NIST GCR 15-981

Community Resilience Workshop October 27-28, 2014

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- Tonia Bohnen, Advanced Innovations and Marketing, LLC
- Stephen Cauffman, NIST
- Erica Kuligowski, NIST
- Therese McAllister, NIST
- Nancy McNabb, NIST

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- Mauricio Justiniano, Energetics Incorporated
- Paget Donnelly, Energetics Incorporated
- Walter Zalis, Energetics Incorporated
- Ann Terranova, URS

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- Keith Stammer, Joplin/Jasper (MO) County
- Deidre Ebrey, City of Moore (OK)

Most importantly, the authors are thankful to the participants who attended the workshop and provided input based on their expertise. The quality of the discussions and input was excellent. The workshop would not have been a success without you. We look forward to your continued input at future workshops.

Community Resilience Workshop
NCED Conference Center and Hotel
Norman, OK

October 27-28, 2014

Meeting Summary

1. Introduction

Presidential Policy Directive 21 defines resilience as the ability to "prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions." Many communities have developed disaster response plans to prepare for disaster events. These disaster response plans will help save lives, protect property and limit economic damage. However, community disaster resilience also includes identifying local hazards, determining vulnerabilities, assessing the risks and improving performance of the built environment during a disaster event, and minimizing recovery times and economic losses.

Buildings and lifelines (transportation, water, energy and communications) play an important role in any community. Historically, buildings and lifelines have been designed and treated as separate entities without much consideration for one another. However, as seen in recent events (e.g., Superstorm Sandy, Hurricane Katrina, and the Joplin Tornado), the interdependencies of buildings and lifelines play a huge role in a community's ability to recover in both the short and long term.

To address this problem, NIST is leading a team to convene quarterly workshops in different regions of the country to inform development of a comprehensive, community-based disaster resilience framework. The goal of the workshops is to engage a diverse group of stakeholders and obtain their input for developing the framework. Version 1.0 of the Disaster Resilience Framework will provide regional, state, local and tribal authorities with a general methodology, and best practices to plan for and support community resilience. NIST will convene a Disaster Resilience Standards Panel (DRSP) in 2015 to expand on and refine Version 1.0 of the framework. The DRSP will also develop Model Resilience Guidelines to catalogue and disseminate standards, codes, best practices and case studies for resilience.

NIST held the first stakeholder workshop at the NIST Gaithersburg, MD Campus to kick-off framework development. NIST held the second workshop at the Stevens Institute of Technology in Hoboken, NJ on July 30, 2014. The third workshop, summarized in this document, was at the NCED Conference Center and Hotel in Norman, OK. Between the second and third workshops, the authors developed a 50% draft of the Disaster Resilience framework, incorporating stakeholder input from previous workshops. The draft was posted to the NIST website for stakeholder review prior to the workshop. The Norman, OK workshop served as the third of a series of workshops to obtain input from stakeholders on a working draft of the framework.

Figure 1 shows the agenda for the October 27-28 NIST Community Resilience Workshop held at the NCED Conference Center and Hotel in Norman, OK. This document summarizes content from the October 27-28 workshop and stakeholder input.

COMMUNITY RESILIENCE WORKSHOP
AT NCED • NORMAN, OK

NIST National Institute of Standards and Technology U.S. Department of Commerce

AGENDA

Monday, Oct 27th

8:30 – 9:15 **Welcome and Scope**–Salon JK

9:15 – 9:30 **Transition to Breakouts**

9:30 – 12:00 **Breakout Session 1**

1. Community Resilience and Metrics–Salon G
2. Buildings–Salon H
3. Infrastructure Systems–Salon I
4. Social Aspects of Resilience–Salon N
5. Disaster Resilience Standards Panel–Salon O

12:00 – 1:00 **Lunch**–Sooner Grill

1:00 – 2:00 **"Resilience Lessons from the Moore and Joplin, Oklahoma Tornadoes,"** an interview with Deirdre Ebrey, Director of Development and Marketing, City of Moore and Keith Stammer, Joplin/Jasper County Emergency Management Agency–Salon JK

2:00 – 2:15 **Transition to Breakouts**

2:15 – 5:00 **Breakout Session 2**

1. Community Resilience and Metrics–Salon G
2. Buildings–Salon H
3. Infrastructure Systems–Salon I
4. Social Aspects of Resilience–Salon N
5. Disaster Resilience Standards Panel–Salon O

6:00 – 7:00 **Networking Session**–North Courtyard

Figure 1. Agenda for October 27th NIST Community Resilience Workshop

COMMUNITY RESILIENCE WORKSHOP

AT NCED • NORMAN, OK

NIST National Institute of Standards and Technology U.S. Department of Commerce

AGENDA

continued

Tuesday, Oct 28th

8:30 – 9:30 **Plenary Session: Sector Dependencies–Salon JK**

9:30 – 9:45 **Transition to Breakouts**

9:45 – 11:30 **Breakout Session 3**

1. Community Resilience and Metrics–Salon G
2. Buildings–Salon H
3. Infrastructure Systems–Salon I
4. Social Aspects of Resilience–Salon N
5. Disaster Resilience Standards Panel–Salon O

11:30 – 12:30 **Lunch–Sooner Grill**

12:30 – 1:20 **Breakout Session 4**

1. Community Resilience and Metrics–Salon G
2. Buildings–Salon H
3. Infrastructure Systems–Salon I
4. Social Aspects of Resilience–Salon N
5. Disaster Resilience Standards Panel–Salon O

1:20 – 1:30 **Transition to Wrap Up Session**

1:30 – 2:40 **Wrap Up Session with all Participants–Salon JK**

2:40 – 4:30 **Optional Tour: National Weather Center**

The National Weather Center in Norman, Oklahoma houses University of Oklahoma, NOAA, and state organizations that work together in partnership. Tours of the facility include visits to the OU School of Meteorology, the NWC Rooftop Observatory, classroom and laboratory facilities, NOAA's Storm Prediction Center, the Norman National Weather Service Forecast Office, and the National Severe Storms Laboratory. The tour lasts between 1 to 1.5 hours.

Shuttles will be boarding at the Main Entrance beginning at 2:30 pm. Please use the shuttle as parking is limited at NWC. Shuttles will return to NCED at the conclusion of the tour.

For attendees who did not pay for catering, the Sooner Grill offers an all you can eat lunch for $14.00 plus tax. There is also an al a carte option, pricing dependent on item selection. Please note, coffee and snacks are only for the attendees who have paid for catering. Coffee and snacks are available in the Sooner Grill.

Figure 2. Agenda for October 28th NIST Community Resilience Workshop

2. Opening Session – October 27, 2014

The Opening Session for the Third Stakeholder Workshop of the NIST Community Resilience Program began at 8:30 a.m. Mr. Stephen Cauffman (NIST) delivered introductory remarks and welcomed participants. Mr. Cauffman introduced Dr. Howard Harary, NIST Director of the Engineering Laboratory, where this resilience program is housed.

Summary of Dr. Harary's Remarks

[The prepared text of Dr. Harary's comments is located on the NIST.gov website.]

Norman, Oklahoma is a fitting location for a disaster resilience workshop. Unfortunately, this part of the United States has experienced many disasters, particularly tornadoes, from which its communities have had to recover. Some of the most notable disasters in this region are the 2013 Moore EF5 tornado, the Joplin, Missouri tornado in 2011 that is the deadliest tornado on record, and the Oklahoma City bombing in 1995.

Norman is also home to the National Weather Service's Forecast Center and National Severe Storms Laboratory, of which there will be a tour of at the end of this workshop.

In recent years, the economic impact of natural disasters has been significant. Specifically, in 2011, there were 14 weather-related events that each resulted in over $1 billion dollars in damages. Moreover, in 2012, Superstorm Sandy resulted in over $65 billion in damage and economic losses. These events illustrate the need for us to work towards reducing the impact of natural and manmade hazards in terms of both cost and recovery time.

Although building resilient communities will protect lives and property, it will do much more than that. Resilient communities will rapidly return to their normal functionality following a disruptive event. The ability to become resilient will allow businesses to stay open, and keep workers employed. Moving forward, resilient communities will be able to remain competitive in business and industry across the country and globally.

We are focused on performance of the built environment for resilience. When considering resilience of the built environment, it is important to understand: 1) the interdependencies among buildings and infrastructure systems, 2) the importance of building and infrastructure to the social needs of the community, and 3) when functionality of these systems is needed in the recovery process for a given community.

NIST is leading several initiatives to advance resilience concepts so that communities can assess their infrastructure and become more resilient. These programs include the following major components:

1. Development of the Disaster Resilience Framework
2. Stakeholder Workshops to inform development of Disaster Resilience Framework
3. Formation of a Disaster Resilience Standards Panel
4. Development of Model Resilience Guidelines
5. Research to develop models to assess effects of disaster events on the built environment of communities
6. Selection of nine Disaster Resilience Fellows with expertise in areas essential to resilience.
7. Formation of a Disaster Resilience Center of Excellence Program.

This workshop, which falls under item #2, is the third in a series of workshops to inform development of the Disaster Resilience Framework (item #1). Working drafts of the framework are released on the NIST website so stakeholders can review, comment on, and contribute directly to the framework at any time.

In 2015, NIST will form the Disaster Resilience Standards Panel (item #3). This stakeholder organization will further develop the framework and develop Model Resilience Guidelines (item #4) to aid communities in implementing the framework.

NIST is also leading a research effort to develop science-based tools to assess resilience at the community

level, and economics-based tools that can be used to plan investments in making their infrastructure more resilient (Item #5).

NIST recently selected nine Disaster Resilience Fellows who are experts in their domains to contribute to development of the framework (Item #6). NIST will select a second group of Fellows next year to support the research program.

Lastly, NIST is currently reviewing many proposals submitted in response to a Federal Funding Opportunity for a Disaster Resilience Center of Excellent (CoE). The goal of the CoE (Item #7) will be to increased NIST's capability and capacity in areas key to disaster resilience, focusing on 3 research topics: 1) Computational Modeling Environment for Community Resilience; 2) Data Management Tools for Community Resilience Systems; and 3) Resilience Data Architecture Validation Studies.

Stakeholder input is critical to the success of these initiates. Thank you for your participation. We expect to receive great input from all participants. We encourage you to reach out to your colleagues in different parts of the country and ask that you inform us of stakeholders who should be involved in these workshops.

Mr. Cauffman then provided background to participants on the NIST Community Resilience Program.

Summary of Mr. Cauffman's Remarks

[The slides referenced in the following text are located on the NIST.gov website.]

The approach we currently take to responding after natural and man-made disaster events is inefficient. As seen in past events, such as Superstorm Sandy, billions of dollars in losses occur every year due to natural and man-made disaster events. Moving forward, we need to consider the changing nature of hazards, interconnectedness of buildings and infrastructure, and the impact of performance of the built environment on social institutions.

Our country has exposure to a wide variety of disaster events due to its size and varying geography. Every year, 45 to 81 Presidential Disaster Declarations are made, illustrating the need to make our communities more resilient.

For the purposes of this program, we are using the definition of resilience that is presented in Presidential Policy Directive-21: *Resilience is the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions*. When we refer to community resilience, the emphasis is not just on mitigating risk, but planning and implementing strategies so a community recovers to near normal functionality in a reasonable timeframe.

The social needs of a community drive the need for infrastructure performance (i.e., the built environment). The community's social needs include those of individual citizens, government, businesses, and industry. These social systems need buildings, energy, transportation, communications, and water to function properly.

A number of forces can cause disruptions in a community, including natural hazards and manmade hazards. Degradation is not specifically addressed in the framework; however, the degradation of our country's aging infrastructure does impact the performance of the built environment. Communities, particularly coastal communities, also need to consider climate change. To offset these potential sources of disruption, we can reconsider our performance goals for the built environment. By establishing more advanced performance goals, we must take actions related to mitigation, and plan for improved response and recovery plans.

There are several key attributes of resilience. Social systems drive a community's needs. Buildings and other infrastructure must be functional to support these social systems. Resilience must also consider the complexities of increasingly interdependent building and infrastructure systems, as well as the relationship of individuals and organizations with the built environment.

Resilience should not consider just a design level event. For the framework, we are considering a routine event (a smaller magnitude event that occurs relatively frequently), an expected event (the design level event), and an extreme event (an event that is greater than a design level event).

Communities should set their own performance goals for their buildings and infrastructure systems. The methodology provides an approach to resilience that begins with performance goals that establish timeframes, days, weeks or months/years, in which buildings and infrastructure need to be functional to meet the social needs of the community.

NIST is convening highly diverse stakeholders to obtain input to be included in Version 1.0 of the Disaster Resilience Framework. In 2015, we will establish a Disaster Resilience Standards Panel to further develop the Disaster Resilience Framework (Version 2.0), and develop Model Resilience Guidelines that will help communities implement the framework by using model codes, standards, and best practices.

Stakeholder input is critical to the success of this effort. As seen on this slide [Slide 10], there is a wide cross-section of stakeholders that should be involved in this process. This list is not exhaustive. The Federal Government also has a number of entities involved in resilience efforts, including the Executive Office of the President, the Departments of Homeland Security, Commerce, Defense, Energy, Transportation, and the National Science Foundation.

The Disaster Resilience Framework focuses on the role of the built environment (i.e., buildings and infrastructure). The framework will: 1) Provide guidance to communities on the types of performance goals that can be used and ways to express them; 2) Identify existing codes, standards, and best practices that address resilience; 3) Identify gaps that must be addressed to achieve resilience; and 4) Capture regional differences in perspective on resilience.

The DRSP will be a self-governing organization representing the broad spectrum of stakeholders. It will be open to anyone interested in participating and focus on developing: 1) Disaster Resilience Framework, Version 2.0 and 2) Model Resilience Guidelines.

The framework is being informed by these stakeholder workshops. The first workshop, held in April (2014) at NIST, kicked off the effort and allowed us to gather information. The second workshop, held in Hoboken, NJ, was used to obtain feedback on the 25% draft. Prior to this workshop, we posted the 50% draft. We welcome feedback on these drafts at any time. We will prepare the 75% draft for the next workshop in San Diego, CA, and the draft for public comment will be released in April 2015.

We thank you for being here today and encourage you to continue participating in development of the Disaster Resilience Framework by attending these workshops, reviewing drafts of the framework as they are posted to our website, and making others aware of the framework, DRSP, and workshops.

NIST is investing a lot of time and effort to help communities become more resilient. We are currently in the Stakeholder Engagement Phase of the program, which includes using these workshops to inform development of the Disaster Resilience Framework and finding stakeholders interested in participating in the DRSP, which will develop Version 2.0 of the framework and Model Resilience Guidelines. Our research initiative to develop models and tools to support decision making and investments in resilience is also underway. As previously mentioned, we recently selected nine Disaster Resilience Fellows who will contribute their expertise to areas important to making communities more resilient. We are also reviewing proposals for a Center of Excellence, which will further develop models for decision makers and look at pilot studies for communities.

If you wish to contact me, you can do so via email (stephen.cauffman@nist.gov or resilience@nist.gov) or phone (301-975-6051). Our website will also be updated regularly and is the source of a lot of useful information for this program (http://www.nist.gov/el/building_materials/resilience/).

Mr. Cauffman was followed by Dr. Therese McAllister who provided information regarding the plan for the day.

Summary of Dr. McAllister's Remarks

[The slides referenced in the following text are located on the NIST.gov website.]

The 50% draft of the framework was posted to our website about one week before this workshop. In this draft, all chapters except Chapters 1 (Introduction), 10 (Existing Tools and Metrics), and 11 (Recommendations) have been developed. We will include the final three chapters in the 75% draft. Chapter 2 discusses the social systems needed within a community. Chapter 3 lays out a methodology to set performance goals for the infrastructure that supports the social systems in Chapter 2, and evaluates the existing built environment of a community. Chapter 4 focuses on the interdependencies of the different infrastructure systems, which are a very important part of the framework as our infrastructure systems become more reliant on one another. Chapters 5-9 focus on the individual sectors (buildings, transportation, energy, water, communications and information, water and wastewater). Each chapter has a similar format, discussing: 1) systems; 2) performance goals; 3) regulatory environment, codes and standards; and 4) tools and strategies to assess resilience of the systems. An outline of a companion document for *Economic Considerations for Community Resilience* has also been developed. A draft of this document will be available with the 75% draft.

Today, we will have five breakout sessions that will focus on 1) Community Resilience and Metrics (Chapters 3 and 10); 2) Buildings (Chapter 5); 3) Infrastructure Systems, including Transportation (Chapter 6), Power (Chapter 7), Communication (Chapter 8), and Water/Wastewater (Chapter 9); 4) Social Aspects of Resilience (Chapter 2); and 5) the DRSP Charter. The breakout sessions will discuss and develop example community performance goals for recovery, identify key interdependencies, and for the framework writing team to learn about concerns and issues for community resilience.

In considering resilience, it is important to maintain acceptable levels of functionality during and after a disaster event. A resilient community will focus on recovering full functionality within a reasonable timeframe. The example performance goals in the framework [see slide 12] can be used to consider a given type of hazard, hazard level, affected area, and disruption level. Given these variables, performance goals, which are specified in terms of recovery time (days, week, months/years), can be set by a community using different levels of desired restoration times, such as 30%, 60%, and 90% recovery.

We include three hazard level definitions:

1. ***Routine*** **–** A hazard below the design level that occurs relatively frequently
2. ***Expected*** **–** Design level event
3. ***Extreme*** **–** Maximum considered event based on historic record and/or changes anticipated due to climate change

The affected area represents the area that is directly impacted by the event, and will likely depend on the type of hazard being considered. The three levels of affected areas are:

1. ***Localized*** **–** Damage and loss of functionality within an isolated area of the community.
2. ***Community*** **–** Significant damage and loss of functionality within a community that warrants the need for assistance from neighboring communities
3. ***Regional*** **–** Significant damage beyond community boundaries

We also use three levels of disruption:

1. ***Minor*** **–** Response and recovery handled within the community with little to no disruption.
2. ***Moderate*** **–** Community Emergency Operations Center (EOC) activates so response and recovery assistance is orchestrated locally.
3. ***Severe*** **–** Response and recovery efforts are beyond the capability and authority of local communities and outside coordination is needed to meet the needs of multiple jurisdictions.

In setting performance goals, communities will need to think about the acceptable level of damage for their buildings and infrastructure systems. There are four building categories identified in this methodology. Category A refers to buildings that must be safe and operational (e.g., hospitals). Category

B refers to buildings that can tolerate some damage as long as the building is usable. Category C refers to buildings that can lose functionality, but still protect life safety. Category D refers to structures that experience partial or full collapse. For infrastructure systems, three levels of performance are considered: 1) resume 100% service within days; 2) resume 90% of services within weeks and 100% within months; and 3) resume 90% within months and 100% within years.

The interdependencies of social systems, buildings and infrastructure systems are a key consideration in setting performance goals and understanding the restoration needs following a disaster event. In San Francisco, CA, a Lifelines Council was formed and conducted a study using a scenario event – a 7.9 magnitude earthquake on the San Andreas Fault. The plot in the slide [slide 20] illustrates the nature of interdependencies for that particular scenario event in that community.

3. Afternoon General Session – October 27, 2014

The afternoon plenary session was conducted using an interview format. Mr. Stephen Cauffman of NIST moderated the discussion with Mr. Keith Stammer of the Joplin/Jasper (Missouri) County Emergency Management Agency and Ms. Deidre Ebrey, Director of Development and Marketing for the City of Moore (Oklahoma). Mr. Cauffman asked the guests questions regarding their experiences during and after two of the most notable recent disaster events in the region: the May 2011 Joplin, MO tornado, and the May 2013 Moore, OK tornado.

Summary of Discussion

The text provided herein does not provide exact quotes.

1. **Mr. Cauffman:** Can you each give everyone some background on your communities and their geographic location?

   Ms. Ebrey: *Moore is a typical suburban community that is a bedroom community for Oklahoma City. It is landlocked on three sides by Oklahoma City and by Norman on the fourth.*

   Mr. Stammer: *Joplin is located in the southwestern corner of Missouri. It was originally a mining town and its citizens are still very much blue collar. It is the largest community in its area. Interestingly, it has more rental units than owned homes.*

2. **Mr. Cauffman:** Can you each describe your role in the aftermath of the tornado events you experienced?

   Ms. Ebrey: *My role was unofficial. To give some background, I was also here during the 1999 Moore, OK tornado, and served as a consultant to the City of Moore. In the 2013 tornado, I was in charge of business relocation and was a contact for resources since we had a lot of outside help.*

   Mr. Stammer: *My role was with the emergency management team.*

3. **Mr. Cauffman:** Can you each describe the impact of the storms? Also, can you discuss what went well and what went wrong?

   Mr. Stammer: *As a result of the 2011 tornado, about 17,000 people were impacted, including approximately 9,200 who were displaced. In terms of what went well, we knew all the exercises ahead of time and were well-prepared for the first 72 hours after the event. In terms of what went wrong, the scale of the disaster was beyond anything we would have anticipated. We were prepared for disasters that had taken place in the past, but this was something that (in terms of scale) had not been seen before.*

   Ms. Ebrey: *In Moore, we are about 18 months out from the event, so we are still in the recovery phase. Moore had experienced two tornadoes prior to May 2013, so we felt we knew a lot about how to handle the recovery phase. In fact, after the Joplin, MO tornado occurred, we were giving Joplin information on how to deal with the situation. Then when Moore was struck again in 2013, we went from the "all-knowing" community to the community that was in need of help.*

   One of the problems for Moore was that a high percentage of Moore's residents commute to work. Since the tornado occurred during the daytime, people were trying to get back into the community to get to school, home, and could not because of all of the debris.

   The residents were well-prepared for a tornado. A large percentage of residents have their own storm shelters, and that has increased even more after the most recent tornado. Many citizens also had enough insurance to deal with the disaster financially.

4. **Mr. Cauffman:** How much time did you have to prepare for the tornado?

   Ms. Ebrey: *We had about 20-30 minutes to prepare for the storm, but we were warned about one day before that there would be severe storms in the area and tornadoes were possible.*

Mr. Stammer: *We had about 60 seconds – more if you were on the east side of town, but there was very little warning before the tornado struck.*

5. **Mr. Cauffman:** How do you prioritize recovery?

   Mr. Stammer: *Deciding what to do is probably one of the more challenging steps in the recovery process because people in the community all have different ideas of what they want to do. We established the Citizens Advisory Recovery Team (CART) to allow the citizens to have a voice in deciding how to rebuild and do what is best for the community.*

   There needs to be an extreme amount of communication to be able to move forward, particularly in the immediate aftermath of a large tornado.

   Ms. Ebrey: *In Moore, people wanted to rebuild the next day. Nobody wanted to wait around for government grants to rebuild. The design wind speed for the area was increased from 90 to 135 mph. The cost to rebuild to a higher standard was only about $1 per square foot and there was not really any push-back from the local residents. However, in other communities, there may be some push back on that additional expense.*

6. **Mr. Cauffman:** What tools and metrics do you feel are needed to prepare for and respond to disasters like the ones you have experienced?

   Mr. Stammer: *Citizens were desensitized from tornado sirens, which were tested every week prior to the tornado. Now, they are tested every month. Changes in construction are also being made: homes are starting to use hurricane clips and bricks filled with concrete.*

   Ms. Ebrey: *We need to incentivize citizens to put storm shelters in homes. Many home builders are now including safe rooms in homes and using them as a selling point.*

7. **Mr. Cauffman:** When a tornado comes through, do different codes-built homes perform differently?

   Both: *No. What really makes a difference is how much people are willing to invest in their homes.*

8. **Mr. Cauffman:** How did being on the edge of a large city help Moore? And how did not having a similar large city nearby Joplin impact the recovery process?

   Ms. Ebrey: *It was advantageous for Moore because the resources were only minutes away and since the type of storm has local damage, our neighbors were able and willing to help almost immediately. We did have help from other communities in the rebuilding process*

   Mr. Stammer: *Joplin was in a different situation because it is really the largest community in the area. Although most people only heard about Joplin, our neighboring town, The extent of damage to Duquesne, being a much smaller community, was disproportionately greater than that of Joplin. So, we were trying to help them while also recovering ourselves, which was very challenging. We also asked for help from other communities in the rebuilding process.*

4. Breakout Session #1: Framework Chapters 3 and 10 – Community Disaster Resilience for the Built Environment and Metrics

The breakout session began by the facilitator, Mr. Walter Zalis, explaining that the session would be conducted using a story boarding approach. Mr. Zalis led introductions around the room. He asked everyone to give their name, affiliation, and their area of interest in disaster resilience. He also explained why we were there – *To provide input that will help NIST develop a Disaster Resilience Framework that will help guide communities in disaster planning*. Then, he reviewed definitions of resilience and disaster resilience as listed below:

- ***Resilience:*** The ability to "prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions."
- ***Disaster resilience:*** Includes determining vulnerabilities, improving the performance of the built environment during disaster events, and reducing recovery times and costs.
- ***Goal:*** To develop a comprehensive, community-based resilience framework and provide guidelines for consistently safe buildings and infrastructure – products that can inform development of private-sector standards and codes.

The author of Chapter 3, Mr. Chris Poland, gave a quick overview of the relationship between social needs and the built environment. He explained that chapters are being developed and are inter-related. He mentioned that the Resilient City Initiative in San Francisco was initiated by a group of concerned citizens (i.e., a bottom up/grassroots approach), and the Oregon Resilience Plan started from the state legislature (i.e., a top down/government led approach). Mr. Poland went through Chapter 3 using Figure 3.1 from the 50% draft framework, *Flow Chart for Developing Resilience Plan*. The facilitator then led the participants' discussion.

Question 1: "Who should be involved in developing a resilience plan for a community and what are their roles and perspectives? Who initiates in the community?"

The participants agreed that public/private partnership is a good approach. The parties involved in development of a resilience plan for a community should include representatives from utility/infrastructure system sectors, local planners, community leaders (e.g., religious, educational), political leaders, the local emergency planning committee, someone speaking for business continuity, disaster-related volunteers [such as Voluntary Organizations Active in Disaster (VOAD)], Non-Governmental Organizations (NGOs)/community based organizations, social scientists, engineers (or experts knowledgeable of hazards and infrastructure performance), community policy makers, community decision makers, representatives from finance and insurance industry, public representative(s), especially those representing vulnerable population in an aging community, and federal agencies, as appropriate.

Some felt we should get managers for utility systems involved because of their overall perspective of their system and their ability to analyze and understand their system performance. If local emergency planning committee members are involved, we need to keep in mind that their perspectives are generally focused on mitigation and emergency operations as opposed to recovery and reconstruction. However, some local emergency planning committees might have expanded their scope to address all hazards, and gone beyond dealing with emergencies to addressing recovery. Some participants felt it is important to engage NGOs or community-based organizations because some of them (e.g., Red Cross) focus on providing emergency housing, while others focus on recovery. Oklahoma City relied on NGOs for meeting their short- and long-term social needs. As private sectors own the majority of infrastructure in America, their involvement will be critical. In general, they care about restoration as "no services" translates to "no revenue" for them. Although they are also interested in mitigation and quick restoration, they are sometimes resistant to certain recommendations due to potential high costs. The participants agreed that we need to get political leaders and decision-makers involved as they will push the process forward. We need to engage representatives from the financial sector to understand long range funding for the

community as well as funding mechanisms to pay for the cost for building community resilience. Since FEMA requires local communities to develop a natural hazards mitigation plan for their community, it is ideal to have the same group of people involved in working on a resilience plan. However, this may not be applicable to communities that hire consultants to write the plan with minimum engagement of the community. Since resilience is about building capacity and being adaptive to changing environment, we need to get everyone involved, and we need to make a transition from "make policy for the people" to "make policy with the people." A summary of the community resilience planning roles discussed and identified by the breakout group appears in Table 1.

Table 1. Community Resilience Planning Roles

<table>
<tr><th colspan="4">Community Resilience Planning Roles</th></tr>
<tr><td>Involved: All</td><td>City/County Planning Departments</td><td>Emergency Managers</td><td rowspan="2">NGOs
• (Role) Recovery
• Needs (Perspective)</td></tr>
<tr><td>Business Organizations</td><td>Decisions Maker
• Government
• Planning
• EOC</td><td rowspan="2">Private Sector
• Role (Infrastructure)
• Restoration $$$</td></tr>
<tr><td>• Stake Holders
• Local Authorities
• Local planning agencies
• Community leaders (depends on type of cluster)</td><td>Business Continuity (Perspective)</td><td></td></tr>
<tr><td>Volunteer Organizations (e.g. churches, civic clubs)</td><td>Who: Citizen
Role: Represent disadvantaged groups and associations
Perspective: The otherwise unprotected</td><td colspan="2">Leaders/Initiators
(Must have authority)</td></tr>
<tr><td>Local Emergency Planning Committee -Enter planning business leaders (Pay for it)
• School/community leaders</td><td>Finance
Funding (Role)
How to pay for it?
What's it going to cost us? (Perspective)</td><td>Leaders: Decision makers outside of Gov. AT LOCAL Level Initiate/Implement(Gov.)</td><td>Leader: Different for each community
• Has connection to local Gov.</td></tr>
<tr><td>Social Scientist, civil engineers, policy makers, public/residence community planners</td><td rowspan="3">• Environmental groups
• Ecosystem services (Importance of marshlands)</td><td colspan="2">Considerations</td></tr>
<tr><td>• Representatives of the different Systems
• Perspective: Overall Systems
• Role: Ensure subsystem is covered
• Lead: someone who the community trusts</td><td>Communities should look to leaders – they may be people affected by events</td><td>Need a regional focus</td></tr>
<tr><td>People intimately familiar with the type of disasters that might occur</td><td>Community resilience is an emerging property/characteristic</td><td>Bottom-up/ top-down: can come either way, but both sides need to be involved to continue</td></tr>
<tr><td>People who are good at team building and who recognize interdependences</td><td>Building and Planning departments</td><td>Decisions with, not for, the people:
• Whole-of-government
• Whole-of-community</td><td>There must be a carrot to get people involved (Incentives)</td></tr>
<tr><td>Utilities Managers – Individual system performance</td><td>Civic/Faith based Organizations</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Engineers – Specifics of a system</td><td>Community political leaders</td></tr>
</table>

Question 2: "Who should lead the community resilience planning effort"?

The participants felt that someone independent from local government should lead the planning effort. Although we need local government to own and implement a resilience plan, we do not want the same organization to develop the plan as they might easily be persuaded by local resources and what they can or cannot do.

Decision makers and policy makers should provide leadership/guidance to promote resilience. A community-based organization needs to organize and lead the efforts.

Who should lead depends on who is interested and motivated, and may vary, depending on a community's situation. We have to recognize every community is different, and we need to look at each community on a case-by-case basis. San Francisco used a bottom up/community-led approach while Oregon used a top down/government-led approach.

The participants felt that someone outside government needs to lead planning. However, resilience planning efforts need endorsement from local government to ensure all relevant parties come to the table.

Building and Planning Departments are important and should be engaged. The Building Department will do the initial inspection before the people can move back into their homes. The Planning Department understands zoning and has the right people and skill sets.

Question 3: "Should building-back-better principles be used to achieve performance goals? If so, what principles need to be in place and why?

- If you adopt building-back-better principles, you need to be in front of the event
- Should we list some principles?
  - Learn from the past and avoid unnecessary damage to future recovery
  - Agencies must be accountable to the people they seek to assist
  - People in the affected area should be the decision-makers rather than external people or groups
  - Recovery of the local economy and livelihoods must be a priority
  - Reconstruction and recovery efforts must recognize diversity
  - Communities should be allowed to use their own resources wherever possible
  - Reconstruction must take account of future hazards and risks.

Participants stated that there have been two schools of thinking. On one side, owners of existing buildings/systems affected by a disaster believe it is their right to build back as before. They feel it is always good enough. The problem is that these buildings/systems are vulnerable for the next event. The great opportunity of building something better ahead of the next event is wasted when the owners spend money and resources on rebuilding them. On the other hand, if damage surpasses a certain threshold, buildings/systems should be required to build back better, meet modern standards, and have resilience built into the systems. This will certainly improve community resilience. The question is, if the buildings/systems are required to build back better, who pays for the difference? And, who is required to build back better?

The group felt the building back better principles should be used. The rationale is that, to be better prepared for the next event, we will have to build back better.

Currently, insurance companies are not required to pay for building back better. The question, again, is who should pay for it? Some felt that the customers who use these systems should pay. A dialogue is needed to make that happen, but it may not be enough. We need a visionary leader who can reach out to the community to make it work. Building back better does not mean building back more expensively. We can use the same resources and build better. Some engineering system analyses can help optimize the use of the same resources and build better without much additional cost. Building codes and zoning are

evolving already. We need to adopt current codes and standards to build better over time. After Superstorm Sandy, some learned from their recovery efforts that it was challenging to find qualified contractors, get permits, and have inspections done in time. To build better, we need active support from the government to augment its capacity as needed to move the project review/permit/inspection process more quickly.

The group agreed that building back better is not enough. We need better planning. In addition to improving building construction, we can reduce our risk by changing the exposure.

Assuming that adopting all codes will make the community resilient is not true. Part of the problem is that when each sector developed their codes and standards independently, we didn't consider dependencies between different sectors.

The goal is to attract people (including business) back to the affected area. We need to use resilience as an effective marketing tool (just like talking about features in the real estate arena). Also, another benefit of building resilience is to increase long-term cost savings (e.g., get discount on insurance), and if there is another similar event, a community as a whole will suffer much less damage, and be able to recover more quickly. The group also felt that we need to educate the public so that they will make better decisions.

Some participants felt that using a carrot and stick strategy is appropriate so we can implement continuous requirements to improve infrastructure (to address "grandfather" situations).

Others felt that we need to figure out a way to market and communicate the value of resilience. There needs to be a marketing campaign and communication tool (e.g., rating system) for resilience value. It may be effective to start a social voluntary movement, motivating and influencing some political leaders. When there is enough support/social demand and an opportunity is present, political leaders can pass a law to adopt a mandatory policy similar to other policies for cigarettes and seat belts.

Although we can communicate the benefits to the public, one challenge is measuring the benefits/value of resilience (with appropriate tools and metrics) so that a community can account for them properly and justify their pre-event investment. Table 2 presents a summary of the participants' discussion.

Table 2. Building-Back Better Principles to Achieve Resilience

<table>
<tr><th colspan="5">Building-back better Principles</th></tr>
<tr><td colspan="3">• Consider insurance comps.
• Should be used specifically for infrastructure systems
• Those that need to be immediately serviceable</td><td colspan="2">Building codes & zoning are evolutionary- should have adopted more recent standards before an event</td></tr>
<tr><td>Yes, but who pays?
• Should gov. be able to force private to spend?</td><td>Need Leader</td><td></td><td>Augment inspection staff to speed/streamline approval</td><td>Improve/ speed process</td></tr>
<tr><td>Being anti-fragile
• -Learning from near hits</td><td>Principle</td><td></td><td colspan="2">Planning-(Back)-better (Not just building-back-better)</td></tr>
<tr><td colspan="3">Building-back-better: yes
• Continuous x interactive improvement
• New future standards
• Part of the planning process</td><td colspan="2">Attract people to return or move to area</td></tr>
<tr><td colspan="3">Risk communication</td><td colspan="2">Long term cost savings
• Higher return on investment
• Look at not only cost but damage avoided</td></tr>
<tr><td colspan="3"></td><td colspan="2">Market and communicable value of resilience</td></tr>
</table>

Question 4: "How should communities approach the implementation of their plan? We know the stakeholders – what steps will ensure success of the plan?

A summary of the input from the participants is shown in Table 3. Similar to sustainability coordination, the participants felt we need to establish an office of resilience or a resilience coordinator, not EOC, to handle resilience issues. An emergency plan is often used as a dumping ground to house challenging

issues in a community. Resilience planning requires a multi-disciplinary, multi-faceted approach, and we need to have the right kind of people with appropriate knowledge and expertise to do that.

Table 3. Implementing Community Resilience Planning

<table>
<tr><th colspan="8">Community Resilience Planning Implementation</th></tr>
<tr><td colspan="2">Adopt and Enforce a building code</td><td colspan="2">Plan→ action →assignment → Time frame</td><td colspan="2">Insurance issues with high risk areas</td><td colspan="2">Non Construction
↓</td><td>Retrofit Programs
↓</td></tr>
<tr><td>Resilience: Make it part of the culture</td><td>Culture of risk mitigation</td><td>Issues with funding, schedule of funding</td><td>Ability to get in front of disasters</td><td>What do we prepare for?</td><td>Continuity of business
• Individual family preparedness</td><td>Stakeholder forum
• Community Process</td><td>Inspection on some buildings</td></tr>
<tr><td colspan="5">Where?</td><td>Land-use policy</td><td>Community process to define/develop:
• Vision/ goals
• Outcomes</td><td></td></tr>
<tr><td colspan="2">Planning Department</td><td>Not EOC?</td><td colspan="2">Office of Sustainability
Make flood insurance not federal subsidy
Not EOC</td><td>How: Evolving planning process for continuously improving resilience performance
Perspective:
Current state of resilience standards
How:
Annual/regular inspection (Like vehicles)</td><td>Public Knowledge of exposure</td><td></td></tr>
<tr><td colspan="2">Office of Resilience/ Coordinator (like sustainability coordinators)</td><td colspan="3"></td><td>Targeted land buy-back program to improve resilience</td><td>Rebuilding for resilience</td><td></td></tr>
</table>

Question 5: "What non-construction programs could be instituted? Who should be involved in these programs and what are their roles and perspectives? What would the role of a resilience implementation office in a community and where should it be located? Government function? City builders? Mayor's office?"

The participants felt that some hazards (e.g., tsunami and flooding) can be avoided. Land use policy can reduce risk exposure. Additionally, we need to have a policy in place to disclose hazards prior to a real estate transaction. However, land use policy in some areas might be politically charged. Following the 1989 Loma Prieta Earthquake, California passed the Seismic Hazard Mapping Act of 1990. This Act directs the Department of Conservation to identify and map areas prone to liquefaction, landslides, etc., and requires mitigation measures prior to permitting development for human occupancy as needed. Land use policy can be especially effective for two scenarios: 1) undeveloped land; and 2) reconstruction after an event.

The group felt it would be appropriate to ask the federal government to stop subsidizing flood insurance such that insurance premiums truly reflect the hazards and costs. The participants felt that hazards need to be clearly communicated to the public. If someone chooses to build in a high hazard area, they need to pay high insurance premiums instead of being subsidized by the government. Currently, public bailout and government subsidy may make it harder for the public to change their behavior.

Participants felt there would be value in getting all businesses in a community to do business continuity planning and preparation. A lot of businesses do not plan and prepare for business disruption. If every

business in a community does continuity planning and preparation, this will significantly improve community resilience. Similarly, homeowners need to prepare so they reduce demand on city systems and services if they can do more for themselves at home. We need to educate the public about why they need to prepare at home, just like why business continuity plans are needed.

Emergency response after an event is critical for any community. Emergency managers tend to focus on the first three to seven days after an event. Community resilience is more than just emergency response. It requires our attention to look at needs of the recovery and reconstruction phases. We need to look at long-term (e.g., 50-year) planning for a better future. If we don't have a plan in place, communities will not be ready, and will miss opportunities to rebuild better when funds are available to invest.

For many of the cities selected as one of the hundred resilient cities by the Rockefeller Foundation, they have Chief Resilience Offices that head an umbrella organization to bring all the pieces together. Some participants felt that planning departments may be good candidates for implementing a resilience plan because they have the right people, skill sets, and understand zoning, planning, and infrastructure.

Having a resilience office makes sense for a community with a lot of resources. But for many small rural communities with limited resources, participants pointed out that it will be a challenge to establish a resilience office. The participants suggested that it may be more realistic to have a regionally shared solution by grouping mid-sized and small-sized communities to pool their resources.

Question 6: "Do mandatory retrofit programs make sense for your community? If so, what programs need to be in place and why?"

First, participants discussed the need to adopt/enforce building codes. They also stated that it is cost effective for small communities to build resilience over time. Institutionalizing resilience to make it a part of community culture and a paradigm shift would be key to success of a framework/program. It is important to convince people that resilience is not something short term – it is a long-term goal.

The group felt there is a parallel between sustainability and resilience. We can learn a lot from sustainability on how to move forward in promoting resilience. Sustainability professionals make a good economic case. We need to figure out a way to calculate the value of resilience so we can justify investments, as is done in sustainability practice.

To address the challenge associated with rural communities, we may want to consider pairing communities with lots of resilience planning experience with communities beginning the planning process so they can develop their resilience plan more efficiently.

Participants felt that getting businesses to the table is imperative. We need to get big and small businesses to see lifeline services beyond their buildings. Many big businesses have a very good handle on their risk management. However, they tend to only focus on their own facilities. Once they understand their business risk, they will be more likely to support community resilience and even contribute to resilience planning and implementation.

The afternoon session discussed tools and metrics that could be used to measure resilience of a community. The group discussed if it would be better to develop and use an all-encompassing single tool/metric for an entire community or whether a suite of metrics would be more appropriate. The general consensus was that a suite of metrics was preferred.

The group also discussed what could be used as a metric. Some of suggestions provided for metrics by the participants included:

- Tracking building and demolition permits
- Percentage of households/businesses without power
- Tracking property and sales taxes
- Number of households/businesses displaced

- Unemployment percentage
- Network redundancy

A participant also noted that in Christchurch, New Zealand, the Gross Domestic Product (GDP) was measured monthly, which may be a good idea, particularly in communities in the recovery process after a disaster event. Others felt that monetary values were important metrics for resilience, including return on investment, benefit-cost analysis, life cycle costs, and losses avoided. The group also discussed the potential to measure a community's resilience after a disaster event by recording the number of businesses that re-establish vs. the number that are replaced with something else.

One of the challenges the group discussed, associated with metrics relating to economic losses, was that there are many different views regarding what are direct losses and what are indirect losses. This is an issue that needs to be clear in establishing a tool/metric, including the use of indirect losses. Furthermore, the economic impact for a community is not always restricted to just the community impacted by a disaster event. There are some communities that have national importance and disruption to those communities can have regional or even national economic impacts. For example, significant disruption to a community with a major port will have economic impact beyond that particular community.

The breakout group also discussed how to account for some counter-intuitive concepts. For example, participants felt that "higher-end" communities sometimes demand/expect more assistance than communities with fewer resources.

Participants discussed the idea of "brittle vs. ductile" communities. A brittle community is one that easily breaks down during or after a disaster event and has difficulty recovering. A ductile community is one that can cope with disaster events and come back even stronger than before in a relatively short timeframe. One key factor that may allow a community to be more ductile, and thus more resilient, is having economic diversity. A brittle community may have few employers that employ the majority of the population.

The group also discussed the need to have recovery plans in place pre-event rather than scrambling after an event to put something together. At the end of the discussion, the participants were given "dots" so that they could vote on what they felt were the most important considerations for resilience metrics. As seen in Table 4, the participants felt that a post disaster economic recovery model was needed. The group also felt strongly about ensuring recovery plans were in place before a disaster occurred and cost-benefit analysis could be performed to justify and sell the investment in becoming more resilient.

Table 4. Tools and Metrics for Evaluating Disaster Resilience

Tools/Metrics for Evaluating Disaster Resilience							
Tools							
Community Level Examples			**Sector Level Examples**			**Sociological Examples**	
SPUR Resilient City	Hazus-MH (REMA GIS Tool) Earthquake, flood, hurricanes		US Resilience Council Rating System (Building Sector)			Canterbury Wellbeing Index (N2-post quake)	
Oregon (Policy options)	UN Disaster Resilience Scorecard		RAMCAP (DHS-water& wastewater)			Social Vulnerability Index (SoVI) (Predicted bounce-back)	
CARI CRS			Optimal recovery sequencing for enhanced resilience			Baseline Resilience Indicators for Communities	
Metrics							
Measure Recovery		Post Event	←Recovery Time (Measure) → ●●	**Prioritize Resilience Alternatives**			Pre and During Event Requires a Culture Change (Terrorism example)
Capacity of what's left vs. alternative ●●	Post economic recover model ●●●●●●●●●●●●	Coupled resilience metrics e.g. social and infrastructure ●●	Social/economic impact on neighboring communities and nation ●●	Distinguish -Leading -Concurrent -Post-event indicator	Pre-stress, Pre-capabilities ●	Level of Redundancy ●●●●●●	What are inter-dependences ●●●
Coded standards community resources: Recovery at different levels ●		More detailed metric – multi-dimensional metric	Avoiding Silo	Service availability ●●●	Identify "essential variables" to be measured	Scenario-based planning tools- "what if" measurement • An ability for user to change parameter and examine outcomes ●●●●	
How fast can we clear debris? How much is removed? ●●		Sector level can be quantitative level of damage - infrastructure, subsystems (buildings, roads, bridges, power) ●●		Recovery Plans in place (governance) ●●●●●●●	Return on investment/ value of mitigation	Quantitative measure of resilience	
Ratio of fatalities/damage to affected/ at risk ●				Building-back-better: Need to be in front of the event	Cost-Benefit analysis	Compare socio-economic impact pre-event	
						Debris-Before: Amount After: Rate of cleanup	

On the second day of the workshop (October 28, 2014), the breakout group reconvened. The facilitator then asked the following topic questions to continue with the same storyboarding process.

- *"Communities are different – what do they consider to be their community/economic plan? What kind of long range plans do communities have? Where should resilience plans go?*
- *How can a resilience plan be integrated into the community economic development plan? What steps need to be taken?"*

The participants felt that a resilience plan needs to be a standalone plan. However, the resilience plan should be integrated into most community plans – natural hazard mitigation plan, emergency operations plan, disaster recovery plan, economic plans, comprehensive plans, etc. An emergency operations plan is also closely related to a resilience plan for phase 1 of response activities. There is also some overlap between the 50% draft resilience framework phases 2 and 3 and a disaster recovery plan. Economic development, comprehensive, and capital improvement plans should be linked with resilience plans so that these plans will lead to building the infrastructure capacity we need to meet our social needs in the response and recovery phases.

Some participants felt that resilience plans have to be developed at the regional rather than the community level. Participants also felt there is a need to reach across state and county lines. Some felt that what we are doing is critical for the long-term; however, it may not be used as it may be challenging to get communities to buy-into its use politically. One of the strongest long-term tools is codes and standards. Codes and standards are moving toward nationally based codes and standards. One key outcome of this initiative is to make recommendations on how to change codes and standards. In the long-term, we will start to build better and become more resilient as a result.

The group re-iterated the need to ensure inclusion of both urban and rural areas with an adaptable framework. Rural communities generally have limitations due to a lack of resources, and may not have community plans. Some felt that a rural regional economic plan might be a viable conduit. Since some multi-county organizations are looking at regional economic development plans, they would probably be open to looking at resilience plans as local communities may not have resources to develop their own resilience plans.

To finish off the two days of breakout sessions, the group worked to identify the key concepts discussed that would be presented to the rest of workshop participants. The agreed upon summary is discussed in Section 10.

Table 5. Resilience Planning Integration

<table>
<tr><th colspan="6">Resilience Planning Integration</th></tr>
<tr><th colspan="3">Strategies</th><th>Stakeholder Access</th><th colspan="2">San Francisco Model</th><th>Parking Lot</th></tr>
<tr><td colspan="2">Develop codes and standards that support the resilience plan, then laws to enforce.</td><td>Evolve/adapt existing rules, plans, and permits</td><td>Utility/Services managers</td><td>Organize a citizens advisory committee for resilience planning</td><td>Add resilience needs to the capital plan</td><td>Climate and disasters are changing- we should look more to how things are evolving vs/ disasters in the past</td></tr>
<tr><td colspan="2">Funding for disaster resilience not always for plan itself- often for tools to define plan itself.</td><td>Resilience plan needs to go with an agency/office with resources and positional authority to enact its recommendations</td><td>Business, commerce, interest/rep groups</td><td>Form a lifelines council for planning and interdependency identification</td><td rowspan="2">Create a resilience improvement office with Chief Resilience officer</td><td>Concern: Will/how this framework will be introduced/implemented</td></tr>
<tr><td colspan="2" rowspan="2">Standalone plan
Link it to existing plans
• Hazard mitigation
• EOP
• Recovery
• Comprehensive Plan
• Capital Improvements Plan</td><td>Must allow for an updated plan process (Continuous)</td><td>Community, stakeholder, citizen groups</td><td>Add key resilience concepts to the general plan</td><td>Work where necessary, live where it’s safe</td></tr>
<tr><td>Resilience plans = Economic development plans (No new label)</td><td>Permitting units</td><td colspan="2">Plans: City vs. Rural</td><td>Solid waste management (not just waste water)</td></tr>
<tr><td>Resilience plans should be regional
• Will not work by city or Community</td><td>National Codes and Standards to help facilitate process?</td><td>Resilience needs own track, but other plans should tie to/draw from the plan</td><td rowspan="3">Development planning Units</td><td colspan="2">Require Resilience plans for all committees</td><td>Human supports:
• -Counselors (post)
• -Education (pre)</td></tr>
<tr><td colspan="2"></td><td>Resilience offices produces annual scorecard of resilience metrics in primary plans</td><td colspan="2">Urban vs. Rural differences</td><td>Provisions for law enforcement in the event of insufficiencies</td></tr>
<tr><td colspan="2"></td><td>Resilience “Plan” is part of all plans
• Looks at the long-term</td><td colspan="2">Rural (regional) economic development plans</td><td></td></tr>
</table>

5. Breakout Session #2: Framework Chapter 5 – Buildings Sector

The buildings sector began with the facilitator, Ms. Ann Terranova of URS, leading introductions of the breakout group participants. The chapter author, Mr. Robert Pekelnicki, then provided an overview of the chapter and how it is being developed. He discussed development of the example performance goals and informed the group that much of the conversation during the breakout would be guided by the example performance goals. The facilitator then laid out how the breakout sessions would be formatted. The participants would use worksheets that showed the example performance goals from the 50% draft framework (see Table 6), and comment on what considerations might be needed for communities to accomplish those goals. The group was reminded that the example goals were for an expected event, with moderate disruption. The intention of this exercise was not to help establish performance goals for use by all communities in the country. Rather, the exercise was intended to obtain stakeholder input on what factors an individual community should consider to achieve advanced performance goals.

Within the buildings sector breakout, participants were split into sub-groups to discuss the various functional categories. Once the sub-groups discussed the example performance goals and what considerations might be taken into account by communities, the sub-groups discussed their thoughts with the larger group.

When discussing the Critical Facilities building cluster, the participants felt a large amount of funding would be needed to achieve advanced performance goals. When discussing the Emergency Housing building cluster, the group felt that using performance goals in the context of being hazard neutral was difficult to do realistically. For example, sheltering-in-place may be reasonable with certain types of hazards, but not others. It was also discussed that hazards may dictate the expected performance of buildings (i.e., design philosophies and types of damage are not the same for all hazard types).

In terms of identifying recovery levels for the performance goals, the group felt that using 25%, 50%, 75%, and 90% may provide more flexibility to communities rather than 30%, 60%, and 90% as is currently used in the 50% draft of the framework.

When discussing the Housing/Neighborhoods building cluster, the group felt that “Neighborhoods” was a more appropriate title because the infrastructure was dealing with an entire neighborhood, not just housing. Some participants felt that spiritual centers, such as churches, should have less stringent performance goals because they are not typically designed to be strong buildings and there are often no fire alarms in sanctuaries. The group did feel that performance goals for schools should be more advanced because vulnerable populations occupy these facilities frequently.

Table 6. Example Performance Goals Worksheet for Building Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Critical Facilities		**A**										
Emergency Operation Centers			90%									
First Responder Facilities			90%									
Acute Care Hospitals			90%									
Emergency Housing		**B**										
Temporary Emergency Shelters				90%								
Single and Multi-family Housing				90%								
Housing/Neighborhoods		**B**										
Critical Retail				30%	60%	90%						
Churches and Spiritual Centers				30%	60%	90%						
Schools					30%	60%	90%					
Community Recovery		**C**										
Businesses						30%		60%		90%		

Footnotes:

1 Specify hazard being considered
Specify level -- Routine, Expected, Extreme
Specify the size of the area affected - localized, community, regional
Specify severity of disruption - minor, moderate, severe

2 30% | 60% | 90% Restoration times relate to number of elements of each cluster

3 X Estimated restoration time for current conditions based on design standards and current inventory
Relates to each cluster or category and represents the level of restoration of service to that cluster or category
Listing for each category should represent the full range for the related clusters
Category recovery times will be shown on the Summary Matrix
"X" represents the recovery time anticipated to achieve a 90% recovery level for the current conditions

4 Indicate levels of support anticipated by plan
R Regional
S State
MS Multi-state
C Civil Corporate Citizenship

5 Indicate minimum performance category for all new construction.
See Section 3.2.6

The group also felt that the Community Recovery building cluster could just be named "Recovery." Participants felt that it would be important for communities to distinguish between small and global businesses because their needs and resources are both different. Furthermore, the group also stated that the impact on the supply chain was a key consideration in establishing performance goals.

Once the breakout group had discussed the example performance goals and what communities would need to consider in setting their own performance goals, the group discussed the dependencies on other sectors (power, water, transportation, and communications). The participants were asked to identify the key dependencies on other sectors so the building sector could achieve its performance goals. Furthermore, the key dependencies on other sectors were to be identified for each of the recovery phases presented in the performance goals table: Phase 1 – Response, Phase 2 – Workforce, and Phase 3 – Community.

For the response phase, the participants identified a number of dependencies on social systems, including emergency care, food and medical distribution, and shelters that accommodate pets. The group also felt transportation was needed to get from point A to B for first responders and as a means to evacuate if necessary. Participants felt that water was needed for critical facilities, fire suppression, and steam. They also discussed the need for communications systems to be online to communicate with EOCs, emergency dispatch and first responders.

When discussing the second and third phases, participants felt that the dependencies were largely the same. The group felt that planning/building department permits would be needed to start the rebuilding process. In many disaster events, debris removal is an important issue to allow transportation system use. Furthermore, getting public transportation up-and-running was seen as important. Participants also felt that power was essential in the longer-term. The group discussed the need for critical facilities beyond 72 hours after an event because back-up power (e.g., generators) is not often provided beyond that timeframe. Participants also discussed power for housing and retail. Participants felt the need for potable water and a source for fire suppression were very important as well as wastewater capabilities for residences. For retail and other businesses to become fully operational again, functioning internet was also seen as a necessity.

After the group identified dependencies on other sectors, the participants were given "dots" to vote on the top 3 dependencies on other sectors for each recovery phase. For the response phase, the results were:

- Communications for EOC (5 votes)
- Open roadways for transportation (4 votes)
- Emergency care (3 votes)
- Food and medical distributions (3 votes)
- Water and steam for critical facilities (2 votes)
- Shelters and accommodating events (2 votes)

For the second and third recovery phases, the results were as follows:

- Power needed for critical facilities after 72 hours (5 votes)
- Potable water for housing (3 votes)
- Start rebuilding (3 votes)
- Water for fire suppression (2 votes)
- Debris removal so transportation system can be used (2 votes)

On the second day of the workshop (October 28, 2014), the breakout group reconvened after the discussion of interdependencies with all the participants (see Section 9). The facilitator instructed the participants to return to the subgroups that were formed on the first day of the workshop. Within those subgroups, participants were asked to revisit the example performance goals from the first day and discuss the impacts of the dependencies from other sectors on the building sector. Specifically, do the

dependencies of other sectors indicate that the example performance goals need to be adjusted to support other systems?

Once the sub-groups discussed the impacts of the dependencies of other sectors, the group discussed the changes as a whole. With respect to the Critical Facilities building cluster, the group felt that the buildings themselves relied more on other infrastructure than the other way around. Specifically, the group identified the need for water, wastewater, power, and other services. Participants felt other sectors must consider the need for an EOC in their dependency assessment. Overall, the participants felt the example performance goals for the Critical Facilities building cluster were reasonable.

When discussing the Emergency Housing building cluster, the group discussed that some temporary emergency shelters would need to be in place on Day 0 to meet the needs of social systems. However, the group did feel that performance goals for single family homes could be relaxed somewhat depending on the type of hazard and expectations within a given community given a particular disaster event.

When discussing the Neighborhoods building cluster, participants felt other sectors did not impact most of the buildings considered. However, for manufacturing industry, participants noted that communities would need to assess power/utility provider goals to determine if a shift was required.

For the Recovery building cluster, the groups felt a timeframe of 4-36 months was too long. Some participants felt taking longer than 24 months to recover would mean your community was not resilient and many businesses, stadiums, conference centers, etc., would not return.

To finish off the two days of breakout sessions, the group worked to identify the key concepts discussed that would be presented to the rest of workshop participants. The agreed upon summary is discussed in Section 10.

6. Breakout Session #3: Framework Chapters 6-9 – Infrastructure Systems

The infrastructure systems breakout group was unique in that it contained participants from multiple sectors: Transportation, power/energy, communication and information systems, and water/wastewater. The session began with the facilitator, Mr. Mauricio Justiniano of Energetics Inc., leading introductions of the participants.

One of the chapter authors, Mr. David Mizzen (co-author of the communications chapter), then presented an overview of how the infrastructure system chapters are being developed. The other chapter authors, Ms. Erin Ashley (transportation), Mr. Scott Tezak (energy), and Ms. Adrienne Sheldon (water/wastewater), each provided the specifics of how their individual chapters are being developed and where they are looking for input from stakeholders. Mr. Mizzen then gave an overview of the goals of the breakout sessions and emphasized that participants were encouraged to provide feedback directly on the 50% draft chapters at any time.

The facilitator explained to the breakout group that subgroups would be formed for each of the sectors and they would be provided with worksheets that showed the example performance goals from the 50% draft framework, as shown in Table 7 through Table 11. The participants formed subgroups corresponding to their sector of expertise/interest and worked with the chapter authors to evaluate the example performance goals for an expected event with moderate disruption. Worksheets were provided to the subgroups, which used the performance goals as a guide to discuss what communities need to consider when setting their own performance goals. The performance goals presented to the subgroups were not intended for adaption by all communities in the country. Rather, they were used by the chapter authors to get input from the stakeholders as to what resources, interdependencies and/or barriers exist in communities and what tools would be needed to accomplish performance goals for resilient infrastructure systems.

Table 7. Example Performance Goals Worksheet for Transportation Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Ingress (goods, services, disaster relief)		**A**										
Regional Airport						90%		X				
National/International Airport					90%	X						
Marine Port						90%						
Ferry Terminal					90%	X						
Subway Station					90%		X					
Rail Station, Local					90%	X						
Rail Station, Regional						90%	X					
Rail Station, National						90%	X					
Egress (emergency egress, evacuation, etc)		**1**										
Bridge				90%	X							
Tunnel					90%	X						
local freeway			90%									
state freeway			90%									
National freeway				90%								
Subway				30%		X						
Ferry				90%	X							
Regional Airport				30%				X				
National/Int'l Airport				30%		X						
Rail Local				30%		X						
Rail Regional					30%	X						
Bus			90%	X								
Community resilience												
Critical Facilities		**A**										
Hospitals			60%	90%								
Police and Fire Stations			60%	90%								
Emergency Operational Centers			60%	90%								

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Breakout Session #3: Framework Chapters 6-9 – Infrastructure Systems

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Emergency Housing		**B**										
Residences				60%	90%							
Emergency Responder Housing					90%							
Public Shelters			90%									
Housing/Neighborhoods		**B**										
Essential City Service Facilities							90%					
Schools					60%	90%						
Medical Provider Offices							90%					
Retail						90%						
Community Recovery		**C**										
Residences						30%		60%	90%			
Neighborhood retail					30%	60%		90%				
Offices and work places						90%	X					
Non-emergency City Services					30%	60%			90%			
All businesses						30%		60%		90%		

Table 8. Example Performance Goals Worksheet for Power/Energy Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	10%	Restored
	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current
	90%	At Goal

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Power - Electric Utilities												
Generation		1										
Critical Facilities and Infrastructure Systems	R/C		10%	30%	60%	90%						
Emergency Housing and Support Systems	R/C		10%	30%	60%	90%						
Housing and Neighborhood infrastructure	R/C					30%	60%	90%				
Community Recovery Infrastructure	R/C					30%	60%	90%				
Transmission (inculding Substations)		1										
Critical Response Facilities and Support Systems												
Hospitals, Police and Fire Stations			10%	30%	60%	90%						
Emergency Operations Centers			10%	30%	60%	90%						
Disaster debris/recycling centers			10%	30%	60%	90%						
Related lifeline systems			10%	30%	60%	90%						
Emergency Housing and Support Systems												
Public Shelters (General Population, Animal, etc.)					30%	60%	90%					
Food distribution centers					30%	60%	90%					
Nursing homes, transitional housing					30%	60%	90%					
Emergency shelter for response/recovery workforce				30%	60%	90%						
Related Lifeline Systems including recharging stations/banking facilities				30%	60%	90%						
Housing and Neighborhood infrastructure												
Essential city services facilities							30%	60%	90%			
Schools							30%	60%	90%			
Medical provider offices							30%	60%	90%			
Houses of worship/meditation/ exercise												
Buildings/space for social services (e.g., child services) and prosecution activities												
Food distribution from local grocery stores (location known by community)						30%	60%	90%	X			
Community Recovery Infrastructure												
Residential housing restoration							30%	60%	90%			
Commercial and industrial businesses							30%	60%	90%			
Non-emergency city services							30%	60%	90%			

Community Resilience Workshop
Breakout Session #3: Framework Chapters 6-9 – Infrastructure Systems

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Distribution												
Critical Response Facilities and Support Systems		1										
Hospitals, Police and Fire Stations				10%		30%	60%	90%				
Emergency Operations Centers				10%		30%	60%	90%				
Disaster debris/recycling centers				10%		30%	60%	90%				
Related lifeline systems				10%		30%	60%	90%				
Emergency Housing and Support Systems												
Public Shelters (General Population, Animal, etc.)							30%	60%	90%			
Residential Shelter-in-place							30%	60%	90%			
Food distribution centers							30%	60%	90%			
Nursing homes, transitional housing							30%	60%	90%			
Emergency shelter for response/recovery workforce							30%	60%	90%			
Related Lifeline Systems including recharging stations and banking facilities							30%	60%	90%			
Housing and Neighborhood infrastructure												
Essential city services facilities							30%	60%	90%			
Schools							30%	60%	90%			
Medical provider offices							30%	60%	90%			
Houses of worship/meditation/ exercise							30%	60%	90%			
Buildings/space for social services (e.g., child services) and prosecution activities							30%	60%	90%			
Food distribution from local grocery stores (location known by community)						30%	60%	90%	X			
Community Recovery Infrastructure												
Residential housing restoration							30%	60%	90%			
Commercial and industrial businesses							30%	60%	90%			
Non-emergency city services							30%	60%	90%			
Related lifeline systems							30%	60%	90%			

Table 9. Example Performance Goals Worksheet for Communications Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current or At Goal

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 -- Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Nodes/Exchange/Switching Points		**A**										
Central Offices			90%			X						
Buildings Containing Exchanges			90%			X						
Internet Exchange Point (IXP)			90%			X						
Towers		**A**										
Free Standing Cell Phone Towers			90%			X						
Towers Mounted on Buildings			90%			X						
Distribution lines to …												
Critical Facilities		**1**										
Hospitals			90%			X						
Police and fire stations			90%			X						
Emergency Operation Center			90%			X						
Emergency Housing		**1**										
Residences					60%	90%		X				
Emergency responder housing					60%	90%		X				
Public Shelters					60%	90%		X				
Housing/Neighborhoods		**2**										
Essential City Service Facilities					30%	90%		X				
Schools					30%	90%		X				
Medical Provider Offices					30%	90%		X				
Retail					30%	90%			X			
Community Recovery Infrastructure		**3**										
Residences					30%	90%		X				
Neighborhood Retail					30%	90%			X			
Offices and Work Places					30%	90%		X				
Non-Emergency City Services					30%	90%			X			
Businesses					30%	90%			X			

Table 10. Example Performance Goals Worksheet for Water Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 – Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Source		1										
Potable water at supply (WTP, wells, impoundment)			30%		60%	90%			X			
Water for fire suppression at key supply points			90%			X						
Transmission (inculding Substations)		1										
Backbone transmission facilities (pipelines, pump stations, and reservoirs)			90%					X				
Distribution												
Critical Facilities		1										
Hospitals, EOC, Police Station, Fire Stations				60%	90%			X				
Emergency Housing		1										
Emergency Shelters				60%	90%			X				
Housing/Neighborhoods		2										
Drink water available at community distribution centers					60%	90%						
Water for fire suppression at fire hydrants						90%				X		
Community Recovery Infrastructure		3										
All other clusters					30%	90%				X		

Table 11. Example Performance Goals Worksheet for Wastewater Sector Breakout Group

Disturbance		
(1)	Hazard	Any
	Hazard Level	Expected
	Affected Area	Community
	Disruption Level	Moderate

Restoration times		
(2)	30%	Restored
	60%	Restored
	90%	Restored
(3)	X	Current

Functional Category: Cluster	(4) Support Needed	(5) Target Goal	Overall Recovery Time for Hazard and Level Listed									Comments on 1) functional category clusters; 2) desired performance goals; 3) tools and capabilities needed to achieve performance goals
			Phase 1 – Response			Phase 2 -- Workforce			Phase 3 -- Community			
			Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-36	Mos 36+	
Treatment Plants												
Treatment plants operating with primary treatment and disinfection					60%	90%						
Treatment plants operating to meet regulatory requirements						30%			60%	90%	X	
Trunk Lines												
Backbone collection facilities (major trunklines and pump stations)						30%		60%	90%		X	
Collection Lines												
Critical Facilities												
Hospitals, EOC, Police Station, Fire Stations					30%	90%				X		
Emergency Housing												
Emergency Shelters					30%	90%				X		
Housing/Neighborhoods												
Threats to public health and safety controlled by containing & routing raw sewage away from public				30%		60%	90%			X		
Community Recovery Infrastructure												
All other clusters						30%		60%		90%	X	

Footnotes:

1 Specify hazard being considered
Specify level -- Routine, Expected, Extreme
Specify the size of the area affected - localized, community, regional
Specify severity of disruption - minor, moderate, severe

2 30% | 60% | 90% Restoration times relate to number of elements of each cluster

3 X Estimated restoration time for current conditions based on design standards and current inventory
Relates to each cluster or category and represents the level of restoration of service to that cluster or category
Listing for each category should represent the full range for the related clusters
Category recovery times will be shown on the Summary Matrix
"X" represents the recovery time anticipated to achieve a 90% recovery level for the current conditions

4 Indicate levels of support anticipated by plan
R Regional
S State
MS Multi-state
C Civil Corporate Citizenship

5 Indicate minimum performance category for all new construction.
See Section 3.2.6

Performance Goal Discussions

Transportation Sector. The transportation subgroup discussed the need to understand the transportation system as a network to address resilience. For example, national and state highways serve more than just individual communities by serving as links between communities. Arterial roads serve counties and large municipalities, while local roads allow people and goods to be transported to their final destinations. Furthermore, communities must also consider road capacity to determine the overall capacity of the road network and understand what will happen if links in the network are lost during a disaster event.

Participants thought that pipelines should be included in the transportation chapter, with a different set of performance goals being developed for pipelines. The group also discussed making changes to the clusters within the functional categories. They felt that buses could be removed from the performance goals table because it was a method of transportation rather than supporting infrastructure. Furthermore, there was discussion of the need to add military airports, particularly for extreme disaster events.

With respect to the ability to measure resilience, the group discussed the need for communities to document the infrastructure conditions. The participants also felt that changing conditions/hazards should be accounted for in predicting the performance of transportation infrastructure in a disaster event. In the response phase, the ability to complete rapid damage assessments is vital to recovery of transportation infrastructure.

Power/Energy Sector. The power subgroup thought that the example performance goals shown in the 50% draft framework were not advanced enough for an expected event. The participants believed that the expectation should be for power generation to be recovered within the response phase of recovery for an expected event.

The group also was of the opinion that that another functional category, called "critical industry," with more advanced performance goals should be listed to support recovery of industries critical to a community's recovery process. The building clusters categorized as critical industry would vary by community. For example, in a town where a manufacturer employs a large percentage of the residents and drives the economy, the restoration of power to that manufacturer would be a high priority that required an advanced performance goal to support community recovery.

When discussing the Emergency Housing and Support Systems cluster, participants discussed the need for different tools that supported different energy sources. The main point was that measures are different for gas and electric energy. Participants also cautioned the author about producing prescriptive language in the document because it would not work for resilience and reliability – there needs to be room for innovation.

Communication Sector. In the communications subgroup, participants agreed that the example performance goals shown in the 50% draft framework were reasonable. However, the group suggested that the functional levels be revised to more accurately represent of the structure of a service provider's network. The participants felt that the functional categories could be separated into four levels: 1) Core, 2) Central Offices, 3) Distribution Nodes, and 4) Last Mile.

"Core" represents the backbone of Service Providers' systems that contain important information for the company to function, including customer data and information. Core facilities are usually geo-redundant so that a disaster event in one part of the country will not impact the entire network. Central Offices are the regional centers that connect different networks. These include data centers, cable head end facilities, and colocation hotels. Outages at these centers can cause regional failures in the communications and information network. "Distribution Nodes" includes cellular towers that collect and distribute phone calls and text messages to customers. The final category, "Last Mile" (or first mile), deals with the infrastructure used to distribute services to the customer.

When considering the core facilities and central offices, participants believed that these facilities should not experience any downtime during an expected event. They stated that because service providers either own these structures or choose which buildings they lease to house switches, they should be able to support the example performance goals.

Participants thought that cell towers should also have a very small percentage of outages during an expected event. They did note, however, that cell towers on top of buildings may be more susceptible to failure due to building performance, because buildings are not owned by service providers. Furthermore, the group also discussed the potential impact of shared equipment such as standby generators. They stated that the Federal Communications Commission (FCC) currently encourages sharing of generators and other equipment between service providers for cost savings. However, they noted that this may also impact redundancy because if multiple towers are connected to a single generator, failure of the generator could impact multiple networks.

While participants agreed that the example performance goals associated with last mile delivery to the customers of the different building clusters were reasonable, they did point out a key concern that needs to be addressed. The group felt that service providers and owners need to work together more to achieve the level of redundancy/resilience desired by the customer. Although the service provider can distribute services to customers, the user may not realize that they only have one wire coming into their building and that failure of that wire results in loss of the service. Moreover, the service provider is not responsible for the communications system within the building and owners should do what they can to maintain a redundant system within the building.

Participants also discussed the need for service providers and community planners to work together to help plan for evacuation situations. The group noted that in past disasters evacuation centers and routes had resulted in communications use that exceeded network capacity. In an evacuation from a disaster event, communication is critical. Working with community planners so that service providers can improve their capacity along evacuation routes and around evacuation centers is needed for future disaster events.

Water/Wastewater Sector. The breakout group first looked at water supply sources. The participants thought that raw/source water and reservoirs should be addressed as they are a major water source. They also suggested that raw water conveyance to water treatment plants via pump stations be included in the performance goals. The group discussed the challenges of meeting the example performance goals in the 50% draft of the framework and stated that generally, the whole water/wastewater system works or nothing works. It was noted that water is required for fire suppression immediately after a disaster event takes place, but potable water is not available in the example performance goals until the workforce recovery phase. The participants also discussed the challenges of controlling the source (e.g., dams, lakes, etc.) because they are natural resources.

The group also discussed whether droughts should be addressed because they impact the levels of nutrients in the system and can affect the level of water treatment needed. Droughts can lead to water quality and health issues, particularly near creeks and lakes where pollution can be added to the water. The participants also discussed the challenges of an aging infrastructure system, which causes inflow and infiltration of pollutants.

When discussing the challenges of setting and achieving performance goals, participants discussed problems faced by communities adjacent to the community that experienced the disaster. Although a second community may not have been directly impacted by a disaster event initially, if it shares the same water system as the community directly impacted by the event, the water supply may be cutoff or otherwise impacted.

Dependencies Discussion

After discussing performance goals within each sector, the facilitator provided each subgroup with another worksheet to identify their key dependencies on other sectors for the three recovery phases: Response, workforce, and community. Once each subgroup identified their sector's dependencies on other sectors, the subgroups were asked to identify the three most important dependencies for each of the three phases.

Transportation Sector. The transportation subgroup identified dependencies on all of the other sectors for the three recovery phases presented in the 50% draft framework.

In the response phase, the group identified Emergency Operation Centers, gas stations, and control towers at airports as facilities on which the transportation system depended. Participants also identified power/energy as a key transportation system dependency. Most importantly, fuel is needed to power almost all modes of transportation – cars, trucks, buses, ferries, airplanes, etc. Power is also needed at gas stations to pump fuel into automobiles. The failure of power lines can impede road traffic if they fall onto roadways. Transportation hubs, such as airports, bus stations, train stations, and subway stations also require power to function properly. Water is also needed for fire suppression in airports, and other transportation hubs for safety. Moreover, clean water and functional wastewater systems are needed to allow transportation hubs to function. The communications system is needed to communicate between transportation hubs.

In the workforce phase, power is needed for all transportation systems. Water is needed to allow DOT offices to be functional. The participants thought that it was critical in this phase of recovery to complete rapid damage assessments of all infrastructure, and coordinate and complete debris removal so roadways could be reopened. The group also thought that long-term needs included rebuilding the transportation infrastructure to help in rebuilding the workforce.

Power/Energy Sector. The power/energy subgroup identified dependencies on all other sectors to support recovery for each of the three phases.

When discussing the response phase, the group thought that buildings were needed for command and control. The participants also identified transportation as critical for repair crews to assess and repair failures, as well as to refuel generators in the field. Water is needed for cooling of generation and data centers.

The group also identified the communications sector as being critical in the response phase because they are a key element of command and control of the electric system. Participants also noted the need for communications to identify, locate, and efficiently dedicate resources to failure locations and their repair.

With respect to the workforce phase of recovery, many dependencies remained the same. However, the group felt that potable water was important to support technicians in this phase. Furthermore, participants identified needs for major asset reconstruction (when necessary), coordination with other entities, emergency housing, and support from the National Guard for fuel, safety, security. In the long-term recovery phase, participants also identified the opportunity to develop a long-term resource management plant that would help make networks more resilient.

The group felt that, given the importance of energy to other sectors, the timeframes for the second and third recovery phases were too long for their sector. The participants suggested that the workforce phase be changed to 1-4 weeks, and the community recovery phased be changed to 4+ weeks.

Communication Sector. The communications subgroup thought that a number of important dependencies on other sectors applied to all phases of recovery. Participants also felt that the first phase of recovery was the most important because customers expect to have their services restored almost immediately since communication is critical to their daily lives and functioning.

First, the group stated that power was critical because nothing in the communication system works without power. Although many service providers use generators for standby power, they are only intended to work for a limited period of time. Generators are not intended as a long-term solution.

The group also thought that water was a key dependency because central offices could not be entered if the building did not have a functioning water system. This means that even if a simple fix was required to get the critical equipment within the central office back online, technicians could not do so, keeping services to customers down. The group also discussed the need to ensure the safety of workers entering buildings or sites. This means having building inspectors available and/or security when necessary so workers are not put in dangerous situations.

Transportation was important to allow repair crews to assess damage and make repairs to the system. The group discussed telling the FCC that the three things they need to restore services after a disruptive event are "access, fuel, and security." That is, service providers need access to the sites for repairs, fuel for standby generators, and security for their technicians.

Although the group felt it was important to focus on restoring communications within the first recovery phase, participants did note that certain long-term initiatives could help improve performance in the next disaster. For example, the group discussed the need to work with community planners to add additional network capacity along emergency evacuation routes. The group also discussed the long-term goal of hardening buildings or portions of buildings that house critical equipment. Lastly, participants felt changes to regulations, particularly building and zoning regulations, could lead to improvements in the resilience of the communications infrastructure system.

Water/Wastewater Sector. The water/wastewater subgroup worked to identify their sector's dependencies on other sectors. Participants thought that during the response phase, the transportation, power, and communication sectors were critical. Transportation would be needed for delivering water treatment chemicals, emergency equipment or parts, and allowing personnel to get to water treatment plants or other critical facilities. Furthermore, transportation routes are needed for repair crews to access transmission and distribution lines.

Power is needed in the response phase because electricity is key for water treatment processes such as supervisory control and data acquisition (SCADA), and functionality of pump stations. Fuel is also needed for utility trucks and refueling standby generators. Similarly, the need for communications in the response phase was also desired for SCADA and service providers.

During the workforce phase, the water system would also rely on large water customers' buildings to be functional to help support the community and economics of the water utility. Smaller water utilities may also rely on buildings with water quality testing labs for monitoring. Similar to the response phase, transportation was also a dependency. However, for the workforce phase, transportation for repair crew access to distribution line flushing was considered most important. Participants also discussed the need for ingress to allow consulting and contractor staff to reach water treatment plants.

Power/energy in the workforce phase is needed for testing water quality. Participants also discussed the need for natural gas in wastewater treatment plant processes. Participants also thought that communications would be needed between key points of the water infrastructure system, including water treatment plants, pump stations, and tanks. Beyond the needs of each infrastructure sector, the water sector depends on recovery of the government, businesses, and residents to pay fees so the utility can operate and cover costs.

The community phase was seen to have the same dependencies as the workforce phase. However, the group thought that the long-term recovery of the water utility would depend on recovery of all buildings/customers to pay fees rather than just the large, more critical customers.

Adjusting Performance Goals Discussion

After the discussion of interdependencies with all of the workshop participants on the second morning of the workshop (October 28, 2014), the breakout group reconvened and broke into their subgroups again. The facilitator explained that the goal of the second day was for each subgroup to discuss the dependencies other sectors have on their sector and identify whether communities would need to adjust performance goals to accommodate the needs of the other sectors. Table 12 summarizes the sector dependencies provided to the subgroups so they could discuss how the dependencies impacted the performance goals.

Table 12. Sector Dependencies

Sector: Dependent Sector	Overall Recovery Time for Hazard and Level Listed Dependencies		
	Phase 1 – Response 0-3 Days	**Phase 2 – Workforce 1-12 Wks**	**Phase 3 – Community 4-36+ Mos**
Buildings and Facilities			
Power/Energy		Critical facilities - Power after 72 hours	Power/Energy
Water	Critical facilities – steam	Potable water – shelter (housing) Fire suppression	Water
Wastewater			Wastewater
Communication and Information	EOC		Communication and Information
Transportation	Open roadways	Debris removal	Transportation
Social	Emergency care Food and Medical Distribution Shelters accommodating pets	Start rebuilding	Social
Power/Energy Systems		**1-4 Wks**	**4+ Wks**
Buildings and Facilities			
Water and Wastewater			
Communication and Information	Command and control and telemetry Response and recovery	Command and control and telemetry	
Transportation	Ability for crews to repair; and staff at command	Ability for crews to repair; and staff at command	
Social		National Guard	Long-term resource management Major asset reconstruction/replacement
Water and Wastewater Systems			
Buildings and Facilities			Housing recovery to support fees/bills Smaller, less-critical buildings/businesses up and running
Power/Energy	Electricity is key for treatment processes Electricity for pump stations	Water quality testing needs	
Communication and Information		Communications between treatment plans, pump stations, tanks, etc.	
Transportation	Ingress for emergency equipment and parts	Access to system for water quality monitoring	
Social			Smaller/less critical businesses up and running
Communication and Information Systems			
Buildings and Facilities			
Power/Energy	Nothing works without power		
Water and Wastewater			
Communication and Information			
Transportation	Need access to assess and make repairs		
Social	Access, fuel, security		
Transportation Systems			
Buildings and Facilities			Facilities associated with transportation reconstruction/restorations

Sector: Dependent Sector	Overall Recovery Time for Hazard and Level Listed Dependencies		
	Phase 1 – Response 0-3 Days	**Phase 2 – Workforce 1-12 Wks**	**Phase 3 – Community 4-36+ Mos**
Power/Energy	Fuel	Power to systems and transportation facilities	
Water and Wastewater	Water to airports and other transportation systems		
Communication and Information	Phone and Internet		
Social		Damage Assessors/bridge inspectors Debris Removal	Workforce to rebuild
Social Systems			
Buildings and Facilities	Emergency and temporary housing	Prioritized resources open*	
Power/Energy	Power for critical facilities		
Water and Wastewater		Prioritized restoration of clean water and wastewater infrastructure*	Restoration of potable water/wastewater infrastructure
Communication and Information	Reliable communications for 911, first responders, and info on family safety/status		
Transportation		Supply chain restoration	
Buildings and Facilities	Emergency and temporary housing	Prioritized resources open*	

Transportation Sector. The transportation subgroup discussed the impact of the dependencies of other sectors on the transportation sector. Participants felt that as a result of the dependencies discussed by all workshop participants, the transportation sector would need to be functional within the response recovery phase (0-3 days). Participants noted that it was unclear which transportation systems were needed by the other sectors, but assumed the other sectors focused on roads. However, the group pointed out that many needs of other sectors on transportation can be met in a number of ways.

The group discussed the impact of regional characteristics and needs. It was also felt that the hazard type also affected the performance goals. The participants felt that the percentage restoration needed to be clarified as a percentage of the system functionality. For critical facilities, it may not be necessary to have 90% recovery. However, it would be essential for communities to prioritize recovery so critical facilities could be accessed.

Power/Energy Sector. The group thought that the discussion of dependencies of other sectors confirmed their initial thought that the example performance goals in the 50% draft were too conservative for communities given an expected event. Participants shifted the example performance goals to the response recovery phase to support the needs of the other sectors. However, they did note that there were a number of challenges that were preventing networks from achieving these goals currently. The participants noted that lack of maintenance in some regions leads to poor performance. Some participants also felt that competition, though good from the cost perspective for customers, also leads to price-driven service rather than quality/reliability-driven services. Thus, a lower cost for customers may result in less maintenance and hardening on the network infrastructure.

Communication Sector. When the communications group reconvened and reviewed the dependencies of other sectors on communications, the group noted that the other sectors generally needed communications in the first recovery phase to support emergency functions. Therefore, the group felt that the example performance goals in the 50% draft of the framework were reasonable and that communities would want to ensure that advanced performance goals are set for the communications systems within their communities to support recovery of other sectors.

Water/Wastewater Sector. After the dependencies discussion with all of the workshop participants, the group thought that the example goals may have to accommodate the performance goals of the energy sector to support recovery of the water system. For the example goals in the 50% draft, either the fire suppression performance goals for critical facilities had to be less stringent or the power performance goals had to be more advanced. The group felt that communities will have to be careful about setting overly aggressive performance goals if supporting infrastructure systems, particularly energy, could hinder its ability to meet the goals.

7. Breakout Session #4: Framework Chapter 2 – Social Aspects of Resilience

At the start of the first breakout session, the facilitator, Ms. Paget Donnelly of Energetics Inc., led introductions of the participants and explained how the session would operate. Chapter author, Dr. Erica Kuligowski, introduced herself and summarized development to-date and sources being used. Dr. Kuligowski emphasized the need for participant input to push chapter development forward. Dr. Kuligowski defined a community as "a cluster of people who live, work, learn, and/or play under the same jurisdiction of a governance structure, such as a town, city or county." She also explained the hierarchy of human needs (Figure 3) and how it relates to resilience of the built environment.

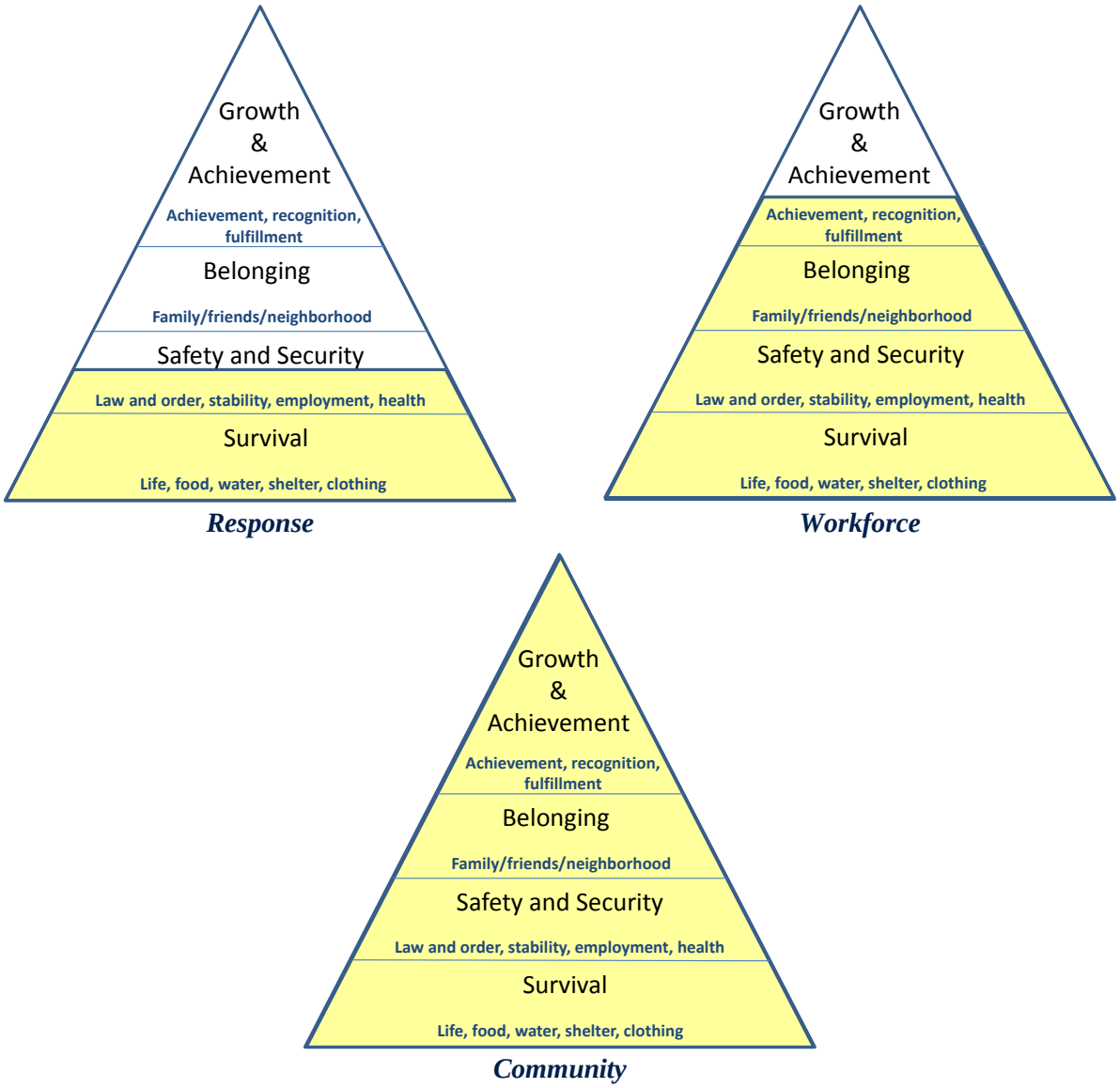

Figure 3. Hierarchy of Human Needs (Adapted from Maslow's Hierarchy of Needs)

The group brainstormed and discussed social systems that are critical to a community, in that they can exist to meet the human needs previously discussed. Participants identified many different social systems (e.g., schools, neighborhoods, religious centers, healthcare, business and commerce, first responders, socializing centers, etc.). Some participants felt communication was a life support and people in this era of technology are lost when not "plugged-in."

The group then discussed the recovery times shown in the 50% draft of the framework and worked to define a community's social needs within each phase. The group felt it was difficult to understand when the 0th hour occurred for different types of hazards. For example, the question was asked: "For a hurricane, is the 0th hour when damage occurs or when the storm is gone and the recovery process can commence?" As a result, when considering the response phase, the group sub-divided the phase into three groups: 1) Pre-zero hour, 2) Zero hour, and 3) 0-3 days.

Table 13 shows stakeholder input with respect to the example performance goals developed in the 50% draft for the response phase. Prior to an event, the discussion focused on the need to clearly communicate evacuation plans, hubs, and systems. When the event occurs, the group felt it was important to share knowledge with others and communicate via mass messaging or social media. In the response phase, participants felt it was critical to provide immediate assistance to vulnerable populations, including those who are seriously injured, via emergency responders. The group discussed the need for communication, availability of emergency shelters and food/water, the provision of mass/critical care (including crisis counseling), reuniting families who were separated before or during the disaster event, and providing shelters for animals.

Table 13. Social Performance Goals for Response Recovery Phase

Response Phase Performance Goals (0 – 3 Days)		
Phase 1 Response 0-3 Days	**Pre-Zero Hour**	**Zero Hour**

• Provide Emergency Response
  ▪ Life safety
  ▪ Food/water
• Provide mass care/critical care
• Provide communications
• Manage public perceptions
• Pay attention to messaging
  ▪ Quality of information
  ▪ Tone/style to reassure public
• Coordinate services
• Gather info on damage/impacts in residential/commercial sectors
  ▪ Identify/communicate danger zones (various geographic levels)
  ▪ Limit access to dangerous and at-risk areas
  ▪ Assure safety of surroundings (downed power lines, etc.)
• Provide emergency shelters
• Establish social(izing) centers
• Physically reunite family members
• Provide crisis counseling, including for first responders
  ▪ Provide meals to displaced/incapacitated citizens
  ▪ Establish counseling centers
  ▪ Provide pet/animal sheltering and central info center on status
  ▪ Streamline volunteer and donations management
	• Plan and communicate evacuation systems	• Establish immediate emergency survival requirements
		• Minimize lives lost
		• Establish location and status of health emergencies in critical zone
		• Establish awareness level/ knowledge of significant others
		• Drive social media messaging by government
		  ▪ 911 services

Table 14 summarizes the example social performance goals that participants thought were important for the workforce recovery phase. The group divided the social performance goals into four categories: Housing, open business/commercial, schools in session, and re-establishing community traditions. Participants felt it was essential to provide housing for both owners and renters because it is key to workforce retention and economic stability within a community.

Table 14. Examples of Social Performance Goals for Workforce Recovery Phase

Workforce Phase Performance Goals* (1 – 12 weeks)	
Housing	**Open Business/Commercial**
• Immediately provide housing for transient workers and renters: key to workforce retention and economic stability of businesses in the community • Transition citizens from emergency to temporary and permanent housing • Provide housing that delivers physical safety and sense of security for residents • Rebuild permanent housing to help reestablish neighborhoods/ community (societal norm) and to restore citizens' economic/financial equity	• Determine whether business facilities are operational. Assess potential alternative locations and the implications. • Encourage/facilitate rebuilding by key employers • Focus on/prioritize reopening of small businesses Rationale: ▪ Personal dignity is tied to having a job/paycheck ▪ Businesses provide essential tax bases for communities
Schools in Session**	**Reestablish Community Traditions**
• Resume classes as soon as safely possible, at alternate location if necessary** • Alternate procedures may meet schedules • Rationale: ▪ Functions as safe daycare ▪ Enables adults to work on recovery or go back to work ▪ Provides meals and nutrition for many students ▪ Provides sense of normalcy for students and their families ▪ Helps meet minimum annual school days required for promotion to next grade or graduation ▪ Enables continuance of education	• Organize community events (catharsis) ▪ Appropriate activities will be community-specific

* Expedited by prior alternate location planning ** Assumes safe transportation/access to class meeting sites

Participants also thought that re-establishing normal school schedules was important for children and parents to feel that life is returning-to-normal. Business is also an important consideration. The example goals of re-establishing households and schools allow residents to return to work. Small businesses cannot survive if closed for extended periods of time. Larger employers that are essential to the economic base of the town are also critical to re-establish so the population will be sustained or grow. Some participants also pointed out that part of getting "back to normal" is organizing traditional events within the community.

Table 15 shows other example social performance goals the group thought were important in the second recovery phase, including healthcare, law and order, financial services, food, government services and transportation.

Table 16 summarizes the example social performance goals for the third recovery phase. The participants categorized their input into six categories: Buildings, business/commercial, government services, healthcare, restorative stepping stones, and recovering a sense of community. The group thought that reoccupying homes and places of business was important in the long-term in order to preserve a sense of normalcy within the original neighborhoods. It was stated that the rebuilding process needed to be simplified and streamlined to support this goal. Similarly to the second phase, the ability to re-establish a business/commercial sector is critical to sustaining a tax base and growing the community. Government initiatives to improve social and infrastructure systems to become more resilient in the long-term will lead to a stronger community.

After discussing example performance goals of social systems, the focus switched to dependencies on the built environment. It was noted that the framework focuses on the built environment; however, social systems (that meet the needs of individuals within the community) drive the need for adequate performance of the built environment. Hence, participant input on the dependencies among various

physical infrastructure sectors (buildings, power/energy, communications, transportation, water/wastewater) was important.

Table 15. Examples of Social Performance Goals for Workforce Recovery Phase

Workforce Phase Performance Goals (1 – 12 Weeks)		
Healthcare	**Law and Order**	**Restore Financial Services**
• Provide crisis counseling • Make provisions to deliver long-term medications and chronic care (e.g., dialysis) • Handle births safety • Restore full emergency room care • Restore full healthcare services in nursing homes or alternative facilities (assess implications of alternatives)	• Provide a police presence • Control re-entry to disaster zone as needed (checkpoints) • Provide back-up traffic guidance (e.g., for road closures and non-functioning signals) • Secure prisons • Reopen courts	• Provide access to credit to help citizens address their needs and start repairs • Protect money and savings
Food	**Government Services**	**Transportation**
• Enable food distribution • Reopen groceries and resume commerce	• Resume issuing food stamps • Expedite building permits to aid recovery; foster improvements to mitigate future disaster impacts	• Enable personal mobility • Enable distribution & commerce

Table 16. Examples of Social Performance Goals for Community Recovery Phase

Community Phase Performance Goals: 4 to 36 Months		
Buildings	**Business/Commercial**	**Government Services**
• Original structures reoccupied • Rebuild on historical footprint to preserve historical continuity • Return to full housing stock • School buildings reopen in original neighborhoods • Rebuilding approval process simplified or streamlined • Provide permanent housing solutions for low-income citizens	• Stimulate economic growth • Attain stable or growing population/population distribution	• Provide capital outlay (government funding to support rebuilding of community) • Restore parks and recreation opportunities • Provide environmental restoration (debris management to assist citizens in mental recovery from disaster mode)
Healthcare	**Restorative Stepping Stones**	**Recovering Sense of Community**
• Provide long-term counseling (PTSD)	• Facilitate review/revive former or new community plans or dreams • Restore/promote public access to beauty and art • Engage citizens in planting trees and vegetation to restore public and private land and instill sense of growth • Provide leisure activities • Provide respite/rejuvenation opportunities to overwhelmed citizens • Plan/build disaster-related memorial and hold event as an opportunity for gathering and healing.	• Achieve sense of normalcy or adaptation to the new normal • Retain sense of historical continuity • Become a model for other communities by building success upon success • Promote sustainability of community

Table 17 shows all dependences of the social systems on the sectors of the built environment. Once dependencies were listed and agreed upon, the facilitator provided participants with "dots" to vote on the top three dependencies for each phase. The top three dependencies for the response phase were the following:

- Buildings and facilities for emergency and temporary housing (5 votes)
- Power/energy for critical facilities (5 votes)
- Reliable communications for contacting 9-1-1 and emergency responders (4 votes)

In the second phase, the most important dependencies were identified as:

- Water restoration to critical and large facilities, and residences (4 votes)
- Reopen buildings to have access to resources, such as groceries (3 votes)
- Transportation is needed for supply chain restoration (2 votes)

In the community phase of recovery, the group thought that the key dependency was on the water sector to provide potable water.

Table 17. Sector Dependencies of Social Systems

Sector > Phase	Building and Facilities	Transportation	Power/ Energy	Water/ Wastewater	Communication and Information
0-3 Days	• Provide emergency and temporary housing ●●●●● • Assess damaged buildings ● • Set up Reunification Center (and provide counseling)	• Provide access for emergency vehicles ● • Provide transport to deliver essential healthcare, food, and water ● • Provide public transport ● • Provide access to damage areas	• Provide power for critical facilities ●●●●● • Provide standalone renewable power ● • Provide cell phone charging stations	• Provide access to clean drinking water ●●● • Provide portable sanitation facilities • Provide interim wastewater processing to avert disease	• Assure quality, reliable communications for first responders & 911 ●●●● • Communicate information on family status and safety • Assure radio and text services • Provide Communications on Wheels (COW) or other communications support (1 – 6 weeks) • Phone and internet.
1-12 Weeks	• Reopen major places of employment ● • Provide meeting places for community and religious groups • Reopen government facilities and provide access to social services ●● • Reopen priority resources ●●●	• Supply chain restoration ●●	• Provide power to priority resources ●● • Provide power to functional needs users ● • Resume normal operations (90%) ●	• Provide prioritized restoration of clean water to critical, large facilities and residences ●●●● • Restore wastewater processing facility operations ●●	• TV, cable ▪ Local resources, news, information
4-36 Months	• Preserve local industries ●	• Restore major thoroughfares ●●		• Restore potable water infrastructure ●●●	• Normal operations ●

The breakout group reconvened on the second day of the workshop, focusing on vulnerable populations. Disasters can create vulnerabilities within groups, but often times, disasters exacerbate vulnerabilities that previously existed.

The group discussed what characteristics make populations vulnerable during and after a disaster event. As shown in Table 18, people/groups that lack mobility, protection, resources, finances, secure shelter, and/or situational awareness can be more vulnerable than others.

Table 18. Characteristics of Vulnerable Populations

Vulnerable Populations
Characteristics
• Unable to live their life as usual • Physically vulnerable to the event • Lack of mobility, protection, resources, finances • Lack of a secure shelter • Lack of information/knowledge/situation awareness • Functional limitations • Lack of trusted leader/source • Access to conflicting information • Medical dependency • Attachments/responsibilities • Fear of authority, disorientation

The group used these traits to identify groups of people that may be vulnerable after disaster events. For example, the participants thought that children could be vulnerable after disasters because they have little/no experience with disaster events, rely on their parents or authority figures for directions, and have not fully developed physically, mentally, or emotionally. Participants also identified those with medical needs as potentially vulnerable, if after an event, they require special medical assistance that is not available within the community. Renters were also identified as potentially vulnerable after an event, since they may rely on the landlord/home owner to make decisions on home repairs and restoration.

8. Breakout Session #5: Disaster Resilience Standards Panel Charter

Ms. Nancy McNabb (NIST) provided an overview and background of the Disaster Resilience Standards Panel (DRSP), pointing out that the framework is designed to be implemented as a community-based approach to resilience rather than a hazard or sector-based approach. The DRSP charter was initially based on the Smart Grid Interoperability Panel charter, but has been modified to include comments received from earlier workshops. The DRSP will take ownership of the framework and develop model resilience guidelines to achieve the goals. The panel will inform NIST of research needs and will work with standards and codes developing organizations to include more resilience in the codes. Ms. McNabb showed the conceptual model and noted that the panel will be formed in June 2015.

One participant suggested that to be effective and to engage the folks who create standards, the panel needs to have groups or individuals involved with economics.

Ms. McNabb responded to the question of what will happen as a result of this group (the DRSP), noting the panel will provide guidance, access to resilience information and work to coordinate resilience stakeholders, i.e. engineers, economists, building officials, etc. The panel will identify gaps in codes and standards and may suggest enhancements. The group thought that the panel should ensure there is a consistent set of metrics (definitions) between sectors.

The group suggested a vision statement: "the panel creates a process to encourage and support resilience, identify impediments and gaps and initiate closing the gaps." The participants felt the objectives of the DRSP should include:

1. Set priorities
2. Identify/develop disaster resilient standards
3. Develop/update disaster resilience conceptual model (performance and recovery goals)
4. Develop and maintain a disaster resilient knowledge base
5. Adopt, maintain and update the framework
6. Develop and implement guidance to assist communities to utilize the framework
7. Establish clear and consistent definitions

Model guidelines will be developed by standing committees comprised of different sectors and the Disaster Resilience Coordinating Committee will ask the standing committees to develop guidance documents and create multi-sector subcommittees or work groups to address interdependencies. The panel will approve documents that are approved by the Coordinating Committee. Chairs of the standing committees will sit on the Coordinating Committee

Activities to Meet Mission and Objectives

The participants brainstormed to develop what activities would need to be taken by the DRSP to meet its mission and objectives. The participants summarized the activities into the following list:

1. Develop priority action plans including a gap analysis, definition of resilience metrics, data, and tools.
2. Define terms common among groups (i.e., consistent terminology)
3. Review and update the framework as needed to adapt to changing technologies, climate change, and the economic environment
4. Collect data to improve modeling future events
5. Establish criteria to decide how the panel will recognize standards, best practices, etc.
6. Plan for implementation (incentives) to adopt resilience (e.g., insurance incentives)
7. Bring outside stakeholders together to provide information to assist prioritization
8. Establish why people should join the panel
9. Develop a decision tree describing the implementation of the framework

10. Develop a method for resolving conflicts and addressing differences (among standing committees)
11. Develop criteria for inclusion and establishing a system for organizing the knowledge database
12. Develop templates (e.g., disaster recovery policies) to help communities develop their own plans.
13. Identify current level of resilience and what to implement to improve resilience.

Governance Principles

The participants developed governance principles of the DRSP as openness and transparency, balance of stakeholders, harmonization, and consensus. The following summarizes the main points/considerations for each governance principle:

Openness and Transparency

1. All meeting minutes posted on the internet
2. All meetings open to the public
3. All information as to how decisions were made will be publically available

Balance

1. For voting, no interest group is allowed to dominate the DRSP or the standing committees. Working groups do not need to be balanced because they will be asked to provide information specific issues or technical matters.
2. Every sector will have representation on the DRSP
3. The DRSP and standing committee members must be geographically balanced
4. Each committee must achieve balance.

Harmonization

1. Publish terms and definitions for consistency throughout the document
2. Avoid gaps, overlaps and conflicts with other resilience guidance
3. Develop mechanisms to respond/resolve conflicts and address differences
4. Ensure decisions are relevant to current markets, existing technologies and current regulations

Consensus

1. Valid votes will require a sufficient number of votes (e.g., 2/3 for a quorum) and a certain % (e.g., 50%) of valid votes. Exact numbers were not determined.

Disaster Resilience Coordinating Committee (DRCC)

The participants felt that a Disaster Resilience Coordinating Committee (DRCC) should be formed to oversee and coordinate between the standing committees of the DRSP. As illustrated in Figure 4, the participants felt that there should be standing committees for the communications and information sector, power/energy sector, transportation sector, buildings and facilities sector, water and wastewater sector, data, metrics and tools, social and economic goals, and a nominating committee.

To oversee and govern/lead these standing committees, the participants felt the DRCC will have the following responsibilities:

1. The DRCC will have the authority to create, dissolve and combine standing committees
2. Each standing committee chair (or another designee appointed by the standing committee) will serve on the Disaster Resilience Coordinating Committee.
3. Members will approve standing committee products and provide recommendations to the full panel for ratification of a standing committee document.
4. The DRCC has the power to create combined standing committees to address interdependencies or other issues that need to be resolved

5. The DRCC will be responsible for coordinating the standing committees' work, e.g., building and infrastructure standing committees
6. The DRCC can authorize standing committees to create subcommittees.
7. The DRCC will create and define community resilience guidelines including lists of standards or recommended thresholds to implement actions to enhance community resilience.
8. The Standing Committees will have the power to create working groups.

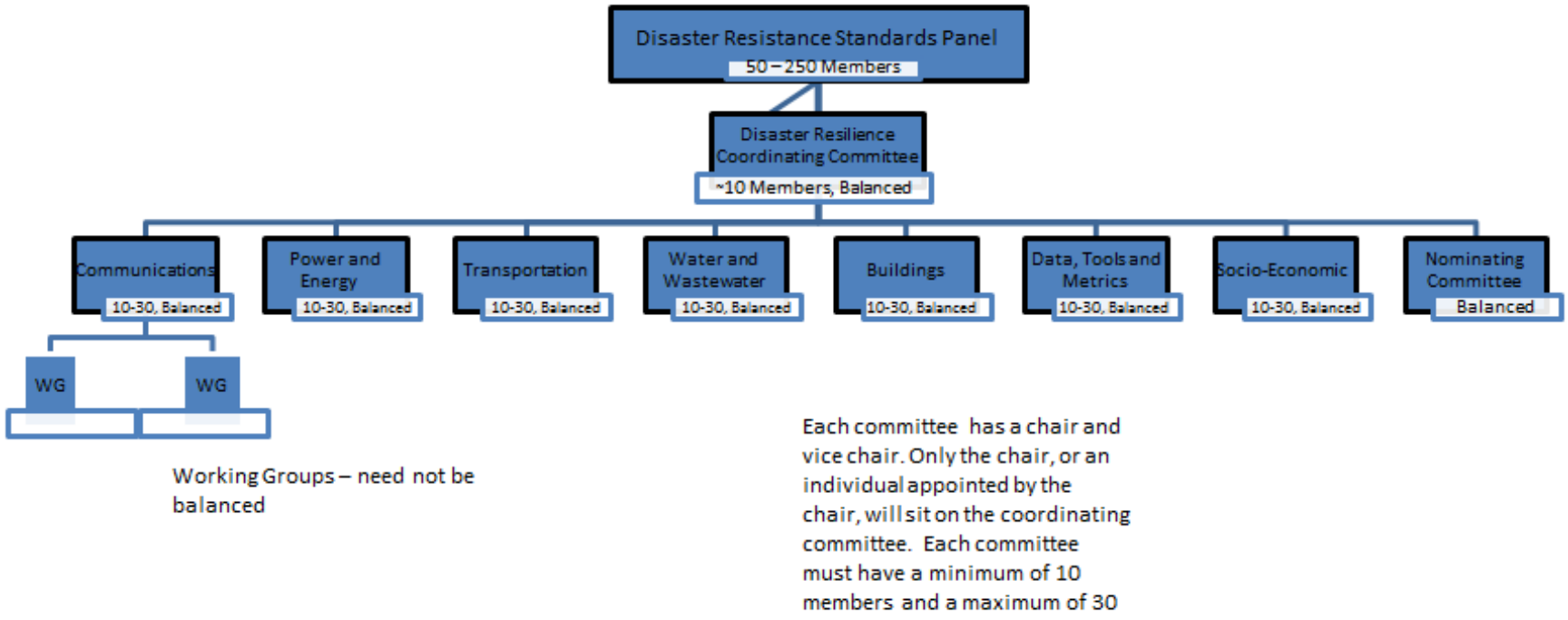

Figure 4. Participants Proposed DRSP Structure

9. Morning General Session – October 28, 2014

The morning plenary session on the second day of the workshop began with remarks from Mr. Chris Poland regarding the interdependencies of buildings and infrastructure systems.

Summary of Mr. Poland's Remarks

Typically, we think about resilience within the silos of our individual sectors. However, we need to consider how our communities function as a system, which makes the interdependencies of buildings and the infrastructure systems needed to support them an important consideration. Furthermore, we also need to consider the interdependencies within those infrastructure systems so they can function and support each other.

In the 50% framework draft, you see example performance goals. This slide [slide 3] shows an example of performance goals tables for the buildings sector. The next slide [slide 4] shows a plot of restoration times for San Francisco for a scenario earthquake. As can be seen, the San Francisco community wanted some buildings to be 90% functional immediately after an event occurs. However, that means they will need to recover the functionality of some of the other sectors more quickly.

The 50% draft of the framework considers interdependencies using the performance goals tables. In each sector chapter, we present example community performance goals as seen here [slide 5] for the water and wastewater sector. You can see that the worst case of the performance goals for a given building cluster translates directly to the performance goals in Chapter 3 [slide 6]. So, using the summary matrix, you can see how the interdependencies play a role in recovery times. For example, if a community determines that they want 90% recovery of the buildings for critical facilities to be functional immediately, after a disaster, but power/energy is not restored for 8-12 weeks, we know that they will need to develop solutions to close that gap in functionality.

Now, we understand that everything will not change overnight. Changes to infrastructure systems take time and funding. However, understanding the interdependencies within the built environment provides opportunities for communities to better define their performance goals, develop options for providing temporary services, and plan for upgrades to the utility system. Communities can use their performance goals and assessment of their infrastructure to identify solutions for both the short and long term, and use long term reconstruction opportunities to move toward/achieve their performance goals.

Following Mr. Poland's remarks on interdependencies, the lead facilitator, Ms. Katie Jereza of Energetics Inc., led a discussion of all participants about the interdependencies of the sectors. During the afternoon of the first workshop, each sector discussed their dependencies on other sectors in terms of needs within three phases: Phase 1) Response (0-3 days); Phase 2) Workforce (1-12 Weeks); and 3) Community (4-36+ Months).

The buildings sector breakout group presented its dependencies first. Within the first phase, participants felt that the most important building sector dependencies were:

- Water (including for steam) for critical facilities such as hospitals and emergency responder facilities
- Communications infrastructure so Emergency Operations Centers can be contacted by those in need
- Roadways to get from one building to another, particularly critical facilities.

The participants also felt buildings were needed in the recovery phase for emergency care, food and medical distribution system, and pet shelters. In the second and third recovery phases, participants in the building sector breakout group felt the dependencies on other sectors were the same. Specifically, they felt the most important dependencies were:

- Power for critical facilities because emergency power is typically required for only 72 hours after a disaster event
- Potable water and water for fire suppression for any building
- Debris removal for transportation so people can return to school, work, and get from point A to B

The power/energy sector group followed with a discussion of their dependencies on other sectors. During the first recovery phase, participants in the power/energy breakout group felt the most important dependencies were:

- Transportation so that repair crews can access sites causing outages
- Communication and information infrastructure for command and control of operations, and telemetry
- Communication and information infrastructure for coordinating response and recovery processes

Participants in the power/energy sector breakout group felt the first two points listed above were needed in all three phases of recovery. However, in the second phase, the group felt the National Guard may be needed for support if there is an extreme event. Participants also felt that for energy, a timeframe of 1-4 weeks may be more appropriate for the second recovery phase. Beyond four weeks after the event, participants in the energy breakout group felt long-term resource management and major asset reconstruction/replacement were the primary needs.

The water and wastewater systems breakout group followed. The water and wastewater participants felt the most important during the recovery phase dependencies were:

- Electricity for treatment processes
- Electricity for pump stations to function
- Transportation systems, namely roads, highways, and bridges, for ingress of emergency equipment and parts

When the breakout group considered the second recovery phase, it felt the most important dependencies of the sector changed to:

- Power to ensure water quality testing can be conducted properly
- Communications and information systems to ensure communication between treatment plants, pump stations, tanks, etc.
- Transportation systems for access to system for water quality monitoring

The water and wastewater breakout group also felt the most important dependencies on other sectors for the third phase of recovery were different than previous phases. The group felt the most important dependencies on other sectors during the third recover phase were:

- Housing recovery to support fees/bills
- Smaller, less-critical buildings/businesses up and running

Communication and information systems breakout group participants felt the sector's most important dependencies were the same regardless of the recovery phases. However, the group did feel that other issues should be considered in the longer term. The communication and information systems breakout group felt the key dependencies for the sector were:

- Power, otherwise nothing else works within the sector
- Transportation for repairs crews to assess damage and make repairs to the infrastructure system
- Access, fuel, and security to enable service providers to do their jobs

Though the group identified these three issues as the most important dependencies, they also noted that other considerations are important for the longer-term. Specifically, changes in regulations (e.g., zoning) could allow improved resilience of the infrastructure systems, and planning for evacuation routes and

critical infrastructure so service providers can work with communities to improve capacity in areas that have large demands in disaster scenarios.

The transportation sector breakout group followed the communication and information sector group. Participants in the breakout group identified the most critical dependencies for transportation in the first recovery phase as:

- Power/energy in the form of fuel for automobiles and to be able to pump from gas stations
- Water supply for airports and other transportation hubs for fire suppression and consumption
- Communication and information systems (telephone and internet) to relay information about traffic routes, as well as to coordinate with emergency repair personnel

Breakout group participants felt the most important dependencies of the transportation sector second recovery phase changed to:

- Power to systems and transportation facilities
- Debris removal
- Damage assessments and bridge inspections.

Participants felt these three dependencies were important during the third recovery phase as well. However, they also noted that ensuring the workforce could be rebuilt, and construction/rehabilitation of transportation facilities was essential for long-term recovery and becoming more resilient.

The final breakout group to present their dependencies was the social systems participants. Participants felt that the most important dependencies for a community's social systems during the first recovery phase were:

- Emergency and temporary housing for citizens who are displaced
- Power for all critical facilities to be operational
- Reliable communications for 9-1-1, first responders, and information on status of family members

During the second phase of recovery, participants felt the most important dependencies on the built environment changed to:

- Opening of prioritized buildings, such as hospitals, schools, daycare facilities, grocery and hardware stores, nursing homes, and government facilities
- Prioritized restoration of clean water, and wastewater infrastructure for critical facilities
- Transportation sector to restore the supply chain

The social systems breakout group felt these dependencies remained largely the same for the third recovery phase. However, participants also noted that restoration of potable water/wastewater infrastructure was a key dependency for the long-term.

After each group presented the dependencies it felt were most important for its sector, there was some discussion about the dependencies and why they were selected. Following the discussion, participants re-convened with their breakout groups to discuss the dependencies presented by the other sectors. Groups then used these interdependencies to assess whether the expected performance of their sector was sufficient or if more advanced performance goals would be necessary.

10. Closing General Session

The closing session was led by Mr. Cauffman, who invited a representative from each breakout group to summarize the main points discussed during the 2-day workshop.

Buildings sector participants felt the challenge of hazard neutrality needs to be further discussed. The group also saw a need to consider differences in construction (old vs. new), and region of the country. Incentives to encourage resilience also must be addressed for the framework to be successful. Building sector breakout group participants also felt that transportation is a key dependency to be considered for businesses because without transportation, employees cannot return to work, shop, and distribution of goods may be delayed or impeded.

When considering performance goals in the framework, the power/energy sector felt that adding another cluster of "critical industry" should be considered. Breakout group participants felt that communities should strive for more advanced performance goals for energy/power than presented in the 50% draft framework example to support building clusters and other infrastructure systems in their recovery. The group also discussed the need to coordinate with transportation sector SMEs the regarding pipelines/fuels.

The water and wastewater sector breakout group discussed the challenges associated with routing fire suppression to critical facilities only. In the participants' experience, either the entire system works or nothing works. The group also discussed the challenges of communities that are near to those impacted by a disaster event. Since water systems are not always confined within the borders of an individual community, water supply to a community not directly impacted by the disaster may be cutoff. With regards to the wastewater infrastructure, the breakout group discussed the need for good relationships with regulators to discuss flexibility during emergency situations. In terms of the example performance goals presented in the 50% draft framework, the breakout group discussed, after the dependencies discussion in the morning plenary, that the dependence of the power/energy should be considered by communities in setting their performance goals for some water source elements.

The communication and information systems breakout group felt the example performance goals tables need to be reorganized so they more accurately depict the systems. The categories they developed were: 1) Core – geo-redundant buildings that house equipment and data critical to service providers businesses; 2) Central Offices – buildings that house critical equipment and switches/exchanges that allow customers to connect to one another; 3) Distribution nodes – switching nodes/hubs and cell towers that distribute to the last mile of the communications system; and 4) Last mile – the portion of the systems that connects to each individual customer. One of the other key concepts that the breakout group felt was important for resilience was the need to coordinate with community planners to understand where evacuation centers and routes are going to be so that additional capacity can be implemented by service providers in these areas for when a disaster event occurs. The participants also emphasized the need for service providers and owners of critical facilities to work together to provide redundancy in their services.

The transportation sector breakout group felt a separate performance goals matrix needs to be developed for pipelines. The group also discussed adding military airports to the list of critical infrastructure. The group felt that the sector needs tools that allow changes in weather conditions and future hazards, and to improve the methodologies for assessing infrastructure. After the discussion of dependencies in the morning plenary session, the breakout group discussed that communities need to ensure that transportation be available with 0-3 days after a disaster event to support recovery of buildings and other infrastructure sectors. The group noted that performance goals would vary by community based on several factors, including the type of hazard identified for that community.

The social systems breakout group followed with an interesting discussion of whether the social performance goals of a community should focus solely on the social systems that could be influenced by government/public policy because other critical systems, such as schools and healthcare could fall outside the public domain. Participants felt that defining the 0^{th} hour for different types of events, such as

droughts, can be difficult. The group felt a pre-0th hour may be needed. Considering the second phase of recovery, i.e., the workforce phase, communities must define what normalcy is when setting performance goals. The breakout group also discussed special considerations for many different types of vulnerable populations within their communities.

One key takeaway from the Community Resilience Planning breakout group was that each community is different in how it is defined and how it prepares/plans for disaster events. The breakout group felt that each community needs an established leader and initiating body to ensure success in implementing the framework. Participants also felt there are key principles communities need to consider to become more resilient, including better planning, funding programs used as incentives, education on avoided costs, building above current code requirements, and developing cost-effective methods to achieve resilience. There was also discussion about ways to implement and integrate disaster resilience plans into long-term planning for a given community. The group felt communities need to be more proactive, rather than reactive, in planning for disasters. The framework needs to continuously evolve as we learn more about implementation. Participants also felt the framework needs to do a better job of including both urban and rural communities.

The same breakout group also discussed tools and metrics used to measure resilience and recovery. The group felt models are needed to: 1) Evaluate economics of post-event recovery; 2) Perform cost-benefit analysis on incorporating resilience into buildings and infrastructure systems; 3) Measure the level of redundancy and understand interdependencies; 4) Evaluate recovery plans; and 5) Evaluate scenario events.

The Disaster Resilience Standards Panel Charter breakout session discussed outcomes of the workshop. The group worked on a draft charter directly to modify language and concepts to include in the mission and vision statements of the DRSP. Within the breakout group, participants also worked to identify the governance principles that should be established for the DRSP, including openness/transparency, balance between stakeholder groups, consensus decisions, and harmonization. The group worked to identify a structure that would be appropriate for the DRSP. Participants agreed that a Disaster Resilience Coordinating Committee (DRCC) should be formed to oversee and coordinate between several standing committees, focusing on different areas important to community disaster resilience. Each standing committee would then have working groups to focus on making advancements within each sector for a future draft of the framework, model resilience guidelines, recommendations for codes and standards development, etc. The standing committees envisioned by the breakout group participants included those for:

- Building and Facilities Sector
- Transportation Sector
- Power/Energy Sector
- Communication and Information Sector
- Water and Wastewater Sector
- Data, Metrics and Tools
- Social and Economics
- Nominating Committee