NISTIR 89-4175

POST-OCCUPANCY EVALUATION OF SEVERAL U.S. GOVERNMENT BUILDINGS

Belinda L. Collins
Gary L. Gillette
Mubarak S. Dahir
Peter J. Goodin

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
National Engineering Laboratory
Center for Building Technology
Gaithersburg, MD 20899

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Raymond G. Kammer, Acting Director

NIST

NISTIR 89-4175

POST-OCCUPANCY EVALUATION OF SEVERAL U.S. GOVERNMENT BUILDINGS

Belinda L. Collins
Gary L. Gillette
Mubarak S. Dahir
Peter J. Goodin

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
National Engineering Laboratory
Center for Building Technology
Gaithersburg, MD 20899

Prepared for:
U.S. Army Communications - Electronics Support Facility
Vint Hill Farms Station
Warrenton, VA 22186-5141

September 1989

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Raymond G. Kammer, Acting Director

ABSTRACT

A post-occupancy evaluation was performed on five small, low-rise U.S. government office buildings at a site south of Washington, D.C. The study recorded occupant response to indoor environmental conditions including lighting, space, noise, and indoor air quality; and provided recommendations for improvements to the facilities. In addition, a comparison was made of environmental conditions before and after renovation of one of the buildings. The study employed a questionnaire about the environmental conditions, physical measures of the space (lighting, space, noise, temperature, etc.), and interviews with personnel at the site. A total of 308 people participated (including measures before and after the renovation) and physical measures were taken at 92 work stations. Analysis of the physical measurement data indicated problems with limited space, lack of adjustable task lighting, and perceptions of poor indoor air quality in two of the buildings. The renovation was perceived to have improved the appearance of one building substantially, however. Suggestions for improvements to the buildings at the site were also made.

KEYWORDS:
Automation, contrast, environmental assessment, indoor air quality, lighting, luminance, noise, post-occupancy evaluation, temperature, VDT's.

FOREWORD

This report summarizes research conducted from September 1987 to June 1989, under contract Number WF 3HYC7237-7-164.

ACKNOWLEDGEMENTS

The authors wish to thank Ms. Belinda Kuo for her efforts in the data transcription and initial analysis, Dr. Arthur Rubin for his assistance in the initial phases of the study and detailed review of the first draft, and Dr. Francis Ventre for his insights and critique of the final draft. The authors also wish to thank all the people at the site who cooperated with us in the course of this research. Without their willing and enthusiastic help and support, this report would not have been possible.

DISCLAIMER

Any commercial products or trade names mentioned in this report are included for informational purposes only, and do not constitute an endorsement or recommendation by the National Institute of Standards and Technology or the U.S. Army.

Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Background

The use of post-occupancy evaluation techniques provides a means for evaluating occupant response to an existing environment and suggesting areas for improvement. Post occupancy evaluations use a battery of tests to assess environmental conditions in the facility, including questionnaire surveys of the occupants, physical measures, personal observations, and individual interviews. The post-occupancy evaluation technique is thus designed to provide information about the occupants' reaction to their work spaces and document the physical conditions to which they are responding.

Dillon and Vischer (1987a, b) used post-occupancy evaluation techniques to study four office buildings in Canada and develop response norms. Rubin and Collins (1987, 1988) and Collins and Rubin (1988) used this technique to evaluate environmental conditions in three U.S. Army field stations. Marans (1987), Marans and Brown (1987), Gillette (1988), Gillette and Brown (1986), and Collins, Fisher, Gillette and Marans (1989) applied post-occupancy evaluation techniques in a study of lighting, energy use, and other environmental conditions in thirteen office buildings in the United States. These studies identified the importance of lighting, thermal comfort, indoor air quality and privacy as major factors in influencing people's response to their environments.

Other studies have used only questionnaire or laboratory techniques to determine people's response to the environment. Thus, when Louis Harris and Associates for Steelcase (1987) questioned workers in the U.S. and Canada, using a telephone survey, they found that respondents placed a great deal of emphasis on office layout, furniture, improved lighting, and chairs as the key to increasing productivity. Respondents also placed considerable importance on privacy, improved temperatures, and reduced distractions or noise as well as reductions of glare on VDT screens. Laboratory studies of the response to lighting systems have identified the importance of lighting distributions in influencing occupant response to the space. For example, Flynn, Spencer, Martyniuk, and Hendrick (1973) found that ratings of perceptual clarity were closely correlated with the "bright/dim" dimensions, while ratings of pleasantness were closely correlated with the "overhead/peripheral" and "uniform/non-uniform" dimensions. Lighting installations identified as pleasant scored higher on the peripheral and non-uniform ends of the scales, while spaciousness appeared to be predicted best by a combination of the three dimensions. Hawkes, Loe, and Rowlands (1979), determined that subjective brightness and interest were important factors in influencing the evaluation of lighting systems. In addition, the pattern of illuminance was important, with designs in which only one wall was lit judged as dim, and designs using only diffuse sources rated as less interesting than situations which used focused sources. Hawkes, et al. suggested that situations that are judged as being brighter and more interesting (or complex) are also preferred. Finally, Ulrich (1987) determined that windows provide important benefits, including speeding the recovery from illness, to people in confined spaces, such as hospitals and even offices.

Other studies have focused on issues such as thermal comfort, including temperature and humidity. For example the ASHRAE Standard (55-1981) states that: "80% of all adults dressed for winter indoor conditions find temperatures acceptable between 68°F and 74.5°F (20-23.5°C), a relative humidity of 30-60%, and the air velocity at 0.15-.-0.25 m/sec. Acceptable summer indoor temperature is between 73 and 79°F (20-26.5°C)." Meyer (1983, p.27) pointed out the "extensive experimentation has shown that for an average, sedentary, lightly clothed person this [thermal comfort] occurs most readily when the air in a standard room has a temperature of 24.5 °C (76.1°F), a relative humidity of 40%, and an air velocity of 0.25 m/sec."

1.2 Technical Approach

The present study used post-occupancy evaluation techniques including questionnaires and physical measurements to evaluate a number of concerns about a specific set of five small U.S. government buildings. In addition, during the course of the study, one building was renovated with new, "systems" furniture replacing older, more conventional office furniture. A secondary goal of the present research was thus to determine if the changes made during the renovation improved physical conditions and occupant response to their environment. Environmental conditions of concern included lighting, air quality, temperature, space, color, and lack of windows. The occupant questionnaire addressed each of these areas, as well as reports of personal health and well-being. The physical measures concentrated on lighting, VDT's, noise, temperatures, and space.

1.2.1 Questionnaire Survey

The study was performed over about a six-month period from July 1988 to January 1989, before and after the renovation of one building. A detailed environmental questionnaire was administered in August to the occupants of the five buildings, and then again in January following the renovation to the occupants of the renovated building. The questionnaire was based on that used by Rubin and Collins (1988) for an evaluation of U.S. Army field stations but modified as appropriate for the present study. Individuals were assured of anonymity and encouraged to participate, with about 40-50% responding for a total of 308 (including both surveys).

The questionnaire generally covered attitudes toward air quality, temperature, lighting, VDT's, space, noise, privacy, windows, facility appearance, furniture, health, and job satisfaction, as well as length of time at the facility and general demographic information. A copy of the questionnaire is provided in Appendix A.

The participants were distributed as follows, with conditions before the renovation in building 268 referred to as 268-1; and those following it as 268-2:

Building 235 - 24 respondents; referred to as A in the figures,
Building 260 - 69 respondents; referred to as B in the figures;
Building 293/98 - 19 respondents; referred to as C in the figures;
Building 268-1 - 114 respondents; referred to as D1 in the figures;
Building 268-2 - 82 respondents; referred to as D2 in the figures.

All the buildings were relatively small (about 60,000 to 80,000 ft^2), one-story, windowless facilities, although buildings 293 and 298 were substantially smaller, between 2400 and 6000 ft^2. Building 268 also had a substantial shops area where equipment repair and maintenance were done. The majority of the occupants performed office-type tasks including routine use of VDT's, although some (about 10-15%) performed equipment maintenance and repair. A few also did warehouse storage and shipping (in building 235).

1.2.2 Physical Measurements

In addition to the questionnaire, detailed physical measurements were also taken in the course of the study. Physical measurements were taken in July and August of 1988 and then again in January, 1989. The physical data collection included lighting measures (both illuminance and luminance), noise, temperature, humidity, air flow, and the physical dimensions of the work station. Other assessments included calculations of contrast, estimations of color, sound intrusiveness, distractions, chair quality, furnishing type and condition, carpet, use of fans and space heaters, personalization of individual spaces, and general environmental quality. The protocol used in collecting these data is also presented in Appendix A.

Physical measurements were taken at a total of 92 individual work stations. Forty-nine work stations were measured in building 268 before the renovation, while 26 were measured after. The remaining 17 work stations were located in building 260 (12) and 235 (5). Because many of the work stations were virtually identical, measurements in only one or two areas characterized the physical conditions in the whole room.

2. Questionnaire Results

2.1 Approach

The tables in section 3 present a summary of the questionnaire results, in terms of mean ratings and number of respondents for selected questions. Appendix B contains the complete data from the questionnaire in terms of percentage frequency for each element of each question, along with the mean and standard deviation for each question for each building. It also contains the mean for all respondents for each question.

Background demographic information was obtained about the respondents who participated in the study. Most respondents were male -- between 56% and 82% depending on the building, with building 260 having the most females - 44%. Most (62 - 75%) were civilians, with the rest being military. According to the classifications given by the respondents, about 35 - 45% classified themselves as managers, 10 - 25% as clerical, 5 - 15% as equipment maintenance, 1-6% as ADP, and 20 - 50% as "other" depending on the building.

In the tables summarizing the mean ratings in the text, responses are categorized according to major environmental classifications, such as air quality, lighting, temperature, noise, and the like. Results are listed by building number with 268-1 representing the findings before renovation and 268-2 after. The scale for the responses is given above each grouping--either a 5 or a 4 point rating scale. The mean for each building is given for each question, identified by a unique identifier such as "AIRCIRC" or "COOLING". The identifier code appears on the questionnaire in appendix A. Where several questions pertained to the same environmental area, and the same rating scale was used (4 point or 5 point), the data were averaged for each building (AVG) and then for the whole data set (Site Mean). (The standard deviations for individual ratings are presented in appendix B.)

Several questions were examined in the data analysis. The first question is whether the ratings from any particular building were noticeably different from the others. The second is whether the ratings in 268 changed following the renovations. The third is whether the mean ratings differed from an expected value. Two values were used for this comparison. The first was simply the scale midpoint or theoretical mean of the scale -- 3 for a 5 point scale and 2.5 for a 4 point scale. (The scale midpoint is the value most likely to be neutral.) Statistical comparisons with the scale midpoint were made. The second comparison was with a set of normative scores developed for Public Works Canada by Dillon and Vischer (1987 a,b). The Canadian scores are based on field data -- ratings given by people in four Canadian office buildings, and so may be a good reflection of typical ratings for government office buildings (at least in Canada). Since these scores were based on five point rather than four point scales, they do not apply to all the present data, but provide a useful reference point where applicable. In addition, frequency distribution data for each individual rating scale are presented in Appendix B and in selected graphs throughout the text. This particular presentation allows detailed comparison of the pattern of responses of people from different buildings to a particular question.

2.2 Air Quality and Temperature

The first three ratings to be discussed pertain to air circulation (AIRCIRC), air quality satisfaction (AIRQSAT), and the presence of fumes. For these scales, a "1" meant poor, while a "5" meant excellent. Table 1 indicates that all the mean ratings were below 3.0, with ratings for air quality satisfaction and air circulation being close to 2.0. Mean ratings for AIRCIRC and AIRQSAT were below 2.0 for buildings 260 and 268, indicating a very serious problem with the perceptions of air quality and circulation in these two buildings. In fact, 75%-80% of these occupants rated their air circulation and air quality satisfaction as only poor to fair as can be seen in figures 1 and 2. In addition, the renovation in 268 improved the ratings for air quality only slightly. (No modifications were made to the air handling system). The perception of fumes appeared to be less of a problem to the occupants of the four buildings with mean ratings around 2.6. The mean site rating of 2.19 was slightly lower than the Canadian rating of 2.3, as can be seen in Table 1 and well below the scale midpoint of 3.0.

The next portion of Table 1 presents several 4-point scales related to air quality. In this set of data, a "1" represented "not at all bothersome"[1] while a "4" represented "Very bothersome". Here a rating of "2.5" was considered neutral, although the question had no obvious neutral point. Again, the ratings suggest that perceptions of stuffy air and indoor air quality were particularly bothersome[1] in buildings 260 and 268, with ratings of 2.9 to 3.0, above the scale midpoint of 2.5. The ratings of 2.3 to 2.4 for smells and smoke suggest that these were less bothersome. (Many of these offices had a "no-smoking" policy; smoking was permitted only if everyone in the office agreed to it.) The data indicate, however, that conditions in 268 worsened somewhat, particularly for smoke, following the renovation. Examining all the data for indoor air quality ratings suggests that fumes, smells, and smoke were not as bothersome as general air quality, circulation and stuffy air. The majority of the offices had a no smoking policy, or the ratings of "smells" etc. might have been substantially more negative. Examination of the comment data reveals, however, that many respondents were dissatisfied with the enforcement of the no smoking policy. The slight increase in ratings of stuffiness and smoke following the renovation in 268 suggests that the new work stations may have blocked some air movement. Furthermore, the comment data suggest that fumes from the shop area continued to be a problem for this building.

The next questions dealt with the thermal environment, with ratings of both heating and cooling on a 5 point scale. Table 1 demonstrates that the site mean for all four buildings was quite low -- 2.24 -- indicating considerable dissatisfaction with temperature. Although there was substantial variation between buildings, ratings for both heating and cooling were quite low (around 2.2) in buildings 260 and 268, whereas cooling was rated more positively in the other buildings. Figures 3 and 4, which present the

---

[1] The word "bothersome" is used because respondents were questioned about "how bothersome" a particular condition was. A colloquial word was selected as being more communicative to those completing the questionnaire.

Table 1. Mean Ratings of Reaction to the Environmental Conditions in the Buildings Studied.

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
			Air Quality				
AIRCIRC	2.46	1.88	2.89	1.59	1.96	1.90	308
AIRQSAT	2.74	1.77	2.79	1.84	2.04	2.00	306
FUMES	2.55	2.63	3.00	2.66	2.67	2.67	286
avg	2.58	2.09	2.89	2.03	2.22	**2.19**	
STUFYAIR	2.38	2.97	2.28	2.95	2.91	2.86	289
SMELLS	2.14	2.31	2.33	2.43	2.23	2.32	293
SMOKE	2.24	2.27	2.16	2.47	2.63	2.43	293
AIRQUAL	2.27	3.01	2.26	2.89	2.90	2.83	296
avg	2.26	2.64	2.26	2.69	2.67	**2.61**	
Canadian Rating for Air Quality				Mean = 2.3 +/- 1.1			
			Thermal Environment				
COOLING	3.04	2.17	3.32	1.81	2.10	2.16	307
HEATING	2.91	2.29	2.78	2.21	2.22	2.32	299
avg	2.98	2.23	2.03	2.01	2.16	**2.24**	
Canadian Rating for Thermal Comfort				Mean = 2.8 +/- 1.0			
DRAFTS	2.00	2.22	2.22	2.18	2.06	2.15	289
HOTSUMR	2.00	2.22	2.42	3.05	2.71	2.66	294
TEMPSWN	2.10	2.70	2.47	2.72	2.63	2.63	291
COLDWTR	2.20	2.39	2.50	2.69	2.58	2.55	291
avg	2.08	2.38	2.40	2.66	2.50	**2.50**	

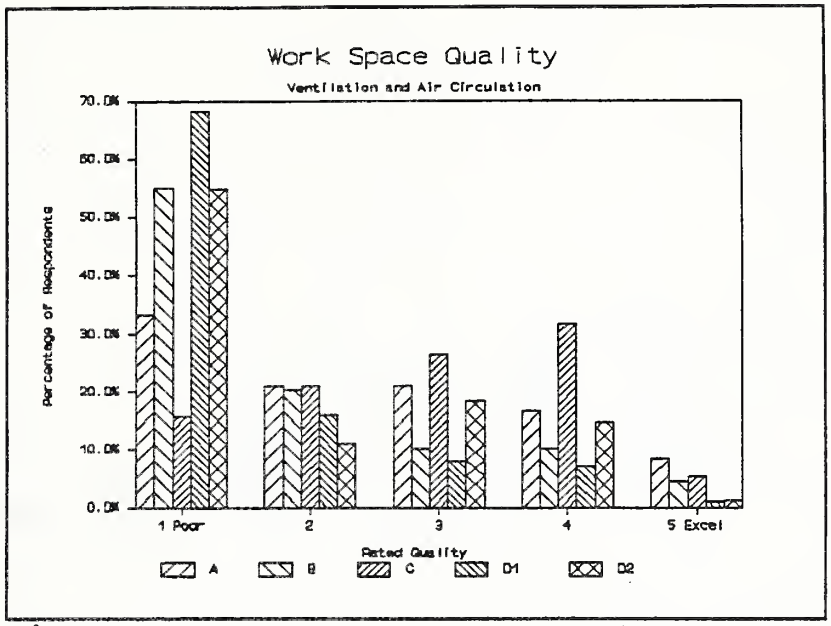

Figure 1. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 1. Percentage of people rating ventilation and air circulation on a scale of poor to excellent.

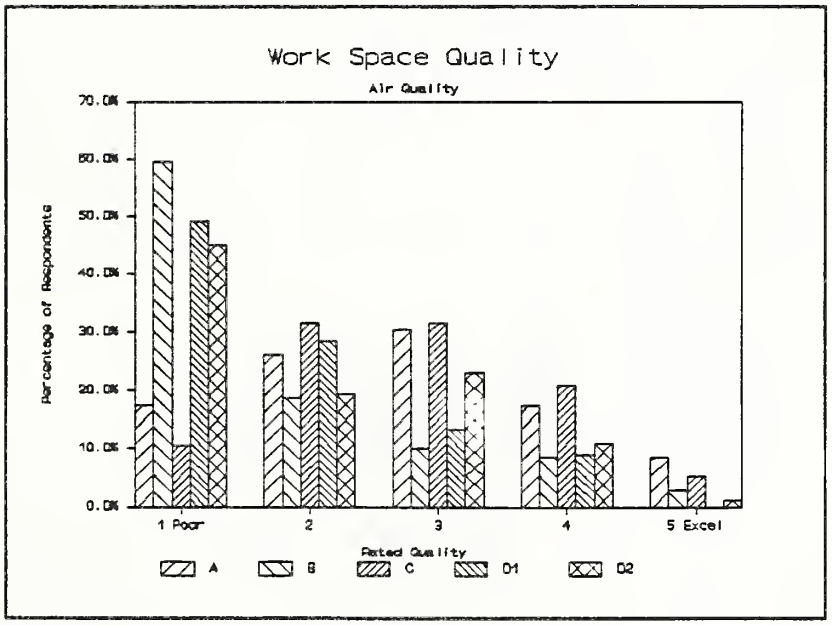

Figure 2. Percentage of respondents rating air quality on a scale of poor to excellent.

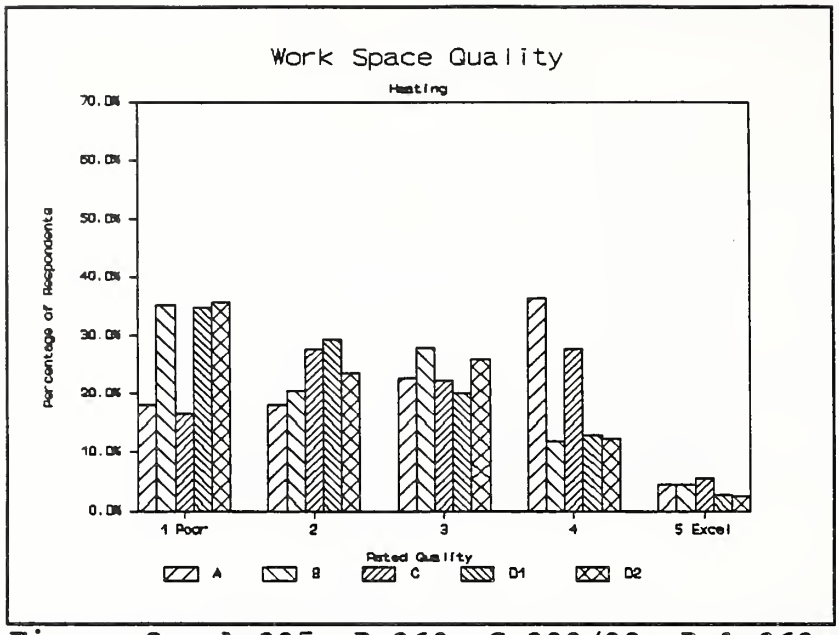

Figure 3. A=235; B=260; C=293/98; D-1=268-1;and D-2=268-2.

Figure 3. Ratings of heating in the work space on a 5-point scale of poor to excellent.

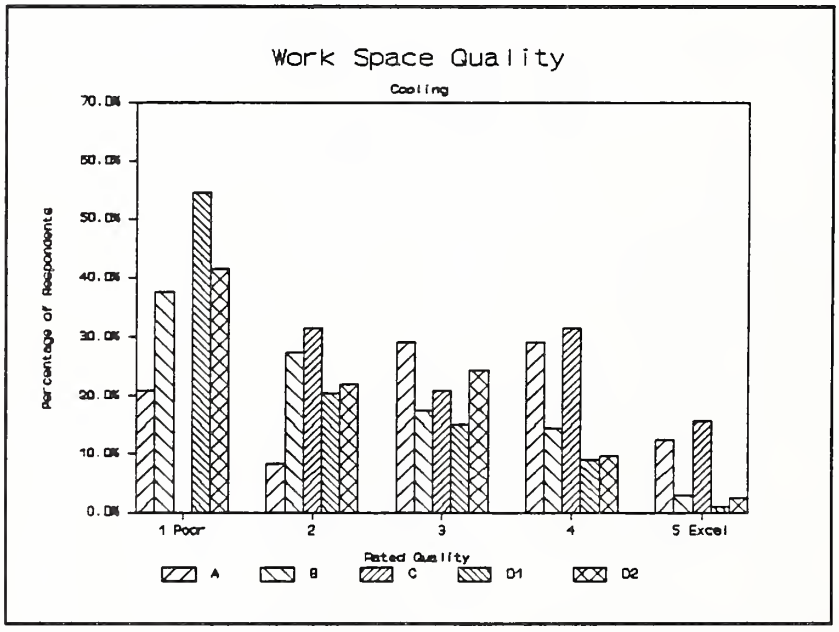

Figure 4. Ratings of cooling in the work space on a 5-point scale of poor to excellent.

distribution of ratings for heating and cooling, demonstrate that the renovation in 268 improved the ratings for cooling slightly, but had little impact on heating. (Since the post-renovation questionnaire was administered in January, heating, not cooling was likely to have been more of a problem.) The mean site rating and the ratings for 260 and 268 were substantially below the Canadian rating of 2.8, as well as below the scale midpoint of 3.0. It should be noted, however, that satisfaction with both indoor air quality and temperature was higher in 293/298, although only 19 people participated in the questionnaire for these two buildings.

Examination of the mean data for the four point scales related to the "bothersomeness" of building temperatures reveals high ratings, indicating problems for occupants of building 268 with hot summer temperatures, temperature swings, and cold winter temperatures. Ratings improved somewhat following the renovation, although occupants had not yet experienced summer conditions. Drafts did not seem to be a problem in any building (which makes sense given the number of complaints about stuffy air). Buildings 235 and 293/8 performed below the scale midpoint of 2.5 on all 4 rating scales, as did building 260 (except for the question about temperature swings).

2.3 Lighting and VDT's

Table 2 presents data on the reaction to lighting -- the amount of light for working, the brightness of the light, and overall lighting satisfaction. These ratings were much more positive than those for air quality, with a group mean of 3.14, which was slightly lower than the Canadian rating of 3.3. There was also less variation among the buildings, although ratings for 260 and 268-1 tended to be lower. The data suggest that the renovation may have generally improved lighting conditions in building 268, with increases in mean lighting satisfaction from 2.96 to 3.46 and rated amount of light for work from 2.88 to 3.39. For example, the percentage of those rating the amount of light as "good" or "excellent" increased from 35% to 55%. Figure 5 indicates that the number who expressed satisfaction with the lighting in 268 (rated it as good or excellent) increased from 26% to 52% after the renovation. This figure also indicates, however, that about 42% of those in building 260 were dissatisfied with their lighting (rating it poor or fair). Figure 6 demonstrates that all buildings except 293/8 were rated as dimmer, rather than brighter.

When the ratings of the quality of light for specific areas and tasks are examined, it is clear that the ratings for building 268 improved for each scale following the renovation. These data support the conclusion that the renovation in 268 with its repainted walls, new furniture, and more task lighting etc. improved the response to the lighting. Although low ratings were given for lighting for break areas, this may have occurred because many of the buildings had inadequate or no break areas, particularly 268, rather than because the lighting was bad. Excluding break areas, the overall site mean for the quality of light in specific areas was 3.16 -- above the scale midpoint of 3.0. The renovation in 268 was particularly important in improving the mean rating for the site. The mean ratings of the lighting for

Table 2. Mean Ratings of Reaction to the Lighting Conditions in the Buildings Studied.

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
Lighting							
AMTLTWRK	2.83	3.09	3.79	2.96	3.46	3.16	307
WSLITSAT	3.38	2.91	3.68	2.88	3.39	3.11	308
avg	3.10	3.00	2.49	2.92	3.43	**3.14**	
Canadian Rating Mean = 2.3 +/-1.0							
RTLTSPAC	3.13	3.01	3.53	2.79	3.33	3.06	307
RTLTRSTM	2.96	3.10	3.42	3.25	3.63	3.31	308
RTLTHALL	3.46	3.39	2.41	3.08	3.51	3.26	306
RTLTCONF	1.95	3.22	2.28	3.05	3.33	3.04	302
RTLTBRK	2.75	2.87	3.58	1.60	1.87	2.18	298
avg	2.85	3.12	3.04	2.76	3.14	**2.97**	
Lighting for Tasks							
LTVDT	3.14	2.70	3.65	2.65	2.90	2.83	247
LTREAD	3.64	2.96	3.74	3.05	3.49	3.23	292
LTOTHER	2.60	1.89	2.33	2.45	2.97	2.51	90
LTFILE	3.31	3.00	3.94	2.84	3.22	3.09	219
LTDRAFT	2.42	2.32	2.69	2.47	2.57	2.48	219
LOCCLNLT	2.79	2.99	3.63	2.92	3.32	3.07	308
avg	2.98	2.64	3.33	2.73	3.08	**2.87**	
GLRCLNLT	2.10	2.25	2.05	2.39	2.15	2.25	291
GLRWKSF	2.23	2.18	2.11	2.35	2.07	2.21	291
DIMLIT	2.14	2.39	1.72	2.21	2.25	2.23	286
avg	2.15	2.28	1.96	2.32	2.15	**2.23**	
LTGHINDR	3.10	3.03	3.63	2.68	3.09	2.96	293
AMTLTBRT	3.57	3.46	2.84	3.35	3.24	3.33	300
ADJAMTLT	2.39	1.75	2.11	1.91	2.52	2.09	302
NOTSKLT	2.30	2.75	2.16	2.71	2.49	2.6	284
avg	2.84	2.75	2.69	2.66	2.84	**2.75**	

Table 2 Continued.

Lighting and VDT's

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
VDTADJLT	2.91	2.54	1.93	2.85	2.54	2.62	206
VDTBRTLT	2.55	2.20	1.64	2.56	2.24	2.32	209
VDTREFSC	2.55	2.43	2.00	2.76	2.54	2.55	216
VDTADJSC	2.30	1.93	1.93	2.31	2.04	2.11	209
VDTGLARE	2.45	2.57	1.94	2.90	2.57	2.63	216
VDTREAD	1.90	1.93	1.56	2.06	2.13	2.00	209
VDTSPACE	2.60	2.51	1.93	2.59	2.54	2.51	207
VDTANGSC	1.82	1.64	1.63	1.99	1.81	1.81	209
VDTDSTSC	1.91	1.68	1.56	1.74	1.62	1.69	211
VDTSEAT	2.18	1.58	1.69	1.91	2.07	1.86	211
VDTFLICK	2.36	1.93	2.19	2.20	1.89	2.05	211
VDTANGKB	2.27	1.92	1.67	1.90	1.93	1.91	211
VDTDSKHT	2.09	1.73	1.60	2.06	1.98	1.91	211
avg	2.30	2.05	1.79	2.30	2.15	2.15	

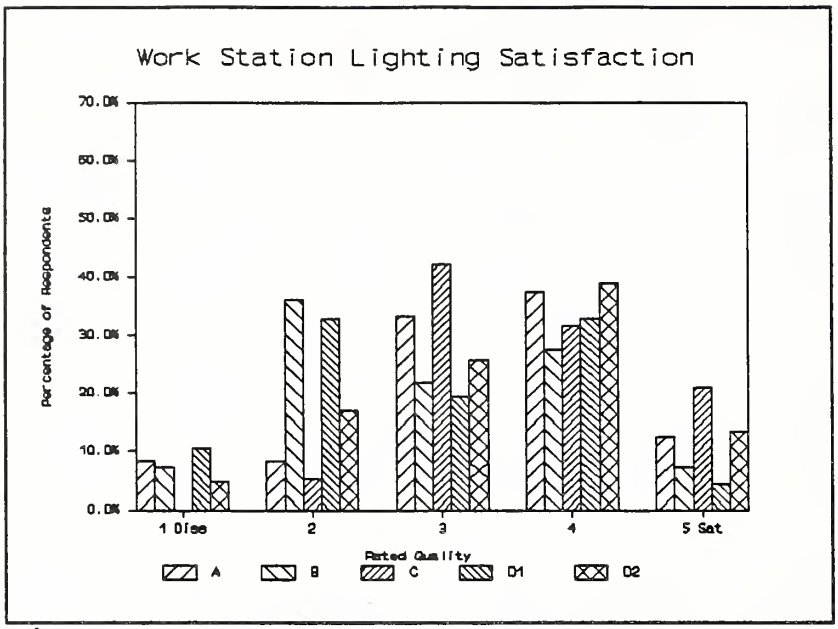

Figure 5. A=235; B=260; C=293/8; D1=268-1; and D2=268-2.

Figure 5. Percentage of respondents rating their satisfaction with the amount of light at their work station.

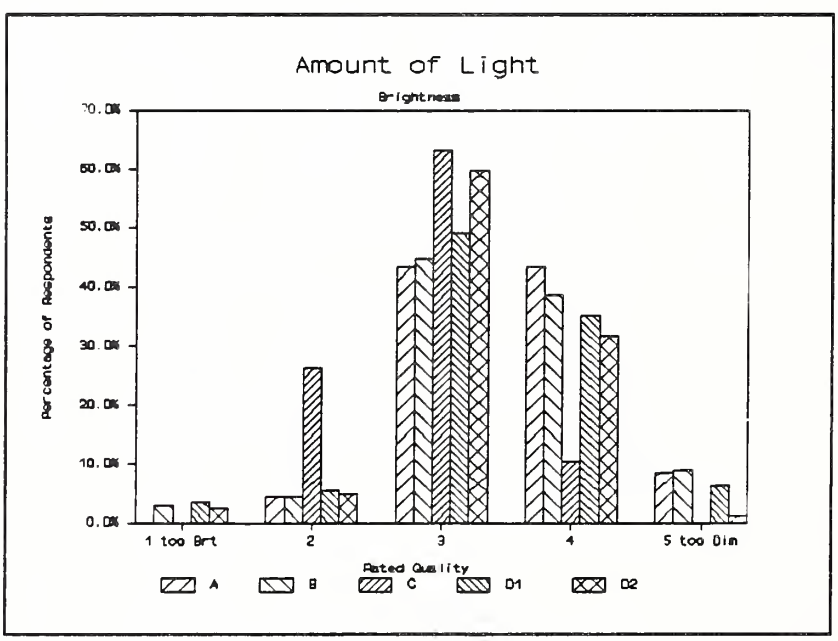

Figure 6. Percentage of respondents rating the amount of light at their work station on a scale of "too bright" and "too dim".

tasks also improved by about 0.4 following the renovation in 268. The rating for lighting for tasks was lowest for 260 with a mean of 2.64.

In all buildings, the lowest ratings for lighting were for drafting and "other"; and highest for reading, and filing. Lighting for VDT's appeared to cause problems in 260 and 268 particularly before the renovation. The next three scales dealt with the perception of the "bothersomeness" of several aspects of lighting; namely, glare from ceiling lights and work surfaces, and dim lighting. On this scale a rating of (4) meant very "bothersome". All four buildings were quite similar -- with a site mean of 2.23, below the scale midpoint (2.5) -- indicating that glare and dim lighting were not particularly bothersome. Again, conditions in 293/8 were least bothersome, while they improved following the renovation in 268. Figure 7 demonstrates that relatively few people rated glare from the work surface as "fairly" or "very" bothersome, with only about 30% being bothered by this type of glare.

Ratings of light as a hindrance to doing the job (where "4" meant that light did not hinder getting the job done), shown in the next portion of Table 2, indicated that this was also not a problem. Issues related to control include the ability to adjust a light for the task as well as the actual presence of a task light. On the first scale (a 5 point scale) respondents clearly felt that they did not have much ability to adjust their light; those in 260 and 268 were the most bothered with mean ratings below 2.6. Figure 8 demonstrates that 35-55% felt that their ability to adjust their light was poor. The renovation in 268 successfully increased the perceived ability to adjust the light, although still not to the scale midpoint of 3.0. Finally the absence of a task light was bothersome to many, as shown by the relatively low site rating of 2.6.

An important issue in lighting is the need to light offices for both paper and "VDT" tasks. The next set of data present the bothersomeness of lighting for VDT's where 4 equaled "very bothersome". Very few problems occurred in building 293/8 where all ratings were below 2. More problems arose in the other buildings where mean ratings were between 2.5 and 2.9. The lack of ability to adjust the light emerged as a particular problem in 260. As with other lighting situations, the renovation in 268 improved the lighting for VDT's.

The next questions dealt with the bothersomeness of various environmental conditions for using VDT's. Again, a higher number implies greater bothersomeness. Table 2 indicates that most conditions associated with VDT's were not particularly bothersome with mean ratings below 2.0, with some important exceptions. "Space for printed material" was rated as particularly bothersome in all buildings except 293/98. (Yet, about 50% of the respondents in 293/8 and 235 indicated that they spent less than 2 hours using a VDT -- as compared with 50% in 260 and 268 who spent 2-6 hours/day at a VDT). The mean rating for the bothersomeness of space for printed material was 2.51 with between 20 and 50% finding it to be fairly or very bothersome.

The renovation in 268 decreased dissatisfaction on this scale only slightly. The flickering of VDT's was a slight problem for those in 235 and 268 before the renovation. VDT characteristics that were not bothersome included screen

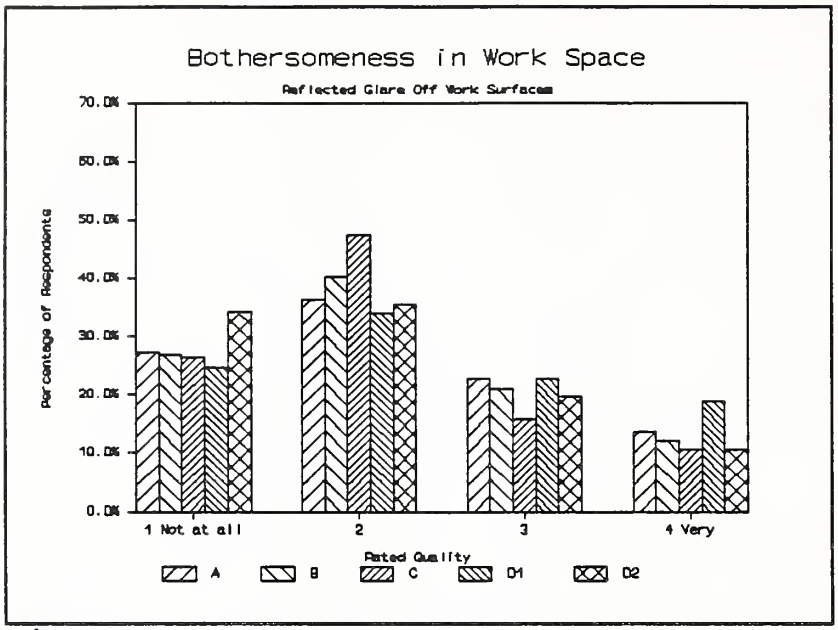

Figure 7. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 7. Percentage of respondents rating the bothersomeness of reflected glare from their work surfaces.

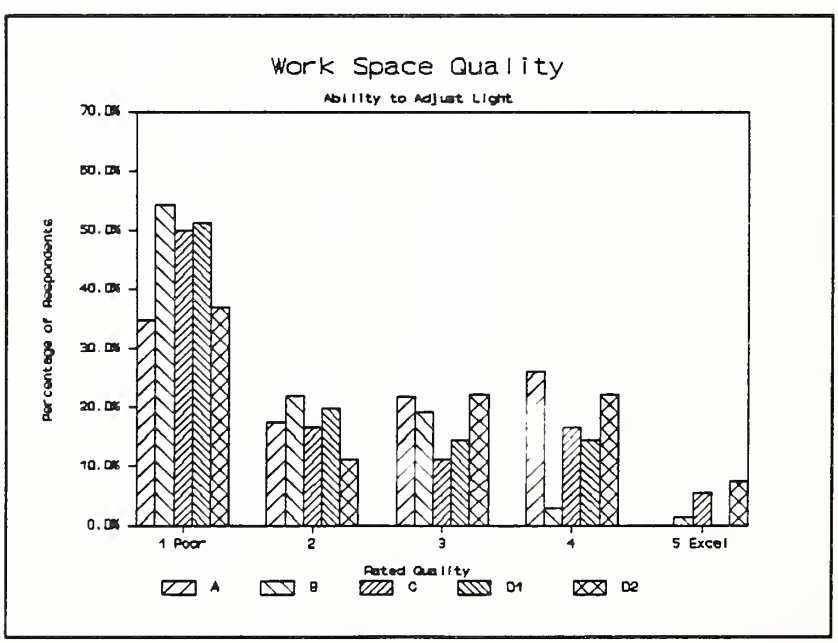

Figure 8. Percentage of respondents rating their ability to adjust the light in their work station.

angle, distance to the screen, seat, keyboard angle and desk height, although the last three were rated as somewhat more bothersome in building 235. Clearly, though, lack of space for paper tasks was considered the most troublesome aspect of VDT's at the site.

2.4 Noise and Privacy

Table 3 indicates that a major concern for respondents in all work stations was noise and privacy. The first set of ratings refers to the bothersomeness of noise from coworkers using a 4-point scale. The low ratings for the first entry indicate that "it is very true" that one can be overheard by coworkers. On this scale, the buildings had very low and similar ratings -- between 1.38 and 1.79 -- indicating that being overheard was a very real concern. Only about 10% of those in any building considered that it was not a problem. Figure 9 presents a distribution of the ratings for this question. The second entry in table 3, indicated that hearing people talk was also a problem, with a mean of 2.53, but not as bothersome as the feelings of being overheard. The ratings on both scales improved slightly following the renovation in 268, although 90% still found that being overheard was bothersome. Nevertheless the site mean was 2.01, below the Canadian Rating of 2.9 (derived from a 5 point scale) and below the theoretical scale midpoint of 2.5.

Another area of concern was that of environmental noises - from the hall, equipment, phones, ventilating systems, and printers. Because a high rating meant "very bothersome," the relatively low ratings for these noise sources indicate that environmental noises were less bothersome than noise from people or concerns about being overheard. Again, the renovation improved the ratings slightly, although no building was rated as being particularly bothersome. Figure 10 reveals a fairly even distribution of ratings--except in building 235 where 40% were very bothered by ringing telephones. The overall site mean for environmental noise was fairly low, 2.14, and better than the scale midpoint of 2.5.

The next series of entries in Table 3 present data on the bothersomeness of people walking around and being too close. Ratings for all buildings were low for these scales, with a site mean of 2.2. This suggests that these two issues were not particularly bothersome (since "4" meant "very bothersome"). On the other hand, ratings of conversational privacy on a five-point scale where 5 meant "excellent" were quite low, indicating that this was a concern to all the occupants. Figure 11 reveals that 58-78% of the respondents considered their conversational privacy to be "poor" to "fair". The renovation improved the situation in 268 -- but 58% of the respondents still found it unacceptable. Ratings of visual privacy were somewhat more positive, with a marked improvement in the ratings for 268 following the renovation. Here 10% rated their visual privacy as good before the renovation, whereas 35% rated it as "good" (or "excellent") after the renovation. Nevertheless, the site mean for privacy in general, 2.11, was somewhat below the Canadian rating of 2.3. Both the site mean and the Canadian rating for privacy were well below the scale midpoint of 3 for these scales, indicating potential problems in this area.

Table 3. Mean Ratings of Reaction to Noise, Space and Privacy Conditions in the Buildings Studied.

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
			Office Noise				
COWRKHR	1.57	1.48	1.79	1.38	1.54	1.49	297
PEPTALK	2.05	2.41	2.53	2.68	2.56	2.53	294
avg	1.81	1.95	1.44	2.03	2.05	**2.01**	
Canadian Rating for Office Noise Mean = 2.9 +/- 0.9							
			Building Noise				
NOISEHAL	1.90	1.85	1.88	1.91	1.79	1.86	288
NOISEEQP	2.00	2.27	2.22	2.29	2.04	2.19	291
NOISEPHN	2.14	2.33	3.00	2.49	2.42	2.44	293
NOISEVNT	1.86	2.08	1.83	2.03	1.82	1.96	289
NOISEPRT	2.06	2.30	2.11	2.27	2.19	2.23	287
avg	1.99	2.17	2.21	2.20	2.05	**2.14**	
Canadian Rating for Building Noise Mean = 4.4 +/- 0.7							
WRKNOISE	3.24	2.82	2.79	2.53	2.50	2.65	295
			Privacy				
PEPLCLOS	1.95	2.14	2.33	2.43	2.30	2.29	290
PEPLWALK	2.00	1.90	2.39	2.15	2.18	2.10	290
avg	1.98	2.02	1.57	2.29	2.24	2.20	
VISPRIV	2.61	2.24	2.84	1.88	2.74	2.31	301
CONVPRIV	1.79	1.80	1.95	1.70	2.29	1.90	307
avg	2.20	2.02	2.39	1.79	2.51	2.11	
Canadian Rating for Privacy Mean = 2.3 +/- 1.0							

Table 3 Continued.

Space

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
WSSPCAMT	3.33	2.97	2.84	2.85	3.17	3.00	309
STORAGE	2.41	1.99	2.37	2.03	2.57	2.21	305
WRKSPACE	2.78	2.50	2.58	2.55	2.77	2.62	305
WALLSPC	3.00	2.64	2.74	2.27	2.63	2.54	306
ARGMTWS	3.30	3.04	2.89	2.82	3.09	2.98	303
avg	2.97	2.63	2.68	2.50	2.85	2.67	

Canadian Rating for Spatial Comfort Mean = 3.3 +/- 1.0

Windows

NOVIEW	2.33	3.05	2.12	2.57	2.38	2.58	276
WEATHER	2.41	1.42	1.95	1.97	2.07	1.91	297
MISSVIEW	2.24	1.42	3.06	1.92	2.11	1.95	296
avg	2.33	1.96	1.78	2.15	2.19	2.15	

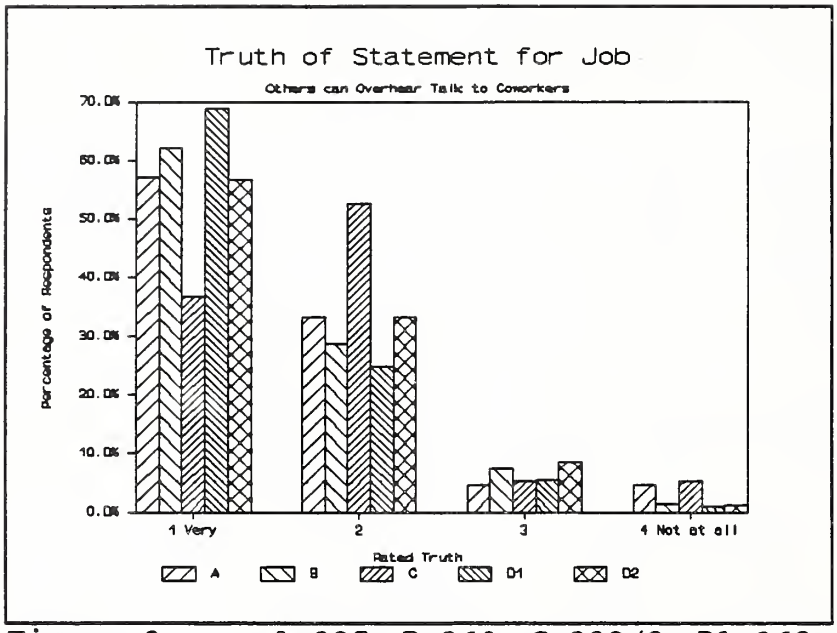

Figure 9. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 9. Percentage of respondents rating the truth of the statement that they are frequently overheard by coworkers.

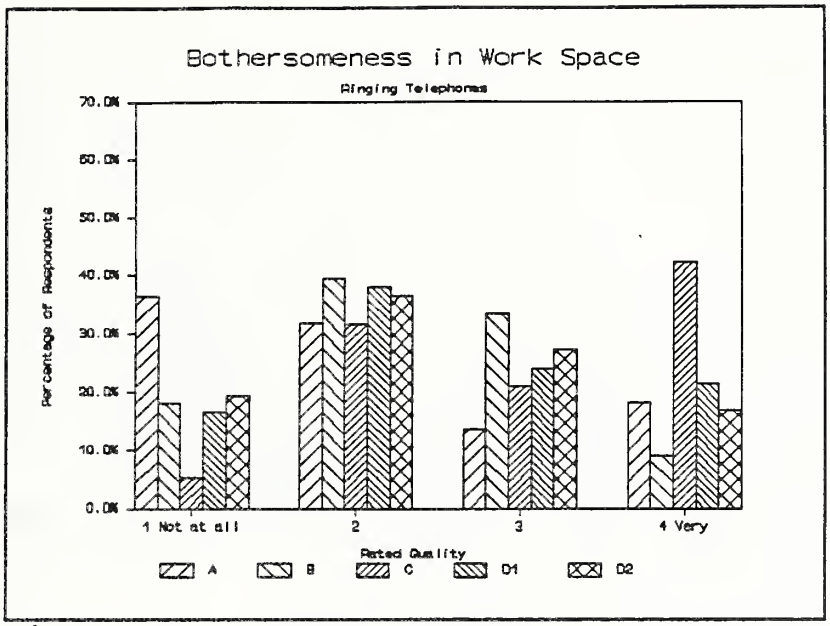

Figure 10. A=235; B=260; C=293/8; D1=268-1; and D2=268-2.

Figure 10. Percentage of respondents rating the bothersomeness of ringing telephones in their office on a 4-point scale.

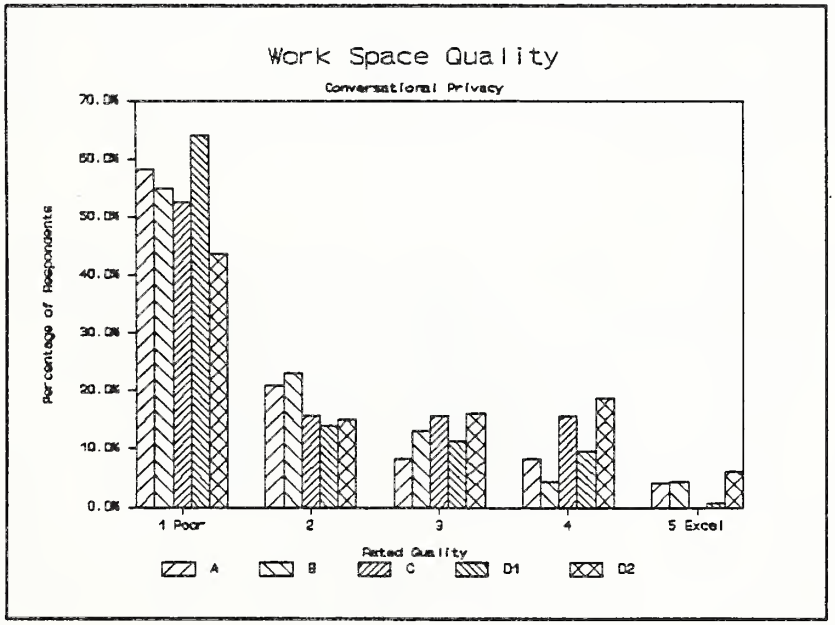

Figure 11. Percentage of respondents rating conversational privacy in their offices on a 5-point scale of poor to excellent.

2.5 Space and Windows

A major issue was the amount of space in the work station, including space for work, storage, surface area, personal items, and general arrangement for doing work. Table 3 demonstrates that the mean ratings were relatively low (below the scale midpoint), particularly for storage space, surface area, and wall space. Figure 12 reveals that between 50 and 70% of the respondents rated their storage space as "poor" to "fair", with less than 10% in any building considering it to be "excellent". Figure 13 demonstrates that about 40% in all buildings felt that they did not have enough surface area to do their jobs properly. Although conditions for storage and space in 268 improved following the renovation, 50% of the respondents remained dissatisfied. Ratings for the amount of space and arrangement of the space-- more general questions -- were somewhat higher. Yet, the overall mean for the five questions was markedly below the Canadian rating of 3.3, as well as below the scale midpoint of 3.0. While the renovation in 268 increased the ratings, especially for storage, they remained below the Canadian rating. These data suggest that lack of storage space and surface area for work continued to be problem areas in all buildings.

Since all the buildings were virtually windowless, a series of questions dealt with the reaction to the absence of windows. Responses to a question about a view out during break or at lunch were overwhelmingly positive with 67% answering it as "yes". Answers to a question about the lack of a view out indicated that this was particularly bothersome to those in 260 and 268 (mean ratings of 2.12 to 2.57) on a 4 point scale. Figure 14 indicates that 75% of the respondents in 260 missed having a view out, while only 10-30% of those in 293/8 and 235 were similarly bothered. The desire to know about the weather and being bothered by the lack of a view out was very strong for those in 260 (mean was 1.42) and 268 (mean was about 2.0). These findings reinforce the desirability of providing a separate windowed area for breaks and lunch, and allowing people to go outside during lunch.

2.6 Appearance and Furnishings

Another important concern, particularly following the renovation in 268, was the general appearance of the work station and materials, as well as overall satisfaction with the furniture, equipment, and chairs. Ratings presented in Table 4 were generally positive and above 3 on the 5 point scale, with the exception of a general question about how the offices looked. Ratings for this question tended to be low (below 2.8) particularly in 260 and 268 before the renovation. As figure 15 demonstrates, however, the renovation had a dramatic impact on the answers to this question, increasing the mean rating from 2.5 to 3.45, and the frequency of those rating it as "pretty good" or "excellent" from about 23% to 63%. Figure 16 demonstrates a similar improvement in the ratings for the condition of desks and chairs, which went from a mean of 2.96 (the lowest of any building) before the renovation to 3.98 after. Ratings for furniture satisfaction and chair comfort were similar and reasonably positive across buildings, particularly following the renovation in 268.

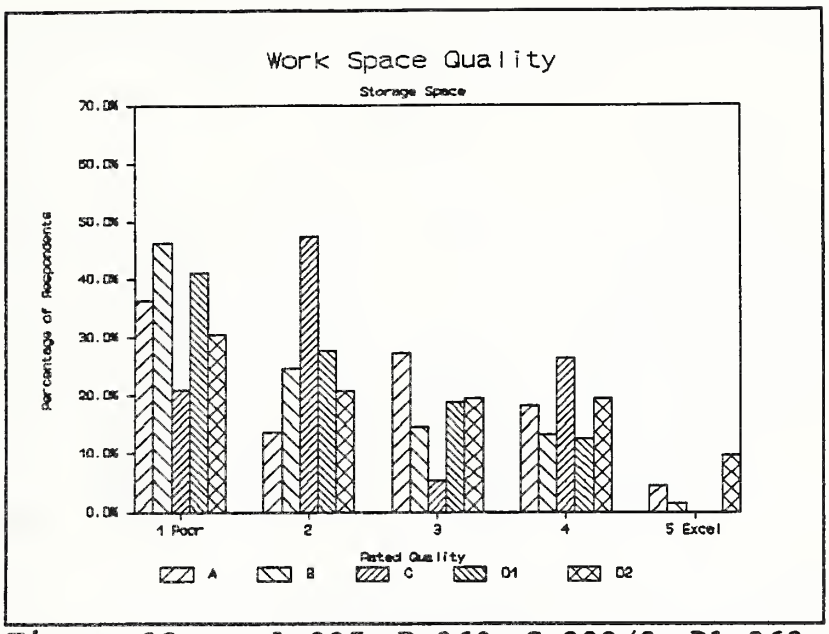

Figure 12. A=235; B=260; C=293/8; D1=268-1; and D2=268-2.

Figure 12. Percentage of respondents rating the amount of storage space in their work stations on a 5-point scale.

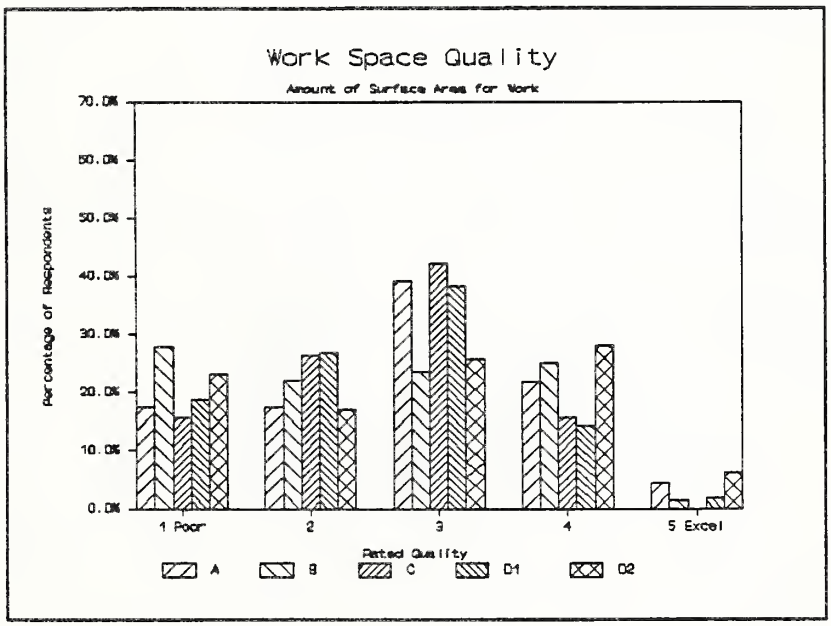

Figure 13. Percentage of respondents rating the amount of surface area for doing their work on a 5-point scale.

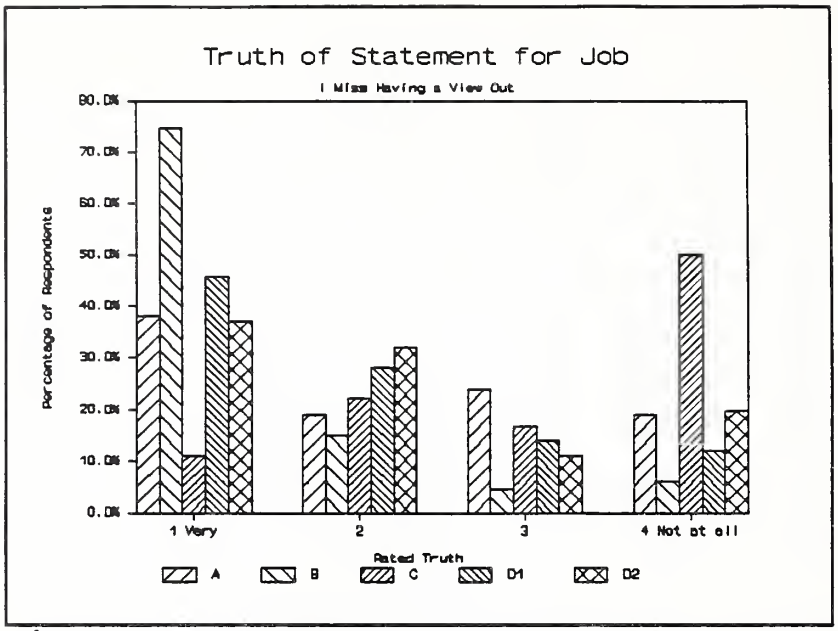

Figure 14. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 14. Percentage of respondents rating the truth of the statment "I miss having a view out" on a 4-point scale.

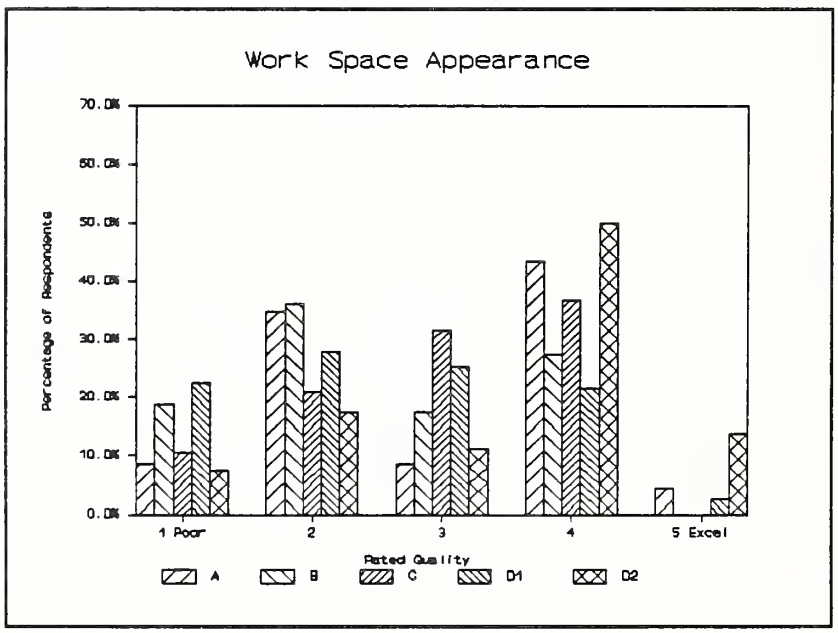

Figure 15. Percentage of respondents rating the appearance of their work station on a 5-point scale of poor to excellent.

Table 4. Mean Ratings of General Appearance and Furniture Condition in the Buildings Studied.

	BLDG 235	BLDG 260	BLDG 293/98	BLDG 268-1	BLDG 268-2	SITE MEAN	TOTAL N
Appearance							
LOOKWS	3.00	2.54	2.95	2.55	3.45	2.84	303
WSMATL	3.38	3.68	3.53	2.96	3.98	3.46	307
EQUIPSAT	3.75	3.20	2.74	3.05	3.30	3.19	305
FURNSAT	3.38	3.14	3.21	2.78	3.32	3.08	305
CHRCMFT	3.08	3.57	3.26	3.15	3.26	3.27	307
avg	3.32	3.23	3.14	2.90	3.46	**3.17**	
Chair Condition							
CHAIRMOV	2.71	2.93	2.74	2.61	2.67	2.72	277
CHRHGT	2.43	2.77	2.32	2.39	2.49	2.50	299
CHRBACK	2.35	2.57	2.05	2.33	2.23	2.34	288
CHAIRCON	2.63	3.04	2.74	2.73	2.73	2.79	303
CHRADJT	2.39	2.83	2.53	2.57	2.54	2.60	295
avg	2.50	2.83	2.47	2.52	2.53	**2.59**	
Color of Furnishings							
FURNCOLR	2.83	3.15	3.16	2.73	3.68	3.11	299
WALLCOLR	3.04	2.51	3.58	3.06	3.48	3.08	307
avg	2.94	2.83	3.37	2.90	3.58	**3.10**	
Maintenance							
FURNDUST	2.88	2.24	2.74	2.77	2.95	2.70	293
CARPET	2.65	2.88	2.68	3.56	3.22	3.17	270
avg	2.76	2.56	2.71	3.17	3.09	**2.94**	

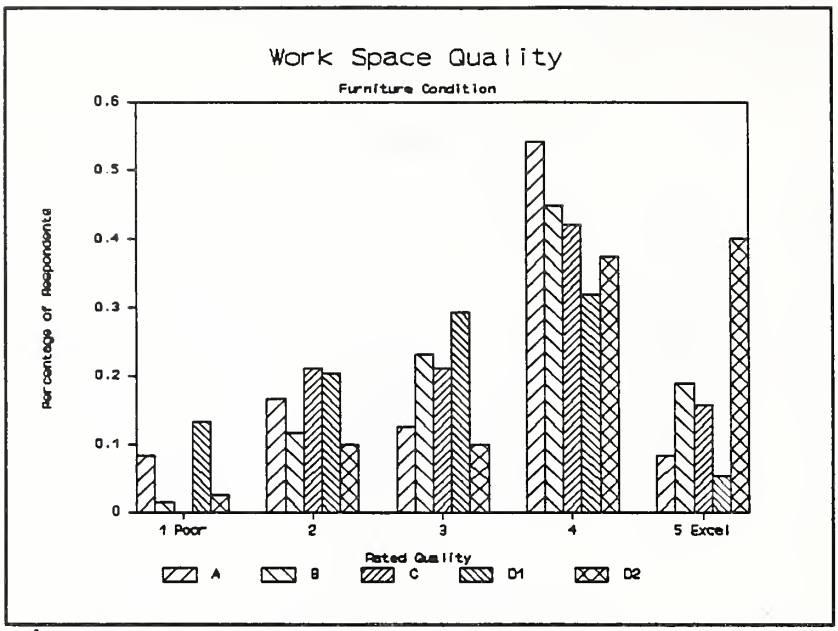

Figure 16. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 16. Percentage of respondents rating the condition of their furniture on a 5-point scale of poor to excellent.

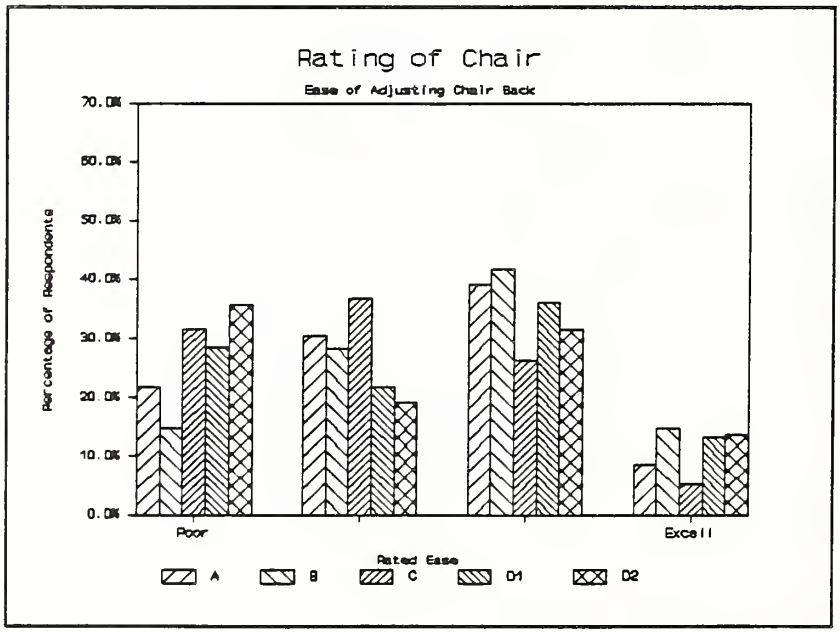

Figure 17. Percentage of respondents rating the ease of adjusting their chair back.

Satisfaction with equipment varied quite a bit with those in 293/8 being most dissatisfied. Here 41% expressed dissatisfaction as compared with 15% in 235. Specific suggestions for improving equipment are discussed at greater length in section 3. The mean site rating of 3.19 was fairly high, however.

The next entries in table 4 present responses to chair characteristics using a four point scale of poor to excellent. Ratings were generally slightly above the theoretical scale midpoint of 2.5. The lowest ratings occurred for a question about the chair back, where between 15 and 35% indicated that the ease of adjustment was poor. This was particularly true for building 293/8 and 268 as shown in figure 17. Unlike the findings reported by Rubin and Collins (1988), chair performance did not appear to be a major problem, with 40-55% considering chair condition to be "good".

Ratings for questions about the color of the furniture and walls varied quite a bit between buildings. Although the overall mean was about 3.0, the mean for wall color in 260 was substantially below that at 2.51. Here 48% rated wall color as "poor" to "fair". The greatest improvement occurred in 268 where the mean rating improved from 2.7 to 3.7 following the renovation. Figure 18 illustrates the marked shift in ratings in 268 where 22% judged furniture color as "good" to "excellent" before the renovation and 62% gave such ratings after. Ratings for maintenance were not as positive with about 62% of those in building 260 considering dust to be a problem. Similarly ratings for carpet condition were relatively low in buildings 235, 260 and 293/8, with 35-45% considering it to be "fair" to "poor". Interestingly, ratings of carpet condition dropped in 268 following the renovation with 15% fewer people giving it an "excellent" rating. Yet its condition was still rated as better (mean 3.22) than in the other buildings (with means of 2.65 to 2.88).

2.7 Health Issues

The next questions dealt with the reported health of the occupants in terms of symptoms that they believed to be related to their office environment. Here a high rating meant frequent occurrence of the symptoms. Although all symptoms had a mean rating below 3, indicating relatively infrequent occurrence, it is instructive to look at the distribution of ratings. Table 5 presents the frequency of occurrence of different symptoms in terms of "never", "rare", "sometimes", "frequently", and "most of the time". The mean ratings tended to be lowest in 235 and highest in 260 and 268 with little change following the renovation in 268.

Table 5 indicates that occupants did not consider dizziness and ear infections to be a frequent occurrence. Conversely, as many as 75% in 260 and 65-70% in 268 experienced headaches, at least some of the time, as figure 19 indicates. Sleepiness occurred at least some of the time to about 75% in 260 and about 60% in 268, whereas sore throats occurred frequently to only about 9 to 18% of the occupants, (although the incidence was greater in 260 and 268). Although runny noses and trouble focusing eyes were reported primarily in 260, they did not occur as frequently as irritated eyes, reported by 30-35% of those in 260 and 268. Occasional to frequent difficulties in concentrating were reported by about 70-75% of those in 260

Table 5. Health Related Responses to the Environment

		Never	Rarely	Some	Freq	Most	N	Mean	Std	Site Mean
235	HEADACHE	22.7%	50.0%	9.1%	13.6%	4.5%	22	2.27	1.09	2.82
260	HEADACHE	5.9%	19.1%	42.6%	27.9%	4.4%	68	3.06	0.94	
293/8	HEADACHE	15.8%	26.3%	31.6%	15.8%	10.5%	19	2.79	1.20	
268-1	HEADACHE	14.8%	19.1%	40.9%	19.1%	6.1%	115	2.83	1.09	
268-2	HEADACHE	17.1%	12.2%	48.8%	19.5%	2.4%	82	2.78	1.02	
235	DIZZY	54.5%	27.3%	13.6%	0.0%	4.5%	22	1.73	1.01	1.78
260	DIZZY	50.0%	22.1%	17.6%	5.9%	4.4%	68	1.93	1.14	
293/8	DIZZY	47.4%	36.8%	10.5%	0.0%	5.3%	19	1.79	1.00	
268-1	DIZZY	54.9%	20.4%	18.6%	4.4%	1.8%	113	1.78	1.01	
268-2	DIZZY	55.6%	29.6%	11.1%	1.2%	2.5%	81	1.65	0.90	
235	SLEEPY	36.4%	36.4%	22.7%	0.0%	4.5%	22	2.00	1.00	2.66
260	SLEEPY	13.4%	11.9%	47.8%	17.9%	9.0%	67	2.97	1.09	
293/8	SLEEPY	31.6%	36.8%	21.1%	10.5%	0.0%	19	2.11	0.97	
268-1	SLEEPY	21.2%	18.6%	31.0%	23.0%	6.2%	113	2.74	1.20	
268-2	SLEEPY	20.7%	22.0%	37.8%	17.1%	2.4%	82	2.59	1.07	
235	SORTHROT	54.5%	36.4%	0.0%	4.5%	4.5%	22	1.68	1.02	2.20
260	SORTHROT	34.3%	17.9%	34.3%	9.0%	4.5%	67	2.31	1.16	
293/8	SORTHROT	42.1%	31.6%	15.8%	5.3%	5.3%	19	2.00	1.12	
268-1	SORTHROT	38.1%	24.8%	19.5%	15.9%	1.8%	113	2.19	1.16	
268-2	SORTHROT	28.8%	27.5%	31.3%	8.8%	3.8%	80	2.31	1.09	
235	RUNNOSE	52.2%	21.7%	17.4%	4.3%	4.3%	23	1.87	1.12	2.38
260	RUNNOSE	34.3%	11.9%	40.3%	7.5%	6.0%	67	2.39	1.20	
293/8	RUNNOSE	31.6%	21.1%	26.3%	10.5%	10.5%	19	2.47	1.31	
268-1	RUNNOSE	33.6%	18.6%	29.2%	15.0%	3.5%	113	2.36	1.19	
268-2	RUNNOSE	24.7%	27.2%	25.9%	17.3%	4.9%	81	2.51	1.18	
235	IRRITEYE	39.1%	21.7%	21.7%	8.7%	8.7%	23	2.26	1.29	2.76
260	IRRITEYE	17.9%	11.9%	34.3%	28.4%	7.5%	67	2.96	1.19	
293/8	IRRITEYE	26.3%	26.3%	26.3%	15.8%	5.3%	19	2.47	1.19	
268-1	IRRITEYE	25.2%	13.0%	30.4%	26.1%	5.2%	115	2.73	1.24	
268-2	IRRITEYE	22.2%	9.9%	35.8%	24.7%	7.4%	81	2.85	1.23	
235	FOCUSEYE	27.3%	40.9%	9.1%	13.6%	9.1%	22	2.36	1.26	2.43
260	FOCUSEYE	19.4%	25.4%	25.4%	26.9%	3.0%	67	2.69	1.15	
293/8	FOCUSEYE	36.8%	31.6%	15.8%	10.5%	5.3%	19	2.16	1.18	
268-1	FOCUSEYE	32.7%	19.5%	24.8%	16.8%	6.2%	113	2.42	1.28	
268-2	FOCUSEYE	27.2%	32.1%	25.9%	11.1%	3.7%	81	2.32	1.10	
235	DIFFCONC	36.4%	22.7%	22.7%	13.6%	4.5%	22	2.27	1.21	2.84
260	DIFFCONC	4.5%	27.3%	54.5%	12.1%	1.5%	66	2.79	0.77	
293/8	DIFFCONC	15.8%	31.6%	36.8%	10.5%	5.3%	19	2.58	1.04	
268-1	DIFFCONC	7.8%	19.1%	49.6%	19.1%	4.3%	115	2.93	0.93	
268-2	DIFFCONC	8.8%	15.0%	50.0%	23.8%	2.5%	80	2.96	0.91	

		Never	Rarely	Some	Freq	Most	N	Mean	Std	Site Mean
235	FATIGUE	36.4%	36.4%	13.6%	9.1%	4.5%	22	2.09	1.12	2.69
260	FATIGUE	9.1%	15.2%	47.0%	27.3%	1.5%	66	2.97	0.92	
293/8	FATIGUE	21.1%	26.3%	36.8%	15.8%	0.0%	19	2.47	0.99	
268-1	FATIGUE	17.4%	18.3%	45.0%	15.6%	3.7%	109	2.70	1.04	
268-2	FATIGUE	7.4%	33.3%	46.9%	9.9%	2.5%	81	2.67	0.85	
235	EAR INF.	65.2%	26.1%	4.3%	0.0%	4.3%	23	1.52	0.93	1.46
260	EAR	73.8%	16.9%	6.2%	3.1%	0.0%	65	1.38	0.74	
293/8	EAR	73.7%	21.1%	5.3%	0.0%	0.0%	19	1.32	0.57	
268-1	EAR	68.2%	16.4%	8.2%	4.5%	2.7%	110	1.57	1.00	
268-2	EAR	73.4%	17.7%	6.3%	1.3%	1.3%	79	1.39	0.77	
235	COLDS	52.2%	39.1%	0.0%	4.3%	4.3%	23	1.70	1.00	2.10
260	COLDS	40.9%	33.3%	16.7%	7.6%	1.5%	66	1.95	1.01	
293/8	COLDS	31.6%	26.3%	31.6%	10.5%	0.0%	19	2.21	1.00	
268-1	COLDS	38.7%	23.4%	21.6%	12.6%	3.6%	111	2.19	1.18	
268-2	COLDS	30.0%	33.8%	25.0%	8.8%	2.5%	80	2.20	1.04	
235	SINUS	52.2%	21.7%	4.3%	13.0%	8.7%	23	2.04	1.37	2.48
260	SINUS	40.9%	12.1%	21.2%	12.1%	13.6%	66	2.45	1.46	
293/8	SINUS	31.6%	21.1%	31.6%	5.3%	10.5%	19	2.42	1.27	
268-1	SINUS	35.7%	15.2%	26.8%	13.4%	8.9%	112	2.45	1.33	
268-2	SINUS	27.5%	15.0%	30.0%	16.3%	11.3%	80	2.69	1.33	
235	ALLERGY	52.2%	30.4%	4.3%	4.3%	8.7%	23	1.87	1.23	2.14
260	ALLERGY	56.1%	15.2%	10.6%	9.1%	9.1%	66	2.00	1.36	
293/8	ALLERGY	42.1%	21.1%	21.1%	5.3%	10.5%	19	2.21	1.32	
268-1	ALLERGY	45.4%	17.6%	19.4%	10.2%	7.4%	108	2.17	1.30	
268-2	ALLERGY	40.5%	17.7%	24.1%	10.1%	7.6%	79	2.27	1.29	

		None	1-2da	3-5da	6-12	12+	N
235	LONGSICK	47.8%	47.8%	0.0%	4.3%	0.0%	23
260	LONGSICK	33.3%	34.8%	15.9%	11.6%	4.3%	69
293/8	LONGSICK	36.8%	15.8%	21.1%	26.3%	0.0%	19
268-1	LONGSICK	40.0%	26.4%	17.3%	10.0%	6.4%	110
268-2	LONGSICK	26.8%	30.5%	30.5%	6.1%	4.9%	82

		Very True			Not at all True	N	Mean	Std	Site Mean
235	TIREDEYE	4.8%	33.3%	33.3%	28.6%	21	2.86	0.89	2.45
260	TIREDEYE	13.6%	43.9%	28.8%	13.6%	66	2.42	0.89	
293/8	TIREDEYE	21.1%	42.1%	26.3%	10.5%	19	2.26	0.91	
268-1	TIREDEYE	19.3%	36.7%	31.2%	12.8%	109	2.38	0.94	
268-2	TIREDEYE	12.3%	40.7%	30.9%	16.0%	81	2.51	0.90	
235	WORKSAT	47.6%	47.6%	0.0%	4.8%	21	1.62	0.72	1.77
260	WORKSAT	43.9%	50.0%	3.0%	3.0%	66	1.65	0.69	
293/8	WORKSAT	26.3%	52.6%	21.1%	0.0%	19	1.95	0.69	
268-1	WORKSAT	28.2%	60.9%	10.0%	0.9%	110	1.84	0.63	
268-2	WORKSAT	35.4%	54.9%	7.3%	2.4%	82	1.77	0.69	

		Very True		Not at all True		N	Mean	Std	Site Mean
235	WRKACR	76.2%	19.0%	4.8%	0.0%	21	1.29	0.55	1.38
260	WRKACR	70.1%	28.4%	1.5%	0.0%	67	1.31	0.50	
293/8	WRKACR	47.4%	36.8%	5.3%	10.5%	19	1.79	0.95	
268-1	WRKACR	68.8%	29.4%	1.8%	0.0%	109	1.33	0.51	
268-2	WRKACR	62.2%	32.9%	4.9%	0.0%	82	1.43	0.58	

		Not at all True		Very True		N	Mean	Std	Site Mean
235	WRKIMPT	0.0%	4.8%	4.8%	90.5%	21	3.86	0.47	3.61
260	WRKIMPT	1.5%	3.0%	18.2%	77.3%	66	3.71	0.60	
293/8	WRKIMPT	10.5%	15.8%	21.1%	52.6%	19	3.16	1.04	
268-1	WRKIMPT	2.8%	5.6%	24.1%	67.6%	108	3.56	0.72	
268-2	WRKIMPT	0.0%	8.5%	20.7%	70.7%	82	3.62	0.64	
235	CONCNTRT	0.0%	9.1%	50.0%	40.9%	22	3.32	0.63	3.34
260	CONCNTRT	0.0%	6.1%	39.4%	54.5%	66	3.48	0.61	
293/8	CONCNTRT	5.3%	15.8%	21.1%	57.9%	19	3.32	0.92	
268-1	CONCNTRT	1.8%	7.3%	49.1%	41.8%	110	3.31	0.68	
268-2	CONCNTRT	3.7%	4.9%	52.4%	39.0%	82	3.27	0.72	
235	JOBSAT	4.8%	9.5%	66.7%	19.0%	21	3.00	0.69	3.04
260	JOBSAT	4.6%	13.8%	46.2%	35.4%	65	3.12	0.81	
293/8	JOBSAT	22.2%	33.3%	27.8%	16.7%	18	2.39	1.01	
268-1	JOBSAT	6.4%	11.9%	52.3%	29.4%	109	3.05	0.82	
268-2	JOBSAT	6.1%	13.4%	42.7%	37.8%	82	3.12	0.86	

		No	Yes	N		No	Yes	N
235	MILITARY	68.2%	31.8%	22	CIVILIAN	31.8%	68.2%	22
260	MILITARY	72.7%	27.3%	66	CIVILIAN	27.3%	72.7%	66
293/8	MILITARY	73.7%	26.3%	19	CIVILIAN	22.2%	77.8%	18
268-1	MILITARY	62.0%	36.0%	100	CIVILIAN	26.0%	74.0%	96
268-2	MILITARY	74.4%	25.6%	82	CIVILIAN	24.4%	74.4%	82

		Female	Male	N		Female	Male	N
235	SEX	18.2%	81.8%	22	268-1 SEX	25.2%	74.8%	107
260	SEX	43.9%	56.1%	66	268-2 SEX	20.7%	79.3%	82
293/8	SEX	26.3%	73.7%	19				

		Yes	No	N		Yes	No	N
235	GLASSES	54.2%	45.8%	24	BIFOCALS	95.7%	4.3%	23
260	GLASSES	50.7%	49.3%	69	BIFOCALS	95.7%	4.3%	69
293/8	GLASSES	47.4%	52.6%	19	BIFOCALS	84.2%	15.8%	19
268-1	GLASSES	33.6%	66.4%	110	BIFOCALS	63.9%	36.1%	97
268-2	GLASSES	32.9%	67.1%	82	BIFOCALS	74.4%	25.6%	82

		20-29	30-39	40-49	50-59	60+	N
235	AGE	0.0%	31.8%	31.8%	22.7%	13.6%	22
260	AGE	1.5%	36.8%	29.4%	23.5%	8.8%	68
293/8	AGE	0.0%	36.8%	26.3%	21.1%	15.8%	19
268-1	AGE	0.0%	22.9%	29.4%	28.4%	19.3%	109
268-2	AGE	0.0%	16.7%	30.8%	30.8%	21.8%	78

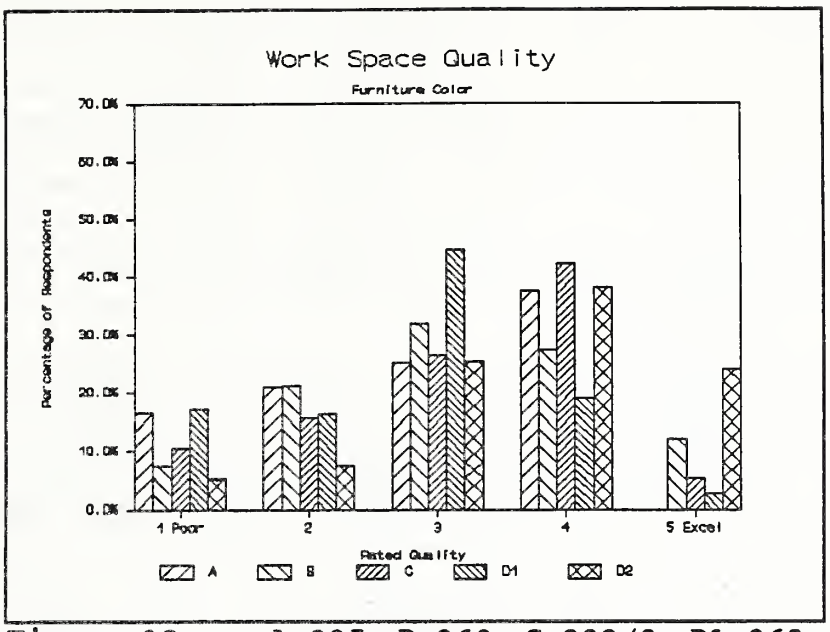

Figure 18. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 18. Percentage of people rating the color of their furniture on a 5-point scale of poor to excellent.

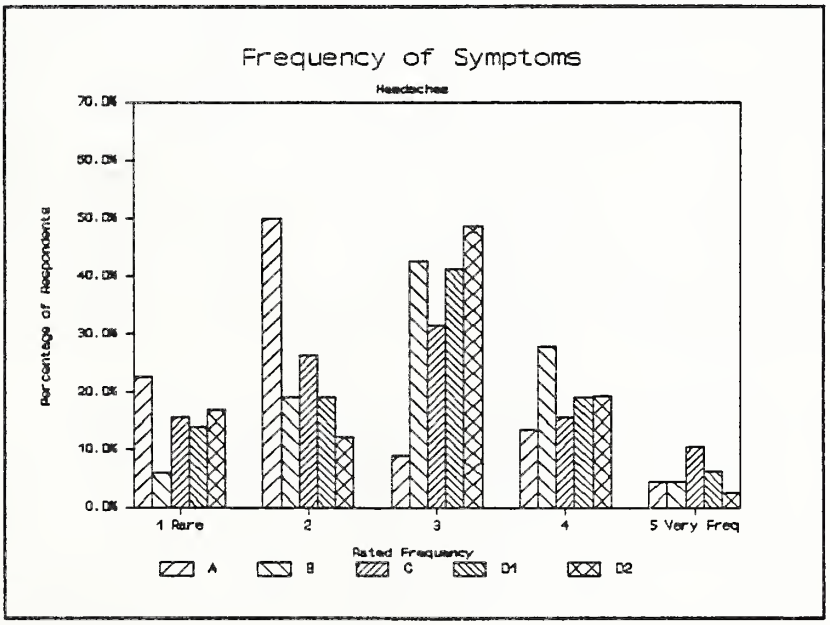

Figure 19. Percentage of people rating the frequency of headaches on a 5-point scale of rare to very frequent.

and 268, while problems with fatigue were mentioned by 60-75% of those in these two buildings. Finally, difficulties with sinuses were more prevalent than colds or allergies, again most frequently in 260 and 268. Inspection of table 5 makes it very clear that problems with headaches, sleepiness, irritated eyes, difficulty in concentration, and fatigue were reported as occurring at least sometimes to 60% of those in buildings 260 and 268. Such a high frequency of health-related symptoms suggests possible problems specific to the two buildings - especially since these buildings also had the lowest ratings for air quality satisfaction. It would seem prudent to investigate this relationship further, particularly since some 30% of the respondents in these two buildings reported frequent headaches.

The air quality problems in 260 and 268 are partially borne out by the number of days reported being sick (LONGSICK) in the last six months -- with between 4-6% being ill for more than 12 days. Yet the data for sick leave reveals that a high percentage (26% -- or about 5 people) in building 293/8 reported being sick 6-12 days -- more than in any other building. People in 293/8 had reported frequent runny noses, colds, and headaches as well. These findings make the health-related effects of the buildings very difficult to determine -- although the problems in 260 and 268 may relate to air quality. Certainly a high incidence of headaches, irritated eyes, sleepiness, and difficulties in concentrating was reported for these two buildings. These conditions may have been annoying, but not serious enough to take sick leave.

2.8 Job Attitudes

The next entries in Table 5 present attitudes toward people's jobs, including job satisfaction, work accuracy, and work importance. Here a high rating indicated a positive attitude for these 4 point scales. The overall mean was 3.0 -- indicating a very positive reaction. The mean for work importance was one of the highest at the site -- 3.61 on a 4 point scale. As figure 20 indicates, more than 70% of those in 235, 260 and 268 felt that their jobs were very important. The lowest mean rating, 3.0, was given by those in building 293/8. Their ratings for overall job satisfaction shown in figure 21 were also the lowest at the site, with a mean of 2.39 as compared with ratings around 3 for the other buildings. As many as 85% in 260 and 269 expressed high levels of job satisfaction. In fact, the data suggest that the majority of the people at the site, particularly those in 260 and 268, took pride in their work and were satisfied with their performance.

Answers to questions about the accuracy and quality of people's work indicated that people felt that their work must be accurate (mean of 1.38 - a low rating meant a positive response) and that they were satisfied with the quality of their work (mean of 1.76). These ratings suggest that only about 5% felt dissatisfied with the accuracy and quality of their work. Those in 293/8 were again least positive, particularly for the accuracy of their work, although the mean ratings were very similar for the five groups. As noted in section 2.1 and shown in table 5, the work force was largely male, civilian, and between 30 and 49, with 45 to 67% wearing glasses, bifocals, or contacts.

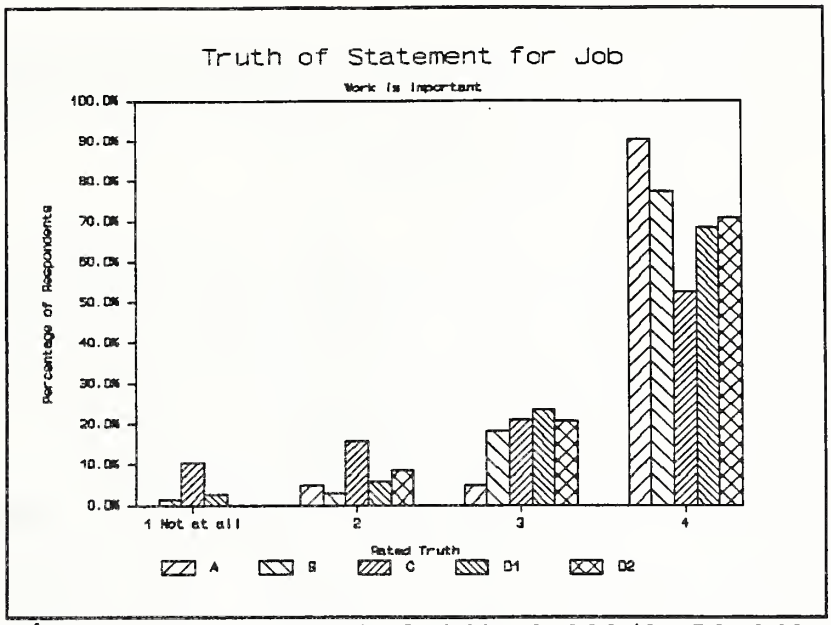

Figure 20. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 20. Percentage of respondents rating the truth that their job is important on a 4-point scale.

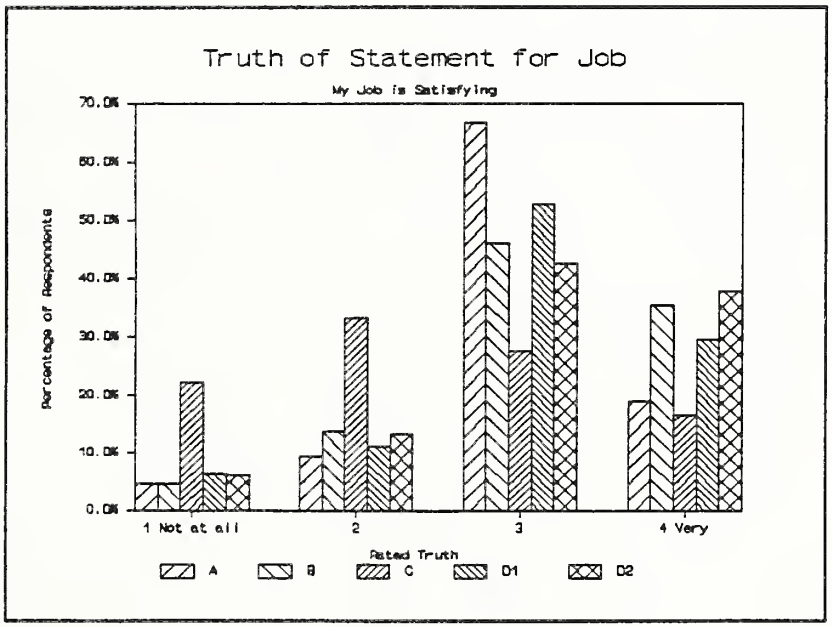

Figure 21. Percentage of respondents rating their satisfaction with their job.

2.9 General Feelings about Facility

Table 6 presents bipolar scale data on the feelings toward the buildings. On a bipolar scale, feelings about a particular attribute of a space are rated on a 5 point scale ranging from positive to negative -- such as pleasant to unpleasant. For these scales, a rating of "3" was neutral -- meaning that a building was neither pleasant nor unpleasant.

The mean ratings for the scale of "smelly-not smelly" (where a high rating meant "not smelly") indicated that building 235 was considered to be the least smelly, while 260 was the most. Building 268 was rated as somewhat more smelly following the renovation -- perhaps because of the new furniture. Ratings of "interesting-boring" indicated that all the buildings were more "boring" than "interesting", with 260 receiving the lowest mean rating (most boring). Scores for 268 improved following the renovation. Ratings for "stimulating-unstimulating" indicated that the buildings were not seen as stimulating. Ratings of "pleasantness" showed the greatest variation among buildings with those in 293/8 being highest and those in 260 being lowest. The ratings of building pleasantness shown in Figure 22 demonstrate that 20% of those in 260 rated it as "not very pleasant". The renovation in 268, however, increased its pleasantness. Although no building was rated as particularly colorful, 260 was judged as least colorful, with 42% rating it as drab. Building 268 was rated as somewhat more colorful following the renovation. Although responses to two questions about lighting, "well lit" and "bright", were more positive, examination of the responses reveals that 25-35% of those in 260 and 268 felt that their spaces were poorly lit and dim.

The mean ratings for questions about building maintenance and cleanliness were positive and similar for all buildings except 260, which was perceived as clean but poorly maintained. Maintenance in Building 268 improved following the renovation. Ratings of "confined-spacious" revealed that the buildings were all perceived to be confined, with 55% of those in 260 rating it as "confined" as shown in figure 23. Building 268 was also thought to be more confined following the renovation. Yet, the buildings were generally considered to be adequate for the job with mean ratings slightly above 3. Responses to a question about noise revealed that respondents rated their buildings as "noisier" rather than quiet. In particular, 45% of those in 268 (before and after the renovation) rated it as noisy, as did 39% in 260. All buildings were rated as more "humid" than "dry", except 293/8 which was seen as neutral by 72% of the respondents. Responses for temperature varied, with 235 and 268-1 receiving higher mean ratings (indicating that they were "hot"). About 13% felt that building 260 was cold, while 18% thought that 268 was too warm before the renovation, but only 5% thought that it was too warm after. (The change in outside temperature from August to January may be more responsible for this shift in attitudes than the renovation itself). The ratings shown in table 5 suggest that respondents were somewhat more negative than positive about their buildings. People were most negative about spaciousness and colorfulness and most positive about cleanliness and adequacy for their jobs. Furthermore, respondents were most positive about building 235 and least positive about 260, with the renovation in 268 improving peoples' attitudes about its appearance.

Table 6. Mean Ratings of Building Appearance from the Environmental Conditions in the Buildings Studied.

Building Appearance

	BLDG 235	BLDG 260	BLDG 293/8	BLDG 268-1	BLDG 268-2	Site Mean	Total N
BLDGSMEL	3.43	2.87	3.33	3.13	2.98	3.06	302
BLDGINTR	2.88	2.20	2.72	2.54	2.70	2.54	303
BLDGPLST	3.10	2.35	3.56	2.84	3.05	2.85	304
BLDGCLR	2.46	2.00	2.78	2.37	2.89	2.46	298
BLDGBRIT	3.22	2.72	3.28	2.86	2.86	2.88	303
BLDGMAIN	3.13	2.65	3.39	3.09	3.35	3.08	300
BLDGCLEN	3.26	3.06	3.17	3.30	3.37	3.25	299
BLDGSPAC	2.65	2.16	2.78	2.50	2.36	2.41	304
BLDGADQT	3.39	3.07	3.56	2.99	3.24	3.14	301
BLDGATMS	3.13	2.46	2.78	2.74	2.84	2.74	140
avg	3.06	2.56	3.13	2.83	2.96	2.84	
			Additional Measures				
BLDGQUIT	3.09	3.34	3.22	3.54	3.38	3.40	282
BLDGTEMP	3.36	2.90	2.94	3.25	3.00	3.09	294
BLDGHUMD	2.79	2.46	3.11	2.71	2.97	2.76	302
avg	3.08	2.90	3.09	3.17	3.12	3.08	

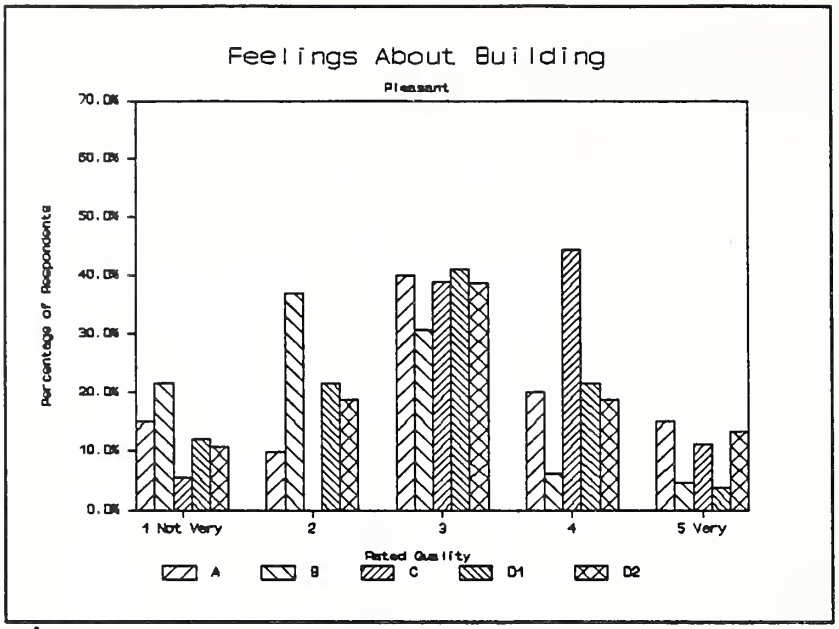

Figure 22. A=235; B=260; C=293/8; D1=268-1; D2=268-2.

Figure 22. Percentage of respondents rating their building as pleasant on a 5-point scale of "not very" to "very".

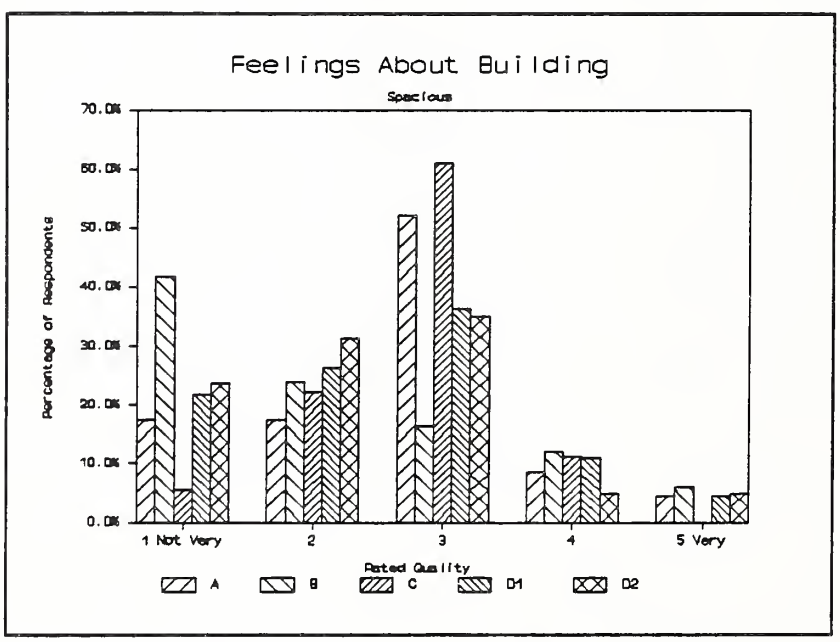

Figure 23. Percentage of respondents rating their building as spacious on a 5-point scale of "not very" to "very".

2.10 Comparison of Rating Differences

Several different procedures were used to make meaningful comparisons of the rating data obtained for the site. A coding scheme was developed to compare the differences from the scale midpoint for each rating for the five buildings. In this scheme, the direction of differences from the scale midpoint was coded by "+", "0", or "-", depending on the relationship to the mean. In addition, an attempt was made to determine the size of the difference. For this comparison, a difference of 0.5 was considered to be meaningful; differences of 1.0 were considered to be important. An indication of the size of the difference is given by the number of "+'s" or "-'s". Thus, for a five-point scale, the following scheme was used:

1.90 → 2.39 = - -; 2.40 → 2.89 = -;
2.90 → 3.09 = 0;
3.10 → 3.59 = +; and 3.60 → 4.10 = + +.

For a four-point scale, the following scheme was used:

1.40 → 1.89 = - -; 1.90 → 2.39 = -;
2.40 → 2.59 = 0;
2.60 → 3.09 = +; and 3.10 → 3.60 = + +.

This scheme thus allows one to compare differences in scales as well as in buildings, and provides an overview of the magnitude of the difference from the scale midpoint of the rating scale. The codings are such that a "-" always means a negative rating; "+" always means a positive one. Thus, for the scales of "bothersomeness", ratings above 2.5 were treated as negative since they indicated "more bothersomeness". Table 7 presents the coding scheme for each of the questions rated.

Table 7 also presents information on the statistical significance of the ratings. An asterisk (*) indicates differences from the scale midpoint that were significant according to a t-test with a significance level of $p < .01$. Because these differences were also lower than expected, they may well indicate problem areas. Significant differences in which performance was better than expected are identified by a double asterisk (**). In the statistical comparisons, the mean for all buildings combined was compared against the scale midpoint.

Use of the coding system and statistical comparisons allowed several areas of potential concern to be identified along with the buildings in which these concerns arose. Entries had to have at least a double minus rating (- -) to and be statistically below the scale midpoint to be included as a problem area. According to this technique, at least six broad areas of concern were identified. These include:

a. Problems related to the HVAC system
    1. Air Circulation (AirCirc)
    2. Heating
    3. Cooling
    4. Air Quality Satisfaction (AirQSat)

Table 7. Rating scheme applied to the results from the questionnaire for the different buildings.

Item	Bldg 235	Bldg 260	Bldg 293/8	Bldg 268-1	Bldg 268-2
WSSPCAMT	+	0	--	--	+
WSMATL**	+	+ +	+	0	+ +
AMTLTWK**	-	0	+ +	0	+
LOCCLNLT	--	0	+ +	0	+
WALLCOLR	0	--	+	0	+
FURNCOLR	--	+	+	--	+ +
*STORAGE	--	-- --	-- --	-- --	--
*CONVPRIV	-- -- --	-- -- --	-- --	-- -- --	-- --
COWORKER	+ +	+	+ +	+	+
*WALLSPC	0	--	--	-- --	--
*ADJAMTLT	-- --	-- -- --	-- --	-- --	--
*VISPRV	--	-- --	--	-- -- --	--
*WRKSPC	--	--	--	--	--
CHRCOMFT**	0	+	+	+	+
*AIRCIRC	--	-- -- --	--	-- -- --	-- --
*HEATING	0	-- --	--	-- --	-- --
*COOLING	0	-- --	+	-- -- --	-- --
*AIRQSAT	--	-- -- --	--	-- -- --	-- --
CARPET	--	--	--	+	+
*FUMES	--	--	0	--	--
*FURNDUST	--	-- --	--	--	0
ARGMTWS	+	0	--	--	0
LOOKWS	0	--	0	--	+
*RTLTBRK	--	--	+	-- -- --	-- -- --
RTLTHALL**	+	+	--	0	+
RTLTRSTM**	0	+	+	+	+ +
RTLTSPAC	+	0	+	--	+
*RTLTCONF	-- --	+	-- --	0	+
LTREAD**	+ +	0	+ +	0	+
LTVDT	+	--	+ +	--	0
LTFILE	+	0	+ +	--	+
*LTDRAFT	--	-- --	--	--	--
*LTOTHER	--	-- -- --	-- --	--	0
*AMTLTBRT	--	--	--	--	--
WSLITSAT	+	0	+ +	--	+
VDTFLICK**	+	+	+	+	+ +
VDTSTSC**	+	+ +	+ +	+ +	+ +
VDTANGSC**	+ +	+ +	+ +	+	+ +
VDTGLARE	0	0	+	--	0
VDTANGKB**	+	+	+ +	+	+
VDTDSKHGT**	+	+ +	+ +	+	+
VDTSEAT**	+	+ +	+ +	+	+

Table 7 Continued.

Item	Bldg 235	Bldg 260	Bldg 293/8	Bldg 268-1	Bldg 268-2
VDTREFSC	0	0	+	--	0
VDTREAD**	+	+	+ +	+	+
VDTBRTLT**	0	+	+ +	0	+
VDTADJSC**	+	+	+	+	+
VDTSPACE	--	0	+	0	0
VDTADJLT	--	0	+	--	0
NOISEPHN	+	+	--	0	0
PEPTALK	+	0	0	--	0
NOISEPRT**	+	+	+	+	+
NOISEEQP**	+	+	+	+	+
NOISEVNT**	+ +	+	+ +	+	+ +
NOISEHAL**	+	+ +	+ +	+	+ +
GLRWKSF**	+	+	+	+	+
GLRCLNLT**	+	+	+	+	+
DIMLT**	+	+	+ +	+	+
NOVIEW	+	--	+	0	+
HOTSUMR	+	+	0	--	--
COLDWTR	+	+	0	--	0
DRAFTS**	+	+	+	+	+
*STUFYAIR	+	--	+	--	--
PEPLWALK**	+	+	+	+	+
PEPLCOS**	+	+	+	0	+
SMELLS**	+	+	+	0	+
SMOKE	+	+	+	0	--
TEMPSWN	+	--	+	--	--
*AIRQUAL	+	--	+	--	--
NOTSKLT	+	--	+	--	0
*BLDGPLST	+	-- --	+	--	0
BLDGADQT	+	0	+	0	+
BLDGMAIN	+	--	+	0	+
*BLDGSPAC	--	-- --	--	--	-- --
*STIMUL	--	-- --	--	-- --	--
*WELLIT	0	--	+	--	--
*BLDGHUMD	--	--	--	--	0
BLDGCLEN	+	0	+	+	+
*BLDGQUIT	0	+	+	+	+
*BLDGCLR	--	-- --	--	--	--
*BLDGINTR	--	-- --	--	--	--
BLDGTEMP	--	0	0	--	0
*BLDGATMS	+	--	--	--	--
BLDGSML	+	--	+	+	0
BLDGBRT	+	--	+	--	--
FURNSAT	+	+	+	--	+
EQUIPSAT	+ +	+	--	0	+

Table 7 Continued.

Item	Bldg 235	Bldg 260	Bldg 293/8	Bldg 268-1	Bldg 268-2
CHAIRMOV**	+	+	+	+	+
CHRHGT	0	+	--	--	0
*CHRBACK	--	0	--	--	--
CHAIRADJ	--	+	0	0	0
CHAIRCON**	+	+	+	+	+
WRKIMPT**	+ + +	+ + +	+ +	+ +	+ + +
*COWRKHR	-- --	-- --	-- --	-- -- --	-- --
JOBSAT	+	+ +	--	+	+ +
WRKACR**	+ + +	+ + +	+ +	+ + +	+ + +
EQUIP	+ +	+	0	+	+
TIREDEYE	+	0	--	--	0
NOMOVFWS	+	0	+	0	+
CONCNTRT**	+ +	+ +	+	+ +	+ +
WORKTIME	+ +	0	0	+	+
LTGHINDR**	+ +	+	+ +	+	+ +
WRKABILIT	+	0	0	0	+
WORKSAT**	+ +	+ +	+	+ +	+ +
*MISSVIEW	--	-- --	+	--	--
WRKNOISE	+ +	+	+	0	0
WORKFAST	+	+ +	+	+	+
*WEATHER	0	-- --	--	--	--

* Indicates statistically significant, and below the scale midpoint; hence a potential problem.

** Indicates statistically significant, and above the scale midpoint; hence not a problem.

b. Problems related to privacy

1. Conversational Privacy (Convpriv)
2. Visual Privacy (Vispriv)
3. Coworkers Overhearing Conversations (Cowrkhr)

c. Problems related to lighting

1. Inability to adjust amount of light (Adjamtlt) - All buildings
2. Right Light for Break (Rtltbrk) - 268-1; 268-2
3. Right Light for Conference Rooms (Rtltconf) - 235; 293/8
4. Light for Drafting (Ltdraft) - 260
5. Light for Other (Ltother) - 260; 293/8

d. Problems related to the interior spaces

1. Storage - all buildings
2. Spaciousness (Bldgspac) - 260; 268-2
3. Stimulating spaces (Stimul) - 260
4. Color - 260
5. Interesting - 260
6. Miss view out (MissView) - 260
7. Want to know weather (Weather) - 260
8. Furndust - 260

Three broad areas stand out as being particularly troublesome in almost all the buildings. These include problems with the HVAC systems (especially the air circulation portion), privacy, and lack of storage. Without doubt, building 260 was plagued with more complaints than the other buildings, although building 268 also experienced numerous problems. While some of these were corrected by the renovation, the concerns with indoor air quality, HVAC operation, and lack of space (and privacy) continued.

At the same time, the coding scheme allowed the identification of areas which did not cause problems, and which were coded positively (+ +, or + + +). These included:

1. Work Importance, Work Accuracy, Ability to Concentrate, and Work Satisfaction for all buildings.

2. Most all areas related to VDT operation in all buildings.

3. Questions related to lighting in buildings 293/8.

In fact, work importance, accuracy, satisfaction, and the ability to concentrate received very positive (and statistically significant) ratings in all buildings (although they were lower in buildings 293/8). This suggests that people took real pride in their work despite their concerns with the physical environment in which the work was performed.

3. Choices for Improvements to the Facility

3.1 Choices Selected as Improvements

Respondents were given a list of 17 possible changes that could be made to improve their work station. These ranged from more comfortable temperature, better lighting, and air quality, to access to the outside, and are listed in question 18 of the questionnaire (see Appendix A). Respondents were asked to select four of the possible choices and indicate the reasons for their selection.

Table 8 presents the percentage of times that each choice was selected by the occupants of each building. Choices are listed in order of the frequency of occurrence for each building. This table indicates that improvement in air circulation was among the first four choices in all buildings but that there was considerable variation in the other selections for the different buildings.

In building 235, improved lighting led the list, followed by improved air circulation. Greater privacy and change in color of walls, furnishings, and carpet tied for third and fourth place. In building 260, the first choices were improved air circulation and greater privacy followed by view out/daylight and improved air quality. Improvements in air circulation and quality were among the most frequent selections. For building 293/298, greater surface area was the first choice followed by less noise and more comfortable temperatures. Air quality and privacy were tied for fourth. For building 268, the choices included improvements in temperature, air circulation, privacy, and air quality before and after the renovation, although the order varied. The renovation in 268 decreased the number of selections for lighting and task lighting but increased the number of choices for greater surface area, decreased noise, and more daylight. Across all buildings, cleaning, moving further from co-workers, and greater access to the outside during breaks were the least frequently selected choices.

3.2 Reasons for Choices

Table B-2 in Appendix B lists the reasons given for the choices by choice type, beginning with air quality and air circulation. The rank of the choice (1, 2, 3 or 4) is listed first followed by the comment. Table 9 summarizes the reasons for the choices. The comments were reviewed and categorized according to the primary content, with the number of times each category occurred given in Table 9. Since not all people gave reasons for their choices, the totals are different from those given in the previous table. Yet, the frequency counts provide insight into the reasons for each choice. For more complete findings, the table in Appendix B should be studied.

Table 9 demonstrates that many people mentioned stuffy air with poor circulation and resulting health problems as the reasons for selecting improved air circulation. In 260, other complaints concerned the lack of windows for ventilation and fresh air, dirty vents, as well as the smoke. In 268, problems with stale, stuffy stagnant air and health problems were noted, as well as the lack of filtering of fumes from the maintenance shop and Table

8. Improvements to the working environment selected by respondents in the different buildings.

Choice 235		Choice 260		Choice 293		Choice 268-1		Choice 268-2	
	%		%		%		%		%
Litng	16.9%	AirCirc	12.4%	Surface	15.9%	Temp.	14.6%	AirCirc	13.2%
AirCirc	12.%	Privacy	12.4%	Noise	12.7%	AirCirc	12.8%	AirQual	12.6%
Privacy	9.6%	Daylt	11.6%	Temp.	11.1%	Privacy	11.3%	Temp.	12.3%
Color	9.6%	AirQual	10.7%	AirQual	7.9%	AirQual	11.3%	Privacy	9.3%
Temp	7.2%	Surface	9.5%	Privacy	7.9%	Litng	8.8%	Surface	8.6%
Daylt	7.2%	Temp	9.1%	AirCirc	6.3%	Surface	6.3%	Noise	7.0%
Surface	7.2%	Litng	7.0%	Break	6.3%	Noise	6.0%	Daylt	6.6%
AirQual	6.0%	Color	6.6%	Chairs	6.3%	Daylt	5.5%	Break	5.6%
TaskLt	6.0%	Noise	4.1%	Furn.	4.8%	Break	5.5%	Litng	5.6%
Furn.	4.8%	Break	3.7%	TaskLt	4.8%	TaskLt	4.8%	TaskLt	3.6%
Noise	3.6%	TaskLt	3.7%	Daylt	4.8%	Furn.	3.0%	Furn.	3.3%
Other	3.6%	Furn.	2.5%	Locat.	3.2%	Locat.	2.8%	Other	3.3%
Chairs	2.4%	Outside	2.5%	Litng	3.2%	Color	2.8%	Chairs	3.0%
Break	2.4%	Clean	2.1%	Clean	3.2%	Chairs	2.3%	Outside	2.0%
Locat.	1.2%	Locat.	1.7%	Color	1.6%	Outside	1.5%	Locat.	1.7%
Outside	0	Chair	0.4%	Outside	0	Clean	1.5%	Color	1.7%
Clean	0	Other	0	Other	0	Other	0.5%	Clean	0.7%
Choice N	83	Choice N	242	Choice N	63	Choice N	398	Choice N	302
Total N	23	Total N	69	Total N	19	Total N	115	Total N	82

Table 9. Reasons Given for Desired Changes to Work Stations

Air Quality

Category	235	260	293/8	268-1	268-2	Total
Stuffy air	3	12	2	13	15	45
Health problems	3	6	2	5	11	27
Poor filtering, venting	2	3	1	4	4	14
Smoking irritating	0	3	2	1	5	11
Smells, fumes	0	1	0	1	4	6
Need window for fresh air	1	3	0	0	1	5
Dirty vents	0	3	0	0	2	5
Swings in temperature	0	1	0	1	2	4
Extremes - hot summer, cold winter	0	0	0	1	3	4
column totals	9	32	7	26	47	121

Temperature

Category	235	260	293/8	268-1	268-2	Total
Swings in temperature	0	11	0	11	10	32
Extremes - hot summer, cold winter	1	2	4	15	7	29
Too hot	2	1	1	7	4	15
Too cold	0	4	1	2	4	11
Stuffy air	3	2	0	2	0	7
Health problems	0	0	0	5	2	7
Break down of HVAC system	0	0	0	4	1	5
column totals:	6	20	6	46	28	106

Lighting and Task Lighting

Category	235	260	293/8	268-1	268-2	Total
Need adjustable light	0	6	0	5	9	20
Glare, glare on VDT screen	0	4	1	11	1	17
Better visual performance	4	1	0	9	1	15
Light task area	3	1	2	4	5	15
Too dim	3	4	0	3	3	13
Health problems	0	1	1	3	0	5
Extreme variation in brightness	3	0	0	1	2	6
Replace bulbs	0	2	0	0	0	2
column totals:	13	19	4	36	21	93

Table 9 Continued.

Noise

Category	235	260	293/8	268-1	268-2	Total
Need quiet to concentrate	1	2	2	9	7	21
Conversations distracting	1	3	0	1	5	10
Interruptions, distractions	0	2	0	2	3	7
Equipment noise bothersome	1	1	1	2	2	7
Health	0	0	0	1	0	1
column totals:	3	8	3	15	17	46

Color, Break areas, Cleaning

Category	235	260	293/8	268-1	268-2	Total
Need break area, place to eat	1	6	3	7	7	24
Change colors	1	4	1	5	0	11
Dirty	0	5	2	1	2	10
Smoke is irritating	0	2	1	2	2	7
Paint walls	2	3	1	1	0	7
Confined, health	0	1	0	2	2	5
Need place to eat	0	1	0	4	0	5
Drab	0	1	0	1	2	4
Need view out	0	0	0	0	3	3
column totals:	4	23	8	23	18	76

Chairs and Furnishings

Category	235	260	293/8	268-1	268-2	Total
Chairs are uncomfortable	0	0	2	2	7	11
Chairs do not adjust	0	0	1	3	2	6
Furniture, chairs, too old	0	3	0	3	2	8
Need more storage,chairs, space	1	0	0	0	2	3
column totals:	1	3	3	8	13	28

Space and Furnishings

Category	235	260	293/8	268-1	268-2	Total
Need more surface, storage area	2	10	2	15	14	43
Need more space in the office	1	7	5	7	6	26
Conversations are distracting	1	2	0	2	4	9
column totals:	4	19	7	24	24	78

Table 9 Continued.

Privacy

Category	235	260	293/8	268-1	268-2	Total
Open area is very distracting	0	5	0	9	7	21
Need private area for counseling	1	8	1	5	4	19
Too many interruptions, distractions	0	4	0	5	3	12
Conversations are distracting	3	3	0	2	4	12
Need more space in the office	1	2	1	5	2	11
Need quiet for concentration	0	0	3	3	3	9
Need partitions, indiv. offices	1	3	0	1	1	6
Health	0	0	0	2	0	2
column totals:	6	25	5	32	24	92

Window and Access to Outside

Category	235	260	293/8	268-1	268-2	Total
Need windows	2	6	1	6	3	18
Improve mood, productivity, health	1	6	0	4	6	17
Office is too confined	1	8	0	3	1	13
Need view out, know weather	0	2	1	3	6	12
Need daylight, sunshine	1	2	0	2	2	7
Need break area, outside	0	0	1	3	2	6
Need window for fresh air	1	2	0	2	1	6
Need more variety, spaciousness	0	0	1	3	1	5
column totals:	6	26	4	26	22	84

Other

Category	235	260	293/8	268-1	268-2	Total
Management issues	1	2	3	3	1	10
Smoke is irritating	2	0	0	1	3	6
Need more storage area	0	0	0	3	1	4
Need more space	0	0	0	1	3	4
Improve phone service	0	0	1	2	0	3
Health	0	1	0	1	0	2
Need more surface area to work	0	0	0	1	0	1
Need window for fresh air	0	0	0	1	0	1
Interruptions, distractions	0	0	0	0	1	1
Glare is annoying	0	0	0	1	0	1
Improve floor	0	0	1	0	0	1
column totals:	3	3	5	14	9	34

smoking, both before and after the renovation. In addition, people claimed that the new furniture blocked ventilation even more. They also noted that the problems with dirty vents and ducts continued, and mentioned failures to enforce the "no smoking" policy. Comments in 293 related to general air quality, while those in 298 concerned smoking.

Most of the reasons for selecting improved temperature involved excessive swings and/or extremes in temperatures from day to day for all buildings. Those in 268 also complained of being too hot and needing air conditioning, while those in 260 complained of extreme fluctuations from too hot to too cold from day to day. Similar comments were made in 268, although there were also many statements that the air conditioning was not effective. In addition, many people mentioned being too cold in winter and too hot in summer. There was little change in these comments after the renovation. Similar complaints were made in building 293/298.

In general, the comments about lighting involved the need to light the task better, by using adjustable or directional lighting, as well as the need to improve the overall quality of the lighting. In 235, many comments indicated that the light was too bright in some areas, but not bright enough in others. In 260, people mentioned both the dimness of the overall lighting and problems with glare. Many suggested that adjustable task lighting could be used to solve these problems. In 268, frequent comments included glare and position of the overhead lighting. The systems furniture was moderately successful in that complaints about glare dropped noticeably following the renovation in 268. Nevertheless, many people commented that they needed more adjustable task lighting to direct the lighting where they needed it most, and away from computer and VDT screens. The comments in 293/298 concerned light source position and glare on computer screens.

Reasons for selecting improvements to noise, location near co-workers, and surface area included the need for more surface area, work space, and fewer distractions. In 235, people mentioned the need for more surface space for reviewing drawings and fewer distractions from conversations in the office. In 260, comments involved the need for more space for privacy and freedom from interruptions and distractions as well as to review printouts and drawings. Comments in 268 concerned distracting noises, conversations, crowding (people too close), and lack of space to review large documents. The number of observations about noise from distracting conversations, phones, and equipment increased after the renovation, with little change in the comments about lack of space. Similar statements about noise, distractions and lack of space were made in 293/298. Although privacy was treated separately from noise, the comments made it clear that excessive noise and interruptions were major reasons for wanting greater privacy.

In 235, privacy selections related to noise, overhearing conversations, and lack of space for private discussions. Similar comments were made in 260, together with the desire for a private area for individual discussions and counseling. Respondents noted that the openness of the space caused interruptions and distractions, which resulted in reduced productivity. In 268, problems with distractions and interruptions in open areas were mentioned, along with overhearing conversations and being overheard. There

was little change after the renovation. Relatively few comments about greater privacy were made in 293/298.

Many respondents mentioned the desirability of windows for their buildings. In 235, most comments addressed the beneficial impact of windows on mood, ventilation, and light. In 260, many people reported a sense of confinement due to lack of windows, need to know the weather, and have sunshine and fresh air in the office. In 268, the beneficial aspects of windows on mood and stimulation were noted, along with a desire for sunshine, daylight, and view out. Comments about the beneficial aspects of windows on mood and productivity increased after the renovation. In 293/8, people mentioned the desirable view outside -- which they could not see since they had no window.

The next topics covered were improved colors, break area, and more frequent cleaning. Suggestions for color included painting the walls in 235; decreasing drabness, improving variety, and painting the walls more frequently in 260; and adding variety and more cheerful colors in 268. The need for a separate break area was noted repeatedly in 268, particularly a place to eat besides one's desk and a separate place for smokers. The need for a non-smoking break area was mentioned repeatedly for 260 and 268. Lack of a break area continued to be an irritant in 268, even after the renovation. The few comments about cleaning were concentrated in 260. Most comments about improvements to the chairs and furnishings noted their age and worn-out condition. Requests for more adjustable chairs with better back support were common with many comments about uncomfortable chairs in 268 after the renovation. Finally, other comments included problems with smoking in 235, need for better management and attention to management's problems in 260, and problems with storage, working conditions, and telephones in both 268 and 298.

Review of the comments thus provides some insight into the areas that caused major concerns to the people at the site. Examination of their comments supports the data obtained with the questionnaire and provides additional insights into areas that troubled them. This list is headed by problems related to indoor air quality, including stuffy air, air circulation, and health. While the renovation was successful in improving the appearance of the space in 268, the comments indicate that people still perceived continuing problems with the indoor air quality after the renovation.

3.3 Changes Suggested by the Occupants

Occupants were also asked to give recommendations for improvements to their work stations and buildings. The questionnaire contained four items which asked respondents to suggest specific changes for equipment, lighting, work space, and the general environment to improve working conditions. Although some suggestions were noted in the "reasons for the choices selected as improvements" presented in 4.3, these four specific questions elicited a broader range of comments.

As in 3.2, the responses were reviewed, condensed, and tabulated to indicate the desired changes and the frequency with which particular suggestions were made. The suggestions derived from this procedure are listed in Table 10

with the complete comments given in Appendix C.

The first portion of Table 10 contains suggestions for changes to equipment. The general theme for equipment improvements involved modernization and increased reliability. In addition, numerous comments referred to the need for more reliable, faster PC's and ADP equipment. In addition, Table 10 indicates that the need for "new equipment" that was not computer-related was mentioned frequently. Although requests for new equipment were generally non-specific -- usually mentioning newer, more reliable equipment, specific requests were made for new forklifts, soldering, and test equipment. The need for newer, more reliable computers, was also mentioned frequently, particularly in 260. Related improvements included newer, more functional software and ready access to a computer for everyone. Other equipment improvements included a better phone system, more adequate supplies, more frequent repairs, and better training. Improvements to procurement procedures were also noted. Many "equipment" comments referred to the work space itself and included comments about better, less glaring lighting, better furniture, more office space, more surface space, use/non-use of systems furniture, better HVAC equipment, and windows.

The second portion of table 10 contains suggestions for improving the lighting. The common thread in these recommendations was the need for better positioning of the light for the task. Most people stated that the lighting should be more flexible, with controls to adjust the light where needed. Such control would minimize glare on VDT screens while providing light for paper tasks. Table 10 indicates that the most common requests were for more task lighting and adjustable lighting. A frequent comment was that the lighting was not in the best place to illuminate the task. Individually controlled lighting would allow people to light their task, yet decrease glare on VDT screens. Other suggestions for redesigning lighting included improvement of the uneven distributions of light. Such comments were most common in 268 before the renovation. After, the most frequent comment was to replace burned out or missing lamps. Other suggestions included changing lamp type from fluorescent (to incandescent or halogen), repairing and maintaining luminaires (often somewhat yellowed and dingy), making a particular area brighter or dimmer, and adding windows.

Recommendations for improving the indoor air quality included adding windows for fresh air, replacing the HVAC system, and enforcing the no-smoking policy. Other suggestions included improving the appearance of the work space, by adding new and better furniture, chairs and carpets, as well as repainting, changing colors, and cleaning.

As table 10 indicates, numerous suggestions were made for improvements to the work space. In fact the total number of suggestions was about 2.5 times the number made for improving the lighting system. The most frequent suggestion (by about 1/3 of those responding) was for more office space to increase privacy and quiet for concentration, reduce distractions and interruptions, and enhance productivity. Other suggestions included more storage space, more surface space, and more effective use of space. Some respondents wished

Table 10. Suggestions for Changes to the Working Environment

Suggested Changes to Equipment

Suggested Changes	235	260	293/8	268-1	268-2	Total
Improve / Add computers	0	19	8	13	8	48
New/more software	2	0	1	7	2	12
More computers per person	0	3	1	2	3	9
More training, better procurement	0	2	0	1	0	3
New equipment	8	7	1	24	18	58
Improve phones	2	6	3	2	3	16
More forklifts	1	0	5	0	0	6
More equipment (non-computer)	0	2	0	1	1	4
Use systems furniture	0	6	1	4	0	11
Improve furniture, chairs	0	2	1	2	1	6
More adequate supplies, repairs	0	0	0	4	1	5
Don't use systems furniture	0	0	0	1	2	3
Redesign lighting, reduce glare	1	3	0	3	0	7
Add task, adjustable lighting	0	0	0	2	0	2
More storage space	0	0	0	5	3	8
More office space, privacy	0	1	0	1	3	5
More surface space	1	1	1	2	0	5
Use space better, get window	0	0	0	1	1	2
Replace HVAC	0	1	0	0	1	2
Column totals:	15	53	22	75	47	212

Suggested Changes to Lighting

Suggested Changes	235	260	293/8	268-1	268-2	Total
More light, make brighter	3	5	0	9	13	30
Add task, adjustable lighting	0	3	5	13	8	29
Redesign lighting	1	5	0	11	7	24
Reduce glare	1	4	0	7	2	14
Replace, repair bulbs	0	9	0	0	0	9
Change bulb type	0	1	0	5	2	8
Fix luminaires	0	1	0	2	1	4
Light specific area	2	0	0	0	0	2
Make dimmer	1	0	0	1	0	2
Need window	0	0	0	0	1	1
Column totals	8	28	5	48	34	123

Table 10 continued.

Suggested Changes to the Work Space

Suggested Changes	235	260	293/8	268-1	268-2	Total
More office space	6	16	6	22	27	77
Greater privacy	1	7	0	9	6	23
Add more storage space	2	3	3	7	7	22
Add more surface space	0	7	0	6	6	19
Utilize space better	0	1	1	9	7	18
Need quiet for concentration	0	3	0	6	3	12
Add partitions	0	1	0	5	0	6
Remove partitions	0	2	0	0	1	3
Redesign lighting	0	7	0	11	8	26
Add task, adjustable lighting	2	1	0	3	2	8
Reduce glare	0	2	0	0	0	2
Need windows, windows for fresh air	0	8	0	7	1	16
Replace HVAC system, improve temps.	0	5	1	6	4	16
Provide better air quality	0	1	0	4	0	5
Enforce no smoking	0	0	1	3	0	4
Get new, better furniture	0	2	1	5	0	8
Get better chairs, carpet	2	0	1	2	2	7
Repaint	3	0	0	3	0	6
Use systems furniture	0	2	1	2	0	5
Change colors	0	1	0	0	1	2
Clean offices	0	0	0	2	0	2
Don't use systems furniture	0	0	0	1	1	2
Modernize, get new equipment, supplies	1	2	1	0	0	4
Improve phones, phone service	0	0	1	1	1	3
Improve / add computers	0	0	1	1	0	2
Get new bldg / remodel	1	2	2	9	2	16
Management	0	1	0	0	0	1
Want music	0	0	0	1	0	1
Column totals:	18	74	20	125	79	316

Table 10 Continued

Suggested Changes to the General Environment

Suggested Changes	235	260	293/8	268-1	268-2	Total
Replace HVAC system	2	4	4	22	14	46
Better air quality, less fumes	1	8	0	8	16	33
Enforce no smoking	0	2	2	4	1	9
Improve phones, add lines	0	4	2	1	4	11
Get new equipment	2	1	0	2	1	6
Improve power	0	0	0	4	0	4
More training	0	0	1	1	0	2
More forklifts	1	0	1	0	0	2
Improve, add computers	0	1	1	0	0	2
Get better chairs	0	0	0	0	21	21
Better colors, redecorate, repaint	3	5	0	1	5	14
Need break area	0	0	0	6	8	14
Add conference area	0	0	0	2	0	2
Improve furniture, use systems furn	0	1	0	1	0	2
Repair roof, carpet	1	0	0	0	1	2
Better lighting	2	8	1	10	7	28
Add task, adjustable lighting	0	0	0	3	0	3
More office space	0	6	1	14	8	29
Greater privacy	0	3	0	5	3	11
Need quiet	0	2	0	3	4	9
More storage space	0	4	1	2	2	9
Utilize space better	0	2	1	2	2	7
More individual offices	1	3	0	0	0	4
Need window	1	12	0	3	6	22
Need windows for fresh air, view out	0	6	0	2	1	9
Get new bldg or remodel	3	10	0	6	6	25
Management	0	0	0	3	3	6
Improve safety, exits, access	1	1	0	1	1	4
Get more people	0	0	0	3	0	3
Improve cafeteria	0	0	0	1	2	3
Need better working conditions	0	0	0	2	0	2
Want music	0	1	0	0	0	1
Column totals:	18	84	15	112	116	345

to add partitions; others wished to remove them. Respondents again mentioned the need to redesign lighting, add task lighting, and reduce glare. Some commented in favor of systems furniture, while others were against it. More general recommendations included a completely new building or extensive remodeling; new equipment, including phones and computers, and improving management procedures. The renovation in 268 decreased the number of suggestions for improving office appearance, but not the number of space-related suggestions.

The fourth set of suggestions presented in table 10 dealt with improving the building to make the job easier. About 25% of the comments referred to air quality with suggestions for replacing the HVAC system, reducing fumes, reducing swings in temperature, and enforcing the no-smoking regulations. Such comments were prevalent in 260 and 268 before and after renovation.

Space issues were the next most frequently mentioned category for change. Respondents again requested more space, privacy, quiet, storage area, better use of space, and individual offices. Many suggestions involved improving the appearance and functioning of the work space. These included new chairs and furniture, better colors, repainting, redecorating, and repairs to the carpet and roof. Adding a separate break area in 268 so that people could eat lunch away from their desks and see outside was a particular concern. A separate break area for smokers was another request, as was a conference area. Many people suggested improving the general lighting and adding task lighting. Adding windows for fresh air, daylight, and view out was another frequent request.

Other recommendations involved improvements to the phone and electrical power service, as well as new equipment, more and better computers, more materials handling equipment such as forklifts, and more training. Other suggestions included improved safety and emergency access/egress. A number of people suggested ways for improving the flow of work; including, hiring more people to solve staffing problems; soliciting and listening to input from personnel; and providing management training. People also requested a better cafeteria (or break area with wider selection from vending machines) and generally better working conditions. Finally, there were recommendations for totally remodeling the building or building an entirely new building to solve the problems of air quality, lighting, and space mentioned throughout the questionnaire.

4. Measurement Data

4.1 Lighting Measurements

Table 11 presents the measurement data for lighting. A total of 92 work stations were examined using the procedure given in Appendix A-2. These included 49 in 268 before the renovation, 26 in 268 after, 12 in 260, and 5 in 235. Illuminance was measured using a hand-held Minolta[2] photometer with a cosine-corrected diffuser and a photopic response filter. Measurements were made in the primary work station at the center of the work surface about 12 in from the edge of the desk, about 18 in from the edge to the right of the center, and about 18 in from the edge to the left.

Table 11 presents the means and standard deviations for the primary illuminance[3] followed by that to the right and to the left for work stations in buildings 260, 235, 268-1 and 268-2. Figure 24 presents the distribution of illuminance at the primary work station for the different buildings. As table 11 indicates, illuminance in 235 tended to be high with large variability (as evidenced by the high standard deviations). Only five work stations were measured in this building, which functioned largely as a warehouse. Comparisons between 260 and 268, which were more conventional office buildings, are therefore more meaningful. In 260, the mean illuminance was 624 lux with about 150 lux less to the immediate left and right. In 268, there was less variation in illuminance from left to right across the task location both before and after the renovation, although the mean illuminance dropped by about 260-300 lux following the renovation. This drop was most likely due to the systems furniture blocking the overhead lighting.

The next entry in table 11, is the average for the three measurement locations (left, center, and right) which confirms that the renovation in 268 lowered the overall light levels at the primary work station from a mean of 685 lux to 391 lux. Yet, as shown by the next series of entries, the renovation had less impact on the illuminances at the secondary work station. In 268 before the renovation, the secondary illuminances were only slightly lower than at the primary work station, while after the renovation they were actually 100-150 lux higher with a mean of 531 lux (although the variability was also greater). There were, however, many more secondary work stations because of the system furniture configuration. Illuminance was lower by 200-800 lux at the secondary work station in building 260 and 235.

---

[2] Brand names are provided for identification purposes only, and do not constitute endorsement by the National Institute of Standards and Technology or the U.S. Army.

[3] Illuminance may be defined as "the density of the luminous flux incident on a surface; it is the quotient of the luminous flux by the area of the surface when the latter is uniformly illuminated" (IESNA, 1984, p.1-16). In lay terms, illuminance is the amount of light falling on a surface.

Table 11. Summary Lighting Measurement Data for the Four Buildings

Building	260		235		268-1		268-2	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Illuminance in Lux								
Primary	624.3	256.4	1536	589	685.4	262.7	391.3	234.9
Right	477.5	243.4	1082	275.3	665	239.5	399	251.4
Left	485.8	274.8	952	236.1	688	266.7	413.4	252.2
Primary Average	481.7	248.9	1017	242.1	662.7	245	406.2	244.3
Secondary	343.4	299.1	706.2	181.6	572.5	298.3	531.2	342.1
Right	384.6	219.5	744.6	226	463.7	204.7	472.1	277.4
Left	335.8	222.4	759.3	216.5	523	193.7	573.5	288.5
Secondary Average	360.2	222.3	728.8	193.8	513.4	197.1	522.8	270.8
Luminance in cd/m2 for Primary Task Area								
White Task	156.7	65.1	408.7	151	164.2	66.2	239	70.7
Black Task	27.7	16.6	72.1	33.5	18.5	15	21.4	16.3
Contrast	0.84	0.13	0.83	0.02	0.89	0.06	0.9	0.13
Luminance in cd/m^2 of Surroundings								
Ceiling	27.2	18.6	45.6	6.3	41.3	19	34	0
Luminaire	2585.4	1691	3672	843.9	4041.	1616.4	2595.6	1382.3
Darkest	3.7	4.2	9.5	4	6.1	4.3	5.6	2.5
Ahead	17.5	48.6	59.2	45.7	60.9	48.5	116.8	90.1
Left	35.7	41.7	20.6	17.7	57	43.6	56.7	56.8
Right	30.4	49.9	104.2	42	62.4	52.6	26.3	21
Average All	453.3	277.6	656.7	141.4	716.8	271.7	473.7	235.6
Average Lft,Rt,Ahd	27.9	33.7	61.4	18.9	60.3	33.6	66.9	32
VDT Characteristics								
Distance (in)	15.8	5.8	12	0	21.7	2.4	25.8	3.1
Illuminance in lux								
Keyboard	438.9	259.4	903.3	199.7	592.7	256.3	424.8	250.2
Screen	335	193.6	488	98.5	433.5	191.7	347.9	141.5
Luminance of VDT Paper Task								
White	122	62.6	218.4	75.4	116.8	58.7	135.9	74.7
Black	21.4	15.3	31	10	15.7	8.3	20.9	15.2

Table 11 continued.

				Luminance in cd/m^2 of Screen				
Center	7.3	18.1	4.7	3.3	19.2	22.2	17.1	22.4
Left	6.8	8.5	9.9	12.3	10.7	10.5	11.6	14.1
Right	6.6	22.9	5.1	3.3	17.4	29.2	16	21.4
Top	5.8	27.1	13.5	13.9	22.3	34.4	13.3	16.8
Bottom	6.2	12.2	4.6	0.5	10.7	15.9	17.3	22.1
Char1	1	17.2	13.6	13.4	7.9	38.2	29.4	23.9
Char2	2	6.2	24.1	0	0	36.1	22.9	21.4
				Average Luminance for Screen and Character				
Screen	7.6	2.3	9.4	4.6	15.5	19.2	16.9	17.8
Char	17.4	13.4	13.4	7.9	37	25.7	25.4	18.4
Screen Contrast	0.36	0.32	0.28	0.12	0.59	0.3	0.5	0.27
				Task Lighting				
				Illuminance				
Primary	710.4	630.9	1873.3	514.1	1127.	730.8	833.1	267.1
				Luminance of Paper Task				
White	183	133.6	523	74.2	238.4	157.6	68.5	6.9
Black	34.9	23.7	98.2	15.4	22.2	22.1	3.4	0
Height (in)	13	7.8	11	0.8	19	8	14.5	3.5

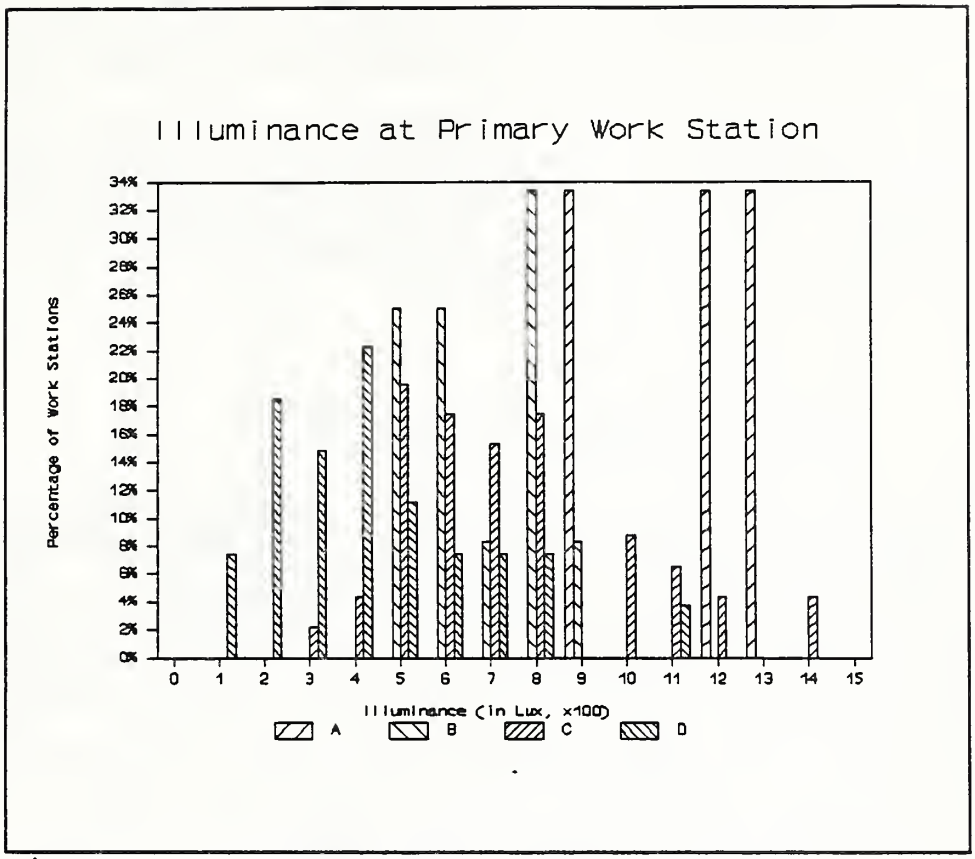

Figure 24. A=235; B=260; C=268-1; and D=268-2.

Figure 24. Distribution of illuminances with body shadow at the primary work station.

The illuminances for the primary and secondary work stations are generally in line with the recommendations for office lighting, including both paper and VDT tasks, given by the Illuminating Engineering Society (IESNA, 1987).

The next entries in Table 11 are the luminance (or brightness) of a paper task. Using a portable Minolta[2] luminance meter with a one-degree spot size, the luminance[4] of a white piece of paper with a very black letterhead was measured, again in the center of the working surface about 12 in from the edge of the desk. The contrast for this "standard" piece of paper was then calculated according to the following formula:

$$C = L_B - L_T / L_B$$

where L_B = luminance of the background
and L_T = luminance of the target.

Task contrast is one measure of the effect of lighting on task visibility. The scale ranges from 0 to 1 with higher values indicating a potentially more "visible" task with "brighter" whites and "darker" blacks. (Rea, 1986 presents a full discussion of the role of task contrast in visibility.) Table 11 demonstrates that the luminance of the white target was highest for Building 235 (as would be expected from the higher overall illuminance) but that the average contrast was low (probably because veiling reflections from the overhead luminaires reduced the blackness of the task). Figure 25 presents a distribution of the luminances of the white task, while figure 26 shows a distribution of contrasts at the primary task location. Both the luminance of the white target and overall contrast were lower in 260 but higher in 268, particularly following the renovation.

The next entries in table 11 present the luminance of different surfaces in the rooms - ceiling, luminaire, darkest object in the field of view, and vertical surfaces immediately ahead, to the left, and to the right. These measures provide an indication of the brightness of different surfaces, as the observer would perceive them. In table 11, all the luminances were averaged together to provide an indication of the overall brightness in the space. As shown in figure 27, the average luminance was highest in 268 before the renovation and lowest in 260. The luminances of the vertical surfaces to the left, right and ahead, when averaged, were highest in 268 following the renovation.

The following entries in table 11 present the illuminance and luminance of VDT tasks. Illuminance was measured at the center of the screen and keyboard. As might be expected, mean keyboard illuminance was lowest in building 260 and 268 following the renovation, highest in 235, and

---

[4] Luminance may be defined as the quotient of the luminous flux at an element of the surface surround the point and propagated in directions defined by an elementary cone containing the given direction; by the product of the solid angle of the cone and the area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction (IESNA, 1984). In lay terms, it is the amount of light reflected from a surface.

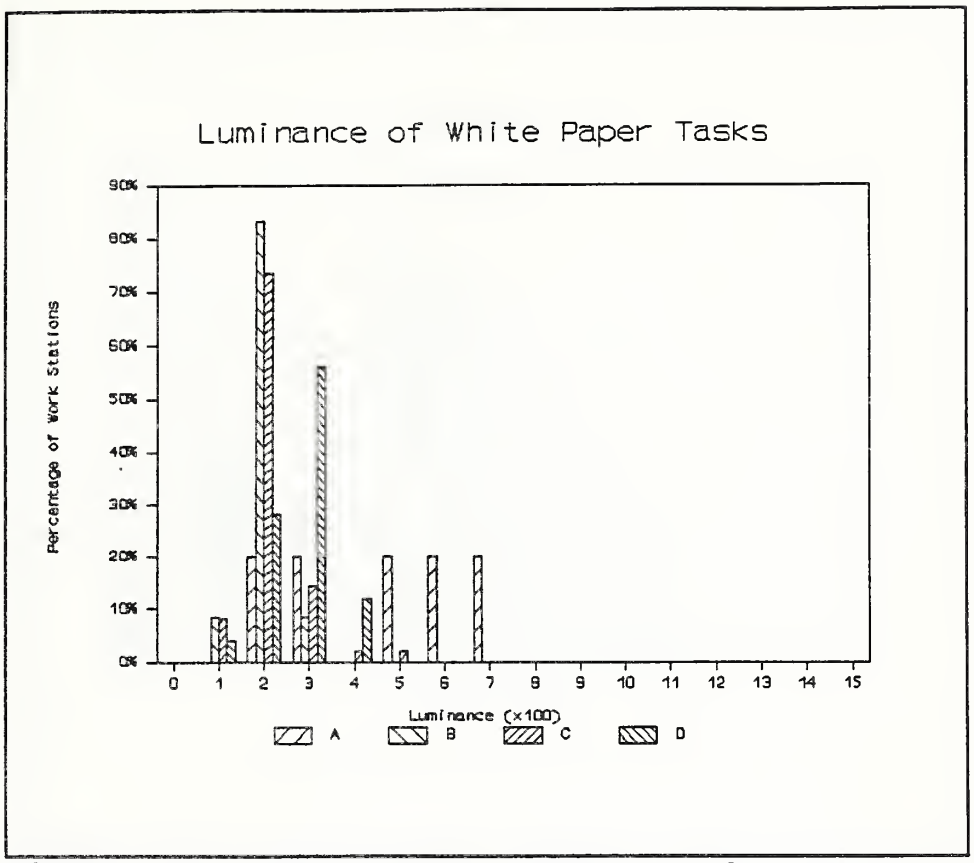

Figure 25. A=235; B=260; C=268-1; and D=268-2.

Figure 25. Distribution of luminances of the white paper task measured at the primary work station.

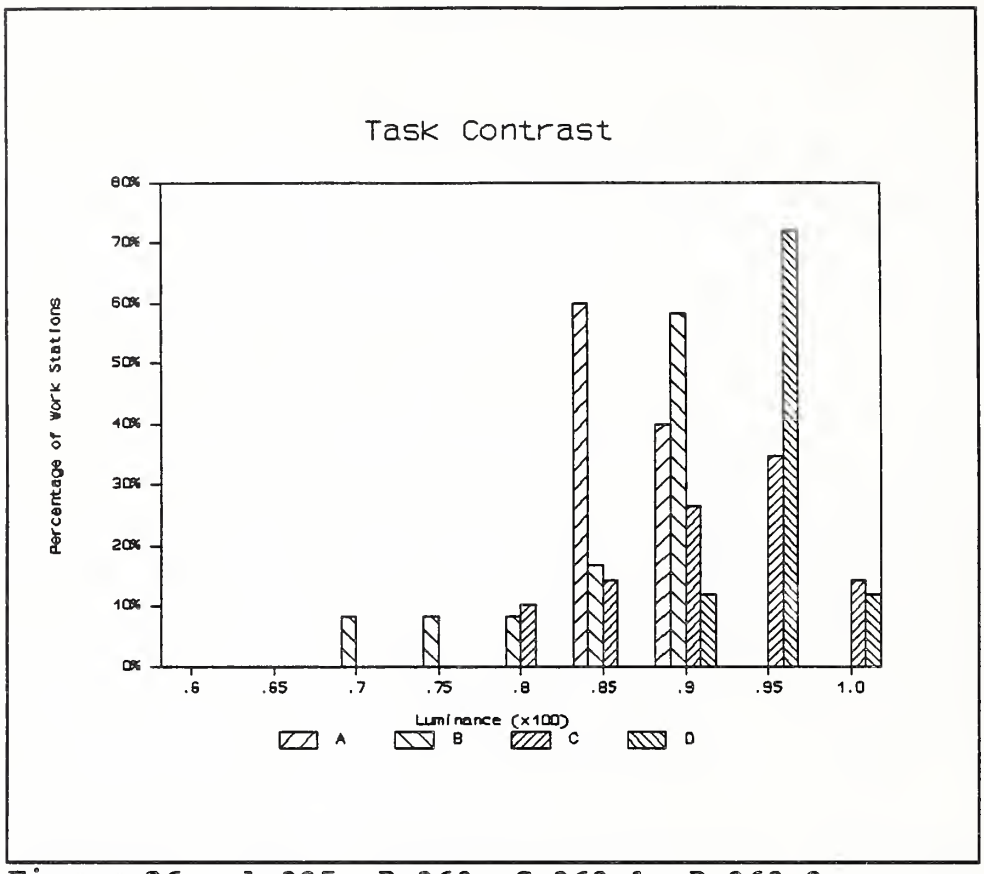

Figure 26. A=235; B=260; C=268-1; D=268-2.

Figure 26. Distribution of contrasts for the luminances of the white paper and black image measured at the primary work location.

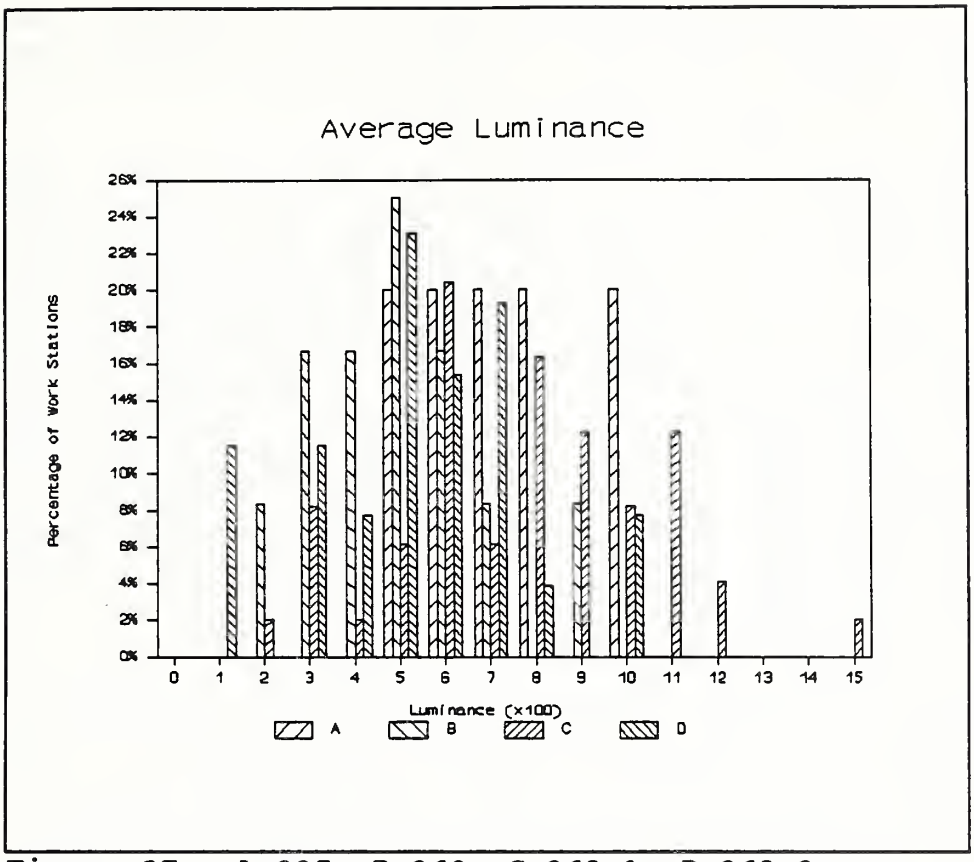

Figure 27. A=235; B=260; C=268-1; D=268-2.

Figure 27. Distribution of average luminances (including luminance straight ahead, to the left, to the right, the ceiling, darkest object, and the luminaire) as seen from the primary work station.

intermediate in 268 before the renovation. As is desirable, mean screen illuminance was lower than keyboard illuminance in all buildings, and ranged from 335 lux in 268-1 to 488 lux in 235. The renovation had little impact on mean keyboard and screen illuminance in 268.

The luminance of six areas on the VDT screen was also measured, again using the Minolta[2] luminance meter. Five measurements of the screen luminance as set by the work station user were made - at the top, bottom, center, right, and left of the screen. In addition, the luminance of two characters was also measured[5]. The five screen luminances were averaged, and then combined with the average of the luminances of the two characters to create a measure of screen contrast. The data for different screen luminances suggest that bright spots -- most likely due to reflections from the overhead luminaires-- occurred at the top of the VDT screens in 235, while dark spots occurred at the bottom of the screen in 268-1. The distribution of mean contrasts was fairly even with a range of 0.1 to 1.0, as shown in figure 28. The low contrasts (below 0.5) obtained at a number of work stations indicates that people with these VDT's may have had trouble seeing all the characters on their screens. The low contrast was likely due to reflections in the screen from overhead luminaires.

In addition to the measurements of the illuminance of the ambient lighting, the illuminance of the task lamp was measured using the Minolta[2] hand-held photometer, again in the center of the primary work surface. Illuminance for the task lights was quite high but with large variability among work stations. Means ranged from 710 to 1873 lux with standard deviations as high as 730 lux. Illuminance of the task light decreased by about 300 lux following the renovation in 268 but was still reasonably high (with a mean of 830 lux).

4.2 Physical Conditions

Table 12 describes the physical conditions in the work stations as recorded by the experimenter during the physical measurement phase using the form given in Appendix A. This table itemizes the number of surfaces used by a work station occupant, control over lighting, task lighting, and some characteristics of the VDT's.

Table 12 makes it very clear that the way that occupants used their work stations changed dramatically following the renovation in 268. Before, 70% had used only one surface -- after, 70% used two surfaces. (Measurements of the area of the work station and surfaces will be discussed in the next section). In 260, 73% used two surfaces, while 40% did in 235, (although only 5 work stations were assessed in 235.)

---

[5] Measurement of character luminance includes some screen luminance in the very immediate surround of the character. As such, it is a biased, but useful estimate of character luminance.

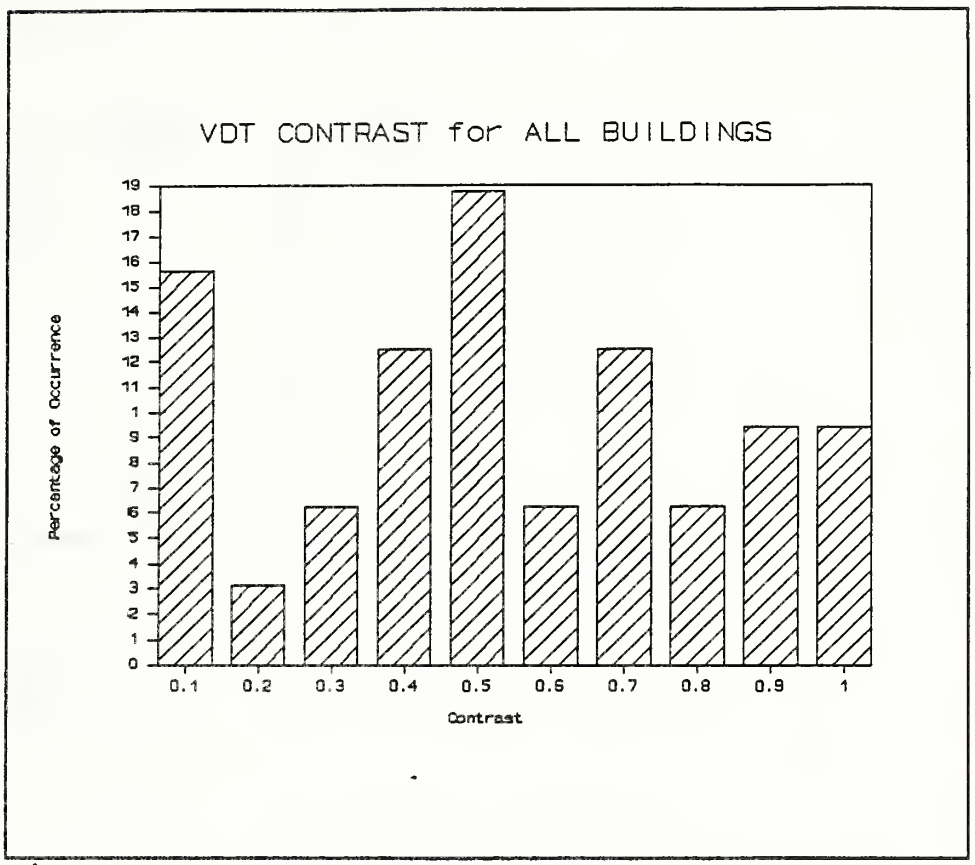

Figure 28. A=235; B=260; D=268-1; and D=268-2.

Figure 28. Distribution of contrasts between screen and character as calculated for VDT's in the different buildings.

Table 12. Additional Lighting and Physical Characteristics of the Work Stations.

		Number of Surfaces	Lamps	Control		TaskLight		Type of TaskLight	
268-1	1	70.5%	0.0%	None	4.3%	No	60.4%	Fixed	27.8%
	2	27.3%	87.0%	On-Off	95.7%	Yes	39.6%	Adj	72.2%
	3	2.3%	6.5%	Switched	2.2%				
	4	0.0%	6.5%						
260	1	18.2%	0.0%	None	100.0%	No	41.7%	Fixed	87.5%
	2	72.7%	66.7%	On-Off	0.0%	Yes	58.3%	Adj	12.5%
	3	9.1%	0.0%	Switched	8.3%				
	4	0.0%	33.3%						
235	1	40.0%	0.0%	None	80.0%	No	40.0%	Fixed	0.0%
	2	40.0%	0.0%	On-Off	20.0%	Yes	60.0%	Adj	100.0%
	3	20.0%	0.0%	Switched	0.0%				
	4	0.0%	100.0%						
268-2	1	21.7%	0.0%	None	0	No	0.0%	Fixed	100.0%
	2	69.6%	100.0%	On-Off	100.0%	Yes	100.0%	Adj	0.0%
	3	8.7%	0.0%	Switched	0.0%				
	4	0.0%	0.0%						

	VDT		Reflections	Keyboard Adj	Screen Adj
268-1	No	63.0%	6.7%	13.3%	13.3%
	Yes	37.0%	93.3%	86.7%	86.7%
260	No	8.3%	0.0%	0.0%	44.4%
	Yes	91.7%	100.0%	100.0%	55.6%
235	No	20.0%	25.0%	0.0%	0.0%
	Yes	80.0%	27.0%	100.0%	100.0%
268-2	No	41.60%	30.8%	0.0%	15.4%
	Yes	58.30%	69.2%	100.0%	84.6%

Position of the Light Source

		Above	Ahead	Right	Left	Behind	Total
268-1	Percent	40.3%	13.4%	14.9%	19.4%	11.9%	67
260	Percent	19.4%	19.4%	25.8%	22.6%	12.9%	31
235	Percent	28.6%	28.6%	14.3%	21.4%	7.1%	14
268-2	Percent	51.6%	12.9%	12.9%	16.1%	6.5%	31

Number of Lamps

		Two	Three	Four	Total
268-1	Percent	87.0%	6.5%	6.5%	46
260	Percent	66.7%	0.0%	33.3%	12
235	Percent	0.0%	0.0%	100.0%	4
268-2	Percent	100.0%	0.0%	0.0%	15

Table 12 Continued.

Type of Work Station

		No	Yes	Total		No	Yes	Total
268-1	Open	8.3%	91.7%	48	Shared	27.1%	72.9%	48
260	Open	8.3%	91.7%	12	Shared	16.7%	83.3%	12
235	Open	20.0%	80.0%	5	Shared	0.0%	100.0%	5
268-2	Open	8.7%	91.3%	23	Shared	50.0%	50.0%	26

Number and Height of Panels

		42-54"	60-64"	68-74"	None	Total
268-1	Panel	20.0%	30.0%	7.5%	42.5%	40
260	Panel	0.0%	80.0%	0.0%	20.0%	10
235	Panel	25.0%	75.0%	0.0%	0.0%	4
268-2	Panel	45.0%	40.0%	15.0%	0.0%	20

Type of Wall System

		Wood	Metal	Fabric	Total
268-1	Panel Type	32.7%	61.8%	5.5%	55
260	Panel Type	37.5%	12.5%	50.0%	24
235	Panel Type	10.0%	40.0%	50.0%	10
268-2	Panel Type	37.5%	31.3%	31.3%	64

Type of Furniture

		Systems	Standard	Other	Total
268-1	Furniture Type	6.7%	80.0%	13.3%	30
260	Furniture Type	90.9%	9.1%	0.0%	11
235	Furniture Type	100.0%	0.0%	0.0%	4
268-2	Furniture Type	100.0%	0.0%	0.0%	23

Type of Wall Construction

		Wood	Metal	Fabric	Dry	Block	Total
268-1	Wall Construction	1.7%	0.0%	3.3%	40.0%	55.0%	60
260	Wall Construction	0.0%	0.0%	14.3%	78.6%	7.1%	14
235	Wall Construction	0.0%	0.0%	0.0%	100.0%	0.0%	5
268-2	Wall Construction	0.0%	0.0%	0.0%	75.9%	24.1%	29

		Chair Arms		Chair Wheels	
		No	Yes	No	Yes
268-1	Chair	40.9%	59.1%	5.9%	94.1%
260	Chair	27.3%	72.7%	54.5%	45.5%
235	Chair	20.0%	80.0%	40.0%	60.0%
268-2	Chair	12.0%	88.0%	4.3%	95.7%

Table 12 Continued.

Experimenter Rating of Chair Condition

		1	2	3	4	5	Mean
268-1	Rating	0.0%	13.3%	55.6%	22.2%	8.9%	3.27
260	Rating	0.0%	27.3%	9.1%	63.6%	0.0%	3.30
235	Rating	0.0%	0.0%	20.0%	80.0%	0.0%	3.80
268-2	Rating	0.0%	12.0%	28.0%	48.0%	12.0%	3.60

Personalization of Work Station

		No	Yes		No	Yes
268-1	Wall	62.5%	37.5%	Desk	52.1%	47.9%
260	Wall	63.6%	36.4%	Desk	63.6%	36.4%
235	Wall	0.0%	100.0%	Desk	40.0%	60.0%
268-2	Wall	15.4%	84.6%	Desk	11.5%	88.5%

Supplementary Fan or Heater

		No	Yes		No	Yes
268-1	Fan	63.8%	36.2%	Heater	93.3%	6.7%
260	Fan	100.0%	0.0%	Heater	100.0%	0.0%
235	Fan	40.0%	60.0%	Heater	100.0%	0.0%
268-2	Fan	57.7%	42.3%	Heater	95.7%	4.3%

Experimenter Ratings of Noise

		Phone	Conver	Printer	Equip	Vent	Outside
268-1	Rating	1.98	2.69	1.71	1.27	2.00	1.13
260	Rating	2.08	3.33	3.00	2.75	4.00	1.18
235	Rating	1.00	3.20	3.20	2.80	3.60	1.60
268-2	Rating	2.75	2.96	1.71	1.25	1.61	1.00

There were two lamps per fixture in Buildings 260 and 268 (both before and after the renovation). There were four lamps per fixture in 235 which may have accounted for the much higher illuminances observed there. Control over the lighting was either non-existent, as in 260, or by "on-off" switches (with virtually no lamps switched off) as in 268 and 235.

The first column of table 12 indicates that the renovation in 268 increased the amount of task lighting from 40% to 100% of the work stations. About 60% of the work stations in 235 and 260 had task lighting. As can be seen from the next column in table 12, the percentage of those with fixed task lighting in 268 increased from 27.8% to 100% following the renovation. About 87% of the task lighting in 260 was also fixed. Relatively few work stations at the site had adjustable task lighting. The next entries in Table 12 present data on VDT's in the work station. The first column presents the number of work stations with VDT's. As can be seen, 80-90% of those in 235 and 260 had VDT's as compared with 42% in 268 before the renovation and 58.3% after. Reflections on the screen were visible at almost all work stations, although the percentage of screen reflections in 268 declined from 93.3% to 69.2% following the renovation. Virtually all work stations had adjustable keyboards; while 55.6% of those in 260 and about 85% in 268 also had adjustable screens.

Table 12 presents further descriptive information about the work stations. The first entries describe the colors (as recorded by the experimenter) of the furnishings (primarily desks, chairs, and dividers) and the approximate frequency with which they were observed. The most frequently occurring colors in 260 were white, wood and beige, with a small amount of blue and orange. In 235, the few colors observed included white, blue, beige and red. In 268 after the renovation, frequent colors included beige, blue, cream, wood, and brown. This description is somewhat deceptive since colors in each work station had been coordinated as part of the renovation so that one office area had rose dividers, while another had brown, and another blue. The color appearance in 268 was greatly improved judging by the favorable response to questions about it on the questionnaire.

The next entries provide information on the position of the light source in the work station. Here, "above" meant the light source directly above, "ahead" meant "in front of", while "right", "left", and "behind" are self explanatory. The distribution of luminaire placement was fairly even in 235 and 260 with sources located in all the major quadrants except behind. In 268, however, noticeably more luminaires were located directly above the work station. This number increased somewhat following the renovation. In all work stations, cool white fluorescent lamps were consistently used (with no mixture with other source types - in accordance with good design practice).

The vast majority (80-92%) of the work stations were both open-plan and shared. All work stations in 235, 260 and 268 following the renovation had panels, typically 60-64 in. in height, separating them from adjacent areas. Before the renovation, 40% in 268 had no panels. Most of the original furniture in 268 was metal and wood with a shift to systems furniture following the renovation. Walls were typically drywall or block with virtually no wallpaper, wood or fiberboard.

Inspection of table 12 indicates that most chairs at the site had arms and four legs with wheels and adjustable (reclining) seats. The condition of the chair was rated by the experimenter using a scale of 1 to 5 where "1" meant poor and "5" meant good. Using this scale, chairs in 268-1 received a mean rating of 3.27; those in 260 a mean rating of 3.36; in 235 a rating of 3.8; and in 268-2 a rating of 3.6 -- indicating that the experimenter rated overall chair condition as above the scale midpoint of 3.0.

Examination of the personalization of desks and walls revealed that 37.5% in 268-1, 36.4% in 260, 100% in 235, and 84.6% in 268-2 had some form of wall personalization such as pictures or posters. Between 36 and 88% had personal items on their desks. In both cases the number of personal items increased in 268 following the renovation -- perhaps because of the addition of cloth covered panel boards or simply due to settling in after the move.

The percentage of fans ranged from 36.2% to 60% in 235 and 268, with none observed in 260. There were slightly more fans after the renovation in 268. The percentage of space heaters was very low -- below 5% -- even in January after the renovation. No space heaters were observed in 235 and 260.

The experimenter also rated the number of intrusive sounds heard in the work station. The mean ratings, presented in Table 12, for all four buildings were highest for conversations of co-workers, with an overall mean of 3.04 on a 4-point scale. At least 40% of the work stations in 235 and 260 were rated as "4" indicating many conversational intrusions, while 68.8% in 268-1 and 95.8% in 268-2 were rated as "3". Intrusive sounds from ventilation were particularly high in 260 (with all work stations receiving the highest rating) and in 235. Ratings were much lower in 268 (with means of 2.0 and 1.61). Ringing telephones were a problem in 268 following the renovation--but not in 235. Printer noise was evident in 260 and 235 with mean ratings of 3.0 and 3.2. Equipment noise was also apparent in these buildings with mean ratings of 2.75 and 2.8. As might be expected ratings of outside noise were very low (between 1.0 and 1.6) due to the absence of windows. The intrusiveness of sounds was, of course, dependent on the activities being performed when they were recorded. The experimenter ratings tend, however, to reinforce the occupant ratings, particularly the annoyance of conversations of co-workers (mean of 3.37).

Table 13 presents summary data for temperature, humidity, and noise. Temperature and humidity were measured with a Solomat[2] multi-channel modometer (2016) which uses a platinum thermohygrometer to measure temperature and humidity. These data indicate a mean temperature of about 74.7°F for the site, near the upper limit of the ASHRAE (1981) comfort guidelines for winter conditions (68°-74.5°F) but at the middle of the summer range (73°-79°F). Relative humidities tended to be higher in buildings 235 and 260 than in 268. (The humidity measures for 268 after the renovation are so low that they are likely to be erroneous and so are not reported.) Noise levels were measured using a Quest[2] model 155 precision hand-held sound level meter with a standard 1/2 in condenser microphone. Ambient sound levels were measured on the dBA scale. The average noise level (52.4 dBA) was within the OSHA guidelines for noise damage, although these guidelines do not provide any indication of perceived annoyance.

Table 13. Average Temperature, Humidity and Noise in the Four Buildings at the Site.

BLDG		Temp (^{o}F)	Humidity	Noise(dBA)
235	Average	73.6	54.8	53.0
	Std. Dev	1.5	2.6	5.1
260	Average	74.2	62.3	52.3
	Std. Dev.	1.7	10.2	6.2
268-1	Average	74.3	41.0	57.1
	Std. Dev.	1.6	19.2	9.4
268-2	Average	75.7	___	44.8
	Std. Dev.	2.0		8.1
	Site Mean	74.7	46.2	52.4
	Std. Dev.	1.9	19.1	10.0

The final measurements were of the office space including the length and width of the desk, work station, chair and files. Detailed measures of binder bins, shelves, files, and secondary desks were taken in 268 after the renovation. Summary data for these measures are presented in table 14.

Examination of the average desk area indicates a sizeable decrease in desk area in 268 following the renovation from 15.1 ft^2 (1.40m^2) to 9.2 ft^2 (0.85m^2). This decrease was attributable primarily to reduced desk width from a mean of 34.7 in (88.1cm) to 24.8 in (63cm). The mean desk area was greater in 260 (11.8 ft^2 or 1.1m^2) and 235 (12.4 ft^2 or 1.15 m^2). In all buildings, desk height was very similar -- 28.3 to 31.7 in (71.9 to 80.5cm).

For all work stations, the mean chair length was very similar - between 19.4 and 21.4 in (49.3 to 54.4cm) while the width ranged from 18.3 to 19.8 in (46.5 to 50.3cm). The mean chair area was 2.2 to 2.9 ft^2 (0.2 to 0.27m^2) with relatively little difference between buildings. Analysis of the additional features of the new furniture from the renovation in 268 revealed more extensive use of binder bins, shelves, and files. Where there was a secondary desk, its mean area was 7.9 ft^2 (0.73 m^2).

The total area of the individual work station was also determined. Since a work station was generally in an open area with no enclosing walls, its size was estimated by measuring the space directly available to the occupant. This typically included the desk, space for chair movement (about 3 ft), and distance to partitions and file cabinets (which often served to delineate the work station). Table 14 indicates that area in the work station declined following the renovation in 268 by about 10 ft^2 per work station. Thus, mean work station area was about 70 ft^2 (6.5 m^2) in 268-1, but only about 63.2 ft^2 (5.87 m^2) after the renovation. In fact, the median area was 60 ft^2 in 260 and 268-1 and 50 ft^2 in 268-2. The mean area in 260 was 71.8 ft^2 (6.67m^2) and 52.3 ft^2 (4.85m^2) in 235. The decline in work station area in 268 may account for the feelings of being cramped and lacking space reported in the questionnaire data.

Table 14. Measurements of Space in the Four Buildings

	268-1		260		235		268-2	
	Avg	Std	Avg	Std	Avg	Std	Avg	Std
DESKLNG	62.6	9.5	58.9	3.6	60.0	0.0	56.4	21.2
DESKWDT	34.7	5.0	28.8	2.6	29.8	0.4	24.8	2.4
DESKHGT	31.3	2.8	28.3	1.1	30.0	0.0	31.7	10.9
SqFt	15.1	3.1	11.8	1.6	12.4	0.2	9.2	3.2
Desk#2							7.9	1.3
WSLENGH	8.9	2.9	9.5	3.6	9.0	1.7	7.8	2.6
WSWIDTH	7.4	2.6	7.0	2.0	5.9	0.9	7.7	2.6
WSarea	70.0	42.0	71.8	53.7	52.3	10.3	63.2	38.9
CHRLNGT	19.4	2.7	20.8	1.9	21.4	1.7	20.9	1.6
CHRWDTH	18.3	1.6	18.5	1.0	18.6	0.8	19.8	1.0
ChrAr	2.2	0.9	2.7	0.4	2.8	0.3	2.9	0.3
FILELNG	0.0	0.0	60.0	0.0	49.0	14.2	35.8	13.8
FILEWDT	0.0	0.0	5.0	0.0	23.7	9.0	28.0	6.0

Distribution of Dimensions in the Work Stations

Length in ft					Width in ft				Work Station area in Ft^2				
	Number				Number					Number			
ft	235	260	268-1	268-2	235	260	268-1	268-2	SqFt	235	260	268-1	268-2
1	0	0	0	0	0	0	0	0	10	0	0	1	0
2	0	0	1	0	0	0	1	0	20	0	0	0	0
3	0	0	0	0	0	0	0	0	30	0	1	0	2
4	0	0	0	1	0	0	0	1	40	1	0	3	6
5	0	0	2	0	2	2	6	0	50	2	2	6	9
6	0	1	0	6	2	3	4	4	60	0	6	9	1
7	1	1	3	11	0	4	6	13	70	2	1	1	0
8	1	3	5	1	1	0	3	1	80	0	0	2	0
9	1	3	9	1	0	2	1	3	90	0	0	1	1
10	0	1	2	0	0	0	3	0	100	0	0	0	3
11	2	1	3	4	0	0	2	1	110	0	1	0	0
12	0	1	1	0	0	1	2	1	120	0	0	1	1
13	0	0	0	0	0	0	0	0	130	0	0	1	0
14	0	0	1	1	0	0	1	0	140	0	0	2	0
15	0	0	0	1	0	0	0	0	150	0	0	0	0
16	0	0	2	0	0	0	0	0	160	0	0	0	1
17	0	0	0	0	0	0	0	0	170	0	0	0	0
18	0	0	0	0	0	0	0	1	180	0	0	1	1
19	0	0	0	0	0	0	0	0	190	0	0	1	0
20	0	1	0	0	0	0	0	0	200	0	0	0	0
Total	5	12	29	26	5	12	29	25		5	12	29	25

5. Recommendations

5.1 Source for Suggestions

Based on the questionnaire results, the physical measures, suggestions by the occupants, interviews with management personnel, and personal observations a number of specific recommendations for improving the buildings are presented in the following pages. Most of the recommendations apply to 260 and 268, since most of the data was obtained for these two buildings, although section 5.1.6 presents recommendations specifically for 235.

5.1.1 Indoor Air Quality

Both the response to the questionnaire and conversations with personnel in the buildings indicated that indoor air quality was perceived to be a major problem. There was a high incidence of reported health problems, including respiratory diseases, headaches, allergies, and irritated eyes. People were convinced that there were major problems in the heating ducts with smells of noxious fumes and smoke appearing in offices located away from the source of the fumes or smoke. The questionnaire data reiterated strongly that the most troublesome problem for people at the site was indoor air quality, especially in buildings 260 and 268. The fact that about 70% of those questioned in these two buildings expressed dissatisfaction with their indoor air quality and air circulation is serious. Their mean rating of 1.95 for air quality and air circulation was significantly below both the Canadian rating (2.3) and the scale midpoint (3.0). In addition, the reported problems with frequent headaches and eye irritation in 260 and 268 reinforce the suggestion that the ventilation system may not perform adequately, or that there may be sources of excessive contaminants.

As a result, the first recommendation for improving the conditions in 260 and 268 is for an engineering survey of the HVAC equipment to determine if it is performing as designed, and if the design is adequate for current conditions in the two buildings. Since the buildings have undergone extensive modifications over the years, with the addition and removal of interior walls, changes in tasking, and increases in personnel load, the original design may well be inadequate. In fact, 268 is really two buildings with separate HVAC systems joined together in what appears to be an unhappy union. Part of the problem with the ventilation may be due to the numerous configuration changes in the building over the years, in which walls were erected and removed without consideration of the placement of heating ducts and vents. The engineering survey should examine the original design, determine if all the buildings meet the original design specifications, and then evaluate whether these specifications are adequate for the current operations, particularly in building 268 and 260. The survey would also suggest design modifications in the HVAC system to meet current needs.

At the same time, the cleanliness of the ducts and vents, as well as the condition of the filters and air exchangers, should be evaluated. The numerous comments by personnel about dust on their desks in the mornings, as well as of stuffy, stale air, indicate that the ventilating system may not be performing adequately. Similarly, the frequent complaints about temperature

swings suggest problems with the heating and cooling part of the HVAC equipment, as well. Noticeable fluctuations occur in heating and cooling with one room being 72°F and another being 82°F, and then reversing the next day for no obvious reason. Because both buildings (260 and 268) are windowless, and should be less subject to daily variations in solar load, the frequent swings in temperature are difficult to explain. As a result, the engineering survey should also assess the performance of the controls, heating, and cooling for the HVAC system.

In addition, because of the health-related symptoms and the numerous comments about poor indoor air quality, a screening analysis should be done to determine if there are any significant pollutants in the air. This is particularly necessary in 268 where chemicals and fumes from the paint and machine shops could enter the space directly or be picked up by the return air. For example, when ammonia was used to clean the shops, there were numerous complaints of eyes watering and people being dizzy. In addition, although the photolab is exhausted separately, this may not be adequate since fumes are often detected. These problems suggest that the ventilation system may malfunction and pick up exhausted fumes. As a result, the screening analysis should focus on the chemicals used in the building, as well as on CO_2 concentrations (high levels of which are associated with high personnel densities).

While some respondents suggested replacing the entire HVAC system, the initial engineering survey could determine the magnitude of the problems, and evaluate whether solutions such as cleaning, modifying the HVAC controls, or changing maintenance routines would solve some problems before the major expense of complete replacement is incurred. Nonetheless, the data from the survey suggest that the complaints about indoor air quality should <u>not</u> be ignored. The condition of the HVAC system should be assessed and improved to ensure that the productivity and health of the occupants are not being seriously impaired.

One easily implemented recommendation is to enforce the "No Smoking" policy in the individual offices. This should remove some complaints about indoor air quality. At the same time, however, some provision should be made for a smoking break area for those who do smoke.

Recommendations

1. Perform a comprehensive engineering survey of the HVAC system including controls. Evaluate air flow rates in work spaces. Clean system thoroughly.

2. Perform limited survey of indoor air quality. Include survey of chemicals known to be used in the facility as well as CO_2.

3. Develop, implement, and follow a regular maintenance program, including regular filter cleaning and changing for the HVAC systems (including ducts and vents) in all buildings.

4. Enforce the "No Smoking" policy stringently. Make break areas available for smokers, as well as consider courses on quitting smoking.

5. Evaluate the performance of controls for temperature on the HVAC system. Determine reasons for, and correct, extreme variations in temperature.

5.1.2 Space and Privacy

Results from the questionnaire, including the comment data, and interviews with management personnel, indicated that space and privacy were another critical concern to people at the facility. These issues include space for storage, horizontal space to spread out papers (including blue prints and other large pieces), and space between people. Analysis of the measurements of the space indicated that most personnel were in spaces smaller than the GSA suggested guidelines of 135 ft^2 per person. As a result, they may feel genuinely cramped. In addition, there is no place for people to sit and think when they are faced with a difficult technical problem. An even more pressing concern from a supervisory standpoint is the lack of a place to counsel employees or hold private discussions without being overheard.

Recommendations

1. Study the existing GSA and military guidelines for space and furniture, evaluate individual tasks, and determine the desk space, file space, and personal space etc., needed to do the task. Use this information to provide a sound rationale for allocating space and furniture.

2. Provide a separate conference/counseling space for private conversations including meetings with outside contractors and employees.

3. Inventory equipment and furniture and remove any unnecessary items, while continuing to meet the needs of employees and tasks. Identify items requiring repair or replacement.

4. Involve employees in decisions about design and renovation so that the ultimate design reflects their needs and concerns.

5. Address staffing needs and space requirements for staff to avoid stress and overcrowding.

5.1.3 Noise and Privacy

One result of the space limitations is that any almost extra noise in the work space is a potential problem. It adds distractions and reduces privacy. For example, people commented that having their conversations overheard was extremely bothersome. On the questionnaire, the mean rating for conversational privacy was 1.9 - significantly below the scale midpoint. Furthermore, people indicated that having outside contractors overhear

private staff conversations was a potential conflict-of-interest problem. In addition, because people tend to use speaker phones, their conversations are easily overhead and add to noise in the offices. Finally, noise from printers was a problem because printer covers are not provided with the printers. Because getting a printer cover or a laser jet printer requires a special requisition, they are not frequently obtained.

Recommendations

1. Limit conversations on the speaker phones when there are several people in the office; use more sound barriers; and provide individual offices for managers or make quiet space available.

2. Provide separate area for contractors to wait and do business in, or remind staff to monitor their conversations carefully when contractors are present.

3. Provide printer covers wherever needed. Consider adding laser printers in areas where high volume printing must be done or move printers out of occupied spaces.

5.1.4 Windows and Break Areas

The negative reaction to the interior environmental conditions may be intensified because of the lack of windows in the buildings. The questionnaire contained numerous comments about the need for windows for fresh air, light, and view out - not only for morale but also to improve physical conditions. For example, the front door to 268 is the only place in the building where people can see out. There is no comparable daylit entry way to 260. In addition, because many people brown bag their lunch, they eat at their desk since neither of the two nearby eating areas allow brown bagging. As a result, they may spend their entire work day at their desks with no access to the outside. Although there are plans to build sunroom break areas in 268, these may be subject to budget cuts.

An additional problem is the need to enforce compliance with the no smoking regulations and provide break areas for smoking. Because of problems with holes in the carpets, smoking was banned in the hallways. Yet productivity is hurt when people must go long distances from their offices to smoke. Using the same break area for smokers and non-smokers is not an appropriate solution.

Recommendations

1. Build sunroom break areas on 268 and 260 if at all possible.

2. Consider providing picnic tables outside for use during the spring, summer and fall; consider making arrangements for people to brown bag at the different eating places; and consider implementing exercise programs over the lunch hour so that people would have a break which might also reduce some of the stress of work.

3. Provide visual interest and relief for the windowless buildings by using appropriately chosen graphics, paintings (posters), and colors. Provide sufficient space for each employee to personalize his/her own area with small photos, cartoons, etc.

4. Evaluate feasibility of adding windows or even skylights to certain offices and break areas.

5. Provide separate break areas for smokers and non-smokers. Consider providing facilities with tables and chairs suitable for eating lunch.

5.1.5 Lighting

Although lighting did not elicit as many complaints as did air quality and space, problems with lighting were observed at the site. Although a variety of fixtures were used in separate areas, both louvered and prismatic, the hodgepodge of fixtures and sources reported by Rubin and Collins (1988) at Army field stations did not exist. Lamps were consistently cool white (except in the warehouse area of 235) so that a checkerboard appearance was avoided. Nonetheless, there was dirt on the fixtures from the air conditioning (perhaps because the louvers were too close to the ceiling). Other fixtures had yellowed and discolored with age. In addition, there was no program for group relamping or fixture replacement; lamps are changed only when someone notices that they have burned out.

Other lighting problems involved glare, particularly on VDT screens, and lack of separate lighting for particular tasks. The addition of systems furniture during the renovation in 268 reduced the overall light levels, because the partitions blocked light from the ceiling fixtures. As the fresh paint and task lighting ages, the light levels may well drop below acceptability and should be monitored. In the shops area of 268, the ambient lighting does not provide enough illuminance for repair of intricate equipment due to the high ceiling and dirty luminaires. In these areas, an adjustable, functioning task lamp is needed to provide high light levels at the task. In more conventional office areas, adjustable task lighting is also needed because the illuminance requirements are so different for paper and VDT tasks.

Recommendations

1. Consider the use of deep cell parabolic-type fixtures in offices where both paper and VDT tasks are performed to reduce glare from the overhead lights.

2. Orient systems furniture properly with respect to the overhead light fixtures to provide more uniform ambient lighting. Relying on the built-in lighting to light the entire work station can be inadequate since these fixtures do not provide sufficient light for the whole desk. Where possible, plan the arrangement of the furniture so that light sources do not shine in a person's eyes or directly on VDT screens.

3. Implement the planned renovation to the lighting in the shops area. Continue to provide good adjustable task lighting for equipment repair.

4. Provide adjustable task lighting for office tasks, in which the luminaire can be moved to illuminate the task. Implement localized lighting controls (both switching and dimming) where feasible.

5. Clean fixtures regularly. Consider moving them away from diffusers to reduce dust and problems with discoloring. Develop regular maintenance and replacement program for lamps and luminaires.

6. Consider use of better color rendering light sources such as the "designer" (3200) series now available from major lighting manufacturers. Better color rendering lamps would improve the appearance of people, walls, and furnishings, and possibly alleviate some of the desire for daylight as a light source. Another alternative might be the use of light pipes to bring daylight into deep interior areas.

5.1.6 Safety and Training

At the time the study was initiated, there was no safety shower immediately in the shops area, although the men's rest room nearby had a conventional shower. If an accident occurred, the individual (regardless of sex) would have to use this shower. Other concerns about safety included electric cords on the floor, which present a tripping hazard, as well as ladders hanging over desks, various industrial hazards, and slippery floors near the doors during wet weather. Training deficiencies were also an issue as there appeared to be no systematic procedures for getting technical advice for hardware, software, and linkages between the two. A frequent comment on the questionnaire was the need for more training on hardware and software use, as well as for new, more functional equipment.

Recommendations

1. Provide accessible safety showers and eyewashes in any area likely to need them.

2. Remove tripping and falling hazards. Provide warning signs about slippery floors and remove standing water.

3. When new software packages are introduced, provide training on them. Also train users on hardware and operating procedures.

4. Evaluate equipment needs, including computers, software, repair and maintenance tools, phone service, and power requirements based on task needs. Institute more effective repair program.

5.1.7 Building 235

In the warehouse of building 235 where packing and crating are done, there is no insulation between the roof and the people. Consequently, it is not environmentally controlled, so that temperatures are very cold in the winter and hot in the summer making it very difficult to work. Although one solution has been to use space heaters and fans, these do not work well, particularly under extreme temperatures. In addition, because the lights were placed over the storage racks in a high bay arrangement, there is little light on work or circulation areas. Another problem is that the color rendering of lighting in this space was quite poor (since high pressure sodium lighting was used). In addition, the ballasts buzz and create an annoying noise. Although personnel have suggested relamping the warehouse with mercury vapor lamps, metal halide lamps are likely to be a better, long-term solution.

Recommendations

1. Insulate the roof of 235 to decrease the extremes in heat and cold, and allow people to work without gloves in the winter and overheating in the summer.

2. Relamp the warehouse portion of 235 with metal halide rather than mercury lamps, as they are longer lived and have better color rendering. Locate fixtures so that they light work and circulation areas. Provide local task lighting where feasible.

5.2 Conclusions

The data analysis clearly indicated that indoor air quality was a major concern in buildings 260 and 268, even after the renovation. The numerous complaints of stuffy, stagnant air appeared to be related to air flow rates and possible contaminants. Temperature and humidity also appeared to be poorly controlled. Analysis of the data indicated that the other major problem was that of space, particularly lack of space for spreading out big documents and blueprints. The lack of space also led to many complaints about noise and lack of privacy. Although the renovation in 268 was successful in improving the appearance of the space, it decreased the satisfaction with the amount of space. Given the physical limitations on the size of the buildings and staffing requirements, quick fixes are not obvious, but clearly the problems of indoor air quality and space demand attention.

6. References

American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Atlanta, GA. 55-1981.

Collins, B.L., Fisher, W.S, Gillette, G.L., Marans, R.W. Evaluating Office Lighting Environments: Second Level Analysis. NISTIR 89-4069, April 1989.

Collins, B.L. and Rubin. A.I. Analysis of Work Environment Data from Three Army Field Stations. National Institute of Standards and Technology, NISTIR 88-3871, October 1988.

Dillon, R., and Vischer, J.C. Derivation of the Tenant Questionnaire Survey Assessment Method: Office Building Occupant Survey Data Analysis. Ottawa, Canada: Public Works Canada, AES/SAG 1-4:87-9, November 1987 b.

Dillon, R., and Vischer, J.C. User Manual: Tenant Questionnaire Survey. Ottawa, Canada: Public Works Canada, AES/SAG 1-4:87-8, November 1987 a.

Flynn, J.E., Spencer, T.J., Martyniuk, O., and Hendrick. C. Interim Study of Procedures for Investigating the Effect of Light on Impression and Behaviour. Journal of the Illuminating Engineering Society, 1973, Pp. 87-94.

Gillette, G., and Brown, M. Occupant Evaluation of Commercial Office Lighting: Volume I., Methodology and Bibliography. ORNL/TM-10264/V1, Oak Ridge National Laboratory, November, 1986.

Gillette, G. Evaluating Office Lighting Environments: Reference Lighting Power Density Data. NBSIR 88-3691, National Bureau of Standards, January, 1988.

Gillette, G., and Brown, M. Occupant Evaluation of Commercial Office Lighting: Volume III., Data Archive and Database Management System. ORNL/TM-10264/V2, Oak Ridge National Laboratory, August, 1987.

Hawkes, R.J., Loe, D.L., and Rowlands, E. A note towards the understanding of lighting quality. Journal of the Illuminating Engineering Society, 1979, Jan, Pp. 111-120.

IES Lighting Handbook: 1987 Application Volume. Illuminating Engineering Society of North America, 345 East 47th Street, NY, NY 10017, 1987.

IES Lighting Handbook: 1984 Reference Volume. Illuminating Engineering Society of North America, 345 East 47th Street, NY, NY 10017, 1984.

Louis Harris Associates for Steelcase. The Office Environment Index: 1987 Full Report, and 1987 Summary Report. Steelcase, 1987.

Marans, R. W. Evaluating office lighting environments: A further report. Lighting Design and Application, 1987, 17, p. 32-36, 51.

Marans, R. W., and Brown, M. Occupant Evaluation of Commercial Office Lighting: Volume II., Preliminary Data Analysis. ORNL/TM-10264/V2, Oak Ridge National Laboratory, November, 1987.

Meyer, B. Indoor Air Quality. Reading, MA: Addison-Wesley Pub. Co., 1983.

Rea, M. Towards a model of visual performance: Foundations and data. Journal of the Illuminating Engineering Society, 1986, 15, pp. 41-57.

Rubin, A.I. and Collins, B.L. Interim Survey of Selected Military Building Environments: A Research Approach. NBSIR 87-3606, August 1987.

Rubin, A.I. and Collins, B.L. Evaluation of the working environment at selected U.S. Army field stations: Suggestions for Improvement. National Bureau of Standards, NBSIR 88-3827, August 1988.

Ulrich, R.S. View through a window may influence recovery from surgery. Science. 1984, 224, pp. 420-421.

Appendix A. Questionaire Administered at the Site.

Room Number_____
Building Number_____

ENVIRONMENT QUESTIONNAIRE
(Including Coding for Identifiers)

1. How long have you worked in the building where you are now employed?

1	Less than 1 year	ID = LONGWORK
2	1-2 years	
3	2-5 years	
4	More than 5 years	

2. How long have you worked at your present job in this building?

1	Less than 1 year	ID = LONGSPAC
2	1-2 years	
3	2-5 years	
4	More than 5 years	

3. Please rate your work space on each of the following:

	Excellent	Good	Adequate	Fair	Poor
Amount of Space Available for Your Work	5	4	3	2	1
		ID = WSSPCAMT			
Condition of Desks and Chairs	_____	_____	_____	_____	_____
		ID = WSMATL			
Amount of Lighting	_____	_____	_____	_____	_____
		ID = ADJAMLIT			
Location of Ceiling Lights for Work	_____	_____	_____	_____	_____
		ID = LOCCLNLT			
Color of Walls and Partitions	_____	_____	_____	_____	_____
		ID = WALLCOLOR			
Color of Furniture	_____	_____	_____	_____	_____
		ID = FURNCOLOR			
Storage Space	_____	_____	_____	_____	_____
		ID = STORAGE			
Conversational Privacy	_____	_____	_____	_____	_____
		ID = CONVPRIV			
Access to Co-workers	_____	_____	_____	_____	_____
		ID = COWORKER			

	Excellent	Good	Adequate	Fair	Poor
Wall/Desk Space for Personal Items	5	ID = WALLSPC 4	3	2	1
Ability to Adjust Light for the Work Station	_____	ID = ADJAMTLT _____	_____	_____	_____
Visual Privacy	_____	ID = VISPRIV _____	_____	_____	_____
Amount of Surface Area for Work	_____	ID = WRKSPACE _____	_____	_____	_____
Comfort of Chair	_____	ID = CHRCMFT _____	_____	_____	_____
Ventilation and Air Circulation	_____	ID = AIRCIRC _____	_____	_____	_____
Heating	_____	ID = HEATING _____	_____	_____	_____
Cooling	_____	ID = COOLING _____	_____	_____	_____
Air Quality	_____	ID = AIRQSAT _____	_____	_____	_____
Condition of Carpet	_____	ID = CARPET _____	_____	_____	_____
Annoying Fumes	_____	ID = FUMES _____	_____	_____	_____
Dust on Furniture	_____	ID = FURNDUST _____	_____	_____	_____

4. The way the offices and other work spaces are arranged in terms of making it easier for employees to get their jobs done is:

5	Excellent	ID = ARGMTWS
4	Pretty Good	
3	Neither good nor bad	
2	Fair	
1	Poor	

5. The way the work spaces and offices look is:

5	Excellent	ID = LOOKWS
4	Pretty Good	
3	Neither good nor bad	
2	Fair	
1	Poor	

6. For each of the following spaces in your building, please rate the quality of the lighting by placing an x in the appropriate column.

	Excellent	Pretty Good	Neutral	Not Very Good	Poor	Not Applicable
		ID = RTLTBREAK				
Break Areas	5	4	3	2	1	0
Corridors & Hallways		ID = RTLTHALL				
Restrooms		ID = RTLTRSTM				
Work Spaces		ID = RTLTSPAC				
Conference Rooms		ID = RTLTCONF				

7. On the average, how many hours a day do you spend at your work space in this building?

1-2 Hours	3-4 Hours	5-6 Hours	7-8 Hours	9-10 Hours	More than 10 hours
		ID = HRSDYBLG			
1	2	3	4	5	

8. Which of the following tasks best describes the work that you normally do. (CHECK THOSE THAT APPLY)

3	Using a video display terminal (VDT)	ID = VDTUSN
1	Reading and writing	ID = READING
5	Filing	ID = FILING
8	Repairing equipment	ID = REPAIIRN
2	Reviewing manuals	ID = REVIEWN
7	Managing	ID = MANAGING
6	Meeting with contractors	ID = MEETING
9	Travel	ID = TRAVLEN
4	Review of technical drawings	ID = REVTECHN
0	Other. Please specify _____	ID = OTHREN _____

9. Please estimate the number of hours that you spend at each task on a typical day.

	Rarely	Less than 2 hours	2-4 hours	4-6 hours	6-8 hours	More than 8 hours
Using VDT	0	1	ID = HRSDYVDT 2	3	4	5
Reading & writing			ID = HRSDYRED			
Filing Material			ID = HRSDYFIL			
Repairing equipment			ID = HRSDYREP			
Reviewing manuals			ID = HRSDYREV			
Managing staff			ID = HRSDYMAN			
Attending Meetings			ID = HRSDYMTG			
Away on Travel			ID = HRSDYTR			
Reviewing technical Drawings			ID = HRSDYDRF			
Other						

10. For each task performed, please rate the lighting available to you.

	Excellent	Pretty Good	Neutral	Not Very Good	Poor	Not Applicable
			ID = LTREAD			
Reading	5	4	3	2	1	0
Using VDT			ID=LTDT			
Filing			ID=LTFILE			
Repairing Equipment			ID = LTREPEQP			
Reviewing Drawings			ID = LTDRAFT			
Other			ID=LTOTHER			

11. How would you describe the amount of light available to you now?

1	Much too bright	ID = AMTLTBRT
2	A bit too bright	
3	Just about right	
4	A bit too dim	
5	Much too dim	

12. Overall, how satisfied are you with the lighting at your work space.

5	Very Satisfied	ID = WSLITSAT
4	Fairly Satisfied	
3	Neither Satisfied nor Dissatisfied	
2	Not Very Satisfied	
1	Not At All Satisfied	

13. Are there any changes that you would make to the lighting at your workstation? ID = CHANGES

_____

_____

_____

_____

14. If you use a Video Display Terminal (VDT), indicate how bothersome each of the following conditions is for you. If you do not use a VDT, please go to question 15.

	Not at all Bothersome	Not very Bothersome	Fairly Bothersome	Very Bothersome
Screen Flicker	1	ID = VDTFLICK 2	3	4
Distance to Screen		ID = VDTDSTSC		
Screen Angle		ID = VDTANGSC		
Glare from Overhead Light		ID = VDTGLARE		
Keyboard Angle		ID = VDTANGKB		
Height of Desk		ID = VDTDSKHT		
Comfort of Chair		ID = VDTSEAT		
Reflections on Screen		ID = VDTREFSC		
Ease of Reading Printed/Typed Material		ID = VDTREAD		
Location of Overhead Light		ID = VDTBRTLT		
Inability to Adjust Screen or Keyboard		ID = VDTADJSC		
Space for Printed Material		ID = VDTSPACE		
Inability to Adjust light		ID = VDTADJLT		

15. Sometimes the arrangements of work stations can be distracting to the people in offices. Please indicate how bothersome each of the following is to you.

	Not at all Bothersome	Not very Bothersome	Fairly Bothersome	Very Bothersome
Ringing Telephones	1	ID = NOISEPHN 2	3	4
Conversations of People		ID = PEPTALK		
Noise From Printers		ID = NOISEPRT		
Noise From Other Equipment		ID = NOISEQP		
Noise From Ventilating System		ID = NOISEVNT		
Noise From Corridors		ID = NOISEHAL		
Reflected Glare Off Work Surfaces		ID = GLRWKSF		
Glare From Ceiling Lights		ID = GLRCLNLT		
Overly Dim Lights		ID = DIMLT		
Absence of View out		ID = NOVIEW		
Too Hot in Summer		ID = HOTSUMR		
Too Cold in Winter		ID = COLDWTR		
Too Many Drafts		ID = DRAFTS		
Air is Too Stuffy		ID = STUFFYAIR		
People Walking Around		ID = PEPLWALK		
People Too Close		ID = PEPLCLOS		
Unpleasant Smells		ID = SMELLS		
Cigarette Smoke		ID = SMOKE		
Wide Swings in Temperature		ID = TEMPSWN		
Indoor Air Quality		ID = AIRQUAL		
Lack of Adjustable Task Light		ID = NOTSKLT		

16. Please rate each of the following by placing an X in the space that best describes your feelings about this building. For example, if you think the building is pleasant, put an X next to the word "pleasant"; if you think it is unpleasant, put an X next to the word "unpleasant"; and if you think it is in between, please put an X where you think it belongs.

Pleasant	5	ID=BLDGPLST	3	2	1	Unpleasant
Adequate for my job	5	ID=BLDGADQT	3	2	1	Not adequate for job
Well Maintained Interiors	5	ID=BLDGMAIN	3	2	1	Poorly Maintained Interiors
Confined	1	ID=BLDGSPAC	3	4	5	Spacious
Stimulating Spaces	5	ID=STIMUL	3	2	1	Unstimulating Spaces
Poorly Lit Spaces	1	ID=WELLIT	3	4	5	Well Lit Spaces
Humid	1	ID=BLDGHUMD	3	4	5	Dry
Clean	5	ID=BLDGCLEN	3	2	1	Dirty
Noisy	5	ID=BLDGQUIT	3	2	1	Quiet
Colorful	5	ID=BLDGCLR	3	2	1	Drab
Interesting	5	ID=BLDGINTR	3	2	1	Boring
Hot	5	ID=BLDGTEMP	3	2	1	Cold
Relaxed Atmosphere	5	ID=BLDGATMS	3	2	1	Tense Atmosphere
Smelly	1	ID=BLDGSML	3	4	5	Not Smelly
Bright	5	ID=BLDGBRT	3	2	1	Dim

17. How often have you experienced any of the following symptoms which you think are caused by working in this building?

	Never	Rarely	Sometimes	Frequently	Most of the Time
			ID = HEADACHE		
Headache	1	2	3	4	5
			ID = DIZZY		
Dizziness					
			ID = SLEEPY		
Sleepiness					
			ID = SORTHROAT		
Sore Throat					
			ID = RUNNOSE		
Runny Nose					
			ID = IRRITEYE		
Irritated Eyes					
			ID = FOCUSEYE		
Trouble Focusing Eyes					

	Never	Rarely	Sometimes	Frequently	Most of the Time
Difficulty in Concentrating	1	2	3	4	5
			ID = DIFFCONC		
Fatigue	_____	_____	_____	_____	_____
			ID = FATIGUE		
Ear Infection	_____	_____	_____	_____	_____
			ID = EAR		
Frequent Colds	_____	_____	_____	_____	_____
			ID = COLDS		
Sinus Problems	_____	_____	_____	_____	_____
			ID = SINUS		
Allergies	_____	_____	_____	_____	_____
			ID = ALLERGY		

18. Suppose you could make 4 changes to your overall work environment. Using the list below, indicate the 4 changes you would make in order of preference (where 1 = most preferred).

_____	A.	More comfortable day-to-day temperatures	ID=WSIMTEMP
_____	B.	More privacy	ID=WSIMPRIV
_____	C.	Access to the outside during lunch and breaks	ID=WSIMACC
_____	D.	Change in color of walls, furnishings or carpets	ID=WSIMCLR
_____	E.	Improved lighting	ID=WSIMLTG
_____	F.	Less noise	ID=WSIMNOIS
_____	G.	Improved air circulation	ID=WSIMAIRC
_____	H.	Move further away from co-workers	ID=WSIMLOC
_____	I.	Better air quality	ID=WSIMAIRQ
_____	J.	Better break areas	ID=WSIMBKSP
_____	K.	More comfortable furnishings	ID=WSIMFURN
_____	L.	More frequent cleaning	ID=WSIMCLN
_____	M.	Adjustable task lighting	ID=WSIMTKLT
_____	N.	More adjustable chair	ID=WSIMCHAR
_____	O.	Simulated view out/daylight	ID=WSIMDLT
_____	P.	More surface area for work	ID=WSIMSURF
_____	Q.	Other_____	ID=WSIMOTHR

19. Please explain the reasons for your four choices.

1. _____ ID = REASON1 _____

_____

2. _____ ID = REASON2 _____

_____

3. _____ ID = REASON3 _____

_____

4. _____ ID = REASON4 _____

_____

20. Overall, how satisfied are you with your work space and furniture?

5	Very Satisfied	ID = FURNSAT
4	Fairly Satisfied	
3	Neither Satisfied Nor Dissatisfied	
2	Not Very Satisfied	
1	Not at all Satisfied	

21. If you could make any changes to your work space what would you do?__

_____

ID = WSCG

_____

22. Do you feel the need to have a view outside during break periods or lunch?

1 Yes 0 No ID = NEEDSOUT

23. Overall, how satisfied are you with your work equipment?

5	Very Satisfied	ID = EQUIPSAT
4	Fairly Satisfied	
3	Neither Satisfied nor Dissatisfied	
2	Not Very Satisfied	
1	Not At All Satisfied	

24. If you could make any changes to the work equipment, what would you do?_____

_____

ID = EQUIPCHG

_____

25. Please rate your chair on each of the following:

	Excellent	Good	Fair	Poor
Ease of movement on carpet	4	ID = CHAIRMOV 3	2	1
Ease of adjusting seat height	_____	ID = CHRHGT _____	_____	_____
Ease of adjusting back height	_____	ID = CHRBACK _____	_____	_____
Back tilt or tension	_____	ID = CHAIRADJ _____	_____	_____
General condition	_____	ID = CHAIRCON _____	_____	_____

26. Please indicate how true the following statements are for your job.

	Very True	Somewhat True	Not Very True	Not At All True	
The work is important	4	3	2	1	ID = WRKIMPT
When I talk to co-workers, others can hear us	1	2	3	4	ID = COWRKHR
My job is satisfying	4	3	2	1	ID = JOBSAT
My work must be very accurate	1	2	3	4	ID = WRKACR
I have the equipment to get my job done well	1	2	3	4	ID = EQUIP
My eyes get tired when I work for more than 2 hours	1	2	3	4	ID = TIREDEYE
My job requires me to stay in one place all day	1	2	3	4	ID = NOMOVFWS
My job requires a great deal of concentration	4	3	2	1	ID = CONCNTRT
I have enough time to get my work done	1	2	3	4	ID = WORKTIME
Lighting at my desk keeps me from doing my job well	1	2	3	4	ID = LTGHINDR
I have opportunities to develop my own special abilities	4	3	2	1	ID = WRKABILIT
I am satisfied with the quality of my work	1	2	3	4	ID = WORKSAT
I miss having a view out or window	1	2	3	4	ID = MISSVIEW
Noise keeps me from doing my job well	1	2	3	4	ID = WRKNOISE
My job requires me to work very fast and accurately	1	2	3	4	ID = WORKFAST
I would like to know what the weather is like outside	1	2	3	4	ID = WEATHER

27. Which of the following best describes your job?

1	Administrative	ID = JOBTYPE
2	Clerical	
3	Equipment Repair & Testing	
4	ADP Operator	
5	Other	

28. Are you Military ? Yes 1 No 0 ID = MILITARY
Civilian? Yes 1 No 0 ID = CIVILIAN
Contractor? Yes 1 No 0 ID = CONTRACT

29. Are you a female? ___1___ Male? ___2___ ID = SEX

30. Do you wear glasses? Yes 1 No 0 ID = GLASSES
Are they bifocals? Yes 1 No 0 ID = BIFOCALS
contact lenses? Yes 1 No 0 ID = CONTACTS

31. If you answered yes to question #30, how long have you worn corrective lenses?

1	Less than 6 months	ID = LONGLENS
2	6-12 months	
3	1-2 years	
4	2-5 years	
5	More than 5 years	

32. How many days have you been absent from work due to illness during the last six months?

0	None	ID = LONGSICK
1	1-2 days	
2	3-5 days	
3	6-12 days	
4	More than 12 days	

33. How old are you?

1 Under 20 2 20-29 3 30-39 ID = AGE

4 40-49 5 50-59 6 60 or over

34. How much overtime did you routinely work before the current budget restrictions?

None	0	ID = OVERTIME
5 hours/week	1	
5-10 hours/week	2	
More than 10 hours/week	3	

35. What suggestions would you make for improving the building to make your job easier? _____

COMMENTS

_____

_____

Thank you very much for your participation.

EMRA Environmental Measures - Direct

Time is: _____ Date is: _____ Space I.D. _____

Recorder: _____

1. Number of work surfaces or places where tasks occur: _____1 _____2 _____3 or more

1a. Illuminance while SEATED in chair:

PRIMARY	SECONDARY
Right_____lux	Right_____ Lux
Left_____Lux	Left_____ Lux
Center_____ Lux	Center_____ Lux
Distance_____ in	Distance _____ in

2. Luminance at PRIMARY task area:

_____ fL WHITE _____ fL BLACK

_____ fL GREY _____ fL CEILING

_____ fL BRIGHTEST _____ fL DARKEST

_____ fL Ahead Center Dist _____

_____ fL Left Dist_____

_____ fL Rt Dist_____

3. Overhead Luminaire Type:
Lens_____ Grille/Louvre_____
Other_____

4. Position with respect to work station:

Above_____ Ahead_____
Right_____ Left_____
Behind_____

5. Lamp type for overhead lighting:_____
Number of tubes _____

6. Control of Switching:

None _____ On-Off_____

7. Have lamps been switched off?

_____Yes _____ How Many? _____No

8. Does the workstation have a VDT? _____Yes _____No

a. Reflected light from electric light sources can be seen on screen?..... ____Yes ____No
b. Keyboard can be raised and lowered?.. ____Yes ____No
c. Screen can be raised, lowered, or tilted?..... ____Yes ____No
d. Location of screen _____ in

9. Luminance at VDT task area:

Keyboard _____lux Screen _____lux

_____ fL White _____ fL on Black

_____ fL Center _____ fL Left

_____ fL Right _____ fL Upper

_____ fL Bottom

_____ fL SCREEN CH _____ CH

_____ fL SCREEN CH _____ CH

10. Dominant colors in workstation: _____
_____

11. Workstation is in an open area:_____Yes _____ No

12. Type of panels:
1. 42"-54" Panels _____
2. 60"-64" Panels _____
3. 68"-74" Panels _____
4. Open without Panels _____
6. Distance to Panel_____

12b. The space containing the workstation is:

1. Private _____
2. Shared _____

13. Furnishings are predominantly (Check all that apply):

Wood _____ Metal _____ Fabric _____
Systems _____ Std Office_____
Other (Specify) _____

14. Walls are predominantly (Check all that apply):

Wood _____ Metal _____
Fabric _____ Dry Wall or Plaster _____
Brick or Block _____
Demountable Ceiling Height Partitions _____
Other (Specify) _____

15. Type of office chair:

Arms _____ Number of legs_____
Wheels_____ Colors_____
Adjustable Reclines_____
Executive_____ Secretarial _____

Condition ___1___2___3___4___5___ (1=poor, 5=good)

16. Does the workstation have:

a. Pictures or poster on wall ..... ____Yes ____No
b. Pictures or other mementos on desk, credenza or tack surface ..... ____Yes ____No
c. Fan ..... ____Yes ____No
d. Space Heater..... ____Yes ____No

17. Is there supplemental task lighting at primary/secondary task location?
Yes_____ No_____

Lamp Type _____

Free Standing Movable_____
Furniture integrated_____
Desk mounted moveable_____
Other_____

18. Illuminance of Task Light _____lux

Luminance _____ fL White _____ fL Black

19. Direction of Light

Fixed _____ Adjustable _____
Height of Task Light Above Task Surface _____in.

20. Instrusive Sounds

	None	Very Little	Some	A Lot
a. Ringing Telephones	____	____	____	_____
b. Conversations of Co-workers	____	____	____	_____
c. Printer or Computer Noise	____	____	____	_____
d. Other Office Equipment Noise	____	____	____	_____
e. Vent System Noise	____	____	____	_____
f. Outside Noise	____	____	____	_____
g. Music or Intercom	____	____	____	_____

21. Temperature:
_____°F Dry Bulb

22. Humidity _____% Relative Humidity

23. Air Flow _____CFM

24. Background Noise Level
_____dBA Reading Source_____

25. Area Occupied by Person

Desk Length_____ Width_____ Ht_____
Office Area Length_____ Width_____
Chair Length_____ Width_____
File Cabinet Length_____ Width_____
Space Type_____

Appendix B. Percentage Response Data for All Buildings

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	WSSPCAMT	0.0%	8.3%	8.3%	37.5%	33.3%	12.5%	24	3.33	1.07	3.00	309
260	WSSPCAMT	0.0%	17.4%	13.0%	34.8%	24.6%	10.1%	69	2.97	1.22		
293/8	WSSPCAMT	0.0%	15.8%	15.8%	42.1%	21.1%	5.3%	19	2.84	1.09		
268-1	WSSPCAMT	0.0%	18.3%	21.7%	27.0%	22.6%	10.4%	115	2.85	1.25		
268-2	WSSPCAMT	0.0%	15.9%	14.6%	20.7%	32.9%	15.9%	82	3.17	1.33		
235	WSMATL	0.0%	8.3%	16.7%	12.5%	54.2%	8.3%	24	3.38	1.11	3.46	307
260	WSMATL	0.0%	1.4%	11.6%	23.2%	44.9%	18.8%	69	3.68	0.96		
293/8	WSMATL	0.0%	0.0%	21.1%	21.1%	42.1%	15.8%	19	3.53	0.99		
268-1	WSMATL	0.0%	13.2%	20.2%	29.8%	31.6%	5.3%	114	2.96	1.12		
268-2	WSMATL	1.2%	2.5%	9.9%	9.9%	37.0%	39.5%	81	3.98	1.14		
235	AMTLTWRK	0.0%	17.4%	26.1%	26.1%	17.4%	13.0%	23	2.83	1.27	3.16	307
260	AMTLTWRK	0.0%	10.1%	20.3%	29.0%	31.9%	8.7%	69	3.09	1.13		
293/8	AMTLTWRK	0.0%	0.0%	5.3%	31.6%	42.1%	21.1%	19	3.79	0.83		
268-1	AMTLTWRK	0.0%	12.3%	19.3%	31.6%	34.2%	2.6%	114	2.96	1.06		
268-2	AMTLTWRK	0.0%	2.4%	18.3%	23.2%	42.7%	13.4%	82	3.46	1.01		
235	LOCCLNLT	0.0%	12.5%	37.5%	20.8%	16.7%	12.5%	24	2.79	1.22	3.07	308
260	LOCCLNLT	0.0%	14.7%	20.6%	25.0%	30.9%	8.8%	68	2.99	1.21		
293/8	LOCCLNLT	0.0%	5.3%	5.3%	31.6%	36.8%	21.1%	19	3.63	1.04		
268-1	LOCCLNLT	0.0%	13.0%	20.9%	29.6%	33.9%	2.6%	115	2.92	1.08		
268-2	LOCCLNLT	0.0%	7.3%	15.9%	28.0%	35.4%	13.4%	82	3.32	1.11		
235	WALLCOLR	0.0%	17.4%	17.4%	17.4%	39.1%	8.7%	23	3.04	1.27	3.08	307
260	WALLCOLR	0.0%	24.6%	24.6%	31.9%	13.0%	5.8%	69	2.51	1.16		
293/8	WALLCOLR	0.0%	5.3%	10.5%	15.8%	57.9%	10.5%	19	3.58	0.99		
268-1	WALLCOLR	0.0%	10.5%	17.5%	31.6%	36.0%	4.4%	114	3.06	1.06		
268-2	WALLCOLR	0.0%	11.0%	7.3%	22.0%	42.7%	17.1%	82	3.48	1.18		
235	FURNCOLR	0.0%	16.7%	20.8%	25.0%	37.5%	0.0%	24	2.83	1.11	3.11	299
260	FURNCOLR	0.0%	7.6%	21.2%	31.8%	27.3%	12.1%	66	3.15	1.12		
293/8	FURNCOLR	0.0%	10.5%	15.8%	26.3%	42.1%	5.3%	19	3.16	1.09		
268-1	FURNCOLR	0.0%	17.1%	17.1%	44.1%	18.9%	2.7%	111	2.73	1.04		
268-2	FURNCOLR	0.0%	5.1%	7.6%	25.3%	38.0%	24.1%	79	3.68	1.07		
235	STORAGE	0.0%	36.4%	13.6%	27.3%	18.2%	4.5%	22	2.41	1.27	2.21	305
260	STORAGE	0.0%	46.4%	24.6%	14.5%	13.0%	1.4%	69	1.99	1.12		
293/8	STORAGE	0.0%	21.1%	47.4%	5.3%	26.3%	0.0%	19	2.37	1.09		
268-1	STORAGE	0.0%	40.7%	28.3%	18.6%	12.4%	0.0%	113	2.03	1.04		
268-2	STORAGE	0.0%	30.5%	20.7%	19.5%	19.5%	9.8%	82	2.57	1.35		
235	CONVPRIV	0.0%	58.3%	20.8%	8.3%	8.3%	4.2%	24	1.79	1.15	1.90	307
260	CONVPRIV	0.0%	55.1%	23.2%	13.0%	4.3%	4.3%	69	1.80	1.10		
293/8	CONVPRIV	0.0%	52.6%	15.8%	15.8%	15.8%	0.0%	19	1.95	1.15		
268-1	CONVPRIV	0.0%	63.5%	13.9%	12.2%	9.6%	0.9%	115	1.70	1.06		
268-2	CONVPRIV	0.0%	43.8%	15.0%	16.3%	18.8%	6.3%	80	2.29	1.35		
235	COWORKER	0.0%	8.7%	0.0%	30.4%	39.1%	21.7%	23	3.65	1.09	3.37	308
260	COWORKER	0.0%	7.2%	8.7%	24.6%	40.6%	18.8%	69	3.55	1.11		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	COWORKER	0.0%	5.3%	0.0%	42.1%	31.6%	21.1%	19	3.63	0.98		
268-1	COWORKER	0.0%	9.6%	13.0%	32.2%	33.9%	11.3%	115	3.24	1.12		
268-2	COWORKER	0.0%	7.3%	17.1%	32.9%	29.3%	13.4%	82	3.24	1.11		
235	WALLSPC	0.0%	20.8%	12.5%	25.0%	29.2%	12.5%	24	3.00	1.32	2.54	306
260	WALLSPC	0.0%	27.5%	11.6%	34.8%	21.7%	4.3%	69	2.64	1.22		
293/8	WALLSPC	0.0%	21.1%	15.8%	36.8%	21.1%	5.3%	19	2.74	1.16		
268-1	WALLSPC	0.0%	31.3%	29.5%	23.2%	13.4%	2.7%	112	2.27	1.12		
268-2	WALLSPC	0.0%	34.1%	13.4%	17.1%	25.6%	9.8%	82	2.63	1.42		
235	ADJAMTLT	0.0%	34.8%	17.4%	21.7%	26.1%	0.0%	23	2.39	1.21	2.09	302
260	ADJAMTLT	0.0%	54.4%	22.1%	19.1%	2.9%	1.5%	68	1.75	0.96		
293/8	ADJAMTLT	0.0%	50.0%	16.7%	11.1%	16.7%	5.6%	18	2.11	1.33		
268-1	ADJAMTLT	0.0%	51.8%	19.6%	14.3%	14.3%	0.0%	112	1.91	1.11		
268-2	ADJAMTLT	0.0%	37.0%	11.1%	22.2%	22.2%	7.4%	81	2.52	1.37		
235	VISPRIV	0.0%	26.1%	21.7%	21.7%	26.1%	4.3%	23	2.61	1.24	2.31	301
260	VISPRIV	0.0%	38.2%	20.6%	25.0%	11.8%	4.4%	68	2.24	1.20		
293/8	VISPRIV	0.0%	21.1%	10.5%	42.1%	15.8%	10.5%	19	2.84	1.23		
268-1	VISPRIV	0.0%	51.4%	18.9%	18.0%	11.7%	0.0%	111	1.88	1.08		
268-2	VISPRIV	0.0%	22.5%	21.3%	21.3%	30.0%	5.0%	80	2.74	1.24		
235	WRKSPACE	0.0%	17.4%	17.4%	39.1%	21.7%	4.3%	23	2.78	1.10	2.62	305
260	WRKSPACE	0.0%	27.9%	22.1%	23.5%	25.0%	1.5%	68	2.50	1.18		
293/8	WRKSPACE	0.0%	15.8%	26.3%	42.1%	15.8%	0.0%	19	2.58	0.94		
268-1	WRKSPACE	0.0%	18.6%	26.5%	38.1%	15.0%	1.8%	113	2.55	1.01		
268-2	WRKSPACE	0.0%	23.2%	17.1%	25.6%	28.0%	6.1%	82	2.77	1.25		
235	CHRCMFT	0.0%	12.5%	20.8%	20.8%	37.5%	8.3%	24	3.08	1.19	3.27	307
260	CHRCMFT	0.0%	1.4%	14.5%	23.2%	47.8%	13.0%	69	3.57	0.94		
293/8	CHRCMFT	0.0%	5.3%	15.8%	42.1%	21.1%	15.8%	19	3.26	1.07		
268-1	CHRCMFT	0.0%	6.2%	18.6%	34.5%	35.4%	5.3%	113	3.15	0.99		
268-2	CHRCMFT	0.0%	6.1%	17.1%	30.5%	37.8%	8.5%	82	3.26	1.03		
235	AIRCIRC	0.0%	33.3%	20.8%	20.8%	16.7%	8.3%	24	2.46	1.32	1.90	308
260	AIRCIRC	0.0%	55.1%	20.3%	10.1%	10.1%	4.3%	69	1.88	1.20		
293/8	AIRCIRC	0.0%	15.8%	21.1%	26.3%	31.6%	5.3%	19	2.89	1.17		
268-1	AIRCIRC	0.0%	67.5%	15.8%	7.9%	7.9%	0.9%	114	1.59	0.99		
268-2	AIRCIRC	0.0%	54.9%	11.0%	18.3%	14.6%	1.2%	82	1.96	1.19		
235	HEATING	0.0%	18.2%	18.2%	22.7%	36.4%	4.5%	22	2.91	1.20	2.32	299
260	HEATING	0.0%	35.3%	20.6%	27.9%	11.8%	4.4%	68	2.29	1.19		
293/8	HEATING	0.0%	16.7%	27.8%	22.2%	27.8%	5.6%	18	2.78	1.18		
268-1	HEATING	0.0%	34.5%	29.1%	20.0%	13.6%	2.7%	110	2.21	1.14		
268-2	HEATING	0.0%	35.8%	23.5%	25.9%	12.3%	2.5%	81	2.22	1.13		
235	COOLING	0.0%	20.8%	8.3%	29.2%	29.2%	12.5%	24	3.04	1.31	2.16	307
260	COOLING	0.0%	37.7%	27.5%	17.4%	14.5%	2.9%	69	2.17	1.17		
293/8	COOLING	0.0%	0.0%	31.6%	21.1%	31.6%	15.8%	19	3.32	1.08		
268-1	COOLING	0.0%	54.9%	20.4%	15.0%	8.8%	0.9%	113	1.81	1.05		
268-2	COOLING	0.0%	41.5%	22.0%	24.4%	9.8%	2.4%	82	2.10	1.12		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	AIRQSAT	0.0%	17.4%	26.1%	30.4%	17.4%	8.7%	23	2.74	1.19	2.00	306
260	AIRQSAT	0.0%	59.4%	18.8%	10.1%	8.7%	2.9%	69	1.77	1.12		
293/8	AIRQSAT	0.0%	10.5%	31.6%	31.6%	21.1%	5.3%	19	2.79	1.06		
268-1	AIRQSAT	0.0%	48.7%	28.3%	13.3%	9.7%	0.0%	113	1.84	0.99		
268-2	AIRQSAT	0.0%	45.1%	19.5%	23.2%	11.0%	1.2%	82	2.04	1.11		
235	CARPET	0.0%	17.4%	21.7%	13.0%	21.7%	4.3%	23	2.65	1.17	3.17	270
260	CARPET	0.0%	13.2%	22.1%	33.8%	25.0%	5.9%	68	2.88	1.11		
293/8	CARPET	0.0%	15.8%	26.3%	31.6%	26.3%	0.0%	19	2.68	1.03		
268-1	CARPET	0.0%	11.8%	10.8%	15.1%	30.1%	32.3%	93	3.56	1.39		
268-2	CARPET	0.0%	16.4%	13.4%	19.4%	32.8%	17.9%	67	3.22	1.34		
235	FUMES	0.0%	22.7%	22.7%	31.8%	22.7%	4.5%	22	2.55	1.08	2.67	286
260	FUMES	0.0%	25.4%	25.4%	17.9%	23.9%	7.5%	67	2.63	1.29		
293/8	FUMES	0.0%	5.6%	27.8%	33.3%	27.8%	5.6%	18	3.00	1.00		
268-1	FUMES	0.0%	15.5%	30.1%	26.2%	24.3%	3.9%	103	2.66	1.16		
268-2	FUMES	0.0%	17.1%	31.6%	25.0%	19.7%	6.6%	76	2.67	1.16		
235	FURNDUST	0.0%	8.3%	33.3%	29.2%	20.8%	8.3%	24	2.88	1.09	2.70	293
260	FURNDUST	0.0%	25.4%	37.3%	26.9%	9.0%	1.5%	67	2.24	0.98		
293/8	FURNDUST	0.0%	15.8%	26.3%	31.6%	21.1%	5.3%	19	2.74	1.12		
268-1	FURNDUST	0.0%	17.0%	22.6%	31.1%	22.6%	6.6%	106	2.77	1.19		
268-2	FURNDUST	0.0%	11.7%	22.1%	33.8%	24.7%	7.8%	77	2.95	1.12		
235	ARGMTWS	0.0%	4.3%	21.7%	21.7%	43.5%	8.7%	23	3.30	1.04	2.98	303
260	ARGMTWS	0.0%	10.3%	19.1%	27.9%	41.2%	1.5%	68	3.04	1.04		
293/8	ARGMTWS	0.0%	15.8%	15.8%	31.6%	36.8%	0.0%	19	2.89	1.07		
268-1	ARGMTWS	0.0%	19.6%	17.0%	30.4%	27.7%	5.4%	112	2.82	1.19		
268-2	ARGMTWS	0.0%	12.3%	19.8%	21.0%	40.7%	6.2%	81	3.09	1.16		
235	LOOKWS	0.0%	8.7%	34.8%	8.7%	43.5%	4.3%	23	3.00	1.14	2.84	303
260	LOOKWS	0.0%	18.8%	36.2%	17.4%	27.5%	0.0%	69	2.54	1.08		
293/8	LOOKWS	0.0%	10.5%	21.1%	31.6%	36.8%	0.0%	19	2.95	1.00		
268-1	LOOKWS	0.0%	22.3%	27.7%	25.0%	22.3%	2.7%	112	2.55	1.14		
268-2	LOOKWS	0.0%	7.5%	17.5%	11.3%	50.0%	13.8%	80	3.45	1.15		
235	RTLTBRK	16.7%	12.5%	8.3%	25.0%	16.7%	20.8%	24	2.75	1.74	2.18	298
260	RTLTBRK	13.0%	2.9%	15.9%	29.0%	30.4%	8.7%	69	2.87	1.44		
293/8	RTLTBRK	0.0%	0.0%	0.0%	52.6%	36.8%	10.5%	19	3.58	0.67		
268-1	RTLTBRK	44.4%	13.0%	3.7%	18.5%	17.6%	2.8%	108	1.60	1.70		
268-2	RTLTBRK	47.4%	5.1%	1.3%	14.1%	23.1%	9.0%	78	1.87	1.95		
235	RTLTHALL	0.0%	8.3%	8.3%	25.0%	45.8%	12.5%	24	3.46	1.08	3.26	306
260	RTLTHALL	0.0%	2.9%	8.7%	43.5%	36.2%	8.7%	69	3.39	0.87		
293/8	RTLTHALL	29.4%	0.0%	5.9%	35.3%	23.5%	5.9%	17	2.41	1.68		
268-1	RTLTHALL	2.6%	7.9%	8.8%	45.6%	29.8%	5.3%	114	3.08	1.07		
268-2	RTLTHALL	0.0%	3.7%	9.8%	31.7%	41.5%	13.4%	82	3.51	0.97		
235	RTLTRSTM	0.0%	16.7%	20.8%	25.0%	25.0%	12.5%	24	2.96	1.27	3.31	308
260	RTLTRSTM	0.0%	10.1%	18.8%	33.3%	26.1%	11.6%	69	3.10	1.14		
293/8	RTLTRSTM	0.0%	0.0%	10.5%	47.4%	31.6%	10.5%	19	3.42	0.82		
268-1	RTLTRSTM	0.0%	7.0%	14.9%	32.5%	36.8%	8.8%	114	3.25	1.04		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
268-2	RTLTRSTM	0.0%	3.7%	7.3%	24.4%	51.2%	13.4%	82	3.63	0.93		
235	RTLTSPAC	4.2%	4.2%	16.7%	33.3%	33.3%	8.3%	24	3.13	1.17	3.06	307
260	RTLTSPAC	0.0%	16.2%	13.2%	27.9%	38.2%	4.4%	68	3.01	1.16		
293/8	RTLTSPAC	0.0%	0.0%	0.0%	57.9%	31.6%	10.5%	19	3.53	0.68		
268-1	RTLTSPAC	0.9%	16.7%	21.1%	28.9%	28.9%	3.5%	114	2.79	1.16		
268-2	RTLTSPAC	1.2%	7.3%	11.0%	25.6%	47.6%	7.3%	82	3.33	1.08		
235	RTLTCONF	47.6%	0.0%	0.0%	23.8%	19.0%	9.5%	21	1.95	1.94	3.04	302
260	RTLTCONF	5.9%	1.5%	16.2%	23.5%	47.1%	5.9%	68	3.22	1.19		
293/8	RTLTCONF	33.3%	0.0%	0.0%	44.4%	16.7%	5.6%	18	2.28	1.69		
268-1	RTLTCONF	6.2%	6.2%	10.6%	35.4%	36.3%	5.3%	113	3.05	1.22		
268-2	RTLTCONF	6.1%	2.4%	7.3%	29.3%	46.3%	8.5%	82	3.33	1.19		
235	LTREAD	0.0%	4.5%	4.5%	27.3%	50.0%	13.6%	22	3.64	0.93	3.23	292
260	LTREAD	3.0%	9.0%	23.9%	23.9%	34.3%	6.0%	67	2.96	1.20		
293/8	LTREAD	0.0%	0.0%	5.3%	36.8%	36.8%	21.1%	19	3.74	0.85		
268-1	LTREAD	0.0%	16.8%	14.0%	23.4%	39.3%	6.5%	107	3.05	1.21		
268-2	LTREAD	0.0%	3.9%	14.3%	19.5%	53.2%	9.1%	77	3.49	0.98		
235	LTVDT	0.0%	7.1%	14.3%	35.7%	42.9%	0.0%	14	3.14	0.91	2.83	247
260	LTVDT	4.7%	12.5%	23.4%	31.3%	23.4%	4.7%	64	2.70	1.22		
293/8	LTVDT	0.0%	0.0%	11.8%	35.3%	29.4%	23.5%	17	3.65	0.97		
268-1	LTVDT	14.1%	12.9%	12.9%	21.2%	31.8%	7.1%	85	2.65	1.55		
268-2	LTVDT	10.4%	9.0%	13.4%	20.9%	40.3%	6.0%	67	2.90	1.44		
235	LTFILE	12.5%	0.0%	0.0%	25.0%	56.3%	6.3%	16	3.31	1.36	3.09	219
260	LTFILE	6.4%	6.4%	17.0%	27.7%	36.2%	6.4%	47	3.00	1.27		
293/8	LTFILE	0.0%	0.0%	0.0%	31.3%	43.8%	25.0%	16	3.94	0.75		
268-1	LTFILE	12.5%	8.8%	6.3%	28.8%	35.0%	8.8%	80	2.84	1.54		
268-2	LTFILE	6.7%	5.0%	3.3%	36.7%	41.7%	6.7%	60	3.22	1.21		
235	LTREPEQP	77.8%	0.0%	0.0%	11.1%	11.1%	0.0%	9	0.78	1.47	1.76	140
260	LTREPEQP	53.8%	0.0%	3.8%	3.8%	26.9%	11.5%	26	1.85	2.07		
293/8	LTREPEQP	31.3%	0.0%	0.0%	43.8%	25.0%	0.0%	16	2.31	1.61		
268-1	LTREPEQP	37.0%	7.4%	14.8%	16.7%	22.2%	1.9%	54	1.82	1.66		
268-2	LTREPEQP	42.9%	14.3%	8.6%	8.6%	25.7%	0.0%	35	1.60	1.68		
235	LTDRAFT	33.3%	0.0%	0.0%	25.0%	41.7%	0.0%	12	2.42	1.75	2.48	185
260	LTDRAFT	24.3%	10.8%	13.5%	18.9%	24.3%	8.1%	37	2.32	1.69		
293/8	LTDRAFT	25.0%	0.0%	6.3%	31.3%	25.0%	12.5%	16	2.69	1.72		
268-1	LTDRAFT	16.2%	12.2%	17.6%	23.0%	24.3%	6.8%	74	2.47	1.54		
268-2	LTDRAFT	21.7%	8.7%	10.9%	17.4%	32.6%	8.7%	46	2.57	1.70		
235	LTOTHER	20.0%	20.0%	0.0%	20.0%	20.0%	20.0%	5	2.60	1.85	2.51	90
260	LTOTHER	33.3%	16.7%	5.6%	22.2%	16.7%	5.6%	18	1.89	1.70		
293/8	LTOTHER	33.3%	0.0%	0.0%	44.4%	11.1%	11.1%	9	2.33	1.76		
268-1	LTOTHER	17.9%	10.7%	7.1%	28.6%	35.7%	0.0%	28	2.45	1.54		
268-2	LTOTHER	10.0%	10.0%	0.0%	36.7%	40.0%	3.3%	30	2.97	1.35		
235	AMTLTBRT	0.0%	0.0%	4.3%	43.5%	43.5%	8.7%	23	3.57	0.71	3.33	300
260	AMTLTBRT	0.0%	3.0%	4.5%	44.8%	38.8%	9.0%	67	3.46	0.83		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	AMTLTBRT	0.0%	0.0%	26.3%	63.2%	10.5%	0.0%	19	2.84	0.59		
268-1	AMTLTBRT	0.0%	3.7%	5.5%	49.5%	34.9%	6.4%	109	3.35	0.83		
268-2	AMTLTBRT	0.0%	2.4%	4.9%	59.8%	31.7%	1.2%	82	3.24	0.67		
235	WSLITSAT	0.0%	8.3%	8.3%	33.3%	37.5%	12.5%	24	3.38	1.07	3.11	308
260	WSLITSAT	0.0%	7.2%	36.2%	21.7%	27.5%	7.2%	69	2.91	1.10		
293/8	WSLITSAT	0.0%	0.0%	5.3%	42.1%	31.6%	21.1%	19	3.68	0.86		
268-1	WSLITSAT	0.0%	10.5%	32.5%	20.2%	32.5%	4.4%	114	2.88	1.11		
268-2	WSLITSAT	0.0%	4.9%	17.1%	25.6%	39.0%	13.4%	82	3.39	1.07		
235	VDTFLICK	0.0%	9.1%	63.6%	9.1%	18.2%	0.0%	11	2.36	0.88	2.05	210
260	VDTFLICK	0.0%	36.7%	45.0%	6.7%	11.7%	0.0%	60	1.93	0.95		
293/8	VDTFLICK	0.0%	37.5%	31.3%	6.3%	25.0%	0.0%	16	2.19	1.18		
268-1	VDTFLICK	0.0%	34.3%	25.7%	25.7%	14.3%	0.0%	70	2.20	1.06		
268-2	VDTFLICK	0.0%	50.9%	18.9%	20.8%	9.4%	0.0%	53	1.89	1.04		
235	VDTDSTSC	0.0%	18.2%	72.7%	9.1%	0.0%	0.0%	11	1.91	0.51	1.69	211
260	VDTDSTSC	0.0%	46.7%	40.0%	11.7%	1.7%	0.0%	60	1.68	0.74		
293/8	VDTDSTSC	0.0%	43.8%	56.3%	0.0%	0.0%	0.0%	16	1.56	0.50		
268-1	VDTDSTSC	0.0%	47.8%	34.8%	13.0%	4.3%	0.0%	69	1.74	0.85		
268-2	VDTDSTSC	0.0%	54.5%	32.7%	9.1%	3.6%	0.0%	55	1.62	0.80		
235	VDTANGSC	0.0%	36.4%	54.5%	0.0%	9.1%	0.0%	11	1.82	0.83	1.81	209
260	VDTANGSC	0.0%	50.8%	37.3%	8.5%	3.4%	0.0%	59	1.64	0.78		
293/8	VDTANGSC	0.0%	37.5%	62.5%	0.0%	0.0%	0.0%	16	1.63	0.48		
268-1	VDTANGSC	0.0%	34.8%	39.1%	18.8%	7.2%	0.0%	69	1.99	0.91		
268-2	VDTANGSC	0.0%	46.3%	35.2%	9.3%	9.3%	0.0%	54	1.81	0.94		
235	VDTGLARE	0.0%	18.2%	45.5%	9.1%	27.3%	0.0%	11	2.45	1.08	2.63	216
260	VDTGLARE	0.0%	13.3%	35.0%	33.3%	18.3%	0.0%	60	2.57	0.94		
293/8	VDTGLARE	0.0%	31.3%	50.0%	12.5%	6.3%	0.0%	16	1.94	0.83		
268-1	VDTGLARE	0.0%	15.1%	21.9%	20.5%	42.5%	0.0%	73	2.90	1.11		
268-2	VDTGLARE	0.0%	25.0%	23.2%	21.4%	30.4%	0.0%	56	2.57	1.16		
235	VDTANGKB	0.0%	9.1%	63.6%	18.2%	9.1%	0.0%	11	2.27	0.75	1.91	211
260	VDTANGKB	0.0%	42.4%	32.2%	16.9%	8.5%	0.0%	59	1.92	0.96		
293/8	VDTANGKB	0.0%	40.0%	53.3%	6.7%	0.0%	0.0%	15	1.67	0.60		
268-1	VDTANGKB	0.0%	42.3%	35.2%	12.7%	9.9%	0.0%	71	1.90	0.97		
268-2	VDTANGKB	0.0%	38.2%	38.2%	16.4%	7.3%	0.0%	55	1.93	0.91		
235	VDTDSKHT	0.0%	9.1%	81.8%	0.0%	9.1%	0.0%	11	2.09	0.67	1.91	211
260	VDTDSKHT	0.0%	50.8%	32.2%	10.2%	6.8%	0.0%	59	1.73	0.90		
293/8	VDTDSKHT	0.0%	53.3%	33.3%	13.3%	0.0%	0.0%	15	1.60	0.71		
268-1	VDTDSKHT	0.0%	35.7%	35.7%	15.7%	12.9%	0.0%	70	2.06	1.01		
268-2	VDTDSKHT	0.0%	32.1%	44.6%	16.1%	7.1%	0.0%	56	1.98	0.88		
235	VDTSEAT	0.0%	18.2%	45.5%	36.4%	0.0%	0.0%	11	2.18	0.72	1.86	211
260	VDTSEAT	0.0%	55.9%	32.2%	10.2%	1.7%	0.0%	59	1.58	0.74		
293/8	VDTSEAT	0.0%	43.8%	50.0%	0.0%	6.3%	0.0%	16	1.69	0.77		
268-1	VDTSEAT	0.0%	45.7%	30.0%	11.4%	12.9%	0.0%	70	1.91	1.04		
268-2	VDTSEAT	0.0%	34.5%	40.0%	9.1%	16.4%	0.0%	55	2.07	1.04		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	VDTREFSC	0.0%	9.1%	54.5%	9.1%	27.3%	0.0%	11	2.55	0.99	2.55	216
260	VDTREFSC	0.0%	16.7%	38.3%	30.0%	15.0%	0.0%	60	2.43	0.94		
293/8	VDTREFSC	0.0%	31.3%	37.5%	31.3%	0.0%	0.0%	16	2.00	0.79		
268-1	VDTREFSC	0.0%	13.9%	30.6%	20.8%	34.7%	0.0%	72	2.76	1.07		
268-2	VDTREFSC	0.0%	21.1%	28.1%	26.3%	24.6%	0.0%	57	2.54	1.08		
235	VDTREAD	0.0%	20.0%	70.0%	10.0%	0.0%	0.0%	10	1.90	0.54	2.00	209
260	VDTREAD	0.0%	33.9%	47.5%	10.2%	8.5%	0.0%	59	1.93	0.88		
293/8	VDTREAD	0.0%	50.0%	43.8%	6.3%	0.0%	0.0%	16	1.56	0.61		
268-1	VDTREAD	0.0%	32.9%	35.7%	24.3%	7.1%	0.0%	70	2.06	0.92		
268-2	VDTREAD	0.0%	24.1%	48.1%	18.5%	9.3%	0.0%	54	2.13	0.88		
235	VDTBRTLT	0.0%	9.1%	54.5%	9.1%	27.3%	0.0%	11	2.55	0.99	2.32	209
260	VDTBRTLT	0.0%	25.4%	35.6%	32.2%	6.8%	0.0%	59	2.20	0.90		
293/8	VDTBRTLT	0.0%	50.0%	42.9%	0.0%	7.1%	0.0%	14	1.64	0.81		
268-1	VDTBRTLT	0.0%	22.5%	25.4%	25.4%	26.8%	0.0%	71	2.56	1.11		
268-2	VDTBRTLT	0.0%	25.9%	35.2%	27.8%	11.1%	0.0%	54	2.24	0.96		
235	VDTADJSC	0.0%	0.0%	80.0%	10.0%	10.0%	0.0%	10	2.30	0.64	2.11	209
260	VDTADJSC	0.0%	40.7%	30.5%	23.7%	5.1%	0.0%	59	1.93	0.92		
293/8	VDTADJSC	0.0%	33.3%	46.7%	13.3%	6.7%	0.0%	15	1.93	0.85		
268-1	VDTADJSC	0.0%	33.8%	22.5%	22.5%	21.1%	0.0%	71	2.31	1.15		
268-2	VDTADJSC	0.0%	40.7%	27.8%	18.5%	13.0%	0.0%	54	2.04	1.05		
235	VDTSPACE	0.0%	0.0%	60.0%	20.0%	20.0%	0.0%	10	2.60	0.80	2.51	207
260	VDTSPACE	0.0%	23.7%	27.1%	23.7%	25.4%	0.0%	59	2.51	1.11		
293/8	VDTSPACE	0.0%	46.7%	33.3%	0.0%	20.0%	0.0%	15	1.93	1.12		
268-1	VDTSPACE	0.0%	20.3%	29.0%	21.7%	29.0%	0.0%	69	2.59	1.11		
268-2	VDTSPACE	0.0%	14.8%	40.7%	20.4%	24.1%	0.0%	54	2.54	1.01		
235	VDTADJLT	0.0%	0.0%	36.4%	36.4%	27.3%	0.0%	11	2.91	0.79	2.62	206
260	VDTADJLT	0.0%	14.0%	36.8%	29.8%	19.3%	0.0%	57	2.54	0.96		
293/8	VDTADJLT	0.0%	40.0%	40.0%	6.7%	13.3%	0.0%	15	1.93	1.00		
268-1	VDTADJLT	0.0%	15.5%	23.9%	21.1%	39.4%	0.0%	71	2.85	1.11		
268-2	VDTADJLT	0.0%	21.2%	28.8%	25.0%	25.0%	0.0%	52	2.54	1.08		
235	NOISEPHN	0.0%	36.4%	31.8%	13.6%	18.2%	0.0%	22	2.14	1.10	2.44	293
260	NOISEPHN	0.0%	18.2%	39.4%	33.3%	9.1%	0.0%	66	2.33	0.88		
293/8	NOISEPHN	0.0%	5.3%	31.6%	21.1%	42.1%	0.0%	19	3.00	0.97		
268-1	NOISEPHN	0.0%	17.4%	37.6%	23.9%	21.1%	0.0%	109	2.49	1.01		
268-2	NOISEPHN	0.0%	19.5%	36.4%	27.3%	16.9%	0.0%	77	2.42	0.98		
235	PEPTALK	0.0%	28.6%	42.9%	23.8%	4.8%	0.0%	21	2.05	0.84	2.53	294
260	PEPTALK	0.0%	13.6%	42.4%	33.3%	10.6%	0.0%	66	2.41	0.85		
293/8	PEPTALK	0.0%	15.8%	47.4%	5.3%	31.6%	0.0%	19	2.53	1.09		
268-1	PEPTALK	0.0%	14.5%	31.8%	24.5%	29.1%	0.0%	110	2.68	1.04		
268-2	PEPTALK	0.0%	14.1%	30.8%	39.7%	15.4%	0.0%	78	2.56	0.91		
235	NOISEPRT	0.0%	27.8%	50.0%	11.1%	11.1%	0.0%	18	2.06	0.91	2.23	287
260	NOISEPRT	0.0%	18.2%	45.5%	24.2%	12.1%	0.0%	66	2.30	0.90		
293/8	NOISEPRT	0.0%	33.3%	33.3%	22.2%	11.1%	0.0%	18	2.11	0.99		
268-1	NOISEPRT	0.0%	28.2%	30.9%	26.4%	14.5%	0.0%	110	2.27	1.03		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
268-2	NOISEPRT	0.0%	29.3%	37.3%	18.7%	14.7%	0.0%	75	2.19	1.02		
235	NOISEEQP	0.0%	31.8%	50.0%	4.5%	13.6%	0.0%	22	2.00	0.95	2.19	291
260	NOISEEQP	0.0%	21.2%	43.9%	21.2%	13.6%	0.0%	66	2.27	0.95		
293/8	NOISEEQP	0.0%	33.3%	33.3%	11.1%	22.2%	0.0%	18	2.22	1.13		
268-1	NOISEEQP	0.0%	25.0%	37.0%	22.2%	15.7%	0.0%	108	2.29	1.01		
268-2	NOISEEQP	0.0%	29.9%	45.5%	15.6%	9.1%	0.0%	77	2.04	0.90		
235	NOISEVNT	0.0%	38.1%	47.6%	4.8%	9.5%	0.0%	21	1.86	0.89	1.96	289
260	NOISEVNT	0.0%	24.6%	52.3%	13.8%	9.2%	0.0%	65	2.08	0.86		
293/8	NOISEVNT	0.0%	38.9%	44.4%	11.1%	5.6%	0.0%	18	1.83	0.83		
268-1	NOISEVNT	0.0%	31.8%	43.0%	15.9%	9.3%	0.0%	107	2.03	0.92		
268-2	NOISEVNT	0.0%	44.9%	37.2%	9.0%	9.0%	0.0%	78	1.82	0.93		
235	NOISEHAL	0.0%	33.3%	47.6%	14.3%	4.8%	0.0%	21	1.90	0.81	1.86	288
260	NOISEHAL	0.0%	34.8%	50.0%	10.6%	4.5%	0.0%	66	1.85	0.78		
293/8	NOISEHAL	0.0%	47.1%	35.3%	0.0%	17.6%	0.0%	17	1.88	1.08		
268-1	NOISEHAL	0.0%	36.1%	43.5%	13.9%	6.5%	0.0%	108	1.91	0.87		
268-2	NOISEHAL	0.0%	44.7%	35.5%	15.8%	3.9%	0.0%	76	1.79	0.85		
235	GLRWKSF	0.0%	27.3%	36.4%	22.7%	13.6%	0.0%	22	2.23	1.00	2.21	291
260	GLRWKSF	0.0%	26.9%	40.3%	20.9%	11.9%	0.0%	67	2.18	0.96		
293/8	GLRWKSF	0.0%	26.3%	47.4%	15.8%	10.5%	0.0%	19	2.11	0.91		
268-1	GLRWKSF	0.0%	25.2%	33.6%	22.4%	18.7%	0.0%	107	2.35	1.05		
268-2	GLRWKSF	0.0%	34.2%	35.5%	19.7%	10.5%	0.0%	76	2.07	0.98		
235	GLRCLNLT	0.0%	33.3%	38.1%	14.3%	14.3%	0.0%	21	2.10	1.02	2.25	291
260	GLRCLNLT	0.0%	23.9%	38.8%	25.4%	11.9%	0.0%	67	2.25	0.95		
293/8	GLRCLNLT	0.0%	26.3%	52.6%	10.5%	10.5%	0.0%	19	2.05	0.89		
268-1	GLRCLNLT	0.0%	21.1%	38.5%	21.1%	19.3%	0.0%	109	2.39	1.02		
268-2	GLRCLNLT	0.0%	32.0%	33.3%	22.7%	12.0%	0.0%	75	2.15	1.00		
235	DIMLIT	0.0%	31.8%	36.4%	18.2%	13.6%	0.0%	22	2.14	1.01	2.23	286
260	DIMLIT	0.0%	21.2%	36.4%	24.2%	18.2%	0.0%	66	2.39	1.01		
293/8	DIMLIT	0.0%	44.4%	38.9%	16.7%	0.0%	0.0%	18	1.72	0.73		
268-1	DIMLIT	0.0%	30.8%	33.6%	18.7%	16.8%	0.0%	107	2.21	1.06		
268-2	DIMLIT	0.0%	30.1%	31.5%	21.9%	16.4%	0.0%	73	2.25	1.06		
235	NOVIEW	0.0%	27.8%	38.9%	5.6%	27.8%	0.0%	18	2.33	1.15	2.58	276
260	NOVIEW	0.0%	11.5%	19.7%	21.3%	47.5%	0.0%	61	3.05	1.06		
293/8	NOVIEW	0.0%	29.4%	41.2%	17.6%	11.8%	0.0%	17	2.12	0.96		
268-1	NOVIEW	0.0%	23.1%	26.9%	12.5%	37.5%	0.0%	104	2.57	1.26		
268-2	NOVIEW	0.0%	27.6%	30.3%	18.4%	23.7%	0.0%	76	2.38	1.12		
235	HOTSUMR	0.0%	40.9%	31.8%	13.6%	13.6%	0.0%	22	2.00	1.04	2.66	294
260	HOTSUMR	0.0%	29.7%	31.3%	26.6%	12.5%	0.0%	64	2.22	1.01		
293/8	HOTSUMR	0.0%	26.3%	31.6%	15.8%	26.3%	0.0%	19	2.42	1.14		
268-1	HOTSUMR	0.0%	11.7%	16.2%	27.0%	45.0%	0.0%	111	3.05	1.04		
268-2	HOTSUMR	0.0%	19.2%	23.1%	25.6%	32.1%	0.0%	78	2.71	1.11		
235	COLDWTR	0.0%	35.0%	35.0%	5.0%	25.0%	0.0%	20	2.20	1.17	2.55	291
260	COLDWTR	0.0%	20.3%	35.9%	28.1%	15.6%	0.0%	64	2.39	0.98		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	COLDWTR	0.0%	27.8%	27.8%	11.1%	33.3%	0.0%	18	2.50	1.21		
268-1	COLDWTR	0.0%	17.0%	25.9%	28.6%	28.6%	0.0%	112	2.69	1.06		
268-2	COLDWTR	0.0%	18.2%	32.5%	22.1%	27.3%	0.0%	77	2.58	1.07		
235	DRAFTS	0.0%	40.0%	35.0%	10.0%	15.0%	0.0%	20	2.00	1.05	2.15	289
260	DRAFTS	0.0%	29.7%	34.4%	20.3%	15.6%	0.0%	64	2.22	1.04		
293/8	DRAFTS	0.0%	33.3%	33.3%	11.1%	22.2%	0.0%	18	2.22	1.13		
268-1	DRAFTS	0.0%	31.8%	34.5%	15.5%	18.2%	0.0%	110	2.18	1.09		
268-2	DRAFTS	0.0%	36.4%	35.1%	14.3%	14.3%	0.0%	77	2.06	1.04		
235	STUFYAIR	0.0%	19.0%	38.1%	28.6%	14.3%	0.0%	21	2.38	0.95	2.86	289
260	STUFYAIR	0.0%	10.9%	23.4%	23.4%	42.2%	0.0%	64	2.97	1.05		
293/8	STUFYAIR	0.0%	27.8%	33.3%	22.2%	16.7%	0.0%	18	2.28	1.04		
268-1	STUFYAIR	0.0%	11.8%	20.9%	27.3%	40.0%	0.0%	110	2.95	1.04		
268-2	STUFYAIR	0.0%	13.2%	23.7%	22.4%	40.8%	0.0%	76	2.91	1.08		
235	PEPLWALK	0.0%	33.3%	47.6%	4.8%	14.3%	0.0%	21	2.00	0.98	2.10	290
260	PEPLWALK	0.0%	34.3%	49.3%	9.0%	7.5%	0.0%	67	1.90	0.85		
293/8	PEPLWALK	0.0%	22.2%	44.4%	5.6%	27.8%	0.0%	18	2.39	1.11		
268-1	PEPLWALK	0.0%	28.2%	42.7%	15.5%	13.6%	0.0%	110	2.15	0.98		
268-2	PEPLWALK	0.0%	25.7%	43.2%	18.9%	12.2%	0.0%	74	2.18	0.95		
235	PEPLCLOS	0.0%	40.0%	35.0%	15.0%	10.0%	0.0%	20	1.95	0.97	2.29	290
260	PEPLCLOS	0.0%	23.1%	52.3%	12.3%	12.3%	0.0%	65	2.14	0.91		
293/8	PEPLCLOS	0.0%	27.8%	38.9%	5.6%	27.8%	0.0%	18	2.33	1.15		
268-1	PEPLCLOS	0.0%	26.1%	27.0%	24.3%	22.5%	0.0%	111	2.43	1.10		
268-2	PEPLCLOS	0.0%	23.7%	36.8%	25.0%	14.5%	0.0%	76	2.30	0.99		
235	SMELLS	0.0%	36.4%	36.4%	4.5%	22.7%	0.0%	22	2.14	1.14	2.32	293
260	SMELLS	0.0%	22.4%	38.8%	23.9%	14.9%	0.0%	67	2.31	0.98		
293/8	SMELLS	0.0%	22.2%	44.4%	11.1%	22.2%	0.0%	18	2.33	1.05		
268-1	SMELLS	0.0%	23.4%	29.9%	25.2%	21.5%	0.0%	107	2.43	1.09		
268-2	SMELLS	0.0%	26.6%	39.2%	19.0%	15.2%	0.0%	79	2.23	1.01		
235	SMOKE	0.0%	38.1%	23.8%	14.3%	23.8%	0.0%	21	2.24	1.19	2.43	293
260	SMOKE	0.0%	35.8%	25.4%	14.9%	23.9%	0.0%	67	2.27	1.18		
293/8	SMOKE	0.0%	31.6%	36.8%	15.8%	15.8%	0.0%	19	2.16	1.04		
268-1	SMOKE	0.0%	31.8%	20.0%	17.3%	30.9%	0.0%	110	2.47	1.23		
268-2	SMOKE	0.0%	28.9%	14.5%	21.1%	35.5%	0.0%	76	2.63	1.23		
235	TEMPSWN	0.0%	35.0%	35.0%	15.0%	15.0%	0.0%	20	2.10	1.04	2.63	291
260	TEMPSWN	0.0%	16.4%	28.4%	23.9%	31.3%	0.0%	67	2.70	1.08		
293/8	TEMPSWN	0.0%	26.3%	26.3%	21.1%	26.3%	0.0%	19	2.47	1.14		
268-1	TEMPSWN	0.0%	13.8%	32.1%	22.9%	31.2%	0.0%	109	2.72	1.05		
268-2	TEMPSWN	0.0%	18.4%	27.6%	26.3%	27.6%	0.0%	76	2.63	1.07		
235	AIRQUAL	0.0%	18.2%	50.0%	18.2%	13.6%	0.0%	22	2.27	0.91	2.83	296
260	AIRQUAL	0.0%	6.0%	26.9%	26.9%	40.3%	0.0%	67	3.01	0.95		
293/8	AIRQUAL	0.0%	15.8%	52.6%	21.1%	10.5%	0.0%	19	2.26	0.85		
268-1	AIRQUAL	0.0%	10.0%	27.3%	26.4%	36.4%	0.0%	110	2.89	1.01		
268-2	AIRQUAL	0.0%	12.8%	25.6%	20.5%	41.0%	0.0%	78	2.90	1.08		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	NOTSKLT	0.0%	30.0%	30.0%	20.0%	20.0%	0.0%	20	2.30	1.10	2.60	284
260	NOTSKLT	0.0%	9.5%	31.7%	33.3%	25.4%	0.0%	63	2.75	0.94		
293/8	NOTSKLT	0.0%	15.8%	63.2%	10.5%	10.5%	0.0%	19	2.16	0.81		
268-1	NOTSKLT	0.0%	20.2%	22.9%	22.9%	33.9%	0.0%	109	2.71	1.14		
268-2	NOTSKLT	0.0%	16.4%	35.6%	30.1%	17.8%	0.0%	73	2.49	0.97		
235	HEADACHE	0.0%	22.7%	50.0%	9.1%	13.6%	4.5%	22	2.27	1.09	2.82	306
260	HEADACHE	0.0%	5.9%	19.1%	42.6%	27.9%	4.4%	68	3.06	0.94		
293/8	HEADACHE	0.0%	15.8%	26.3%	31.6%	15.8%	10.5%	19	2.79	1.20		
268-1	HEADACHE	0.0%	14.8%	19.1%	40.9%	19.1%	6.1%	115	2.83	1.09		
268-2	HEADACHE	0.0%	17.1%	12.2%	48.8%	19.5%	2.4%	82	2.78	1.02		
235	DIZZY	0.0%	54.5%	27.3%	13.6%	0.0%	4.5%	22	1.73	1.01	1.78	303
260	DIZZY	0.0%	50.0%	22.1%	17.6%	5.9%	4.4%	68	1.93	1.14		
293/8	DIZZY	0.0%	47.4%	36.8%	10.5%	0.0%	5.3%	19	1.79	1.00		
268-1	DIZZY	0.0%	54.9%	20.4%	18.6%	4.4%	1.8%	113	1.78	1.01		
268-2	DIZZY	0.0%	55.6%	29.6%	11.1%	1.2%	2.5%	81	1.65	0.90		
235	SLEEPY	0.0%	36.4%	36.4%	22.7%	0.0%	4.5%	22	2.00	1.00	2.66	303
260	SLEEPY	0.0%	13.4%	11.9%	47.8%	17.9%	9.0%	67	2.97	1.09		
293/8	SLEEPY	0.0%	31.6%	36.8%	21.1%	10.5%	0.0%	19	2.11	0.97		
268-1	SLEEPY	0.0%	21.2%	18.6%	31.0%	23.0%	6.2%	113	2.74	1.20		
268-2	SLEEPY	0.0%	20.7%	22.0%	37.8%	17.1%	2.4%	82	2.59	1.07		
235	SORTHROT	0.0%	54.5%	36.4%	0.0%	4.5%	4.5%	22	1.68	1.02	2.20	301
260	SORTHROT	0.0%	34.3%	17.9%	34.3%	9.0%	4.5%	67	2.31	1.16		
293/8	SORTHROT	0.0%	42.1%	31.6%	15.8%	5.3%	5.3%	19	2.00	1.12		
268-1	SORTHROT	0.0%	38.1%	24.8%	19.5%	15.9%	1.8%	113	2.19	1.16		
268-2	SORTHROT	0.0%	28.8%	27.5%	31.3%	8.8%	3.8%	80	2.31	1.09		
235	RUNNOSE	0.0%	52.2%	21.7%	17.4%	4.3%	4.3%	23	1.87	1.12	2.38	303
260	RUNNOSE	0.0%	34.3%	11.9%	40.3%	7.5%	6.0%	67	2.39	1.20		
293/8	RUNNOSE	0.0%	31.6%	21.1%	26.3%	10.5%	10.5%	19	2.47	1.31		
268-1	RUNNOSE	0.0%	33.6%	18.6%	29.2%	15.0%	3.5%	113	2.36	1.19		
268-2	RUNNOSE	0.0%	24.7%	27.2%	25.9%	17.3%	4.9%	81	2.51	1.18		
235	IRRITEYE	0.0%	39.1%	21.7%	21.7%	8.7%	8.7%	23	2.26	1.29	2.76	305
260	IRRITEYE	0.0%	17.9%	11.9%	34.3%	28.4%	7.5%	67	2.96	1.19		
293/8	IRRITEYE	0.0%	26.3%	26.3%	26.3%	15.8%	5.3%	19	2.47	1.19		
268-1	IRRITEYE	0.0%	25.2%	13.0%	30.4%	26.1%	5.2%	115	2.73	1.24		
268-2	IRRITEYE	0.0%	22.2%	9.9%	35.8%	24.7%	7.4%	81	2.85	1.23		
235	FOCUSEYE	0.0%	27.3%	40.9%	9.1%	13.6%	9.1%	22	2.36	1.26	2.43	302
260	FOCUSEYE	0.0%	19.4%	25.4%	25.4%	26.9%	3.0%	67	2.69	1.15		
293/8	FOCUSEYE	0.0%	36.8%	31.6%	15.8%	10.5%	5.3%	19	2.16	1.18		
268-1	FOCUSEYE	0.0%	32.7%	19.5%	24.8%	16.8%	6.2%	113	2.42	1.28		
268-2	FOCUSEYE	0.0%	27.2%	32.1%	25.9%	11.1%	3.7%	81	2.32	1.10		
235	DIFFCONC	0.0%	36.4%	22.7%	22.7%	13.6%	4.5%	22	2.27	1.21	2.84	302
260	DIFFCONC	0.0%	4.5%	27.3%	54.5%	12.1%	1.5%	66	2.79	0.77		
293/8	DIFFCONC	0.0%	15.8%	31.6%	36.8%	10.5%	5.3%	19	2.58	1.04		
268-1	DIFFCONC	0.0%	7.8%	19.1%	49.6%	19.1%	4.3%	115	2.93	0.93		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
268-2	DIFFCONC	0.0%	8.8%	15.0%	50.0%	23.8%	2.5%	80	2.96	0.91		
235	FATIGUE	0.0%	36.4%	36.4%	13.6%	9.1%	4.5%	22	2.09	1.12	2.69	297
260	FATIGUE	0.0%	9.1%	15.2%	47.0%	27.3%	1.5%	66	2.97	0.92		
293/8	FATIGUE	0.0%	21.1%	26.3%	36.8%	15.8%	0.0%	19	2.47	0.99		
268-1	FATIGUE	0.0%	17.4%	18.3%	45.0%	15.6%	3.7%	109	2.70	1.04		
268-2	FATIGUE	0.0%	7.4%	33.3%	46.9%	9.9%	2.5%	81	2.67	0.85		
235	EAR	0.0%	65.2%	26.1%	4.3%	0.0%	4.3%	23	1.52	0.93	1.46	296
260	EAR	0.0%	73.8%	16.9%	6.2%	3.1%	0.0%	65	1.38	0.74		
293/8	EAR	0.0%	73.7%	21.1%	5.3%	0.0%	0.0%	19	1.32	0.57		
268-1	EAR	0.0%	68.2%	16.4%	8.2%	4.5%	2.7%	110	1.57	1.00		
268-2	EAR	0.0%	73.4%	17.7%	6.3%	1.3%	1.3%	79	1.39	0.77		
235	COLDS	0.0%	52.2%	39.1%	0.0%	4.3%	4.3%	23	1.70	1.00	2.10	299
260	COLDS	0.0%	40.9%	33.3%	16.7%	7.6%	1.5%	66	1.95	1.01		
293/8	COLDS	0.0%	31.6%	26.3%	31.6%	10.5%	0.0%	19	2.21	1.00		
268-1	COLDS	0.0%	38.7%	23.4%	21.6%	12.6%	3.6%	111	2.19	1.18		
268-2	COLDS	0.0%	30.0%	33.8%	25.0%	8.8%	2.5%	80	2.20	1.04		
235	SINUS	0.0%	52.2%	21.7%	4.3%	13.0%	8.7%	23	2.04	1.37	2.48	300
260	SINUS	0.0%	40.9%	12.1%	21.2%	12.1%	13.6%	66	2.45	1.46		
293/8	SINUS	0.0%	31.6%	21.1%	31.6%	5.3%	10.5%	19	2.42	1.27		
268-1	SINUS	0.0%	35.7%	15.2%	26.8%	13.4%	8.9%	112	2.45	1.33		
268-2	SINUS	0.0%	27.5%	15.0%	30.0%	16.3%	11.3%	80	2.69	1.33		
235	ALLERGY	0.0%	52.2%	30.4%	4.3%	4.3%	8.7%	23	1.87	1.23	2.14	295
260	ALLERGY	0.0%	56.1%	15.2%	10.6%	9.1%	9.1%	66	2.00	1.36		
293/8	ALLERGY	0.0%	42.1%	21.1%	21.1%	5.3%	10.5%	19	2.21	1.32		
268-1	ALLERGY	0.0%	45.4%	17.6%	19.4%	10.2%	7.4%	108	2.17	1.30		
268-2	ALLERGY	0.0%	40.5%	17.7%	24.1%	10.1%	7.6%	79	2.27	1.29		
235	FURNSAT	0.0%	4.2%	16.7%	25.0%	45.8%	8.3%	24	3.38	0.99	3.08	305
260	FURNSAT	0.0%	5.8%	30.4%	10.1%	50.7%	2.9%	69	3.14	1.07		
293/8	FURNSAT	0.0%	5.3%	15.8%	36.8%	36.8%	5.3%	19	3.21	0.95		
268-1	FURNSAT	0.0%	9.0%	38.7%	21.6%	26.1%	4.5%	111	2.78	1.07		
268-2	FURNSAT	0.0%	7.3%	20.7%	17.1%	42.7%	12.2%	82	3.32	1.15		
235	NEDSEOUT	34.8%	65.2%	0.0%	0.0%	0.0%	0.0%	23	0.65	0.48	0.71	296
260	NEDSEOUT	9.2%	87.7%	1.5%	0.0%	1.5%	0.0%	65	0.97	0.50		
293/8	NEDSEOUT	22.2%	77.8%	0.0%	0.0%	0.0%	0.0%	18	0.78	0.42		
268-1	NEDSEOUT	34.5%	63.6%	0.9%	0.0%	0.9%	0.0%	110	0.69	0.58		
268-2	NEDSEOUT	47.5%	52.5%	0.0%	0.0%	0.0%	0.0%	80	0.53	0.50		
235	EQUIPSAT	0.0%	0.0%	4.2%	25.0%	62.5%	8.3%	24	3.75	0.66	3.19	305
260	EQUIPSAT	0.0%	8.7%	20.3%	18.8%	46.4%	5.8%	69	3.20	1.10		
293/8	EQUIPSAT	0.0%	10.5%	31.6%	31.6%	26.3%	0.0%	19	2.74	0.96		
268-1	EQUIPSAT	0.0%	7.1%	28.6%	25.0%	30.4%	8.9%	112	3.05	1.11		
268-2	EQUIPSAT	0.0%	7.4%	19.8%	21.0%	39.5%	12.3%	81	3.30	1.14		
235	CHAIRMOV	0.0%	9.5%	23.8%	52.4%	14.3%	0.0%	21	2.71	0.82	2.72	277
260	CHAIRMOV	0.0%	4.4%	16.2%	61.8%	17.6%	0.0%	68	2.93	0.71		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	CHAIRMOV	0.0%	5.3%	36.8%	36.8%	21.1%	0.0%	19	2.74	0.85		
268-1	CHAIRMOV	0.0%	13.1%	25.3%	49.5%	12.1%	0.0%	99	2.61	0.86		
268-2	CHAIRMOV	0.0%	11.4%	31.4%	35.7%	21.4%	0.0%	70	2.67	0.94		
235	CHRHGT	0.0%	17.4%	30.4%	43.5%	8.7%	0.0%	23	2.43	0.88	2.50	299
260	CHRHGT	0.0%	7.2%	24.6%	52.2%	15.9%	0.0%	69	2.77	0.80		
293/8	CHRHGT	0.0%	15.8%	47.4%	26.3%	10.5%	0.0%	19	2.32	0.86		
268-1	CHRHGT	0.0%	23.6%	26.4%	37.3%	12.7%	0.0%	110	2.39	0.98		
268-2	CHRHGT	0.0%	17.9%	28.2%	41.0%	12.8%	0.0%	78	2.49	0.93		
235	CHRBACK	0.0%	21.7%	30.4%	39.1%	8.7%	0.0%	23	2.35	0.91	2.34	288
260	CHRBACK	0.0%	14.9%	28.4%	41.8%	14.9%	0.0%	67	2.57	0.92		
293/8	CHRBACK	0.0%	31.6%	36.8%	26.3%	5.3%	0.0%	19	2.05	0.89		
268-1	CHRBACK	0.0%	29.2%	21.7%	35.8%	13.2%	0.0%	106	2.33	1.03		
268-2	CHRBACK	0.0%	35.6%	19.2%	31.5%	13.7%	0.0%	73	2.23	1.08		
235	CHRADJT	0.0%	17.4%	34.8%	39.1%	8.7%	0.0%	23	2.39	0.87	2.60	295
260	CHRADJT	0.0%	10.1%	14.5%	58.0%	17.4%	0.0%	69	2.83	0.83		
293/8	CHRADJT	0.0%	21.1%	26.3%	31.6%	21.1%	0.0%	19	2.53	1.04		
268-1	CHRADJT	0.0%	14.2%	28.3%	44.3%	13.2%	0.0%	106	2.57	0.89		
268-2	CHRADJT	0.0%	16.7%	26.9%	42.3%	14.1%	0.0%	78	2.54	0.93		
235	CHAIRCON	0.0%	4.2%	41.7%	41.7%	12.5%	0.0%	24	2.63	0.75	2.79	303
260	CHAIRCON	0.0%	2.9%	15.9%	55.1%	26.1%	0.0%	69	3.04	0.73		
293/8	CHAIRCON	0.0%	0.0%	42.1%	42.1%	15.8%	0.0%	19	2.74	0.71		
268-1	CHAIRCON	0.0%	9.1%	25.5%	49.1%	16.4%	0.0%	110	2.73	0.84		
268-2	CHAIRCON	0.0%	9.9%	23.5%	50.6%	16.0%	0.0%	81	2.73	0.85		
235	COWRKHR	0.0%	57.1%	33.3%	4.8%	4.8%	0.0%	21	1.57	0.79	1.49	297
260	COWRKHR	0.0%	62.1%	28.8%	7.6%	1.5%	0.0%	66	1.48	0.70		
293/8	COWRKHR	0.0%	36.8%	52.6%	5.3%	5.3%	0.0%	19	1.79	0.77		
268-1	COWRKHR	0.0%	69.1%	24.5%	5.5%	0.9%	0.0%	110	1.38	0.63		
268-2	COWRKHR	0.0%	56.8%	33.3%	8.6%	1.2%	0.0%	81	1.54	0.70		
235	TIREDEYE	0.0%	4.8%	33.3%	33.3%	28.6%	0.0%	21	2.86	0.89	2.45	296
260	TIREDEYE	0.0%	13.6%	43.9%	28.8%	13.6%	0.0%	66	2.42	0.89		
293/8	TIREDEYE	0.0%	21.1%	42.1%	26.3%	10.5%	0.0%	19	2.26	0.91		
268-1	TIREDEYE	0.0%	19.3%	36.7%	31.2%	12.8%	0.0%	109	2.38	0.94		
268-2	TIREDEYE	0.0%	12.3%	40.7%	30.9%	16.0%	0.0%	81	2.51	0.90		
235	NOMOVFWS	0.0%	4.5%	31.8%	45.5%	18.2%	0.0%	22	2.77	0.79	2.62	299
260	NOMOVFWS	0.0%	9.0%	50.7%	26.9%	13.4%	0.0%	67	2.45	0.83		
293/8	NOMOVFWS	0.0%	5.3%	31.6%	31.6%	31.6%	0.0%	19	2.89	0.91		
268-1	NOMOVFWS	0.0%	9.2%	41.3%	32.1%	17.4%	0.0%	109	2.58	0.88		
268-2	NOMOVFWS	0.0%	9.8%	34.1%	31.7%	24.4%	0.0%	82	2.71	0.94		
235	CONCNTRT	0.0%	0.0%	9.1%	50.0%	40.9%	0.0%	22	3.32	0.63	3.34	299
260	CONCNTRT	0.0%	0.0%	6.1%	39.4%	54.5%	0.0%	66	3.48	0.61		
293/8	CONCNTRT	0.0%	5.3%	15.8%	21.1%	57.9%	0.0%	19	3.32	0.92		
268-1	CONCNTRT	0.0%	1.8%	7.3%	49.1%	41.8%	0.0%	110	3.31	0.68		
268-2	CONCNTRT	0.0%	3.7%	4.9%	52.4%	39.0%	0.0%	82	3.27	0.72		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	WORKTIME	0.0%	38.1%	57.1%	4.8%	0.0%	0.0%	21	1.67	0.56	2.27	298
260	WORKTIME	0.0%	12.1%	45.5%	27.3%	15.2%	0.0%	66	2.45	0.89		
293/8	WORKTIME	0.0%	15.8%	31.6%	31.6%	21.1%	0.0%	19	2.58	0.99		
268-1	WORKTIME	0.0%	23.6%	43.6%	22.7%	10.0%	0.0%	110	2.19	0.91		
268-2	WORKTIME	0.0%	17.1%	46.3%	26.8%	9.8%	0.0%	82	2.29	0.86		
235	LTGHINDR	0.0%	0.0%	28.6%	33.3%	38.1%	0.0%	21	3.10	0.81	2.96	293
260	LTGHINDR	0.0%	7.7%	10.8%	52.3%	29.2%	0.0%	65	3.03	0.84		
293/8	LTGHINDR	0.0%	0.0%	10.5%	15.8%	73.7%	0.0%	19	3.63	0.67		
268-1	LTGHINDR	0.0%	8.3%	38.0%	31.5%	22.2%	0.0%	108	2.68	0.91		
268-2	LTGHINDR	0.0%	1.3%	25.0%	37.5%	36.3%	0.0%	80	3.09	0.81		
235	WRKABILIT	0.0%	13.6%	22.7%	45.5%	18.2%	0.0%	22	2.68	0.92	2.59	297
260	WRKABILIT	0.0%	12.1%	31.8%	43.9%	12.1%	0.0%	66	2.56	0.86		
293/8	WRKABILIT	0.0%	21.1%	31.6%	31.6%	15.8%	0.0%	19	2.42	0.99		
268-1	WRKABILIT	0.0%	13.9%	29.6%	48.1%	8.3%	0.0%	108	2.51	0.83		
268-2	WRKABILIT	0.0%	6.1%	29.3%	48.8%	15.9%	0.0%	82	2.74	0.79		
235	WORKSAT	0.0%	47.6%	47.6%	0.0%	4.8%	0.0%	21	1.62	0.72	1.77	298
260	WORKSAT	0.0%	43.9%	50.0%	3.0%	3.0%	0.0%	66	1.65	0.69		
293/8	WORKSAT	0.0%	26.3%	52.6%	21.1%	0.0%	0.0%	19	1.95	0.69		
268-1	WORKSAT	0.0%	28.2%	60.9%	10.0%	0.9%	0.0%	110	1.84	0.63		
268-2	WORKSAT	0.0%	35.4%	54.9%	7.3%	2.4%	0.0%	82	1.77	0.69		
235	MISSVIEW	0.0%	38.1%	19.0%	23.8%	19.0%	0.0%	21	2.24	1.15	1.95	296
260	MISSVIEW	0.0%	74.6%	14.9%	4.5%	6.0%	0.0%	67	1.42	0.83		
293/8	MISSVIEW	0.0%	11.1%	22.2%	16.7%	50.0%	0.0%	18	3.06	1.08		
268-1	MISSVIEW	0.0%	46.3%	27.8%	13.9%	12.0%	0.0%	108	1.92	1.04		
268-2	MISSVIEW	1.2%	36.6%	31.7%	11.0%	19.5%	0.0%	82	2.11	1.14		
235	WRKNOISE	0.0%	0.0%	9.5%	57.1%	33.3%	0.0%	21	3.24	0.61	2.65	295
260	WRKNOISE	0.0%	6.2%	27.7%	44.6%	21.5%	0.0%	65	2.82	0.84		
293/8	WRKNOISE	0.0%	5.3%	26.3%	52.6%	15.8%	0.0%	19	2.79	0.77		
268-1	WRKNOISE	0.0%	10.2%	44.4%	27.8%	17.6%	0.0%	108	2.53	0.90		
268-2	WRKNOISE	0.0%	8.5%	42.7%	39.0%	9.8%	0.0%	82	2.50	0.78		
235	WORKFAST	0.0%	14.3%	66.7%	19.0%	0.0%	0.0%	21	2.05	0.58	2.14	295
260	WORKFAST	0.0%	26.2%	58.5%	12.3%	3.1%	0.0%	65	1.92	0.71		
293/8	WORKFAST	0.0%	31.6%	15.8%	42.1%	10.5%	0.0%	19	2.32	1.03		
268-1	WORKFAST	0.0%	14.8%	53.7%	25.9%	5.6%	0.0%	108	2.22	0.76		
268-2	WORKFAST	0.0%	11.0%	59.8%	28.0%	1.2%	0.0%	82	2.20	0.63		
235	WEATHER	0.0%	27.3%	22.7%	31.8%	18.2%	0.0%	22	2.41	1.07	1.91	297
260	WEATHER	0.0%	67.2%	26.9%	3.0%	3.0%	0.0%	67	1.42	0.69		
293/8	WEATHER	0.0%	42.1%	31.6%	15.8%	10.5%	0.0%	19	1.95	1.00		
268-1	WEATHER	0.0%	36.4%	40.2%	13.1%	10.3%	0.0%	107	1.97	0.95		
268-2	WEATHER	0.0%	30.5%	41.5%	18.3%	9.8%	0.0%	82	2.07	0.93		
235	BLDGPLST	0.0%	15.0%	10.0%	40.0%	20.0%	15.0%	20	3.10	1.22	2.85	286
260	BLDGPLST	0.0%	21.5%	36.9%	30.8%	6.2%	4.6%	65	2.35	1.03		
293/8	BLDGPLST	0.0%	5.6%	0.0%	38.9%	44.4%	11.1%	18	3.56	0.90		
268-1	BLDGPLST	0.0%	12.0%	21.3%	40.7%	22.2%	3.7%	108	2.84	1.02		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
268-2	BLDGPLST	0.0%	10.7%	18.7%	38.7%	18.7%	13.3%	75	3.05	1.15		
235	BLDGADQT	0.0%	8.7%	4.3%	43.5%	26.1%	17.4%	23	3.39	1.09	3.14	304
260	BLDGADQT	0.0%	7.4%	23.5%	35.3%	22.1%	11.8%	68	3.07	1.10		
293/8	BLDGADQT	0.0%	0.0%	11.1%	33.3%	44.4%	11.1%	18	3.56	0.83		
268-1	BLDGADQT	0.0%	8.0%	21.2%	41.6%	22.1%	7.1%	113	2.99	1.02		
268-2	BLDGADQT	0.0%	8.5%	11.0%	40.2%	28.0%	12.2%	82	3.24	1.08		
235	BLDGMAIN	0.0%	8.7%	4.3%	60.9%	17.4%	8.7%	23	3.13	0.95	3.08	303
260	BLDGMAIN	0.0%	18.8%	24.6%	36.2%	13.0%	7.2%	69	2.65	1.14		
293/8	BLDGMAIN	0.0%	5.6%	5.6%	33.3%	55.6%	0.0%	18	3.39	0.83		
268-1	BLDGMAIN	0.0%	9.8%	11.6%	46.4%	24.1%	8.0%	112	3.09	1.03		
268-2	BLDGMAIN	0.0%	6.2%	14.8%	34.6%	27.2%	17.3%	81	3.35	1.11		
235	BLDGSPAC	0.0%	17.4%	17.4%	52.2%	8.7%	4.3%	23	2.65	1.00	2.41	299
260	BLDGSPAC	0.0%	41.8%	23.9%	16.4%	11.9%	6.0%	67	2.16	1.25		
293/8	BLDGSPAC	0.0%	5.6%	22.2%	61.1%	11.1%	0.0%	18	2.78	0.71		
268-1	BLDGSPAC	0.0%	21.6%	27.0%	36.0%	10.8%	4.5%	111	2.50	1.08		
268-2	BLDGSPAC	0.0%	23.8%	31.3%	35.0%	5.0%	5.0%	80	2.36	1.05		
235	STIMUL	0.0%	17.4%	17.4%	43.5%	13.0%	8.7%	23	2.78	1.14	2.47	295
260	STIMUL	0.0%	26.9%	29.9%	28.4%	7.5%	7.5%	67	2.39	1.17		
293/8	STIMUL	0.0%	17.6%	23.5%	41.2%	17.6%	0.0%	17	2.59	0.97		
268-1	STIMUL	0.0%	23.6%	30.0%	36.4%	6.4%	3.6%	110	2.36	1.02		.
268-2	STIMUL	0.0%	19.2%	26.9%	34.6%	14.1%	5.1%	78	2.59	1.10		
235	WELLIT	0.0%	4.3%	34.8%	34.8%	13.0%	13.0%	23	2.96	1.08	2.83	301
260	WELLIT	0.0%	15.9%	21.7%	43.5%	11.6%	7.2%	69	2.72	1.09		
293/8	WELLIT	0.0%	11.1%	5.6%	44.4%	22.2%	16.7%	18	3.28	1.15		
268-1	WELLIT	0.0%	16.5%	22.0%	34.9%	16.5%	10.1%	109	2.79	1.21		
268-2	WELLIT	0.0%	17.1%	18.3%	37.8%	18.3%	8.5%	82	2.83	1.17		
235	BLDGHUMD	0.0%	12.5%	16.7%	58.3%	4.2%	8.3%	24	2.79	1.00	2.76	294
260	BLDGHUMD	0.0%	26.2%	26.2%	30.8%	9.2%	7.7%	65	2.46	1.19		
293/8	BLDGHUMD	0.0%	0.0%	11.1%	72.2%	11.1%	5.6%	18	3.11	0.66		
268-1	BLDGHUMD	0.0%	13.9%	26.9%	41.7%	9.3%	8.3%	108	2.71	1.08		
268-2	BLDGHUMD	0.0%	10.1%	8.9%	62.0%	11.4%	7.6%	79	2.97	0.95		
235	BLDGCLEN	0.0%	4.3%	13.0%	47.8%	21.7%	13.0%	23	3.26	0.99	3.25	300
260	BLDGCLEN	0.0%	7.6%	19.7%	43.9%	16.7%	12.1%	66	3.06	1.07		
293/8	BLDGCLEN	0.0%	5.6%	16.7%	50.0%	11.1%	16.7%	18	3.17	1.07		
268-1	BLDGCLEN	0.0%	7.2%	9.0%	44.1%	26.1%	13.5%	111	3.30	1.04		
268-2	BLDGCLEN	0.0%	3.7%	13.4%	39.0%	30.5%	13.4%	82	3.37	0.99		
235	BLDGQUIT	0.0%	4.5%	27.3%	31.8%	27.3%	9.1%	22	3.09	1.04	3.40	301
260	BLDGQUIT	0.0%	2.9%	13.2%	44.1%	26.5%	13.2%	68	3.34	0.96		
293/8	BLDGQUIT	0.0%	5.6%	11.1%	50.0%	22.2%	11.1%	18	3.22	0.97		
268-1	BLDGQUIT	0.0%	2.7%	5.4%	45.5%	28.6%	17.9%	112	3.54	0.93		
268-2	BLDGQUIT	0.0%	3.7%	9.9%	40.7%	35.8%	9.9%	81	3.38	0.92		
235	BLDGCLR	0.0%	20.8%	25.0%	41.7%	12.5%	0.0%	24	2.46	0.96	2.46	304
260	BLDGCLR	0.0%	42.0%	27.5%	23.2%	2.9%	4.3%	69	2.00	1.08		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	BLDGCLR	0.0%	11.1%	11.1%	66.7%	11.1%	0.0%	18	2.78	0.79		
268-1	BLDGCLR	0.0%	30.6%	19.8%	35.1%	10.8%	3.6%	111	2.37	1.13		
268-2	BLDGCLR	0.0%	14.6%	19.5%	35.4%	23.2%	7.3%	82	2.89	1.14		
235	BLDGINTR	0.0%	12.5%	25.0%	33.3%	20.8%	8.3%	24	2.88	1.13	2.54	303
260	BLDGINTR	0.0%	34.8%	26.1%	27.5%	7.2%	4.3%	69	2.20	1.12		
293/8	BLDGINTR	0.0%	11.1%	22.2%	50.0%	16.7%	0.0%	18	2.72	0.87		
268-1	BLDGINTR	0.0%	21.8%	23.6%	40.0%	8.2%	6.4%	110	2.54	1.11		
268-2	BLDGINTR	0.0%	17.1%	24.4%	37.8%	13.4%	7.3%	82	2.70	1.12		
235	BLDGTEMP	0.0%	4.5%	4.5%	54.5%	22.7%	13.6%	22	3.36	0.93	3.09	282
260	BLDGTEMP	0.0%	12.9%	4.8%	66.1%	11.3%	4.8%	62	2.90	0.93		
293/8	BLDGTEMP	0.0%	0.0%	11.1%	83.3%	5.6%	0.0%	18	2.94	0.40		
268-1	BLDGTEMP	0.0%	10.0%	7.0%	49.0%	16.0%	18.0%	100	3.25	1.13		
268-2	BLDGTEMP	0.0%	8.8%	8.8%	61.3%	16.3%	5.0%	80	3.00	0.89		
235	BLDGATMS	0.0%	8.3%	12.5%	45.8%	25.0%	8.3%	24	3.13	1.01	2.74	302
260	BLDGATMS	0.0%	22.4%	32.8%	29.9%	6.0%	9.0%	67	2.46	1.16		
293/8	BLDGATMS	0.0%	11.1%	22.2%	44.4%	22.2%	0.0%	18	2.78	0.92		
268-1	BLDGATMS	0.0%	15.3%	23.4%	37.8%	18.9%	4.5%	111	2.74	1.07		
268-2	BLDGATMS	0.0%	13.4%	23.2%	37.8%	17.1%	8.5%	82	2.84	1.12		
235	BLDGSMEL	0.0%	13.0%	8.7%	34.8%	8.7%	34.8%	23	3.43	1.38	3.06	302
260	BLDGSMEL	0.0%	15.9%	21.7%	34.8%	14.5%	13.0%	69	2.87	1.23		
293/8	BLDGSMEL	0.0%	5.6%	11.1%	44.4%	22.2%	16.7%	18	3.33	1.05		
268-1	BLDGSMEL	0.0%	10.0%	12.7%	48.2%	12.7%	16.4%	110	3.13	1.14		
268-2	BLDGSMEL	0.0%	8.5%	15.9%	52.4%	15.9%	7.3%	82	2.98	0.97		
235	BLDGBRIT	0.0%	8.7%	13.0%	47.8%	8.7%	21.7%	23	3.22	1.18	2.88	298
260	BLDGBRIT	0.0%	14.7%	25.0%	41.2%	11.8%	7.4%	68	2.72	1.08		
293/8	BLDGBRIT	0.0%	5.6%	0.0%	66.7%	16.7%	11.1%	18	3.28	0.87		
268-1	BLDGBRIT	0.0%	11.0%	22.0%	45.0%	13.8%	8.3%	109	2.86	1.05		
268-2	BLDGBRIT	0.0%	10.0%	16.3%	53.8%	17.5%	2.5%	80	2.86	0.90		
235	WSIMTEMP	0.0%	66.7%	0.0%	0.0%	33.3%	0.0%	6	2.00	1.41	1.92	130
260	WSIMTEMP	0.0%	36.4%	27.3%	22.7%	13.6%	0.0%	22	2.14	1.06		
293/8	WSIMTEMP	0.0%	42.9%	57.1%	0.0%	0.0%	0.0%	7	1.57	0.49		
268-1	WSIMTEMP	0.0%	50.0%	20.7%	13.8%	15.5%	0.0%	58	1.92	1.14		
268-2	WSIMTEMP	0.0%	56.8%	8.1%	29.7%	5.4%	0.0%	37	1.84	1.03		
235	WSIMPRIV	0.0%	37.5%	37.5%	0.0%	25.0%	0.0%	8	2.13	1.17	2.27	116
260	WSIMPRIV	0.0%	40.0%	16.7%	16.7%	26.7%	0.0%	30	2.30	1.24		
293/8	WSIMPRIV	0.0%	20.0%	0.0%	40.0%	40.0%	0.0%	5	3.00	1.10		
268-1	WSIMPRIV	0.0%	22.2%	40.0%	24.4%	13.3%	0.0%	45	2.29	0.96		
268-2	WSIMPRIV	0.0%	35.7%	35.7%	10.7%	17.9%	0.0%	28	2.11	1.08		
235	WSIMACC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00	2.83	18
260	WSIMACC	0.0%	0.0%	33.3%	33.3%	33.3%	0.0%	6	3.00	0.82		
293/8	WSIMACC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00		
268-1	WSIMACC	0.0%	0.0%	16.7%	33.3%	50.0%	0.0%	6	3.33	0.75		
268-2	WSIMACC	0.0%	33.3%	33.3%	16.7%	16.7%	0.0%	6	2.17	1.07		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	WSIMCLR	0.0%	0.0%	37.5%	50.0%	12.5%	0.0%	8	2.75	0.66	2.94	41
260	WSIMCLR	0.0%	0.0%	18.8%	37.5%	43.8%	0.0%	16	3.25	0.75		
293/8	WSIMCLR	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	1	3.00	0.00		
268-1	WSIMCLR	0.0%	18.2%	18.2%	45.5%	18.2%	0.0%	11	2.42	1.19		
268-2	WSIMCLR	0.0%	0.0%	0.0%	60.0%	40.0%	0.0%	5	3.40	0.49		
235	WSIMLTG	0.0%	35.7%	0.0%	50.0%	14.3%	0.0%	14	2.43	1.12	2.42	85
260	WSIMLTG	0.0%	35.3%	23.5%	29.4%	11.8%	0.0%	17	2.18	1.04		
293/8	WSIMLTG	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	2	3.00	0.00		
268-1	WSIMLTG	0.0%	17.1%	34.3%	20.0%	28.6%	0.0%	35	2.60	1.07		
268-2	WSIMLTG	0.0%	23.5%	47.1%	11.8%	17.6%	0.0%	17	2.24	1.00		
235	WSIMNOIS	0.0%	0.0%	66.7%	0.0%	33.3%	0.0%	3	2.67	0.94	2.71	66
260	WSIMNOIS	0.0%	0.0%	50.0%	30.0%	20.0%	0.0%	10	2.70	0.78		
293/8	WSIMNOIS	0.0%	37.5%	12.5%	25.0%	25.0%	0.0%	8	2.38	1.22		
268-1	WSIMNOIS	0.0%	8.3%	33.3%	12.5%	45.8%	0.0%	24	2.96	1.06		
268-2	WSIMNOIS	0.0%	19.0%	28.6%	28.6%	23.8%	0.0%	21	2.57	1.05		
235	WSIMAIRC	0.0%	10.0%	30.0%	10.0%	50.0%	0.0%	10	3.00	1.10	2.37	135
260	WSIMAIRC	0.0%	26.7%	40.0%	20.0%	13.3%	0.0%	30	2.20	0.98		
293/8	WSIMAIRC	0.0%	25.0%	25.0%	0.0%	50.0%	0.0%	4	2.75	1.30		
268-1	WSIMAIRC	0.0%	17.6%	37.3%	27.5%	17.6%	0.0%	51	2.45	0.98		
268-2	WSIMAIRC	0.0%	20.0%	45.0%	30.0%	5.0%	0.0%	40	2.20	0.81		
235	WSIMLOC	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	1	3.00	0.00	2.80	23
260	WSIMLOC	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%	4	3.50	0.50		
293/8	WSIMLOC	0.0%	50.0%	0.0%	0.0%	50.0%	0.0%	2	2.50	1.50		
268-1	WSIMLOC	0.0%	18.2%	9.1%	36.4%	36.4%	0.0%	11	2.67	1.31		
268-2	WSIMLOC	0.0%	20.0%	20.0%	40.0%	20.0%	0.0%	5	2.60	1.02		
235	WSIMAIRQ	0.0%	20.0%	40.0%	20.0%	20.0%	0.0%	5	2.40	1.02	2.37	118
260	WSIMAIRQ	0.0%	26.9%	26.9%	23.1%	23.1%	0.0%	26	2.42	1.12		
293/8	WSIMAIRQ	0.0%	60.0%	40.0%	0.0%	0.0%	0.0%	5	1.40	0.49		
268-1	WSIMAIRQ	0.0%	31.8%	13.6%	34.1%	20.5%	0.0%	44	2.43	1.14		
268-2	WSIMAIRQ	0.0%	28.9%	26.3%	21.1%	23.7%	0.0%	38	2.39	1.14		
235	WSIMBKSP	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	2	2.50	0.50	2.76	54
260	WSIMBKSP	0.0%	11.1%	22.2%	33.3%	33.3%	0.0%	9	2.89	0.99		
293/8	WSIMBKSP	0.0%	25.0%	0.0%	50.0%	25.0%	0.0%	4	2.75	1.09		
268-1	WSIMBKSP	0.0%	22.7%	22.7%	13.6%	40.9%	0.0%	22	2.73	1.21		
268-2	WSIMBKSP	0.0%	23.5%	17.6%	17.6%	41.2%	0.0%	17	2.76	1.21		
235	WSIMFURN	0.0%	0.0%	25.0%	25.0%	50.0%	0.0%	4	3.25	0.83	3.11	35
260	WSIMFURN	0.0%	0.0%	16.7%	50.0%	33.3%	0.0%	6	3.17	0.69		
293/8	WSIMFURN	0.0%	33.3%	0.0%	33.3%	33.3%	0.0%	3	2.67	1.25		
268-1	WSIMFURN	0.0%	16.7%	16.7%	16.7%	50.0%	0.0%	12	3.00	1.15		
268-2	WSIMFURN	0.0%	20.0%	0.0%	10.0%	70.0%	0.0%	10	3.30	1.19		
235	WSIMCLEN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00	3.36	11
260	WSIMCLEN	0.0%	0.0%	0.0%	20.0%	80.0%	0.0%	5	3.80	0.40		
293/8	WSIMCLEN	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	2	3.00	0.00		
268-1	WSIMCLEN	0.0%	50.0%	0.0%	0.0%	50.0%	0.0%	2	2.50	1.50		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
268-2	WSIMCLEN	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%	2	3.50	0.50		
235	WSIMTKLT	0.0%	40.0%	20.0%	0.0%	40.0%	0.0%	5	2.40	1.36	2.72	47
260	WSIMTKLT	0.0%	0.0%	33.3%	44.4%	22.2%	0.0%	9	2.89	0.74		
293/8	WSIMTKLT	0.0%	66.7%	0.0%	0.0%	33.3%	0.0%	3	2.00	1.41		
268-1	WSIMTKLT	0.0%	21.1%	5.3%	47.4%	26.3%	0.0%	19	2.79	1.06		
268-2	WSIMTKLT	0.0%	9.1%	27.3%	36.4%	27.3%	0.0%	11	2.82	0.94		
235	WSIMCHAR	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	2	1.00	0.00	2.88	25
260	WSIMCHAR	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	1	2.00	0.00		
293/8	WSIMCHAR	0.0%	0.0%	50.0%	0.0%	50.0%	0.0%	4	3.00	1.00		
268-1	WSIMCHAR	0.0%	0.0%	22.2%	11.1%	66.7%	0.0%	9	3.44	0.83		
268-2	WSIMCHAR	0.0%	11.1%	33.3%	22.2%	33.3%	0.0%	9	2.78	1.03		
235	WSIMDLT	0.0%	16.7%	0.0%	33.3%	50.0%	0.0%	6	3.17	1.07	2.58	79
260	WSIMDLT	0.0%	50.0%	17.9%	25.0%	7.1%	0.0%	28	1.89	1.01		
293/8	WSIMDLT	0.0%	0.0%	33.3%	33.3%	33.3%	0.0%	3	3.00	0.82		
268-1	WSIMDLT	0.0%	18.2%	9.1%	27.3%	45.5%	0.0%	22	3.00	1.13		
268-2	WSIMDLT	0.0%	20.0%	5.0%	45.0%	30.0%	0.0%	20	2.85	1.06		
235	WSIMSURF	0.0%	0.0%	50.0%	16.7%	33.3%	0.0%	6	2.83	0.90	2.87	90
260	WSIMSURF	0.0%	13.0%	21.7%	8.7%	56.5%	0.0%	23	3.09	1.14		
293/8	WSIMSURF	0.0%	0.0%	50.0%	20.0%	30.0%	0.0%	10	2.80	0.87		
268-1	WSIMSURF	0.0%	16.0%	24.0%	16.0%	44.0%	0.0%	25	2.88	1.14		
268-2	WSIMSURF	0.0%	19.2%	26.9%	19.2%	34.6%	0.0%	26	2.69	1.14		
235	WSIMOTHR	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00	0.05	12
260	WSIMOTHR	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00		
293/8	WSIMOTHR	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0	0.00	0.00		
268-1	WSIMOTHR	0.0%	50.0%	0.0%	0.0%	50.0%	0.0%	2	0.31	0.98		
268-2	WSIMOTHR	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10	0.00	0.00		
235	LONGWORK	0.0%	45.8%	45.8%	4.2%	8.3%	0.0%	24	1.79	0.87	2.40	309
260	LONGWORK	0.0%	26.1%	11.6%	39.1%	21.7%	1.4%	69	2.61	1.13		
293/8	LONGWORK	0.0%	52.6%	21.1%	26.3%	0.0%	0.0%	19	1.74	2.36		
268-1	LONGWORK	0.0%	25.2%	27.0%	27.0%	20.9%	0.0%	115	2.43	1.08		
268-2	LONGWORK	0.0%	26.8%	25.6%	17.1%	30.5%	0.0%	82	2.51	1.18		
235	LONGSPAC	0.0%	43.5%	47.8%	0.0%	8.7%	0.0%	23	1.74	0.85	2.14	307
260	LONGSPAC	0.0%	33.3%	13.0%	39.1%	13.0%	1.4%	69	2.36	1.12		
293/8	LONGSPAC	0.0%	52.6%	21.1%	26.3%	0.0%	0.0%	19	1.74	0.85		
268-1	LONGSPAC	0.0%	35.7%	28.7%	24.3%	11.3%	0.0%	115	2.11	1.02		
268-2	LONGSPAC	0.0%	34.6%	28.4%	19.8%	17.3%	0.0%	81	2.20	1.09		
235	WRKIMPT	0.0%	0.0%	4.8%	4.8%	90.5%	0.0%	21	3.86	0.47	3.61	296
260	WRKIMPT	0.0%	1.5%	3.0%	18.2%	77.3%	0.0%	66	3.71	0.60		
293/8	WRKIMPT	0.0%	10.5%	15.8%	21.1%	52.6%	0.0%	19	3.16	1.04		
268-1	WRKIMPT	0.0%	2.8%	5.6%	24.1%	67.6%	0.0%	108	3.56	0.72		
268-2	WRKIMPT	0.0%	0.0%	8.5%	20.7%	70.7%	0.0%	82	3.62	0.64		
235	JOBSAT	0.0%	4.8%	9.5%	66.7%	19.0%	0.0%	21	3.00	0.69	3.04	295
260	JOBSAT	0.0%	4.6%	13.8%	46.2%	35.4%	0.0%	65	3.12	0.81		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
293/8	JOBSAT	0.0%	22.2%	33.3%	27.8%	16.7%	0.0%	18	2.39	1.01		
268-1	JOBSAT	0.0%	6.4%	11.9%	52.3%	29.4%	0.0%	109	3.05	0.82		
268-2	JOBSAT	0.0%	6.1%	13.4%	42.7%	37.8%	0.0%	82	3.12	0.86		
235	WRKACR	0.0%	76.2%	19.0%	4.8%	0.0%	0.0%	21	1.29	0.55	1.38	298
260	WRKACR	0.0%	70.1%	28.4%	1.5%	0.0%	0.0%	67	1.31	0.50		
293/8	WRKACR	0.0%	47.4%	36.8%	5.3%	10.5%	0.0%	19	1.79	0.95		
268-1	WRKACR	0.0%	68.8%	29.4%	1.8%	0.0%	0.0%	109	1.33	0.51		
268-2	WRKACR	0.0%	62.2%	32.9%	4.9%	0.0%	0.0%	82	1.43	0.58		
235	EQUIP	0.0%	52.4%	33.3%	14.3%	0.0%	0.0%	21	1.62	0.72	2.19	297
260	EQUIP	0.0%	22.7%	48.5%	22.7%	6.1%	0.0%	66	2.12	0.83		
293/8	EQUIP	0.0%	5.3%	52.6%	31.6%	10.5%	0.0%	19	2.47	0.75		
268-1	EQUIP	0.0%	18.2%	54.5%	17.3%	10.0%	0.0%	110	2.19	0.85		
268-2	EQUIP	0.0%	21.0%	38.3%	29.6%	11.1%	0.0%	81	2.31	0.92		
235	JOBTYPE	9.1%	31.8%	9.1%	4.5%	0.0%	45.5%	22	2.91	0.85	2.67	293
260	JOBTYPE	1.6%	39.1%	14.1%	0.0%	6.3%	39.1%	64	2.88	0.70		
293/8	JOBTYPE	0.0%	52.3%	4.8%	19.0%	0.0%	23.8%	21	2.38	0.42		
268-1	JOBTYPE	0.0%	44.8%	9.3%	16.8%	1.0%	28.0%	107	2.58	0.47		
268-2	JOBTYPE	0.0%	45.6%	10.1%	10.1%	2.5%	31.6%	79	2.64	0.54		
235	MILITARY	68.2%	31.8%	0.0%	0.0%	0.0%	0.0%	22	0.32	0.47	0.33	289
260	MILITARY	72.7%	27.3%	0.0%	0.0%	0.0%	0.0%	66	0.27	0.45		
293/8	MILITARY	73.7%	26.3%	0.0%	0.0%	0.0%	0.0%	19	0.26	0.44		
268-1	MILITARY	62.0%	36.0%	0.0%	0.0%	2.0%	0.0%	100	0.44	0.70		
268-2	MILITARY	74.4%	25.6%	0.0%	0.0%	0.0%	0.0%	82	0.26	0.44		
235	CIVILIAN	31.8%	68.2%	0.0%	0.0%	0.0%	0.0%	22	0.68	0.47	0.75	284
260	CIVILIAN	27.3%	72.7%	0.0%	0.0%	0.0%	0.0%	66	0.73	0.45		
293/8	CIVILIAN	22.2%	77.8%	0.0%	0.0%	0.0%	0.0%	18	0.78	0.42		
268-1	CIVILIAN	26.0%	74.0%	0.0%	0.0%	0.0%	0.0%	96	0.73	0.44		
268-2	CIVILIAN	24.4%	74.4%	0.0%	0.0%	1.2%	0.0%	82	0.79	0.56		
235	CONTRACT	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22	0.00	0.00	0.01	277
260	CONTRACT	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	66	0.00	0.00		
293/8	CONTRACT	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18	0.00	0.00		
268-1	CONTRACT	96.6%	3.4%	0.0%	0.0%	0.0%	0.0%	89	0.03	0.18		
268-2	CONTRACT	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	82	0.00	0.00		
235	SEX	0.0%	18.2%	81.8%	0.0%	0.0%	0.0%	22	1.82	0.39	1.72	296
260	SEX	0.0%	43.9%	56.1%	0.0%	0.0%	0.0%	66	1.56	0.50		
293/8	SEX	0.0%	26.3%	73.7%	0.0%	0.0%	0.0%	19	1.74	0.44		
268-1	SEX	0.0%	25.2%	74.8%	0.0%	0.0%	0.0%	107	1.73	0.46		
268-2	SEX	0.0%	20.7%	79.3%	0.0%	0.0%	0.0%	82	1.79	0.41		
235	GLASSES	54.2%	45.8%	0.0%	0.0%	0.0%	0.0%	24	0.46	0.50	0.60	304
260	GLASSES	50.7%	49.3%	0.0%	0.0%	0.0%	0.0%	69	0.49	0.50		
293/8	GLASSES	47.4%	52.6%	0.0%	0.0%	0.0%	0.0%	19	0.53	0.50		
268-1	GLASSES	33.6%	66.4%	0.0%	0.0%	0.0%	0.0%	110	0.66	0.47		
268-2	GLASSES	32.9%	67.1%	0.0%	0.0%	0.0%	0.0%	82	0.67	0.47		

		0's	1's	2's	3's	4's	5's	N	Avg	Std	SMean	SN
235	BIFOCALS	95.7%	4.3%	0.0%	0.0%	0.0%	0.0%	23	0.04	0.20	0.21	290
260	BIFOCALS	95.7%	4.3%	0.0%	0.0%	0.0%	0.0%	69	0.04	0.20		
293/8	BIFOCALS	84.2%	15.8%	0.0%	0.0%	0.0%	0.0%	19	0.16	0.36		
268-1	BIFOCALS	63.9%	36.1%	0.0%	0.0%	0.0%	0.0%	97	0.35	0.48		
268-2	BIFOCALS	74.4%	25.6%	0.0%	0.0%	0.0%	0.0%	82	0.26	0.44		
235	CONTACTS	91.3%	8.7%	0.0%	0.0%	0.0%	0.0%	23	0.09	0.28	0.14	287
260	CONTACTS	82.6%	17.4%	0.0%	0.0%	0.0%	0.0%	69	0.17	0.38		
293/8	CONTACTS	78.9%	21.1%	0.0%	0.0%	0.0%	0.0%	19	0.21	0.41		
268-1	CONTACTS	87.2%	12.8%	0.0%	0.0%	0.0%	0.0%	94	0.13	0.33		
268-2	CONTACTS	90.2%	8.5%	0.0%	0.0%	1.2%	0.0%	82	0.13	0.51		
235	LONGLENS	0.0%	16.7%	8.3%	0.0%	25.0%	50.0%	12	3.83	1.52	4.47	201
260	LONGLENS	0.0%	5.0%	2.5%	7.5%	7.5%	77.5%	40	4.50	1.07		
293/8	LONGLENS	0.0%	7.7%	0.0%	0.0%	7.7%	84.6%	13	4.62	1.08		
268-1	LONGLENS	2.6%	2.6%	5.1%	5.1%	11.5%	73.1%	78	4.40	1.21		
268-2	LONGLENS	0.0%	1.7%	1.7%	5.2%	12.1%	79.3%	58	4.66	0.80		
235	LONGSICK	47.8%	47.8%	0.0%	4.3%	0.0%	0.0%	23	0.61	0.71	1.19	303
260	LONGSICK	33.3%	34.8%	15.9%	11.6%	4.3%	0.0%	69	1.19	1.15		
293/8	LONGSICK	36.8%	15.8%	21.1%	26.3%	0.0%	0.0%	19	1.37	1.22		
268-1	LONGSICK	40.0%	26.4%	17.3%	10.0%	6.4%	0.0%	110	1.16	1.23		
268-2	LONGSICK	26.8%	30.5%	30.5%	6.1%	4.9%	1.2%	82	1.35	1.15		
235	AGE	0.0%	0.0%	31.8%	31.8%	22.7%	13.6%	22	3.30	1.16	3.39	296
260	AGE	0.0%	1.5%	36.8%	29.4%	23.5%	8.8%	68	3.01	1.01		
293/8	AGE	0.0%	0.0%	36.8%	26.3%	21.1%	15.8%	19	3.16	1.09		
268-1	AGE	0.0%	0.0%	22.9%	29.4%	28.4%	19.3%	109	3.46	1.07		
268-2	AGE	0.0%	0.0%	16.7%	30.8%	30.8%	21.8%	78	3.70	1.11		
235	OVERTIME	91.3%	4.3%	0.0%	4.3%	0.0%	0.0%	23	0.17	0.64	0.53	284
260	OVERTIME	61.7%	20.0%	10.0%	8.3%	0.0%	0.0%	60	0.65	0.96		
293/8	OVERTIME	84.2%	5.3%	5.3%	5.3%	0.0%	0.0%	19	0.32	0.80		
268-1	OVERTIME	66.3%	16.3%	12.5%	4.8%	0.0%	0.0%	104	0.55	0.88		
268-2	OVERTIME	67.9%	14.1%	11.5%	6.4%	0.0%	0.0%	78	0.56	0.93		

Appendix C. Suggestions for Changes to the Buildings
Table C1. Reasons for Choice Selection

Air Circulation and Air Quality Comments

BLDG	AirCirc	AQ	Reasons for Choice
			Building 235
235	1	2	Parts of building has very bad air circulation. Air gets stuffy in the winter time. Because of poor ventilation and circulation smoking can cause problems to those people who are allergic to smoke
235	4	2	Recirculation of same old air.
235	4		Sometimes air becomes stuffy because there are no windows in area.
235	2		So I can be at ease when I do my job.
235	4		No ceiling fans or wall fans.
235	4		Need more fans.
235	2	3	Better breathing. Better breathing.
235	3		Warehouse air circ poor/storage A/C often broke.
			Building 260
260	3		Air circulation poor/vent above head/cold or stuffy.
260	1	4	Clean or replace the air vents in the ceiling. better air quality should not include being able to smell cigarette smoke
260	4		It smells like an old shoe in here.
260		1	Air quality very poor; trash comes out of vents.
260	1		Air not properly filtered; not enough outside air.
260	2	4	Air circulation poor; too strong or too weak. temperature and air quality are very poor
260		3	Stale air.
260	1	2	Too cold in summer; walls added, vents remained. Poor circulation with poor quality & less filtering.
260	1		Headaches, etc from stale, smoky, dead air.
260	2		Air circulation is poor.
260		2	Air qual terrible; headaches, sore throats/asbestos.
260	2	3	Too stuffy. Air quality terrible.
260	4		Work demands concentration/less noise/air quality/private. Improved air circulation fosters concentration on work as opposed to attempts to breathe and long-term health worries. Sus
260	2		Would help maintain constant temperature.
260		4	smoke hangs in our area
260	2	4	Vents noisy and dirty/lack of air circulation. Much more needed things ie: air and lighting to daily supplies
260	1	2	Poor circulation:air stuffy, headaches, nausea, dizzy.

260	3		Many times the air blows constantly without control.
260	1	2	Smelly & stuffy/some days cold, then warm & muggy.
260	3	4	Air is stale & not very good from office to office.
			same air seems to circulate in the office
260	2	3	Need to see daylight; not be closed in all the day
260		2	Dust particles in air irritating to eyes & sinus.
260	4	1	Office is very stuffy.
260		1	Air always damp and stale.
260		1	Air quality poor: Room smells stale in morning.
260	2	3	Temp ranges from hot to cold.
			Building has no windows.
260	2	1	Air very dry causing irritated eyes,headaches,etc.
			No air circulation/need fresh air for health.
260	2	3	Always have a runny nose.
			Always coughing.
260		1	Need air purification system since no windows.
			Hot and stuffy in the mornings.
260	2	3	Improve air; able to open window would be nice.
		#2 & 3	about same/little (if any) air circulation.

Building 268 - First Survey

268		1	Air and lighting quality are most important.
			Recs called for proper lighting & air at25% outdoor.
			Need venting, electrostatic cleaning and ionizing.
268	1		There is poor air circulation now.
268	3	4	Poor circulation.
268	4		No air circulation.
268		1	Air circulation heat/cool are undesirable.
268		3	Often stuffy.
268	2	1	Poor air quality causes many of problems in 17.
			air conditioning/heating systems are inefficient and break down frequently
			Stale air causes many of the problems in 17.
268	2	3	Temperature is seldom adequate.
			Quality of air is poor.
			Air becomes very stale.
268	4	4	Can do good job if air circulated & comfortable.
268	2	3	Circulation of fresh air essential for good health.
268	2		Better conditions relieve stress & improve performance
268	3		Very stuffy when weather is hot and humid.
268		2	Sometimes parts of bldg hotter/ colder than others.
268		3	Ventilation is poor, air quality is not good.
268	1	4	A/C is not always functioning.
			men's bathroom sink smells when water is running
268	2	1	Room really smells; irritating to eyes & nose.
			Real smothery especially when A/C broken or off.
268	2	1	Improve air quality, circulation, heat and A/C.
268	2		No venting exists.
268	3		The shop seems to be off the AC track.
268	3	2	Air temperature: back dock is too hot or too cold.
			Air circulation in the shop is poor.
117	3		Muggy air needs to be replaced w/new fresh air.
268	4	3	Fresh air would help me be more alert.

			Pollutants such as cigarette smoke can irritate my eyes.
268		4	What quality?
268		3	My health.
268	4	1	Ventilation not very good for a maintenance shop.
			The ventilation is not very good for a maintenance shop.
268		2	Too much smoke from smokers.
268	3		Chairs are uncomfortable.
268	1		Very stuffy at times.
268	2	3	Air is stagnant.
			Air is humid causes drowsiness.
268		3	Dislike smoking/people smoke in non-smoking areas.
			Better the air because of the smoke.
268	1		No circulation in room now.
268		2	The air is real stuffy and that is uncomfortable.
268	2	4	Air circulation is very poor in this area.
			Because of poor circulation we have poor air quality
268	2		Provide more fresh air/air is pretty stagnant.
268	3	1	No ventilation in my office.
			We need air vents in my office.
268	2		I would like better air circulation.
268	3	4	Poor air, often stale.
			Air smells stale, cold or hot.
268	3		Not allowed to comment.
268	4		We need a break area.
268	2	1	Air recirculated/lack of fresh air causes illness.
			The A/C needs cleaning, germs spread in abundance.
268		4	Poor air circulation, current ventilating system was designed for the smaller room
268	1	2	Nice to get stale smoke out of the office.
268	2	3	Air stale & recirculated/ high disease risk.
268	2		Would make it easier to tolerate smokers.
268		1	Air quality poorest I've ever experienced.
			Cold in winter; hot/humid in summer.
268	1		No air circulation; hot in summer/cold in winter.
268	2	3	Improve air circulation.
			Improve air circulation would lower sick leave.
268	3		Need air circulation when 20 people are soldering.
268		3	Air is recirculated without adding fresh air.
268		1	Smoking.
			smoking is obnoxious
268	3	4	Air has been bad for years.
268	2	3	Fans have to be used to properly circulate air.
			Air quality needs upgrading.
268	2	1	Air is stale, poor quality.
			Stagnant filters need changing.
268		1	Stuffy, no windows. No break area exist, therefore smokers tempted to pollute air.
268		1	Self explanatory.
268	1	2	Air/temp problems known for years & nobody acts!

293	2	1	Air seems moldy during summer; aggravates allergy.
			Air seems moldy during summer; aggravates allergy.
293		1	Air quality is bad.
298		2	More comfortable and healthy.
298 area		2	Frequent headaches, fatigue -- cigarette smoke. Break is also smoking area. Not really separate from rest of building -- smoke filters to rest of building.
298	1		Cold in winter/stuffy in summer.
298		1	Smoke bothers me and is a health hazard.
			Vents are dirty.
298	4		Ringing of phones, vents, etc.
			At times it's a little warm.

Comments on Temperature

BLDG	TEMP	REASON
		Building 235
235	1	Either very hot in summer or is just plain hot.
235	1	Poor air circulation/temperatures not maintained.
235	1	It's hot in summer and cold in winter.
235	1	No exhaust fans.
235	1	Need air-conditioning.
235	4	Warehouse air circ poor/storage A/C often broke.
		Building 260
260	1	Sometimes too warm in building when hot outside.
260	3	Adjust temperature to the outside temperature.
260	1	Some days it is freezing, others too warm.
260	2	Never know what to expect by day or season.
260	1	Vents blow air much cooler than needed in summer.
260		Too cold in summer/walls added, vents remained.
260	2	Most important.
260	2	Even temperature/now have drastic change in temp.
260	4	Temperature fluctuates daily (sometimes hour to hour) - either too hot or too cold - very seldom is there a happy medium.
260	1	Too cold all the time.
260	1	Goes up too high, down too low.
260	4	Temps go from cold extremes to hot.
260	1	Temperature never comfortable;too hot or too cold.
260	3	Some days cold/some warm; never know how to dress.
260	2	I find the building cold most days.
260	2	Temperature never constant/too hot or too cold.
260	3	Office is very stuffy.
260	3	Temps in summer hot; temps in winter cold.
260	3	Temperature varies a lot during the day.
260	1	Temperature varies too much.
260	2	Hot and stuffy in the mornings.
		Building 268 First Survey
268	3	Need venting, electrostatic cleaning and ionizing.
268	1	Temperature fluctuates.

268	1	Temperature is too warm in winter and summer.
268	1	Temperature in our room is never constant.
268	4	air conditioning/heating systems inefficient; break down frequently.
268	1	Temperature is seldom adequate.
268	4	Can do good job if air circulated & comfortable.
268	4	Better conditions relieve stress & improve performance.
268	1	Uncomfortable to work when hot and sticky.
268	2	Temperatures too uneven.
268		A/C is not always functioning.
268	3	A/C does not reset after power outage.
268		A/C not effective on hot days.
268	3	Temp. varies too much between out/indoor & windows.
268	3	Improve air quality, circulation, heat and A/C.
268	1	Aids concentration.
268	1	No control:too hot in winter and in summer.
268	1	The temp makes work impossible.
268	1	The shop seems to be off the AC track.
268	1	Air temperature: back dock is too hot or too cold.
268	1	A/C.
268	3	Fluctuation Terrible.
268	1	A/C not adequate during summer with all equipment.
268	1	Much too hot in summer.
268	2	No circulation in room now.
268	2	Winter too cold and in the summer too hot.
268	1	Sometimes it gets very warm or cold in this room.
268	1	Wide temperature range.
268	2	Not allowed to comment.
268	4	We need a break area.
268	2	Some days are hot and cold days get really warm.
268	3	Large temperature difference office to office.
268	2	Never sure about temperature. 85 one day 60 the next.
268	1	Too hot in summer, too cold in winter.
268	1	Unpleasant temperatures, both hot/cold.
368	1	Temperature control is poor.
268	1	Heater and A/C don't work.
268	1	At desk all day, so temps. critical to comfort.
268	4	Sometimes you freeze, sometimes you roast. There is no consistency with temperatures
268	4	Room 316 is very cold in the winter.
268	1	Air conditioning does not work well.
268	2	Cold in winter; hot/humid in summer.
268		No air circulation; hot in summer/cold in winter.
268	1	Must I be sweaty or be frozen stiff to do my job?
268	1	Temperature in shop can go from 65 to 95.
268	1	No temperature controls (too cold year round).
268	3	One day hot, one day not; need consistent temps.
268	3	Air/temp problems known for years & nobody acts!
		<u>Buildings 293 and 298</u>
293	2	A/C in summer, heat in winter & insulation in bldg.
293	2	Have outside temperature not change so much.
293	2	The day to day temperatures are not comfortable.

298	1		Always cold;need wear sweater when 95 outside.
298	2		Cold in winter/stuffy in summer.
298	1		Hot in summer and winter.

Comments About Lighting and Task lighting

BLDG	Lite	Task L	REASON
			Building 235
235	2		Better lighting, not bright enough.
235	3		Proper lighting is essential for reading.
235		1	Light too bright some tasks/not enough others.
235	1	2	To help inside the warehouse.
235	3		Lights need rearrangement in some areas.
235	1		So I can see to do my job better.
235	3		Need more light to see better.
235	4		Put lights over work area.
235	3		Back corner needs light.
235	1		See better.
235	1		Lighting is poor in a large portion of work area.
235	3		Lighting is too bright.
235		4	need more intense light for review of drawings
			Building 260
260	2		Light is not spread out enough.
260	4		Lighting could be improved at our work station; the bulbs aren't replaced as they blow out.
260	3		Lights are inadequate.
260	1	2	Too dim. Cannot place lighting were needed.
260		3	Need adjustable light/fixed in wrong place.
260	3		Most import.
260	4		too dim in some places
260	3	2	Task light is a fixed desk lamp. The overhead lights are in line.
260	1	3	You can see better - cause less shadows. Would better light your immediate work area.
260	3		Glare, bright in some places, too dull in others.
260		3	I don't like dimly lit areas.
260	1		I find the lighting very poor.
260		3	Glare on desk and terminal from overhead lighting.
260		4	being able to adjust the lighting is a comforting
260	2		Lights are old and need to be replaced.
260	1	4	My eyes are always irritated. Would like to adjust glare on screen.
260	1	2	Bright fluorescent lights create glare. Do not have adjustable task lighting.
			Building 268
268	2		Air and lighting quality are most important. Recs called for proper lighting & air at 25% outdoor
268	2		Poor lighting.
268	2	3	Lighting produces glare in wrong places. Light hard to focus on work area.

268		4		need brighter lights
268			3	glare on VDT could be avoided, more light to read.
268		4		Glare is annoying
268		2		Get headache from glare on word processor screen.
268			1	Adjustable lighting is needed.
268		1		So I can read the papers on the desk.
268			3	Sounds good: I don't have a problem w/ desk lamp.
268		4		Too much glare - lighting needs to be softer and c
268		1		Light location is not situated over work areas.
268		1		I use my eyes constantly.
268		2		More individual lighting made available.
268		1		Lighting is poor.
268		2	1	My health.
268		2		It is too dim to do close work on circuit cards.
268			3	Would like to have a desk light attached to desk.
268			3	Adjustable to meet the varied work sessions/types.
268		1		Eyes hurt from lack of lighting/gives headaches.
268			1	Decrease eyestrain and glare. Partition work area or provide built-in lighting.
268		4		Not allowed to comment.
268			3	Glare on CRT's needs to be eliminated.
268			3	Proper lighting would help job performance.
368		2		Bad lighting.
268		2	3	Lights too dim and glaring.
268		3		Eye strain major production loss when reading/writ
268		3		I feel the lighting is a bit dim for working.
268			1	Glare from overhead lights makes VDT work difficult.
268		3		Glare is tremendous. glare, reflections, printer noise, etc.
268		2		Lighting does not seem to be adequate.
268			4	One would think that if one could see what one was one could work faster and accomplish more.
268			4	good lighting is a must when doing new soldering
268		1		Lighting is horrible, the glare is very bothersome
268			4	Lighting directed to area.
268			2	VDTs need less light/equipment work needs more.
268			4	No light adjustments.
293			1	Lights are too far away from work areas.
298			1	Glare on computer screen.
298		3	4	No direct light over desks.
298		3		Lighting is good, but not if one has bad vision.

Comments Related to Noise and Space

BLDG	Noise	Loc	Surf	REASON
				Building 235
235			2	Reviewing drawings requires more work surface area.
235		3	4	So when I'm busy I don't have to listen to them. So I can perform my job easily, in my controlled and organized work space.
235			2	Very little space.
235	2			Transformer outside office is very noisy.
235	2		3	Can always hear conversations in other areas.

				Only have a desk for reviewing technical drawings.
				Noise high w/ no real partitions between areas.
				Building 260
260			4	More privacy/control conversations.
				need more desk space
260			1	Each employee needs his/her own space.
				To get your work done w/o so many interruptions.
260			2	Need more room to work/ sometimes use the floors.
				I work out in full view of everyone in my section
260		4		keep from people walking around and too close
				Need own office for more privacy.
260			3	Phone conversations easily overheard.
				No space to look at computer printouts.
260	4			work positions are too crowded
260			2	There is less than 80 sq ft per person.
260	3			Hard to concentrate with all the noise/no privacy.
260			4	Much paperwork is generated through normal work tasks,
				No desk or table area provided to support this.
260	3		2	Job requires spreading out quite a bit of data.
				Can hear conversations from the entire work area.
260			1	Most import.
260			4	intrusion from others distracting while on phone.
				this would help greatly as everything has to be
				jam-packed on top of each other and no place
				to use when using terminal.
260			4	need more surface area
260	2			Work demands concentration/less noise/air qual/private.
				No attempt to lower voices in large area w/partitions.
260			4	would help in organizing work
260			2	No room to review drawings, etc.
260			1	Not enough area around PC for data input.
				Impossible to talk w/o entire office hearing.
260	2		4	I don't like being interrupted.
				just not enough room for work
260			4	bigger table for video display terminal
260		3		Space the way I need/don't like others around.
				Too many people coming through disrupting work.
260	4			A lot of noise from printers & humming from terminals.
				Building 268
268			2	Desperately need room to lay out trend papers.
				My particular division is spread out.
268			4	No room for access to printer or keyboard for PC.
268	4			Quieter would be better.
268			4	I am confined in my area and need more working
				area with the furniture.
268			3	Need room for ease of looking at drawings.
268			1	I move table because it's easier to work on.
268	3		2	Important for improved work/quality.
				Could improve work quality.
268	2			Will be able to concentrate better.
268	4			Too much outside interference.
268	4			My health.

268	3			35 people in area w/concrete floors, walls.
268	1			Noise from machine shop, phones, conversations, etc.
268	2			Cannot concentrate with music playing.
268	2			Not sure due to type of work environment.
268			4	to hold drawings, books, and note-pads - all at the same time
268		4	3	For soldering I need much more room. I like to work alone without being interrupted
268		1		Not allowed to comment.
268	2	3	4	Tech work easily distracted by noisy environment. I could use 1.5 times my alloted work space and function more effectively.
268		4		Area cluttered because of lack of storage area. So we are stumbling over each other.
368	3			Plenty of loud noises.
268			4	Restricted work area is cumbersome and a major hindrance to productivity.
268			3	Need large surface for viewing prints, manuals.
268			4	Area too open (Bull Pen Atmosphere).
268			4	benches do not provide enough space
268			4	My office is very crowded and not enough room for all the paperwork.
268	2			Work area much too small. Too many people in space provided.
268	2	4	3	People talking can be heard, too small area. To eliminate noise. No space for technical drawings for review.
268	4	3	2	Work area is crowded. More concentration. More concentration.
268	4	3	2	No surface area for work that's required. with people so close and normal business conducted, every conversation can be heard which results in loss of concentration Everyone is jammed together desk against desk.
268	2			Equipment and A/C noise cuts hearing ability. Distracted by hall traffic and conversations.
268			1	Technical work demands equipment, manuals, etc together.
268		2		Jammed in, distracting.
268	4			It is too noisy.

<u>Buildings 293 and 298</u>

293	1		4	Do less noisy work. Need more room.
293	4		2	Too cluttered.
293	3			Noise hurts my ears.
298			2	Room between files & to spread computer listings.
298	1			Less distracting.
298	4	1	4	Too many people - not enough space.
298			4	Office is crowded.
298			3	
298	1		2	Ringing of phones, vents, etc.

298	2	4	3 Not much room to move around in work area. To allow for reference material.
298			2 Larger desk/more storage/correct WS for VDT.
298	4		

Comments Related to Privacy

BLDG	Privacy	REASON
		Building 235
235	1	Unable to counsel employees effectively.
235	1	Sometimes it is very noisy in the work area.
235	2	Partition off work area.
235	4	Move to an office area.
235	2	You can hear each others conversation.
235	1	Can always hear conversations in other areas.
		Building 260
260	1	More privacy/control conversations.
260	3	To get your work done w/o so many interruptions.
260	4	I work out in full view of everyone in my section
260	2	Need own office for more privacy.
260	2	Phone conversations easily overheard.
260	4	There is less than 80 sq ft per person.
260	1	Can't concentrate w/conversations going on.
260	1	Need private area for discussions.
260	2	Area now occupying lacks adequate privacy/quietness.
260	3	Intrusion from others distracting while on phone.
260	1	We need more privacy, there is none.
260	3	Could be more efficient if we had private area.
260	1	Work demands concentration/less noise/air qual/private.
260	3	Impossible to talk w/o entire office hearing.
260	1	I don't like being interrupted.
260	4	need to be treated more like adults and be trusted to work rather than be watched all the time.
260	3	Space between desks, but find little privacy.
260	1	Open area.
260	2	Too many people coming through disrupting work.
260	1	Work in hectic office.
260	4	everybody likes privacy
260	4	we need more partitions for better concentration and privacy
260	4	there is no conference room
260	4	partitions are old and not tall enough
260	2	Branch chiefs require some privacy.
		Building 268
268	2	sometimes hard to concentrate in open space.
268	3	Quieter would be better.
268	3	Better working conditions, relieve stress.
268	2	Partitions do not isolate outside noise.
268	1	Most important for improved work/quality.
268	2	Open office space - too much distraction.
268	2	Aids concentration.
268	2	Too wide open for privacy.

268	4	Distracted by people walking pass desk, no place in shop to hold private conversation (counseling) with coworkers.
268	3	Open area/everything is subject to anyone's eyes.
268	3	Partition work area or provide built-in lighting.
268	4	While I am on the phone and in general
268	2	Personnel walking around.
268	1	Tech work easily distracted by noisy environment.
268	3	Too confined.
268	2	Lack of privacy makes the job difficult for supervisors.
368	2	No privacy.
268	2	Privacy for better concentration & productivity.
268	3	Work area near a door, so constant interruptions.
268	1	Area to open (Bull Pen Atmosphere).
268	2	Too many nosy people.
268	2	Can't talk on the phone without being interrupted.
268	1	Work area much too small.
268	1	Everybody hears each other's conversations.
268	1	No place to have private conversation.
268	1	More concentration. Work Area is crowded
268	1	Office is too small for the number of people.
268	3	Distracted by hall traffic and conversations.
268	3	Contractors can at various times overhear discussions.
268	2	Too many people in one room.
268	3	There is no privacy currently.
268	4	No conversation/written material personal. Everyone hears & sees everybody's business. Too close/no divided workspace

Buildings 293 and 298

293	3	Too cluttered.
293	4	There is very little privacy.
298	4	Less distracting.
298	3	A problem only when 2/more conversations at once.
298	1	For better concentration.

Comments on Windows and Access to Outside

BLDG	Acc	Day	REASON

Building 235

235			Never had a job without windows; feel closed in.
235		4	good views from one's workplace stimulates productivity and can increase thinking ability.
235		3	It would be nice to have windows.
235		4	Sometimes air becomes stuffy because there are no windows in
235		4	Let sun shine in.
235		1	We need windows.

Building 260

260		3	Put window in.
260		1	Add windows: sunshine healthy/see weather.
260		2	Would like to know weather via window.
260		3	Building feels like a prison:there are no windows!
260		1	No windows cause jail-like feeling while working.
260	4	1	Reassure myself that the world is still out there.

it is important to get outdoors and exercise in order to get a break from the routine and compensate for a relatively sedentary job.

260 4 Never know weather
260 3 Windows beneficial to morale, quality of life.
260 1 Building has no windows.
260 3 Outside covered area for lunch/no time go to club.
260 4 I think a view of the outside will be stimulating and will alleviate some of the gloom inside.
260 4 1 Need to see daylight & not closed in all day.
260 1 Feel boxed in: would like view outside & sunlight.
260 1 Office is like a cave.
260 2 Self-explanatory.
260 2 Would like windows. Closed in all the time.
260 Building has no windows.
260 1 Don't like to be cooped up with no outside view.
260 3 Attitudes would be different if we could see out.
260 2 Would like see out/like being buried 8 hrs a day.
260 1 No windows.
260 3 Need air purification system since no windows.
There are not windows.
260 1 Improve air; able to open window would be nice.
260 1 No windows.

Building 268

268 4 There is poor air circulation now.
268 3 No windows to look out.
268 Need windows or plant lights - plants give the office a comfy/homey look.
268 3 2 There are no windows in the building.
no break areas at the moment
268 4 No sunlight is depressing & detrimental to health.
Circulation of fresh air essential for good health.
268 2 Personal feeling.
268 4 Isolation is not stimulating to the work area.
268 3 4 Variety.
268 3 Anything better than off-white cinder blocks.
268 3 Would be nice to have.
268 2 Building has no windows.
268 4 Would be nice
268 Building is drab & boring, especially since there are no outside windows.
268 4 I know that time is passing with the changing of outside.
268 1 A view from a window is very relaxing/stimulating.
268 4 I've got to see the sunshine
268 4 Sometimes it gets very warm or cold in this room.
268 4 We need a break area.
268 1 Would be nice to see outside w/daylight.
268 4 There is none on this side of building
268 4 I sometimes feel I am in a prison.
268 3 Would be relaxing, nice to see.
268 There are no windows at all.
268 3 In building w/o daylight gives low morale, fatigue.
268 3 more reliable

Buildings 293 and 298

293		4	Need windows in back wall - view of fields outside.
298		3	A break from the routine.
298		2	Need more windows.
298	1		It is good to be able to get away for lunch.
			More professional looking rooms/improves attitude.

Comments about Color, Break areas, Cleaning

BLDG	Colr	Break	Clean	REASON
Building 235				
235		3		Don't have a break area.
235	2			The walls in the work area are in need of painting.
235	3			Need all.
235	2			Change yellow to bright blue.
Building 260				
260		4		With no windows, picnic table w/ shade desirable.
260	3			The work area looks drab/ paint on walls looks old.
260		1		Need lobby for break areas.
260		2		Break area poor/Would like room without smoke.
260	2			Colors are glaring white/hospital green, & peeling.
260	3	2		One break area, but too far for some offices.
				Blocked in feeling due to cubicle arrangement.
260			4	not more frequent, more complete cleaning
260	3			Replace furnishings w/modular styles & imp colors.
260			4	very dusty/dirty area
260		3		The break area is not good.
260	4			the walls are white and gray, prefer warm soft colors
260	2	4		Hallways and offices haven't been painted in years.
				there is little room for lunch and breaks.
				The carpet has never been cleaned - it is stained and ugly.
260	4			it's been a while
260	4			carpet is old and worn
				Lights are old and need to be replaced.
260	2	3		More colorful walls would be pleasant to look at.
				It would be nice to have a non-smoking break area.
260		3	4	Cafeteria should at least be upgraded.
				Management doesn't care how it looks until high ranking people come through.
260	4		3	Floors and walls are very dirty.
				drab colors/ no carpet/ old furnishings
Building 268				
268	1			The walls are dirty and area made of concrete.
268		4		No break areas at the moment.
268		4		No break areas or places to eat lunch.
268	3	1		Better conditions relieve stress & improve performance.
268		4		need a break area so if we bring our lunch we have somewhere other than our desk to eat it at.
268		2		We don't have a specific break area.

268	4			Not too important for quality of work
268		3	1	Insufficient custodial work: to much dust & dirt. Need more than what is currently available.
268	3			White and green wall seems like a prison or jail.
268		2		Very Stuffy inside
268	4			Building is drab & boring, especially since there are no outside windows.
268		1		Would like a spacious break area and snack bar.
268		1		We need a break area.
268	3			Entire building same color/Variety would be nice.
268	1			Need new furnishings.
268		2		We have no break areas.
268		4		would be nice to have a sit-down lunch/break room so you don't have to eat at your desk.
268	2			Cheerful colors will make people happy.
268	3	2		There are none. Green is obnoxious.
268		4		have no break area
268		3		No smoking areas designated for smokers.
268		4		No break area exist, therefore smokers tempted to pollute air.
268		2		There are currently no break areas.
				Buildings 293 and 298
293	3			Needs brighter colors.
293		3		New break area.
293		3		No real break area.
298			3	Cleaning in infrequently used places.
298		4		Break area is also smoking area. Not really separate from rest of building.
298			3	Vents are dirty.
298		1		Large area with more vending machines.
298	2			More professional looking rooms/improves attitude.

Comments Related to Chairs and Furnishings

BLDG	Furn	Chair	Reason for Choice
			Building 235
235	3		To help inside the warehouse.
235		1	Need more chairs.
260	4		furnishings are old and almost worn out
260	4		furniture is old but adequate
260	2		Temperature varies too much.
260	3	2	Chairs too old. partitions are old and not tall enough
			Building 268
268		2	The chairs do not adjust.
268	4		Chairs either too high or too low, Not enough back support, not well cushioned
268	4		the items we have are fairly old
268	1		Furniture is old - does not match.

268	2		The shop seems to be off the AC track.
268	1		Chairs are uncomfortable.
268	3		A view form a window is very relaxing/stimulating.
			Air circulation is very poor in this area.
268	4		Need new furnishings.
268		4	Need large surface for viewing prints, manuals.
268	2	3	Area to open (Bull Pen Atmosphere).
268		4	Not enough room for all files & equipment needed.
			at this time I do not have an adjustable chair
268		2	Chairs are uncomfortable.
			benches do not provide enough space
293		4	Chairs are not adjustable enough.
298	4		Too many people - not enough space.
298		2	Back aches from poor support.
			Office is crowded.
298	3	4	Area with a sofa.
			Prefer more comfortable chair.

Comments Related to Other

Building	Comments and Reasons
	Building 235
235	Smoking
	because of poor ventilation and circulation, smoking can cause
	problems to those that are allergic to cigarette smoke
235	Classes on teamwork.
235	No smoking
	I don't like smoke; it stinks, irritates my eyes, and gets on my clothes
260	Better work condition.
	Air qual terrible/headaches,sore throats/asbestos.
	Could be more efficient if we had private area.
	Building 260
260	Less crisis management.
	Cafeteria should at least be upgraded.
	management doesn't care how it looks until high ranking people come through
260	More room for expansion.
	Branch chiefs require some privacy.
	Concern about utility of modular furniture
	Building 268
268	Location between staff. My particular division is spread out.
	Have 4 blank walls with command (Post Commander)
	not letting us put up pictures or drapes.
268	Windows. Circulation of fresh air essential for good health.
268	No smoking anywhere. Smoking policy is flawed.
268	Storage area. So we are stumbling over each other.
268	Healthier work environment. The A/C needs cleaning, germs spread in

abundance. The building has a high mold/mildew problem; new carpet and painting without proper ventilation causes more illness.

268 More room. Too confined.

268 More phones. Only 2 lines available for 12 people, who must coordinate with contractors around the U.S. Access to Autovon is almost non-existent.

268 Place for VDT/printers. Glare, reflections, printer noise, etc.

268 Increased professional attitudes. Too many nosy people.

268 More file space.

268 Telephones.
more reliable

Building 298

298 More telephone lines.

298 Improvements in atmosphere. To relax; greater space for more frequent meetings to discuss procedures and problems weekly

298 New management.

298 Uneven hallway floors; Very dangerous to have uneven floors.
Paved parking lot.

268 Storage area. Not enough room for all files & equipment needed.

268 Improved management technique by supervisors

298 Get rid of unnecessary correspondence.

Data Collected in January 1989 for Building 268
After the Rennovation

Choices Related to Air Quality and Air Circulation

AirC Rank	AQ Rank	Reason for Choice
2	1	No way to get away from smoke.
	2	Better control for A/C.
3	2	Bad air; not enough fresh air added. Drafts.
	3	Need window for fresh air, cigarette smoke bothers.
1	2	Fumes (electronic/maintenance shop) enter air vents. Fumes (electronic/maintenance shop) enter air vents.
3	4	No air circulation. Poor air quality.
3	4	Circulation not very good. Sinuses act up halfway through the day.
3	4	New furniture restricts air circulation even more.
	1	Reduction of allergies/related problems.
3		Poor air quality.
1		Stuffy air causes fatigue and eye irritation. Feel overly ill because too warm (& stuffy air).
2	3	No air condition; hot in summer. Heat drawn out of building in winter.
	4	Secondary air ventilation poor, esp in paint mixing.
	1	Air quality extremely poor.
1	4	Eliminates need for fans; too hot in summer, too cold in winter. Very stuffy.
1	2	Employees less productive. Funds used poorly; even less ventilated than before.
4		Old system needs replacement.
	1	Air stale; ducts contain bacteria.
3	4	Frequent changes in heat (winter) A/C (summer). Air circulation poor; causes dry throat.
2	1	Very little/no fresh air. No circulation of air.
3	2	Air stuffy; room does not get much air. Need air circulation to alleviate stuffy feeling.
1	2	Air forced directly on person and work. System picks up outside odors.
	2	Uncontrollable.
	1	Air quality cause of colds/flus; multiple systems not good.
	3	Partitions should be arranged according to A/C.
2		Smoke gets into shop.
3	2	Air stale in the morning. A/C & heat regulation very poor.
1		Air is stuffy and very dusty. Place is very drafty.
1		Too many people in room at times; office totally open.
2	1	Air quality poor due to concentration of cigarette smokers; an effective air filtration/circulation system should be installed to minimize irritation & obnoxious smells from cigarettes.
	4	Air makes one tired; no fresh air.
	2	Air quality has direct effect on ability to perform.
2	1	Too many common illnesses (flu)/complaints (stuffy). Irritated eyes/headaches.

2	1	Air quality terrible. Air circulation terrible.
	3	Air stuffy.
2		Recommend air cleaners/smoke grabbers be provided.
2	3	No air circulation right now. Horrible air quality; cigarette smoke lingers.
2	1	No windows, fresh air would be great. Always stuffy.
2		Room hot & humid in summer, hot & dry in winter.
2		No air circulation.
	4	No smoking policy not enforced. Smoke makes air quality poor.
2	4	Same air circulated all day; easy to get sick. Stale air due to closed room.
1		Too many people sick - bad air.
3	2	Vent/ducts never cleaned - poor air quality. Room air stale or air blasts too hard; causes colds. Too many smokers; non-smoking areas not enforced.

Choices related to Temperature

Temp Rank	Reason for Choice
3	Too hot in summer, too cold in winter.
3	Large differences in temperature.
1	Poorly controlled temperatures.
2	Temperature either too cold or too hot.
1	Room temperature fluctuates.
1	Office freezing in winter.
2	Feel overly ill because too warm (and stuffy air).
3	Too hot.
1	No air conditioning; hot in summer. Heat drawn out of building in winter.
1	Maintenance work demanding & too hot.
3	Too hot in summer, too cold in winter.
1	Frequent changes in heat (winter) A/C (summer). Heat and A/C should be same temperature year-round.
3	Temperature fluctuates; too hot/too cold.
1	Uncontrollable.
4	System unable to balance itself in spring/fall.
3	Too hot in summer/too cold in winter.
2	Usually too cold in winter.
1	Heat in summer oppressive, not well regulated.
3	Place is very drafty.
3	People sluggish if too warm.
1	Never know temperature in advance.
1	Should have consistent temperatures.
3	Too hot/too cold.
1	Room hot & humid in summer, hot & dry in winter.
1	Either too cold or too hot.
3	No heat in office.
3	Room at about 65 degrees, 42% humidity, with drafts.
1	Temperatures never comfortable - too hot or cold.

Choices related to Lighting and Task Lighting

Lght Rank	TskLt Rank	Reason for Choice
2		Lighting insufficient; dark around work area.
2		Light in wrong place for new furniture.
	4	Not able to get good light for reading.
	2	Would be nice to be able to adjust light.
3		Need fluorescent lighting.
2		Lighting not intense enough.
2		Overhead glare and inability to adjust frustrating.
1	2	Poor lighting; poor lighting.
2		Light arrangement should be distributed evenly.
4		Lighting under desk should be improved.
	4	Adjustable lighting would be helpful.
1		Lights sometimes too bright, too dim.
	4	Light sometimes too intense; cannot adjust.
	3	Uncontrollable.
2		Poor modern lighting on new furniture.
	3	Only one light, would like another.
4		Adjustable light level.
1		No light at desk.
	1	Detailed work difficult on bench without proper light.
4		Need modern lighting fixtures.

Choices related to Noise, Location of Others and Surface Area

Nois Rank	Loc Rank	Surf Rank	Reason for Choice
2			Distractions from others, machines.
		3	Less work & storage area because of new furniture.
		1	Work spaces poorly laid out; equipment in different places.
2			Others talking annoying/distracting, breaks concentration.
	3		Less noise, less interruptions.
		2	Surface area too small; papers shuffled often.
		3	No place for printer/typewriter.
2			Too noisy, hard to concentrate.
		2	Area crowded.
		4	Lots of room required in shop.
3			Noise level very intense.
3			Noise distracting.
4			Needed for concentration.
		2	Improves work environment.
		2	Phone & accessories take up lots of area.
		4	Need more open areas; computer takes much room.
		2	Work surfaces too small/poorly laid out.
2	1		Too much chatter. Too many bodies in small area.
2	4	3	Talk, unanswered phones, hall traffic. Large drawings do not fit on desk surface. Not needed if talk, unanswered phones go away.
	3	4	Much noise from people and equipment.
4		3	Cannot hold private conversation or work due to traffic. Work requires 2,3x work space available.

	4	Too crowded at workbench.
4	1	Equipment takes up too much space. Many people waste time by talking at bench.
1		Too much noise from telephones/conversation, etc.
	2	Need more space for terminals & spreadsheet analysis.
3		Conversation heard through walls, many people in office.
	4	Obnoxious smells from cigarettes.
	1	Need more space to spread out work.
1		Driven nuts by printer in cubicle.
3		Noise level is obnoxious.
3	4	More privacy = less distractions. Not enough storage space.
	1	No room on desk to do work. Nowhere to store work/equipment.
3		Better concentration.
4		Nothing to cut noise from other people.
	2	Very poor work area.

Choices Related to Privacy

Priv Rank	Reasons for Choice
1	Better concentration in seclusion. Distractions from others, machines.
4	Very crowded - no privacy.
4	More privacy to work.
1	Others talking annoying/distracting, breaks concentration.
1	High traffic area.
2	Often distracted.
1	Too many distractions; encourages b.s. sessions.
2	Needed for concentration.
2	Some stations too open.
3	Too many bodies in small area. Too much chatter.
1	Talk, unanswered phones, hall traffic.
2	Cannot hold private conversation or work - traffic.
1	Sometimes privacy needed to talk with employee.
1	No privacy exists.
2	Work better in confined area. Many people waste time by talking at bench.
2	Too many people in room at times. Office totally open.
1	Isolation necessary sometimes.
4	Too many bozos running around the area.
2	People in other cubicles can hear all.
3	More privacy = less distractions.
4	No privacy to talk.
4	Better concentration.

Choices Related to Daylight and Access Outside

Choice Acc Rank	Dylt Rank	Reason for Choice
	1	Cannot see outside - feel bored,confined,irritable.
	4	No windows.
2		No place to go (outside).
	3	Absence of sunlight depressing.
	1	Would like to see daylight.

	1	Makes work are seem more spacious.
	4	Employees less productive.
	3	Need better view.
	4	No outside view throughout day.
	4	Uncontrollable.
3		No windows cause depression; need access.
	3	No windows.
	3	Office too confining.
	3	No view.
	1	Outside view helps morale.
	2	Eyes need to rest; want to see outside.
1		Need break area with exposure to outside and place to relax/break.
	4	Improves work attitude to see outside.
	3	Personal preference.
	3	Need outside light and view.
4		No windows, fresh air would be great.
	3	Would be nice to be able to see outside.

Choices related to Color, Break Areas, and Maintenance

Colr	Brk	Clean	Reason for Choice
4			Office too drab, no carpet.
	1		No break area because not funded.
	4		No break area.
	4		Need break area.
	1		No break area other than coffee pot area.
	3		Drab.
3			Makes work area seem more spacious.
		3	Dusty - cleaned during work hours.
	3		Must use designated smoking areas.
	2		No break areas available.
	4		Smokers should get own area.
	1		Don't like to leave building when too hot/cold.
	4		Break area just part of shop.
		4	Cleaning done by self.
	3		No break area now; want to see view.
	2		Need break area with exposure to outside and place to relax.
	4		No break area for civilians.
4			More colorful workplace contributes to productivity.
	3		No break areas presently.

Choices Related to Furnishings and Chair

Furn Rank	Chair Rank	Reason for Choice
	4	Must sit most of day.
3	4	Chairs/accessories do not match new furniture.
	3	Back aches due to poor design.
4		Need new chairs; present ones 8 yrs old.
4		Chairs uncomfortable.
	1	Chair uncomfortable.
4		Makes work are seem more spacious.
1		Chairs uncomfortable.

4	3	Need ergonomic chair.
		Desks and storage too confusing.
4		Adjustments to desk tops should be easier.
1	2	Chair and desk are uncomfortable.
		Chair is stiff.
	2	Height of workbench chairs should move up & down.

Other Choices

4	Rest are about equal.
3	More employee space, work area, etc.
1	Less tense atmosphere/more cooperation.
4	Less interruptions, rearrange workstations.
4	Larger rooms to work in.
3	Prohibit smoking and enforce it!
4	Printer space for computer.
2	More storage area.
1	Limit smokers.
4	Smoke-free environment.

Table C1. Suggested Changes to Lighting, Work Space, Equipment and General Comments from First and Second Surveys

Changes to Lighting

First Survey

Bldg.	Comment
235	A little brighter.
235	Reduce flare.
235	Yes, in the warehouse.
235	Put in more lights as needed.
235	Add more lights.
235	Put lights over work equipment in shop and office.
235	Back corner needs lights.
235	Dim the lighting.
260	Need more even light/not all the light in one spot
260	No, lighting is excellent.
260	I would put another bulb in (blown since Dec).
260	Something done about replacing lamps at work station.
260	I could use a light at my desk.
260	Add additional lights.
260	Adjustable task lighting/less overhead lights.
260	Arrange work stations to meet lighting arrangement
260	Double amount of ceiling fixtures.
260	Several areas need better lighting.
260	Replace light covers.
260	More suitable lighting fixtures attached to work station.
260	I'd like to have my work station light repaired.
260	Would be nice to be able to get lights for work station.
260	More concerned about air quality.
260	Distribute the light more evenly.
260	Have the lamps that come with workstation fixed.
260	Better availability of replacement "desk" lights.
260	Fix the desk lights/get desk lamps.
260	Bulbs burned out or nowhere to plug them in.
260	Move VDT: glare from overhead lights.
260	Brighter bulbs.
260	Brighter.
260	Lights are always breaking (old & need replacing).
260	Cut out shadows.
260	Cut out the glare.
260	Repair light on desk (requested six months ago).
260	Glare on terminals, screens.
260	Too much glare on the terminal, irritates eyes.
260	Install soft fluorescent bulbs.
268	Ceiling "day" fluor w/better orientation; desk lights.
268	Reduce glare.
268	Need additional lights.
268	Indirect lighting for VDT; more light for reading.
268	Desk lamp, glare guard over computer screen.
268	Reduce glare.
268	Increase slightly.
268	Change lighting to get rid of glare on screen.

268 Light directly over the desk; VDT glare guard.
268 Table lights - reduce ceiling light glare.
268 Relocation of ceiling lighting/desk lamp.
268 I would cover the lights for softer application.
268 More overhead light.
117 Better lighting.
268 Currently I am using a desk lamp from home.
268 Increase light & change positions of fixtures.
268 Lighting should be lower over desks.
268 More lights.
268 Infra red.
268 Add reading desk lamps.
268 Change location and intensity.
268 Brighter lights or add more ceiling lights.
268 Replace with indirect lighting and desk lamp.
268 Use clamp-on adjustable fluorescent desk fixture.
268 Position lights where needed.
268 Need desk lamps.
268 When building is demolished, redesign the lighting
268 Get the glare off of the CRT screens.
268 Cut overhead lighting & distribute task lighting.
268 Using a softer light; fluorescent is very harsh.
268 More government desks should be made available.
368 Halogen lighting.
268 Individualized lights for each work station.
268 Reading light adjustment for location/brightness.
268 New covers over lights.
268 Individual controls and lights.
268 Glare is a big problem - reading, writing, & VDT.
268 Add a desk lamp.
268 More softer light, more control.
268 New lighting stations with guards over light bulb.
268 Increase the number & quality of adjustable lamps.
268 More light.
268 Change to a "naturalite" instead of fluorescent.
268 There has to be a better way.
268 More light.
268 Softer.
268 Would be nice if softer.
268 Make it adjustable (individually).
268 Lights better arranged over work area.
268 Adjustable desk lamps.
268 Have it controllable.
368 Install lighting directly over the work area.
268 Add reading desk light.
293 More and better lights - closer to work.
293 More drop lights.
293 Install drop lights in each bay for portability.
298 Desk lamps.
298 Would like to have a dimmer switch.

BLDG Changes to Lighting - Building 268 - Jan 89

268	Place lights such that no shadow falls on desk.
268	Add light diffuser, change to non-fluorescent lights.
268	More ceiling & work area light.
268	Direct light towards work space.
268	More lighting needed.
268	Put light under counter top.
268	More lighting, better location of light switches.
268	Install fluorescent lights.
268	More overhead lighting.
268	Get rid of overhead glare.
268	Additional overhead lighting.
268	More lights.
268	More light.
268	Additional lights.
268	Change light location (near computer).
268	For secretaries - put lights under counter.
268	More direct overhead light.
268	Change light reflected off VDT.
268	More adjustable lights.
268	Add lights to areas that need it.
268	Brighter, more direct light.
268	Add positional lamp to bench.
268	Install work lamp over typewriter & PC.
268	More flexibility in positioning light source.
268	Windows.
268	Use incandescent lights; fluorescent hard on eyes.
268	Better, adjustable lighting.
268	Add light over filing drawers.
268	Better overhead/indirect lighting.
268	Change lighting system.
268	More lights.
268	Brighter at mechanic repair work bench.
268	Purchase better lighting fixtures.

Comments about Equipment

BLDG	Equipment Change
235	Modernize.
235	Update with newer state of the art equip.
235	Larger work surface area, more computer software, redesign lighting.
235	Get a decent phone system.
235	Update equipment.
235	Replace it all and get into the 20th century.
235	Get new equipment.
235	Order new equipment.
235	Get more forklifts.
235	Modernize.
235	More materials handling equipment for warehousing effort and newer equipment.
235	Get programs so we can use our computers at each location instead of very few locations.
260	Better access to VDT.

260 Get better equipment so that each employee has his/her own.
260 Newer equipment.
260 Computer gives me trouble; breaks down all the time, I need to do my work.
260 I would update the equipment; it's too old and out of date.
260 Get a more modern machine that operated more than half the time.
260 Get new computer terminals and desks for them.
260 PC at every work station.
260 Replace phone system. Replace air handling equipment.
260 Upgrade phone system/equipment, modularize desks and work areas.
260 Make equipment more available.
260 Update phone switchboard and trunk lines, new phones (merlins) are terrifc, trunk lines generate a lot of cross talk especially when raining.
260 Improve the current telephone system.
260 We need more room for our computer terminal.
260 Improve computer system.
260 Better automation and more training.
260 More dependable ADP system.
260 Get new computers and workable telephones, more lights and more comfortable chairs.
260 Get more up to date equipment.
260 I'd like to have my own VDT instead of having to share.
260 Need more desk area to work on.
260 Install reliable PC in place of terminal and improve reliability of all software.
260 Obtain the proper furniture for my PC equipment.
260 Would have training on equipment - instead of whatever you can pick up.
260 Buy more PC's etc., new work stations, better phones.
260 Get updated to at least 1960.
260 Faster, more efficient.
260 Update and improve computer terminals and system.
260 I would prefer to have a personal computer instead of terminal.
260 Get better more efficient equipment.
260 More speed on the VDT.
260 Updated computer system and better lighting system.
260 Task station is large enough but not the design I need for work I do.
260 More handy.
260 Improve computers.
260 New furniture.
260 Change computer system.
260 Chairs should have clear padding to roll on to protect carpeting.
260 Get an optical character reader.
260 Upgrade computer system.
260 Screen glare.
260 Improve response time on the main computer.
260 Would like an adjustable screen.
268 Provide materials to meet the needs. Never enough pens, pencils, paper, copy machines out of order & limited reference material (technical/other) non-existent or out of date;and archaic telephone capability; needs changed.
268 Reduce glare, change lighting; Need space for safes, etc.
268 My own PC.

268 New/acquire ADP Equipment & Software. Need to do a massive overhaul in replacing & acquiring ADP equipment due to requirements of statistics and extreme shortage of manpower.
268 Have furniture that matched in design. More modern software for my PC. Better brand PC.
268 Proper software for VDTs and adequate general office supplies, rearrange furniture for more efficient use of it.
268 Change typewriter from Olivetti to IBM.
268 Find the intermittent fault in my PC.
268 Buy more software.
268 Replace older PCs with newer ones with higher resolution screens
268 Need new printer.
268 Install vacuum tubes for distribution.
268 Better choice of ADP equipment and software.
268 Update if possible.
268 Get same new equipment for the welders.
268 Update old machines.
117 Buy better and more modern equipment.
268 I think the modular furniture will be an improvement.
268 Have the rules on procurement of Pc's eased so it would be easier to get good automation.
268 Have the wp in more light area.
268 Get new test equipment and cables.
268 Replace it with new equipment.
268 Make it from this decade.
268 Newer equipment.
268 Get better soldering stations. Get some up to date test equipment.
268 Update the antique equipment.
268 Have the basic supplies we need to do our work.
268 Get a letter quality printer.
268 Bring up to current standards/technology.
268 Update it with equipment that the market uses today or as close as possible. Our antique stuff just doesn't cut it.
268 Better desk and computer stand, book shelves.
268 Update the equipment that work with in supply.
268 Provide equipment that work properly.
268 Move moderate and increase quantity of reference storage equipment.
268 Scrap the 1800 stuff and get 1900.
268 Keyboards should be located on office furniture designed for such use.
268 Telephones need a lot of work.
268 Get more up to date equipment.
268 We have PC's. However, every time we order software the request is canned.
268 Junk it.
268 A computer terminal with printer and EGA monitor, access to a good program library.
268 Have a steady supply of ribbons and paper. You can't depend on self-service supply.
268 Update computer.
268 Get more equipment.
268 Desks - not work stations.
268 More VDT/automation capability.
268 Upgrade furniture-expected in next week.

268 Bigger desk, lamp.
268 Update with new state of the art user friendly equipment.
268 Update it.
268 Get modern "state of the art" equip. or at least something from this decade
268 Get some.
268 Need much more space.
268 More desk space and files.
268 Add ADP equipment.
268 Get files.
268 Bring in up to date equipment that performs technical and managerial duties of job.
268 New desks and lamps, more file space.
268 Need personal PC and printer at each persons desk.
268 Improve and develop procedures for obtaining equipment/materials required to perform the job.
293 Need forklift.
293 Need forklift.
293 Buy a forklift.
293 We need our own fork lift & better air & power tools and better safety equipment to use with them.
293 Buy a forklift.
298 Better computer.
298 Go back to speedy IBM terminal.
298 Change software, update software and hardware, more phones.
298 More CRT's available. Better computer tables. Better quality copiers and microfiche machines.
298 Office automation to speed document preparation.
298 Better/faster computers.
298 Additional phone lines.
298 Add L-unit to desk for more work space, have own VDT with work space, more phone extensions and autovon lines.
298 Improve computer terminals.
298 Correct workstation for VDT.
298 Upgrade system -- all terminals need to be linked to one mainframe.

Changes to Equipment Jan 89

268 New equipment.
268 New equipment, more equipment.
268 Workable printer.
268 Microfiche reader that works.
268 Add PC, filing space.
268 Correct software.
268 Improve repair service.
268 Software for computers.
268 More space-storage,equipment,etc.
268 More software for ADP equipment.
268 Better phone system.
268 More efficient equipment.
268 Upgrade, modernize.
268 Safety equipment, upgrade.
268 Better ADP equipment.

268 Replace Intel PC.
268 Desk.
268 Better supply, tools, equipment, hood.
268 Move phone, have computer.
268 Space for PC & printer, etc.
268 More work equipment.
268 More computers, printers.
268 Larger space near computer area.
268 Own PC at desk, reliable copier.
268 Trade terminal for PC.
268 Different, better equipment.
268 Add drawer onto desk.
268 Update equipment.
268 Need internal communication.
268 Adjustable equipment.
268 Better access to parts.
268 Upgrade equipment.
268 Newer equipment.
268 Better access to PC.
268 Better equipment.
268 Better computer/software.
268 More PC's, work area larger.
268 Faster computer.
268 Better work equipment.
268 Better PC's or computers for all.
268 Get printers or remove VDT.
268 Climate control/air quality, window,privacy.
268 Better telephone service.
268 More PC's.
268 New furniture.
268 Up-grade test equipment.
268 Modern furniture horrible.
268 More files.

Suggested Changes to Work Space - First Survey

Bldg Work Station Change

235 Repaint, more privacy for employees
235 Variable lighting, more work space, more storage space
235 Paint walls and area.
235 I could spend my time doing my job rather than filling out paper work like this.
235 Build another building with more space.
235 Put in carpet, new chairs, light recess, file cabinets, central air-conditioning.
235 Move to an office area.
235 Get more space.
235 Modernize.
235 Painting of office.
235 I would make more space available for myself
235 Increase size and privacy.
260 Bigger desk and extra tables.

260 A little more work area.
260 More comfortable.
260 If I could make any changes I would have more lighting at my desk.
260 Have more storage space (filing cabinets, etc.)
260 Check out air coming in through old ducts and check air return to see if hooked up and working.
260 Another desk.
260 Move to new building.
260 Make it larger and more functional.
260 Need more room.
260 Create a bit of privacy for everyone.
260 More private space, reduce lighting glare, more privacy between employees, reduce noise.
260 Remove partitions that cause cubicle style and make more room for desk and table area.
260 Add lighting, fixed and adjustable.
260 Have a window and fresh air.
260 More work space.
260 More space for working or better arrangement.
260 Take partitions down and give us a little more work space and put in some real walls for privacy.
260 Need more space and privacy.
260 Confine it too a more private area where I could work by myself in peace and quiet. Additional work space would be nice.
260 I'd like to see some of the bays opened.
260 Spread out to create more room between workers. Replace hard-rock radio station with low volume easy listening station. Institute a campaign for quietness and professionalism.
260 Enlarge.
260 Change the wall colors and change the overhead lighting.
260 More work surface - better light.
260 Tables to review drawings and work space for material using terminal.
260 Put in windows/improve AC/heat ducts, new work station designed around PC's; not just provide more privacy.
260 Call a contractor.
260 Work stations help to organize work area and make office have a greater appearance of professionalism.
260 More room, more up to date office furniture and modern surroundings.
260 Get more.
260 Better lighting, more privacy, more room and would be nice to have window.
260 Add windows.
260 Move to area that has access to a window for sunshine and fresh air
260 Bigger table for video display terminal and better lighting system, one with no glare.
260 Tear it down and then rebuild it with windows - install a modern heating and air conditioning system; have cubicles instead of open bays; have secretary/receptionist for screening visitors and calls.
260 Add more.
260 More lighting and better air quality.
260 Better supplies and furniture.
260 Better lighting.
260 Add more shelves.

260 Better positioning on VDT with space for printouts and other documents.
260 Put away from telephone printer.
260 More partitions.
260 Have a private office.
260 Have windows.
260 Need more filing space and table top space.
260 Windows.
260 Better utilize space.
268 Leave the furniture we have here, increase space/person to at least minimum required, and allow reasonable individualization to meet desires/needs; work station concept equals robots on top of unnecessary expenditure of money.
268 Move.
268 Task/Modular Furniture would help. A new building for maintenance Dir. only would be better.
268 Improve lighting, air temperature and circulation, provide more space.
268 Paint, carpet, plants.
268 Have more comfortable workspace so I don't have to move far from my desk to my PC.
268 Change lighting, air quality, make furniture arrangement easier/ more efficient to use.
268 Put in a skylight or windows.
268 Knock hole in the wall and put in a window.
268 Better air and quieter.
268 Add a privacy screen, arrange furniture so everything would be more accessible; have more storage space.
268 Have things better arranged, controlled lighting.
268 See question 18. Also, give adequate space to workers.
268 More surface area.
268 Replace furniture, improve lighting.
268 Privacy.
268 Privacy
268 Install one-way windows, air conditioning and cover music.
268 AC
268 A window.
268 Add a door for privacy.
268 Better lighting and more privacy for concentrating.
268 Increase lighting and install sound insulation and make the area non-smoking.
268 Make it in another state.
268 Make it 100% no smoking. Block off my area.
268 New chairs, paint, enclose ceiling.
268 Nothing really can be done.
268 Stop the smokers and music.
268 Locate my desk in a quieter place.
268 Air, circulation and cleanliness - lighting - desk type.
268 Better lighting, more bench/drawer space, put up a partition between the benches.
268 Put in windows and improve air circulation.
268 Partition for privacy and utilize work station with built-in work surface lighting.
268 Put functions that work together in same office.
268 More room for cabinets and reference materials.

268 Scrap it and re-do.
268 More space, more storage area, more classroom space.
268 Have more storage area.
268 Move my position station.
268 More work space - table tops; more book cases; areas to hang personal items.
268 Doesn't matter; We asked for what we needed and we're getting something unusable.
268 More room, privacy, and better/adjustable lighting.
368 Install picture window.
268 Better lighting and better telephone service.
268 Cooler and less humid, more privacy, better lighting, and more room.
268 Have a better work station.
268 Install modular furniture.
268 Better furniture, more privacy - windows.
268 Move it beside a wall, away from the door--less disturbing.
268 I would not change furniture from desks to work stations.
268 More privacy.
268 Add computer terminal.
268 Need more work area for area, modular/system furniture, lighting/sound design, air quality.
268 Put paper in the trash.
268 More comfortable chairs, more table space & better lighting.
268 Enlarge it.
268 Increase work space.
268 Move terminal tables closer to task stations.
268 Burn it.
268 Torch it.
268 Move people to a larger work area.
268 Need more work space.
268 More area space.
268 Need larger space with privacy.
268 More room.
268 Have rack for storage of reqs, drawings, and provisioning parts lists, table for spread out of drawings, etc. A little more elbow room.
268 Buy myself more files to clear off desk top.
268 Open 323 and 322 into one computer area.
268 New furniture.
268 Get a bigger room with adjustable temperature.
268 Better, fresher air. Not so crowded.
268 Increase.
268 The changes indicated in question 18.
268 Expand office and work area to allow for more space.
268 Make workspace private and roomier.
293 Make each work station independent in itself.
293 Move
293 More space.
293 Leave
298 Enlarge.
298 Extend space for getting into filing cabinets.
298 Spread out, get more phones, get more printers, get several typewriters.
298 Change layout in certain areas so that coworkers' chairs are not always

in the aisle.
298 More filing cabinets.
298 Ventilate smokers area to outside; clean ducts; provide better chairs; provide more work space per person.
298 Enlarge and enclose.
298 More storage place for supplies; correct work station for VDT.
298 Furniture is functional, but ugly -- and very old. Needs to be upgraded.

Changes to Work Station Jan 89

268 More work area.
268 Enlarge working/surface area two-fold.
268 More room, privacy.
268 Reorganize!
268 Drawer space.
268 Enlarge, more flexible.
268 Bigger area.
268 Larger space for equipment.
268 More private, quiet.
268 More space.
268 Expand areas.
268 Better ventilation in shop.
268 No partitions.
268 More storage.
268 A DESK!
268 More work area.
268 Better sandblasting room.
268 Larger.
268 More room per employee.
268 Integrate computers with other offices.
268 Better chair, more lighting.
268 Larger work surfaces.
268 Move people.
268 More storage, improve lighting.
268 Larger working/desk area.
268 Larger surface, file space, quieter.
268 Bigger space, rearrange space.
268 Lighting, more space.
268 More privacy - a door.
268 Better phone service.
268 Widen desk.
268 Better lighting, color, privacy.
268 More bench space, light.
268 Less noise.
268 Rearrange workstations.
268 Adjustable bench chairs.
268 Windows, A/C & heat.
268 One person per office.
268 Enlarge.
268 Leave building altogether.
268 Larger, more storage, space for printer.
268 Larger/more organized work station.

268 Move printer.
268 Individual/adjustable lighting.
268 Larger, more privacy.
268 Enlarge.
268 Better lighting, more privacy.
268 More work area, better lighting.
268 Room for printer, light over desk.
268 L or U shaped desk, wider too.
268 Larger, better lit.
268 More work/storage area.
268 Larger/more private area.
268 Bigger office, heat.
268 Light.
268 More room.
268 Better air quality, room.

General Comments First Survey

BLDG

235 See question 18 and install windows.
235 Better air circulation - better color tones on walls and ceilings.
235 None - everything is perfect and conducive to getting the job done!
235 More moderate equipment, painting, redecorating.
235 Better lighting and temperature control.
235 Completely remodel building, or build a new one.
235 An office for individual work area.
235 More forklifts.
235 Update office equipment.
235 Build new building.
235 New roof, improved lighting, new emergency exit doors, better HVAC.
235 Move it closer to building 268.
260 Put some windows in improve the lighting. Put some walls around the desk and have a shuttle to work.
260 View out of a window, more work area and a better phone, my phone doesn't work well.
260 In own office will be best work.
260 Tear it down and rebuild a new one.
260 More storage space, windows and better ventilation.
260 More space and better or cleaner air.
260 There is not much that can be done based on the type of building and mission.
260 Air handling equipment refurbishment; include ability to bring in fresh air; more functional office furnishings and space; desks, shelves, partitions, tables, phones and PC's.
260 Privacy/quiet.
260 Put in windows.
260 Need windows in building.
260 Increase lighting, update phone lines.
260 Less crowding.
260 Improve air.
260 Dismantle and start anew.
260 More privacy; there is no privacy.
260 I'd like to move out of this building to one with windows and one with

good air quality and ventilation.
260 Tear it down and start over again.
260 Install windows and insure excellent air quality. Temperature generally good.
260 Have an office setting.
260 Lights, different color schemes and artificial view to outside
260 Add on to make more storage, office space; add filing cabinets; add windows on outside walls.
260 Smoke eaters, one at or over my cube. Would like to be able to hear the music or be allowed to use my own radio; Main hallway is slippery when wet (rain or snow).
260 Call in contractor.
260 Improve all of the problems throughout this questionnaire.
260 More space per person, printer covers, better and more equipment/office supplies; better phone system; more phones, more phone lines.
260 Some other color in the offices.
260 Better air, better lighting, windows, better arrangements of furniture and let people have a voice in it.
260 Install windows, and improve air quality and lighting.
260 Bulldoze it and start over with a modern set of blueprints and multimillion dollar cost plus contract; we deserve it, the economy needs it and the taxpayers are stuck with it.
260 Replace it!
260 Add windows, closer parking.
260 Better ventilation and air quality. Improve lighting and appearance. Windows would be nice, but impossible.
260 Lighting, even temperatures.
260 Larger bathroom door.
260 Improve air quality.
260 Better air quality; more circulation, and windows to let a little sun in
260 Need storage area to store ADP paper and other equipment.
268 Stop the micro-management and management indifference to workers/ families when it comes to their resultant impact(s) from decisions or changes to/for mission performance; cut out cosmetic moral boosting for these/similar things; fix building.
268 Better lighting - break area - more eating places closer.
268 Better lighting, improve air circulation, and temp. control.
268 Windows in building; break area.
268 Fix air quality, air conditioning, heating, make adjustable lighting.
268 Put in windows, improve circulation of fresh air, replace heater/AC
268 Improved air temp, break areas.
268 Windows for fresh air, improve lighting, a better heating/cooling system
268 Install new work stations.
268 Get better means of keeping the AC working and a light directly over desk.
268 More storage space.
268 Privacy.
268 Lights, air quality.
268 Office area rearranged for quietness/privacy.
268 Complete renovation of the air and circulating systems.
268 Put all divisions in one building.

268 Improve AC and circulation.
268 Increase floor space for shop, improve heating and AC.
268 Window space.
268 Improve machine shop location and cooler break area.
268 Fix light & air.
268 Better working conditions overall.
268 Better lighting, newer test equipment, better air circulation.
268 Less noise/no smoking in shop area.
268 Up grade the electric power and air conditioning
268 A better ventilation system.
268 Cut out the smoke and noise.
268 Get power capabilities and courses up to meet requirements. Fix air handling system. Give me direct access to my area of control - room 319; Fix the phone system.
268 Lighting, stable electrical system, better workspace.
268 Provide better work station lighting at each work surface.
268 Increase size.
268 Improve air circ., better lighting, more individual room.
268 Tear it down and start it over.
268 More storage and work area.
268 Renovation of air system and insulation, install one large A/C unit.
268 Install a break area, improve air circulation.
268 Add classrooms. More heating/air conditioning, ventilation. Add another building.
268 Outside views, better heating/air conditioning, improved lighting, privacy.
268 Better temperature control, better lighting.
268 Better climate control and the air circulation, better lighting.
268 Bring more people on board -- too much work, not enough people.
268 The building needs a break room, so we don't have to eat at our desks.
268 Better temperature/atmospheric control.
268 Make all areas accessible without going all the way around the building.
268 More people.
268 It's not so much the building as it is the people, and budget restraints.
268 New building.
268 Better electrical system, a V.P.S. uninterruptable power supply for all computers and systems.
268 Provide good training to management.
268 Remodel.
268 Move us out.
268 Get more people on board, larger work area, better working conditions.
268 Need break area, conference area, more space.
268 Allocate space in building according to function.
268 Room too small for the number of people assigned.
268 More room with more privacy to be able to concentrate more.
268 Partition office area from equipment area to confine noise.
268 More space, individual climate control.
268 Heating/cooling need fixing, additional space for work, smoking area.
268 Enforce smoking prohibition.
268 Increase space for each branch, increase secure area work space.
268 Organize functions to eliminate time spent going to another building.

268 Enlarge/ increase space.
268 Improve air movement/temp/quality.
293 Insulate roof & walls/better lighting/better A/C, heat.
293 Get forklift for our use.
293 It should be more organized & not considered a storage area for the rest of the post.
293 More room for storage or less equipment to store. Clean or install air circulation system.
293 Get a new air system.
298 More telephone lines.
298 Everything is wonderful except as stated. (only minor things)
298 More automation/computer assistance.
298 Smoke at work stations -- separate smokers from non-smokers.
298 Better temperature control, more confined smoking area.
298 Get rid of smoke from smokers.
298 Additional phone lines.
298 Enlarge it.

General Comments - Jan 89

268 Privacy, carpet, less noise.
268 More space.
268 Add break rooms, add "healthy food" vending machines; enlarge, add-on space.
268 New break area, more work area.
268 Better laid-out work spaces; put microfiche, safe, files in same building.
268 Window, four walls for sound proofing.
268 Move electronic maintenance shop to separate building (fumes from shop often get into air vents.
268 Better air quality, windows, less fumes/smells.
268 Paint, new carpet.
268 Air quality.
268 Lights, air.
268 Better cooling and heating.
268 Clean air ducts, allow windows where practical.
268 Better air circulation, storage space.
268 Privacy, quiet, better phones.
268 Windows.
268 Relocate people who complain about shop smells.
268 Secondary ventilation, larger side entrance to paint spray booth area.
268 A/C, suspended ceilings, better lighting system.
268 Modular buildings.
268 Improve/replace heating & cooling, fix telephone system.
268 Improve heating/cooling, more space.
268 Different & consistent color scheme.
268 Ventilation, windows, space.
268 Improve lighting and air control system.
268 Move people.
268 Better air circulation/temperature control/lights in work area; break area with outside windows,
268 Move light fixtures; paint halls; install bulletin boards.
268 More Autovon lines (probably a post phone problem).
268 Change workstation layout, hallway paint job, fresh air circulation.

268 More space/privacy, better lighting/temperature/air control.
268 More space for workers.
268 Better heating and cooling system.
268 Better air quality/break areas too.
268 Better chair.
268 Less noise, better heating/cooling.
268 Better heating system, add cafeteria to building.
268 Temperature control, better ventilation.
268 Give repair facility its own building.
268 Improve air quality and circulation.
268 Break area; yellow lights instead of "white"; more space; better air circulation.
268 Replace management because they do not care.
268 Break area.
268 Improved air quality and flow with accompanying climate control; windows.
268 Improve air quality and circulation.
268 Lock it up and throw away the key.
268 Temperature control, better phone system, more phone.
268 Break area, cafeteria, smoking areas, better music/chairs, more concerned upper management.
268 Outside view.
268 Suggestions don't count.
268 Lighting, newer & better equipment.
268 Build - more room needed.
268 Break area.

NBS-114A (REV. 2-8C)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)	1. PUBLICATION OR REPORT NO. NISTIR 89-4175	2. Performing Organ. Report No.	3. Publication Date SEPTEMBER 1989

4. TITLE AND SUBTITLE

Post-Occupancy Evaluation of Several U.S. Government Buildings

5. AUTHOR(S)

Belinda L. Collins, Gary L. Gillette, Mubarak S. Dahir, Peter S. Goodin

6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions)

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

7. Contract/Grant No.

8. Type of Report & Period Covered

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)

U.S. Army Communications - Electronics Support Facility
Vint Hill Farms Station
Warrenton, VA 22186-5141

10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

A post-occupancy evaluation was performed on five small, low-rise U.S. government buildings at a site south of Washington, D.C. The purpose of the study was to evaluate environmental conditions including lighting, space, noise, and indoor air quality, and provide recommendations for change. In addition, a comparison was made of environmental conditions before and after renovation of one of the buildings. The study employed a questionnaire about the environmental conditions, physical measures of the space (lighting, space, noise, temperature, etc.) and interviews with personnel at the site. A total of 308 people participated (including measures before and after the renovation) and physical measures were taken at 92 work stations. Analysis of the physical measurement data indicated problems with limited space, lack of adjustable task lighting, and perceptions of poor indoor air quality in two of the buildings. The renovation was perceived to have improved the appearance of one building substantially, however. Suggestions for improvements to the buildings at the site were also made.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

automation; contrast, environmental assessment; indoor air quality; lighting; luminance; noise; post-occupancy evaluation; temperature; VDT's

13. AVAILABILITY

☒ Unlimited

☐ For Official Distribution. Do Not Release to NTIS

☐ Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

☒ Order From National Technical Information Service (NTIS), Springfield, VA. 22161

14. NO. OF PRINTED PAGES

158

15. Price

A08


AMERICAN BINDERY-FAST
1993