERISTIC FOUNDATION LENGTH BASED ON AREA
:       :       :   :       :   :......-6246* CHARACTERISTIC FOUNDATION LENGTH BASED ON INERTIA
:       :       :   :       :.............-6218* HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :   :       :.................-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:       :       :   :...6264  FOUNDATION DAMPING FACTOR FOR PILE FOUNDATIONS
:       :       :       :..-6266  TOTAL DEPTH OF SOFT STRATUM
:       :       :       :.................-6224* AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS
:       :       :       :......-6210* PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :       :..-6256* DAMPING VALUE FROM FIGURE 6-1
:       :       :.............-6210* PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:       :       :.........................-6211* PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION
:       :.................................-6208* GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
:......-4208  %* ELF SEISMIC BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
:...4522  %* OVERTURNING MOMENT AT FOUNDATION WITHOUT REDUCTION
:...4608  %* ELF DEFLECTIONS WITHOUT SOIL STRUCTURE INTERACTION
:.....................................-6216* ROCKING STIFFNESS OF FOUNDATION
:..................................................-2226  % HEIGHT TO LEVEL X
6340  MODE 1 DEFLECTIONS MODIFIED FOR SOIL STRUCTURE INTERACTION
:...6300  MODE 1 HASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
:   :...6310  SOIL STRUCTURE INTERACTION REDUCTION IN MODE 1 BASE SHEAR
:   :   :...5520  %* MODAL SEISMIC COEFFICIENT
:   :   :...6320  MODE 1 SEISMIC COEFFICIENT MODIFIED FOR SOIL STRUCT INT
```

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:   :   :   :.................-6210* PERIØD EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:   :   :   :..-1405  %* EFFECTIVE PEAK ACCELERATIØN
:   :   :   :..................................-1415  %* EFFECTIVE PEAK VELØCITY-RELATED ACCELERATIØN
:   :   :   :..-3210  %* SØIL PRØFILE TYPE
:   :   :   :..-3220  %* SEISMIC SØIL CØEFFICIENT
:   :   :   :...5550  % MØDE NUMBER
:   :   :   :..-3354  %* RESPØNSE MØDIFICATIØN FACTØR
:   :   :..-6206* FRACTIØN ØF CRITICAL DAMPING IN STRUCT FØUND SYSTEM
:   :   :................................-6208* GRAVITY LØAD EFFECTIVE FØR SØIL STRUCTURE INTERACTIØN
:   :...5515  %* MØDE 1 BASE SHEAR WITHØUT SØIL STRUCTURE INTERACTIØN
:......-5515  %* MØDE 1 BASE SHEAR WITHØUT SØIL STRUCTURE INTERACTIØN
:...5720  %* MØDAL STØRY ØVERTURNING MØMENTS
:.................................................-2226  % HEIGHT TØ LEVEL X
:...................................-6216* RØCKING STIFFNESS ØF FØUNDATIØN
:...5635  %* MØDE 1 STØRY DEFLECTIØN WITHØUT SØIL STRUCTURE INTERACT
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GLOBAL INGREDIENCE OF CHAPTER 7

EXTREME LEVEL FROM OUTPUT

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0   1   2   3   4   5   6   7

7001  FOUNDATION DESIGN REQUIREMENTS
:...1490  %* SEISMIC PERFORMANCE CATEGORY
:...7210  FOUNDATION COMPONENT STRENGTH REQUIREMENT
:   :...3702  %* REQUIRED STRENGTH
:   :...7220  REQUIRED STRENGTH WITHOUT SEISMIC LOAD
:   :   :...3707  %* DEAD LOAD EFFECT
:   :   :...3708  %* LIVE LOAD EFFECT
:   :   :...3710  %* SNOW LOAD EFFECT
:   :...7215  STRENGTH OF FOUNDATION COMPONENTS
:   :   :...9210  %* STRENGTH OF WOOD COMPONENTS
:   :   :..10210  %* STRENGTH OF STEEL COMPONENTS
:   :   :..11210  %* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:   :   :..12210  %* STRENGTH OF MASONRY COMPONENTS
:   :...9001  %* WOOD MATERIALS REQUIREMENT
:   :..10001  %* STEEL MATERIALS REQUIREMENT
:   :..11001  %* CONCRETE MATERIALS REQUIREMENT
:   :..12001  %* MASONRY MATERIALS REQUIREMENT
:...7230  FOUNDATION SOIL CAPACITY REQUIREMENT
:   :...7240  SOIL CAPACITY UNDER NON-SEISMIC CONDITIONS
:   :..-7220* REQUIRED STRENGTH WITHOUT SEISMIC LOAD
:   :...7250  SETTLEMENT UNDER NON-SEISMIC CONDITIONS
:   :...7260  MAXIMUM SETTLEMENT STRUCTURE CAN WITHSTAND
:   :...7270  ELASTIC LIMIT OF SOIL UNDER SEISMIC CONDITIONS
:   :   :...3160  %* FOUNDATION DESIGN CRITERIA REQUIREMENT
:   :..-3702  %* REQUIRED STRENGTH
:...............7300  CATEGORY A FOUNDATION REQUIREMENT
:...........7400  CATEGORY B FOUNDATION REQUIREMENT
:           :..-7300  CATEGORY A FOUNDATION REQUIREMENT
:           :...7404  CATEGORY B SOIL INVESTIGATION REQUIREMENT
:           :   :...7408  REGULATORY AGENCY REQUIRES SOIL INVESTIGATION REPORT
:           :   :...7410  SOIL INVESTIGATION MADE
:           :   :...7412  SOIL INVEST REPORT SATISFIES NON-SEISMIC REQUIREMENTS
:           :   :...7413  SOIL INVEST REPORT INCLUDES ELASTIC LIMIT UNDER SEIS COND
:           :   :...7414  SOIL INVEST REPORT CONSIDERS SOIL CAPACITY UNDER SEIS COND
:           :   :...7416  SOIL INVEST REPORT CONSIDERS SLOPE INSTABIL UNDER SEIS COND
:           :   :...7418  SOIL INVEST REPORT CONSIDERS LIQUEFACTION UNDER SEIS COND
:           :   :...7420  SOIL INVEST REPORT CONSIDERS SURFACE RUPTURE UNDER SEIS COND
:           :   :...7424  POLES EMBEDDED IN EARTH USED TO RESIST AXIAL AND LAT LOAD
:           :   :...7426  SOIL INVEST REPORT GIVES DESIGN CRITERIA FOR POLE EMBEDMENT
:           :...7428  CATEGORY B FOUNDATION TIE REQUIREMENT
:           :   :...7430  EA INDIVID PILE CAP, DRILLED PIER, OR CAISSON INTERCONNECTED
:           :   :...3125  %* MEMBER STRENGTH
:           :   :...1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:           :   :...7432  LARGER OF CONNECTED PILE CAP LOADS
:           :   :...7434  LARGER OF CONNECTED COLUMN LOADS
:           :   :...7436  EQUIVALENT FOUNDATION RESTRAINT PROVIDED AND APPROVED
:           :...7438  CATEGORY B FOUNDATION PILE REQUIRMENT
:               :...7440  FOUNDATION STRUCTURAL COMPONENTS
:               :...7442  EMBEDDMENT OF PILE REINFORCEMENT IN PILE CAP
:               :.......7444  MINIMUM DEVELOPMENT LENGTH
```

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:                  :       :...7450  BAR DEVELOPMENT LENGTH PER CHAPTER 11 (ACI 318)
:                  :       :...7448  REINFORCING BAR CONFIGURATION
:                  :...7446  PILE TYPE
:                  :...7452  CATEGORY B UNCASED CONCRETE PILE REQUIREMENT
:                  :    :...7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:                  :    :...7456  PILE DIAMETER
:                  :    :...7458  AREA OF PILE REINFORCEMENT
:                  :    :...7460  AREA OF PILE CONCRETE
:                  :    :...7462  NUMBER OF BARS IN PILE
:                  :    :...7464  SIZE OF BARS IN PILE
:                  :    :...7466  TIES PROVIDED FOR FULL LENGTH OF PILE REINFORCEMENT
:                  :    :...7468  MAXIMUM SPACING OF TIES IN PILE
:                  :    :...7470  DIAMETER OF BARS IN PILE
:                  :    :...7472  SPACING OF TIES AT TOP 2 FEET OF PILE
:                  :    :...7474  SPIRAL PROVIDED EQUIVALENT TO TIES
:                  :...7476  CATEGORY B CASED CONCRETE PILE REQUIREMENT
:                  :    :..-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:                  :    :...7478  LENGTH OF PILE
:                  :    :..-7458  AREA OF PILE REINFORCEMENT
:                  :    :..-7460  AREA OF PILE CONCRETE
:                  :    :...7480  SPIRAL REINFORCEMNT PROVIDED FOR FULL LENGTH OF PILE REINF
:                  :    :...7482  DIAMETER OF SPIRAL BAR IN PILE
:                  :    :...7484  MAXIMUM PITCH OF SPIRAL IN PILE
:                  :    :...7486  PITCH OF SPIRAL AT TOP 2 FEET OF PILE
:                  :    :...7488  TIES PROVIDED EQUIVALENT TO SPIRAL
:                  :...7490  CATEGORY B STEEL PIPE PILE REQUIREMENT
:                  :    :..-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:                  :    :..-7444* MINIMUM DEVELOPMENT LENGTH
:                  :    :..-7458  AREA OF PILE REINFORCEMENT
:                  :    :..-7460  AREA OF PILE CONCRETE
:                  :...7492  CATEGORY B PRECAST CONCRETE PILE REQUIREMENT
:                  :    :..-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:                  :    :..-7478  LENGTH OF PILE
:                  :    :..-7458  AREA OF PILE REINFORCEMENT
:                  :    :..-7460  AREA OF PILE CONCRETE
:                  :...7494  CATEGORY B PRESTRESSED CONCRETE PILE REQUIREMENT
:                       :..-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:                       :..-7444* MINIMUM DEVELOPMENT LENGTH
:                       :..-7458  AREA OF PILE REINFORCEMENT
:                       :..-7460  AREA OF PILE CONCRETE
:                       :...7496  TIES PROVIDED AT TOP 2 FEET OF PILE
:                       :..-7472  SPACING OF TIES AT TOP 2 FEET OF PILE
:                       :...7498  SIZE OF TIES IN PILE
:                       :..-7474  SPIRAL PROVIDED EQUIVALENT TO TIES
:.......7500  CATEGORY C FOUNDATION REQUIREMENT
:         :..-7400* CATEGORY B FOUNDATION REQUIREMENT
:         :...7510  CATEGORY C SOIL INVESTIGATION REQUIREMENT
:         :    :......-7408  REGULATORY AGENCY REQUIRES SOIL INVESTIGATION REPORT
:         :    :..-7404* CATEGORY B SOIL INVESTIGATION REQUIREMENT
:         :    :...7515  SOIL INVEST REPORT INCLUDES LATERAL PRESS ON WALL DUE TO EQ
:         :...7520  CATEGORY C FOUNDATION TIE REQUIREMENT
:         :    :...7525  EACH INDIVIDUAL SPREAD FOOTING INTERCONNECTED
:         :    :......-3125  %* MEMBER STRENGTH
:         :    :......-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:         :    :...7530  LARGER OF CONNECTED FOOTING LOADS
:         :    :......-7436  EQUIVALENT FOUNDATION RESTRAINT PROVIDED AND APPROVED
:         :...7535  CATEGORY C FOUNDATION PILE REQUIREMENT
:              :......-7440  FOUNDATION STRUCTURAL COMPONENTS
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:          :.......-7446  PILE TYPE
:          :...7540  CATEGORY C UNCASED CONCRETE PILE REQUIREMENT
:          :   :.......-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:          :   :.......-7478  LENGTH OF PILE
:          :   :.......-7458  AREA OF PILE REINFORCEMENT
:          :   :.......-7460  AREA OF PILE CONCRETE
:          :   :.......-7462  NUMBER OF BARS IN PILE
:          :   :.......-7464  SIZE OF BARS IN PILE
:          :   :.......-7466  TIES PROVIDED FOR FULL LENGTH OF PILE REINFORCEMENT
:          :   :.......-7468  MAXIMUM SPACING OF TIES IN PILE
:          :   :.......-7470  DIAMETER OF BARS IN PILE
:          :   :...7545  SPACING OF TIES AT TOP 4 FEET OF PILE
:          :   :.......-7456  PILE DIAMETER
:          :   :.......-7498  SIZE OF TIES IN PILE
:          :...7550  CATEGORY C CASED CONCRETE PILE REQUIREMENT
:          :   :.......-7454  LENGTH OF PILE REINFORCEMENT FROM TOP
:          :   :.......-7478  LENGTH OF PILE
:          :   :...7555  AREA OF PILE REINFORCEMENT IN UPPER 2/3 OF PILE
:          :   :.......-7460  AREA OF PILE CONCRETE
:          :   :...7560  NUMBER OF HARS IN UPPER 2/3 OF PILE
:          :   :.......-7480  SPIRAL REINFORCEMNT PROVIDED FOR FULL LENGTH OF PILE REINF
:          :   :.......-7482  DIAMETER OF SPIRAL BAR IN PILE
:          :   :.......-7484  MAXIMUM PITCH OF SPIRAL IN PILE
:          :   :...7565  PITCH OF SPIRAL AT TOP 4 FEET OP PILE
:          :...7570  CATEGORY C PRECAST CONCRETE PILE REQUIREMENT
:          :   :...7575  TIES PROVIDED IN TOP HALF OF PILE
:          :   :..11662  %* ORDINARY CONCRETE BEAM COLUMN LATERAL REINFORCEMENT REQT
:          :   :...7580  PILE DESIGNED TO RESIST FLEXURE DUE TO EARTHQUAKE
:          :   :...7585  PILE STRESS AT MAXIMUM SOIL DEFORMATION IN EARTHQUAKE
:          :   :...7590  ELASTIC LIMIT OF PILE
:          :...7595  CATEGORY C STEEL PILE REQUIREMENT
:              :...3130  %* CONNECTION STRENGTH
:              :..-3125  %* MEMBER STRENGTH
:...7600  CATEGORY D FOUNDATION REQUIREMENT
    :..-7500* CATEGORY C FOUNDATION REQUIREMENT
    :...7620  PRECAST-PRESTRESSED PILES USED TO RESIST FLEX DUE TO EQ
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GLOBAL INGREDIENCE OF CHAPTER 8

EXTREME LEVEL FROM OUTPUT

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0   1   2   3   4   5   6   7   8

8001  ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
:...8100  ARCHITECTURAL/MECHANICAL/ELECTRICAL PROVISIONS APPLICABLE
:   :......................2114  % ELEMENT OF BUILDING (COMPONENT)
:   :...8205  ARCHITECTURAL COMPONENT LISTED IN TABLE8-B
:   :...8303  MECH/ELEC COMPONENT LISTED IN TABLE8-C
:   :..............8105  A/M/E PERFORMANCE LEVEL
:   :               :......-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :               :...8106  PERFORMANCE LEVEL FROM TABLE8-B
:   :               :   :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :               :   :...1430  %* SEISMIC HAZARD EXPOSURE GROUP
:   :               :   :...2243  % NUMBER OF LEVELS (STORIES)
:   :               :   :...2227  % TOTAL HEIGHT
:   :               :   :...8236  DISTANCE FROM EXT WALL TO CLOSEST POINT OF ACCESS
:   :               :   :...8237  BUILDING LOCATED IN AN URBAN AREA
:   :               :   :...8238  BUILDING CONTAINS HIGHLY FLAMMABLE MATERIAL
:   :               :...8107  PERFORMANCE LEVEL FROM TABLE8-C
:   :                   :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :                   :..-1430  %* SEISMIC HAZARD EXPOSURE GROUP
:   :...........1425  %* SEISMICITY INDEX
:   :.....................-1430  %* SEISMIC HAZARD EXPOSURE GROUP
:...8110  A/M/E COMPONENT STRENGTH REQUIREMENT
:   :...8115  NONSTRUCTURAL SEISMIC FORCE
:   :   :.................-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :...8215  SEISMIC FORCE FOR ARCHITECTURAL COMPONENTS
:   :   :   :...1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:   :   :   :...8220  SEISMIC COEFFICIENT FOR ARCHITECTURAL COMPONENTS
:   :   :   :   :..........-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :   :...8190  PERFORMANCE CHARACTERISTIC FACTOR
:   :   :   :   :..-8105* A/M/E PERFORMANCE LEVEL
:   :   :   :...........8225  WEIGHT OF A/M/E COMPONENT
:   :   :...8309  SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT
:   :       :...8310  ANALYSIS PERFORMED TO JUSTIFY REDUCED M/E FORCE
:   :       :...8311  RESULT OF MECH/ELECT COMPONENT FORCE ANALYSIS
:   :       :..-1415  %* EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
:   :       :...8312  SEISMIC COEFFICIENT FOR MECHANICAL/ELECTRICAL COMPONENT
:   :       :   :..........-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :       : . :...8339  TYPE OF LIGHT FIXTURE SUPPORT
:   :       :..-8190* PERFORMANCE CHARACTERISTIC FACTOR
:   :       :...8315  AMPLIFICATION FACTOR FOR ATTACHMENT OF M/E COMPONENT
:   :       :   :...........2160  % TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT
:   :       :   :...2166  % TYPE OF RESTRAINING DEVICE
:   :       :   :...8324  NATURAL PERIOD OF VIBRATION OF COMPONENT AND ATTACHMENT
:   :       :   :   :..-8225  WEIGHT OF A/M/E COMPONENT
:   :       :   :   :...8330  STIFFNESS OF M/E SUPPORT WITH RESPECT TO CENTER OF GRAVITY
:   :       :   :   :   :..-2160  % TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT
:   :       :   :   :   :...8321  TYPE OF RESILIENT MOUNTING SYSTEM
:   :       :   :   :   :   :...2161  % HORIZ FORCE DISPLACEMENT RATIO OF RESILIENT MOUNTING SYS
:   :       :   :   :   :   :...2162  % VERT FORCE DISPLACEMENT RATIO OF RESILIENT MOUNTING SYS
:   :       :   :   :   :...8332  SPRING CONSTANT FOR MOUNTING SYSTEM
:   :       :   :   :   :...8333  SLOPE OF M/E SUPPORT LOAD DEFLECTION CURVE AT POINT OF LOAD
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:   :       :   :   :...8340  USE OF OTHER SUBSTANTIATED VALUE OF PERIOD DESIRED
:   :       :   :   :...8342  PROPERLY SUBSTANTIATED VALUE OF PERIOD
:   :       :   :...4240  %* BUILDING PERIOD
:   :       :   :...8327  LOCATION OF MECH/ELEC MOUNTING SYSTEM
:   :       :...8318  AMPLIFICATION FACTOR FOR LOCATION OF M/E COMPONENT
:   :       :   :...2226  % HEIGHT TO LEVEL X
:   :       :   :..........-2227  % TOTAL HEIGHT
:   :       :..........-8225  WEIGHT OF A/M/E COMPONENT
:   :...8112  A/M/E COMPONENT RESISTANCE
:   :...8120  POINT OF APPLICATION OF FORCE ON A/M/E COMPONENT
:   :...8125  DIRECTION OF APPLICATION OF FORCE ON A/M/E COMPONENT
:   :.....................-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :...8130  VERTICAL SEISMIC FORCE
:   :   :...8313  SEISMIC COEFFICIENT FOR VERTICAL FORCE ON M/E COMPONENT
:   :   :   :.............-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :   :.......-8339  TYPE OF LIGHT FIXTURE SUPPORT
:   :   :..-8309* SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT
:   :...8230  WIND LOAD ON EXTERIOR WALL
:   :...8235  CODE HORIZONTAL LOAD ON PARTITION
:...8135  A/M/E INTERRELATIONSHIP REQUIREMENT
:   :...8140  INTERRELATIONSHIP OF A/M/E SYSTEMS EXISTS
:   :...8145  FAILURE OF A/M/E COMPONENT CAUSES FAILURE AT HIGHER PERF LEV
:   :...8150  INTERACTION OF A/M/E SYSTEM WITH STRUCTURE EXISTS
:   :...8155  EFFECT OF A/M/E RESPONSE ON STRUCTURE CONSIDERED
:   :...8160  EFFECT OF A/M/E DEFORM COMPATIBILITY WITH STRUCT CONSIDERED
:...8165  A/M/E ATTACHMENT REQUIREMENT
:   :...8170  ALL A/M/E COMPONENTS ATTACHED TO STRUCTURE
:   :...8175  ATTACHEMENTS TRANSMIT SEISMIC FORCE TO STRUCTURE
:   :...8180  FRICTION DUE TO GRAVITY CONSIDERED AS RESISTANCE
:   :...8185  ATTACHMENT DES DOCUMENTATION SUFFICIENT TO VERIFY COMPLIANCE
:...8200  ARCHITECTURAL DESIGN REQUIREMENT
:   :...8210  ARCH COMPONENT DESIGN OR CRITERIA INCLUDED IN DESIGN DOC
:   :...8240  EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT
:   :   :.................-2114  % ELEMENT OF BUILDING (COMPONENT)
:   :   :...8245  DUCTILITY/ROTATION CAPACITY PROVIDED
:   :   :...4660  %* DESIGN STORY DRIFT
:   :...8250  ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT
:   :   :..........-8105* A/M/E PERFORMANCE LEVEL
:   :   :...8255  HORIZONTAL DRIFT PROVIDED FOR IN DESIGN OF ARCH COMPONENT
:   :   :..-4660  %* DESIGN STORY DRIFT
:   :   :...8260  ARCH COMPONENT RELATED TO HORIZONTAL CANTILEVER
:   :   :...8265  VERTICAL DEFLECTION OF CANTILEVER PROVIDED FOR IN ARCH COMP
:   :...8270  ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT
:       :...8275  MATERIAL BEHAVIOR OF ARCHITECTURAL COMPONENT
:       :...8280  OUT OF PLANE BENDING DEFLECTION DUE TO SEISMIC FORCE
:       :...8285  DEFLECTION CAPABILITY OF ARCHITECTURAL COMPONENT
:...8300  MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
:   :...8306  M/E COMPONENT DESIGN OR CRITERIA INCLUDED IN DESIGN DOCUMENT
:   :...8345  MECH/ELEC ATTACHMENT DESIGN REQUIREMENT
:   :   :.................-2160  % TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT
:   :   :...9001  %* WOOD MATERIALS REQUIREMENT
:   :   :..10001  %* STEEL MATERIALS REQUIREMENT
:   :   :..11001  %* CONCRETE MATERIALS REQUIREMENT
:   :   :..12001  %* MASONRY MATERIALS REQUIREMENT
:   :   :.................-8321* TYPE OF RESILIENT MOUNTING SYSTEM
:   :   :...8348  RESTRAINING DEVICE PROVIDED FOR RESILIENT MOUNTING
:   :   :...........-2166  % TYPE OF RESTRAINING DEVICE
:   :   :...8351  RESISTANCE OF RESTRAINING DEVICE ON RESILIENT MOUNT
```

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:   :   :..-8309* SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT
:   :   :...8354  FORCE ON COMPONENT DUE TO DECELERATION BY RESTRAINT
:   :   :...8357  RESTRAINING FORCE DETERMINED BY DYNAMIC ANALYSIS
:   :...8360  MECHANICAL/ELECTRICAL COMPONENT DESIGN REQUIREMENT
:   :   :...8363  M/E COMPONENT CERTIFICATION (TESTING) REQUIRED
:   :   :   :..............-2160  % TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT
:   :   :   :.......-8105* A/M/E PERFORMANCE LEVEL
:   :   :   :..-1425  %* SEISMICITY INDEX
:   :   :...8369  M/E ATTACHMENT CERTIFICATION (TESTING) REQUIRED
:   :   :   :..............-2160  % TYPE OF MOUNTING SYSTEM FOR MECH/ELEC EQUIPMENT
:   :   :   :.......-8105* A/M/E PERFORMANCE LEVEL
:   :   :...1644  %* MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
:   :...8372  M/E UTILITY SERVICE INTERFACE REQUIREMENT
:       :.................-1430  %* SEISMIC HAZARD EXPOSURE GROUP
:       :.......-1425  %* SEISMICITY INDEX
:       :.................-2114  % ELEMENT OF BUILDING (COMPONENT)
:       :...8375  TYPE OF UTILITY SERVICE
:       :...8378  UTILITY SHUTOFF DEVICE PROVIDED
:       :...8381  ACTION TO TRIGGER UTILITY SHUTOFF DEVICE
:       :...1405  %* EFFECTIVE PEAK ACCELERATION
:...1230  % BUILDING STAGE
:...1240  % PROPOSED WORK ON EXISTING BUILDING
:..13301  %* HAZARD ABATEMENT REQUIREMENT
```

GLOBAL INGREDIENCE OF CHAPTER 9

EXTREME LEVEL FROM OUTPUT

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0   1   2   3   4   5   6   7   8   9  10  11

9001  WOOD MATERIALS REQUIREMENT
:...9110  BUILDING ELEMENTS THAT RESIST SEISMIC FORCE
:...9120  REQUIREMENTS OF WOOD REFERENCE DOCUMENTS
:...1270  % BUILDING USE
:.......................1350  % CONSTRUCTION TYPE
:.......................2243  % NUMBER OF LEVELS (STORIES)
:...2227  % TOTAL HEIGHT
:...1425  %* SEISMICITY INDEX
:...9701  CONVENTIONAL LIGHT TIMBER REQUIREMENT
:   :...9706  CONVENTIONAL WALL FRAMING REQUIREMENT
:   :   :...9709  DIAMETER OF FOUNDATION SILL ANCHOR BOLTS
:   :   :...9712  SPACING OF FOUNDATION SILL ANCHOR BOLTS
:   :   :...9715  EMBEDDMENT OF FOUNDATION SILL ANCHOR BOLTS
:   :   :...9718  DOUBLE PLATES PROVIDED AT TOP OF WALL
:   :   :...9721  INDIVIDUAL TOP PLATES OVERLAP AT CORNERS AND INTERSECTIONS
:   :   :...9724  SPACING BETWEEN JOINTS IN INDIVIDUAL TOP PLATES
:   :   :...9727  WALL STUDS BEAR FULLY ON BOTTOM PLATES
:   :   :...9730  THICKNESS OF BOTTOM PLATE
:   :   :...9733  WIDTH OF BOTTOM PLATE
:   :   :...9736  WIDTH OF STUD
:   :...9739  CONVENTIONAL WALL SHEATHING REQUIREMENT
:       :...9742  WALLS WITH SEISMIC BRACING SECTION
:       :...............9763  WALL SHEATHING APPLICATION REQUIREMENT
:       :                :...................9545  SHEAR WALL SHEATHING MATERIAL
:       :                :...............9766  SPACING OF STUDS
:       :                :...................9769  THICKNESS OF SHEATHING
:       :                :...9772  BOARDS APPLIED DIAGONAL TO FRAMING
:       :                :...................9775  SHEATHING PANEL SIZE
:       :                :...9778  SHEATHING PANEL ORIENTATION
:       :                :...................9781  SIZE OF NAILS IN SHEATHING
:       :                :...................9784  SPACING OF NAILS IN SHEATHING
:       :                :...9828  CONVENTIONAL DIAGONAL SHEATHING REQUIREMENT
:       :                    :..............-9769  THICKNESS OF SHEATHING
:       :                    :...9829  BOARD WIDTH
:       :                    :..............-9781  SIZE OF NAILS IN SHEATHING
:       :                    :...............9831  TYPE OF NAIL
:       :                    :...9821  DEPTH OF DIAPHRAGM NORMAL TO OPEN SIDE
:       :                    :...9832  NAILS PER BOARD AT PANEL BOUNDARDY
:       :                    :...9833  NAILS PER BOARD AT INTERIOR FRAMING
:       :                    :...9834  SPACING OF JOINTS IN ADJACENT BOARDS
:       :                    :...9853  SPACING OF FRAMING MEMBERS
:       :                    :...9836  SPACING OF JOINTS IN BOARDS ON ANY FRAMING MEMBER
:       :                    :...........9760  THICKNESS OF FRAMING MEMBERS
:       :                    :...9838  DEPTH OF FRAMING
:       :                    :...9839  ANGLE BETWEEN BOARDS AND FRAMING
:       :...9745  LOCATION OF SEISMIC BRACING SECTIONS ON WALL
:       :...9748  SPACING OF SEISMIC BRACING SECTIONS ON WALL
:       :...9751  WIDTH OF SEISMIC BRACING SECTION
:       :...9754  VERTICAL JOINTS IN SHEATHING OCCUR ONLY ON STUDS
:       :...9757  HORIZONTAL JOINTS IN SHEATHING OCCUR ONLY ON FRAMING
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:        :..............................-9760  THICKNESS OF FRAMING MEMBERS
:        :..........................1490  %* SEISMIC PERFORMANCE CATEGORY
:        :..............-2243  % NUMBER OF LEVELS (STORIES)
:        :...............9330  WALL LOCATION
:        :...............9320  PORTION OF LENGTH OF WALL WITH BRACING
:...9200  WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT
:   :.....................9210  STRENGTH OF WOOD COMPONENTS
:                         :...9220  CAPACITY REDUCTION FACTOR FOR WOOD
:                         :   :...2114  % ELEMENT OF BUILDING (COMPONENT)
:                         :   :...9240  STRESS TYPE
:                         :   :...9250  DIAPHRAGM STRENGTH CALCULATED FROM FRINCILES OF MECHANICS
:                         :   :.......9260  SPECIES GROUP
:                         :   :...9270  DIAPHRAGM STRENGTH FROM THESE PROVISIONS
:                         :   :...9280  NUMBER OF SCREWS OR NAILS IN JOINT
:                         :   :.......9290  WIDTH OF PANEL BOUNDARY MEMBERS
:                         :...9230  ALLOWABLE STRENGTH OF WOOD COMPONENTS
:                             :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:                             :..-9250  DIAPHRAGM STRENGTH CALCULATED FROM PRINCILES OF MECHANICS
:                             :...9130  COMPONENT COVERED BY WOOD REFERENCE DOCUMENTS
:                             :..-1490  %* SEISMIC PERFORMANCE CATEGORY
:                             :...9630  BUILDING CONTAINS CONCRETE OR MASONRY WALLS
:                             :...9867  ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD DIAPHRAGM
:                             :   :...9868  PLYWOOD GRADE
:                             :   :......-9781  SIZE OF NAILS IN SHEATHING
:                             :   :...9869  PENETRATION OF NAIL INTO FRAMING
:                             :   :......-9769  THICKNESS OF SHEATHING
:                             :   :..-9760  THICKNESS OF FRAMING MEMBERS
:                             :   :..-9290  WIDTH OF PANEL BOUNDARY MEMBERS
:                             :   :.......9858  FRAMING MEMBERS PROVIDED AT ALL EDGES OF EA SHEET (BLOCKED)
:                             :   :...9871  ANGLE BETWEEN LOAD AND UNBLOCKED EDGES
:                             :   :...9872  ANGLE BETWEEN LOAD AND CONTINUOUS SHEET EDGES
:                             :   :...9873  SPACING OF NAILS AT PANEL BOUNDARY
:                             :   :...9874  SPACING OF NAILS AT CONTINUOUS SHEET EDGES
:                             :   :...9876  SPACING OF NAILS AT OTHER SHEET EDGES
:                             :   :......-9831  TYPE OF NAIL
:                             :...9877  ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD SHEAR WALLS
:                             :   :..-9868  PLYWOOD GRADE
:                             :   :......-9781  SIZE OF NAILS IN SHEATHING
:                             :   :..-9869  PENETRATION OF NAIL INTO FRAMING
:                             :   :......-9769  THICKNESS OF SHEATHING
:                             :   :...9570  PLYWOOD APPLICATION
:                             :   :..-9873  SPACING OF NAILS AT PANEL BOUNDARY
:                             :   :..-9290  WIDTH OF PANEL BOUNDARY MEMBERS
:                             :   :..-9766  SPACING OF STUDS
:                             :   :...9864  DIRECTION OF FACE GRAIN
:                             :   :..-9260  SPECIES GROUP
:                             :   :......-9831  TYPE OF NAIL
:                             :...9886  ALLOWABLE WORKING STRESS SHEAR FOR FIBERBOARD SHEAR WALLS
:                             :   :......-9769  THICKNESS OF SHEATHING
:                             :   :......-9781  SIZE OF NAILS IN SHEATHING
:                             :   :......-9831  TYPE OF NAIL
:                             :   :...9887  FIBERBOARD SHEATHING TYPE
:                             :   :...9896  WALL SHEATHED WITH OTHER MATERIAL THAT IS USED FOR SHEAR RES
:                             :   :...9897  SAME MATERIAL APPLIED ON BOTH FACES OF WALL
:                             :   :..-9873  SPACING OF NAILS AT PANEL BOUNDARY
:                             :   :...9866  SPACING OF NAILS AT INTERMEDIATE MEMBERS
:                             :...9888  ALLOWABLE WORKING STRESS SHEAR FOR LATH AND PLASTER WALLS
:                             :   :......-9545  SHEAR WALL SHEATHING MATERIAL
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:                                       :    :......-9769  THICKNESS ØF SHEATHING
:                                       :    :...9889  LATH THICKNESS
:                                       :    :...9891  PLASTER THICKNESS
:                                       :    :......-9784  SPACING ØF NAILS IN SHEATHING
:                                       :    :......-9781  SIZE ØF NAILS IN SHEATHING
:                                       :    :......-9831  TYPE ØF NAIL
:                                       :    :..-9896  WALL SHEATHED WITH ØTHER MATERIAL THAT IS USED FØR SHEAR RES
:                                       :    :..-9897  SAME MATERIAL APPLIED ØN BØTH FACES ØF WALL
:                                       :...9892  ALLØWABLE WØRKING STRESS SHEAR FØR GYPSUM BØARD WALLS
:                                       :    :..-9896  WALL SHEATHED WITH ØTHER MATERIAL THAT IS USED FØR SHEAR RES
:                                       :    :..-9897  SAME MATERIAL APPLIED ØN BØTH FACES ØF WALL
:                                       :    :...9893  BASIC WØRKING STRESS SHEAR FØR GYPSUM BØARD WALLS
:                                       :         :..-9545  SHEAR WALL SHEATHING MATERIAL
:                                       :         :..-9769  THICKNESS ØF SHEATHING
:                                       :         :..-9775  SHEATHING PANEL SIZE
:                                       :         :..-9858  FRAMING MEMBERS PRØVIDED AT ALL EDGES ØF EA SHEET (BLØCKED)
:                                       :         :..-9784  SPACING ØF NAILS IN SHEATHING
:                                       :         :..-9781  SIZE ØF NAILS IN SHEATHING
:                                       :         :..-9831  TYPE ØF NAIL
:                                       :         :...9894  2-5/8" LAYERS ØN SAME FACE W/#6 AT 9" BØT AND #8 AT 7" TØP"
:                                       :...9235  STRENGTH FRØM REFERENCE DØCUMENTS
:...9801  ENGINEERED TIMBER CØNSTRUCTIØN REQUIREMENT
:    :...9802  ENGINEERED WØØD FRAMING REQUIREMENT
:    :    :...9803  ALL CØLUMNS FRAMED TØ TRUE END BEARING
:    :    :...9804  ALL CØLUMNS SUPPØRTED SECURELY IN PØSITIØN
:    :    :...9806  ALL CØLUMNS PRØTECTED FRØM DETERIØRATIØN
:    :    :.............-1350  % CØNSTRUCTIØN TYPE
:    :    :...9807  PØSITIVE CØNN PRØVIDED TØ RESIST UPLIFT AND LATERAL DISPL
:    :...9808  ENGINEERED WØØD SHEAR PANEL REQUIREMENT
:    :    :...9809  ENGINEERED WØØD SHEAR PANEL FRAMING REQUIREMENT
:    :    :    :.......................-9760  THICKNESS ØF FRAMING MEMBERS
:    :    :    :...9811  CHØRDS, BØUND MEMB, CØLLECTØRS TRANSMIT INDUCED AXIAL FØRCES
:    :    :    :.......9812  BØUNDARY MEMBERS TIED TØGETHER AT CØRNERS
:    :    :    :...9813  SHEAR STRESS TRANSFERRED ARØUND ØPENINGS
:    :    :    :...9814  ØPENING MATERIALLY AFFECTS PANEL STRENGTH
:    :    :    :...9816  ØPENING FULLY DETAILED ØN PLANS
:    :    :    :...9817  CØNN BETWEEN PANEL AND CØMPØNENT RESISTS PRESCRIBED FØRCES
:    :    :...9818  BUILDING HAS ØNE SIDE WITHØUT SHEAR WALLS
:    :    :...9819  WØØD DIAPHRAGM TØRSIØN REQUIREMENT
:    :    :    :............................-9545  SHEAR WALL SHEATHING MATERIAL
:    :    :    :.................-9821  DEPTH ØF DIAPHRAGM NØRMAL TØ ØPEN SIDE
:    :    :    :..........-2243  % NUMBER ØF LEVELS (STØRIES)
:    :    :    :...9823  DEPTH TØ WIDTH RATIØ FØR DIAPHRAGM
:    :    :    :    :.............-9821  DEPTH ØF DIAPHRAGM NØRMAL TØ ØPEN SIDE
:    :    :    :    :...9822  WIDTH ØF DIAPHRAGM
:    :    :    :...9826  DIAGØNAL SHEATHING TYPE
:    :    :    :...3756  %* DEFLECTIØN IN PLANE ØF DIAPHRAGM
:    :    :    :...3758  % PERMISSIBLE DEFLECTIØN ØF ELEMENTS ATTACHED TØ DIAPHRAGM
:    :    :................................-9545  SHEAR WALL SHEATHING MATERIAL
:    :    :...9827  DIAGØNALLY SHEATHED SHEAR PANEL REQUIREMENT
:    :    :    :..-9826  DIAGØNAL SHEATHING TYPE
:    :    :    :.............-9828* CØNVENTIØNAL DIAGØNAL SHEATHING REQUIREMENT
:    :    :    :...9841  SPECIAL DIAGØNAL SHEATHING REQUIREMENT
:    :    :         :...9842  NUMBER ØF LAYERS ØF CØNVENTIØNAL DIAGØNAL SHEATHING
:    :    :         :...9843  BØTH LAYERS ØN SAME FACE ØF FRAMING
:    :    :         :...9844  ANGLE BETWEEN THE BØARDS IN THE TWØ LAYERS
:    :    :         :...9846  CHØRD STRENGTH REQUIREMENT (SPECIAL DIAGØNAL)
:    :    :              :...9847  CHØRD BEAM RESISTANCE
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:   :   :           :   :..-9210* STRENGTH OF WOOD COMPONENTS
:   :   :           :...9848  CHORD DESIGN LOAD EFFECT
:   :   :           :   :...9849  CHORD DESIGN LOAD MAGNITUDE
:   :   :           :   :...9851  CHORD DESIGN LOAD DIRECTION
:   :   :           :   :...9852  CHORD SPAN
:   :   :           :......-9849  CHORD DESIGN LOAD MAGNITUDE
:   :   :           :...3706  %* EARTHQUAKE FORCE EFFECT
:   :   :           :......-9851  CHORD DESIGN LOAD DIRECTION
:   :   :           :......-9852  CHORD SPAN
:   :   :           :..........-9853  SPACING OF FRAMING MEMBERS
:   :   :...9854  PLYWOOD SHEAR PANEL REQUIREMENT
:   :   :   :...9856  PLYWOOD SHEAR PANEL FRAMING REQUIREMENT
:   :   :   :   :........................-9775  SHEATHING PANEL SIZE
:   :   :   :   :...9565  SHEAR PANEL TYPE
:   :   :   :   :...9857  ARRANGEMENT OF SHEATHING PANELS
:   :   :   :   :........................-9858  FRAMING MEMBERS PROVIDED AT ALL EDGES OF EA SHEET (BLOCKED)
:   :   :   :   :...9859  PLYWOOD DESIGNED TO RESIST SHEAR ONLY
:   :   :   :   :...9860  FRAMING MEMBERS DESIGNED TO RESIST AXIAL FORCES
:   :   :   :   :..-9812  BOUNDARY MEMBERS TIED TOGETHER AT CORNERS
:   :   :   :   :...9882  WIDTH OF SHEAR PANEL
:   :   :   :...9861  PLYWOOD SHEAR PANEL NAILING REQUIREMENT
:   :   :       :...9862  SIZE OF NAIL AT INTERNAL MEMBERS
:   :   :       :...9863  PANEL LOCATION
:   :   :       :........................-9769  THICKNESS OF SHEATHING
:   :   :       :.....................-9766  SPACING OF STUDS
:   :   :       :.....................-9864  DIRECTION OF FACE GRAIN
:   :   :       :.....................-9866  SPACING OF NAILS AT INTERMEDIATE MEMBERS
:   :   :...9878  OTHER MATERIAL SHEAR PANEL REQUIREMENT
:   :       :...9879  DISTANCE FROM NAIL TO EDGE OF SHEET
:   :       :...9883  HEIGHT TO WIDTH RATIO OF SHEAR PANEL
:   :       :   :...9881  HEIGHT OF SHEAR PANEL
:   :       :   :..-9882  WIDTH OF SHEAR PANEL
:   :       :...9884  WALL RESISTS LOADS FROM CONCRETE OR MASONRY WALLS
:   :...9898  ENGINEERED WOOD WALL CONNECTION REQUIREMENT
:       :...3786  % TYPE OF SEISMIC FORCE EFFECT
:       :........................-2114  % ELEMENT OF BUILDING (COMPONENT)
:       :...9899  ELEMENT PROVIDES RESIST TO ANCH FORCE FOR CONC/MAS WALLS
:...9002  WOOD DESIGN CATEGORY REQUIREMENT
    :............................-1490  %* SEISMIC PERFORMANCE CATEGORY
    :..............9300  CATEGORY A WOOD REQUIREMENT
    :                   :..-1350  % CONSTRUCTION TYPE
    :                   :..-2243  % NUMBER OF LEVELS (STORIES)
    :                   :..-9763* WALL SHEATHING APPLICATION REQUIREMENT
    :                   :..-9320  PORTION OF LENGTH OF WALL WITH BRACING
    :                   :..-9330  WALL LOCATION
    :                   :...9340  WALL BRACING APPLIED OVER FULL HEIGHT OF STORY
    :..........9400  CATEGORY B WOOD REQUIREMENT
    :               :..-9300* CATEGORY A WOOD REQUIREMENT
    :               :...9420  CATEGORY B WOOD TIE REQUIREMENT
    :               :   :...9430  COMPONENT PROVIDING SEISMIC TIE BETWEEN TWO PORTIONS OF BLDG
    :               :   :...9440  COMPONENT PROVIDING ANCHORAGE OF CONC OR MAS WALLS TO FLOORS
    :               :...9450  CATEGORY B LAG SCREW WASHER REQUIREMENT
    :               :   :...9460  BEARING MATERIAL UNDER HEAD OF LAG SCREW
    :               :   :...9470  WASHER PROVIDED UNDER HEAD OF LAG SCREW
    :               :...9480  CATEGORY B ECCENTRIC JOINT REQUIREMENT
    :                   :...9485  GREATEST END DISTANCE IN ANY ECCENTRIC WOOD JOINT
    :                   :...9490  DEPTH OF MEMBER
    :                   :...9495  SECT 208B OF REF 9.1 MODIFIED, DELETE 50% STRESS INCREASE
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:.......9500  CATEGORY C WOOD REQUIREMENT
:        :..-9400* CATEGORY B WOOD REQUIREMENT
:        :...9515  CATEGORY C PLYWOOD MATERIAL REQUIREMENT
:        :   :...9520  EXPOSURE OF STRUCTURAL PLYWOOD
:        :   :...9525  STRUCTURAL PLYWOOD EXPOSURE TYPE
:        :   :...9530  GLUE TYPE FOR STRUCTURAL PLYWOOD
:        :...9535  CATEGORY C WOOD FRAMING REQUIREMENT
:        :   :......-2243  % NUMBER OF LEVELS (STORIES)
:        :   :...9540  WOOD DIAPHRAGM USED TO RESIST TORSION FROM CONC/MAS WALLS
:        :   :........................-9545  SHEAR WALL SHEATHING MATERIAL
:        :   :......-9330  WALL LOCATION
:        :...9555  CATEGORY C WOOD DETAILING REQUIREMENT
:            :...9560  REF 9.1 MODIFIED FOR RESISTANCE OF NAILS PARALLEL TO GRAIN
:            :........................-9545  SHEAR WALL SHEATHING MATERIAL
:            :..-9565  SHEAR PANEL TYPE
:            :....................-9570  PLYWOOD APPLICATION
:...9600  CATEGORY D WOOD REQUIREMENT
    :..-9500* CATEGORY C WOOD REQUIREMENT
    :................................-9545  SHEAR WALL SHEATHING MATERIAL
    :...9620  TYPE OF DIAPHRAGM FRAMING
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GLOBAL INGREDIENCE OF CHAPTER 10

EXTREME LEVEL FROM OUTPUT

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   0   1   2   3   4   5   6   7

 10001  STEEL MATERIALS REQUIREMENT
  :...9110  % BUILDING ELEMENTS THAT RESIST SEISMIC FORCE
  :..10100  REQUIREMENTS OF STEEL REFERENCE DOCUMENTS
  :..10200  STEEL STRENGTH CALCULATION PRODECURE REQUIREMENT
  :   :..........10210  STRENGTH OF STEEL COMPONENTS
  :                 :..10220  CAPACITY REDUCTION FACTOR FOR STEEL
  :                 :   :...2114  % ELEMENT OF BUILDING (COMPONENT)
  :                 :   :..10225  TYPE OF STEEL CONNECTION
  :                 :   :..10290  CONNECTION DESIGNED TO DEVELOP FULL STRENGTH OF MEMBER
  :                 :   :..10640  MODIFICATION 6 OF SECTION 10.6 (BEAM COLUMN JOINT)
  :                 :..10245  MODIFIED REFERENCE STRENGTH FOR STEEL
  :                     :..10240  MODIFICATION TO STEEL REFERENCE DOCUMENTS REQUIREMENT
  :                     :   :...2115  % MATERIAL OF COMPONENT OR SYSTEM
  :                     :   :..10250  MODIFICATIONS A THROUGH D OF SECTION 10.2.1 (AISC STRENGTHS)
  :                     :   :..10260  MODIFICATION E OF SECTION 10.2.1 (AISC P-DELTA EFFECTS)
  :                     :   :..10265  P-DELTA EFFECT INCLUDED IN ANALYSIS
  :                     :   :..10270  MODIFICATIONS A AND B OF SECTION 10.2.2 (AISI COLD FORMED)
  :                     :   :..10280  MODIFICATION OF SECTION 10.2.3 (CABLE STRENGTHS)
  :                     :..10230  STRENGTH PERMITTED BY STEEL REFERENCE DOCUMENTS
  :..10002  STEEL DESIGN CATEGORY REQUIREMENT
      :.......1490  %* SEISMIC PERFORMANCE CATEGORY
      :..........10300  CATEGORY A STEEL REQUIREMENT
      :......10400  CATEGORY B STEEL REQUIREMENT
      :        :.-10300  CATEGORY A STEEL REQUIREMENT
      :        :..10450  ORDINARY STEEL MOMENT FRAME REQUIREMENT
      :        :   :..10420  REQUIREMENTS OF PART I OF REF 10.1 (AISC ELASTIC DESIGN)
      :        :   :..10430  REQUIREMENTS OF REFERENCE 10.2 (AISI COLD FORMED)
      :        :   :..10440  REQUIREMENTS OF REFERENCE 10.3 (AISI STAINLESS)
      :        :...3303  %* GENERAL FRAMING CLASS
      :        :..........-2114  % ELEMENT OF BUILDING (COMPONENT)
      :        :..............-2115  % MATERIAL OF COMPONENT OR SYSTEM
      :        :......-10420  REQUIREMENTS OF PART I OF REF 10.1 (AISC ELASTIC DESIGN)
      :        :......-10430  REQUIREMENTS OF REFERENCE 10.2 (AISI COLD FORMED)
      :        :......-10440  REQUIREMENTS OF REFERENCE 10.3 (AISI STAINLESS)
      :..10500  CATEGORY C AND D STEEL REQUIREMENT
          :.-10400* CATEGORY B STEEL REQUIREMENT
          :......-3303  %* GENERAL FRAMING CLASS
          :...3309  % SEISMIC RESISTING SYSTEM
          :................-2115  % MATERIAL OF COMPONENT OR SYSTEM
          :...3327  % FRAME RESPONSE TYPE
          :..10600  SPECIAL STEEL MOMENT FRAME REQUIREMENT
          :   :..10620  REQUIREMENTS OF PART II OF REF 10.1 (AISC PLASTIC DESIGN)
          :   :..10630  MODIFICATIONS 1 THRU 7 OF SECT 10.6 (SPECIAL MOMENT FRAMES)
          :..-1490  %* SEISMIC PERFORMANCE CATEGORY
          :...2243  % NUMBER OF LEVELS (STORIES)
          :.....-10450* ORDINARY STEEL MOMENT FRAME REQUIREMENT
          :..10520  COMPRESSION STRENGTH OF BRACED FRAME MEMBER
          :   :.-10210* STRENGTH OF STEEL COMPONENTS
          :..10530  TENSION STRENGTH OF BRACED FRAME MEMBER
              :.-10210* STRENGTH OF STEEL COMPONENTS
```

GLOBAL INGREDIENCE OF CHAPTER 11

EXTREME LEVEL FROM OUTPUT

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   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14

  11001  CONCRETE MATERIALS REQUIREMENT
   :..............9110  % BUILDING ELEMENTS THAT RESIST SEISMIC FORCE
   :.....................11100  REQUIREMENT OF CONCRETE REFERENCE DOCUMENT
   :..11200  CONCRETE STRENGTH CALCULATION PROCEDURE REQUIREMENT
   :   :...............................11210  STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
   :                                       :..11220  TYPE OF FINAL PLACEMENT OF CONCRETE
   :                                       :.......2114  % ELEMENT OF BUILDING (COMPONENT)
   :                                       :..11230  CAPACITY REDUCTION FACTOR FOR CONCRETE
   :                                       :   :..-2114  % ELEMENT OF BUILDING (COMPONENT)
   :                                       :   :..11245  TYPE OF STRESS
   :                                       :   :..11290  AXIAL FORCE DUE TO ALL LOADS**
   :                                       :   :..11295  AXIAL FORCE DUE TO EARTHQUAKE**
   :                                       :   :..........11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
   :                                       :   :..........11280  GROSS AREA OF CONCRETE
   :                                       :   :..11765  SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT
   :                                       :   :   :.......11766  YEILD STRENGTH OF LATERAL REINFORCEMENT
   :                                       :   :   :..11767  YEILD STRENGTH OF LONGITUDINAL REINFORCEMENT
   :                                       :   :   :..11768  POINT OF CONTRAFLEXURE LOCATED IN MIDDLE HALF OF MEMBER
   :                                       :   :   :..11664  DIST FROM EA JOINT OR SEC OF YIELD WHERE LAT REINF PROVIDED
   :                                       :   :   :..11770  MINIMUM DISTANCE FOR SPECIAL LATERAL REINF
   :                                       :   :   :   :..11690  CLEAR HEIGHT OF COLUMN
   :                                       :   :   :   :..11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
   :                                       :   :   :..11771  LATERAL REINFORCEMENT PROVIDED THROUGHOUT MEMBER
   :                                       :   :   :..11773  MINIMUM AMOUNT OF SPECIAL LATERAL REINF REQT
   :                                       :   :   :   :..11778  TYPE OF LATERAL REINFORCEMENT
   :                                       :   :   :   :..11779  VOLUMETRIC RATIO OF LATERAL REINFORCEMENT
   :                                       :   :   :   :.-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
   :                                       :   :   :   :.-11766  YEILD STRENGTH OF LATERAL REINFORCEMENT
   :                                       :   :   :   :.-11280  GROSS AREA OF CONCRETE
   :                                       :   :   :   :..11781  CROSS SECT AREA OF COMPONENT MEASURED TO OUTSIDE OF S L R
   :                                       :   :   :   :..11782  CROSS SECT CORE DIMENSION TO OUTSIDE OF SPEC LAT REINF
   :                                       :   :   :   :..11656  AREA OF WEB REINFORCEMENT
   :                                       :   :   :   :..11652  SPACING OF WEB REINFORCEMENT
   :                                       :   :   :   :..11750  MINIMUM CROSS SECTION DIMENSION THROUGH CENTROID
   :                                       :   :   :..11774  CROSS SECTIONAL DISTANCE BETWEEN TIES
   :                                       :   :   :..11775  LAP OF OVERLAPPING HOOPS
   :                                       :   :   :..11777  SPECIAL CONCRETE BEAM COLUMN DESIGN SHEAR REQT
   :                                       :   :       :..11735  MEMBER END MOMENTS TAKEN AS MAX RESIST MOMENTS OF OPP SIGN
   :                                       :   :       :..11783  MEMBER ASSUMED TO BE LOADED WITH APPLICABLE STATIC FORCES
   :                                       :   :       :..11738  MAX RESIST MOMENT CALCULATED WITHOUT CAPACITY REDUCT FACTOR
   :                                       :   :       :..11785  MEMBER AXIAL FORCE ASSUMED TO BE MAX DESIGN COMPR FORCE
   :                                       :   :..11260  WEIGHT OF CONCRETE AGGREGATE
   :                                       :   :..11270  MODE OF STRESS GOVERNING STRENGTH OF COMPONENT
   :                                       :   :...1490  %* SEISMIC PERFORMANCE CATEGORY
   :                                       :   :..11235  CAPACITY REDUCTION FACTOR FROM SEC 9.2 OF REF DOCUMENT
   :                                       :   :..11285  ALL SHEAR RESISTED BY DOWELS AND SHEAR FRICTION
   :                                       :..11240  STRENGTH PERMITTED FROM REFERENCE DOCUMENT
   :                                       :..11275  ALLOWABLE LOADS ON ANCHOR BOLTS
   :                                           :..11271  DIAMETER OF ANCHOR BOLT
   :                                           :..11272  MINIMUM EMBEDMENT OF ANCHOR BOLT
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:                                        :.........-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:                                        :.-11260  WEIGHT OF CONCRETE AGGREGATE
:                                        :..11276  ANCHOR BOLT SPECIFICATIONS
:                                        :..11277  ANCHOR BOLT SPACING
:                                        :..11278  ANCHOR BOLT EDGE DISTANCE
:                                        :..11350  LOCATION OF ANCHOR BOLT
:                                        :...1425  %* SEISMICITY INDEX
:..11002  CONCRETE DESIGN CATEGORY REQUIREMENT
    :......................................-1490  %* SEISMIC PERFORMANCE CATEGORY
    :..........11300  CATEGORY A CONCRETE REQUIREMENT
    :           :..11310  CATEGORY A CONCRETE FRAMING REQUIREMENT
    :           :    :...3303  %* GENERAL FRAMING CLASS
    :           :    :...2115  % MATERIAL OF COMPONENT OR SYSTEM
    :           :    :...3309  % SEISMIC RESISTING SYSTEM
    :           :    :...3327  % FRAME RESPONSE TYPE
    :           :    :..11320  TYPE OF CONCRETE BRACED FRAME
    :           :    :..11330  TYPE OF CONCRETE SHEAR WALL
    :           :    :.-11100  REQUIREMENT OF CONCRETE REFERENCE DOCUMENT
    :           :..11340  CATEGORY A CONCRETE ANCHOR BOLT REQUIREMENT
    :                :.......................-2114  % ELEMENT OF BUILDING (COMPONENT)
    :                :......................-11350  LOCATION OF ANCHOR BOLT
    :                :..11360  TIES PROVIDED AROUND ANCHOR BOLT
    :                :..11370  DISTANCE OF ANCHOR BOLT TIES FROM TOP
    :                :..11380  SIZE OF ANCHOR BOLT TIES
    :                :..11390  NUMBER OF ANCHOR BOLT TIES
    :......11400  CATEGORY B CONCRETE REQUIREMENT
    :         :.-11300* CATEGORY A CONCRETE REQUIREMENT
    :         :..........-3303  %* GENERAL FRAMING CLASS
    :         :..........-2115  % MATERIAL OF COMPONENT OR SYSTEM
    :         :..........-3327  % FRAME RESPONSE TYPE
    :         :..11600  CATEGORY B ORDINARY CONCRETE MOMENT FRAME REQUIREMENT
    :              :..11602  ORDINARY CONCRETE FLEXURAL MEMBER REQUIREMENT
    :              :    :......11604  ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT REQUIREMENT
    :              :    :         :..11606  TENSILE REINFORCEMENT RATIO FOR TOP REINFORCEMENT
    :              :    :         :..11608  TENSILE REINFORCEMENT RATIO FOR BOTTOM REINFORCEMENT
    :              :    :         :..11610  YIELD STRENGTH OF TENSILE REINFORCEMENT
    :              :    :         :..11612  NUMBER OF CONTINUOUS TOP BARS
    :              :    :         :..11614  NUMBER OF CONTINUOUS BOTTOM BARS
    :              :    :         :..11616  MINIMUM SIZE OF CONTINUOUS BARS
    :              :    :......11618  ORDINARY CONCRETE FLEXURAL MEMBER MOMENT RESISTANCE REQT
    :              :    :         :..11620  POSITIVE MOMENT STRENGTH AT FACE OF JOINT
    :              :    :         :    :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
    :              :    :         :..11622  NEGATIVE MOMENT STRENGTH AT FACE OF JOINT
    :              :    :         :    :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
    :              :    :         :..11624  POSITIVE MOMENT STRENGTH AT SECTION OF POTENTIAL YIELD
    :              :    :         :    :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
    :              :    :         :..11626  MINIMUM MOMENT STRENGTH IN MEMBER
    :              :    :              :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
    :              :    :......11628  ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT ANCHORAGE
    :              :    :         :..11630  FLEXURAL MEMBERS FRAME INTO OPPOSITE FACES OF COLUMN
    :              :    :         :..11632  FLEXURAL REINFORCEMENT IS CONTINUOUS THROUGH COLUMN
    :              :    :         :..11634  VARIATION IN BEAM CROSS SECTION PREVENTS CONTINUOUS REINF
    :              :    :         :..11636  FLEXURAL REINF EXTENDED TO FAR FACE OF COLUMN CONFINED AREA
    :              :    :         :..11638  FLEXURAL REINFORCEMENT ANCHORED TO DEVELOP YIELD STRESS
    :              :    :..11640  ORDINARY CONCRETE FLEXURAL MEMBER WEB REINF REQUIREMENT
    :              :         :..11642  WEB REINFORCEMENT PROVIDED OVER ENTIRE MEMBER
    :              :         :..11644  ORIENTATION OF WEB REINFORCEMENT
    :              :         :..11646  NUMBER OF LEGS IN EACH STIRRUP
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:            :        :..11648  SIZE OF WEB REINFORCEMENT
:            :        :..........11650  DISTANCE FROM END OF CONCRETE FLEXURAL MEMBER
:            :        :.............................-11652  SPACING OF WEB REINFORCEMENT
:            :        :.............................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:            :        :.............................-11656  AREA OF WEB REINFORCEMENT
:            :        :..11658  AREA OF TENSION REINFORCEMENT
:            :        :..11660  AREA OF COMPRESSION REINFORCEMENT
:            :        :......11661  HOOPS PROVIDED FOR WEB REINFORCEMENT
:            :.............................-11290  AXIAL FORCE DUE TO ALL LOADS**
:            :.....................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:            :.....................................-11280  GROSS AREA OF CONCRETE
:            :..11662  ORDINARY CONCRETE BEAM COLUMN LATERAL REINFORCEMENT REQT
:                :.............................-11664  DIST FROM EA JOINT OR SEC OF YIELD WHERE LAT REINF PROVIDED
:                :..11668  MINIMUM DISTANCE FOR LATERAL REINFORCEMENT
:                :   :.............................-11690  CLEAR HEIGHT OF COLUMN
:                :   :..11692  MAXIMUM DIMENSION OF COLUMN CROSS SECTION
:                :..11670  ANGLE OF HOOK AT END OF TIE
:                :..11672  EXTENSION AT END OF TIE
:                :..........11674  DIAMETER OF TIE BAR
:                :..11676  CROSS TIES USED FOR LATERAL REINFORCEMENT
:                :..........11678  SPACING OF LATERAL REINFORCEMENT WITHIN LO
:                :..11680  MAXIMUM ALLOWABLE SPACING OF LATERAL REINFORCEMENT
:                :   :..11694  MINIMUM DIMENSION OF COLUMN CROSS SECTION
:                :   :......-11674  DIAMETER OF TIE BAR
:                :   :......11696  DIAMETER OF SMALLEST LONGITUDINAL BAR
:                :..........11682  DISTANCE FROM FACE OF JOINT TO FIRST LATERAL REINFORCEMENT
:                :..11684  MAXIMUM SPACING OF LATERAL REINFORCEMENT IN MEMBER
:                :..11686  TIES OR LATERAL REINFORCEMENT PROVIDED THROUGHOUT
:                :..11688  LATERAL REINFORCEMENT PROVIDED THROUGH JOINT
:..11500  CATEGORY C AND D CONCRETE REQUIREMENT
    :.-11400* CATEGORY B CONCRETE REQUIREMENT
    :..11507  CATEGORY C AND D CONCRETE MATERIAL REQUIREMENT
    :   :..11514  CATEGORY C AND D CONCRETE STRENGTH REQUIREMENT
    :   :   :.............................-2114  % ELEMENT OF BUILDING (COMPONENT)
    :   :   :.............................-11260  WEIGHT OF CONCRETE AGGREGATE
    :   :   :.....................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
    :   :..11521  CATEGORY C AND D CONCRETE REINFORCEMENT REQUIREMENT
    :       :.............................-2114  % ELEMENT OF BUILDING (COMPONENT)
    :       :..11528  MATERIAL SPECIFICATION OF REINFORCEMENT
    :       :..11535  ACTUAL MILL TEST YIELD STRESS
    :       :..11542  ACTUAL MILL RETEST YIELD STRESS
    :       :..11549  ACTUAL MILL TEST ULTIMATE STRESS
    :       :..............11550  SPECIFIED YIELD STRESS
    :..11556  CATEGORY C AND D CONCRETE FRAMING LIMITATION
    :   :..........-3303  %* GENERAL FRAMING CLASS
    :   :..........-2115  % MATERIAL OF COMPONENT OR SYSTEM
    :   :..........-3327  % FRAME RESPONSE TYPE
    :   :..11700  SPECIAL CONCRETE MOMENT FRAME REQUIREMENT
    :   :   :.............................-11290  AXIAL FORCE DUE TO ALL LOADS**
    :   :   :.....................................-11280  GROSS AREA OF CONCRETE
    :   :   :.....................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
    :   :   :..11701  SPECIAL CONCRETE SHEAR STRENGTH REQUIREMENT
    :   :   :   :..11702  SHEAR STRESS DUE TO SEISMIC FORCES**
    :   :   :   :..11704  SHEAR STRESS DUE TO ALL FORCES **
    :   :   :   :..11705  AXIAL COMPRESSIVE FORCE DUE TO SEISMIC AND DEAD LOAD**
    :   :   :   :.................................-11280  GROSS AREA OF CONCRETE
    :   :   :   :.................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
    :   :   :   :..11707  SHEAR RESIST OF CONC USED TO DETERMINE AMOUNT OF LAT REINF
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:   :   :..11708  SPECIAL CONCRETE FLEXURAL MEMBER REQUIREMENT
:   :   :   :..11710  SPECIAL CONCRETE FLEXURAL MEMBER PROPORTIONING REQT
:   :   :   :   :............................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:   :   :   :   :..11711  CLEAR SPAN OF FLEXURAL MEMBER
:   :   :   :   :..11713  WIDTH OF FLEXURAL MEMBER
:   :   :   :   :..11714  WIDTH OF FLEXURAL MEMBER OVERHANGING SUPPORT
:   :   :   :..11716  SPECIAL CONCRETE FLEXURAL MEMBER REINFORCEMENT REQT
:   :   :   :   :.-11604* ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT REQUIREMENT
:   :   :   :   :.-11618* ORDINARY CONCRETE FLEXURAL MEMBER MOMENT RESISTANCE REQT
:   :   :   :   :.-11628* ORDINARY CONCRETE FLEXURAL MEMBER REINFORCEMENT ANCHORAGE
:   :   :   :   :..11717  LONGITUDINAL REINF IN SPECIAL MOMENT FRAME IS SPLICED
:   :   :   :   :......11719  SPECIAL CONCRETE FLEXURAL MEMBER REINFORCEMENT SPLICE REQT
:   :   :   :           :..11720  TYPE OF REINFORCEMENT SPLICE
:   :   :   :           :..11722  HOOP OR SPIRAL REINFORCEMENT PROVIDED OVER THE LAP LENGTH
:   :   :   :           :..11723  SPACING OF HOOP OR SPIRAL LAP REINFORCEMENT
:   :   :   :           :....................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:   :   :   :           :..11725  LOCATION OF LAP SPLICE
:   :   :   :           :..11726  REQUIREMENT OF SECT 7.5.5.1 OF REFERENCE 11.1
:   :   :   :           :..11728  REQUIREMENT OF SECT 7.5.5.2 OF REFERENCE 11.1
:   :   :   :           :..11729  NOT MORE THAN ALTERNATE BARS IN A LAYER SPLICED AT A SECTION
:   :   :   :           :..11731  LONGITUDINAL DISTANCE BETWEEN SPLICES OF ADJACENT BARS
:   :   :   :..11732  SPECIAL CONCRETE FLEXURAL MEMBER LATERAL REINFORCEMENT REQT
:   :   :       :..11734  SPECIAL CONCRETE FLEXURAL MEMBER DESIGN SHEAR REQT
:   :   :       :   :........................-11735  MEMBER END MOMENTS TAKEN AS MAX RESIST MOMENTS OF OPP SIGN
:   :   :       :   :..11737  MEMB ASSUMED TO LOADED WITH TRIBUTARY GRAVITY LOAD
:   :   :       :   :........................-11738  MAX RESIST MOMENT CALCULATED WITHOUT CAPACITY REDUCT FACTOR
:   :   :       :   :..11740  MAX RESIST MOMENT CALCULATED WITH TENSILE STRESS OF 1.25 FY
:   :   :       :..11741  SPECIAL CONCRETE FLEXURAL MEMBER HOOP REINFORCEMENT REQT
:   :   :           :..11743  LOCATION REQUIRES HOOP REINFORCEMENT
:   :   :           :   :.-11650  DISTANCE FROM END OF CONCRETE FLEXURAL MEMBER
:   :   :           :   :..11744  DISTANCE FROM POINT OF POTENTIAL YIELD IN CONCRETE FLEX MEMB
:   :   :           :   :..11746  COMPRESSION REINFORCEMENT REQUIRED TO PROVIDE RESISTANCE
:   :   :           :   :....................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:   :   :           :.-11661  HOOPS PROVIDED FOR WEB REINFORCEMENT
:   :   :           :..11747  REQT OF REF 11.1 FOR LATERAL SUPPORT OF LONG. BARS WITH TIES
:   :   :           :.-11682  DISTANCE FROM FACE OF JOINT TO FIRST LATERAL REINFORCEMENT
:   :   :           :.-11678  SPACING OF LATERAL REINFORCEMENT WITHIN LO
:   :   :           :........................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:   :   :           :.-11696  DIAMETER OF SMALLEST LONGITUDINAL BAR
:   :   :           :.-11674  DIAMETER OF TIE BAR
:   :   :......11749  SPECIAL CONCRETE BEAM COLUMN REQUIREMENT
:   :   :       :............................-11750  MINIMUM CROSS SECTION DIMENSION THROUGH CENTROID
:   :   :       :..11752  CROSS SECTION DIMENSION ORTHOGONAL TO MINIMUM
:   :   :       :..11753  SPECIAL CONCRETE BEAM COLUMN FLEXURAL STRENGTH REQT
:   :   :       :   :..11755  SUM OF FLEXURAL STRENGTH OF COLUMNS AT JOINT
:   :   :       :   :   :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:   :   :       :   :..11756  SUM OF FLEXURAL STRENGTH OF BEAMS AT JOINT
:   :   :       :   :   :.....-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:   :   :       :   :..11758  SHEAR REDISTRIB ACCOUNTING FOR OMISSION OF NONCONFORMING JTS
:   :   :       :   :..11759  COLUMNS FRAMING INTO CONFORMING JOINTS RESIST ALL SEIS SHEAR
:   :   :       :   :................-11765* SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT
:   :   :       :..11761  SPECIAL CONCRETE BEAM COLUMN REINFORCEMENT REQT
:   :   :       :   :..11762  REINFORCEMENT RATIO IN BEAM COLUMN
:   :   :       :   :.....-11720  TYPE OF REINFORCEMENT SPLICE
:   :   :       :   :.....-11725  LOCATION OF LAP SPLICE
:   :   :       :   :..11764  LAP SPLICE PROPORTIONED AS A TENSION SPLICE
:   :   :       :   :.-11719* SPECIAL CONCRETE FLEXURAL MEMBER REINFORCEMENT SPLICE REQT
:   :   :       :....................-11765* SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT
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:   :   :..11786  SPECIAL CONCRETE MOMENT FRAME JOINT REQUIREMENT
:   :       :..11787  LATERAL REINFORCEMENT PROVIDED THROUGHOUT JOINT
:   :       :..........................-11773* MINIMUM AMOUNT OF SPECIAL LATERAL REINF REQT
:   :       :..........................-11774  CROSS SECTIONAL DISTANCE BETWEEN TIES
:   :       :..........................-11775  LAP OF OVERLAPPING HOOPS
:   :       :..11789  JOINT SHEAR STRESS CALCULATION REQUIREMENT
:   :       :   :..11795  SHAPE OF CROSS SECTION
:   :       :   :..11792  JOINT DESIGN SHEAR FORCE
:   :       :   :.-11713  WIDTH OF FLEXURAL MEMBER
:   :       :   :..........................-11654  EFFECTIVE DEPTH OF FLEXURAL MEMBER
:   :       :   :..11788  SHEAR STRESS IN JOINT
:   :       :   :..........................-11781  CROSS SECT AREA OF COMPONENT MEASURED TO OUTSIDE OF S L R
:   :       :..11790  MAXIMUM ALLOWABLE SHEAR STRESS IN JOINT REQUIREMENT
:   :       :   :..........................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:   :       :   :..................-11260  WEIGHT OF CONCRETE AGGREGATE
:   :       :   :..11791  JOINT TYPE
:   :       :   :   :..11793  OPPOS FACE IN DIRECT OF SEIS FORCE CONFINED BY MONOLITH MEMB
:   :       :   :   :..11794  MEMBERS COVER 75% OF WIDTH AND DEPTH
:   :       :   :..11796  MODIFIED ALLOWABLE STRESS
:   :       :..11797  JOINT DESIGN SHEAR FORCE REQUIREMENT
:   :           :..11798  JOINT SHEAR FORCE DET FROM STATIC FORCES AND JOINT MOMENTS
:   :           :..11799  JOINT MOMENTS ASSUMED TO BE MAX RESIST MOMENTS OF MEMBERS
:   :           :..........................-11738  MAX RESIST MOMENT CALCULATED WITHOUT CAPACITY REDUCT FACTOR
:   :           :.....-11740  MAX RESIST MOMENT CALCULATED WITH TENSILE STRESS OF 1.25 FY
:   :..-9110  % BUILDING ELEMENTS THAT RESIST SEISMIC FORCE
:   :..11800  CAT C/D CONCRETE SHEAR WALL, BRACED FRAME AND DIAPHRAGM REQT
:       :..........................-2114  % ELEMENT OF BUILDING (COMPONENT)
:       :..11818  CATEGORY C AND D CONCRETE SHEAR WALL REQUIREMENT
:       :   :..11820  CATEGORY C AND D CONCRETE SHEAR WALL DETAILING REQUIREMENT
:       :   :   :..11802  CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM REINF REQT
:       :   :   :   :..11804  MINIMUM WALL OR DIAPHRAGM REINFORCEMENT RATIO
:       :   :   :   :..11806  SPACING OF WALL OR DIAPHRAGM REINFORCEMENT
:       :   :   :   :..11808  WALL OR DIAPHRAGM REINFORCEMENT FOR SHEAR IS CONTINUOUS
:       :   :   :   :..11810  WALL OR DIAPHRAGM REINF FOR SHEAR IS UNIFORMLY DISTRIBUTED
:       :   :   :......11816  RATIO OF HORIZONTAL SHEAR REINFORCEMENT
:       :   :   :..11822  RATIO OF VERTICAL SHEAR REINFORCEMENT
:       :   :   :..11824  HORIZONTAL WALL REINFORCEMENT SPLICED
:       :   :   :..11826  LOCATION OF SPLICES STAGGERED
:       :   :   :..11828  NUMBER OF CURTAINS OF REINFORCEMENT IN WALL
:       :   :   :..11830  EACH CURTAIN SPLICED IN DIFFERENT LOCATION
:       :   :   :......11814  MAXIMUM SHEAR STRESS
:       :   :   :..........................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:       :   :..11832  CATEGORY C AND D CONCRETE SHEAR WALL STRENGTH REQUIREMENT
:       :   :   :..11812  CAT C AND D CONC SHEAR WALL AND DIAPHRAGM SHEAR STRESS LIMIT
:       :   :   :   :.-11814  MAXIMUM SHEAR STRESS
:       :   :   :   :......................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:       :   :   :   :.-11550  SPECIFIED YIELD STRESS
:       :   :   :   :.-11816  RATIO OF HORIZONTAL SHEAR REINFORCEMENT
:       :   :   :   :................-11260  WEIGHT OF CONCRETE AGGREGATE
:       :   :   :......................-2114  % ELEMENT OF BUILDING (COMPONENT)
:       :   :   :.....-11814  MAXIMUM SHEAR STRESS
:       :   :   :..........................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:       :   :..-3303  %* GENERAL FRAMING CLASS
:       :   :......11833  ACTUAL COMPRESSIVE STRESS
:       :   :       :......11831  ELASTIC ANALYSIS OF GROSS CROSS SECTION
:       :   :       :.......3702  %* REQUIRED STRENGTH
:       :   :..............................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:       :   :......11846  CATEGORY C AND D CONCRETE BOUNDARY MEMBER REQUIREMENT
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:        :   :        :..11858  CATEGORY C AND D CONCRETE BOUNDARY MEMBER MATERIAL REQT
:        :   :        :   :..11860  TYPE OF BOUNDARY MEMBER
:        :   :        :   :..10001  %* STEEL MATERIALS REQUIREMENT
:        :   :        :   :............-11765* SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT
:        :   :        :..11862  CAT C AND D CONCRETE BOUNDARY MEMBER AXIAL STRENGTH REQT
:        :   :        :   :..11850  LOCATION OF BOUNDARY MEMBER
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:        :   :        :   :..11864  AXIAL RESISTANCE OF CONCRETE BOUNDARY MEMBER
:        :   :        :   :   :.-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:        :   :        :   :..11866  TOTAL GRAVITY LOAD ON WALL
:        :   :        :   :   :...3707  %* DEADLOAD EFFECT
:        :   :        :   :   :...3708  %* LIVE LOAD EFFECT
:        :   :        :   :   :...3710  %* SNOW LOAD EFFECT
:        :   :        :   :..11868  VERTICAL FORCES FROM SEISMIC OVERTURNING MOMENT
:        :   :        :   :   :...3706  %* EARTHQUAKE FORCE EFFECT
:        :   :        :   :..11870  AXIAL FORCE IN DIAPHRAGM
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:        :   :        :   :   :..-3706  %* EARTHQUAKE FORCE EFFECT
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:        :   :        :   :   :.-11210* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:        :   :        :   :..11878  BOUND MEMB ANCHORED TO DEVEL YIELD STRENGTH AT EDGE OF OPNG
:        :   :        :..11848  BOUNDARY MEMBER CONTINUOUSLY ATTACHED TO WALL OR DIAPHRAGM
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:        :   :        :.....-11851  ORIENTATION OF BOUNDARY MEMBER
:        :   :        :..11852  BOUNDARY MEMBER DISCONTINUED
:        :   :        :..11834  ACTUAL COMPRESSIVE STRESS WHERE BOUNDARY MEMBER DISCONTINUED
:        :   :        :   :.-11831  ELASTIC ANALYSIS OF GROSS CROSS SECTION
:        :   :        :   :..-3702  %* REQUIRED STRENGTH
:        :   :        :.......................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:        :   :        :..11856  HORIZ WALL REINF ANCHORED IN BOUNDARY MEMB TO DEVELOP YIELD
:        :   :..11840  CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM OPENING REQT
:        :       :..11842  SHEAR WALL OR DIAPHRAGM CONTAINS OPENING
:        :       :..11844  OPENINGS PROVIDED WITH BOUNDARY MEMBERS
:        :       :.-11846* CATEGORY C AND D CONCRETE BOUNDARY MEMBER REQUIREMENT
:        :       :.-11833* ACTUAL COMPRESSIVE STRESS
:        :       :...........................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:        :..11835  CAT C AND D CONCRETE DIAPHRAGM REQUIREMENT
:        :   :.....-11802* CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM REINF REQT
:        :   :.....-11812* CAT C AND D CONC SHEAR WALL AND DIAPHRAGM SHEAR STRESS LIMIT
:        :   :.....-11833* ACTUAL COMPRESSIVE STRESS
:        :   :..............................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:        :   :.....-11846* CATEGORY C AND D CONCRETE BOUNDARY MEMBER REQUIREMENT
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:        :   :..11838  CAST-IN-PLACE TOPPING DESIGNED TO RESIST ALL SHEAR
:        :   :.-11840* CAT C AND D CONCRETE SHEAR WALL AND DIAPHRAGM OPENING REQT
:        :..11880  CATEGORY C AND D CONCRETE BRACED FRAME REQUIREMENT
:        :   :........................-2114  % ELEMENT OF BUILDING (COMPONENT)
:        :   :.......................-11290  AXIAL FORCE DUE TO ALL LOADS**
:        :   :..............................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:        :   :..............................-11280  GROSS AREA OF CONCRETE
:        :   :.-11749* SPECIAL CONCRETE BEAM COLUMN REQUIREMENT
:        :..11881  CATEGORY C AND D CONCRETE REINF SPLICE AND ANCHORAGE REQT
:        :   :........................-2114  % ELEMENT OF BUILDING (COMPONENT)
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:        :   :..11886  DEVELOPMENT LENGTH REDUCED FOR EXCESS STEEL AREA
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:           :..11892  SURFACE OF JOINT THOROUGHLY ROUGHENED
:           :..11893  SHEAR RESISTED SOLELY BY FRICTION AND DOWEL ACTION
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:           :.........-11550  SPECIFIED YIELD STRESS
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:..11563  CATEGORY C AND D NON-SEISMIC RESISTING SYSTEM CONCRETE REQT
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:   :................................-11290  AXIAL FORCE DUE TO ALL LOADS**
:   :........................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
:   :........................................-11280  GROSS AREA OF CONCRETE
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    :........................................-11250  NOMINAL CONCRETE COMPRESSIVE STRENGTH
    :........................................-11280  GROSS AREA OF CONCRETE
    :................................-11765* SPECIAL CONCRETE BEAM COLUMN LATERAL REINF REQT
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GLOBAL INGREDIENCE OF CHAPTER 12

EXTREME LEVEL FROM OUTPUT

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   :..12110  REQUIREMENTS OF CHAPTER 12A AND REFERENCES
   :..12200  MASONRY STRENGTH CALCULATION PROCEDURE REQUIREMENT
   :   :..12210  STRENGTH OF MASONRY COMPONENTS
   :       :..12220  CAPACITY REDUCTION FACTOR FOR MASONRY
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   :           :.............12230  ALLOWABLE WORKING STRESS FROM CHAPTER 12A
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   :                       :   :..12274  MASONRY BOND TYPE
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   :                       :   :..12280  BED JOINTS CONTAIN CRACKED ZONE
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       :.............12300  CATEGORY A MASONRY REQUIREMENT
       :.........12400  CATEGORY B MASONRY REQUIREMENT
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       :           :   :.........-12274  MASONRY BOND TYPE
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       :           :   :..12406  COMPONENT IS A PART OF SEISMIC RESISTING SYSTEM
       :           :   :...2115  % MATERIAL OF COMPONENT OR SYSTEM
       :           :..12409  CATEGORY B MASONRY ANCHOR BOLT TIE REQUIREMENT
       :           :   :..........-2114  % ELEMENT OF BUILDING (COMPONENT)
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       :           :   :......12412  REQUIREMENT OF REF SECTION 12A.6.3(F)
       :           :   :..12415  TIES PROVIDED AROUND ANCHOR BOLTS IN MASONRY
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:          :   :..12418  TIES ENGAGE AT LEAST 4 VERTICAL BARS IN MASØNRY CØLUMN
:          :   :..12421  DISTANCE ØF TIES FRØM TØP ØF MASØNRY
:          :   :..12424  SIZE ØF TIES ARØUND ANCHØR BØLTS IN MASØNRY
:          :   :..12427  NUMBER ØF TIES ARØUND ANCHØR BØLTS IN MASØNRY
:          :..12430  CATEGØRY B MASØNRY SCREEN WALL REQUIREMENT
:          :   :..........-2114  % ELEMENT ØF BUILDING (CØMPØNENT)
:          :   :.....-12245  LEVEL ØF REINFØRCEMENT IN MASØNRY
:          :   :..12433  JØINT REINF CØNSIDERED EFFECT IN RESIST TENS AND CØMPR STRES
:          :   :..12436  JØINT IS CØNTINUØUS WITHØUT ØFFSET
:          :   :..12439  AREA ØF JØINT REINFØRCEMENT
:          :   :..12442  JØINT REINFØRCEMENT EMBEDDED IN MØRTAR ØR GRØUT
:          :   :..12445  TYPE ØF MASØNRY JØINT REINFØRCEMENT
:          :   :..12448  JØINT REINFØRCEMENT SPLICED
:          :   :..12451  WIDTH ØF JØINT REINFØRCEMENT
:          :..12454  CATEGØRY B NØNSTRUCTURAL MASØNRY REQUIREMENT
:          :   :..........-2114  % ELEMENT ØF BUILDING (CØMPØNENT)
:          :   :..12457  CØMPØNENT DESIGNED TØ SUPPØRT SELF WEIGHT AND SEISMIC FØRCE
:          :   :..12460  HØLES SUITABLY STRENGTHENED AND STIFFENED
:          :   :..12463  REQUIREMENT ØF REF SECTIØN 12A.2.6
:          :..12466  MASØNRY CØNSTRUCTIØN TYPE
:          :..12469  CØMPØNENT IS PART ØF STRUCTURAL SYSTEM
:          :..12472  CATEGØRY B MASØNRY MATERIAL LIMITATIØN
:          :   :..12475  MASØNRY MATERIAL
:          :   :..12478  MASØNRY UNIT TYPE
:          :   :..12481  MASØNRY GRADE
:          :   :..12484  CØNFIGURATIØN ØF MASØNRY UNIT
:          :   :..12487  LØAD CLASS ØF MASØNRY UNIT
:          :..12496  CATEGØRY B MØRTAR REQUIREMENT
:          :   :..12490  MØRTAR TYPE
:          :   :..12493  TYPE ØF CEMENT FØR MØRTAR AND GRØUT
:          :..12700  MASØNRY SHEAR WALL REQUIREMENT
:              :..-1490  %* SEISMIC PERFØRMANCE CATEGØRY
:              :.....-12245  LEVEL ØF REINFØRCEMENT IN MASØNRY
:              :.-12250* UNREINFØRCED MASØNRY DESIGN PRØCEDURE REQUIREMENT
:              :..12702  MASØNRY SHEAR WALL REINFØRCEMENT REQUIREMENT
:              :   :..12584  RATIØ ØF HØRIZØNTAL REINFØRCEMENT IN MASØNRY
:              :   :..12704  RATIØ ØF VERTICAL REINFØRCEMENT
:              :   :..12581  SPACING ØF HØRIZØNTAL REINFØRCEMENT
:              :   :..12706  SPACING ØF VERTICAL REINFØRCEMENT
:              :   :..12708  LENGTH ØF MASØNRY SHEAR WALL ELEMENT
:              :   :..12710  HEIGHT ØF MASØNRY SHEAR WALL ELEMENT
:              :   :..12712  AREA ØF SHEAR REINFØRCEMENT
:              :   :..12714  SPACING ØF SHEAR REINFØRCEMENT
:              :   :..12716  AREA ØF REINFØRCEMENT PERPENDICULAR TØ SHEAR REINFØRCEMENT
:              :   :..12718  SPACING ØF REINFØRCEMENT PERPENDICULAR TØ SHEAR REINF
:              :   :..12720  SHEAR REINFØRCEMENT IS UNIFØRMLY DISTRIBUTED
:              :   :..12722  SHEAR REINF RESIST ALL SHEAR ØN MAS SHEAR WALL
:              :   :.....-12274  MASØNRY BØND TYPE
:              :..12724  MASØNRY SHEAR WALL BØUNDARY REQUIREMENT
:              :   :..12726  MASØNRY SHEAR WALL INTERSECTIØN REQUIREMENT
:              :   :   :..-2114  % ELEMENT ØF BUILDING (CØMPØNENT)
:              :   :   :..12728  INTERSECTIØN CØNSTRUCTIØN SATISFIES WALL REQUIREMENT
:              :   :   :..12730  INTERSECTIØN UNITES CØNCRETE WITH MAS SHEAR WALL
:              :   :   :..12732  REQUIREMENT ØF REF SECTIØN 12A.2.1
:              :   :...3306  % VERTICAL LØAD SYSTEM
:              :   :..12734  BØUNDARY MEMBER PRØVIDED AT EACH END ØF EACH WALL
:              :   :..12736  BØUNDARY MEMBER DESIGN REQUIREMENT
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:                 :   :   :..12738  STRENGTH OF VERTICAL BOUNDARY MEMBER
:                 :   :   :   :..11210  %* STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
:                 :   :   :   :..10210  %* STRENGTH OF STEEL COMPONENTS
:                 :   :   :..12740  EFFECT OF VERTICAL LOAD ON MAS SHEAR WALL
:                 :   :   :   :...2146  % DEAD LOAD
:                 :   :   :   :...2148  % LIVE LOAD
:                 :   :   :..12742  EFFECT OF VERTICAL FORCES DUE TO EQ
:                 :   :   :   :...3706  %* EARTHQUAKE FORCE EFFECT
:                 :   :   :..12744  BOUNDARY MEMBER MATERIAL
:                 :   :   :...3333  % FRAME MATERIAL
:                 :   :   :...3327  % FRAME RESPONSE TYPE
:                 :   :   :..10600  %* SPECIAL STEEL MOMENT FRAME REQUIREMENT
:                 :   :   :..11700  %* SPECIAL CONCRETE MOMENT FRAME REQUIREMENT
:                 :   :..12746  BOUNDARY MEMBER ANCHORAGE REQUIREMENT
:                 :       :..12748  HORIZ REINF IN MAS SHEAR WALL ANCHORED TO BOUND MEMB
:                 :       :.-12744  BOUNDARY MEMBER MATERIAL
:                 :       :..12750  MEANS OF ANCHORING HORIZ REINF TO BOUND MEMB
:                 :       :..12752  MEANS OF SHEAR TRANSFER TO BOUNDARY MEMBER
:                 :..12754  MASONRY SHEAR WALL COMPRESSION STRESS REQUIREMENT
:                 :   :..12756  LOAD EFFECT INCLUDES SEISMIC FORCE IN PLANE
:                 :   :..12758  ALLOWABLE COMPRESSION STRESS IN MASONRY SHEAR WALL
:                 :   :.-12230  ALLOWABLE WORKING STRESS FROM CHAPTER 12A
:                 :   :.-12245  LEVEL OF REINFORCEMENT IN MASONRY
:                 :   :.....-12258  REQUIREMENT OF REF SECTION 12A.6.1
:                 :   :.....-12268  SOURCE OF MAXIMUM ALLOWABLE STRESS
:                 :   :..12760  ALLOWABLE WORKING STRESS REDUCED FOR SLENDERNESS, IF ANY
:                 :   :..12762  HORIZ UNSUPPORTED DIST CONSIDERED IN LIEU OF VERT DIST
:                 :   :..12763  ALLOWABLE WORKING STRESS IN FLEXURE FROM REF 12A
:                 :   :......-2114  % ELEMENT OF BUILDING (COMPONENT)
:                 :..12764  MASONRY SHEAR WALL HORIZ COMPONENT REQUIREMENT
:                     :......-2114  % ELEMENT OF BUILDING (COMPONENT)
:                     :..12768  SIESMIC LOADS REQUIRE SHEAR REINFORCEMENT
:                     :..12770  DIAGONAL SHEAR REINFORCEMENT PROVIDED
:                     :..12772  REQUIREMENT REF SECTION 12A.6.4(D)
:                     :..12774  HORIZONTAL REINFORCEMENT ANCHORED IN PIERS
:                     :..12776  HORIZONTAL REINFORCEMENT CONTINUOUS THROUGH PIERS
:                     :..12778  HORIZONTAL COMPONENT SEPARATED FROM PIER WITH JOINT
:                     :..12780  JOINT BETWEEN PIER AND HORIZ COMPONENT PROVIDES FOR MOVEMENT
:                     :..12782  HORIZONTAL COMPONENT ANCHORED TO BUILDING
:                     :.-12712  AREA OF SHEAR REINFORCEMENT
:                     :.-12714  SPACING OF SHEAR REINFORCEMENT
:                     :.-12716  AREA OF REINFORCEMENT PERPENDICULAR TO SHEAR REINFORCEMENT
:                     :.-12718  SPACING OF REINFORCEMENT PERPENDICULAR TO SHEAR REINF
:......12500  CATEGORY C MASONRY REQUIREMENT
:       :.-12400* CATEGORY B MASONRY REQUIREMENT
:       :............-12245  LEVEL OF REINFORCEMENT IN MASONRY
:       :..12503  CATEGORY C MASONRY TIE ANCHORAGE REQUIREMENT
:       :   :..12506  REQUIREMENT OF REF SECTION 12A.6.3(D)
:       :   :..12509  TURN ANGLE AT ANCHORAGE OF MASONRY TIE
:       :   :..12512  EXTENSION AT ANCHORAGE OF MASONRY TIE
:       :   :..........12515  DIAMETER OF MASONRY TIE BAR
:       :......12518  CATEGORY C MASONRY COLUMN REQUIREMENT
:       :         :..........-2114  % ELEMENT OF BUILDING (COMPONENT)
:       :         :..-2115  % MATERIAL OF COMPONENT OR SYSTEM
:       :         :..12560  MASONRY COLUMN BAR SUPPORT REQUIREMENT
:       :         :   :.-12412  REQUIREMENT OF REF SECTION 12A.6.3(F)
:       :         :   :..12524  DISTANCE FROM LONGITUDINAL BAR TO LATERALLY SUPPORTED BAR
:       :         :   :..12527  LONGITUDNAL BAR LOCATION
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:       :       :   :..12530  CRØSS TIE USED TØ PRØVIDE LATERAL SUPPØRT FRØM ØPPØSITE FACE
:       :       :..12563  MASØNRY CØLUMN TIE SPACING REQUIREMENT
:       :           :..12533  MAS CØL IS BØUNDARY MEMBER ØF MAS SHEAR WALL
:       :           :..12536  MAS CØL RESISTS AXIAL STRESS FRØM EQ ØVERTURNING FØRCES
:       :           :..12539  DISTANCE FRØM TØP AND BØT ØF MAS CØL WITH CLØSE TIE SPACING
:       :           :..12542  MAXIMUM DIMENSIØN ØF MASØNRY CØLUMN
:       :           :..12545  CLEAR CØLUMN HEIGHT
:       :           :..12548  DIAMETER ØF LØNGITUDINAL REINF IN MASØNRY CØLUMN
:       :           :..12551  SMALLEST DIMENSIØN ØF MASØNRY CØLUMN
:       :           :..12554  SPACING ØF TIES IN PØRTIØN ØF MAS CØL WITH CLØSE SPACING
:       :           :..12557  SPACING ØF TIES IN PØRTIØN ØF MAS CØL WITH WIDE SPACING
:       :           :.-12515  DIAMETER ØF MASØNRY TIE BAR
:       :..12566  CATEGØRY C MASØNRY SHEAR WALL BØUNDARY REQUIREMENT
:       :   :.............-2114  % ELEMENT ØF BUILDING (CØMPØNENT)
:       :   :......-2115  % MATERIAL ØF CØMPØNENT ØR SYSTEM
:       :   :..11846  %* CAT C & D CØNCRETE BØUNDARY MEMBER REQUIREMENT
:       :   :.-12518* CATEGØRY C MASØNRY CØLUMN REQUIREMENT
:       :..12569  CATEGØRY C MASØNRY JØINT REINFØRCEMENT REQUIREMENT
:       :   :.-12466  MASØNRY CØNSTRUCTIØN TYPE
:       :   :.....-12484  CØNFIGURATIØN ØF MASØNRY UNIT
:       :   :..12572  LØNGITUDINAL JØINT REINF USED TØ FULFILL MIN REINF REQT
:       :   :..12575  LØNGITUDINAL JØINT REINF USED IN DETERMINING STRENGTH
:       :..12578  CATEGØRY C STACKED BØND REQUIREMENT
:       :   :.............-12274  MASØNRY BØND TYPE
:       :   :.........-12581  SPACING ØF HØRIZØNTAL REINFØRCEMENT
:       :   :.........-12584  RATIØ ØF HØRIZØNTAL REINFØRCEMENT IN MASØNRY
:       :   :.....-12406  CØMPØNENT IS A PART ØF SEISMIC RESISTING SYSTEM
:       :   :.....-12484  CØNFIGURATIØN ØF MASØNRY UNIT
:       :   :.-12466  MASØNRY CØNSTRUCTIØN TYPE
:       :   :.........-12245  LEVEL ØF REINFØRCEMENT IN MASØNRY
:       :..12590  CATEGØRY C MASØNRY MATERIAL LIMITATIØN
:           :.....-12475  MASØNRY MATERIAL
:           :.....-12478  MASØNRY UNIT TYPE
:           :.....-12487  LØAD CLASS ØF MASØNRY UNIT
:..12600  CATEGØRY D MASØNRY REQUIREMENT
    :.-12500* CATEGØRY C MASØNRY REQUIREMENT
    :..12602  CATEGØRY D MØRTAR AND GRØUT REQUIREMENT
    :   :................-2114  % ELEMENT ØF BUILDING (CØMPØNENT)
    :   :..12604  SUITABLY CALIBRATED DEVICE USED TØ MEASURE MATERIALS
    :   :..12608  GRØUT CØNTAINS APPRØVED  ADMIXT FØR WATER LØSS AND EXPANSIØN
    :   :..12610  GRØUT WILL NØT DEVELØP SHRINKAGE CRACKS
    :   :..12612  THICKNESS ØF GRØUT BETWEEN MASØNRY AND REINFØRCEMENT
    :..12614  CATEGØRY D GRØUT SPACE REQUIREMENT
    :   :......12616  TYPE ØF GRØUT LIFT
    :   :..12618  MINIMUM GRØUT SPACE
    :..12620  CATEGØRY D HØLLØW UNIT MASØNRY REQUIREMENT
    :   :.........-12484  CØNFIGURATIØN ØF MASØNRY UNIT
    :   :.............-12245  LEVEL ØF REINFØRCEMENT IN MASØNRY
    :   :.....-12469  CØMPØNENT IS PART ØF STRUCTURAL SYSTEM
    :   :..12622  HØLLØW MASØNRY VERTICAL CELLS REQUIREMENT
    :   :   :..12624  WYTHE AND ELEMENT THICKNESS
    :   :   :..12626  ALL VERTICAL CELLS ARE CLEAR, CØNTINUØUS AND NØ ØFFSETS
    :   :   :..12628  DIAMETER ØF LARGEST CIRCLE ENCLØSED BY VERTICAL CELLS
    :   :   :..12630  AREA ØF VERTICAL CELL
    :   :..12632  HØLLØW MASØNRY GRØUT REQUIREMENT
    :   :   :..12634  TYPE ØF GRØUT AGGREGATE
    :   :   :..12636  TYPE ØF CØNSØLIDATIØN USED FØR GRØUT
    :   :   :..12638  GRØUT RECØNSØLIDATIØN AFTER EXCESS MØISTURE ABSØRBED
```

```
:   :   :..12640  GROUT RECONSOLIDATION BEFORE WORKABILITY LOST
:   :..12642  HOLLOW MASONRY REINFORCEMENT SUPPORT REQUIREMENT
:   :   :..12644  LOCATIONS OF SECURE SUPPORT FOR VERTICAL REINFORCEMENT
:   :   :..12646  MAXIMUM DISTANCE BETWEEN SUPPORTS OF VERTICAL REINF
:   :   :..12648  DIAMETER OF VERTICAL REINFORCEMENT IN MASONRY
:   :   :.-12616  TYPE OF GROUT LIFT
:   :   :..12650  SUPPORTS FOR VERT BARS AT INTERMEDIATE LOCATION APPROVED
:   :   :..12652  HORIZONTAL REINFORCEMENT SECURELY TIED TO VERT REINF
:   :   :..12654  EQUIVALENT SUPPORT PROVIDED FOR HORIZ REINF
:   :..12656  HOLLOW MASONRY BAR SIZE REQUIREMENT
:   :   :.-12624  WYTHE AND ELEMENT THICKNESS
:   :   :..12658  SIZE OF VERTICAL REINFORCEMENT BAR
:   :   :..12660  NUMBER OF VERTICAL BARS IN ONE CELL
:   :   :..12662  SPLICES OF VERTICAL BARS STAGGERED
:   :..12664  FIRST EXCEPTION OF REF SECTION 12A.6.3(F) APPLIED
:   :.............-12551  SMALLEST DIMENSION OF MASONRY COLUMN
:..12666  CATEGORY D STACKED BOND REQUIREMENT
:   :.................-12274  MASONRY BOND TYPE
:   :..12668  STACKED BOND REINFORCEMENT REQUIREMENT
:   :   :.-12469  COMPONENT IS PART OF STRUCTURAL SYSTEM
:   :   :.........-12584  RATIO OF HORIZONTAL REINFORCEMENT IN MASONRY
:   :   :.........-12581  SPACING OF HORIZONTAL REINFORCEMENT
:   :..12670  HOLLOW STACKED BOND REQUIREMENT
:       :.....-12484  CONFIGURATION OF MASONRY UNIT
:       :.....-12406  COMPONENT IS A PART OF SEISMIC RESISTING SYSTEM
:       :.-12466  MASONRY CONSTRUCTION TYPE
:..12676  CATEGORY D MASONRY MATERIALS LIMITATION
:   :.........-12484  CONFIGURATION OF MASONRY UNIT
:   :.........-12487  LOAD CLASS OF MASONRY UNIT
:   :.........-12478  MASONRY UNIT TYPE
:   :.........-12475  MASONRY MATERIAL
:   :.....-12469  COMPONENT IS PART OF STRUCTURAL SYSTEM
:.........-12469  COMPONENT IS PART OF STRUCTURAL SYSTEM
:...1652  % ACTUAL SPECIAL INSPECTION
```

```
GLØBAL INGREDIENCE ØF CHAPTER 13

EXTREME LEVEL FRØM ØUTPUT

   0   1   2   3   4   5   6   7   8   9

 13001  SYSTEMATIC HAZARD ABATEMENT REQUIREMENT
  :......13000  CHAPTER 13 ADØPTED INTØ PRØVISIØNS
  :.............13110  EXTENT ØF EVALUATIØN REQUIRED
  :                :...1425  %* SEISMICITY INDEX
  :                :..13120  DATE ØF DESIGN ØF BUILDING
  :                :..13130  BUILDING INCLUDES FEATURES PRØVEN VULERNABLE TØ EARTHQUAKE
  :                :..13140  BUILDING STRUCT SYS SIGNIFICANTLY WEAKENED SINCE CØNST
  :                :.......1490  %* SEISMIC PERFØRMANCE CATEGØRY
  :                :......13160  ØCCUPANCY PØTENTIAL
  :                        :..13180  SQUARE FEET ØF FLØØR PER ØCCUPANT
  :                        :   :..13170  SQUARE FEET PER ØCCUPANT ESTABLISHED BY CØGNIZANT JURIS
  :                        :   :..13185  SQUARE FEET PER ØCCUPANT FRØM TABLE 13-A
  :                        :       :...1270  % BUILDING USE
  :                        :..13190  TØTAL SQUARE FEET IN BUILDING
  :..13200  SYSTEMATIC EVALUATIØN REQUIREMENT
  :   :.........-13110* EXTENT ØF EVALUATIØN REQUIRED
  :   :..13150  TYPE ØF EVALUATIØN REQUIRED
  :   :   :..............-1490  %* SEISMIC PERFØRMANCE CATEGØRY
  :   :   :......13216  RESULTS ØF QUALITATIVE EVALUATIØN
  :   :..13202  QUALITATIVE EVALUATIØN PRØCEDURES REQUIREMENT
  :   :   :..13204  ENTITY PERFØRMING EVALUATIØN
  :   :   :..13206  AVAILABLE PERTINENT DØCUMENTATIØN EXAMINED
  :   :   :..13208  ØN SITE INSPECTIØN PERFØRMED
  :   :   :..13210  ELEMENT EVALUATIØN REQUIRED
  :   :   :   :.-13110* EXTENT ØF EVALUATIØN REQUIRED
  :   :   :   :..........-1490  %* SEISMIC PERFØRMANCE CATEGØRY
  :   :   :   :.-13216  RESULTS ØF QUALITATIVE EVALUATIØN
  :   :   :   :...........2114  % ELEMENT ØF BUILDING (CØMPØNENT)
  :   :   :   :..13218  ELEM CØULD CAUSE INJURY/BLK EXIT/START FIRE/RELEASE TØXIC
  :   :   :..13212  ELEMENT CLASSED AS TØ HAZARD
  :   :   :..13214  DETAIL ØF QUALITATIVE EVALUATIØN REPØRT REQUIREMENT
  :   :       :..13220  SKETCHES ØF STRUCTURAL SRS PRØVIDED
  :   :       :..13222  SKETCHES ØF DETAILS ØF STRUCT SRS PRØVIDED
  :   :       :.-13216  RESULTS ØF QUALITATIVE EVALUATIØN
  :   :       :..13224  REASØNS PRØVIDED FØR CLASSIFICATIØN AS CAPABLE
  :   :..13226  ANALYTICAL EVALUATIØN PRØCEDURES REQUIREMENT
  :       :.-13204  ENTITY PERFØRMING EVALUATIØN
  :       :..13228  ANALYSIS METHØD REQUIREMENT
  :       :   :..13232  ANALYSIS BASED ØN RECØMMENDATIØNS ØF PREVIØUS CHAPTERS
  :       :   :..13234  RECØMMENDATIØNS ØF PREV CHAPS FØR ANALYSIS NØT APPLICABLE
  :       :   :..13236  DEVIATIØNS FRØM RECØMMEND FØR ANAL PERMITTED BY REG AGENCY
  :       :   :..13238  DEVIATIØNS FRØM RECØMMENDS FØR ANAL JUSTIFIED IN REPØRT
  :       :..13230  DETAILS ØF ANALYTICAL EVALUATIØN REPØRT REQUIREMENT
  :       :   :..13240  DIAGRAMS ØF STRUCT SRS PRØVIDED
  :       :   :..13242  CALCULATIØNS FØR DETERMINING CAPACITY RATIØ PRØVIDED
  :       :   :..13246  RESULTS ØF ANALYTICAL EVALUATIØN
  :       :   :   :..13248  GØVERNING EARTHQUAKE CAPACITY RATIØ
  :       :   :   :   :..13250  ACTUAL CAPACITY IN SEISMIC SHEAR FØRCE
  :       :   :   :   :   :...3125  %* MEMBER STRENGTH
  :       :   :   :   :   :...3130  %* CØNNECTIØN STRENGTH
```

```
:        :   :   :   :..13256  REQUIRED CAPACITY IN SEISMIC SHEAR FORCE
:        :   :   :   :   :...3706  %* EARTHQUAKE FORCE EFFECT
:        :   :   :   :...3860  %* ALLOWABLE STORY DRIFT
:        :   :   :   :..13254  ACTUAL STORY DRIFT
:        :   :   :       :...4660  %* DESIGN STORY DRIFT
:        :   :   :..13262  ALLOWABLE EARTHQUAKE CAPACITY RATIO
:        :   :       :..-1490  %* SEISMIC PERFORMANCE CATEGORY
:        :   :       :..-2114  % ELEMENT OF BUILDING (COMPONENT)
:        :   :       :.-13160* OCCUPANCY POTENTIAL
:        :   :..13244  TIME PERMITTED FOR CORRECTION PROVIDED IN REPORT
:        :.-13210* ELEMENT EVALUATION REQUIRED
:        :.-13212  ELEMENT CLASSED AS TO HAZARD
:............-13216  RESULTS OF QUALITATIVE EVALUATION
:............-13246* RESULTS OF ANALYTICAL EVALUATION
:..13301  HAZARD ABATEMENT REQUIREMENT
    :.-13000  CHAPTER 13 ADOPTED INTO PROVISIONS
    :......13310  COMPONENTS CLASSIFIED AS HAZARDOUS
    :..13320  TYPE OF ABATEMENT TO BE USED
    :..13330  BUILDING IS CLASSIFIED AS HISTORICAL
    :..13340  ALTERNATE ABATEMENT APPROVED
    :..13350  NEW EARTHQUAKE CAPACITY RATIO TO BE PROVIDED
    :..13360  REQUIRED NEW EARTHQUAKE CAPACITY RATIO
    :   :.............-1490  %* SEISMIC PERFORMANCE CATEGORY
    :   :.............-2114  % ELEMENT OF BUILDING (COMPONENT)
    :   :............-13160* OCCUPANCY POTENTIAL
    :..13370  TIME PROPOSED FOR ABATEMENT
    :..13380  MAXIMUM TIME PERMITTED FOR ABATEMENT
        :.............-1490  %* SEISMIC PERFORMANCE CATEGORY
        :.............-2114  % ELEMENT OF BUILDING (COMPONENT)
        :.-13310  COMPONENTS CLASSIFIED AS HAZARDOUS
        :..13385  COEFFICIENT FOR PERMISSIBLE TIME
        :..13390  EARTHQUAKE CAPACITY RATIO FOR COMPUTING TIME
            :.-13216  RESULTS OF QUALITATIVE EVALUATION
            :.....-13248* GOVERNING EARTHQUAKE CAPACITY RATIO
```

Chapter 1

The network for chapter 1 shows seven terminal nodes:

1305 Application requirement
1405 Effective peak acceleration
1415 Effective peak velocity-related acceleration
1469 Group III functional requirement
1472 Group III access requirement
1493 Category D site limitation requirement
1510 Alternate acceptable

Except 1405 and 1415, which are used as ingredients for determining seismic forces in chapters 3 through 8, all of these remain as terminal nodes in the complete network. Furthermore, they are the only terminal nodes in the complete network because all other provisions are referenced directly or indirectly by chapter 1. One of these five terminal nodes (1305) is the root of virtually the entire network, the other four having very minor networks in comparison. The last of these, number 1510, is unique in this analysis because it is "understood" to be an ingredient of most of the requirements of the Provisions.

The network shows that the requirements of all the other chapters are referenced as input nodes for chapter 1 (datum numbers 2001, 3001, . . . 13001). There are two points worthy of note: 1) there are no requirements in chapter 2, only definitions, and thus there is no network emanating from datum 2001; and 2) chapters 3, 4, 5, and 6 have multiple terminal nodes, yet only one terminal node per chapter is referenced in chapter 1 (3001, 4001, etc.), therefore much of the network of each of those chapters is not directly addressed by chapter 1. In fact all of the nodes in chapters 3, 4, 5, and 6 do end up in the global ingredience of chapter 1 because those chapters are so interrelated as to bring this about.

Chapter 3

The network for chapter 3 shows five terminal nodes:

3001 Structural design requirement
3210 Soil profile type
3220 Seismic soil coefficient
3348 Deflection amplification factor
3354 Response modification factor

The last four of these are parameters used in chapters 4, 5, and 6 to evaluate the seismic force. Since the seismic force from those chapters is an input item for the network for this chapter (e.g., datum 4010, Earthquake load effect from ELF/Modal analysis, is an ingredient of datum 3560, analyzed seismic load effect) the result is that these "terminal nodes" show up in the global ingredience of datum 3001 in the complete network. The full impact of this arrangement is discussed in detail in the comments on the complete network.

Chapter 3 shows a large number of references to other chapters, more than any other chapter. It almost, but not quite, serves as a directory for chapters 4, 5, 6, 7, 9, 10, 11, and 12. (There are a small number of requirements in chapters 4, 5, 6, 7, and 9 that are not referenced by chapter 3; they are referenced by chapter 1, however.) The principal references from chapter 3 fall into the following categories:

1) to chapters 4, 5, and 6 for the effect of seismic forces;
2) to chapters 9, 10, 11, and 12 for the strength of structural components; and
3) to chapters 7, 9, 10, 11, and 12 for the special requirements that are applicable to the different seismic performance categories

It is interesting to note how poorly the network duplicates the ordering of the provisions in the chapter, particularly when compared to other chapters. The most notable example is the splitting of the nodes from section 3.7 between the portion of the network emanating from datum 3120, Strength requirement, and the portion from datum 3610, Structural design and detailing requirement. Note that the sequence of numbers switches back and forth between the two portions of the network (e.g., numbers 3714, 3717, and 3734 are ingredients of "strength," while numbers 3715, 3719, and 3737 are ingredients of "detailing"). One reason for this is that the provisions of section 3.6 override the implications of the arrangement of section 3.7.

Chapter 4

The network for chapter 4 shows three terminal nodes:

4001 Equivalent lateral force analysis requirement
4010 Earthquake load effect from ELF/Modal analysis
4522 Overturning moment at foundation without reduction

The first of these brings together the small number of data items in the chapter that are not directly involved in the numerical calculation of the seismic forces and effects. There is only one derived node in its global ingredience, datum 4560, "Overturning moment requirement." The very fact that it is unique calls into question the consistency of placing it in chapter 4. The provision from which it was taken is more like the provisions of chapter 3 than the other provisions of chapter 4.

Most of the network for chapter 4 stems from the second of the three terminal nodes; the third terminal node is simply an intermediate quantity that is called for in chapter 6. Note that it was assumed that the principal force effects determined in chapter 4 were to be summed in datum 4010 from the implications of the wording of chapter 3 and the organization of chapter 4.

It is interesting to consider how the nodes in this chapter would need to be indexed to provide for a computer program for design verification:

1) nearly all of the nodes would be indexed according to the direction in which the seismic force is acting, the exceptions being a few of the nodes close to input, such as the soil profile and the total weight;
2) the nodes in the middle levels would also be indexed by story; and
3) the nodes closest to output would be indexed by component.

Subscripted notation has not been used in this analysis; it is mentioned here because it is useful to recall the implications of applying the _Provisions_ to an entire building by examining instances where indexing of variables is necessary. In this chapter the move from the general building to the individual component is quite clear.

The network clearly shows that the results of chapter 5 are picked up in chapter 4, although the text of chapter 4 in the _Provisions_ never mentions chapter 5. The reason is that the text of chapter 5 contains several references to the provisions of chapter 4 for evaluation of the seismic force effects. Such cross-references require careful consideration by readers.

It is also interesting to note how well correlated the order of the text in sections 4.2, 4.5, and 4.6 is with the order of the corresponding portions of the network.

Chapter 5

The network for chapter 5 shows six terminal nodes:

5001 Modal analysis requirement
5515 Mode 1 base shear without soil structure interaction
5820 Story shear design value
5840 First order story drift design value
5850 First order story deflection design value
5910 Overturning moment design value

The first of these again brings together several data items that are not directly involved in the numerical computation of the seismic forces and effects. The second one is a quantity that is called for in chapter 6. The other four are the principal outputs of the chapter, and they are all used in the network for chapter 4, as discussed earlier.

The nodes in this chapter are similar to those in chapter 4 in many ways, including the indexing that would be necessay for computerized design verification. One additional index would be necessary in this chapter, however, that being the mode number.

Chapter 6

The network for chapter 6 shows three terminal nodes:

6001 Soil structure interaction analysis requirement
6268 Modified ELF deflections for soil strucure interaction
6340 Mode 1 deflections modified for soil strucutre interaction

The first of these is at the root of a very small network that, like similar terminal data items in chapters 4 and 5, brings together those data items that are not directly involved in the numerical computation of the seismic forces and effects. The second and third are at the root of networks that provide modified forces and deflections for chapters 4 and 5. These two terminal data items are not the most easily recognized data items for reference to their networks, however: datums 6200, ELF base shear modified by soil structure interaction, and 6300, Mode 1 base shear modified by soil structure interaction, are more frequently referenced directly. The base shear quantities are ingredients of the deflection quantities, though, so they are not terminal nodes.

Just as the network for chapter 4 is strongly influenced by the provisions of chapter 5, the network for section 6.2 is strongly influenced by backpointing cross references in the provisions of section 6.3. Thus quantities from the modal analysis chapter (e.g., 5330, Modal period, and 5530, Effective modal gravity load) show up in the global ingredience of modifications to the equivalent lateral force method.

Chapter 7

The network for chapter 7 shows two significant differences from those of the previous four chapters:

1) there is only one terminal node
2) the network is, relatively speaking, less deep (fewer levels) and more broad (the typical derived node has more ingredients).

In both these respects this chapter resembles the chapters for the various materials, chapters 9 through 12. There is less interaction with other chapters than the structural design and analysis chapters show.

Chapter 8

The network for chapter 8 shows only one terminal node, 8001, Architectural/mechanical/ electrical design requirement. Two other nodes are referenced frequently in chapters 1 and 3; they are:

8105 A/M/E performance level
8115 Nonstructural seismic force

The network as a whole closely follows the order of the text, with the exception that some portions of sections 8.2 and 8.3 are brought into the ingredience of the strength requirement of section 8.1. Note that the four chapters for structural materials are brought in as ingredients for datum 8345, Mechanical/Electrical attachment design requirement.

Chapter 9

The network for chapter 9 shows only one terminal node, 9001, Wood materials requirement. However, several other nodes are referenced from other chapters:

1) 9210, Strength of wood components, is referenced in chapters 3 and 7;
2) 9701, Conventional light timber requirement, is referenced in chapter 1; and
3) the design category requirements, datums 9300, 9400, 9500, and 9600, are referenced in chapters 3 and 7.

The network shows that section 9.8 is split between the ingredience of the strength datum, 9210, and the ingredience of datum 9801, which brings together many detailing requirements. This splitting is very similar to that observed for section 3.7. Section 9.8 is unique among the materials chapters, because no other chapter specifies allowable strengths for components in the way that chapter 9 does.

Chapter 10

The network for chapter 10 is quite small, and it shows a single terminal node, 10001, Steel materials requirement. Note that datums 10450, Ordinary steel moment frame requirement, and 10600, Special steel moment frame requirement are referenced directly in chapter 3.

Chapter 11

The network for chapter 11 has the largest number of nodes of all the individual chapter networks. Even so, the network bears a strong resemblance to that of chapter 10, having one terminal node, 11001, Concrete materials requirement, and having the major structure shaped by the nodes for the various design category requirements. Also like chapter 10, the two nodes representing moment frame requirements, datums 11600 (ordinary) and 11700 (special) are referenced directly in chapter 3.

There are several strength requirements in this chapter, particularly in section 11.8, which modify the strength requirement of chapter 3 (e.g., datum 11862, Category C and D concrete boundary member axial strength requirement). In addition, there are several provisions for allowable strengths that apparently modify the concrete design reference document, although the references to the appropriate sections of reference document are not made explicit as they are in chapter 10, (e.g., datum 11790, Maximum allowable shear stress in joint requirement).

Note that the provisions for strength of concrete components occur at a high level from output because they are ingredients to detailed design requirements for moment frames and shear walls. Also note that chapter 11 makes reference to all of the provisions of chapter 10 through datum 11858, Category C and D concrete boundary member material requirement.

Chapter 12

This chapter is very similar to the other materials chapters. In some respects the network for chapter 12 is the prototypical one of the four because it does not have many exceptions to be commented upon. Note that this analysis does not include chapter 12A; it was treated as an independent reference, just as the reference from the other materials chapters.

Chapter 13

The network for chapter 13 shows a single terminal node, 13001, Systematic hazard abatement requirement. There is one other node that is referenced from the other chapters: datum 13301, Hazard abatement requirement. As the comments on its decision table point out, the applicability of those references is not clear, whether chapter 13 is included in the provisions or not.

Complete Network

As already pointed out in the discussion of chapter 1, there are five terminal nodes in the complete network, all from chapter 1, and one of these (datum 1305, Application requirement) is the root of nearly the entire network. Merging all the chapter networks produced two significant results:

1) complete loops were detected in the precedence of some provisions, which correspond to circular definitions, and
2) the total depth of the network is significantly greater than any of the individual chapters; in fact elements of the same chapter are frequently found to occur at widely separated extremes of levels of precedence.

These two observations are worthy of examination in some detail.

A common point in all the loops which were detected can be found in table 3-B of the Provisions, which defines the response modification factor, R, (datum 3345) and the deflection amplification factor, C_d, (datum 3348). For all buildings that use moment frames to resist seismic loads, that table includes statements that have been interpreted as strength requirements on the moment frames: for example, "Seismic force resistance is provided by Ordinary or Special Moment Frames capable of resisting the total prescribed forces" (emphasis added). Those requirements (e.g., datum 3315) are in the global ingredience of the response modification factor, R, and have as ingredients the strength of the moment frame and the required resistance. However, R is the global ingredience of the seismic force (see chapter 4), so when chapters 3 and 4 are merged the loop is closed: R depends on the required strength which depends on the earthquake force which, in turn, depends upon R. Closed loops in precedence networks can and do exist in especially defined instances of iterative calculation, but this is not such an instance.

This same requirement on moment frames leads to two other loops when chapters 3 and 4 are merged with chapter 11. Chapter 11 defines the strength of concrete components in such a fashion that the required strength, and thus the earthquake force, show up in the global ingredience of strength (i.e., datum 11230, capacity reduction factor for concrete, depends upon datums 11290 and 11295, axial force due to all loads and due to earthquake). The loop goes thus: R depends on the strength which depends on the capacity reduction factor which depends on the earthquake force which, in turn, depends on R. The second loop involving chapter 11 occurs in section 11.7, the requirement for special concrete moment frames. The section is explicitly referenced in a footnote to table 3-B, thus it is in the global ingredience of R. The loop is completed by the reference to shear stress due to earthquake forces in section 11.7.

Because it is impossible to display a directed network, such as the information network presented here, with a loop, the loops were arbitrarily cut in this analysis. The cuts were made at the points where the cross-references in the text seemed to be the weakest, by deleting the ingredients from the following datums:

3324	Total required strength
3342	Total required strength with 25% of the seismic force
11290	Axial force due to all loads
11295	Axial force due to earthquake
11702	Shear stress due to seismic forces
11704	Shear stress due to all forces
11705	Axial compressive force due to seismic and dead load

Note that each of these nodes is marked in the data list and the networks by "**" occurring at the end of the data description.

It is not recommended that the provisions be changed where these cuts were made. The requirements on the strength of moment frame system seem to be reasonable, and the best solution would be to retain them, but to detach them completely from the evaluation of R by placing them alongside other strength requirements from section 3.7 of the Provisions. In other words, it would seem most appropriate to make those special strength requirements dependent on the value of R used in analysis, and not the opposite as implied by the present organization of the Provisions. In fact, many engineers would probably do precisely that if they were given the Provisions, some without even recognizing that they were avoiding a circular definition. The rearrangement is recommended because the circular definition would undoubtedly cause some individuals significant problems in understanding the Provisions.

The longest paths from input to output in the complete network include 51 steps, far more than the longest such path in any individual chapter, which is 15 steps. Fifty-one steps are also far less than the sum of the lengths of paths from all chapters, which is 126, but that would be expected since the various chapters appear to be designed to act in parallel rather than in series. Table A3.1 lists the nodes that occur along one of the most densely populated paths from output to input. Read bottom-to-top, the table represented one path in a step-by-step design procedure that leads to the top level requirement. Read top-to-bottom, the table represents one path in a checking procedure that may be followed to ascertain whether the top requirement is satisfied.

Examination of table A3.1 shows that some nodes from chapter 11 occur at levels 7 through 13 while others occur at levels 42 through 48. This means that cross-references to other chapters have effectively made the global network for chapter 11 include nearly all the Provisions. This is primarily because the special requirements for moment frames appear in the global ingredience of the seismic force through R, the response modification factor. Chapter 10, although it is quite small by itself, shows a similar splitting. The depth of the complete network would be slightly reduced by the changes recommended earlier in the discussion of the circular definition of R. The provisions shown at levels 40 through 48 would appear at a much smaller level, because they would no longer be in the ingredience of the response modification factor, and there would be some reduction of total depth occurring in the levels that those provisions would vacate.

The real reason for the large number of levels in the network is that chapters 3, 4, 5 and 6 act in series, for all practical purposes. Note that chapter 3 is split around the analysis chapters and also references the materials chapters. A portion of chapter 3 uses the results of chapter 4, which in turn uses the results of chapter 5, etc. Another portion of chapter 3 establishes parameters (e.g., R) for use in chapters 4, 5, and 6. The large number of levels is not necessarily a defect in the Provisions; it seems necessary to properly specify all the aspects of building analysis and design. However, the wide splitting of chapter 3 with some portions at levels 3 through 6, others at levels 14 through 20, and still others at levels 37 through 41 does seem to indicate some problems in arrangement.

Table A3.1 Nodes Along a Path with Float = 0

Level	Number	Data Description
0	1305	Application requirement
1	1345	New building requirement
2	1365	Structural analysis and design requirements
3	3001	Structural design requirement
4	3610	Structural design and detailing requirement
5	3680	Category D design and detailing requirement
6	3670	Category C design and detailing requirement
7	11500	Category C and D concrete requirement
8	11556	Category C and D concrete framing limitation
9	11800	Cat C/D concrete shear wall, braced frame and diaphragm requirement
10	11818	Category C and D concrete shear wall requirement
11	11840	Cat C and D concrete shear wall and diaphragm opening requirement
12	11846	Category C and D concrete boundary member requirement
13	11834	Actual compressive stress where boundary member discontinued
14	3702	Required strength
15	3704	Combined load effect
16	3705	Additive load combination
17	3706	Earthquake force effect
18	3711	Critical earthquake load effect
19	3717	Orthogonal combination earthquake force effect
20	3560	Analyzed earthquake force effect
21	4010	Earthquake load effect from ELF/modal analysis
22	4665	Increase in force effects from second order effects
23	4660	Design story drift
24	4640	Stability coefficient
25	4605	First order design story drift
26	4610	Deflection at story X
27	5850	First order story deflection design value
28	5630	Modal story deflection
29	6340	Mode 1 deflections modified for soil structure interaction
30	5635	Mode 1 story deflection without soil structure interaction
31	5640	Elastic modal story deflection
32	5610	Modal story force
33	5510	Modal base shear
34	6300	Mode 1 base shear modified by soil structure interaction
35	5515	Mode 1 base shear without soil structure interaction
36	5520	Modal seismic coefficient
37	3354	Response modification factor
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40	3315	Moment frame requirement
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48	11230	Capacity reduction factor for concrete
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50	1425	Seismicity index
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APPENDIX A4

INDEX AND OUTLINES

This appendix is divided into six major parts as follows:

1) The classification system in table A4.1;
2) Comments on the classification system;
3) An index of all provisions, referenced by the classifiers ordered alphabetically;
4) Several outlines for various portions of the Provisions in tables A4.2 through A4.16;
5) Comments on the outlines; and
6) A list of the requirements potentially applicable to seismic performance category A buildings with comments in table A4.19.

The classification system, the index, the outlines, and the list of requirements for category A are products of a computer program that stores the relations between provisions and classifiers and is able to sort and display the classifiers and provisions in various ways. The provisions are always referenced by datum number and title, just as in the previous appendixes. The classifiers are normally referenced only by title, however, in some displays a number is also shown for the classifier. This number is merely a reference number and bears no particular significance as far as the Provisions are concerned.

The list of classifiers and the outlines are displayed as indented outlines, a convenient way of showing their tree-like structure. Outlines generated from a single tree of classifiers are shown with the applicable provisions directly beneath each classifier. Outlines generated by appending trees of classifiers onto other trees are displayed with the classifiers in a column on the left and the appropriate provisions in a column on the right. A dotted line connects a classifier with the first of the provisions that are applicable to it. Provision numbers in the outlines carry a "-" sign if they are a determination and have no sign if they are a requirement (a determination is a derived datum with a value other than "satisfied" or "violated"). Classifiers with an asterisk preceding the title are not ordinarily used to classify provisions, only to name a group of classifiers. Such classifiers are referred to as transparent classifiers.

The total number of provisions classified is 405; of these, 242 are requirements. There are 178 classifiers in the system. They are grouped into five major categories and are described in more detail on the pages immediately following. The total number of associations between provisions and classifiers is 2108, however, 645 of the associations are for the purpose of indexing alone and are ignored in the generation of outlines.

One special note about the index: although it contains all the provisions, it does not contain all the classifiers. Some classifiers, like "Abstract Physical Qualities," serve only to group other classifiers and are never used alone to class a provision, thus they do not appear in the index. Furthermore, a few classifiers are used for such a large number of provisions that their utility in an index is questionable, although they are of great utility in outlining. Four such classifiers were deleted from the index: Material Generic, Material Specific, Structural, and Seismic Resisting.

Table A4.1 Classification System

CLASSIFIERS ENTERED FOR INDEXING AND OUTLINING.
NEGATIVE SIGN INDICATES THE CLASSIFIER IS NOT ASSOCIATED WITH A PROVISION IN AN OUTLINING MODE.
ASTERISK INDICATES THE CLASSIFIER IS TRANSPARENT.

1	BUILDING		
2		PART OF BUILDING	
-4	*SPECIFIC BUILDINGS		
-5		*SEISMIC PERFORMANCE	
6			CATEGORY A
7			CATEGORY B
8			CATEGORY C
9			CATEGORY D
-10		*SEISMIC HAZARD EXPOSURE	
11			GROUP III
-12			GROUPS I AND II (NOT USED)
-13		*EXISTENCE OF BUILDING	
14			PROPOSED (NEW)
15			EXISTING
-17	*MATERIAL NATURE OF BLDG PART		
18		MATERIAL GENERIC	
19		MATERIAL SPECIFIC	
-20	*SCALE OF BUILDING PART		
21		SYSTEM	
22		COMPONENT	
23		MATERIAL	
-26	*FUNCTION OF BUILDING PART		
27		STRUCTURAL	
28			SEISMIC RESISTING
29			NON-SEISMIC RESISTING
30			FOUNDATION
31		NON-STRUCTURAL	
32			ARCHITECTURAL
33			MECHANICAL/ELECTRICAL
-39	*STRUCTURAL COMPONENTS		
40		CONNECTION	
-41		MEMBER (NOT USED)	
-42	*MATERIALS OF CONSTRUCTION		
43		WOOD	
44		STEEL	
45		REINFORCED CONCRETE	
46		MASONRY	

```
-54     *TYPE OF MEMBER STRESS
 55            AXIAL STRESS
 56            FLEXURAL STRESS
 57            SHEAR STRESS
 58            TORSION STRESS


-61     *TYPE OF SEISMIC RESISTING COMP
-62            FRAME
 63                  MOMENT FRAME (UNBRACED)
 64                        ORDINARY MOMENT FRAME
 65                        SPECIAL MOMENT FRAME
 66                  BRACED FRAME
 67            SHEAR PANEL
 68                  SHEAR WALL
 69                  DIAPHRAGM

-71     *FRAME COMPONENTS
 72            BEAM
 73            COLUMN
 74            JOINT

-76     *PART OF SHEAR PANEL
 77            BOUNDARY MEMBER
-78            WEB (NOT USED)


-82     *PART OF FOUNDATION
 83            SOIL
 84            FOUNDATION STRUCTURE
 85                  PILE
-86                  NON-PILE (NOT USED)


-90     *NON-STRUCTURAL COMPONENTS
 91            EQUIPMENT
 92            ANCHORAGE


-97     *WOOD DESIGN METHOD
 98            CONVENTIONAL
 99            ENGINEERED
-100    *PART OF WOOD SHEAR PANEL
 101           FRAMING (WOOD)
 102           SHEATHING
 103                 PLYWOOD
 104                 DIAGONAL BOARD
 105                 OTHER SHEATHING MATERIAL
```

-112 *REINF CONCRETE CONSTITUENTS
113 CONCRETE
114 REINFORCEMENT (CONCRETE)
115 LATERAL REINFORCEMENT
116 LONGITUDINAL REINFORCEMENT

-119 *CONCRETE PILE CONSTRUCTION
-120 CAST-IN-PLACE
121 CASED
122 UNCASED
123 PRECAST
124 PRESTRESSED
-125 NON-PRESTRESSED (NOT USED)

-131 *MASONRY CONSTITUENTS
132 MASONRY UNIT, MORTAR, GROUT
133 REINFORCEMENT (MASONRY)

-136 *MASONRY CONSTRUCTION
137 UNREINFORCED
138 STACKED BOND
139 HOLLOW UNIT MASONRY

143 BUILDING PROCESSES
144 REGULATION
145 DESIGN
146 SITE/SOIL INVESTIGATION
147 CONCEPTUAL DESIGN
148 ANALYSIS
149 SEISMIC LOAD ANALYSIS
150 EQUIVALENT LATERAL FORCE
151 MODAL
152 SOIL-STRUCTURE INTERACTION
153 MEMBER FORCE ANALYSIS
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157 PLANNING (QA)
158 INSPECTION
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202 GENERAL FAILURE
203 PROGRESSIVE FAILURE
204 OVERTURNING
205 HAZARDOUS DAMAGE
206 COLLISION
207 DRIFT, EXCESSIVE
208 ACCESS/EGRESS BLOCKED
209 COMPONENT FAILURE
210 COMPONENT ANCHORAGE FAILURE
211 SECONDARY HAZARD
212 GROUND RUPTURE
213 DYSFUNCTION OF DSS

-235 DERIVED VALUES
-236 BASIC PHYSICAL MEASURES
-237 HEIGHT
-238 LENGTH
-239 WEIGHT
-240 TIME

-242 REGULATORY PARAMETERS
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-244 GROUND MOTION
-245 CLASSIFICATION OF OBJECTS
-246 FUNCTIONAL MEASURES
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-248 OCCUPANCY POTENTIAL
-249 CAPACITY
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-251 STRUCTURAL RESPONSE
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-253 DAMPING
-254 PERIOD OF VIBRATION
-255 SEISMIC BASE SHEAR
-256 SEISMIC STORY FORCE
-257 SEISMIC FORCE EFFECT
-258 SEISMIC DEFLECTION
-259 SEISMIC DRIFT
-260 COMBINED FORCE EFFECT
-261 SECOND ORDER EFFECTS
-262 NON-STRUCTURAL SEISMIC FORCE

COMMENTS ON THE CLASSIFICATION SYSTEM

There are five basic categories of classifiers as described in section 2.5. Classifiers number 1 through 139 are physical entity classifiers; they are used to classify the subject of all requirements. Numbers 143 through 167 are building processes; they are used to classify the subject of some requirements and they are also used to classify some requirements and all determinations for purposes of arrangement. Numbers 171 through 189 are required qualities; they are used to classify the predicate of all requirements. Numbers 200 through 213 are limits states; they are used to classify the predicate of some requirements. Numbers 235 through 262 are the types of derived measures. With the exception of the physical entity category, each of these basic categories is represented by a single tree of classifiers. Except for purposes of indexing no provision is associated with more than one classifier from any single tree. The physical entity category consists of 22 separate trees, which may be combined into a large single tree in a great number of ways. The transparent classifiers in the physical entity trees, that is, those classifiers with an asterisk preceding their name, are used to indicate how the many small trees might be connected to form a large tree. The name of the transparent classifier is simply the name of a class (i.e., a group of classifiers). Such a class is always used to further distinguish between physical entities already classed by some other classifier. For example, classifier 119, "Concrete Pile Construction," is the name of the tree which is used to distinguish among various types of concrete piles and would only be used to classify physical entities that are already classified as a concrete pile.

Most of the classifiers are physical entity classifiers. The primary reason for this is that the present organization is almost purely according to physical entity. The formulation of the decision tables of appendix A2 was influenced by the organization of the Provisions. Most of the decision tables are specifically for one physical entity but involve many required qualities. Examination of either the text for the Provisions or the decision tables shows that there is no shortage of required qualities that can be used for classification. However, there are two factors which combine to prevent the use a very rich tree of required qualities for classification of the Provisions. First, the arrangement of required qualities in a coherent classification system appears to be more difficult than that for the physical entities. This is probably because there are no "whole-to-part" or "thing-versus-quality" groupings, which give a convenient structure to the physical entity classification. Second, because the existing organization of the Provisions influenced the identification of datums and construction of decision tables, many datums cannot be uniquely classified by what could be terminal level classifiers for required qualities. There is no shortage of classifiers for required quality. As an example consider datum 9739, which is "Conventional Wall Sheathing Requirement." The physical classifiers for this datum would be as follows: building part, component, structural, seismic resisting, wood, conventional, shear panel, wall, and sheathing. They serve to identify a unique physical entity. There are a great number of required qualities in the decision table including the following: the extent of walls with seismic bracing, location of seismic bracing on the wall, the spacing of seismic bracing sections along a wall, the width of seismic bracing in each section, the location of horizontal and vertical joints in the sheathing, thickness of the framing members, the portion of the wall length which has seismic bracing, and many additional qualities for the application of the sheathing to the wall. Since this is a single datum it must be classified by a single required quality and thus the classifier for required quality must be general enough to cover all of the mentioned qualities. "Design Details" or a similar classifier is the level of generality that must be resorted to.

The category of limits states is closely related to the performance concept behind building design. The only performance attribute that is clearly identified in the Provisions is that of safety. Two kinds of safety are distinguished (although not in precisely these terms): safety of the occupants of a building and safety of the community served by particularly important buildings. Limit states 201 through 211 are specifically for the safety of the occupants of a building. They can be further divided into those pertaining to the whole building, limit states 201 through 204, and those pertaining to part of the building, limit states 205 through 211. The limit states that apply only to safety of a community served by a building are numbers 212 and 213. A building that is required to provide safety for a community would also be expected to satisfy the requirements for limit states 201 through 211, and in some instances with a higher degree of reliability. Only a small portion of the total number of requirements is classified by limit states. There are at least two reasons for this. First, several of the requirements in the Provisions are very difficult to relate to performance concepts (that is, they are prescriptive provisions) and it would be presumptious to link such provisions to any particular limit state. Second, it is questionable that the concept of limit states is really applicable to requirements that are imposed on building processes other than design, for example, quality assurance.

The classification contains some classes that merit specific comment. Several of the classes do not appear to follow the logical principles of mutual exclusion and collective exhaustion. For example, the class for "Seismic Hazard Exposure" (10) contains only one active classifier--"Group III." Groups I and II are not used as classifiers because no provision applies to them that does not also apply to Group III. Thus, the logical principles of classification are intact for such a class in the context of this set of provisions, because reference is always made to the whole set or the active subset, never the inactive subset. Other classes with only one active classifier include "Type of Structural Component"(39), "Part of Shear Panel"(76), "Type of Foundation Structure" (84), and "Type of Precast Concrete" (123). Each of these is also complete in the context this set of provisions because it is never necessary to class a provision as the inactive classifier ("Member", "Shear Panel Web," or other equivalent classifiers) in order to exclude the active classifier. The classifier "Part of Building" is discussed in a following paragraph.

A considerable amount of similar condensation from a purely logical structure has occurred in other classes, for example, the constituents and types of masonry construction. As a matter of fact, the classifiers for types of masonry construction ("Unreinforced", Stacked Bond," Hollow Unit Masonry") are not mutually exclusive. This drawback was accepted in this study because the infrequent use of those classifiers did not justify the amount of hierarchical structure required to maintain the logical principles. Other classes such as the class for type of member stress, numbers 55 through 58, exhibit a potential ambiguity in that any given member could be subjected to more than one of the types of stress listed. The Provisions never refer to a member under combined stress situations, therefore, in the context of these provisions once again, the logical principles are intact.

Some classes exhibit an unusual structure or relation between the classifiers at a given level. For example, the classifiers of the class called "Scale of Building Part" ("System," "Component" and "Material") are related to each other in that a component may be made of a material, a system may contain several components which are in turn made of materials, etc. The use of this class follows the policy that a provision is classified according to the scale of the building part for which required qualities are specified. Thus, components or materials may be specified as required qualities of a system, however, components would not be specified as required qualities of a component. A provision that specified a component as a required quality would be classified as system. This may be contrasted with the use of "Building Part" as a subdivision of "Building". Those two classifiers could be used on the same level, as subdivisions of "Physical Entity," in a similar fashion to "System," "Component," and "Material," but it happened to be of some use in outlining to demonstrate the two on different levels.

Each of these deviations from the logical principles of classification have been made to reduce the cumbersome nature of the classification system and make it more streamlined and useful.

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METHOD

3105 STRUCTURAL ANALYSIS REQUIREMENT
3160 FOUNDATION DESIGN CRITERIA REQUIREMENT
5001 MODAL ANALYSIS REQUIREMENT
9200 WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT

10200 STEEL STRENGTH CALCULATION PRODECURE REQUIREMENT
11200 CONCRETE STRENGTH CALCULATION PROCEDURE REQUIREMENT
11734 SPECIAL CONCRETE FLEXURAL MEMBER DESIGN SHEAR REQT
11777 SPECIAL CONCRETE BEAM COLUMN DESIGN SHEAR REQT
11797 JOINT DESIGN SHEAR FORCE REQUIREMENT
12200 MASONRY STRENGTH CALCULATION PROCEDURE REQUIREMENT
12250 UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT

TECHNIQUE

1315 LOAD COMBINATION REQUIREMENT
1510 ALTERNATE ACCEPTABLE
1605 DETAILS OF QUALITY ASSURANCE PLAN
1644 MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
1651 QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
3270 SOIL STRUCTURE INTERACTION USE REQUIREMENT
3510 SEISMIC LOAD ANALYSIS REQUIREMENT
3701 CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
4001 EQUIVALENT LATERAL FORCE ANALYSIS REQUIREMENT
5310 MODES REQUIREMENT
5410 PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
6001 SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT
11789 JOINT SHEAR STRESS CALCULATION REQUIREMENT
12569 CATEGORY C MASONRY JOINT REINFORCEMENT REQUIREMENT
12602 CATEGORY D MORTAR AND GROUT REQUIREMENT
12632 HOLLOW MASONRY GROUT REQUIREMENT
12754 MASONRY SHEAR WALL COMPRESSION STRESS REQUIREMENT
13200 SYSTEMATIC EVALUATION REQUIREMENT
13202 QUALITATIVE EVALUATION PROCEDURES REQUIREMENT
13226 ANALYTICAL EVALUATION PROCEDURES REQUIREMENT
13228 ANALYSIS METHOD REQUIREMENT

PRINCIPLES AND ASSUMPTIONS

3790 CATEGORY C AND D VERTICAL MOTION REQUIREMENT
5210 MODELING REQUIREMENT
11701 SPECIAL CONCRETE SHEAR STRENGTH REQUIREMENT
12253 GENERAL UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT
12256 ALTERNATE UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT

DOCUMENTATION

1604 QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
1613 STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
1640 MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
1654 QUALITY ASSURANCE REPORTING REQUIREMENT
1655 SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
1662 SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
1668 CONTRACTORS FINAL REPORT REQUIREMENT
1674 MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT
13214 DETAIL OF QUALITATIVE EVALUATION REPORT REQUIREMENT
13230 DETAILS OF ANALYTICAL EVALUATION REPORT REQUIREMENT

TABLE A4.3 REQUIREMENTS OUTLINED ON THE TREE FROM THE ROOT BUILDING PROCESSES

BUILDING PROCESSES
- 1305 APPLICATION REQUIREMENT
- 1345 NEW BUILDING REQUIREMENT
- 1370 MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS
- 12001 MASONRY MATERIALS REQUIREMENT
- 12002 MASONRY DESIGN CATEGORY REQUIREMENT
- 12600 CATEGORY D MASONRY REQUIREMENT
- 12620 CATEGORY D HOLLOW UNIT MASONRY REQUIREMENT

REGULATION
- 1510 ALTERNATE ACCEPTABLE

DESIGN
- 1315 LOAD COMBINATION REQUIREMENT
- 1365 STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS
- 3001 STRUCTURAL DESIGN REQUIREMENT
- 3160 FOUNDATION DESIGN CRITERIA REQUIREMENT
- 3700 COMPONENT DESIGN REQUIREMENT
- 8001 ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
- 8300 MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
- 8372 M/E UTILITY SERVICE INTERFACE REQUIREMENT
- 9001 WOOD MATERIALS REQUIREMENT
- 10001 STEEL MATERIALS REQUIREMENT
- 11001 CONCRETE MATERIALS REQUIREMENT

SITE/SOIL INVESTIGATION
- 7404 CATEGORY B SOIL INVESTIGATION REQUIREMENT
- 7510 CATEGORY C SOIL INVESTIGATION REQUIREMENT

CONCEPTUAL DESIGN
- 3145 LOAD PATH REQUIREMENT
- 3330 ORDINARY MOMENT FRAME REQUIREMENT
- 3336 SPECIAL MOMENT FRAME REQUIREMENT
- 3369 GENERAL FRAMING REQUIREMENT
- 3372 CATEGORY C AND D SEISMIC RESISTING SYSTEM LIMITATION
- 3725 REDUNDANCY REQUIREMENT
- 3810 SEPARATION REQUIREMENT
- 7600 CATEGORY D FOUNDATION REQUIREMENT
- 8135 A/M/E INTERRELATIONSHIP REQUIREMENT
- 10500 CATEGORY C AND D STEEL REQUIREMENT
- 11556 CATEGORY C AND D CONCRETE FRAMING LIMITATION

ANALYSIS
- 3105 STRUCTURAL ANALYSIS REQUIREMENT
- 3381 CATEGORY C AND D INTERACTION REQUIREMENT

SEISMIC LOAD ANALYSIS
- 3510 SEISMIC LOAD ANALYSIS REQUIREMENT
- 3701 CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
- 3790 CATEGORY C AND D VERTICAL MOTION REQUIREMENT

EQUIVALENT LATERAL FORCE
- 4001 EQUIVALENT LATERAL FORCE ANALYSIS REQUIREMENT

MODAL
- 5001 MODAL ANALYSIS REQUIREMENT

5210 MODELING REQUIREMENT
5310 MODES REQUIREMENT
5410 PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT

SOIL-STRUCTURE INTERACTION
3270 SOIL STRUCTURE INTERACTION USE REQUIREMENT
6001 SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT

MEMBER FORCE ANALYSIS
11734 SPECIAL CONCRETE FLEXURAL MEMBER DESIGN SHEAR REQT
11777 SPECIAL CONCRETE BEAM COLUMN DESIGN SHEAR REQT
11789 JOINT SHEAR STRESS CALCULATION REQUIREMENT
11797 JOINT DESIGN SHEAR FORCE REQUIREMENT
12253 GENERAL UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT
12256 ALTERNATE UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT

DETAILED DESIGN
3120 STRENGTH REQUIREMENT
3140 DEFORMATION REQUIREMENT
3315 MOMENT FRAME REQUIREMENT
3318 DUAL SYSTEM REQUIREMENT
3363 COMBINED FRAMING REQUIREMENT
3390 CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT
3610 STRUCTURAL DESIGN AND DETAILING REQUIREMENT
3620 CATEGORY A DESIGN AND DETAILING REQUIREMENT
3630 CATEGORY B DESIGN AND DETAILING REQUIREMENT
3640 CATEGORY B OPENINGS REQUIREMENT
3670 CATEGORY C DESIGN AND DETAILING REQUIREMENT
3680 CATEGORY D DESIGN AND DETAILING REQUIREMENT
3719 DISCONTINUITY REQUIREMENT
3737 INTERCONNECTION REQUIREMENT
3741 CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
3747 NONSTRUCTURAL ANCHORAGE REQUIREMENT
3752 COLLECTOR REQUIREMENT
3755 DIAPHRAGM REQUIREMENT
3770 BEARING WALL REQUIREMENT
3850 DRIFT LIMIT
4560 OVERTURNING MOMENT REQUIREMENT
8110 A/M/E COMPONENT STRENGTH REQUIREMENT
8165 A/M/E ATTACHMENT REQUIREMENT
8200 ARCHITECTURAL DESIGN REQUIREMENT
8240 EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT
8250 ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT
8270 ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT
8345 MECH/ELEC ATTACHMENT DESIGN REQUIREMENT
9200 WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT
10200 STEEL STRENGTH CALCULATION PRODECURE REQUIREMENT
11200 CONCRETE STRENGTH CALCULATION PROCEDURE REQUIREMENT
12200 MASONRY STRENGTH CALCULATION PROCEDURE REQUIREMENT

CONSTRUCTION
12602 CATEGORY D MORTAR AND GROUT REQUIREMENT
12632 HOLLOW MASONRY GROUT REQUIREMENT

QUALITY ASSURANCE
1601 QUALITY ASSURANCE REQUIREMENT
1625 QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
1640 MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT

1651 QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
1654 QUALITY ASSURANCE REPORTING REQUIREMENT
1668 CONTRACTORS FINAL REPORT REQUIREMENT
8360 MECHANICAL/ELECTRICAL COMPONENT DESIGN REQUIREMENT

PLANNING (QA)
1604 QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
1605 DETAILS OF QUALITY ASSURANCE PLAN
1613 STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN

INSPECTION
1655 SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
1662 SPECIAL INSPECTORS FINAL REPORT REQUIREMENT

TESTING
1644 MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
1674 MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT

USE

ALTERATION
1380 ALTERATION AND REPAIR REQUIREMENT

REPAIR

CHANGE OF USE
1390 CHANGE OF USE REQUIREMENT

HAZARD ABATEMENT
13001 SYSTEMATIC HAZARD ABATEMENT REQUIREMENT
13200 SYSTEMATIC EVALUATION REQUIREMENT
13301 HAZARD ABATEMENT REQUIREMENT

QUALITATIVE EVALUATION
13202 QUALITATIVE EVALUATION PROCEDURES REQUIREMENT
13214 DETAIL OF QUALITATIVE EVALUATION REPORT REQUIREMENT

ANALYTICAL EVALUATION
13226 ANALYTICAL EVALUATION PROCEDURES REQUIREMENT
13228 ANALYSIS METHOD REQUIREMENT
13230 DETAILS OF ANALYTICAL EVALUATION REPORT REQUIREMENT

TABLE A4.4 REQUIREMENTS OUTLINED ON THE TREE FROM THE ROOT LIMIT STATES

LIMIT STATES

COLLAPSE

3145 LOAD PATH REQUIREMENT

GENERAL FAILURE

1315 LOAD COMBINATION REQUIREMENT
1380 ALTERATION AND REPAIR REQUIREMENT
1390 CHANGE OF USE REQUIREMENT
3120 STRENGTH REQUIREMENT
3315 MOMENT FRAME REQUIREMENT
3318 DUAL SYSTEM REQUIREMENT
3381 CATEGORY C AND D INTERACTION REQUIREMENT
3390 CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT
3701 CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
3719 DISCONTINUITY REQUIREMENT
3752 COLLECTOR REQUIREMENT
3770 BEARING WALL REQUIREMENT
3790 CATEGORY C AND D VERTICAL MOTION REQUIREMENT
7210 FOUNDATION COMPONENT STRENGTH REQUIREMENT
7230 FOUNDATION SOIL CAPACITY REQUIREMENT
7595 CATEGORY C STEEL PILE REQUIREMENT

PROGRESSIVE FAILURE

3725 REDUNDANCY REQUIREMENT

OVERTURNING

4560 OVERTURNING MOMENT REQUIREMENT

HAZARDOUS DAMAGE

3140 DEFORMATION REQUIREMENT
3737 INTERCONNECTION REQUIREMENT
3755 DIAPHRAGM REQUIREMENT
8001 ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
8200 ARCHITECTURAL DESIGN REQUIREMENT
8300 MECHANICAL/ELECTRICAL DESIGN REQUIREMENT

COLLISION

3810 SEPARATION REQUIREMENT

DRIFT, EXCESSIVE

3850 DRIFT LIMIT

ACCESS/EGRESS BLOCKED

1472 GROUP III ACCESS REQUIREMENT

COMPONENT FAILURE

3640 CATEGORY B OPENINGS REQUIREMENT
3741 CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
8110 A/M/E COMPONENT STRENGTH REQUIREMENT
8135 A/M/E INTERRELATIONSHIP REQUIREMENT
8250 ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT
8270 ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT
8360 MECHANICAL/ELECTRICAL COMPONENT DESIGN REQUIREMENT

COMPONENT ANCHORAGE FAILURE

3747 NONSTRUCTURAL ANCHORAGE REQUIREMENT
8165 A/M/E ATTACHMENT REQUIREMENT
8240 EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT
8345 MECH/ELEC ATTACHMENT DESIGN REQUIREMENT

SECONDARY HAZARD
8372 M/E UTILITY SERVICE INTERFACE REQUIREMENT

GROUND RUPTURE
1493 CATEGORY D SITE LIMITATION REQUIREMENT

DYSFUNCTION OF DSS
1469 GROUP III FUNCTIONAL REQUIREMENT

TABLE A4.5 DETERMINATIONS OUTLINED ON THE TREE FROM THE ROOT BUILDING PROCESSES

BUILDING PROCESSES

REGULATION

- -1210 PROVISIONS APPLICABLE
- -1405 EFFECTIVE PEAK ACCELERATION
- -1415 EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
- -1425 SEISMICITY INDEX
- -1430 SEISMIC HAZARD EXPOSURE GROUP
- -1490 SEISMIC PERFORMANCE CATEGORY

DESIGN

- -8100 ARCHITECTURAL/MECHANICAL/ELECTRICAL PROVISIONS APPLICABLE
- -8105 A/M/E PERFORMANCE LEVEL
- -8106 PERFORMANCE LEVEL FROM TABLE8-B
- -8107 PERFORMANCE LEVEL FROM TABLE8-C
- -8190 PERFORMANCE CHARACTERISTIC FACTOR

SITE/SOIL INVESTIGATION

CONCEPTUAL DESIGN

- -3303 GENERAL FRAMING CLASS
- -3405 BUILDING CONFIGURATION
- -3410 PLAN CONFIGURATION
- -3415 VERTICAL CONFIGURATION

ANALYSIS

SEISMIC LOAD ANALYSIS

- -3210 SOIL PROFILE TYPE
- -3220 SEISMIC SOIL COEFFICIENT
- -3345 SINGLE SYSTEM RESPONSE MODIFICATION FACTOR
- -3348 DEFLECTION AMPLIFICATION FACTOR
- -3354 RESPONSE MODIFICATION FACTOR
- -3530 REQUIRED SEISMIC LOAD ANALYSIS
- -4605 FIRST ORDER DESIGN STORY DRIFT
- -4610 DEFLECTION AT STORY X
- -4640 STABILITY COEFFICIENT
- -4660 DESIGN STORY DRIFT
- -4665 INCREASE IN FORCE EFFECTS FROM SECOND ORDER EFFECTS
- -8115 NONSTRUCTURAL SEISMIC FORCE
- -8215 SEISMIC FORCE FOR ARCHITECTURAL COMPONENTS
- -8220 SEISMIC COEFFICIENT FOR ARCHITECTURAL COMPONENTS
- -8309 SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT
- -8312 SEISMIC COEFFICIENT FOR MECHANICAL/ELECTRICAL COMPONENT
- -8313 SEISMIC COEFFICIENT FOR VERTICAL FORCE ON M/E COMPONENT
- -8315 AMPLIFICATION FACTOR FOR ATTACHMENT OF M/E COMPONENT
- -8318 AMPLIFICATION FACTOR FOR LOCATION OF M/E COMPONENT
- -8321 TYPE OF RESILIENT MOUNTING SYSTEM
- -8324 NATURAL PERIOD OF VIBRATION OF COMPONENT AND ATTACHMENT
- -8330 STIFFNESS OF M/E SUPPORT WITH RESPECT TO CENTER OF GRAVITY

EQUIVALENT LATERAL FORCE

- -4205 SEISMIC BASE SHEAR
- -4208 ELF SEISMIC BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
- -4210 SEISMIC DESIGN COEFFICIENT
- -4215 TOTAL GRAVITY WEIGHT OF BUILDING

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        -4230  EFFECTIVE SNOW LOAD
        -4240  BUILDING PERIOD
        -4255  APPROXIMATE BUILDING PERIOD
        -4260  COEFFICIENT FOR APPROXIMATE PERIOD
        -4310  SEISMIC STORY FORCE
        -4320  VERTICAL DISTRIBUTION FACTOR
        -4330  VERTICAL DISTRIBUTION EXPONENT
        -4520  ELF OVERTURNING MOMENT AT LEVEL X
        -4522  OVERTURNING MOMENT AT FOUNDATION WITHOUT REDUCTION
        -4530  OVERTURNING MOMENT REDUCTION FACTOR
        -4608  ELF DEFLECTIONS WITHOUT SOIL STRUCTURE INTERACTION
        -4615  ELASTIC DEFLECTION AT STORY X

MODAL
        -5510  MODAL BASE SHEAR
        -5515  MODE 1 BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
        -5520  MODAL SEISMIC COEFFICIENT
        -5530  EFFECTIVE MODAL GRAVITY LOAD
        -5610  MODAL STORY FORCE
        -5620  MODAL VERTICAL DISTRIBUTION FACTOR
        -5630  MODAL STORY DEFLECTION
        -5635  MODE 1 STORY DEFLECTION WITHOUT SOIL STRUCTURE INTERACTION
        -5640  ELASTIC MODAL STORY DEFLECTION
        -5650  FIRST ORDER MODAL STORY DRIFT
        -5810  BASE SHEAR DESIGN VALUE
        -5820  STORY SHEAR DESIGN VALUE
        -5830  STORY OVERTURNING MOMENT DESIGN VALUE
        -5840  FIRST ORDER STORY DRIFT DESIGN VALUE
        -5850  FIRST ORDER STORY DEFLECTION DESIGN VALUE
        -5860  COMPARITIVE ELF BASE SHEAR
        -5880  ELF ADJUSTMENT FACTOR
        -5910  OVERTURNING MOMENT DESIGN VALUE

SOIL-STRUCTURE INTERACTION
        -6200  ELF BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
        -6202  SOIL STRUCT INTERACTION REDUCTION OF ELF BASE SHEAR
        -6204  ELF SEISMIC COEFFICIENT MODIFIED FOR SOIL STRUCT INT
        -6206  FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYSTEM
        -6207  ELF GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
        -6208  GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
        -6210  PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
        -6211  PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION
        -6212  STIFFNESS OF BUILDING FIXED AT BASE
        -6217  ELF HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
        -6218  HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
        -6222  AVERAGE SHEAR MODULUS OF SOIL AT LARGE STRAINS
        -6224  AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS
        -6226  SHEAR MODULUS OF SOIL AT SMALL STRAINS
        -6238  EFFECTIVE PERIOD FOR TYPICAL BUILDING
        -6240  EFFECTIVE PERIOD FOR MAT FOUNDATION BUILDING
        -6242  RELATIVE DENSITY OF STRUCTURE AND SOIL
        -6244  CHARACTERISTIC FOUNDATION LENGTH BASED ON AREA
        -6246  CHARACTERISTIC FOUNDATION LENGTH BASED ON INERTIA
        -6252  COMPUTED FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYS
        -6254  FOUNDATION DAMPING FACTOR
        -6256  DAMPING VALUE FROM FIGURE 6-1
        -6258  CHARACTERISTIC FOUNDATION LENGTH
        -6264  FOUNDATION DAMPING FACTOR FOR PILE FOUNDATIONS
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-6268 MODIFIED ELF DEFLECTIONS FOR SOIL STRUCTURE INTERACTION
-6300 MODE 1 BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
-6310 SOIL STRUCTURE INTERACTION REDUCTION IN MODE 1 BASE SHEAR
-6330 MODAL HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
-6340 MODE 1 DEFLECTIONS MODIFIED FOR SOIL STRUCTURE INTERACTION

MEMBER FORCE ANALYSIS
-3560 ANALYZED EARTHQUAKE FORCE EFFECT
-3704 COMBINED LOAD EFFECT
-3705 ADDITIVE LOAD COMBINATION
-3706 EARTHQUAKE FORCE EFFECT
-3711 CRITICAL EARTHQUAKE LOAD EFFECT
-3713 COUNTERACTING LOAD COMBINATION
-3717 ORTHOGONAL COMBINATION EARTHQUAKE FORCE EFFECT
-3731 MINIMUM SEISMIC FORCE
-3765 MINIMUM DIAPHRAGM SIESMIC FORCE EFFECT
-3771 MINIMUM BEARING WALL SEISMIC FORCE
-3788 ADJUSTMENT TO OVERTURNING MOMENT OF INVERTED PENDULUM
-3797 ALTERED LOAD COMBO FOR EFFECTS OF VERT MOTION
-3860 ALLOWABLE STORY DRIFT
-4010 EARTHQUAKE LOAD EFFECT FROM ELF/MODAL ANALYSIS
-4410 SEISMIC STORY SHEAR
-4460 TORSIONAL MOMENT
-4480 ACCIDENTAL TORSIONAL MOMENT
-4515 OVERTURNING MOMENT AT LEVEL X

DETAILED DESIGN
-3125 MEMBER STRENGTH
-3130 CONNECTION STRENGTH
-3702 REQUIRED STRENGTH
-7444 MINIMUM DEVELOPMENT LENGTH
-9210 STRENGTH OF WOOD COMPONENTS
-9220 CAPACITY REDUCTION FACTOR FOR WOOD
-9230 ALLOWABLE STRENGTH OF WOOD COMPONENTS
-9867 ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD DIAPHRAGM
-9877 ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD SHEAR WALLS
-9886 ALLOWABLE WORKING STRESS SHEAR FOR FIBERBOARD SHEAR WALLS
-9888 ALLOWABLE WORKING STRESS SHEAR FOR LATH AND PLASTER WALLS
-9892 ALLOWABLE WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS
-9893 BASIC WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS
-10210 STRENGTH OF STEEL COMPONENTS
-10220 CAPACITY REDUCTION FACTOR FOR STEEL
-11210 STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
-11230 CAPACITY REDUCTION FACTOR FOR CONCRETE
-11275 ALLOWABLE LOADS ON ANCHOR BOLTS
-11668 MINIMUM DISTANCE FOR LATERAL REINFORCEMENT
-11680 MAXIMUM ALLOWABLE SPACING OF LATERAL REINFORCEMENT
-11743 LOCATION REQUIRES HOOP REINFORCEMENT
-11770 MINIMUM DISTANCE FOR SPECIAL LATERAL REINF
-11791 JOINT TYPE
-12210 STRENGTH OF MASONRY COMPONENTS
-12220 CAPACITY REDUCTION FACTOR FOR MASONRY
-12225 ALLOWABLE STRENGTH OF MASONRY COMPONENT

CONSTRUCTION

QUALITY ASSURANCE

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PLANNING (QA)
            -1602  QUALITY ASSURANCE PLAN REQUIRED

INSPECTION
            -1628  MINIMUM SPECIAL INSPECTION

TESTING
            -1635  MINIMUM SPECIAL TESTING
            -1637  MECEANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
            -1641  MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
            -8363  M/E COMPONENT CERTIFICATION (TESTING) REQUIRED
            -8369  M/E ATTACHMENT CERTIFICATION (TESTING) REQUIRED

USE

ALTERATION

REPAIR

CHANGE OF USE

HAZARD ABATEMENT
           -13110  EXTENT OF EVALUATION REQUIRED
           -13150  TYPE OF EVALUATION REQUIRED
           -13160  OCCUPANCY POTENTIAL
           -13180  SQUARE FEET OF FLOOR PER OCCUPANT
           -13185  SQUARE FEET PER OCCUPANT FROM TABLE 13-A
           -13360  REQUIRED NEW EARTHQUAKE CAPACITY RATIO
           -13380  MAXIMUM TIME PERMITTED FOR ABATEMENT
           -13390  EARTHQUAKE CAPACITY RATIO FOR COMPUTING TIME

    QUALITATIVE EVALUATION
               -13210  ELEMENT EVALUATION REQUIRED

    ANALYTICAL EVALUATION
               -13246  RESULTS OF ANALYTICAL EVALUATION
               -13248  GOVERNING EARTHQUAKE CAPACITY RATIO
               -13262  ALLOWABLE EARTHQUAKE CAPACITY RATIO
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TABLE A4.6 DETERMINATIONS OUTLINED ON THE TREE FROM THE ROOT DERIVED VALUES

DERIVED VALUES

- BASIC PHYSICAL MEASURES
  - HEIGHT
    - -6217 ELF HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
    - -6218 HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
    - -6330 MODAL HEIGHT EFFECTIVE FOR SOIL STRUCTURE INTERACTION
  - LENGTH
    - -6244 CHARACTERISTIC FOUNDATION LENGTH BASED ON AREA
    - -6246 CHARACTERISTIC FOUNDATION LENGTH BASED ON INERTIA
    - -6258 CHARACTERISTIC FOUNDATION LENGTH
    - -7444 MINIMUM DEVELOPMENT LENGTH
    - -11668 MINIMUM DISTANCE FOR LATERAL REINFORCEMENT
    - -11680 MAXIMUM ALLOWABLE SPACING OF LATERAL REINFORCEMENT
    - -11770 MINIMUM DISTANCE FOR SPECIAL LATERAL REINF
  - WEIGHT
    - -4215 TOTAL GRAVITY WEIGHT OF BUILDING
    - -4230 EFFECTIVE SNOW LOAD
    - -6207 ELF GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
    - -6208 GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
    - -6242 RELATIVE DENSITY OF STRUCTURE AND SOIL
  - TIME
    - -13380 MAXIMUM TIME PERMITTED FOR ABATEMENT
- REGULATORY PARAMETERS
  - SCOPE
    - -1210 PROVISIONS APPLICABLE
    - -1602 QUALITY ASSURANCE PLAN REQUIRED
    - -1628 MINIMUM SPECIAL INSPECTION
    - -1635 MINIMUM SPECIAL TESTING
    - -1637 MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
    - -1641 MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
    - -8100 ARCHITECTURAL/MECHANICAL/ELECTRICAL PROVISIONS APPLICABLE
    - -8363 M/E COMPONENT CERTIFICATION (TESTING) REQUIRED
    - -8369 M/E ATTACHMENT CERTIFICATION (TESTING) REQUIRED
    - -13110 EXTENT OF EVALUATION REQUIRED
    - -13150 TYPE OF EVALUATION REQUIRED
    - -13210 ELEMENT EVALUATION REQUIRED
  - GROUND MOTION
    - -1405 EFFECTIVE PEAK ACCELERATION
    - -1415 EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
    - -1425 SEISMICITY INDEX
  - CLASSIFICATION OF OBJECTS
    - -1430 SEISMIC HAZARD EXPOSURE GROUP
    - -1490 SEISMIC PERFORMANCE CATEGORY
    - -3303 GENERAL FRAMING CLASS
    - -3405 BUILDING CONFIGURATION
    - -3410 PLAN CONFIGURATION
    - -3415 VERTICAL CONFIGURATION

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          -3530  REQUIRED SEISMIC LOAD ANALYSIS
          -8321  TYPE OF RESILIENT MOUNTING SYSTEM
         -11743  LOCATION REQUIRES HOOP REINFORCEMENT
         -11791  JOINT TYPE

FUNCTIONAL MEASURES

    PERFORMANCE LEVEL
          -8105  A/M/E PERFORMANCE LEVEL
          -8106  PERFORMANCE LEVEL FROM TABLE8-B
          -8107  PERFORMANCE LEVEL FROM TABLE8-C
          -8190  PERFORMANCE CHARACTERISTIC FACTOR

    OCCUPANCY POTENTIAL
         -13160  OCCUPANCY POTENTIAL
         -13180  SQUARE FEET OF FLOOR PER OCCUPANT
         -13185  SQUARE FEET PER OCCUPANT FROM TABLE 13-A

    CAPACITY
          -3125  MEMBER STRENGTH
          -3130  CONNECTION STRENGTH
          -3702  REQUIRED STRENGTH
          -9210  STRENGTH OF WOOD COMPONENTS
          -9220  CAPACITY REDUCTION FACTOR FOR WOOD
          -9230  ALLOWABLE STRENGTH OF WOOD COMPONENTS
          -9867  ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD DIAPHRAGM
          -9877  ALLOWABLE WORKING STRESS SHEAR IN PLYWOOD SHEAR WALLS
          -9886  ALLOWABLE WORKING STRESS SHEAR FOR FIBERBOARD SHEAR WALLS
          -9888  ALLOWABLE WORKING STRESS SHEAR FOR LATH AND PLASTER WALLS
          -9892  ALLOWABLE WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS
          -9893  BASIC WORKING STRESS SHEAR FOR GYPSUM BOARD WALLS
         -10210  STRENGTH OF STEEL COMPONENTS
         -10220  CAPACITY REDUCTION FACTOR FOR STEEL
         -11210  STRENGTH OF CONCRETE COMPONENTS AND SYSTEMS
         -11230  CAPACITY REDUCTION FACTOR FOR CONCRETE
         -11275  ALLOWABLE LOADS ON ANCHOR BOLTS
         -12210  STRENGTH OF MASONRY COMPONENTS
         -12220  CAPACITY REDUCTION FACTOR FOR MASONRY
         -12225  ALLOWABLE STRENGTH OF MASONRY COMPONENT
         -13246  RESULTS OF ANALYTICAL EVALUATION
         -13248  GOVERNING EARTHQUAKE CAPACITY RATIO
         -13262  ALLOWABLE EARTHQUAKE CAPACITY RATIO
         -13360  REQUIRED NEW EARTHQUAKE CAPACITY RATIO
         -13390  EARTHQUAKE CAPACITY RATIO FOR COMPUTING TIME

    SOIL PROPERTIES
          -3210  SOIL PROFILE TYPE
          -3220  SEISMIC SOIL COEFFICIENT
          -6212  STIFFNESS OF BUILDING FIXED AT BASE
          -6222  AVERAGE SHEAR MODULUS OF SOIL AT LARGE STRAINS
          -6224  AVERAGE SHEAR WAVE VELOCITY OF SOIL AT LARGE STRAINS
          -6226  SHEAR MODULUS OF SOIL AT SMALL STRAINS

STRUCTURAL RESPONSE

    RESPONSE MODIFICATION
          -3345  SINGLE SYSTEM RESPONSE MODIFICATION FACTOR
          -3348  DEFLECTION AMPLIFICATION FACTOR
```

-3354 RESPONSE MODIFICATION FACTOR

DAMPING
- -6206 FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYSTEM
- -6252 COMPUTED FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYS
- -6254 FOUNDATION DAMPING FACTOR
- -6256 DAMPING VALUE FROM FIGURE 6-1
- -6264 FOUNDATION DAMPING FACTOR FOR PILE FOUNDATIONS

PERIOD OF VIBRATION
- -4240 BUILDING PERIOD
- -4255 APPROXIMATE BUILDING PERIOD
- -4260 COEFFICIENT FOR APPROXIMATE PERIOD
- -6210 PERIOD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
- -6211 PERIOD WITHOUT MODIFICATION FOR SOIL STRUCTURE INTERACTION
- -6238 EFFECTIVE PERIOD FOR TYPICAL BUILDING
- -6240 EFFECTIVE PERIOD FOR MAT FOUNDATION BUILDING
- -8324 NATURAL PERIOD OF VIBRATION OF COMPONENT AND ATTACHMENT
- -8330 STIFFNESS OF M/E SUPPORT WITH RESPECT TO CENTER OF GRAVITY

SEISMIC BASE SHEAR
- -4205 SEISMIC BASE SHEAR
- -4208 ELF SEISMIC BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
- -4210 SEISMIC DESIGN COEFFICIENT
- -5510 MODAL BASE SHEAR
- -5515 MODE 1 BASE SHEAR WITHOUT SOIL STRUCTURE INTERACTION
- -5520 MODAL SEISMIC COEFFICIENT
- -5530 EFFECTIVE MODAL GRAVITY LOAD
- -5810 BASE SHEAR DESIGN VALUE
- -5860 COMPARITIVE ELF BASE SHEAR
- -5880 ELF ADJUSTMENT FACTOR
- -6200 ELF BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
- -6202 SOIL STRUCT INTERACTION REDUCTION OF ELF BASE SHEAR
- -6204 ELF SEISMIC COEFFICIENT MODIFIED FOR SOIL STRUCT INT
- -6206 FRACTION OF CRITICAL DAMPING IN STRUCT FOUND SYSTEM
- -6207 ELF GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
- -6208 GRAVITY LOAD EFFECTIVE FOR SOIL STRUCTURE INTERACTION
- -6300 MODE 1 BASE SHEAR MODIFIED BY SOIL STRUCTURE INTERACTION
- -6310 SOIL STRUCTURE INTERACTION REDUCTION IN MODE 1 BASE SHEAR

SEISMIC STORY FORCE
- -4310 SEISMIC STORY FORCE
- -4320 VERTICAL DISTRIBUTION FACTOR
- -4330 VERTICAL DISTRIBUTION EXPONENT
- -5610 MODAL STORY FORCE
- -5620 MODAL VERTICAL DISTRIBUTION FACTOR

SEISMIC FORCE EFFECT
- -3560 ANALYZED EARTHQUAKE FORCE EFFECT
- -3706 EARTHQUAKE FORCE EFFECT
- -3711 CRITICAL EARTHQUAKE LOAD EFFECT
- -3717 ORTHOGONAL COMBINATION EARTHQUAKE FORCE EFFECT
- -3731 MINIMUM SEISMIC FORCE
- -3765 MINIMUM DIAPHRAGM SIESMIC FORCE EFFECT
- -3771 MINIMUM BEARING WALL SEISMIC FORCE
- -3788 ADJUSTMENT TO OVERTURNING MOMENT OF INVERTED PENDULUM
- -4010 EARTHQUAKE LOAD EFFECT FROM ELF/MODAL ANALYSIS
- -4410 SEISMIC STORY SHEAR

-4460 TORSIONAL MOMENT
-4480 ACCIDENTAL TORSIONAL MOMENT
-4515 OVERTURNING MOMENT AT LEVEL X
-4520 ELF OVERTURNING MOMENT AT LEVEL X
-4522 OVERTURNING MOMENT AT FOUNDATION WITHOUT REDUCTION
-4530 OVERTURNING MOMENT REDUCTION FACTOR
-5820 STORY SHEAR DESIGN VALUE
-5830 STORY OVERTURNING MOMENT DESIGN VALUE
-5910 OVERTURNING MOMENT DESIGN VALUE

SEISMIC DEFLECTION
-4608 ELF DEFLECTIONS WITHOUT SOIL STRUCTURE INTERACTION
-4610 DEFLECTION AT STORY X
-4615 ELASTIC DEFLECTION AT STORY X
-5630 MODAL STORY DEFLECTION
-5635 MODE 1 STORY DEFLECTION WITHOUT SOIL STRUCTURE INTERACTION
-5640 ELASTIC MODAL STORY DEFLECTION
-5650 FIRST ORDER STORY DEFLECTION DESIGN VALUE
-6268 MODIFIED ELF DEFLECTIONS FOR SOIL STRUCTURE INTERACTION
-6340 MODE 1 DEFLECTIONS MODIFIED FOR SOIL STRUCTURE INTERACTION

SEISMIC DRIFT
-3860 ALLOWABLE STORY DRIFT
-4605 FIRST ORDER DESIGN STORY DRIFT
-4660 DESIGN STORY DRIFT
-5650 FIRST ORDER MODAL STORY DRIFT
-5840 FIRST ORDER STORY DRIFT DESIGN VALUE

COMBINED FORCE EFFECT
-3704 COMBINED LOAD EFFECT
-3705 ADDITIVE LOAD COMBINATION
-3713 COUNTERACTING LOAD COMBINATION
-3797 ALTERED LOAD COMBO FOR EFFECTS OF VERT MOTION

SECOND ORDER EFFECTS
-4640 STABILITY COEFFICIENT
-4665 INCREASE IN FORCE EFFECTS FROM SECOND ORDER EFFECTS

NON-STRUCTURAL SEISMIC FORCE
-8115 NONSTRUCTURAL SEISMIC FORCE
-8215 SEISMIC FORCE FOR ARCHITECTURAL COMPONENTS
-8220 SEISMIC COEFFICIENT FOR ARCHITECTURAL COMPONENTS
-8309 SEISMIC FORCE FOR MECHANICAL/ELECTRICAL COMPONENT
-8312 SEISMIC COEFFICIENT FOR MECHANICAL/ELECTRICAL COMPONENT
-8313 SEISMIC COEFFICIENT FOR VERTICAL FORCE ON M/E COMPONENT
-8315 AMPLIFICATION FACTOR FOR ATTACHMENT OF M/E COMPONENT
-8318 AMPLIFICATION FACTOR FOR LOCATION OF M/E COMPONENT

TABLE A4.7 - ALL REQUIREMENTS, ØRDERED BY PHYSICAL ENTITIES ALØNE

ØUTLINE ØF PRØVISIØNS

CLASSIFIERS	PRØVISIØNS	
BUILDING	1305	APPLICATIØN REQUIREMENT
	1315	LØAD CØMBINATIØN REQUIREMENT
	1510	ALTERNATE ACCEPTABLE
	1601	QUALITY ASSURANCE REQUIREMENT
	1604	QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
	1605	DETAILS ØF QUALITY ASSURANCE PLAN
	1613	STATEMENT ØF CØNTRACTØR ØN QUALITY ASSURANCE PLAN
	1625	QUALITY ASSURANCE PERSØNNEL ARRANGEMENTS
	1640	MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
	1644	MECHANICAL/ELECTRICAL TEST CØMPLIANCE REQUIREMENT
	1651	QUALITY ASSURANCE PLAN CØMPLIANCE REQUIREMENT
	1654	QUALITY ASSURANCE REPØRTING REQUIREMENT
	1655	SPECIAL INSPECTØRS WEEKLY REPØRT REQUIREMENT
	1662	SPECIAL INSPECTØRS FINAL REPØRT REQUIREMENT
	1668	CØNTRACTØRS FINAL REPØRT REQUIREMENT
	1674	MECH/ELECT EQUIP MANUFACTURER CERTIFICATIØN PRØGRAM REQT
	3810	SEPARATIØN REQUIREMENT
SPECIFIC BUILDINGS		
EXISTENCE ØF BUILDING		
PRØPØSED (NEW)	1345	NEW BUILDING REQUIREMENT
EXISTING	1380	ALTERATIØN AND REPAIR REQUIREMENT
	1390	CHANGE ØF USE REQUIREMENT
	13001	SYSTEMATIC HAZARD ABATEMENT REQUIREMENT
	13200	SYSTEMATIC EVALUATIØN REQUIREMENT
	13202	QUALITATIVE EVALUATIØN PRØCEDURES REQUIREMENT
	13214	DETAIL ØF QUALITATIVE EVALUATIØN REPØRT REQUIREMENT
	13226	ANALYTICAL EVALUATIØN PRØCEDURES REQUIREMENT
	13228	ANALYSIS METHØD REQUIREMENT
	13230	DETAILS ØF ANALYTICAL EVALUATIØN REPØRT REQUIREMENT
	13301	HAZARD ABATEMENT REQUIREMENT
GRØUP III	1469	GRØUP III FUNCTIØNAL REQUIREMENT
	1472	GRØUP III ACCESS REQUIREMENT
CATEGØRY D	1493	CATEGØRY D SITE LIMITATIØN REQUIREMENT
PART ØF BUILDING		
STRUCTURAL	1365	STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS
MATERIAL GENERIC	3001	STRUCTURAL DESIGN REQUIREMENT
SYSTEM	3105	STRUCTURAL ANALYSIS REQUIREMENT
	3140	DEFØRMATIØN REQUIREMENT
SEISMIC RESISTING	3145	LØAD PATH REQUIREMENT
	3270	SØIL STRUCTURE INTERACTIØN USE REQUIREMENT
	3369	GENERAL FRAMING REQUIREMENT
	3510	SEISMIC LØAD ANALYSIS REQUIREMENT
	3725	REDUNDANCY REQUIREMENT
	3752	CØLLECTØR REQUIREMENT
	3850	DRIFT LIMIT
	4001	EQUIVALENT LATERAL FØRCE ANALYSIS REQUIREMENT
	4560	ØVERTURNING MØMENT REQUIREMENT
	5001	MØDAL ANALYSIS REQUIREMENT
	5210	MØDELING REQUIREMENT

	5310	MODES REQUIREMENT
	5410	PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
	6001	SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT
MOMENT FRAME (UNBRACED)	3315	MOMENT FRAME REQUIREMENT
	3318	DUAL SYSTEM REQUIREMENT
ORDINARY MOMENT FRAME	3330	ORDINARY MOMENT FRAME REQUIREMENT
SPECIAL MOMENT FRAME	3336	SPECIAL MOMENT FRAME REQUIREMENT
SEISMIC PERFORMANCE		
CATEGORY C	3372	CATEGORY C AND D SEISMIC RESISTING SYSTEM LIMITATION
	3381	CATEGORY C AND D INTERACTION REQUIREMENT
NON-SEISMIC RESISTING		
CATEGORY C	3390	CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT
FOUNDATION	3160	FOUNDATION DESIGN CRITERIA REQUIREMENT
	7001	FOUNDATION DESIGN REQUIREMENTS
PART OF FOUNDATION		
SEISMIC PERFORMANCE		
CATEGORY B	7400	CATEGORY B FOUNDATION REQUIREMENT
	7404	CATEGORY B SOIL INVESTIGATION REQUIREMENT
FOUNDATION STRUCTURE	7428	CATEGORY B FOUNDATION TIE REQUIREMENT
CATEGORY C	7500	CATEGORY C FOUNDATION REQUIREMENT
	7510	CATEGORY C SOIL INVESTIGATION REQUIREMENT
SOIL	7230	FOUNDATION SOIL CAPACITY REQUIREMENT
FOUNDATION STRUCTURE	7520	CATEGORY C FOUNDATION TIE REQUIREMENT
COMPONENT	3120	STRENGTH REQUIREMENT
	3610	STRUCTURAL DESIGN AND DETAILING REQUIREMENT
	3700	COMPONENT DESIGN REQUIREMENT
	3737	INTERCONNECTION REQUIREMENT
CONNECTION	3741	CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
	3747	NONSTRUCTURAL ANCHORAGE REQUIREMENT
	3770	BEARING WALL REQUIREMENT
SEISMIC PERFORMANCE		
CATEGORY A	3620	CATEGORY A DESIGN AND DETAILING REQUIREMENT
CATEGORY B	3630	CATEGORY B DESIGN AND DETAILING REQUIREMENT
CATEGORY C	3670	CATEGORY C DESIGN AND DETAILING REQUIREMENT
	3790	CATEGORY C AND D VERTICAL MOTION REQUIREMENT
CATEGORY D	3680	CATEGORY D DESIGN AND DETAILING REQUIREMENT
SEISMIC RESISTING	3363	COMBINED FRAMING REQUIREMENT
	3701	CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
	3719	DISCONTINUITY REQUIREMENT
SHEAR PANEL		
DIAPHRAGM	3755	DIAPHRAGM REQUIREMENT
CATEGORY B	3640	CATEGORY B OPENINGS REQUIREMENT
NON-SEISMIC RESISTING		
FOUNDATION		
FOUNDATION STRUCTURE	7210	FOUNDATION COMPONENT STRENGTH REQUIREMENT
PILE		
CATEGORY B	7438	CATEGORY B FOUNDATION PILE REQUIRMENT
CATEGORY C	7535	CATEGORY C FOUNDATION PILE REQUIREMENT
MATERIAL	1370	MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS
MATERIAL SPECIFIC		
WOOD	9001	WOOD MATERIALS REQUIREMENT
	9002	WOOD DESIGN CATEGORY REQUIREMENT
	9200	WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT
WOOD DESIGN METHOD		
CONVENTIONAL	9701	CONVENTIONAL LIGHT TIMBER REQUIREMENT
SHEAR WALL		
FRAMING (WOOD)	9706	CONVENTIONAL WALL FRAMING REQUIREMENT
SHEATHING	9739	CONVENTIONAL WALL SHEATHING REQUIREMENT

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    CATEGORY C
      COMPONENT ........................................ 12500  CATEGORY C MASONRY REQUIREMENT
        REINFORCEMENT (MASONRY) ........................ 12503  CATEGORY C MASONRY TIE ANCHORAGE REQUIREMENT
                                                         12518  CATEGORY C MASONRY COLUMN REQUIREMENT
                                                         12569  CATEGORY C MASONRY JOINT REINFORCEMENT REQUIREMENT
          LATERAL REINFORCEMENT ........................ 12563  MASONRY COLUMN TIE SPACING REQUIREMENT
          LONGITUDINAL REINFORCEMENT ................... 12560  MASONRY COLUMN BAR SUPPORT REQUIREMENT
          STACKED BOND ................................. 12578  CATEGORY C STACKED BOND REQUIREMENT
        SEISMIC RESISTING
          SHEAR WALL
            BOUNDARY MEMBER ............................ 12566  CATEGORY C MASONRY SHEAR WALL BOUNDARY REQUIREMENT
      MATERIAL ......................................... 12590  CATEGORY C MASONRY MATERIAL LIMITATION
    CATEGORY D
      COMPONENT ........................................ 12600  CATEGORY D MASONRY REQUIREMENT
        MASONRY UNIT, MORTAR, GROUT .................... 12614  CATEGORY D GROUT SPACE REQUIREMENT
        STACKED BOND ................................... 12666  CATEGORY D STACKED BOND REQUIREMENT
          REINFORCEMENT (MASONRY) ...................... 12668  STACKED BOND REINFORCEMENT REQUIREMENT
        HOLLOW UNIT MASONRY ............................ 12620  CATEGORY D HOLLOW UNIT MASONRY REQUIREMENT
                                                         12622  HOLLOW MASONRY VERTICAL CELLS REQUIREMENT
                                                         12632  HOLLOW MASONRY GROUT REQUIREMENT
                                                         12670  HOLLOW STACKED BOND REQUIREMENT
          REINFORCEMENT (MASONRY) ...................... 12642  HOLLOW MASONRY REINFORCEMENT SUPPORT REQUIREMENT
                                                         12656  HOLLOW MASONRY BAR SIZE REQUIREMENT
      MATERIAL ......................................... 12602  CATEGORY D MORTAR AND GROUT REQUIREMENT
                                                         12676  CATEGORY D MASONRY MATERIALS LIMITATION
NON-STRUCTURAL
  MATERIAL GENERIC ..................................... 8001   ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
                                                         8110   A/M/E COMPONENT STRENGTH REQUIREMENT
                                                         8135   A/M/E INTERRELATIONSHIP REQUIREMENT
    COMPONENT
      ANCHORAGE ........................................ 8165   A/M/E ATTACHMENT REQUIREMENT
    ARCHITECTURAL ...................................... 8200   ARCHITECTURAL DESIGN REQUIREMENT
                                                         8250   ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT
                                                         8270   ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT
      ANCHORAGE ........................................ 8240   EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT
    MECHANICAL/ELECTRICAL .............................. 8300   MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
      EQUIPMENT ........................................ 8360   MECHANICAL/ELECTRICAL COMPONENT DESIGN REQUIREMENT
                                                         8372   M/E UTILITY SERVICE INTERFACE REQUIREMENT
      ANCHORAGE ........................................ 8345   MECH/ELEC ATTACHMENT DESIGN REQUIREMENT
  MATERIAL SPECIFIC
    COMPONENT
      MASONRY .......................................... 12001  MASONRY MATERIALS REQUIREMENT
                                                         12002  MASONRY DESIGN CATEGORY REQUIREMENT
        CATEGORY B ..................................... 12454  CATEGORY B NONSTRUCTURAL MASONRY REQUIREMENT


ALL PROVISIONS WERE OUTLINED


THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(3)  3741  CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
(2) 12001  MASONRY MATERIALS REQUIREMENT
(2) 12002  MASONRY DESIGN CATEGORY REQUIREMENT
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TABLE A4.8 - CHAPTER 1 WITH QUALITY ASSURANCE, ACTIVITIES FIRST

OUTLINE OF PROVISIONS

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CLASSIFIERS                                                     PROVISIONS

  BUILDING
    REQUIRED QUALITIES
      BUILDING PROCESSES ..................................  1305  APPLICATION REQUIREMENT
        REGULATION
          TECHNIQUE .......................................  1510  ALTERNATE ACCEPTABLE
          REGULATORY PARAMETERS
            SCOPE ......................................... -1210  PROVISIONS APPLICABLE
            GROUND MOTION ................................. -1405  EFFECTIVE PEAK ACCELERATION
                                                            -1415  EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
                                                            -1425  SEISMICITY INDEX
            CLASSIFICATION OF OBJECTS ..................... -1430  SEISMIC HAZARD EXPOSURE GROUP
                                                            -1490  SEISMIC PERFORMANCE CATEGORY
        DESIGN
          METHOD
            TECHNIQUE .....................................  1315  LOAD COMBINATION REQUIREMENT
          DOCUMENTATION
        CONSTRUCTION
        QUALITY ASSURANCE
          SOCIAL QUALITIES ................................  1601  QUALITY ASSURANCE REQUIREMENT
                                                             1625  QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
            EXISTENCE OF PROCESS
              PLANNING (QA) ............................... -1602  QUALITY ASSURANCE PLAN REQUIRED
              INSPECTION
              TESTING ..................................... -1637  MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
            METHOD
              TECHNIQUE ...................................  1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
                PLANNING (QA) .............................  1605  DETAILS OF QUALITY ASSURANCE PLAN
                INSPECTION ................................ -1628  MINIMUM SPECIAL INSPECTION
                TESTING ................................... -1635  MINIMUM SPECIAL TESTING
                                                            -1641  MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
                                                             1644  MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
            DOCUMENTATION .................................  1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
                                                             1654  QUALITY ASSURANCE REPORTING REQUIREMENT
                                                             1668  CONTRACTORS FINAL REPORT REQUIREMENT
              PLANNING (QA) ...............................  1604  QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
                                                             1613  STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
              INSPECTION ..................................  1655  SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
                                                             1662  SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
              TESTING .....................................  1674  MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT
        USE
      SPECIFIC BUILDINGS
        PROPOSED (NEW)
          BUILDING PROCESSES ..............................  1305  APPLICATION REQUIREMENT
                                                             1345  NEW BUILDING REQUIREMENT
            REGULATION
            DESIGN
              PART OF BUILDING
                SYSTEM
                  STRUCTURAL ..............................  1365  STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS
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          NON-STRUCTURAL
            MATERIAL ........................................ 1370  MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS
        CONSTRUCTION
        QUALITY ASSURANCE
    EXISTING
      BUILDING PROCESSES .................................... 1305  APPLICATION REQUIREMENT
        USE
          ALTERATION
            STRENGTH REQUIRED ............................... 1380  ALTERATION AND REPAIR REQUIREMENT
          REPAIR
          CHANGE OF USE
            STRENGTH REQUIRED ............................... 1390  CHANGE OF USE REQUIREMENT
          HAZARD ABATEMENT
    GROUP III
      DYSFUNCTION OF DSS .................................... 1469  GROUP III FUNCTIONAL REQUIREMENT
      ACCESS/EGRESS BLOCKED ................................. 1472  GROUP III ACCESS REQUIREMENT
    CATEGORY D
      GROUND RUPTURE ........................................ 1493  CATEGORY D SITE LIMITATION REQUIREMENT
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ALL PROVISIONS WERE OUTLINED

THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(3) 1305 APPLICATION REQUIREMENT

TABLE A4.9 - CHAPTER 1 WITH QUALITY ASSURANCE, BUILDING TYPES FIRST

OUTLINE OF PROVISIONS

```
CLASSIFIERS                                                    PROVISIONS

  BUILDING
    REQUIRED QUALITIES
      SPECIFIC BUILDINGS
        PROPOSED (NEW)
          BUILDING PROCESSES ,................................   1305  APPLICATION REQUIREMENT
                                                                 1345  NEW BUILDING REQUIREMENT
            REGULATION
            DESIGN
              PART OF BUILDING
                SYSTEM
                  STRUCTURAL .................................   1365  STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS
                  NON-STRUCTURAL
                MATERIAL .....................................   1370  MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS
            CONSTRUCTION
            QUALITY ASSURANCE
              SOCIAL QUALITIES ...............................   1601  QUALITY ASSURANCE REQUIREMENT
                                                                 1625  QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
                EXISTENCE OF PROCESS
                  PLANNING (QA) ..............................  -1602  QUALITY ASSURANCE PLAN REQUIRED
                  INSPECTION
                  TESTING ....................................  -1637  MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
                METHOD
                  TECHNIQUE ..................................   1651  QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
                    PLANNING (QA) ............................   1605  DETAILS OF QUALITY ASSURANCE PLAN
                    INSPECTION ...............................  -1628  MINIMUM SPECIAL INSPECTION
                    TESTING ..................................  -1635  MINIMUM SPECIAL TESTING
                                                                -1641  MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
                                                                 1644  MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
                DOCUMENTATION ................................   1640  MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
                                                                 1654  QUALITY ASSURANCE REPORTING REQUIREMENT
                                                                 1668  CONTRACTORS FINAL REPORT REQUIREMENT
                  PLANNING (QA) ..............................   1604  QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
                                                                 1613  STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
                  INSPECTION .................................   1655  SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
                                                                 1662  SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
                  TESTING ....................................   1674  MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT
        EXISTING
          BUILDING PROCESSES .................................   1305  APPLICATION REQUIREMENT
            REGULATION
            DESIGN
            CONSTRUCTION
            QUALITY ASSURANCE
            USE
              ALTERATION
                STRENGTH REQUIRED ............................   1380  ALTERATION AND REPAIR REQUIREMENT
              REPAIR
              CHANGE OF USE
                STRENGTH REQUIRED ............................   1390  CHANGE OF USE REQUIREMENT
              HAZARD ABATEMENT
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      GROUP III
        DYSFUNCTION OF DSS .................................  1469  GROUP III FUNCTIONAL REQUIREMENT
        ACCESS/EGRESS BLOCKED ..............................  1472  GROUP III ACCESS REQUIREMENT
      CATEGORY D
        GROUND RUPTURE .....................................  1493  CATEGORY D SITE LIMITATION REQUIREMENT
    BUILDING PROCESSES .....................................  1305  APPLICATION REQUIREMENT
      REGULATION
        TECHNIQUE ..........................................  1510  ALTERNATE ACCEPTABLE
        REGULATORY PARAMETERS
          SCOPE ............................................ -1210  PROVISIONS APPLICABLE
          GROUND MOTION .................................... -1405  EFFECTIVE PEAK ACCELERATION
                                                             -1415  EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
                                                             -1425  SEISMICITY INDEX
          CLASSIFICATION OF OBJECTS ........................ -1430  SEISMIC HAZARD EXPOSURE GROUP
                                                             -1490  SEISMIC PERFORMANCE CATEGORY
      DESIGN
        METHOD
          TECHNIQUE ........................................  1315  LOAD COMBINATION REQUIREMENT
        DOCUMENTATION
      CONSTRUCTION
      QUALITY ASSURANCE
    ' USE


ALL PROVISIONS WERE OUTLINED


THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(3)  1305  APPLICATION REQUIREMENT
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TABLE A4.10 - CHAPTER 1 WITH QUALITY ASSURANCE, MODIFIED ACTIVITIES TRE

OUTLINE OF PROVISIONS

CLASSIFIERS		PROVISIONS
BUILDING		
REQUIRED QUALITIES		
BUILDING PROCESSES	1305	
REGULATION		
TECHNIQUE	1510	ALTERNATE ACCEPTABLE
REGULATORY PARAMETERS		
SCOPE	-1210	PROVISIONS APPLICABLE
GROUND MOTION	-1405	EFFECTIVE PEAK ACCELERATION
	-1415	EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION
	-1425	SEISMICITY INDEX
CLASSIFICATION OF OBJECTS	-1430	SEISMIC HAZARD EXPOSURE GROUP
	-1490	SEISMIC PERFORMANCE CATEGORY
DEVELOPMENT AND USE	1305	APPLICATION REQUIREMENT
DEVELOPMENT		
DESIGN		
METHOD		
TECHNIQUE	1315	LOAD COMBINATION REQUIREMENT
DOCUMENTATION		
SPECIFIC BUILDINGS		
PROPOSED (NEW)	1345	NEW BUILDING REQUIREMENT
DESIGN		
SYSTEM		
STRUCTURAL	1365	STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS
NON-STRUCTURAL	8001	ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT
MATERIAL	1370	MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS
CONSTRUCTION		
QUALITY ASSURANCE		
SOCIAL QUALITIES	1601	QUALITY ASSURANCE REQUIREMENT
	1625	QUALITY ASSURANCE PERSONNEL ARRANGEMENTS
EXISTENCE OF PROCESS		
PLANNING (QA)	-1602	QUALITY ASSURANCE PLAN REQUIRED
INSPECTION		
TESTING	-1637	MECHANICAL/ELECTRICAL EQUIPMENT TESTING REQUIRED
METHOD		
TECHNIQUE	1651	QUALITY ASSURANCE PLAN COMPLIANCE REQUIREMENT
PLANNING (QA)	1605	DETAILS OF QUALITY ASSURANCE PLAN
INSPECTION	-1628	MINIMUM SPECIAL INSPECTION
TESTING	-1635	MINIMUM SPECIAL TESTING
	-1641	MINIMUM SPECIAL TESTING FOR MECH/ELECT EQUIPMENT
	1644	MECHANICAL/ELECTRICAL TEST COMPLIANCE REQUIREMENT
DOCUMENTATION	1640	MECHANICAL/ELECTRIAL TESTING PLAN ACCEPTANCE REQUIREMENT
	1654	QUALITY ASSURANCE REPORTING REQUIREMENT
	1668	CONTRACTORS FINAL REPORT REQUIREMENT
PLANNING (QA)	1604	QUALITY ASSURANCE PLAN ACCEPTANCE REQUIREMENT
	1613	STATEMENT OF CONTRACTOR ON QUALITY ASSURANCE PLAN
INSPECTION	1655	SPECIAL INSPECTORS WEEKLY REPORT REQUIREMENT
	1662	SPECIAL INSPECTORS FINAL REPORT REQUIREMENT
TESTING	1674	MECH/ELECT EQUIP MANUFACTURER CERTIFICATION PROGRAM REQT
USE		

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      SPECIFIC BUILDINGS
        EXISTING
          ALTERATION
            STRENGTH REQUIRED ...........................  1380  ALTERATION AND REPAIR REQUIREMENT
          REPAIR
          CHANGE OF USE
            STRENGTH REQUIRED ...........................  1390  CHANGE OF USE REQUIREMENT
          HAZARD ABATEMENT ..............................13001  SYSTEMATIC HAZARD ABATEMENT REQUIREMENT
  SPECIFIC BUILDINGS
    GROUP III
      DYSFUNCTION OF DSS ................................  1469  GROUP III FUNCTIONAL REQUIREMENT
      ACCESS/EGRESS BLOCKED .............................  1472  GROUP III ACCESS REQUIREMENT
    CATEGORY D
      GROUND RUPTURE ....................................  1493  CATEGORY D SITE LIMITATION REQUIREMENT
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ALL PROVISIONS WERE OUTLINED

NO PROVISIONS WERE OUTLINED MORE THAN ONCE

TABLE A4.11 - STRUCTURAL DESIGN, FUNCTION AND SCALE DOMINANT

OUTLINE OF PROVISIONS

CLASSIFIERS		PROVISIONS
BUILDING		
BUILDING PROCESSES		
REQUIRED QUALITIES		
PART OF BUILDING		
STRUCTURAL		
DESIGN	3001	STRUCTURAL DESIGN REQUIREMENT
SYSTEM		
CONCEPTUAL DESIGN		
CONFIGURATION (ARRANGEMENT)	3810	SEPARATION REQUIREMENT
ANALYSIS		
METHOD	3105	STRUCTURAL ANALYSIS REQUIREMENT
DETAILED DESIGN		
STIFFNESS/FLEXIBILITY REQD	3140	DEFORMATION REQUIREMENT
COMPONENT	3700	COMPONENT DESIGN REQUIREMENT
SEISMIC LOAD ANALYSIS		
PRINCIPLES AND ASSUMPTIONS		
CATEGORY C	3790	CATEGORY C AND D VERTICAL MOTION REQUIREMENT
DETAILED DESIGN	3610	STRUCTURAL DESIGN AND DETAILING REQUIREMENT
STRUCTURAL COMPONENTS		
STRENGTH REQUIRED	3120	STRENGTH REQUIREMENT
STIFFNESS/FLEXIBILITY REQD		
INTEGRITY	3737	INTERCONNECTION REQUIREMENT
CONNECTION		
MEASURABLE PHYSICAL QUALITIES	3770	BEARING WALL REQUIREMENT
EXISTENCE OF OBJECTS	3741	CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
	3747	NONSTRUCTURAL ANCHORAGE REQUIREMENT
STRENGTH REQUIRED	3120	STRENGTH REQUIREMENT
CATEGORY A		
PHYSICAL QUALITIES	3620	CATEGORY A DESIGN AND DETAILING REQUIREMENT
CATEGORY B		
PHYSICAL QUALITIES	3630	CATEGORY B DESIGN AND DETAILING REQUIREMENT
CATEGORY C	3670	CATEGORY C DESIGN AND DETAILING REQUIREMENT
CATEGORY D	3680	CATEGORY D DESIGN AND DETAILING REQUIREMENT
MATERIAL		
SEISMIC RESISTING		
SYSTEM		
CONCEPTUAL DESIGN		
PHYSICAL QUALITIES	3369	GENERAL FRAMING REQUIREMENT
MEASURABLE PHYSICAL QUALITIES		
MEASURABLE PHYSICAL QUALITIES		
EXISTENCE OF OBJECTS		
ORDINARY MOMENT FRAME	3330	ORDINARY MOMENT FRAME REQUIREMENT
SPECIAL MOMENT FRAME	3336	SPECIAL MOMENT FRAME REQUIREMENT
DETAILS		
CATEGORY C	3372	CATEGORY C AND D SEISMIC RESISTING SYSTEM LIMITATION
ABSTRACT PHYSICAL QUALITIES		
INTEGRITY	3145	LOAD PATH REQUIREMENT
	3725	REDUNDANCY REQUIREMENT
ANALYSIS		

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    PHYSICAL QUALITIES
      INTERRELATIONSHIP
        CATEGORY C ...........................  3381  CATEGORY C AND D INTERACTION REQUIREMENT
    SOCIAL QUALITIES
      SEISMIC LOAD ANALYSIS
        TECHNIQUE ............................  3510  SEISMIC LOAD ANALYSIS REQUIREMENT
        EQUIVALENT LATERAL FORCE
          TECHNIQUE ..........................  4001  EQUIVALENT LATERAL FORCE ANALYSIS REQUIREMENT
        MODAL
          METHOD .............................  5001  MODAL ANALYSIS REQUIREMENT
          TECHNIQUE ..........................  5310  MODES REQUIREMENT
                                                5410  PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
          PRINCIPLES AND ASSUMPTIONS .........  5210  MODELING REQUIREMENT
        SOIL-STRUCTURE INTERACTION
          TECHNIQUE ..........................  3270  SOIL STRUCTURE INTERACTION USE REQUIREMENT
                                                6001  SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT
      MEMBER FORCE ANALYSIS
        METHOD
  DETAILED DESIGN
    PHYSICAL QUALITIES .......................  4560  OVERTURNING MOMENT REQUIREMENT
      DETAILS
        CONFIGURATION (ARRANGEMENT) ..........  3752  COLLECTOR REQUIREMENT
      STRENGTH REQUIRED
        MOMENT FRAME (UNBRACED) ..............  3315  MOMENT FRAME REQUIREMENT
                                                3318  DUAL SYSTEM REQUIREMENT
      STIFFNESS/FLEXIBILITY REQD .............  3850  DRIFT LIMIT
COMPONENT
  ANALYSIS
    SEISMIC LOAD ANALYSIS
      TECHNIQUE ..............................  3701  CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
  DETAILED DESIGN
    PHYSICAL QUALITIES
      DETAILS ................................  3363  COMBINED FRAMING REQUIREMENT
      INTERRELATIONSHIP ......................  3719  DISCONTINUITY REQUIREMENT
    SHEAR PANEL
      MEASURABLE PHYSICAL QUALITIES
        DIAPHRAGM ............................  3755  DIAPHRAGM REQUIREMENT
        CATEGORY B ...........................  3640  CATEGORY B OPENINGS REQUIREMENT
NON-SEISMIC RESISTING
  SYSTEM
    DETAILED DESIGN
      STRENGTH REQUIRED
        CATEGORY C ...........................  3390  CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT
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THE FOLLOWING PROVISIONS WERE NOT OUTLINED

3160 FOUNDATION DESIGN CRITERIA REQUIREMENT

THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(2) 3120 STRENGTH REQUIREMENT

TABLE A4.12 - STRUCTURAL DESIGN, DESIGN STAGE DOMINANT

OUTLINE OF PROVISIONS

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CLASSIFIERS                                                 PROVISIONS

 BUILDING
   BUILDING PROCESSES
     REQUIRED QUALITIES
       PART OF BUILDING
         STRUCTURAL
           DESIGN ......................................  3001  STRUCTURAL DESIGN REQUIREMENT
                                                          3700  COMPONENT DESIGN REQUIREMENT
             SITE/SOIL INVESTIGATION
             CONCEPTUAL DESIGN
               SYSTEM
                 CONFIGURATION (ARRANGEMENT) ...........  3810  SEPARATION REQUIREMENT
                 SEISMIC RESISTING
                   PHYSICAL QUALITIES ..................  3369  GENERAL FRAMING REQUIREMENT
                     MEASURABLE PHYSICAL QUALITIES
                       EXISTENCE OF OBJECTS
                         ORDINARY MOMENT FRAME .........  3330  ORDINARY MOMENT FRAME REQUIREMENT
                         SPECIAL MOMENT FRAME ..........  3336  SPECIAL MOMENT FRAME REQUIREMENT
                       DETAILS
                         CATEGORY C ....................  3372  CATEGORY C AND D SEISMIC RESISTING SYSTEM LIMITATION
                         CONFIGURATION (ARRANGEMENT)
                     ABSTRACT PHYSICAL QUALITIES
                       INTEGRITY .......................  3145  LOAD PATH REQUIREMENT
                                                          3725  REDUNDANCY REQUIREMENT
             ANALYSIS
               SYSTEM
                 METHOD ................................  3105  STRUCTURAL ANALYSIS REQUIREMENT
                 SEISMIC RESISTING
                   PHYSICAL QUALITIES
                     INTERRELATIONSHIP
                       CATEGORY C ......................  3381  CATEGORY C AND D INTERACTION REQUIREMENT
                   SEISMIC LOAD ANALYSIS
                     TECHNIQUE .........................  3510  SEISMIC LOAD ANALYSIS REQUIREMENT
                     EQUIVALENT LATERAL FORCE
                       TECHNIQUE .......................  4001  EQUIVALENT LATERAL FORCE ANALYSIS REQUIREMENT
                     MODAL
                       METHOD ..........................  5001  MODAL ANALYSIS REQUIREMENT
                         TECHNIQUE .....................  5310  MODES REQUIREMENT
                                                          5410  PERIOD AND MODE SHAPE ANALYSIS REQUIREMENT
                         PRINCIPLES AND ASSUMPTIONS ....  5210  MODELING REQUIREMENT
                     SOIL-STRUCTURE INTERACTION
                       TECHNIQUE .......................  3270  SOIL STRUCTURE INTERACTION USE REQUIREMENT
                                                          6001  SOIL STRUCTURE INTERACTION ANALYSIS REQUIREMENT
               COMPONENT
                 SEISMIC LOAD ANALYSIS
                   SEISMIC RESISTING
                     TECHNIQUE .........................  3701  CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT
                   CATEGORY C
                     PRINCIPLES AND ASSUMPTIONS ........  3790  CATEGORY C AND D VERTICAL MOTION REQUIREMENT
             DETAILED DESIGN
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SYSTEM
  PHYSICAL QUALITIES
    STIFFNESS/FLEXIBILITY REQD .................  3140  DEFORMATION REQUIREMENT
  SEISMIC RESISTING
    PHYSICAL QUALITIES .........................  4560  OVERTURNING MOMENT REQUIREMENT
      CONFIGURATION (ARRANGEMENT) ..............  3752  COLLECTOR REQUIREMENT
      STRENGTH REQUIRED
        MOMENT FRAME (UNBRACED) ................  3315  MOMENT FRAME REQUIREMENT
                                                  3318  DUAL SYSTEM REQUIREMENT
      STIFFNESS/FLEXIBILITY REQD ...............  3850  DRIFT LIMIT
  NON-SEISMIC RESISTING
    CATEGORY C
      STRENGTH REQUIRED ........................  3390  CATEGORY C AND D DEFORMATION COMPATIBILITY REQUIREMENT
COMPONENT ......................................  3610  STRUCTURAL DESIGN AND DETAILING REQUIREMENT
  STRENGTH REQUIRED ............................  3120  STRENGTH REQUIREMENT
  INTEGRITY ....................................  3737  INTERCONNECTION REQUIREMENT
  CONNECTION
    MEASURABLE PHYSICAL QUALITIES ..............  3770  BEARING WALL REQUIREMENT
      EXISTENCE OF OBJECTS .....................  3741  CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT
                                                  3747  NONSTRUCTURAL ANCHORAGE REQUIREMENT
  CATEGORY A
    PHYSICAL QUALITIES .........................  3620  CATEGORY A DESIGN AND DETAILING REQUIREMENT
  CATEGORY B
    PHYSICAL QUALITIES .........................  3630  CATEGORY B DESIGN AND DETAILING REQUIREMENT
  CATEGORY C ...................................  3670  CATEGORY C DESIGN AND DETAILING REQUIREMENT
  CATEGORY D ...................................  3680  CATEGORY D DESIGN AND DETAILING REQUIREMENT
  SEISMIC RESISTING
    DETAILS ....................................  3363  COMBINED FRAMING REQUIREMENT
    INTERRELATIONSHIP ..........................  3719  DISCONTINUITY REQUIREMENT
    SHEAR PANEL
      CATEGORY B
        MEASURABLE PHYSICAL QUALITIES ..........  3640  CATEGORY B OPENINGS REQUIREMENT
      DIAPHRAGM
        MEASURABLE PHYSICAL QUALITIES ..........  3755  DIAPHRAGM REQUIREMENT
```

THE FOLLOWING PROVISIONS WERE NOT OUTLINED

3160 FOUNDATION DESIGN CRITERIA REQUIREMENT

NO PROVISIONS WERE OUTLINED MORE THAN ONCE

TABLE A4.13 - FOUNDATION CHAPTER, SEISMIC PERFORMANCE CATEGORIES DOMINA

OUTLINE OF PROVISIONS

```
CLASSIFIERS                                                   PROVISIONS

 BUILDING
   BUILDING PROCESSES
     REQUIRED QUALITIES
       PART OF BUILDING
         STRUCTURAL
           FOUNDATION ..................................  7001  FOUNDATION DESIGN REQUIREMENTS
             STRENGTH REQUIRED
               SOIL ....................................  7230  FOUNDATION SOIL CAPACITY REQUIREMENT
               FOUNDATION STRUCTURE ....................  7210  FOUNDATION COMPONENT STRENGTH REQUIREMENT
             CATEGORY B ................................  7400  CATEGORY B FOUNDATION REQUIREMENT
               SOIL
                 EXISTENCE OF PROCESS
                   SITE/SOIL INVESTIGATION .............  7404  CATEGORY B SOIL INVESTIGATION REQUIREMENT
               FOUNDATION STRUCTURE
                 INTERRELATIONSHIP .....................  7428  CATEGORY B FOUNDATION TIE REQUIREMENT
                 PILE
                   QUANTITIES AND DIMENSIONS ...........  7438  CATEGORY B FOUNDATION PILE REQUIRMENT
                     REINFORCEMENT (CONCRETE)
                       STEEL ...........................  7490  CATEGORY B STEEL PIPE PILE REQUIREMENT
                       REINFORCED CONCRETE
                         CAST-IN-PLACE
                           CASED .......................  7476  CATEGORY B CASED CONCRETE PILE REQUIREMENT
                           UNCASED .....................  7452  CATEGORY B UNCASED CONCRETE PILE REQUIREMENT
                         PRECAST .......................  7492  CATEGORY B PRECAST CONCRETE PILE REQUIREMENT
                           PRESTRESSED .................  7494  CATEGORY B PRESTRESSED CONCRETE PILE REQUIREMENT
             CATEGORY C ................................  7500  CATEGORY C FOUNDATION REQUIREMENT
               SOIL
                 EXISTENCE OF PROCESS
                   SITE/SOIL INVESTIGATION .............  7510  CATEGORY C SOIL INVESTIGATION REQUIREMENT
               FOUNDATION STRUCTURE
                 INTERRELATIONSHIP .....................  7520  CATEGORY C FOUNDATION TIE REQUIREMENT
                 PILE
                   MEASURABLE PHYSICAL QUALITIES .......  7535  CATEGORY C FOUNDATION PILE REQUIREMENT
                     STEEL
                       STRENGTH REQUIRED ...............  7595  CATEGORY C STEEL PILE REQUIREMENT
                     REINFORCED CONCRETE
                       QUANTITIES AND DIMENSIONS
                         REINFORCEMENT (CONCRETE)
                           CAST-IN-PLACE
                             CASED .....................  7550  CATEGORY C CASED CONCRETE PILE REQUIREMENT
                             UNCASED ...................  7540  CATEGORY C UNCASED CONCRETE PILE REQUIREMENT
                           PRECAST .....................  7570  CATEGORY C PRECAST CONCRETE PILE REQUIREMENT
             CATEGORY D
               PILE
                 REINFORCED CONCRETE
                   PRECAST
                     PRESTRESSED
                       EXISTENCE OF OBJECTS
                         CONCEPTUAL DESIGN .............  7600  CATEGORY D FOUNDATION REQUIREMENT
```

ALL PROVISIONS WERE OUTLINED

NO PROVISIONS WERE OUTLINED MORE THAN ONCE

TABLE A4.14 - FOUNDATION CHAPTER, PHYSICAL COMPONENT DESCRIPTION DOMINA

OUTLINE OF PROVISIONS

```
CLASSIFIERS                                                       PROVISIONS

 BUILDING
   BUILDING PROCESSES
     REQUIRED QUALITIES
       PART OF BUILDING
         STRUCTURAL
           FOUNDATION ........................................  7001  FOUNDATION DESIGN REQUIREMENTS
             SOIL
               STRENGTH REQUIRED .............................  7230  FOUNDATION SOIL CAPACITY REQUIREMENT
               EXISTENCE OF PROCESS
                 SITE/SOIL INVESTIGATION
                   CATEGORY B ................................  7404  CATEGORY B SOIL INVESTIGATION REQUIREMENT
                   CATEGORY C ................................  7510  CATEGORY C SOIL INVESTIGATION REQUIREMENT
             FOUNDATION STRUCTURE
               STRENGTH REQUIRED .............................  7210  FOUNDATION COMPONENT STRENGTH REQUIREMENT
               INTERRELATIONSHIP
                 CATEGORY B ..................................  7428  CATEGORY B FOUNDATION TIE REQUIREMENT
                 CATEGORY C ..................................  7520  CATEGORY C FOUNDATION TIE REQUIREMENT
               PILE
                 EXISTENCE OF OBJECTS
                   CONCEPTUAL DESIGN
                     REINFORCED CONCRETE
                       PRECAST
                         PRESTRESSED
                           CATEGORY D ........................  7600  CATEGORY D FOUNDATION REQUIREMENT
                 QUANTITIES AND DIMENSIONS
                   REINFORCEMENT (CONCRETE)
                     REINFORCED CONCRETE
                       CAST-IN-PLACE
                         CASED
                           CATEGORY B ........................  7476  CATEGORY B CASED CONCRETE PILE REQUIREMENT
                           CATEGORY C ........................  7550  CATEGORY C CASED CONCRETE PILE REQUIREMENT
                         UNCASED
                           CATEGORY B ........................  7452  CATEGORY B UNCASED CONCRETE PILE REQUIREMENT
                           CATEGORY C ........................  7540  CATEGORY C UNCASED CONCRETE PILE REQUIREMENT
                       PRECAST
                         CATEGORY B ..........................  7492  CATEGORY B PRECAST CONCRETE PILE REQUIREMENT
                         CATEGORY C ..........................  7570  CATEGORY C PRECAST CONCRETE PILE REQUIREMENT
                         PRESTRESSED
                           CATEGORY B ........................  7494  CATEGORY B PRESTRESSED CONCRETE PILE REQUIREMENT
                     STEEL
                       CATEGORY B ............................  7490  CATEGORY B STEEL PIPE PILE REQUIREMENT
                 STRENGTH REQUIRED
                   STEEL
                     CATEGORY C ..............................  7595  CATEGORY C STEEL PILE REQUIREMENT
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THE FOLLOWING PROVISIONS WERE NOT OUTLINED

7400 CATEGORY B FOUNDATION REQUIREMENT
7438 CATEGORY B FOUNDATION PILE REQUIRMENT
7500 CATEGORY C FOUNDATION REQUIREMENT
7535 CATEGORY C FOUNDATION PILE REQUIREMENT

NO PROVISIONS WERE OUTLINED MORE THAN ONCE

TABLE A4.15 - WOOD CHAPTER, SEISMIC PERFORMANCE CATEGORIES DOMINANT

OUTLINE OF PROVISIONS

CLASSIFIERS	PROVISIONS	
BUILDING		
BUILDING PROCESSES		
REQUIRED QUALITIES		
MATERIAL SPECIFIC		
PART OF BUILDING		
WOOD		
DESIGN	9001	WOOD MATERIALS REQUIREMENT
DETAILED DESIGN		
METHOD	9200	WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT
PHYSICAL QUALITIES	9002	WOOD DESIGN CATEGORY REQUIREMENT
CATEGORY A		
SHEAR WALL		
FRAMING (WOOD)		
SHEATHING		
QUANTITIES AND DIMENSIONS	9300	CATEGORY A WOOD REQUIREMENT
CATEGORY B		
COMPONENT		
PHYSICAL QUALITIES	9002	WOOD DESIGN CATEGORY REQUIREMENT
	9400	CATEGORY B WOOD REQUIREMENT
CONFIGURATION (ARRANGEMENT)		
CONNECTION	9450	CATEGORY B LAG SCREW WASHER REQUIREMENT
	9480	CATEGORY B ECCENTRIC JOINT REQUIREMENT
INTERRELATIONSHIP		
DIAPHRAGM		
SHEATHING	9420	CATEGORY B WOOD TIE REQUIREMENT
CATEGORY C		
MEASURABLE PHYSICAL QUALITIES		
SYSTEM	9500	CATEGORY C WOOD REQUIREMENT
SEISMIC RESISTING		
EXISTENCE OF OBJECTS	9535	CATEGORY C WOOD FRAMING REQUIREMENT
COMPONENT		
SHEAR PANEL		
CONFIGURATION (ARRANGEMENT)	9555	CATEGORY C WOOD DETAILING REQUIREMENT
MATERIAL		
PLYWOOD		
REFERENCE STANDARDS	9515	CATEGORY C PLYWOOD MATERIAL REQUIREMENT
CATEGORY D		
SHEAR PANEL		
EXISTENCE OF OBJECTS	9600	CATEGORY D WOOD REQUIREMENT
CONVENTIONAL		
DETAILS		
SYSTEM	9701	CONVENTIONAL LIGHT TIMBER REQUIREMENT
COMPONENT		
SHEAR WALL		
FRAMING (WOOD)	9706	CONVENTIONAL WALL FRAMING REQUIREMENT
SHEATHING	9739	CONVENTIONAL WALL SHEATHING REQUIREMENT
QUANTITIES AND DIMENSIONS	9763	WALL SHEATHING APPLICATION REQUIREMENT
MATERIAL		
ENGINEERED		

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MEASURABLE PHYSICAL QUALITIES
  SYSTEM .....................................  9801  ENGINEERED TIMBER CONSTRUCTION REQUIREMENT
    DETAILS ..................................  9802  ENGINEERED WOOD FRAMING REQUIREMENT
  COMPONENT
    SHEAR PANEL ..............................  9808  ENGINEERED WOOD SHEAR PANEL REQUIREMENT
      SHEAR WALL
        CONNECTION
          EXISTENCE OF OBJECTS ...............  9898  ENGINEERED WOOD WALL CONNECTION REQUIREMENT
      DIAPHRAGM
        TORSION STRESS .......................  9819  WOOD DIAPHRAGM TORSION REQUIREMENT
      FRAMING (WOOD) .........................  9809  ENGINEERED WOOD SHEAR PANEL FRAMING REQUIREMENT
        DETAILED DESIGN
      SHEATHING
        PLYWOOD
          DETAILS ............................  9854  PLYWOOD SHEAR PANEL REQUIREMENT
                                                9856  PLYWOOD SHEAR PANEL FRAMING REQUIREMENT
            QUANTITIES AND DIMENSIONS ........  9861  PLYWOOD SHEAR PANEL NAILING REQUIREMENT
        DIAGONAL BOARD .......................  9827  DIAGONALLY SHEATHED SHEAR PANEL REQUIREMENT
          DETAILS
            QUANTITIES AND DIMENSIONS ........  9828  CONVENTIONAL DIAGONAL SHEATHING REQUIREMENT
            CONFIGURATION (ARRANGEMENT) ......  9841  SPECIAL DIAGONAL SHEATHING REQUIREMENT
          STRENGTH REQUIRED ..................  9846  CHORD STRENGTH REQUIREMENT (SPECIAL DIAGONAL)
        OTHER SHEATHING MATERIAL
          DETAILS ............................  9878  OTHER MATERIAL SHEAR PANEL REQUIREMENT


ALL PROVISIONS WERE OUTLINED


THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(2)  9002  WOOD DESIGN CATEGORY REQUIREMENT
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TABLE A4.16 - WOOD CHAPTER, PHYSICAL COMPONENT DESCRIPTION DOMINANT

OUTLINE OF PROVISIONS

CLASSIFIERS	PROVISIONS	
BUILDING		
BUILDING PROCESSES		
REQUIRED QUALITIES		
MATERIAL SPECIFIC		
PART OF BUILDING		
WOOD		
DESIGN	9001	WOOD MATERIALS REQUIREMENT
PHYSICAL QUALITIES	9002	WOOD DESIGN CATEGORY REQUIREMENT
SOCIAL QUALITIES		
DETAILED DESIGN		
METHOD	9200	WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT
SYSTEM		
SEISMIC RESISTING		
CONVENTIONAL		
DETAILS	9701	CONVENTIONAL LIGHT TIMBER REQUIREMENT
ENGINEERED		
MEASURABLE PHYSICAL QUALITIES	9801	ENGINEERED TIMBER CONSTRUCTION REQUIREMENT
DETAILS	9802	ENGINEERED WOOD FRAMING REQUIREMENT
CATEGORY C		
MEASURABLE PHYSICAL QUALITIES	9500	CATEGORY C WOOD REQUIREMENT
EXISTENCE OF OBJECTS	9535	CATEGORY C WOOD FRAMING REQUIREMENT
COMPONENT		
PHYSICAL QUALITIES	9002	WOOD DESIGN CATEGORY REQUIREMENT
CATEGORY B	9400	CATEGORY B WOOD REQUIREMENT
CONNECTION		
CONFIGURATION (ARRANGEMENT)	9450	CATEGORY B LAG SCREW WASHER REQUIREMENT
	9480	CATEGORY B ECCENTRIC JOINT REQUIREMENT
SHEAR PANEL		
FRAMING (WOOD)		
MEASURABLE PHYSICAL QUALITIES		
ENGINEERED	9808	ENGINEERED WOOD SHEAR PANEL REQUIREMENT
	9809	ENGINEERED WOOD SHEAR PANEL FRAMING REQUIREMENT
DETAILED DESIGN		
EXISTENCE OF OBJECTS		
CATEGORY D	9600	CATEGORY D WOOD REQUIREMENT
DETAILS		
CONFIGURATION (ARRANGEMENT)		
CATEGORY C	9555	CATEGORY C WOOD DETAILING REQUIREMENT
SHEATHING		
ENGINEERED		
MEASURABLE PHYSICAL QUALITIES	9808	ENGINEERED WOOD SHEAR PANEL REQUIREMENT
PLYWOOD		
DETAILS	9854	PLYWOOD SHEAR PANEL REQUIREMENT
	9856	PLYWOOD SHEAR PANEL FRAMING REQUIREMENT
QUANTITIES AND DIMENSIONS	9861	PLYWOOD SHEAR PANEL NAILING REQUIREMENT
DIAGONAL BOARD	9827	DIAGONALLY SHEATHED SHEAR PANEL REQUIREMENT
QUANTITIES AND DIMENSIONS	9828	CONVENTIONAL DIAGONAL SHEATHING REQUIREMENT
CONFIGURATION (ARRANGEMENT)	9841	SPECIAL DIAGONAL SHEATHING REQUIREMENT
STRENGTH REQUIRED	9846	CHORD STRENGTH REQUIREMENT (SPECIAL DIAGONAL)

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            OTHER SHEATHING MATERIAL
              DETAILS ........................  9878  OTHER MATERIAL SHEAR PANEL REQUIREMENT
        SHEAR WALL
          FRAMING (WOOD)
            CONVENTIONAL
              DETAILS .........................  9706  CONVENTIONAL WALL FRAMING REQUIREMENT
            ENGINEERED
              CONNECTION
                EXISTENCE OF OBJECTS ...........  9898  ENGINEERED WOOD WALL CONNECTION REQUIREMENT
          SHEATHING
            DETAILS
              CONVENTIONAL .....................  9739  CONVENTIONAL WALL SHEATHING REQUIREMENT
                QUANTITIES AND DIMENSIONS ......  9763  WALL SHEATHING APPLICATION REQUIREMENT
              CATEGORY A
                QUANTITIES AND DIMENSIONS ......  9300  CATEGORY A WOOD REQUIREMENT
        DIAPHRAGM
          MEASURABLE PHYSICAL QUALITIES
            TORSION STRESS
              ENGINEERED ......................  9819  WOOD DIAPHRAGM TORSION REQUIREMENT
          ABSTRACT PHYSICAL QUALITIES
            INTERRELATIONSHIP
              SHEATHING
                CATEGORY B .....................  9420  CATEGORY B WOOD TIE REQUIREMENT
  MATERIAL
    REFERENCE STANDARDS
      FLYWOOD
        CATEGORY C ............................  9515  CATEGORY C PLYWOOD MATERIAL REQUIREMENT
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ALL PROVISIONS WERE OUTLINED

THE FOLLOWING PROVISIONS WERE OUTLINED THE INDICATED NUMBER OF TIMES

(2) 9002 WOOD DESIGN CATEGORY REQUIREMENT
(2) 9808 ENGINEERED WOOD SHEAR PANEL REQUIREMENT

COMMENTS ON THE OUTLINES

Requirements Arranged by Required Quality (Table A4.2)

The most significant feature of the outline arranged purely according to the required qualities is that it bears no resemblance at all to the existing arrangement of the Provisions. In nearly every heading there are found provisions which range from chapter 1 or 3 to chapter 12 or 13. One significant point is to note the large number of provisions classified by the most general of all the classifiers, required qualities. This is just another manifestation of the fact that this analysis has been influenced by the present arrangement of the Provisions in that these datums contain several required qualities for a single physical entity. This presents a drawback in the use of an outline such as this in that the heading is somewhat misleading. Many of those datums classified by the very general classifier do contain quite explicit required qualities. In this study the requirements classified by physical qualities are requirements in which the subject is a physical entity. Those requirements classified by social qualities are requirements in which the subject is a building process.

Requirements Arranged by Building Processes (Table A4.3)

It is important to note that the building processes are not exhaustive for the requirements, therefore this outline does not include a large number of requirements. The original intent in the study was to make building processes exhaustive for requirements, because it was felt that even those requirements that deal specifically, or only, with a physical entity can be classified by the building process in which the requirement would normally be satisfied. It was further thought that this classification would then serve to be a useful means of ordering provisions that would give an alternative from a purely physical order. However, such a large number of provisions would be classed by the heading detail design, which did not appear to be divisible coherently, that the objective was not attainable. Therefore, in many of the chapters filled with detailed requirements (for example, those for the materials of construction), no attempt was made to complete the classification of requirements according to processes unless the building process was other than detail design.

The fact that four provisions from chapter 12 are classed by the very general heading, building processes, merits comment. Note that other than chapter 1, no provisions are so general as to cover more than one of the basic building processes of regulation, design, construction, quality assurance, and use. It is perfectly expectable that chapter 1 should contain some very general provisions that serve as a guideline for application of all the other provisions. The reason that the four provisions from chapter 12 are classified as building processes is that they deal with both the process of design and construction. Note that this is not true for any other chapter. It appears that the small number of provisions in chapter 12 that do deal with construction could easily be overlooked in the present organization and that it might be better to place all provisions specifically applying to construction in a separate chapter.

A large number of provisions classified as detail design do show up because some chapters, notably chapters 3 and 8, were classified so that building process is exhaustive for all requirements.

Requirements Arranged by Limit States (Table A4.4)

Note that this outline is very brief; very few provisions are classified by limit states. As discussed previously, it is difficult to connect many of the provisions with performance attributes, and since limit states directly relate to performance attributes the outline is quite short and incomplete. One comment is in order about the large number of provisions classified by the limit state general failure. In many design standards that do give consideration to limit states, it is common practice to subdivide the category general failure by categories like fracture, instability, crushing and mechanism formation. The reason that such a subdivision is not used here is that it does not serve to separate this clump of provisions and such separations tend to quickly become very material dependent. Apparently, the reason so many provisions are associated with this particular limit state, is that different levels of performance with respect to general failure are prescribed for buildings or parts of buildings that present different hazards.

Determinations Arranged by Building Processes (Table A4.5)

This category is exhaustive for all determinations. Notice that a great majority of the determinations are classified as seismic load analysis or as one of the methods of seismic load analysis. It is instructive to know that some provisions from chapter 4, which is titled "Equivalent Lateral Force Method of Analysis," are located under the heading seismic load analysis. This means that those provisions apply to modal or soil-structure interaction analysis in addition to equivalent lateral force analysis. There are also provisions from chapter 4 which are classified under member force analysis; such provisions apply to all methods of seismic load analysis. The conclusion one may draw from these observations is that chapter 4 contains some material which might better be located in a chapter common to all methods of analysis. The organization of the Provisions might confuse individuals who are using a method of analysis other than the equivalent lateral force method.

Determinations Arranged According to Type of Derived Measure (Table A4.6)

This particular outline seems to follow present organization of the analytical chapters of the Provisions rather well. There is nothing unusual about it except that it could be used as an index for derived values.

Requirements Arranged According to Physical Entities (Table A4.7)

Note that this outline is produced by appending the many trees for physical entities into one large tree. There are a very large number of possible ways to join the physical entity trees together. This one was selected for display because it has the property of having very little redundancy in the provisions. It does not correspond precisely to the existing arrangement of the Provsions but it does preserve the distinction between the materials oriented chapters and the chapters that apply to parts of buildings without regard to the material of construction. Chapters 7, 8 and 13 are treated differently in this outline than they are in the organization of the Provisions. Note that two requirements from chapter 12 are located with those from chapter 8. Chapter 12 is the only one of the four chapters dealing with materials that includes provisions for non-structural items, a fact that can be easily overlooked.

It is possible to develop an outline according to physical entities alone in which the correspondence with the present organization of the Provisions is much closer. For example, see table A4.17 in which the classifier "foundation" has been put on the same level as the classifier "structural". One deviation of the outline in table A4.17 from the existing organization is that the material specific provisions for foundation piles would not be located at the heading "Foundation" although they are contained in chapter 7 of the Provisions. Note that this example does show that the top level of the existing organization can be duplicated entirely from physical considerations, and that no consideration of administrative or regulatory activities as being distinct from design, construction, or use activities is necessary to isolate chapter 1 from the other chapters.

Table A4.17 - Existing Top Level Outline

Modified Physical Entity Tree	Existing Chapter
Building	1
New	
Part of Building	
Material Generic	
Structural	3, 4, 5, 6
Foundation	7
Non-Structural	8
Material Specific	
Wood	9
Steel	10
Concrete	11
Masonry	12
Existing	13

Outlines of the Provisions of Chapter 1 -- Administration (Tables A4.8 - A4.10)

Three detailed outlines for the provisions of chapter 1 including both requirements and determinations are presented. The outlines are constructed by appending physical entity trees along with the building process tree and the required qualities tree. The limits states tree was generally ignored in constructing these outlines. The three outlines are relatively similar and all incorporate the provisions for quality assurance as described in the example presented in chapter 2. Note that the third of the three outlines is produced using a modified tree of building process classifiers in which two new classifiers, "Development and Use" and "Development," have been inserted to group the building processes in a different fashion.

The outlines produced by appending trees of classifiers tend to require a large number of levels of indentation. It is possible to convert these outlines, which one might call organizational networks of classifiers, into a more conventional outline in a relatively straightforward fashion. Table A4.18 presents just such a conversion for the third of the three chapter 1 outlines.

Outlines of the Requirements of Chapters 3, 4, 5 and 6--Structural Design Requirements (Tables A4.11 and A4.12)

Both these outlines were produced by merging the physical entity, building process, and required quality trees. The limit states tree was ignored in the production of both outlines. The primary difference between the two outlines is that the physical classifiers of function and scale are used as primary top level organizers in table A4.11, whereas in table A4.12 the stages of design are used as the primary top level organizers. Neither of these outlines corresponds very well with the existing arrangement of chapter 3, but it would be difficult to do so with the classification system used in this study. Of the two outlines, the one organized primarily by design stage (A4.12) seems to be somewhat more even than the other. The reason for this is that the distribution of provisions according to function is unbalanced with few provisions classed as non-seismic resisting. The division between seismic resisting and non-seismic resisting is not very appropriate for arrangement, although it is useful for other purposes. A division between those provisions that apply only to the seismic resisting elements and those provisions that apply to all structural elements would be more reasonable.

Outlines of Chapter 7 -- Foundation Design Requirements (Tables A4.13 and A4.14)

The two outlines for the foundation requirements were produced much as the outlines for chapter 3 by ignoring the tree for limit states classifiers. Among the two choices, one is produced by using the seismic performance category as a top level organizer whereas the other is produced by using a more functional description of the physical components as the dominant organizer. Table A4.13, which is outlined according to seismic performance categories, is very similar to the existing outline whereas table A4.14 is quite different. The fact that four provisions are not outlined according to table A4.14 is of little consequence because each of those four provisions are simply a collection of several basic requirements, none of them introduce any new basic requirements themselves.

Outline of Chapter 9 -- Wood (Tables A4.14 and A4.16)

Two outlines are presented for the requirements of chapter 9; they were produced by much the same techniques as used for the two outlines for chapter 7. Also similar to chapter 7, the outline with the seismic performance category as the dominant organizer (table A4.15) is very similar to the existing arrangement of the Provisions. Note that in the four chapters relating to the materials of construction each of the sections for a seismic performance category is divided into subsections titled respectively framing systems, details, and materials. In fact these three subsections can be shown to correspond quite well with the three classifiers belonging to the class scale of building parts ("System," "Component," and "Material").

Table A4.18 -- Conversion from Preliminary Outline (Table A4.10) to Final Outline

Classifiers	Outline	Provisions
Building		
Required Qualities	1.1 General Performance Requirements for Buildings	Section 1.1
Building Processes		
Regulation	1.2 Regulatory Procedures and Parameters	
Technique	1.2.1 Acceptance of Alternates	1510
Regulatory Parameters		
Scope	1.2.2 Scope	-1210
Ground Motion	1.2.3 Ground Motion	-1405
		-1415
		-1425
Classification	1.2.4 Hazard Classification	-1430
		-1490
Development and Use	1.3 General Requirements for the Development and Use of Buildings	1305
Development		
Design		
Method		
Technique	1.3.1 Load Combination	1315
Documentation	1.3.2 Design Documentation	Part of 1305
Specific Buildings		
Proposed (New)	1.4 Development of New Buildings	1345
Design	1.5 Design of New Buildings	
System		
Structural	1.5.1 Structural Design	1365
Non-structural	1.5.2 Non-structural Design	8001
Material	1.5.3 Materials of Construction	1370
Construction	1.6 Construction of New Buildings	
Quality Assurance	1.7 Quality Assurance for New Buildings	
Social Qualities		1601
		1625
Existence of Process	1.7.1 Procedures Required	
Planning (QA)		1602
Inspection		
Testing		1637

Table A4.19, on the following pages, contains a list of the requirements which may apply to Category A buildings. There is some ambiguity as to just what requirements a building belonging to seismic performance category A would be required to fulfill. With the exception of one- or two-family dwellings, all buildings must be classified according to the seismic performance category. There would be no ambiguity if no requirements were specifically identified as category A requirements because it is clearly explained that buildings belonging to a higher seismic performance category must satisfy all requirements for the lower seismic performance categories, and there would be four sets of requirements (unmarked, B, C, and D) that would correspond to the four categories (A, B, C, D). However, with some requirements classed as category A, the reader is confronted with five categories of requirements. The question arises as to what is the proper application of those requirements that are not identified by any seismic performance category. The list of requirements on the following pages was produced by isolating all requirements which were not classified by seismic performance categories B, C, or D or by a small number of other classifiers which seem to preclude the application to seismic performance category A. Thus, what remains is a set of requirements some of which are classified according to seismic performance category A but most of which are not.

Those classifiers used to exclude requirements from the list are shown at the top of the table. The classifiers for the three methods of seismic load analysis were used because the seismic load analysis requirement (datum 3510) makes it clear that no explicit seismic load analysis need be performed for category A buildings. Therefore any requirement pertaining to a method of seismic load analysis would not be required for a category A building. Similar reasons apply for the use of the classifiers for hazard abatement, quality assurance, and moment frames.

The 86 requirements in the list can be classified into 8 categories, which are explained below. Each requirement on the following pages is noted as to which category is appropriate.

a) Requirements apparently applicable to category A buildings with no ambiguity.

b) Requirements apparently not applicable to category A buildings because of other statements in the Provisions.

c) Requirements apparently not applicable to category A buildings because the requirement seems to depend upon an analysis of the seismic forces.

d) Requirements involving the strength or resistance of a component to a seismic load effect. It is not clear as to how the resistance to seismic load effects is determined for category A buildings, because it is not clear that the modifications to the normal calculation processes for resistance that are specified in chapters 9 through 12 are applicable.

e) Requirements for a seismic resisting system that are apparently applicable to category A buildings.

f) Requirements for architectural, mechanical, and electrical systems and components, which are based on a different combination of seismic hazard exposure group and seismicity index than the seismic performance categories and, therefore, are apparently applicable to category A buildings.

g) Requirements for conventional wood framing systems which apparently only apply to one- or two-family residential buildings and, therefore, would not apply to category A buildings.

h) Requirements for engineered wood buildings that are apparently not applicable category A buildings because they seem to imply the existence of a seismic force analysis.

Table A4.19 Requirements for SPC A

PROVISIONS NOT ASSOCIATED WITH A SPECIFIED SET OF CLASSIFIERS

SPECIFIED CLASSIFIERS

7	CATEGORY B
8	CATEGORY C
9	CATEGORY D
64	ORDINARY MOMENT FRAME
65	SPECIAL MOMENT FRAME
150	EQUIVALENT LATERAL FORCE
151	MODAL
152	SOIL-STRUCTURE INTERACTION
156	QUALITY ASSURANCE
165	HAZARD ABATEMENT

PROVISIONS		Comment Category
1305	APPLICATION REQUIREMENT	a
1315	LOAD COMBINATION REQUIREMENT	c
1345	NEW BUILDING REQUIREMENT	a
1365	STRUCTURAL ANALYSIS AND DESIGN REQUIREMENTS	a
1370	MATERIAL DESIGN AND CONSTRUCTION REQUIREMENTS	a
1380	ALTERATION AND REPAIR REQUIREMENT	a
1390	CHANGE OF USE REQUIREMENT	a
1469	GROUP III FUNCTIONAL REQUIREMENT	a
1472	GROUP III ACCESS REQUIREMENT	a
1510	ALTERNATE ACCEPTABLE	a
3001	STRUCTURAL DESIGN REQUIREMENT	c,d,e
3105	STRUCTURAL ANALYSIS REQUIREMENT	a
3120	STRENGTH REQUIREMENT	c,d
3140	DEFORMATION REQUIREMENT	c
3145	LOAD PATH REQUIREMENT	a
3160	FOUNDATION DESIGN CRITERIA REQUIREMENT	c
3315	MOMENT FRAME REQUIREMENT	c
3318	DUAL SYSTEM REQUIREMENT	c
3363	COMBINED FRAMING REQUIREMENT	e
3369	GENERAL FRAMING REQUIREMENT	e
3510	SEISMIC LOAD ANALYSIS REQUIREMENT	a
3610	STRUCTURAL DESIGN AND DETAILING REQUIREMENT	a
3620	CATEGORY A DESIGN AND DETAILING REQUIREMENT	a
3700	COMPONENT DESIGN REQUIREMENT	b
3701	CRITICAL EARTHQUAKE FORCE DIRECTION REQUIREMENT	b
3719	DISCONTINUITY REQUIREMENT	b
3725	REDUNDANCY REQUIREMENT	b
3737	INTERCONNECTION REQUIREMENT	a
3741	CONCRETE AND MASONRY WALL ANCHORAGE REQUIREMENT	a
3747	NONSTRUCTURAL ANCHORAGE REQUIREMENT	a
3752	COLLECTOR REQUIREMENT	b
3755	DIAPHRAGM REQUIREMENT	b
3770	BEARING WALL REQUIREMENT	b
3810	SEPARATION REQUIREMENT	c
3850	DRIFT LIMIT	c
4560	OVERTURNING MOMENT REQUIREMENT	c
7001	FOUNDATION DESIGN REQUIREMENTS	a
7210	FOUNDATION COMPONENT STRENGTH REQUIREMENT	c
7230	FOUNDATION SOIL CAPACITY REQUIREMENT	c
8001	ARCHITECTURAL/MECHANICAL/ELECTRICAL DESIGN REQUIREMENT	f
8110	A/M/E COMPONENT STRENGTH REQUIREMENT	f
8135	A/M/E INTERRELATIONSHIP REQUIREMENT	f
8165	A/M/E ATTACHMENT REQUIREMENT	f

8200	ARCHITECTURAL DESIGN REQUIREMENT	f
8240	EXTERIOR WALL PANEL ATTACHMENT REQUIREMENT	f
8250	ARCHITECTURAL COMPONENT DEFORMATION REQUIREMENT	f
8270	ARCH COMPONENT OUT OF PLANE BENDING REQUIREMENT	f
8300	MECHANICAL/ELECTRICAL DESIGN REQUIREMENT	f
8345	MECH/ELEC ATTACHMENT DESIGN REQUIREMENT	f
8372	M/E UTILITY SERVICE INTERFACE REQUIREMENT	f
9001	WOOD MATERIALS REQUIREMENT	a
9002	WOOD DESIGN CATEGORY REQUIREMENT	a
9200	WOOD STRENGTH CALCULATION PROCEDURE REQUIREMENT	d
9300	CATEGORY A WOOD REQUIREMENT	a
9701	CONVENTIONAL LIGHT TIMBER REQUIREMENT	g
9706	CONVENTIONAL WALL FRAMING REQUIREMENT	g
9739	CONVENTIONAL WALL SHEATHING REQUIREMENT	g
9763	WALL SHEATHING APPLICATION REQUIREMENT	g
9801	ENGINEERED TIMBER CONSTRUCTION REQUIREMENT	h
9802	ENGINEERED WOOD FRAMING REQUIREMENT	h
9808	ENGINEERED WOOD SHEAR PANEL REQUIREMENT	h
9809	ENGINEERED WOOD SHEAR PANEL FRAMING REQUIREMENT	h
9819	WOOD DIAPHRAGM TORSION REQUIREMENT	h
9827	DIAGONALLY SHEATHED SHEAR PANEL REQUIREMENT	h
9828	CONVENTIONAL DIAGONAL SHEATHING REQUIREMENT	h
9841	SPECIAL DIAGONAL SHEATHING REQUIREMENT	h
9846	CHORD STRENGTH REQUIREMENT (SPECIAL DIAGONAL)	h
9854	PLYWOOD SHEAR PANEL REQUIREMENT	h
9856	PLYWOOD SHEAR PANEL FRAMING REQUIREMENT	h
9861	PLYWOOD SHEAR PANEL NAILING REQUIREMENT	h
9878	OTHER MATERIAL SHEAR PANEL REQUIREMENT	h
9898	ENGINEERED WOOD WALL CONNECTION REQUIREMENT	h
10001	STEEL MATERIALS REQUIREMENT	a
10002	STEEL DESIGN CATEGORY REQUIREMENT	a
10200	STEEL STRENGTH CALCULATION PRODECURE REQUIREMENT	d
10240	MODIFICATION TO STEEL REFERENCE DOCUMENTS REQUIREMENT	d
11001	CONCRETE MATERIALS REQUIREMENT	a
11002	CONCRETE DESIGN CATEGORY REQUIREMENT	a
11200	CONCRETE STRENGTH CALCULATION PROCEDURE REQUIREMENT	d
11300	CATEGORY A CONCRETE REQUIREMENT	a
11310	CATEGORY A CONCRETE FRAMING REQUIREMENT	a
11340	CATEGORY A CONCRETE ANCHOR BOLT REQUIREMENT	a
12001	MASONRY MATERIALS REQUIREMENT	a
12002	MASONRY DESIGN CATEGORY REQUIREMENT	a
12200	MASONRY STRENGTH CALCULATION PROCEDURE REQUIREMENT	d
12250	UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT	d
12253	GENERAL UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT	d
12256	ALTERNATE UNREINFORCED MASONRY DESIGN PROCEDURE REQUIREMENT	d

APPENDIX B

USE OF THE TECHNOLOGY FOR ANALYSIS AND REPRESENTATION IN THE DEVELOPMENT OF STANDARDS

APPENDIX B1

REVIEW OF PROJECT ACTIVITIES

B1.1 Introduction

The purpose of this appendix is to record the manner in which the project was carried out and the participants' perceptions of the successes and failures of the project so that it might serve as a guide for similar projects in the future. As stated in chapter 1, this project began in 1976, following the beginning of the ATC-3 project by nearly one-and-one-half years, with a three fold objective:

1) to assist ATC in the preparation of their provisions by studying successive drafts of their work with the aim of resolving possible discrepancies, investigating alternative organizations, and ensuring that the provisions would be easily adoptable, easily updated, and consistent;

2) to document the final Provisions by publishing a formal representation of the provisions; and

3) to provide alternative organizations of the Provisions which would be of use to special categories of users.

It is important to realize that this project was not initiated by the staff of ATC nor by the participants in the ATC-3 project. It was initiated at the National Bureau of Standards and at Carnegie-Mellon University by R. N. Wright, who was associated with the initiation of the ATC-3 project, and S. J. Fenves, who was a member of the Format Committee of ATC-3. Thus, at least at the beginning, this project was undoubtedly something of an unknown quantity to the principals of the ATC-3 project, and the priorities of this project may have been perceived as different than those of the ATC-3 project. The interactions between the two projects were developed as the work proceeded, rather than being consciously planned and agreed upon at the beginning. These factors unquestionably had an effect on the interrelationship between the two projects, and thereby on their combined success. It is difficult, if not impossible, to determine precisely just how these factors worked, because many things changed over the course of this project with respect to strategies and methods of conducting the work and interacting with the ATC-3 participants.

This project was not the first in which a team of analysts developed a formal representation (decision tables and a network) analysis or design provisions and interacted with a committee of authors of the provisions. There have been at least five similar projects in the past:

1) In 1968-1969 Fenves, Gaylord, and Goel first used decision tables for analyzing the Specification for the Design, Fabrication and Erection of Structural Steel [14] (the "AISC Specification"). Although the project was intended to produce a post-facto formal representation of the then-completed new AISC specification, some interaction between the analysts and the specification committee took place, resulting in modifications and clarifications of the text of the AISC Specification. The interaction was facilitated by the fact that one member of the team (Gaylord) was a member of the Specification Committee. The principal communication was the final report of the project [15].

2) In 1970-1972 Wright, Fenves, and Nyman continued the work on the AISC Specification with a "Restructuring Study". The intent was to synthesize a more ideal organization and arrangement of the existing provisions. They made use of (and modified) the results of the previous analytical study and also interacted with the Specification Committee, making interim reports and presentations. Their final report [16] contained recommendations for new approaches to the organization of the AISC Specification, but recommended against a reorganization for its own sake. The concept of reorganization has recently been put on the agenda of the Specification Committee for further consideration.

3) In 1969-1974 Noland, Feng and others analyzed the Recommended Building Code Requirements for Reinforced Concrete [17] (American Concrete Institute Standard 318, commonly referred to as "ACI 318"). The analysts interacted with a committee of ACI, but it was a committee on the use of computers, not the committee responsible for ACI 318. The results of the analysis are documented in reference [18]. The present status of the effort is not known.

4) In 1972-1976 Nyman, Mozer, and Fenves applied the decision table, network, and organizational methods of analysis to the "Load and Resistance Factor Design Criteria" [19] (the "LRFD Criteria") being developed by the American Iron and Steel Institute (AISI) and AISC. Their project was much like this project, in that an initial objective was to assist the team of researchers drafting the LRFD Criteria in the development and organization of new design criteria, and a final objective was to provide a formal representation of the LRFD Criteria. Interim results and recommendations were communicated directly to the principal investigator charged with developing the new provisions. The final report presents a formal representation of the provisions in a fashion similar to this report. That report [20] is currently being used by the AISC specification advisory committee in the review and revision of the draft LRFD Criteria.

5) In 1976-1977 Cunningham, Melin, and Tavis analyzed the provisions of the American National Standard A58.1-1972, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures [21]. During the course of their work they had no interaction with the A58 committee. However, that committee is now examining their final report [22] as part of the task of updating the standard. No feedback has yet occurred. The fact that their analysis was done completely without interaction with the A58 Committee necessitated some innovative analytical procedures to deal with problems of interpretation of the provisions.

These predecessor case studies had obvious effects on this project. It was decided early that the best use of the analytical techniques would be in assisting the ATC-3 effort in producing clear and complete provisions rather than just passively documenting the final provisions. Thus the project participants attempted to provide quick response to each intermediate draft of the provisions, foregoing detailed analyses when time did not permit. In addition, it was decided to interact personally with the authors as much as feasible. Note that there is a contrast with the LRFD criteria project described above, in which direct contact with the single principal research investigator was possible. In contrast, consistent with the magnitude of effort involved, the ATC-3 project consisted of some 80 people from all regions of the country grouped in various committees, with complex lines of interaction among them. Thus, a recommendation from this project was just one of many communications received and distributed by the ATC staff for evaluation and action on the part of the ATC committees.

There were other recent projects in the area of systematic analysis of design provisions that have had an effect on this project, but they were primarily conceptual in nature (Fenves, Rankin, and Tejuja on the structure and classification of individual provisions [11], and Harris and Wright on the organization of design standards [12]). This appendix concentrates on the actions taken and results observed during the project rather than on the concepts behind the techniques used. The activities are discussed chronologically in the following sections.

B1.2 Analysis of Working Draft of the Provisions

The "Working Draft" of the Provisions (ATC-3-04) was issued on January 31, 1976, several months prior to the initiation of this project. Although ATC had received numerous comments from outside reviewers and was well along in the production of a new draft, it was decided to issue a report ("Working Report Number 1" [4]) based on the analysis of the working draft in order to begin the interaction. Four issues were raised for the attention of ATC:

1) The organization was critiqued as lacking a clear path for the user to follow. The analytical tool used to demonstrate the problem was a classification of the key provisions, and a method to generate outlines of provisions based on classification was illustrated. A recommendation was made that ATC should consider this technique for organizing their next draft.

2) The form of regulatory criteria was critiqued. An analysis of the time sequence of decision and action in the regulatory control of design and construction was used to demonstrate that certain key elements were missing in several provisions. A standard model of regulatory criteria was proposed.

3) A particularly important provision--the table for the response modification factor, the ductility factor, and the structural damping, which evolved into the present table 3-B--was analyzed in detail through a complete datum identification and decision table analysis. The provision was quite complex and was not complete; recommendations were made that ATC should consider remedies for both problems.

4) The procedures of seismic load analysis which evolved into the present chapters 4 and 5 (the ELF method and the Modal method) were analyzed with an information network. The analysis highlighted the fact that many of the steps performed in the ELF analysis are also called for in the Modal analysis.

The ATC-3 participants made little response to the report. Essentially no questions were asked, and the inference drawn by the project team was that the recommendations weren't considered heavily, probably because the report was not read by many individuals. Therefore a decision was made to try a modified approach by making two changes:

1) The written reports were not to present background descriptions of the analytical techniques used. It is quite difficult to do so briefly, and the intended readers for this project's reports really did not have time to study such material. This also was to have the desirable effect of making the reports much briefer.

2) The written reports were to make specific recommendations for change that the ATC-3 participants could debate and then accept or reject based on their perceptions of the recommendation. Some of the recommendations in the first report were for the use of a method, which is a somewhat abstract concept. In addition some of the recommendations in the first report were not clearly stated. In particular, it should be noted that later analysis of the network for the load analysis methods changed the perspective of the project team. Had the project team made that realization earlier, it is possible that the cross-references between chapters 4 and 5 of the Provisions would have been modified so that the comments made in appendix A3 of this report about those cross-references might have been averted.

It became apparent later that some of the recommendations did have an impact. In part, this is because the recommendations on the organization were also submitted through Task Group 4 (TG-4) of ATC-3, the group concerned with format and liaison, by the member of the project team who was also on TG-4 (Fenves). In addition, several specific recommendations were made in a letter that followed the report by about two weeks. The inference drawn is that the ATC-3 participants preferred that the project work through TG-4. It is presently the opinion of the project team, given the benefit of hindsight, that a separate "format" committee may be too remote for most of the issues dealing with the substance of the provisions, and that for an optimal balance of effort and benefit, direct interaction should be established between the analysts and the groups that initially develop the provisions.

B1.3 Proposals for Organization of the Final Review Draft

Because of the comments made on ATC-3-04 by the ATC-3 participants, many outside reviewers, and this project, ATC decided to issue a second draft for external review, rather than proceeding directly to the final report as had previously been planned. The project team took this opportunity to issue a report ("Working Report Number 2" [5]) focused on a single issue: the organization of the new draft. The primary resources were an internal draft of the provisions prepared in the late summer of 1976 plus several proposed outlines prepared by various participants in ATC-3.

The recommendations on organization were of four basic types: more descriptive headings for some sections, new headings in some areas, reordering of some sections, and provision for explicit cross-referencing. The basic analytical tool was a classification of key provisions, but in this report the rationale supporting the recommendations was couched in practical terms (e.g., relating the order of provisions governing design to the normal stages of design work).

This report enjoyed more success than the earlier one. Several of the recommendations were considered and eventually followed, but more importantly, a stage of direct two-way discussion was achieved between the project team and several key participants in ATC-3. As a result of various meetings and telephone conversations, several other issues were raised and communicated to ATC in three letters:

1) The outline recommended in "Working Report Number 2" was refined.

2) Comments concerning wording and arrangement were handwritten on intermediate drafts of the chapters dealing with steel and wood. (None of the "materials" chapters had been analyzed prior to this time.)

3) Comments were made on the scope and arrangement of the chapter dealing with foundations, and two revised outlines were recommended for consideration.

Although the report and each of the letters did receive due consideration from ATC and the project team felt that the new approach was working well, there remained a perception that the interaction could have been more effective.

As an example, the offers made by the project team to travel to ATC headquarters to assist in the final editing of the new draft were not responded to. It now appears that this may have been due, at least in part, to the fact that this project was initiated long after the ATC-3 project, and to the fact that the project was initiated outside ATC.

Given two years hindsight, there are at least two aspects of the conduct of this stage of the project that were less than optimal. First, the rationale presented for ATC's consideration of several of the recommendations was not as strong and clear as would have been desirable, particularly with regard to the arrangement of provisions. However, it must be noted that the analytical and synthetic techniques that were being used were essentially on the edge of the state-of-the-art; a better understanding of their use and usefulness exists today as a result of this project. Second, the decision to forego detailed decision table and information network analysis, which was absolutely necessary in light of the time schedules, resources available, and priorities at that time, had somewhat regrettable consequences later in the project. It became easier and easier to postpone the detailed analyses for various reasons, with the result that some portions were not analyzed with decision tables until after the final Provisions were published.

B1.4 Analysis of the Final Review Draft

The "Final Review Draft" of the Provisions (ATC-3-05) was issued on January 7, 1977. The project team had been advised that the resolution of comments made in response to this draft would be the last opportunity for substantive change. Given the proposed schedule for receiving and resolving the comments, a decision was made to once again forego the decision table and information network analyses so that the review and recommendations could address all of the provisions. The comments were issued in the form of "Working Report Number 3" [6] and were based on relatively soft analyses. The report was organized according to the format requested by the ATC-3 staff; general comments on the overall organization of the Provisions and major items affecting more than one chapter were grouped together, and then detailed comments were grouped by chapter. For over half of the chapters, complete revised drafts were offered, with the suggested changes highlighted.

Three principal issues were identified that pertained to more than one chapter:

1) The organization still lacked a clear-cut path for the user to follow in some instances. The comments on this subject were not as extensive as those made in the earlier reports; the recommendations generally consisted of resolution of a few loose ends.

2) Several important cross-references were misplaced or missing. Both this and the previous issue were analyzed by classifying the provisions. This particular issue would also have been raised by an information network analysis. The recommendations for change were simple.

3) The provisions required the user to repeat similar decisions several times. Different combinations of the seismic hazard exposure group and the seismicity index were used to determine the applicability of provisions at seven locations, giving rise to numerous groupings of buildings and provisions, and to potential problems for the users. It was recommended that the redundant decision points be consolidated. Although this issue was discovered through a careful reading, an analysis of the information network would also have detected the problem.

A large number of recommendations were included in the detailed comments on the individual chapters, including the arrangement of the chapter, provision of cross-references, rewording specific provisions, and in some cases, suggested new provisions. Little systematic analysis was done in support of the recommendations, because of time pressures.

Once again, the report enjoyed more success than earlier reports. Key individuals did consider the recommendations, and further discussions were held between members of the project team and ATC-3 participants. In some instances, the recommendations were repetitions of earlier recommendations. In other instances entirely new issues had been identified. The total impact of this report on the Provisions seemed quite large to the project team. Hindsight indicates that the mode of operation was becoming close to crossing the fuzzy line between analyst and author.

Another observation made possible by hindsight is that closer interaction between the analysts and the ATC-3 participants might have helped achieve earlier definition of the nature and scope of the administrative and regulatory provisions. What became chapter 1 in the Provisions was in a state of flux to the end. Early identification and resolution of those issues would have speeded up the ATC-3 project, and more attention could have been given to the other issues raised by the analysis. Such resolution might have been aided by a closer following of the performance concept of building regulation.

B1.5 Final Round of Recommendations for the Provisions

During the late spring and summer of 1977 ATC-3 produced several internal drafts of each chapter of the Provisions as the final resolution of issues and editing was occurring. The project team decided that providing aid to the authors was still of the highest priority and that response would be made to each of the internal drafts. Several modes of communication were used: letters on a few specific issues, cut and paste revisions of the drafts, handwritten comments on the margins of the drafts, and telephone conversations.

In total, a large number of issues were raised. Some of these were very substantive, for example, internal conflicts were identified between the overall structural design requirements and the "materials" chapters. Other issues were more detailed, concerning clear wording, cross-references, and the organization of the "materials" chapters. Some of the issues had been raised before in the Working Reports. Although much of the analysis was still "soft", consisting primarily of careful reading, some work was progressing towards documentation of the provisions with decision tables and information networks (primarily for chapters 3 through 8); and this work did provide the rationale for several recommendations.

Some of the recommendations were accepted, others were not. There was little time for discussion, because the ATC-3 participants were under severe time constraints in producing such a large volume. Some of the issues identified during this period still create problems (for example, see the comments in appendix A2 for datums 3372, 10500, and 11556).

The offer to travel to ATC headquarters to assist in the final editing was made again, with no response.

The quick action necessary to respond successfully to repeated drafts in a short time was difficult to achieve. The techniques of analysis using decision tables do not now lend themselves to quick updating of a large volume of material, although the information network analysis techniques might. It appears that a high priority item for improvement of the technology would be to develop computer aids to allow systematic storage and retrieval of decision tables and rapid updating.

B1.6 Final Documentation

The objective of the final documentation presented in this report was not to improve the Provisions through interaction with the authors, but to aid the users of the Provisions. Thus a complete expression of the data list, decision tables, and information network was necessary. The issues raised in the comments offered in this report are generally intended to aid the reader in forming his own interpretation of the Provisions, rather than to make suggestions for improvement. Chapter 3 summarizes many issues raised by the analysis and appendix A provides more detail.

Although the project team began a detailed analysis during the late spring of 1977, that activity was suspended in the late summer in anticipation of the final issue of the Provisions (with one exception: the related project conducted by Melin and Miller continued to analyze chapter 11 and to interact with one of the authors of that chapter [13]). The final analysis resumed in the spring of 1978. In the end, very little use was made of prior analyses, because they were fragmentary and because of the lack of computer aids for updating the previous work.

Because the objective of the documentation was to aid users of the Provisions, a new philosophy was adopted in performing the analysis. Potential redundancies, inconsistencies, and contradictions in the text were not followed slavishly in the preparation of the data list and decision tables. Instead, for the instances in which the intent was clear to the project team, the assumptions necessary to resolve the problem were made and noted in the comments. This is not the philosophy followed in earlier analyses, because the intent then had been to demonstrate problems to the authors. It should be noted that the task of making interpretations about the intent is quite difficult, and in some instances it may be presumptuous. This task was made possible only because the project team enjoyed the advantage of exposure to the deliberations of the authors and of interaction with key individuals over the duration of the project. It should also be noted that there are provisions for which the project team could not make such interpretations (for example, the applicability of the quality assurance provisions for mechanical and electrical equipment--see the decision table for datum 1601).

Several observations are now possible on the final analysis of the provisions that are pertinent to the planning of future projects. The preparation of decision tables for such a large set of provisions is a much larger job than the project team anticipated. It was expected that the analysis of certain key chapters would include the level of detail contained in this report and that it would be possible to step back to a more aggregate level for the analysis of other chapters. In practice this turned out to be difficult to achieve on a consistent basis, so the analysis was performed at the more detailed level throughout. On the other hand, there was also a failure to perceive just how valuable the detailed analysis would be. It is now thought that many potential problems in the Provisions could have been averted if a full detailed analysis had been performed earlier in the project. Recalling that time and resource limitations were the principal reasons for postponement of the analysis, it is apparent that at least two improvements in the overall methodology are necessary:

1) The development of the computer aid mentioned in section B1.5 for storage, retrieval, and updating of decision tables is of the highest priority. Ideally this aid would work off an integrated data base also used by the network and index/outline computer programs.

2) There is a significant amount of work that could be performed by technician level personnel, although the initial datum identification and decision table formulation, along with the network interpretation and provision classification, would still require professional effort. The possibilities for shifting some of the work burden depends to some extent on the functional aspects of the improved computer aids.

Two final comments sum up many of the lessons learned on this project. First, it is very important to gain a rapport with the committee authoring the provisions, so that they understand what can and cannot be done and that they are willing to take full advantage of all possible benefits. Second, this kind of project tends to proceed in a "hurry-up and wait" manner; it is probably inevitable for any operation so dependent on many interactions between widely separated individuals. It is important to take full advantage of the slow periods in order to build up the analytical data base.

APPENDIX B2

RECOMMENDATIONS FOR THE CONDUCT OF FUTURE PROJECTS

The development of provisions for codes and voluntary standards usually assumes one of two basic forms: a modification of past practice through revision of existing provisions or a radical departure from past practice through the formulation of a completely new set of provisions. The second form typically becomes a large project (for example the ATC-3 project, new provisions for energy conservation, etc.) in which the visibility and funding are high enough to encourage the acceptance of new techniques such as this project. However the systematic analysis with decision tables, networks, and classifications is also applicable to revisions of existing provisions. In either case, it is important for a project such as this to begin at the right time, "to get in on the ground floor," so to speak. For a project that involves the formulation of a new set of provisions, the systematic analysis should begin at the same time as the overall project of standards writing and be closely coordinated with it. This avoids the possibility of the analysts appearing as intruders, and allows the analysts a better chance to keep up with the committee of authors. For a project that involves a revision of existing provisions, it would be desirable to begin analysis of the existing provisions before the committee begins considering revisions. Once again, this would allow the analysts to keep up with the committee. It would also allow a thorough study of the possible flaws in the existing provisions, which could serve as part of the rationale for change.

For efficient and effective work, it is desirable that future projects have available more sophisticated computer aids and make use of techniques to divide the labor between professionals and technicians. As discussed in sections B1.5 and B1.6, rapid updating of a large volume of information is necessary to successfully keep up with a committee of authors. Both of these factors are important contributors in achieving that goal. NBS has recently initiated sponsorship of a project at Carnegie-Mellon University that is a first step in developing the improved computer aids needed.

It is important to accomplish the detailed analysis early and then keep it up to date as the project continues. There are several advantages:

1) it provides a firm basis for recommendations made to the authors;

2) the details of the analysis may be important to some of the authors; and

3) the final documentation can be completed and released very soon after the completion of the written text.

It is important to recall that the philosophy of the detailed analysis may well change through the duration of the project, as was described in section B1.6.

The interactions with the committee of authors are of the utmost importance. Close and frequent contact with the committee facilitates the work and greatly improves the likelihood of significant benefit to the provisions. Organization and expression of provisions are too important to the success of the result to be delegated to a format committee remote from the main thrust of the standard writing project. The analysts should interact directly with the committee concerned with the substance of the provisions, for that is where the key issues will arise and the decisions will be made. Group dynamics are an important factor, and it can become easy to fall into adversary positions when such committees and the analysts are too far removed from one another because of the organizational structure. Close contact increases the spirit of cooperation and lessens the chance of the analyst antagonizing the committee. Successful interaction also relies upon quick response. In this regard, it might be desirable to adopt a standard form of written communication that will carry a recognition factor associating the document with the systematic analysis and that will be quick and easy to dispatch. The recognition, of course, would depend on early explanations of some form to the authors as to just what the systematic analysis entails.

Typically, two forms of recommendations are generated by the analysts: to raise a question or to suggest an improvement. Both types are valid, but it must be clear as to which it is and what the appropriate action for the committee is. In addition, all recommendations must be carefully explained, with due consideration of present problems and the impacts of change. Finally, the participants in such projects must frequently conduct critiques of their work, their effectiveness, and the provisions that they are working on.

In summary, then, the following items are important components for the execution of projects similar to the one reported herein in the future:

1) begin at the earliest possible time;

2) obtain early agreement with the committee of authors on the interaction of the committee and the analysts;

3) make optimum use of computer aids and human resources;

4) conduct full detailed analyses early and keep them up to date;

5) cultivate close and effective interactions with the committee of authors;

6) make all recommendations clear; and

7) conduct on-going critiques.

These items are not panaceas nor are they all inclusive. The techniques of analysis are not intended to be slighted, but their application may well be for naught if they have no effect on the provisions being developed. The items listed above are the minimal set needed to assure their effectiveness.

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SI CONVERSION UNITS

In view of the present accepted practice for building technology in this country, common U.S. units of measurements were used throughout the Provisions. Therefore their use is continued in this publication. In recognition of the position of the United States as a signatory to the General Conference on Weights and Measures, which gave official status to the International System of Units (SI) in 1960, the table below is presented to facilitate conversion to SI Units. Readers interested in making further use of the coherent system of SI units are referred to: NBS SP 330, 1972 Edition, The International System of Units; and ASTM E380-76, Standard for Metric Practice.

Table of Conversion Factors to SI Units

To Convert From	To	Multiply By
degree	radian	1.7453×10^{-2}
inch	meter	$2.54^{*} \times 10^{-2}$
in^2	m^2	$6.4516^{*} \times 10^{-4}$
in^4	m^4	4.1623×10^{-7}
foot	meter	$3.048^{*} \times 10^{-1}$
pound-force	newton	4.4482
lbf/ft	N/m	1.4594×10
lbf/in^2	pascal	6.8947×10^{3}

*Exact value; others are rounded to five digits.

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

This report presents the results of a thorough study of the internal logic of the Tentative Provisions for the Development of Seismic Regulations for Buildings developed by the Applied Technology Council. The methods of analysis employed in the study provide objective measures of clarity, completeness, and consistency and an alternative form in which to examine the technical validity of the provisions. These methods include decision logic tables for examining individual provisions, information networks for representing the precedence among provisions, and classification of the provisions to study their scope and arrangement. A formal representation of the provisions is presented by the data items, decision tables, networks, and classification systems developed in the study. An index and several alternate arrangements of the provisions are also included. Opportunities for improvement of the tentative provisions are identified and discussed, and considerations for their future development and implementation within various national standards are highlighted.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

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