

AN ASSESSMENT FOR INCREASING COMMUNITY NATURAL DISASTER RESILIENCY THROUGH THE
AIRPORT'S ROLE BEFORE, DURING, AND AFTER NATURAL HAZARDS AND DISASTERS

By

Joshua Vertalka

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF URBAN AND REGIONAL PLANNING

Urban and Regional Planning

2012

ABSTRACT

AN ASSESSMENT FOR INCREASING COMMUNITY NATURAL DISASTER RESILIENCY THROUGH THE AIRPORT'S ROLE BEFORE, DURING, AND AFTER NATURAL HAZARDS AND DISASTERS

By

Joshua Vertalka

Airports today are serving multiple functions including: passenger enplanement, cargo operations, and military flights. The operations of such functions are hyper-sensitive to an airport's ability to maintain a state of operational normalcy, of which is dependent on an airport's potential to not become disrupted from external forces. One example of an airport experiencing external disruptions that decrease operational function includes severe weather events. These disruptive weather events can range from fog and snowfall to tornadoes and hurricanes. Therefore, before, during, and after the time of a disruptive weather event, the airport has the potential to become operationally paralyzed. When such paralysis ensues, it could alter the role of the airport before, during and after a disaster. Despite numerous research pieces being focused on airports' in-flight operational status during normal and adverse weather conditions very little has been discussed about airports' operational role before, during, or after a severe weather event. Research needs to be focused on what the airport's role is before, during, and after a disaster and how that role can be internally and externally strengthened by adapting its operational procedures and infrastructure components from the effects of extreme weather conditions by establishing a grounded theory of airport resiliency or lack thereof.

Copyright by
JOSHUA VERTALKA
2012

*Dedication to
My Father, Late Mr. Randy Vertalka
My family, Mrs. Terri Vertalka-Good, Mrs. Alaina Vertalka-Maidens, and Ms. Alexis Vertalka
My Family and Friends*

ACKNOWLEDGEMENTS

I cannot begin to express the joy of writing this portion of my thesis but I will try with eternal gratitude. When looking back at the entire process, I think I may have learned more about myself than the actual subject, not to say I have not learned about the subject or the processes of research. So, for that, I am also forever grateful. I would like to use the following space to provide a more personal thank you.

To my mother, *Terri Vertalka-Good*, I thank you for your support in all of my life decisions. Without, it would have been a long and painful ordeal. To my two sisters, *Alaina and Alexis Vertalka*, I cannot even begin to thank you for numerous memories of laughter you bought me when times were difficult.

Next, I would like to thank my advisor, *Dr. Eva Kassens-Noor*. I cannot image the frustrations you have gone through while reading some of my drafts or me missing deadlines and for that I am sorry. More thankfully though, I am glad you let me explore the subject as I felt fit. It is through this exploration that I discovered a lot about the subject and how and what I want to research. Thank You!

To *Dr. Mark Wilson*, thank you for encouraging me to study abroad in Asia. It was one of the best things I have done in my life and will never forget it. You have now given me the traveling bug virus, thank you.

Next, I would like to thank other members of my graduate committee of *Dr. Rene Hinojosa* and *Dr. Lifeng Luo*. The knowledge each of you holds is highly respected by me. More importantly is how you express that knowledge with me. Weather it is the excitement in Dr.

Hinojosa's intriguing questions and ideas about my methodology or Dr. Luo's joy of describing extreme weather events. I thank you all for sharing your exciting knowledge.

My dearest friends, the joys and pitfalls we have shared together in the last few years will never be forgotten. Whether it is in the lab goofing off in the attempt to forget the amount of work to be completed, an approaching thesis deadline, or going to football games and eating wings; a special thank you *Andy LeMarbe, Ankur Desai, Ali Lahouti, Federico Steinvorth, Lulu Shi, and Huijing Geng*.

To my study abroad peeps and especially *Eric Philips* and *Andrew Baglini*, thank you for such a great adventure. I can't image Asia without you guys.

Finally, thanks to all the colleagues who made my experience at Michigan State University enjoyable and memorable. Our interactions and adventures will always be in my heart and memories; especially *Pat Daughenbaugh, Valerie Geyer, and Robin Rennie* for the delicious chocolate and wonderful conversations.

Once Again,

Thank you
Danke
Kamsahamnida
Dhanyawaad
Xie xie
Gracias
Sapas

TABLE OF CONTENTS

LIST OF TABLES	xi
LIST OF FIGURES	xiii
Chapter-1 INTRODUCTION.....	1
1.1 Introduction.....	2
1.2 Need Statement	3
1.3 Research Questions.....	3
1.4 Research Goals and Methods.....	5
1.5 Research Benefits and Contributions.....	6
1.6 Chapter Summary.....	7
1.7 Research Outline	7
Chapter-2 LITERATURE REVIEW	11
2.1 Introduction.....	12
2.2 Defining Risk	12
2.2.1 Vulnerability	13
2.2.2 Hazard Exposure	15
2.2.3 Adaptation	16
2.2.4 Resiliency	18
2.3 Defining Disasters.....	19
2.3.1 Tornadoes	19
2.3.2 Blizzards	23
2.3.3 Hurricanes.....	24
2.4 Increase in Disaster Costs.....	29
2.5 Airline Regulation, Airports, and Definitions	30
2.5.1 Airports Introduction.....	30
2.5.2 Classes of Airports	31
2.5.3 Commercial Aviation Airports	32
2.5.4 General Aviation Airports.....	33
2.6 Aviation Fragility from Hazards and Countermeasures	33
2.6.1 National Response Plan	35
2.6.2 Transportation Security Administration Authority in Decreasing Hazard Fragility.....	36
2.6.3 Federal Emergency Management Agency in Decreasing Hazard Fragility.....	38
2.6.4 Federal Aviation Administration’s Role in Disaster Prevention	39
2.6.5 Other Agencies Responses to Disaster	40
2.7 Defining Critical Infrastructure.....	41
2.7.1 Geographically Critical Infrastructure	41
2.7.2 Technologically Critical Infrastructure.....	43
2.8 Critical Infrastructure of Airports.....	43
2.9 Disaster Shelters and the Airport.....	44

2.10 Chapter Summary.....	47
Chapter-3 Methods.....	48
3.1 Introduction.....	49
3.2 Theoretical Background on Qualitative Data and Grounded Theory	49
3.3 Bartlett and Payne’s Method for Grounded Theory	50
3.4 Collecting Data through Interviews	52
3.4.1 Determining Research Profile.....	52
3.4.2 Determining Research Participants	53
3.4.3 Determining Questions for Research Participants	55
3.5 Saturating Data from Research Participants	56
3.5.1 Open Coding and Data Saturation Procedure	57
3.6 Axial Coding from Saturated Categories	58
3.6.1 Defining Categories through Revised Code and Identifying Meaning	59
3.6.2 Theoretical Sampling	60
3.6.2 Axial Coding the Dataset	61
3.7 Pre – Grounded Theory Analyzes.....	62
3.8 Grounding the Theory	62
3.8.1 Theoretical Integration from the Axial Coding.....	63
3.8.2 Grounded Theory Data Analyses.....	64
3.9 Research Rationale.....	64
3.10 Limitations to the Methodology	65
3.11 Chapter Summary.....	65
Chapter-4 RESULTS	67
4.1 Introduction.....	68
4.2 Pre-Grounded Theory Analysis Results	68
4.2 Research Participant Profile	69
4.3 Transcribing the Interviews.....	71
4.4 Developing Open Coded Categories	71
4.5 Saturated Data	73
4.6 Revised Codes and Axial Coding.....	79
4.7 Theoretical Integration on the Role of the Airport using Axial Coding.....	86
4.7.1 The Airport’s Relationship with the Community in Hazardous or Disastrous Events ..	86
4.7.2 Research Participant’s Perspective on the Airport for Evacuation	90
4.7.3 Research Participant’s perspective on the Airport as a Shelter	93
4.7.4 Research Participant’s Perspective of the Airport as a Staging Area Following the Hazard.....	95
4.7.5 Research Participant’s Perspective of the Airport’s Critical Infrastructure	98
4.7.6 Research Participant’s Overall Perspective on the Airport	102
4.8 Government Agencies Role Airport Operations	106
4.8 Views of the Airport’s Role based on the Perspectives of Consultants, Airport Officials, and Government Officials	108
4.9 Grounded Theory Generation	111

4.10 Chapter Summary.....	115
Chapter-5 DISCUSSION	116
5.1 Introduction.....	117
5.2 The Airport’s Role Before, During, and After a Hazard or Disaster	118
5.2.1 The Airport’s Current Role Before a Hazard or Disaster	118
5.2.2 The Airport’s Current Role During a Hazard or Disaster	119
5.2.3 The Airport’s Current Role After a Hazard or Disaster	119
5.3 Adaptation Avenues for Airports	120
5.3.1 Adaptation when a Hazard Approaches.....	120
5.3.2 Adaptation during a Disaster.....	122
5.3.3 Adaptation after the Occurrence of a Hazard or Disaster.....	123
5.4 Affiliations with the Airport	124
5.4.1 Federal Emergency Management Agency and Airport Operation Groups	125
5.4.2 State and Local Government	126
5.4.3 Airline Companies.....	126
5.5 Local Government Affiliation Logistics with Airports.....	127
5.5.1 Recovery Logistics.....	127
5.5.2 Evacuation Logistics.....	130
5.5.3 Infrastructure Reuse	131
5.5.4 Airport Shelters.....	132
5.6 Adapting Different Types of Airports	133
5.6.1 Different Classes of Airports.....	133
5.6.2 General Aviation Adaptation	134
5.6.3 Commercial Aviation Adaptation	135
5.7 Creating adaptation: A Step-by-Step Approach.....	136
5.8 Limitations.....	140
5.9 Chapter Summary.....	141
Chapter-6 CONCLUSION.....	142
6.1 Introduction.....	143
6.2 Research Benefits.....	143
6.3 Planning Lessons	143
6.4 Transitioning Mindsets to View Infrastructure Multilaterally	145
6.5 Adaptation Measures	146
6.6 Future Areas of Research	149
APPENDICES	150
Appendix A - Interview Participant Consent Form.....	151
Appendix B – Code Book	153
Appendix C - Coded Interview for 1	158
Appendix D - Coded Interview for 7.....	172
Appendix E - Coded Interview for 11	183
Appendix F - Coded Interview for 4	193

Appendix G - Coded Interview for 4.....	206
Appendix H - Coded Interview for 6.....	217
Appendix I – Coded Interview for 9	228
Appendix J – Coded Interview for 10	237
Appendix K – Coded Interview for 2	253
Appendix L – Coded Interview for 8.....	262
Appendix M - Coded Interview for 4.....	273
Appendix N – Coded Interview for 12.....	284
Appendix O – Coded Data Input.....	297
REFERENCES	336

LIST OF TABLES

Table 2.1 – A Matrix of Adaptation Approaches	17
Table 2.2 – Well Known Hurricanes.....	29
Table 3.1 – Research Participant Profile	54
Table 3.2 – The “Is” Questions.....	55
Table 3.3 – The “Should” Questions	55
Table 4.1 – Research Participant Profile	69
Table 4.2 – Open Coded Categories.....	72
Table 4.3 – Open Coded Categories for the Current Role of the Airport	72
Table 4.4 – Open Coded Categories what needs to be the Role of the Airport	72
Table 4.5 – Revised Coded Categories for Research Participants	80
Table 4.6 – Initial Interviews with Revised Code (Axial Code Group 1).....	83
Table 4.7 – Second Set of Interviews with Revised Code (Axial Code Group 2).....	84
Table 4.8 – Last Set of Interviews with Revised Code (Axial Code Group 3)	85
Table 4.9 – Research Participant’s Perspective on the Airport and Community Relationship in Times of Hazards or Disasters.....	87
Table 4.10 – Research Participant’s Perspective on the Airport and Community Relationship Before, During, and After Hazards or Disasters.....	88
Table 4.11 – Research Participant’s Perspective on the Airport for Evacuation.....	91
Table 4.12 – Research Participant’s Perspective on the Airport for Evacuation Before, During, and After a Hazard or Disaster.....	92
Table 4.13 – Research Participant’s Perspective on the Airport as a Shelter	93
Table 4.14 – Research Participant’s Perspective on the Airport as a Shelter Before, During, and After a Hazard or Disaster.....	94
Table 4.15 – Research Participant’s Perspective on the Airport as a Staging Area Following the Hazard	96

Table 4.16 – Research Participant’s Perspective on the Airport as a Staging Area Before, During, and After a Hazard or Disaster	97
Table 4.17 – Research Participant’s Perspective on the Airport’s Critical Infrastructure	100
Table 4.18 – Research Participant’s Perspective on the Airport’s Critical Infrastructure Before, During, and After a Hazard or Disaster	101
Table 4.19 – Research Participant’s Perspective on the Airport’s Operations.....	103
Table 4.20 – Research Participant’s Perspective on the Airport’s Operations Before, During, and After a Hazard or Disaster	104
Table 4.21 – Research Participant’s Perspective on Government Agencies in times of Hazards and Disasters	107
Table 4.22 – Consultant’s Perspective on the Role of the Airport	109
Table 4.23 – Airport Official’s Perspective on the Role of the Airport	110
Table 4.24 – Government Official’s Perspective on the Role of the Airport	111
Table 6.1 – Adaptation Measures for Airport Officials	147
Table 6.2 – Possible Adaptations for Different Classes of Airports	148
Table A.1 – Question 1 Key	315
Table A.2 – Question 2 Key	317
Table A.3 – Question 3 Key	319
Table A.4 – Question 4 Key	321
Table A.5 – Question 5 Key	323
Table A.6 – Question 6 Key	325
Table A.7 – Question 7 Key	327
Table A.8 – Question 8 Key	329
Table A.14 – Statistical Output of Consultants’ versus Airport Officials’ Responses	334
Table A.15 – Statistical Output of Government Officials’ versus Airport Officials’ Responses ..	335

LIST OF FIGURES

Figure 2.1 – Tornado Alley	20
Figure 2.2 – Average Tornadoes per Year per State	21
Figure 2.3 – Tornado Totals in the United States from 1950 - 2008	22
Figure 2.4 Hurricane Points of Origin from 1944 – 2010.....	25
Figure 2.5 – Global Hurricane Tracks from 1855 – 2005	26
Figure 2.6 – Northern Hook Course for Hurricanes in the Northern Hemisphere	26
Figure 2.7 – Southern Hook Course for Hurricanes in the Northern Hemisphere	27
Figure 2.8 – Network Centrality Concept	42
Figure 3.1 – Qualitative Data Analysis Procedure	51
Figure 3.2 – The Iterative Process of Data Saturation	58
Figure 3.3 – The Iterative Process of Theoretical Samples.....	59
Figure 3.4 – The Iterative Process of Grounded Theory	63
Figure 4.1 – Saturated Code Book	74
Figure 5.1 – The Infrastructural Relationship between the Airport and Community	128
Figure 5.2 – Airport and Community Disconnect from Failed Infrastructure	129
Figure 5.3 – Airport and Community Disconnect from Non-Airport Recovery Supplies.....	130
Figure A.1 – Total Response for each Code	313
Figure A.2 – Total Responses for Question 1.....	316
Figure A.3 – Total Responses for Question 2.....	318
Figure A.4 – Total Responses for Question 3.....	320
Figure A.5 – Total Responses for Question 4.....	322
Figure A.6 – Total Responses for Question 5.....	324
Figure A.7 – Total Responses for Question 6.....	326

Figure A.8 – Total Responses for Question 7	328
Figure A.9 – Total Responses for Question 8.....	329
Figure A.10 – The Airport’s Role in Community Response	331
Figure A.11 – Average Response per Consultant	332
Figure A.14 – Average Response Differences between Government Officials’ and Airport Officials’	333
Figure A.15 – Average Response Differences between Consultants’ Vs. Airport Officials’ Responses	334
Figure A.16 – Average Response Differences between Government Officials’ versus Airport Officials’ Responses	335

Chapter-1
INTRODUCTION

“Mr. Speaker, from hurricanes and floods in Latin America to earthquakes in Asia, natural disasters are increasingly becoming a regular feature of life for large numbers of people around the globe.”

– Earl Blaumenaur

“There are two big forces at work, external and internal. We have very little control over external forces such as tornadoes, earthquakes, floods, disaster, illness and pain. What really matters is the internal force. How do I respond to those disasters? Over that I have control.”

– Leo F. Buscaglia

1.1 Introduction

Airports today are serving various functions including: passenger, cargo, and military flights and, in brief adverse weather conditions, a shelter. Despite numerous research pieces being focused on airport’s operational flight status during normal and adverse weather conditions very little has been discussed about airports’ infrastructure and operational status before, during and after adverse weather conditions. Therefore, research needs to be focused on the categories and status of airports infrastructure and operations when confronted with extreme hazardous weather conditions.

Many of today’s airports are concerned with time and cost efficiency during normal weather conditions. Likewise, airports spend a great deal of time advancing their infrastructure components to increase their logistical efficiency. Here, airports are taking for granted that their infrastructure will withstand the effects of natural hazards. To further clarify, airports are updating their infrastructure to increase on-time performance of airliners while ignoring operational infrastructure status during extreme hazards and disasters. By recognizing the potential for airports to identify and adapt their infrastructure for disaster operation, they

could provide long-term shelter during a disaster and crucial supplies after a disaster, allowing numerous lives to be saved.

1.2 Need Statement

When researching airports' infrastructure and operational vulnerabilities to hazards, this paper needs to explore how airports prepare their infrastructure and operations that protect themselves from hazardous events. By exploring the aforementioned, recommendations can be made to further protect and enhance the responsibility of airport infrastructure so that airports can provide additional roles that mitigate the onset and negative consequences of a disaster. Therefore, by further protecting the infrastructure, airports could become operational more quickly after the hazard, potentially leading to an increase in fundamental recovery supplies, such as food, water, medicine, and building materials. Additionally, protecting pieces of infrastructure may prelude the airport to act as a shelter and as a conduit for relief and recovery supplies, consequently saving lives. This scenario would be most beneficial when airports encounter extreme natural long-term hazards.

1.3 Research Questions

Natural disasters are disruptive hazards that have the potential to last several days. During this tenure, natural disasters can produce adverse environments, such as strong winds and torrential rainfall. These ill-effects can quickly deteriorate infrastructure's stability rendering expensive physical damage, potentially resulting in human loss. Emergency managers attempt to prevent human loss by evacuating an area or by providing shelters. However, due to the long duration and extreme conditions produced by such hazards, physical damage to

community infrastructure is often the recipient. Therefore, how can airports be adapted to better create a more resilient airport and community?

When natural disasters encounter airports, there is a potential occurrence for infrastructural damage and the loss of human life. As previously mentioned, natural disasters have the possibility to shut down flight operations. During this period of closure, airports may have the potential to be converted from a transportation node to a community shelter. This is often the case during brief closure periods, such as blizzard conditions, when airports temporarily house delayed passengers. However, during longer meteorological events, such as hurricanes it is unknown how effective airports can respond to that hazard as a shelter. This process is similar to residents seeking refuge in sporting venues and convention centers, as was the case in New Orleans during Hurricane Katrina (Pampel, 2008); only in this case, residents at nearby airports can seek asylum within the airport terminal. This asylum would clearly benefit residents who have structurally weak housing or are vulnerable to flooding. Therefore, can an airport shelter nearby community members that are vulnerable to the effects of hurricane? Thereby increasing community resiliency before, during, or after a hazard or disaster?

If residents near an airport can seek refuge in an airport's terminal, it could have numerous benefits for nearby residents and disaster management officials, such as lessening the evacuation traffic surge. Evacuation traffic surge could produce grid-lock highways and chaotic public transportation routes. Therefore, if residents residing near an airport can utilize that airport as a shelter, then outbound city traffic should be less congested resulting in a quicker and less expensive evacuation. Likewise, if adaptation policies are effectively enacted,

then airports can become a hub for recovery operations after a hazard passes. Additionally, if the airport could assist in the evacuation process it could lessen the traffic demand of the evacuation process. Therefore, does the airport have a role in the evacuation processes of a community before, during, or after a hazard or disaster?

Having the logistical means and variety of large cargo operations, ideally formulates the airport as a suitable recovery agent. After a hazard strikes, damage may have ensued on nearby communities, resulting in needed relief supplies. Airports are an ideal candidate to transport relief supplies from national sources. Protecting the infrastructure that assists in cargo operations will be vital to quick urban recovery. If the infrastructure that is necessary for cargo operations is not resilient to the effects of hazards, such as hurricanes and blizzards then community recovery will become more expensive in both time and finance. Therefore, how and what airport infrastructure can become more resilient to extreme hazards for disaster recovery before, during, or after a hazard or disaster?

1.4 Research Goals and Methods

This research encompasses a wide variety of adaption mechanisms, ideas, and recommendations for airports and communities. The goal of this research is to establish a grounded theory for avenues of airport adaptation to extreme natural hazards to create airport and community resiliency. This is accomplished by first, constructing an extensive literature review then recording expert opinions about what the airports' role is and should be before, during, and after a disaster. Therefore, this research produced results that:

1. Identify the airport's role before, during, and after a hazard or disaster

2. Identify characteristics of airports that provide the greatest avenues for adaptability to increase its and the communities extreme long term disaster resiliency.
3. Identify airport issues that arise when airports are actively involved in hazard or disaster scenarios.
4. Identify community issues that arise when airports are actively involved in hazard or disaster scenarios.
5. Identify the ability of the airport to act as a sheltering devise for vulnerable people.
6. Identify the ability of the airport to act as a tool for evacuations before, during, and after a hazard or disaster.
7. Identify the infrastructure necessary for the airport to be more resilient.
8. Generate recommendations on avenues for airport adaptation, which are most viable for the airport and community to achieve better extreme long term natural disaster resiliency.

1.5 Research Benefits and Contributions

The benefits presented in this research are to provide information on the likelihood of extreme weather adaptation on airports. This information entails identifying problems and avenues of adaptation for airports that will either formulate a more successful or less successful airport and community during an extreme weather hazard. By gathering and formulating the previous benefits, a grounded theory can be created as to which avenues of adaptation are likely to increase airports and communities resiliency to extreme weather hazards.

1.6 Chapter Summary

Chapter 1 provides an understanding about the need for adaptation planning for airports. It includes information on how questions regarding the need for adaptation planning will be answered through qualitative methods. By executing such methods, suitable adaptation mechanisms can be identified and fitted for airports and communities to increase their resiliency to negative effects of natural disaster. Succeeding chapters further describe this research paper.

1.7 Research Outline

Chapter 2 provides definitions about key concepts of the research including: risk, vulnerability, hazard exposure, critical infrastructure, and shelters of airports. It is reported that risk of a particular system involves identifying its hazard exposure and vulnerability. To combat risk, a concept of adaptation is presented. This concept focuses on increasing the coping capacity of a system so that when confronted with a hazard, it does not transform into a disaster. By channeling adaptation concepts towards critical infrastructure of a system, coping capacity can increase, thereby decreasing the likelihood of a disastrous outcome. If a disaster outcome does occur, this chapter discusses federal agencies' roles in disaster prevention and recovery but all fail to significantly mention airports within their framework. Therefore, information needs to be assembled for understanding the adaption extent and likelihood that airports can handle the before, during and after effects of hazards and disasters. This can be accomplished through an extensive methodology that is based on the previously stated concepts of risk and resiliency.

Chapter 3 provides a framework for executing the research. It states that the research is conducted by first determining how airports are vulnerable to hurricane hazards. Research participants were selected based on their employment sector: government, airport, or consultant and their exposure to hurricanes, blizzards, or tornadoes. Once determined, a grounded theory was constructed. The grounded theory was produced using Bartlett and Payne's (1997) approach for analyzing qualitative data to formulate a theoretical grounding. These authors suggest that the researcher use the following proceeding steps:

1. Collecting the data through interviews
2. Transcribe the data
3. Develop open coding categories
4. Saturate the categories
5. Defining categories
6. Theoretical sampling
7. Axial coding
8. Theoretical integration
9. Grounding the theory

Questions for the selected research participants involved two types of questions: "is" and "should" questions in a semi-structured, counterpoised interview process. The "is" questions provide information on the current role of the airport. The "should" questions provide information on what the potential role of the airport could be. This information was coded or categorized and saturated based on those questions and sub-categories of adaptation

concepts. Then the coded information was analyzed by finding linkages and relationships among the categories through theoretical sampling and axial coding. One qualitative method was used to provide background information on the interviews by using Dey's (1993) suggestion of a matrix to locate and determine significant variables. Utilizing the aforementioned procedures, a grounded materialized.

Chapter 4 provides the results from the analysis. There are two main views of the airport: the airport acting in an active role with communities during a disaster and the airport acting more independently. Similarly, each main discussion point within the interviews represents outcomes that dissemble information regarding not only the airport's role but additional issues involving operations, infrastructure capabilities, and vulnerabilities before, during and after a disaster, such as airports engaging communities for disaster recovery. Much of the coded information provided by the interviews also appears to be dependent on the type of occupation for each interviewee. Each one of these views has its strengths and weaknesses depending on the context of the airport and hazard they respectively encounter. It is apparent that the current role of the airport before, during, and after a hazard or disaster is to operate as an airport. However, given the right circumstances such as proper planning and infrastructure, the airport could become a more permanent tool for communities to use in disaster recovery.

Chapter 5 presents information on what the airport's role is and should be before, during, and after encountering a hazard or disaster and suitable adaption approaches. It is apparent that the airport's first objective is to become operational as quickly as possible following a hazard or disaster. However, there are multiple approaches that decrease the time

necessary for the airport to become operational. These include retrofitting and passively adapting the critical infrastructure for operations that are present in the C-139 requirements. Once operational, the airport can begin to resume normal operations. However, the airport may be able to play additional roles in response and recovery of hazard or disaster. After an assessment of the airport's infrastructure and operational capacity, the airport may be able to provide the community with recovery supplies given the necessary adaptation procedures.

Chapter 6 concludes the research topic by acknowledging various avenues government and airport officials, in addition to consultants, can utilize to increase airport adaptation. The approach for determining proper adaptation avenues is based on the class of airport and the perceived level of risk. Additionally, chapter 6 provides information on how to change the mindset of airport officials into believing their airport is adaptable. Lastly, chapter 6 leaves the reader with knowledge and questions about future research.

Chapter-2
LITERATURE REVIEW

2.1 Introduction

When discussing the impacts that a hazardous event has on something, that something will be henceforth known as “system”; a system in the sense that it encompasses a spectrum of physical and non-physical relationships, of which these relationships determine the role of the system. In this regard, the airport is a system that contains various sub-systems such as, airplanes, communication linkages, internal and external infrastructure (air traffic control tower and highway, respectively), management decisions, policy formulation and so forth. When these pieces come together, they create a functional relationship based on the sum of its parts. The degradation or failure of one of the previously mentioned components can create system failure. However convoluted or infinitely encompassing hazardous events are on a system, they can be defined in terms of their potential destruction from hazards through a concept called risk.

2.2 Defining Risk

Hazards are events that have the potential to break the capabilities of a system. For example, a thunderstorm event that produces an amount of precipitation that a system can handle (i.e, will not flood), whether that precipitation is above its normal precipitation level or not, the event is not considered hazardous. Alternatively, a thunderstorm that produces rainfall that a system cannot handle (i.e, will flood), whether that rainfall is above the normal amount or not, the event is considered hazardous. Therefore, when determining if a hazard exists, it is important to examine both the hazard event and the hazard system.

Identifying if a hazard exists requires the examination of both the event that causes the hazard and the system which receives the effects of the hazard event. By examining the event, one is studying how the natural event is increasing or decreasing in intensity whether that is through examining climate change or atmospheric stability. By examining the system, one is studying how the system is prepared for the intensity of the occurring event. Studying how a system is prepared for the intensity of an event contains many factors and the combination of those factors is known as risk.

When a system is at risk for natural disasters it is often calculated by a risk assessment. This assessment is quantitatively described by Brooks (2003) as:

$$Risk = Vulnerability \times Hazard \text{ Exposure}$$

Qualitatively this function can be described as an interaction of a system's vulnerability to the hazard directly determined by the system's exposure to that hazard, thus producing a system's overall risk. In other words, the determination of risk is functionally conditional on two independent factors: vulnerability and hazard exposure (Intergovernmental Panel on Climate Change, 2007 and Brillinger, 2003).

2.2.1 Vulnerability

If the system is left unprepared for a hazard it will be vulnerable to the negative effects created by that hazard. Vulnerability can be described as a system's susceptibility or inability to cope when encountering hazardous or atypical circumstances (Cutter, 1996). For a system to cope with a hazard, it must not receive any inoperable damage. However, if a system does receive inoperable damage, the system's coping abilities were weaker than the effects of the

hazard. Therefore, when a system can cope with the negative effects of a hazard, it will not break the system but still may cause physical or social damage (Brooks, 2003). Conversely, if a system cannot cope with the negative effects of the hazard, its normal role or function decreases or is non-existence. This is often referred to as coping capacity. For example, a system can only cope with a 2 inch storm surge but a hazard delivers a 3 inch storm surge. Then the system is likely to experience functional degradation (i.e., the system is broken) and is therefore vulnerable to 3 inch storm surges. Vulnerability can be determined by how a system receives physical and social damage from the potential negative impacts of hazards (Cutter, 1996; Cutter *et al.*, 2003; and Watson *et al.*, 1998).

The potential damages of a system encountering hazards can be described by examining the physical and social dimensions of vulnerability. The physical dimension of vulnerability refers to a system's tangible objects, of which their destruction creates direct and indirect damage. Physical damage can occur to any object, such as transportation systems, buildings, natural features, etc (Cutter, 1996; Cutter *et al.*, 2000; Brooks, 2003; and Klein *et al.*, 1998). For example, a hazard is located near a cement industrial plant. The industrial plant is vulnerable to the extreme effects of that hazard and therefore destroyed. The destroyed plant can no longer deliver the necessary cement to construction companies across the region. In this scenario, the cement industrial plant was physically vulnerable to the effects of the hazard because the tangible building was destroyed. The resulting physical damage is often determined by operational status of the system after the hazard (Brooks, 2003). When physical systems become increasingly inoperable, it often has detrimental effects on society.

Social vulnerability is concerned with specific human groups being subjected to the ill effects of a hazard (Cutter and Emrich, 2006 and Cutter *et al.*, 2003). Brooks (2003) has defined social vulnerability as the internal mechanism and forces that create operational and functional inflexibility when encountered with a hazard. In other words, some social groups can be more vulnerable to the effects of hazards than other groups. This is similar to how the physical framework of a system is vulnerable, only this recognizes personal vulnerability (Cutter, 2000). For example, when the aforementioned cement factory was destroyed by a hazard, it increased the unemployment in the area due to the inoperable status of the cement plant. In this case, the cement factory's employees would be vulnerable to the effects of the hazard. Social dimension of vulnerability are strongly but not solely related to economics status, social fabric, and political strength (Cutter *et al.*, 2003).

Often social vulnerability is associated with disadvantaged social groups that are usually in poverty and/or have physical and/or mental disabilities (Cutter, 2000). Social groups that do not have adequate financial incomes are often subject to political and mainstream society ignorance and therefore are the most exposed to hazards. These groups are often the most exposed to the hazardous effects and possess poor social frameworks for coping with the hazard. Therefore disadvantaged social groups are the most exposed to the negative aspects of hazards (Cutter and Emrich, 2006; Cutter *et al.*, 2003; and Cutter *et al.*, 2000).

2.2.2 Hazard Exposure

Hazard exposure refers to a system's likelihood of encountering an abnormal event, not the resulting impacts of the abnormal event. If a system's likelihood of encountering a

hazardous event is low, the system's overall risk will decrease and vice versa (Brooks, 2003). In most cases, hazard exposure involves the system's geographical location. For example, hurricanes are more likely to strike a coastal region than an inland region. Therefore, geographical location often dictates a system's hazard exposure, a prerequisite in determining a system's risk.

Hazard exposure is a prerequisite in determining a system's risk. In other words, hazard exposure determines if the system is likely to experience an extreme event. If the system never experiences an extreme event, its hazard exposure can therefore be numerically represented by zero. Using the zero property of multiplication, it is apparent that the overall risk would equal zero if any of the independent variables (vulnerability and hazard exposure) were zero. Therefore, it is futile to examine a system's vulnerability to a hazard if the exposure to that hazard is zero (Cutter, 1996 and Watson *et al.*, 1998). Quantitatively this can be represented by:

$$Risk = Vulnerability \times 0 = 0$$

Ideally, systems want their risk to be as close as possible, if not, zero. This can be achieved by formulating adaptation measures.

2.2.3 Adaptation

Adaptation measures are often implemented by a system to combat negative effects of hazards. This is accomplished by altering a system's physical and social coping capacity, so that a non-negative systematic response to external stimuli is achieved. More specifically, this response requires two types of sub-adaptation: passive and active. Passive adaptation is a conditional response to the effects of hazards; whereas active adaptation is an absolute

response to the effects of hazards (Bicknell *et al.*, 2009). To further clarify, passive adaptation involves individuals or groups organizing to quickly diminish the effects of hazards. Whereas active adaptation involves a long term plan that specifically calculates the necessities to reduce or eliminate the effects of hazards. In other words, passive adaptation is a reactionary response whereas active adaptation is a proactive response. Examples of these responses are shown in Table 2.1. By reducing or eliminating the effects of hazards through adaptation, systems are able to increase their resiliency to hazards.

Table 2.1 – A Matrix of Adaptation Approaches

Adaptation Approaches	Passive	Active
Physical	Using sandbags to stop a storm surge from flooding a neighborhood.	Constructing concrete barricades to stop a 4 foot storm surge from flooding a neighborhood.
Social	Telling a flood prone neighborhood an evacuation has been issued.	Having an evacuation route for a flood prone neighborhood.

For example, the Chicago fire of 1871 presents an extreme situation that involves both passive and active adaptation methods to combat the fire. In 1871, Chicago experienced a large fire that spread quickly due to buildings being composed of wood and located close to each other. Attempts to extinguish the fire with water failed, resulting in nearly 4 square miles of burned buildings and property. To avoid similar events, the City of Chicago mandated that buildings be spaced apart more appropriately and composed of different material (Cronon, 1992). The attempt to extinguish the fire is an example of passive adaption, while the enactment of building material and setback codes, proved the city actively adapted itself to the effects of the fire. The latter processes increased the resiliency of Chicago to future fires.

2.2.4 Resiliency

The resilience of a system is its ability to be physically and socially flexible when encountered by a hazard. This is different than vulnerability. As previously mentioned, vulnerability is a system's inability to cope whereas resilience is the degree to which a system can cope. In other words, resilience is the degree to which a system bends to the effects of the hazard without that bend breaking, causing physical and/or social damage whereas, vulnerability is a measurement of the amount of intensity required to break a system. Creating a bending but not breaking system is often achieved by applying various physical and social adaptations (Cutter and Emrich, 2006; Cutter *et al.*, 2000; Cutter, 1996). Therefore, resiliency measures the effectiveness of adaptation on diminishing the negative effects of a hazard (IPCC, 2007). For example, assume a system has implemented adaptation pieces to decrease its vulnerability to a hazard but yet suffered the same damage as if those adaption pieces had not been in place. Through this example, the resilience of the system has not increased because the adopted adaptation pieces were ineffective. Conversely, if a system creates adaptation policies of which the systems now suffers less damage when exposed to a hazard, then the resiliency of the system has increased and therefore less vulnerable to negative effects of hazards. When a system becomes less vulnerable, through adaptation, the likelihood of a hazard converting into a disaster also diminishes and vice versa. When adaptation is ineffective, the hazards have the potential to turn into disasters.

A disaster is a result of a hazard event that breaks the physical and social flexibility of a system's coping capacity and adaptation measures, leading to physical and social damage (Pielke and Sarewitz, 2005). For example, a system may be able to cope or bend with a storm

surge of 2 inches, but storm surges larger, will begin to break the system's resiliency i.e., floods that cause property damage. That is, storm surges larger than 2 inches may cause damages to buildings, infrastructure, people, the economy, etc. Therefore, the stronger the hazard is, the more damage that may potentially result. To further clarify, communities often plan for 100 year floods; that is, a flood of a certain magnitude that has a 1% chance of occurring every year or 100% chance within 100 years (Ward and Trimble, 2004). When flood events are beyond the 100 year flood plan, it can often break a system, potentially leading to a disaster. Likewise, the type of hazard that is present also dictates how the system needs to respond.

2.3 Defining Disasters

There are numerous types of disaster; however, there are two main categories: man-made and natural disasters. As it suggests, man-made disasters are triggered by purposeful or accidental decisions by human-beings, of which that decision creates negative effects that break a system. Such examples include: chemical spills on a freeway, terrorist attacks, or nuclear accidents. Natural disasters are events triggered by the physical interactions that define the event. For example, natural disasters can include: meteorological events, such as hurricanes, tornadoes, freezing rain, extreme temperature changes, floods, droughts, etc.; geological events such as earthquakes, volcanoes, landslides, etc; biological events, such as influenza, SARS, and yellow fever. The succeeding chapters focus on meteorological hazards including: hurricanes, tornadoes, and blizzards.

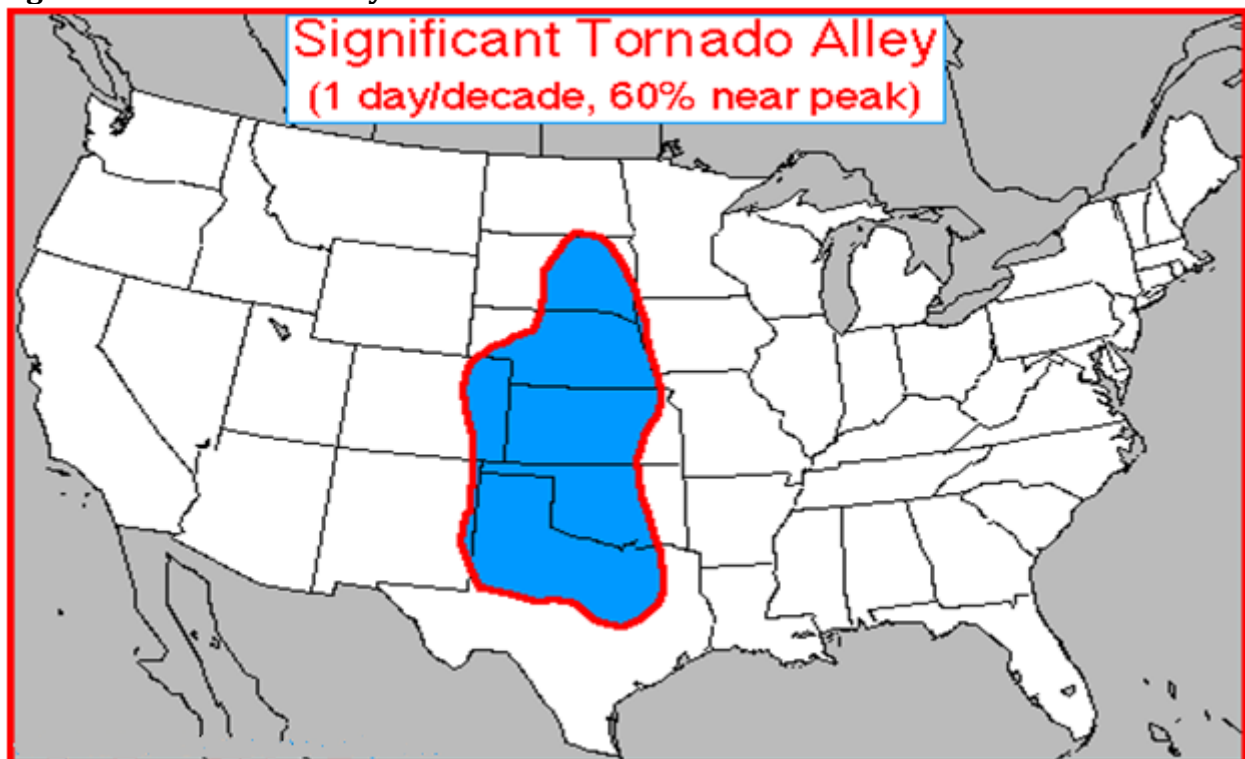
2.3.1 Tornadoes

Tornadoes are cyclonic storms that form when warm, moist air meets eastward cold air masses potentially causing violent rotations. Rising air within a thunderstorm creates rotational

air masses from horizontal to vertical direction. When these forces meet and a rotational funnel cloud forms, the damage can be catastrophic depending on strength of the tornado. Tornadoes usually form in the early spring season in the Central States of the US (National Oceanic and Atmospheric Administration, 2012). Figure 2.1, highlights tornado alley, a region frequently prone to tornadoes. However, tornadoes have the potential to form anywhere. Figure 2.2 displays the average occurrence of tornadoes in each respective state per year. The data is based on number of occurrences tornado between 1950 and 2004.

Occasionally but rarely, tornadoes can also accompany hurricanes. Globally, the United States experiences the most tornadoes.

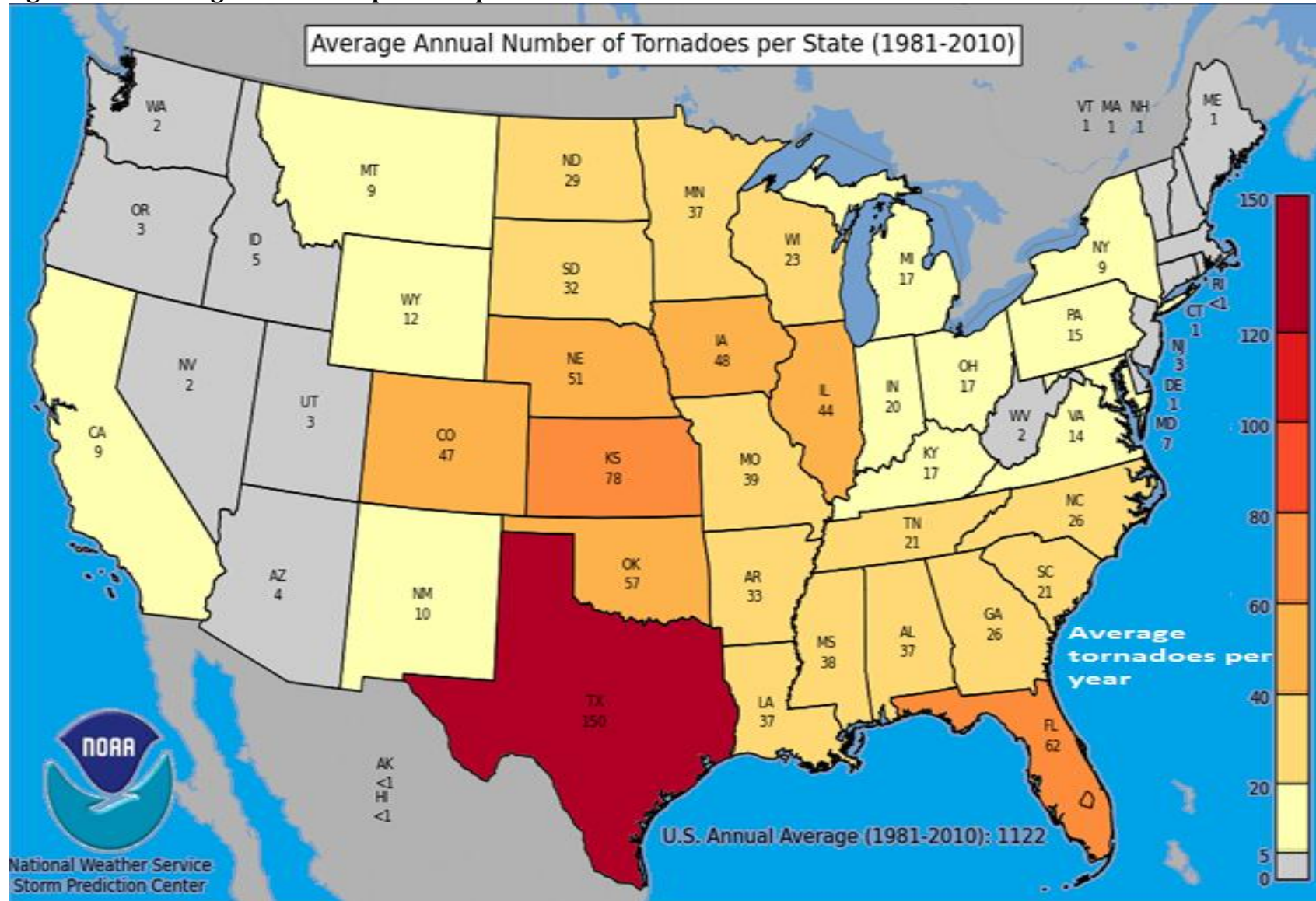
Figure 2.1 – Tornado Alley



For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this thesis.

Source: Concannon *et al.*, 2000

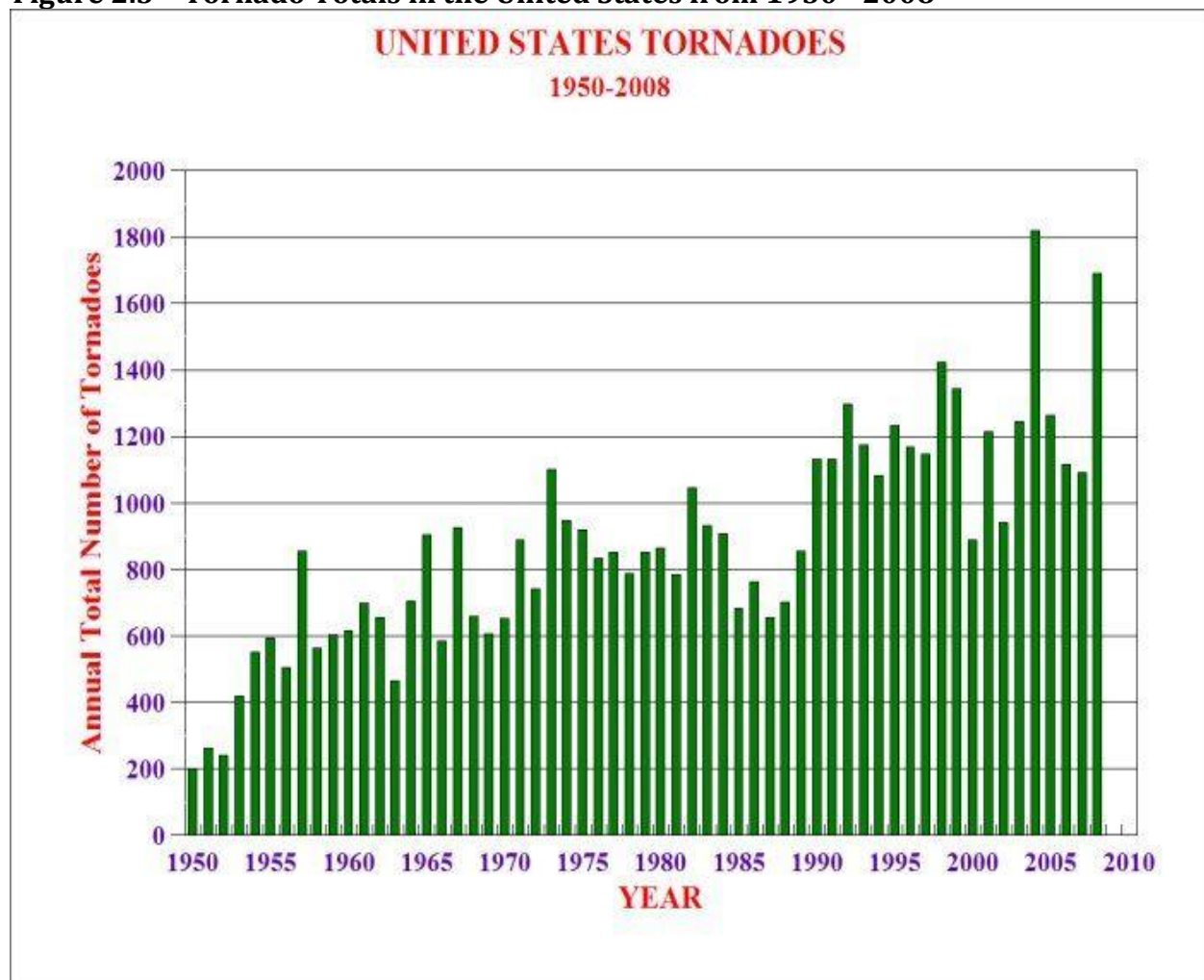
Figure 2.2 – Average Tornadoes per Year per State



Source: National Oceanic and Atmospheric Administration, 2012

Tornadoes appear on average 800 times in the nation resulting in roughly 80 deaths per year and another 150,000 injured. In comparison to hurricanes' regional destruction, damage from a tornado is more local with damage correlated to the tornado's path (Rauber *et al.*, 2008). Often, the paths of destruction can be over one mile wide and 50 miles in length. Accompanied by wind speeds of up to 250 miles per hour and surrounding homes roofs are blown off (University of Nebraska – Lincoln, 2012). Figure 2.3, displays total tornados from 1950 – 2008.

Figure 2.3 – Tornado Totals in the United States from 1950 - 2008



Source: University of Nebraska – Lincoln, 2012

While airports do not often experience tornadoes, it can occur. When such incidents do arrive, airports are reluctant to operate for fear of airplanes crashing and causing injuries or deaths (Chang *et al.*, 2005). Therefore, airports will temporarily close waiting until the storm has passed upon which damage assessments will ensue.

2.3.2 Blizzards

Blizzards may be confused with a snow storms however, blizzards are much more. Blizzards include weather activity of intense blowing snow, creating low visibility. The low visibility results not solely from the falling snow blowing but also snow on the ground blowing, essentially creating drifts (Rauber *et al.*, 2008). To quantify blizzards the National Weather Service considers blizzards as a storm with large amounts of snow or blowing snow exceeding 35 miles per hours with visibility less than 0.25 miles. The formation of blizzards revolves around low pressure gradients.

When a blizzard storm arrangement is present, there is a low pressure system that centers it, west of low pressure center the pressure is much greater yielding strong wind forces to account for the difference. The winds produced in turn move falling or fallen snow. Certain regions of the United States are more prone to experience blizzards than others, particularly the upper Midwest and the Great Plains region (Rauber *et al.*, 2005). These types of events can have debilitating effects on airports.

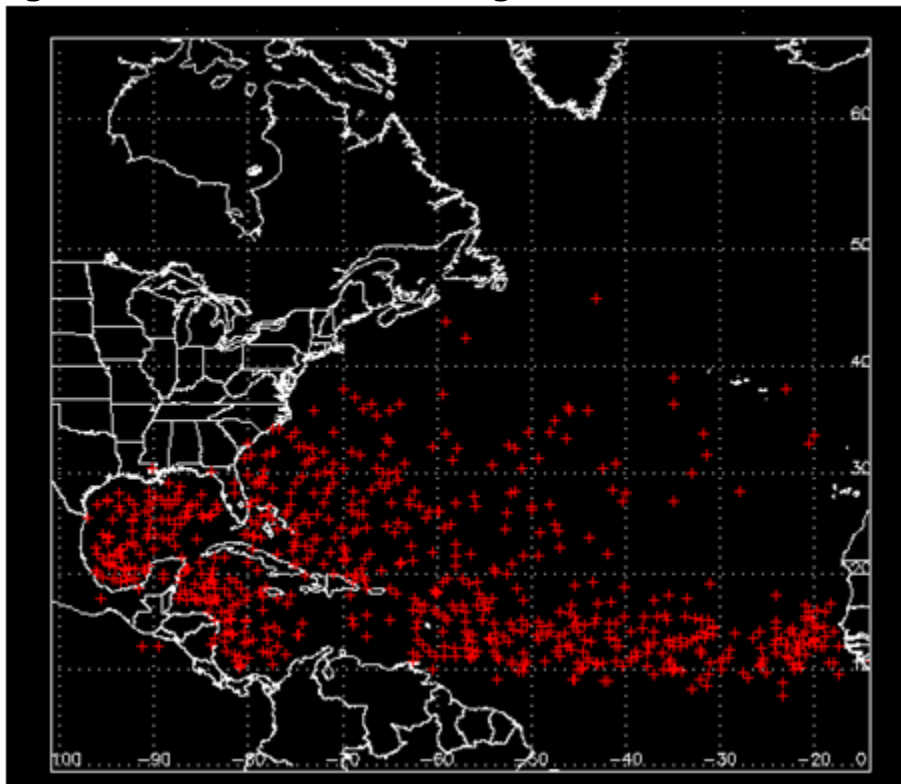
Airport operations are subject to various forms of weather conditions including blizzards. Since blizzards present low visibility and high wind speeds, airports are reluctant or at least cautious to operate. This is because the operating conditions for airplanes are less than

ideal rendering them susceptible for runway crashes, icing issues, and in-flight complications (Chang *et al.*, 2003). As a result, airports will cease operations until favorable conditions emerge.

2.3.3 Hurricanes

Hurricanes are created when thunderstorms manifest into an organized cyclonic system, when the proper oceanic and atmospheric conditions are present. Hurricane formation usually requires deep surface water temperature above 80°F in addition to limited vertical wind shear. Given these requirements, the ideal hurricane inducing conditions are seasonally correlated with early June through late November. Hurricanes can form in many locations, but there are some very common formation locations. In the northern hemisphere, hurricanes form in the Atlantic and Pacific Ocean. In the Atlantic Ocean, hurricanes are usually constructed near the coast of northwestern Africa, the coast of Brazil, and in Central America, as shown in Figure 2.4. In the Pacific Ocean, hurricanes commonly form near the west coast of Mexico and in the South Pacific Ocean, as shown in Figure 2.5. Once hurricanes are formed, they tend to follow a generalized path (Rauber *et al.*, 2008).

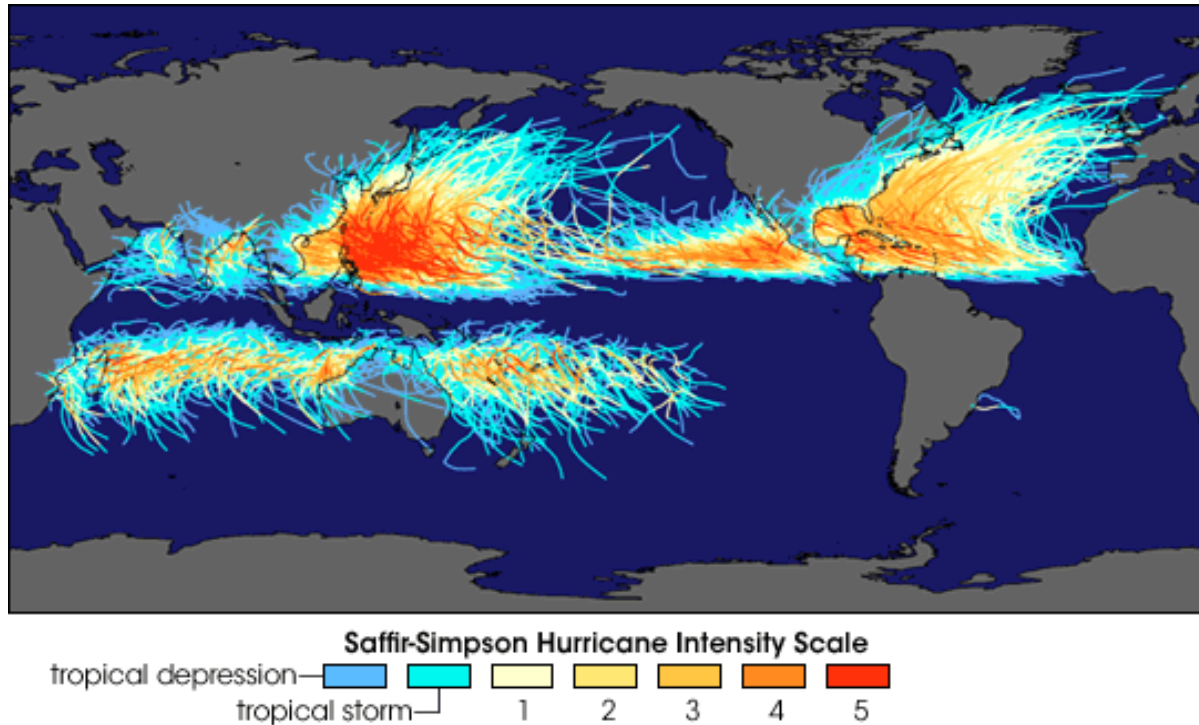
Figure 2.4 Hurricane Points of Origin from 1944 – 2010



Source: <http://stormcarib.com/climatology/origin1944.htm>

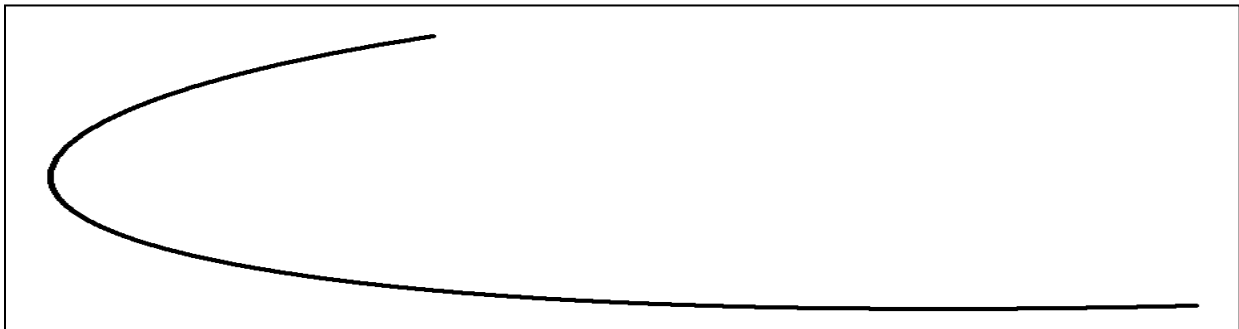
Macroscopically speaking, a hurricane's likely course is relatively simple to determine. A majority of hurricanes traverse on a course that resembles a hook, as shown in Figure 2.5 (NASA Earth Observatory, 2008). In the northern hemisphere it will travel west from the Atlantic or Pacific eventually turning northward then northwestward, creating a northern hook course, as shown in Figure 2.6.

Figure 2.5 – Global Hurricane Tracks from 1855 – 2005



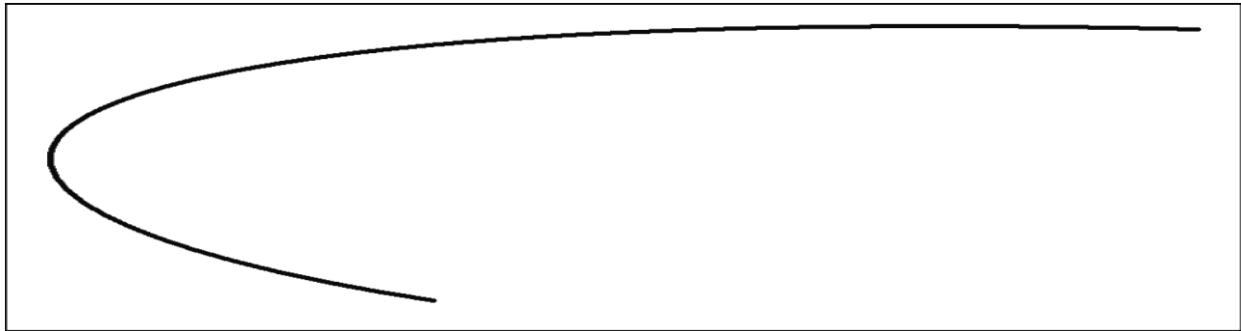
Source: NASA Earth Observatory, 2008

Figure 2.6 – Northern Hook Course for Hurricanes in the Northern Hemisphere



In the southern hemisphere it will travel east from the Pacific and eventually turn southward then southeastward, creating a southern hook course, as shown in Figure 2.7, which is a mirror image of the northern hook resembled in Figure 2.6.

Figure 2.7 – Southern Hook Course for Hurricanes in the Northern Hemisphere



These common trajectories increase the hazard expose for regions such as the gulf and eastern coast regions of the United States and the south and eastern coasts of Asia, as indicated by Figure 2.5, where hurricanes make landfall. Microscopically, the specific path a hurricane will follow is much more difficult, requiring robust analytical computer models and other forecasting techniques. In addition, to the numerous studies on where a hurricane forms, there are studies on the formation of hurricanes and its components (Rauber *et al.*, 2008).

As a hurricane intensifies, it becomes an increasingly powerful hazard, escalating the potential for physical and social disaster. To determine the likelihood of potential damage caused to a system, a classification system known as the Saffir – Simpson scale was developed (Haddow and Bullock, 2004 and Rauber *et al.*, 2008). This scale measures how hazardous a hurricane is by identifying the attributes of the hurricane and referencing those attributes to the potential damage a hurricane may impose by indentifying (Senkbeil and Sheridan, 2006) eye pressure, wind speed, and storm surge.

Eye pressure is the atmospheric pressure at the center of the hurricane, which is usually an indication of hurricane strength. The lower the eye pressure, the stronger the hurricane and

more hazardous it becomes, consequently the opposite is true. Wind speed refers to the rotational vortices speed. Finally, storm surge is the amount of water being pushed by the hurricane's wind. Assembling the intensity of the hurricane's attributes creates different categories. For example, a category 4 hurricane will produce central pressure (eye pressure) between 920 – 944 millibars, winds between 131 – 155 mph, and a storm surge between 4 – 5.5 meters (Senkbeil and Sheridan, 2006 and Haddow and Bullock, 2004). These parameters are an indication of whether the hurricane can jeopardize a system's coping capacity. Two examples, Hurricane Katrina in New Orleans and Hurricane Andrew in Florida are described below to further explain this concept.

Hurricane Katrina, in 2005, became a category 3 hurricane when it made landfall, it was not the highest rated landfall hurricane in the United States, but was the most destructive. Hurricane Katrina's wind speed was measured between 130 – 155 mph; however, it was not the speed that caused much of the destruction, but the storm surge. The storm surge that followed Hurricane Katrina was roughly 10 meters high. The 10 meter storm surge accompanied by New Orleans low elevation resulted in large flood damage. To date, this is the costliest hurricane in the United States, with damage worth nearly \$75 billion (McCallum and Herning, 2006). However, unlike Hurricane Katrina, Hurricane Andrew caused destruction in a different form.

Unlike Hurricane Katrina, Hurricane Andrew's destructive power resulted from wind speed, not the storm surge. Hurricane Andrew, in 1992, became a category 4 storm when it made landfall in Southern Florida, with its destructive winds. It is difficult to indicate how powerful the hurricane's wind speed was because during landfall the hurricane destroyed many

meteorological stations that measure wind speed. However, there were reports of wind gusts reaching roughly 200 mph. The storm also produced about 5 meter storm surge. Until the events of Katrina, Hurricane Andrew was the costliest hurricane in United States history, costing nearly \$40 – 45 billion (Labisky *et al.*, 1991 and Greenough *et al.*, 2001). However, this type of scenario is not uncommon because succeeding hurricanes are usually more costly than their predecessor due to the increase in the sophistication of human produced environments (Flynn *et al.*, 2007).

Table 2.2 – Well Known Hurricanes

Hurricane	Date	Category at Landfall	Location	Deaths	Damage (USD)	Damage Cause
Andrew	1992	5	Florida	≈14 – 40	≈\$40 – 45	High Winds
Katrina	2005	3	Louisiana, Alabama,	≈1,300	≈\$75	Flooding and Torrential Rainfall

Source: McCallum and Herning, 2006; Labisky *et al.*, 1991; Greenough *et al.*, 2001.

2.4 Increase in Disaster Costs

Human induced effects are causing the magnitude of hazards to increase but not the frequency. Hazard frequency and magnitude are two separable terms. Hazard frequency implies how many hazards are occurring (Pielke and Sarewitz, 2005). Hazard magnitude refers to the strength of the hazard and the likelihood of hazard transformation into a disaster.

Damage caused by such a transformation is increasing due to three factors: increasing urban population, none or minimal adaptation policies, and high-tech infrastructure in complex urban systems. When urban population increases, it increases the potential for the total amount of lives lost during a disaster (Basher, 2006). For example, if system 1 has a population of 10,000 and system 2 has a population of 100,000 and both experience 20% loss of live, system 2 loses

more life. This situation is often magnified when urban systems are quickly developing because development occurs so rapidly that adaptation policies are often ignored. Finally, complex urban systems with high-tech infrastructure have the potential for large financial loss when exposed to hazards (Pielke *et al.*, 2003 and Fitzpatrick, 2006). This is because the more advance the technology, the more it costs to replace or fix. For example, if both a conventional and magnetic rail system were destroyed, it would cost more to replace the magnetic system (Weichselgartner and Sendzimir, 2004). Therefore, system vulnerability is often associated with systems that possess a lack of adaptation policy accompanied by complex infrastructure.

2.5 Airline Regulation, Airports, and Definitions

2.5.1 Airports Introduction

On October 24, 1978, the airline industry forever changed when congress passed the Airline Deregulation Act of 1978. This act essentially eliminated the Civil Aeronautics Board (CAB) Sunset Act and replaced it with the Department of Transport (DOT). By creating such act, it eliminated the difficulty of entry and exit of airliners to airports and mandated route protocols and replaced it with government written certificate based on consumer demands. In other words, the government wrote entry certificates based on if the airline's fit, are willing, and able to meet consumer demands. Likewise, if the airliner is not fit, willing, or able to meet the demands of consumers and is generally performing below expectations, the DOT will revoke their certificate. The latter of which applies only to domestic flight because DOT's revocation power for international flight is dependent on presidential approval. With the de-regulated doctrine in place, airliners were granted more freedom to expand or contract services to or from airports. However, airports themselves remained controlled by a government

agency, therefore creating two distinct entities: the airport and the airliner (Bailey, 1986; Morrison and Winston, 1989; and Wells, 1996). The deregulated market potentially increased airports and airlines importance in the transportation of people and cargo.

Since aviation deregulation, aviation's air traffic has doubled every 15-20 years and since 2000 has grown by 3.1% per year. The reason for growth lies in the nature of the aviation sector providing services for people, businesses, products, and even real estate (Wells, 1996) but also the more obvious reasons such as, job growth directly, indirectly, and inductively related to airports and aviation (Chalabi, 2002). The aforementioned phenomenon is exaggerated through processes of when businesses and people meet globalization demands of expanding economies (Wells, 2002). To continue to meet such demands, different classes of airports were developed that accommodate a spectrum of service demands.

2.5.2 Classes of Airports

The FAA has recognized that there are four main types of classes: class I, II, III, and IV. They are defined by their operational role and capacity. Only 3 classes are currently subjects to the laws of part 139 airport certification. Class III will be newly certified. Class I consists of supports aircraft that accommodate at least 30 passengers on scheduled and unscheduled routes in addition to scheduled small aircraft seating 10-20 passengers. Class II consists of unscheduled aircraft that seat at least 30 passengers. Class III consists of scheduled small aircraft that seat between 10 and 20 passengers. Class IV consists of unscheduled aircraft that seats at least 30 passengers. The FAA has defined unscheduled operations as, "any common passenger-carrying operation for compensation or hire, using aircraft designed for at least 31 passenger seats, conducted by an air carrier for which the departure time, departure location,

and arrival location are specifically negotiated with the customer or the customer's representatives." (FAA, 2012). Despite the brevity of airport class definitions, there are two larger definitions of airports.

2.5.3 Commercial Aviation Airports

A hub-and-spoke network is a series of connections of which the hub is centrally located to consolidate people, freight, and ideas to one location. The spoke is where the people, freight, and ideas originate from or are directed to (Brueckner *et al.*, 1992 and Campbell and Krishnamoorth, 2005). Hub-and-spoke networks became popular after the deregulation act (Morrison and Winston, 2008) and are expected to become increasingly popular. More commonly though, the hub of such network is where the largest airports, or class I airports, are found, accounting for at least 1% of passenger enplanements. However, hub-and-spoke networks have created air carrier delays due to airlines willing to accept delay costs in return for the benefits of a hub-and-spoke network (Mayor and Sinai, 2003). In other words, the airline's marginal benefits outweigh the marginal costs and thus, are willing to maintain operation at a hub despite frequent delays. However, airlines are beginning to adapt procedures that create "safety times" that introduce additional travel time which in turn minimally and insufficiently disrupts the network's travel time. If delay is continuously increasing it may begin to jeopardize the network's travel time integrity. Therefore, even in increasingly congested hub airports, airlines will continue operating there (Lederer and Nambimadom, 1998).

2.5.4 General Aviation Airports

While there is no legal definition (Truitt and Tarry, 1995), general aviation airports can be summarized as multi-purpose facilities for small airplanes, in comparison to their larger counterpart, commercial aviation. According to Wells (1996) general aviation systems account for more than just passenger and cargo enplanement, but also for crop dusting, search and rescue operations and even medical transport. Usually these types of systems are small in the nature with the intended function, as suggested by the basic utility (BU) and the general utility (GU) categories of general aviation airports of which these categories provide the base for other aviation sectors (Truitt and Tarry, 1995).

2.6 Aviation Fragility from Hazards and Countermeasures

While flight delays are nuisances, flight cancellations have the potential to cause large rippling consequences of airliner and airport profit loss due to direct and indirect revenue decreasing from consumer dissatisfaction. Avoidance of the aforementioned consequences is either resolved by airlines frantically rescheduling flights or customers switching airlines (Rupp *et al.*, 2005). However, airport and the airline's network can experience chaos when presented with a cancellation or delay if it is not properly resolved (Filar, 2001). When not properly resolved, airlines and airports will reap large financial loss especially when cancellations occur at hub airports (Rupp and Holmes, 2005).

The Air Transport Association (ATA) in 2009 stated that the total passenger airline industry lost 100 million delay minutes creating a direct cost of nearly \$6 billion (Air Transportation Association, 2010). Most of these cancellations and delays were generated through three

scenarios: airline resource shortages, airport and airspace capacity shortages (Bratu and Barnhart, 2006), and generate economic trends (Rupp and Holmes, 2005). Airline resource shortages can be described as delays or cancellations caused by maintenance issues, crew shortages, or longer than expected passenger embarking or disembarking procedures. Airport and airspace capacity shortages can be described as delays or cancellations caused by airliners exceeding the arrival and departure capacity of the airport usually caused by meteorological events or other types of short term scenarios that create peak arrivals and departures from airports. This system behavior often jeopardizes sequential flights (Bratu and Barnhart, 2006). Finally, cancellations and delays can be caused an airliner's financial decision to eliminate a flight due to the lack of passengers (Rupp and Holmes, 2005). However, airports can also be mandated to "shut down" as an ordered by the Federal Aviation Administration (Winston and Rus, 2008). Some commonly occurring events that have caused airport closures include: 9/11, volcanic ash, winter storms, and storm surges.

Airport closures can affect airliners, passengers, cargo, tourism, surrounding and inner businesses associated with airports (Chang *et al.*, 2003) depending on the magnitude of the closure or delay. However, Robinson (1989) was able to calculate the direct financial impacts of weather events on airliners and airports by isolating airport delays and cancellations caused by thunder and snowstorms. For example, Robinson (1989) concluded that airliners in Atlanta who averaged about 260 flights per day lost about 5160 minutes per day due to the presents of thunderstorms. This research can be used to quantify the yearly cost of delays by multiplying it by the operating cost of airliners per minute. For example, the ATA (2010) estimates that the average minute of operation for an airplane in 2009 was about \$60.99 per minute. Therefore, if

an airport experienced 100 days of thunderstorms of which an airliner averaged about 260 flights per day would experience an annual loss of:

$$= 100 \text{ (days)} \times 60.99 \text{ (airliner cost per minute)} \times 5190 \text{ (average delays minutes per day)}$$

Using this formula represents direct costs airlines receive when confronted with a flight delay or cancellation. Alternatively, however, there are numerous indirect and often difficult to measure consequences associated with flight delays and cancellations. In many cases the airport is shut down for long term disasters, relaying on the national response plan.

2.6.1 National Response Plan

The National Response Plan (NRP), announced in 2004 by the Department of Homeland Security, is based on the communication and coordination of federal agencies to respond to a disaster. While the plan responds to a single disaster, it structured to perform its duties on an all hazards approach (Pampell, 2008 and Department of Homeland Security, 2004); meaning the plan can respond to both natural and man-made disaster events ranging from terrorist attacks to hurricanes based on the National Incident Management System (NIMS). Being based on NIMS, the NRP is designed to effectively coordinate and communicate disaster response and recovery not only between the federal agencies but also between federal agencies and state, local, non-government organizations (NGOs) and tribes (Haddow and Bullock, 2006). However, for NPS to be implemented local and state authorities are required to argue the need for federal assistance after local and states exhaust their resources (Pampell, 2008).

2.6.2 Transportation Security Administration Authority in Decreasing Hazard Fragility

Perhaps the most notorious event in recent history involved the national closure of airports due to the events on 9/11. After receiving messages of planes inbound for various high profile cities, following the collision on the World Trade Center, the FAA closed down all airports for the following two days. In Washington DC, the Reagan National Airport was closed for 23 days and gradually reopened over the following 6 months. During this time of airport closure, the local, regional and international economies experienced large financial effluxes. It has been estimated that the economic impact of the Reagan National Airport closing was about \$330 million per day (Robinson, 1998). In addition to the direct costs, 9/11 created numerous indirect costs to the aviation sector.

Years after the events of September 11th, the aviation sector still experienced economic stagnation or decline. The month of September, the aviation traffic decreased between 35 – 40% (Bailey, 2002). From August 2001 to December 2002, aviation employment declined by 13%. Additionally, the airport industry was estimated to have lost \$16.6 billion in property and businesses interruptions (Rhoades, 2004). For fear that this trend would continue, the US Congress quickly passed a financial stabilization fund for airliners worth \$5 billion with a loan package for 9 months granting an addition \$10 billion (Bailey, 2002). Despite the financial bailout from the federal government, airport systems experienced new costs which were created by the latest security measures established from government intervention in post-September 11th aviation (Rhoades, 2004).

The government responded to airport's vulnerability to terrorist attacks by establishing the Transportation Security Administration (TSA) within the Department of Homeland Security (Moteff, 2003). The goal of TSA was to minimize the likelihood of physical or cognitive terrorist activities that jeopardize aviation businesses. However, the government's new adaptation program is creating aggravated customers by increasing travel times due to waiting periods for security procedures despite their potential to decrease terrorism activity (Rhoades, 2004).

It appears that the Transportation Security Administration was created with the intentions of establishing terrorist resilient aviation facilities but also created a defiant economic market. On one hand, the Transportation Security Administration negates terrorist activities or at least diminishes the likelihood of such occurrence by advancing screen procedures and security technologies (Bailey, 2002). For example, Mathews (2010) claims that a full body scan during airport check might have exploited the explosives knitted in a person's underwear. On the other hand, the Transportation Security Administration is fostering lengthy processing times, in some scenarios hours long (Peterson *et al.*, 2007), impeding business transactions such as mail, cargo, and face-to-face business deals. For example Moorman (2007) states that for cargo over the next 10 years to be inspected would cost approximately \$3.6 billion due to the lack of technology that would be able to process that much cargo in a quick matter. Additionally, when airports experience an influx of passengers the security delays are compounded because the security infrastructure has not "caught up" to the new passenger loads (Pool Jr, 2007). However, the TSA is designed for intentional man-made disasters, not natural disasters such as hurricanes or snowstorms.

The aforementioned statistics are an extreme outcome of an unforeseen assault on the aviation transportation network whereas; extreme weather events are a foreseeable event that affects transportation infrastructure. For example, hurricanes are monitored well before they make landfall (Cutter *et al.*, 2006). Whereas terrorist events are unforeseeable in the sense that are difficult to predict and monitor (O'Day, 2004) when compared to natural events.

2.6.3 Federal Emergency Management Agency in Decreasing Hazard Fragility

In 1988, the Robert T. Stafford Disaster Relief and Emergency Assistance Act were signed to amend the Disaster Relief Act of 1974. The more specific goal of the Robert T. Stafford Disaster Relief and Emergency Assistance Act was to alleviate damage from disasters by:

1. “ Revising and broadening the scope of existing disaster relief programs;
2. Encouraging the development of comprehensive disaster preparedness and assistance plans, programs capabilities, and organizations by the States and by local governments;
3. Achieving greater coordination and responsiveness of disaster preparedness and relief programs;
4. Encouraging individuals, States, and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance;
5. Encouraging hazard mitigation measures to reduce losses from disaster, including development of land use and construction regulations; and

6. Providing Federal assistance programs for both public and private losses sustained in disasters.” – pg 1 Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities, 2007

When disasters strike States, it is the responsibility of the governor to declare a state disaster and request federal emergency relief. However, for the federal funds to be allocated toward the state, a disaster must be declared or approved by the President. If a disaster is declared by the governor and the president, Federal disaster assistance provides: facilities, personnel, and supplies for disaster relief such as medicine and food among technical advisory reports of disaster recovery, such as impact assessments and planning (Robert T. Stafford Disaster Relief and Emergency Assistance Act, 2007).

2.6.4 Federal Aviation Administration’s Role in Disaster Prevention

The Federal Aviation Administration was created in 1958, with the intent of providing safe use of the national airspace. Additionally, in 1958 established the FAR Part 139 Certification and Operations of Air Carrier Airports as a policy and handbook impetus to promote aviation safety (FAA, 2007). The handbook outlines safety issues and standards, followed by Federal inspections such as, microscopic and macroscopic conditional status, such as pavement improvements and safety inspections. Even though aviation safety is a concern for the FAA, successful aviation operations are an increasing demand of FAA tasks.

As aviation traffic began to increase, airport systems responded to assure the hindrance of delays and other adverse effects of aviation. For airports to respond to the demand, the government issued responsibilities for the FAA additional which included: technologically

upgrading airport facilities, addressing environmental pollution, and prescribing airplane noise measures to cope with the increase in aviation traffic. Upgraded facilities include the air traffic control tower, which improved the volume of traffic. At the heart of such upgrades, was the 1970 edition of the Central Flow Control Facility, which allowed the FAA to predict any “trouble spot” of the aviation network and predict weather for further prediction of delays. However, the base of this technology lies on the World War II technology. In 2003, multiple federal departments announced the production of a satellite based system for navigating airplanes from the departure to arrival gate called Integrated Plan for the Next Generation Air Transportation System (FAA, 2012). While the plan is not entirely complete, benefits are already being present by that airliners are saving money because pilots and airplanes are more predictable within the aviation network.

2.6.5 Other Agencies Responses to Disaster

There are several other government agencies that participate in disaster recovery such as: Departments of Housing and Urban Development, Health and Human Services, and Department of Transportation. The Department of Housing and Urban Development actively participates in disaster recovery by allocating grants for the mitigation of future disaster through the Community Development Block Grant (CDBG), such as increasing the elevation of buildings to prevent floods. The Department of Health and Human Services is responsible for providing assistance to those who cannot physically or mentally obtain the necessary assistance for recovery. The Department of Transportation is responsible for repairing federal-aid highways and roads on federal property through a trust fund established for such special

occurrences (Haddow and Bullock, 2006). These are important agencies considering when the failure of critical infrastructure occurs.

2.7 Defining Critical Infrastructure

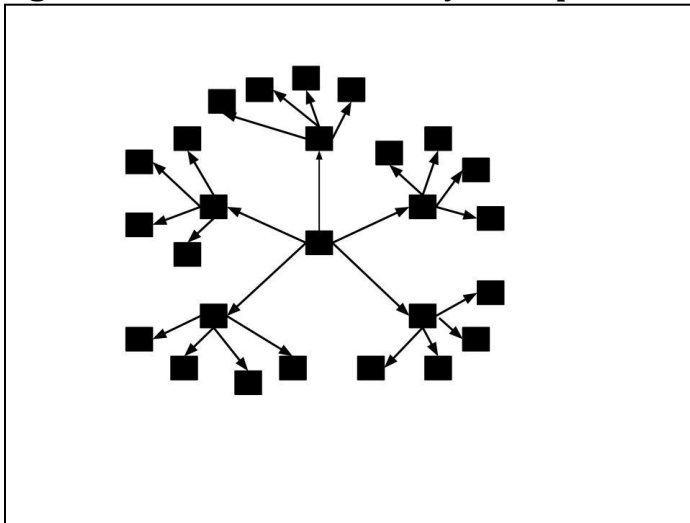
Critical infrastructure can be determined by when its destruction or disruption leads to detrimental impacts on the economy, well-being, or safety at the local, regional, or national scale. Usually when critical infrastructure fails it is the result of other infrastructure's inability to replicate the failed infrastructure's behavior (Moteff *et al.*, 2003 and Church *et al.*, 2004). For example, if a cargo rail line failed in providing a plant with freight and no other transportation network could mimic the rail line's freight ability, that rail line would be considered critical. In this example, when the rail line failed, it would decrease or halt the industrial plant's production, hence the rail line would be classified as critical infrastructure. Such a classification can be determined by geography and technology associated with the infrastructure.

2.7.1 Geographically Critical Infrastructure

Geographically, critical infrastructure can be determined by network centrality. Figure 2.8 displays the concept of centrality, where point 1 is the central point and all other points are periphery. If a piece of infrastructure is centrally located, that is, the location or point where periphery infrastructure are dependent on, such as a hub of an airport. The purpose of the centrality is to provide a gathering or distribution location for supplies, material, people, and even ideas. This rule also applies to transportation networks for cargo and passengers. Once the cargo and passengers are located at the central point, they are redirected on a different route for their final destination. In the aviation sector, this concept is known as a layover.

Therefore, when the central point is disrupted, all preceding layovers are disrupted, halting the movement of goods and people (Graham, 2010). It is difficult for non-central points to mimic the behavior of a central point because the non-central point does not have the same degree of accessibility to the network, as shown in Figure 2.8.

Figure 2.8 – Network Centrality Concept



Likewise, central points are the busiest points in the network because of the aforementioned redistribution of cargo and people from the periphery (Church *et al.*, 2004). Since, they are the busiest; they will often have the most direct access to points across the network unlike a non-central point (Frey Luechinger, 2007). For example, a central point could be networked with 15 points in direct connection unlike a non-central point which is networked with $n-2/p$. The geographical location of a network can help determine its status as being critical or not, but so can technology.

2.7.2 Technologically Critical Infrastructure

Advanced technology usually amplifies infrastructure's responsibilities. Since advanced technology in infrastructure usually results in an increase in load capacity (weight, traffic, wind resistance, etc), any disruption would cause an overload in a less advanced but duplicate system. For example, an advance air traffic control tower that uses satellite technology instead of radar systems has the ability to coordinate more airline traffic at a given time. If a satellite air traffic control tower were to suddenly be replaced by a radar air traffic control tower, the system would overload because the radar ATC tower cannot coordinate as much airliner traffic (Moteff *et al.*, and Church *et al.*, 2004). Therefore, when technologically advanced system disruption occurs, technologically basic systems trying to replicate its behavior are overloaded and eventually fail. Using the aforementioned pieces of information, critical components of airports can be identified.

2.8 Critical Infrastructure of Airports

There are two main ways an airport can be critically defined; as a facility for airliners (sum of its parts) and as a facility composed of operating infrastructure (its parts). In terms of critical infrastructure, airports can be geographically defined by their role within an airliner's network, such as, a hub-and-spoke network. A hub-and-spoke network is a series of connection that congregate at a central location (the hub) (Bruekner *et al.*, 1992 and Campbell and Krishnamoorth, 2005). The connections are composed of routes that radiate from the hub, often termed spokes. Since the hub is a centrally located, it can be considered a critical aspect within the network. In other words, if a hub airport were to close, all outgoing routes would be negatively affected (Lederer and Nambimadom, 1998; Rupp and Holmes, 2005; Filar, 2001).

Therefore, hub airports can be deemed critical components of an airline network.

Technologically, airports also contain critical infrastructure pieces.

The air traffic control (ATC) tower consists of advanced technology to assist in the logistical take-off and landing of airplanes. If the ATC tower were to become dysfunctional for whatever reason, it is difficult but not impossible for airliners to coordinate their departures and arrivals. This difficulty arises from the lack of other infrastructure pieces successfully reproducing functions similar to that of the ATC (Moteff *et al.*, 2003 and Church *et al.*, 2004). When the Next Generation Air Traffic System becomes operational, it will increase the capacity of airliner coordination (FAA, 2011), if this system were to become dysfunctional, it may temporarily cripple the airline industry at certain locations. This is an example of technologically critical infrastructure because the sophistication of airliner coordination would suddenly be reduced if the Next Generation Air Traffic System were inoperable. Therefore, it is suggested that airports identify their critical infrastructure to increase its resilience against hazards to diminish any potential adverse impacts on airport operations.

2.9 Disaster Shelters and the Airport

While the airport and its network contain numerous pieces of critical infrastructure due to its geographic position and technological capacities, it may also contain critical infrastructure based on its sheltering role during short-term weather events. When a hazard or disaster strikes an airport or community, the airport may have the potential to convert various infrastructure components into adequate shelters. This can be accomplished by examining the duration necessary for which people will need shelter. In other words, as time away from

people's original home increases and time in shelters increases, than additional social conditions apply to the shelter. For example, social conditions in a shelter are mostly ignored due the short duration tenure. Whereas social conditions in temporary housing are focused on reestablishing a level of household normalcy due the longer duration periods (Curtis and Mills, 2009) but also to provide for personal items such as pets, recreation outlets, and communication items (internet, radio, etc) (Barnes, 2006) and to meet the physiological needs of evacuees such as, reuniting with loved ones (Watson *et al.*, 2003). Through this example, it is apparent that the more extended shelter occupation is, the more diverse and complicated the social requirements are for that shelter to be successful. Sometimes though, shelters are not successful and additional detrimental health and physiological effects often ensue on the most vulnerable groups (Pampel, 2008).

When exposed to the harsh realities of a shelter, there is an increase of adverse health conditions often induced by stress related issues. Often, vulnerable groups of people seek refuge in shelters and temporary housing because they are unable to evacuate (Eisenman *et al.*, 2007). When vulnerable groups seek shelters, it is often because of their lack of transportation options and/or they are too disabled or sick to physically handle the stress of evacuations. If placed in a shelter, evacuees are exposed to crowded conditions, concentration of disease, and inadequate medical supplies, ripe conditions for demoting health. After the disaster when disadvantage evacuees relocate back into their neighborhoods, conditions are still unfavorable (Becker, 2009).

Vulnerable groups that have damaged homes are the least likely to experience a seamless transition to normality. As previously mentioned, vulnerable groups are usually less financially secure and therefore have decreased ability to repair their home. Likewise, government response to vulnerable individuals whose homes were destroyed is lackluster; often requiring months to years for full recovery. Additionally, vulnerable groups regularly possess insufficient insurance, if they even have insurance at all (Eisenman *et al.*, 2007). This lack of insurance leads groups into social life of uncertainty and mobility. In other words, vulnerable groups that have a lack of insurance and experience government welfare delays either become homeless or extensively participate in disaster shelters. These shelters, of which, contains limited support networks (churches, food banks, etc.) for individuals especially those that experience adverse social conditions, such as single parent households (Curtis and Mills, 2009). This was the case with New Orleans when Hurricane Katrina arrived.

When Hurricane Katrina made landfall in New Orleans evacuation orders were given for people to relocate to the Superdome and the New Orleans Convention Center (Pampell, 2008 and Brodie *et al.*, 2006). The living conditions present were abysmal to say the least. According to Brodie et al (2006), half of the shelter residents did not have adequate food or water and nearly a third reported they were threatened with violence. An airport, if planned properly, may provide relief or at least an alternative or addition to other conventional means of sheltering vulnerable population groups.

2.10 Chapter Summary

Chapter 2 provides definitions about key concepts of the research including: risk, vulnerability, hazard exposure, critical infrastructure, and shelters of airports. It is reported that risk of a particular system involves identifying its hazard exposure and vulnerability. To combat risk, a concept of adaptation is presented. This concept focuses on increasing the coping capacity of a system so that when confronted with a hazard, it does not transform into a disaster. By channeling adaptation concepts towards critical infrastructure of a system, coping capacity can increase, thereby decreasing the likelihood of a disastrous outcome. If a disaster outcome does occur, this chapter discussed federal agencies' roles in disaster prevention and recovery but all fail to significantly and directly mention airports within their framework. Therefore, information needs to be assembled for understanding the adaption extent and likelihood that airports can handle the before, during and after effects of hazards and disasters. This can be accomplished through an extensive methodology that is based on the previously stated concepts of risk and resiliency.

Chapter-3

Methods

3.1 Introduction

The purpose of this research is to lay a foundation for understanding airport's physical and social vulnerability to multiple hazards including hurricanes, tornadoes, and blizzards as each relates to airport infrastructure and operations to determine risk and adaptation. Additionally, this research's goal is to determine the potential role airports play before, during, and after a disaster and how it affects its resiliency and the resiliency of nearby communities (Chapter 1.3). Therefore, methods need to be constructed to answer the aforementioned goal. However, current research and databases provide too little data to explicitly solve this research's goal. To solve this problem, qualitative methods are utilized from Bartlett and Payne's (1997), procedure to formulate a grounded theory on the airport's role before, during, and after a disaster and how it can affect the resiliency of itself and nearby communities.

3.2 Theoretical Background on Qualitative Data and Grounded Theory

Several researchers, Pidgeon and Henwood (1997), and Strauss and Corbin (1990) state that meaning is always in qualitative data, it is just identifying the relationships that exist within the data. Identifying these relationships is dependent on how the interviewer recognizes the context of the data. These authors suggest that the grounded theory should be produced using literature as a guide for sifting through the data. However, Glaser (1978) suggests that Strauss and Corbin's technique will produce biased results because it makes the coder sensitive to the data. Therefore, Glaser (1978) suggests that the coder simply approaches the data with little understanding of the literature that surrounds it, consequently formulating a grounded theory on the bases of one's unbiased interpretation. On the other hand, such unguided techniques may not produce a significant grounded theory because the researcher does not reflect on the

data therefore, ignoring multiple paths of relationship among the data. Each one of these techniques has its strengths and weakness. Therefore, the research will employ both techniques for determining a grounded theory. The first technique will be Gasser's (1973) method of an unbiased sensitivity towards the data. This will be followed by creating sensitivity through the data using Strauss and Corbin's (1990) technique to determine meaning within the data. The former of which applied to all the interviews simultaneously. The latter of which applied to each separate interview within the entire dataset. Using these researchers ideas and framework allowed Bartlett and Payne's method for grounded theory to be easily employed.

3.3 Bartlett and Payne's Method for Grounded Theory

As previously discussed, Bartlett and Payne's (1997) method for grounded theory used several step-by-step procedures. Their procedure is as follows:

1. Collecting the data through interviews
2. Transcribe the data
3. Develop open coding categories
4. Saturate the categories
5. Defining categories
6. Theoretical sampling
7. Axial coding
8. Theoretical integration
9. Ground the theory

While this process may seem like a linear relationship, it is not. Instead, it is iterative in the sense that the data is inspected multiple times to ensure that extracting meaning or relationships from the data is in accordance to the perspective of the research participants' responses. Figure 3.1 illustrates these relationships in a sequential manner.

Figure 3.1 – Qualitative Data Analysis Procedure

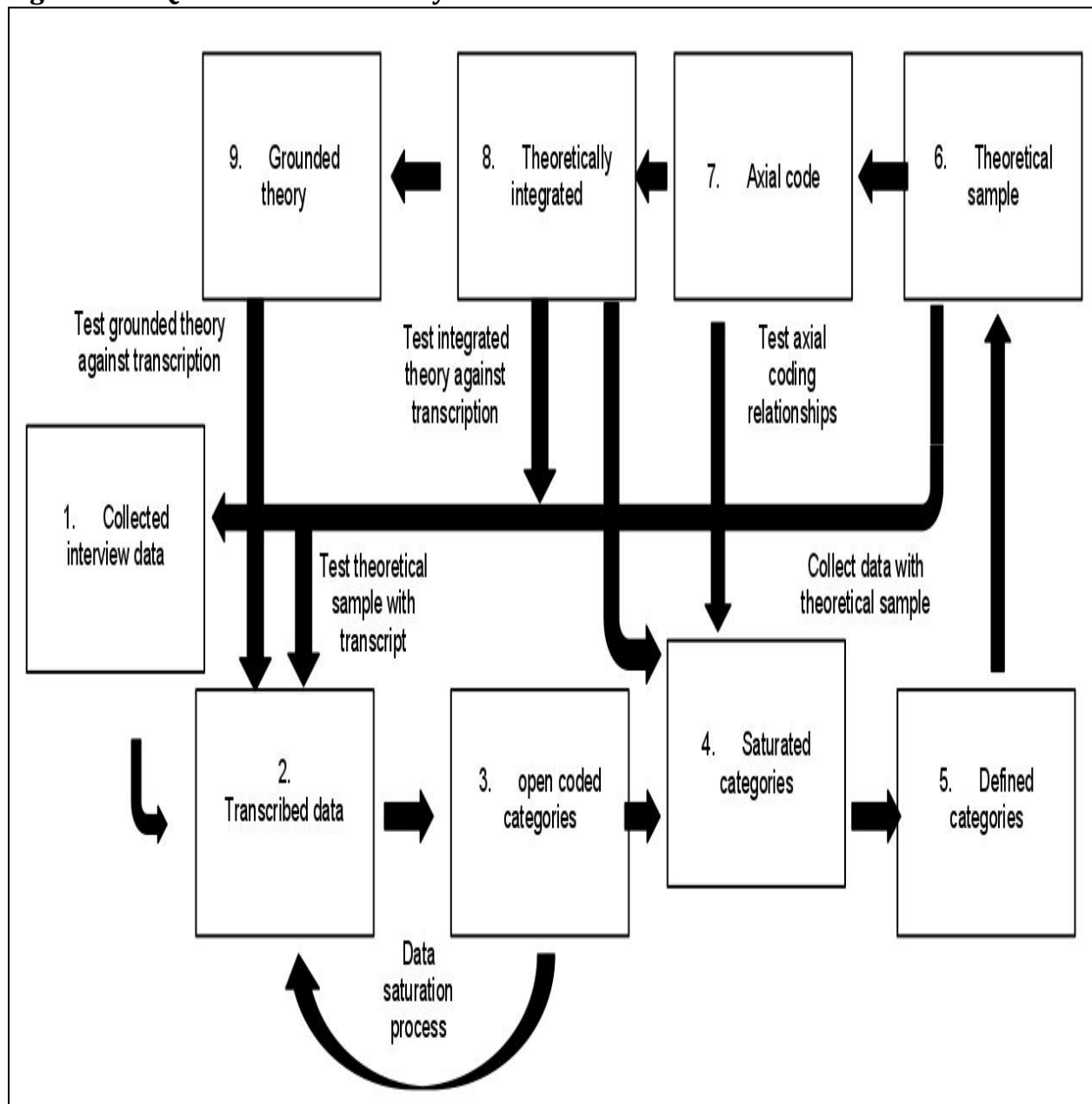


Figure 3.1 displays the process of analyzing qualitative data based on Bartlett and Payne's (1997) method. Figure 3.1 appears to be an intricate process of multiple iterations. However, this process can be broken down into three main components of analysis, as discussed later in this chapter.

3.4 Collecting Data through Interviews

Data was collected by selecting appropriate research participants. As Bartlett and Payne describe in their approach to establishing a grounded theory, the research participants can be selected based on numerous criteria. The following sections reveal the criteria to selecting the research participants.

3.4.1 Determining Research Profile

Interviewing was chosen as a data collection method because raw numerical data relating to long term hazards effects on airport infrastructure and operations with airports has yet to exist. Therefore, representatives were interviewed that possess knowledge on airport and disaster management procedures, causes, problems, and solutions, more so than randomly choosing research participants (Conrad, 1978). The representatives that were chosen to for the interview process includes: the Federal Emergency Management Agency (FEMA), airport representatives, regional representatives, county representatives, city representatives, and consultant agencies that specialize in airports and/or disasters. Each level of government was interviewed to provide multiple perspectives to the effectiveness or ineptness of disaster risk and resiliency. While only one interview from each governmental level was conducted it does provide a framework for a larger schematic for the intricacies of disaster recovery between the aforementioned agencies. Chapter 4 discusses detailed results between governmental

perspectives about disaster risk, resiliency, preparation, and recovery. More importantly is discovering the feasibility and issues centered on airport's perspective of their role in disaster management. Therefore, a large portion of the research participants were airport officials that have experience with hurricanes, tornadoes, or blizzards. Finally, consultants were interviewed to determine an outsider's perspective that understood both the federal and airport perspectives as they related to disaster management.

3.4.2 Determining Research Participants

The research participants were selected based on several criteria that assists in cementing conclusions reported in this research. As previously mentioned, the research participants were grouped into three categories: government officials, airport officials, and consultants. Within each category research participants were selected based on geographic location and type of risk. The severity of risk was kept constant for the purpose of not influencing the responses of the research participants. Therefore, perspectives recorded in the interview maybe based on the geographical location and type of risk but not the severity of risk. Table 3.1, displays the geographical location of the research participants and the likely risks they are exposed to.

Table 3.1 – Research Participant Profile

Research Participant	Occupation	Location	Specialization
Tim Philips	Consultant	Montana	Owner: Critical Path Inc.
Don Griffith	Consultant	North Carolina	Airport Operations Manager: Innovative Emergency Management
Stephanie Ward	Consultant	Michigan	Aviations Manager: Mead and Hunt
Hud Hopkins	Airport Official	Texas	Airport Manager: Scholes International Airport
Jim Smith	Professor and Consultant	West Virginia	Researcher: American Public University
Jeff Copeland	County Government Emergency Planner	Florida	Interim Director: Hillsborough County of Emergency Management
Anthony Williams	Airport Official	Louisiana	Chief of Police Department of Baton Rouge Airport
James Duncan	Federal Government Emergency Planner	FEMA Region IV (IL, IN, MI, MN, OH, WI)	Federal Preparedness Coordinator: FEMA Region IV
Robert Guevara	Airport Official	Texas	Airport Operations Manager: Hobby International Airport
John Glass	Airport Official	Pennsylvania	Airport Operations Superintendent: Philadelphia Airport
Andy Singhas	Airport Official	Georgia	Airport Operations Manager: Savannah International Airport
Derrec Becker	State Emergency Manager	South Carolina	Public Information Officer: South Carolina Emergency Management Division
Allen Porter	City Emergency Manager	Texas	Emergency Planner: City of Houston

A majority of the research participants' are at risk for hurricanes. This is because, as previously described, geography is the main factor for hazard exposure. A majority of the research participants are located on the Gulf and Eastern coast of the United States. However, tornadoes and snow storms pose additional threats to several of research participants. A multi-hazard approach to assessing airport risk and resiliency allows the researcher to examine the role of the airport on multiple fronts.

3.4.3 Determining Questions for Research Participants

Research participants were asked two types of questions that counterpoise each other. Type one involves determining what "is" the airport's role before, during, and after a hazard or disaster. The second type involves assessing what "should" be the role of airports before, during, and after a hazard or disaster. These two steps involved similar questions but counterpoised to each other. The "is" questions can be viewed in Table 3.2 and the "should" questions can be viewed in Table 3.3.

Table 3.2 – The "Is" Questions

Questions for Interview	
1.	What is the airport's role in response to a natural hazard?
2.	What is the airport's role in response to a natural disaster?
3.	What is the airport's role in prevention of a hazard?
4.	What is the airport's role in recovery from a natural disaster?

Table 3.3 – The "Should" Questions

Questions for Interview	
5.	What should be the airport's role in response to a natural hazard?
6.	What should be the airport's role in response to a natural disaster?
7.	What should be the airport's role in prevention of a hazard?
8.	What should be the airport's role in recovery from a natural disaster?

By asking the "is" question, it generated responses based on the research participant's perspective of what the current role is of the airports during hazards and disasters. By asking

the “should” question, it created responses stemming from what the research participant’s perspective was for ideally and effectively solving problems airports and communities witnessed before, during, and after hazards and disasters were encountered. For the previously stated reasons, these questions are referred to as the primary interview questions. However, the interview process was not limited to the primary questions in Figure 3.2 and Figure 3.3.

To avoid vague responses, additional questions were asked to the participants, allowing the participants to indulge deeper into the topic. The additional questions were not predetermined. Instead, the interviewee must have first discussed the topic in order for an additional question to be asked. For example, an interviewee was asked about what is the airport’s role in response to a natural disaster and if their response included information on infrastructure or operations, then more specific questions would be asked regarding infrastructure and operations, as suggested by Lyons and Coyle (2007). However, if their response did not include infrastructure, it would still warrant additional questions they discussed in the primary question. This processes enriched the depth and clarity of the interview therefore, coding the interviews and the preceding policy recommendations were more accurate.

3.5 Saturating Data from Research Participants

After the research participant profile was established, data could be recorded from the interviews. This process involves the first iterative series of Bartlett and Payne’s method for constructing a grounded theory.

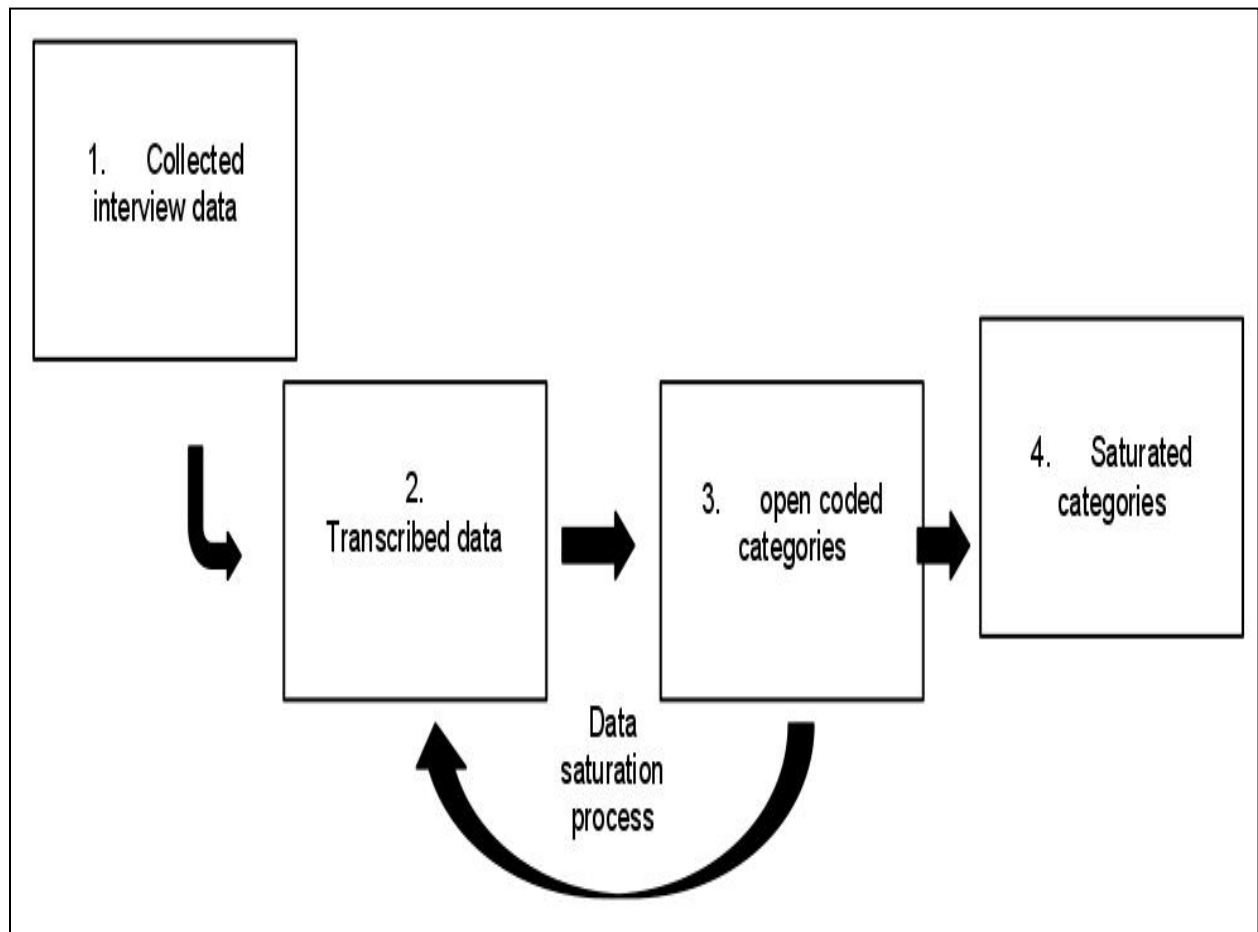
3.5.1 Open Coding and Data Saturation Procedure

After an interview was conducted and recorded, it was transcribed as presented by the research participant. Upon completion of the transcribing, coding was conducted based on the responses from the research participant. This is often referred to as open coding. According to Dey (1993), open coding involves the research participant's responses to dictate the code. It is the responsibility of the researcher to identify the research participant's meaning behind the code or category (Glaser, 1978). In other words, the research participant answers the questions with certain themes embedded in their response. These themes are codes or categories. It is the researcher's job to identify the codes embedded in their response.

When the coding process occurred, interview responses were decomposed into hierarchal sections that provided meaning to the transcript in its entirety. To maintain the meaning of the research participant's responses, the decomposition processes was often referred back to the interview's entirety (Strauss and Corbin, 1990). This process was continued until the data was saturated to produce a code book. Results are in Appendix C.

Saturating the data involved categorizing the transcript until no additional meaning was found (Lyons and Coyle, 2007). This process is an iterative approach, requiring numerous passages over each transcription until no new categories are discovered within any transcription (Lyons and Coyle, 2007; Dey, 1993; and Bartlett and Payne, 1997), as shown in Figure 3.2. However, this required the user's interpretation of meaning with each transcript to define categories from research participant's responses.

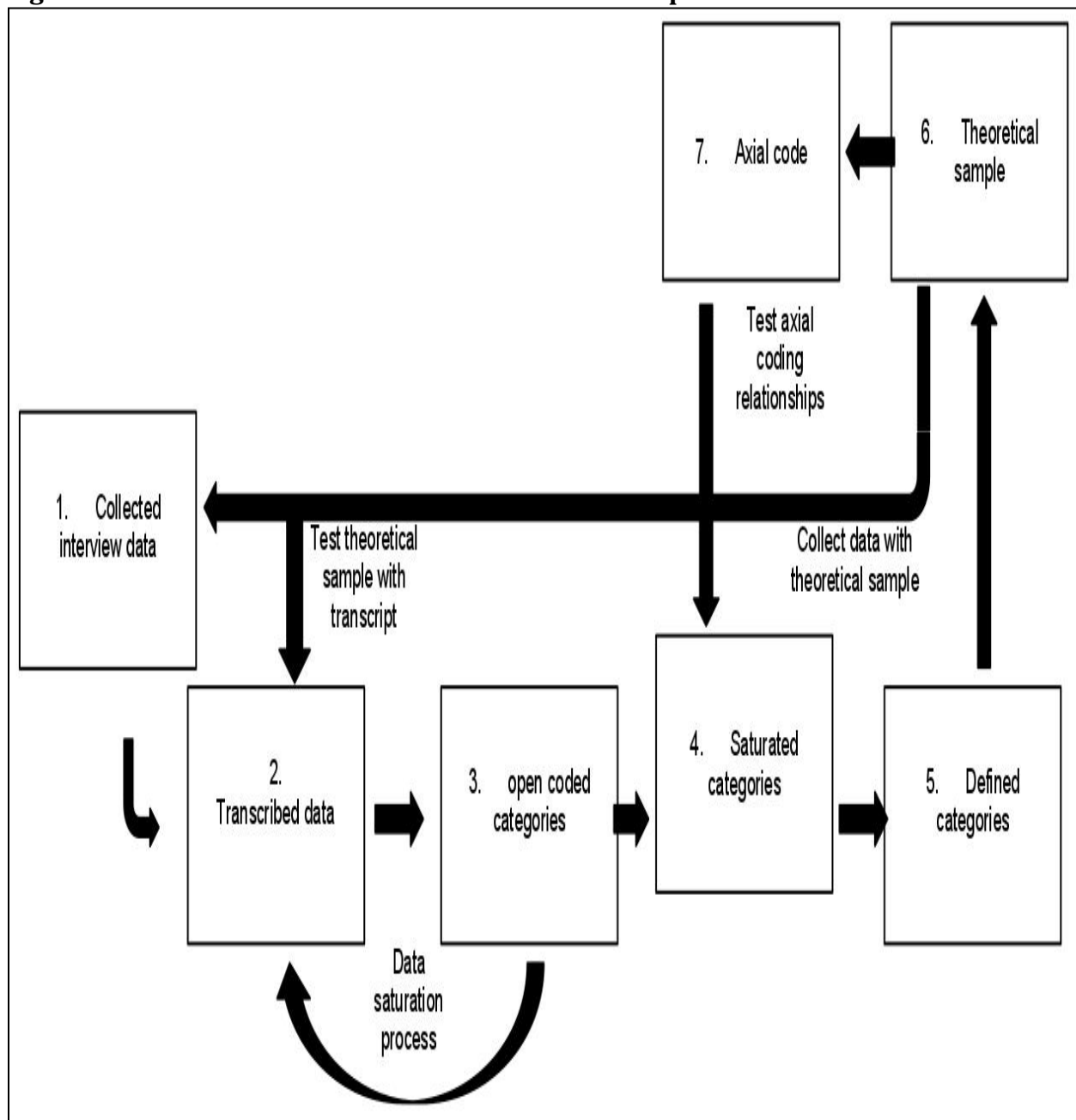
Figure 3.2 – The Iterative Process of Data Saturation



3.6 Axial Coding from Saturated Categories

After the interviews were saturated with categories, axial coding could occur. This process is the second iterative step in Bartlett and Payne's (1997) method for grounded theory. Axial coding helps solidify meaning and relationships within the data. Figure 3.3 displays the iterative process of constructing axial codes from theoretical sampling.

Figure 3.3 – The Iterative Process of Theoretical Samples



3.6.1 Defining Categories through Revised Code and Identifying Meaning

Obtaining meaningful information from the transcriptions involved interpreting what each sentence's meaning was. To execute this, the sentence had to be read along with the entire response to the question. This allowed the true meaning of the sentence to be understood. Otherwise, reading a standalone sentence maybe misinterpreted based on

opposing content within its paragraph (Rennie, 2000). For example, the following sentence seems explicit; “Nonetheless, changing the channel is easy for the users with a remote control.” In this sentence, it appears that the changing the channel is easy for all users. However, the paragraph which houses the sentence reads, “In the 1970’s, TV remote controls were easy to use because of the limited number of buttons to choose from, therefore decreasing the complicity of the remote. Additionally, TV remotes allowed the user to stay in the comfort of the couch or chair. Today, with the advancement of technology, remotes have become more complicated, often confusing the user as how to change the channel with an increasing number of unnecessary bottoms. Nonetheless, changing the channel is easy for the users with a remote control.” With the information included in the paragraph, several categories and relationships emerge. First, changing the channel by using a remote makes it easier for the user as long as he or she understands how to use the buttons. Therefore, not all remotes will make channel changing easy. Second, by making it easy to change the channel, to what extent does the interviewee imply? It appears that the interviewee means easy in the terms of the user not having to manually change the channel of the TV on the TV box. Lastly, it appears that the more advanced the remote, the less practical it becomes. Without the content presented in the paragraph, a standalone sentence has the potential to be misinterpreted. Once the meaning was identified from the transcription, it could be theoretically sampled.

3.6.2 Theoretical Sampling

According to Bartlett and Payne (1997), theoretical sampling is the processes of developing categories further by sampling relevant categories. This again is an iterative process that involves identifying categories in an earlier dataset and then testing those categories

against new preceding datasets. However, this does not mean the original primary questions were ignored. Just the opposite; the primary questions were further probed for meaning on the account of emergent categories from former dataset. For this research process, theoretical sampling occurred two times; once after every four interviews. Therefore, when four interviews were completed, they were coded, saturated, and revised as explained in Chapter 3.5.3 and 3.5.4. The categories that emerged from the four interviews were asked in the next series of four interviews. This procedure continued until all the desired interviews were completed. When this process is complete it creates a master code book (Appendix C) of which each transcription is tested against.

3.6.2 Axial Coding the Dataset

According to Bartlett and Payne (1997), axial coding is when relationships between the established categories are identified and tested against the data. The linkages and relationships between the categories allow the researcher to reduce the number of categories into a more cohesive meaning. Strauss and Corbin (1990) urge the researcher to familiarize themselves with the literature to identify meaning within the data. However, Glaser (1978) claims that when the researcher familiarizes themselves with the data they are sensitizing themselves to interpreting the data and the relationships in a biased manner towards that familiarity and not towards new relationships. Fortunately for this topic, little research exists that comprehensively examines the roles of the airport before, during, and after a disaster. However, extensive literature exists on system vulnerability and resiliency (Chapter 2). Consequently, both Strauss and Corbin's (1990) and Glaser's (1970) grounded theory philosophies apply to this research; Strauss and Corbin's (1990) in the sense that formularization with the literature on such topics as

vulnerability and resiliency; Glaser's (1978) in the sense that not familiarization on the literature of airports roles before, during, or after a disaster because, minimal research exists on the topic. Either way, qualitative data contains meaning, but additional meaning is dependent on how the researcher reorganizes it, which is based on both Strauss and Corbin's (1990) and Glaser's (1978) theories about data sensitively. After the data was coded through axial coding, then theoretical integration could occur.

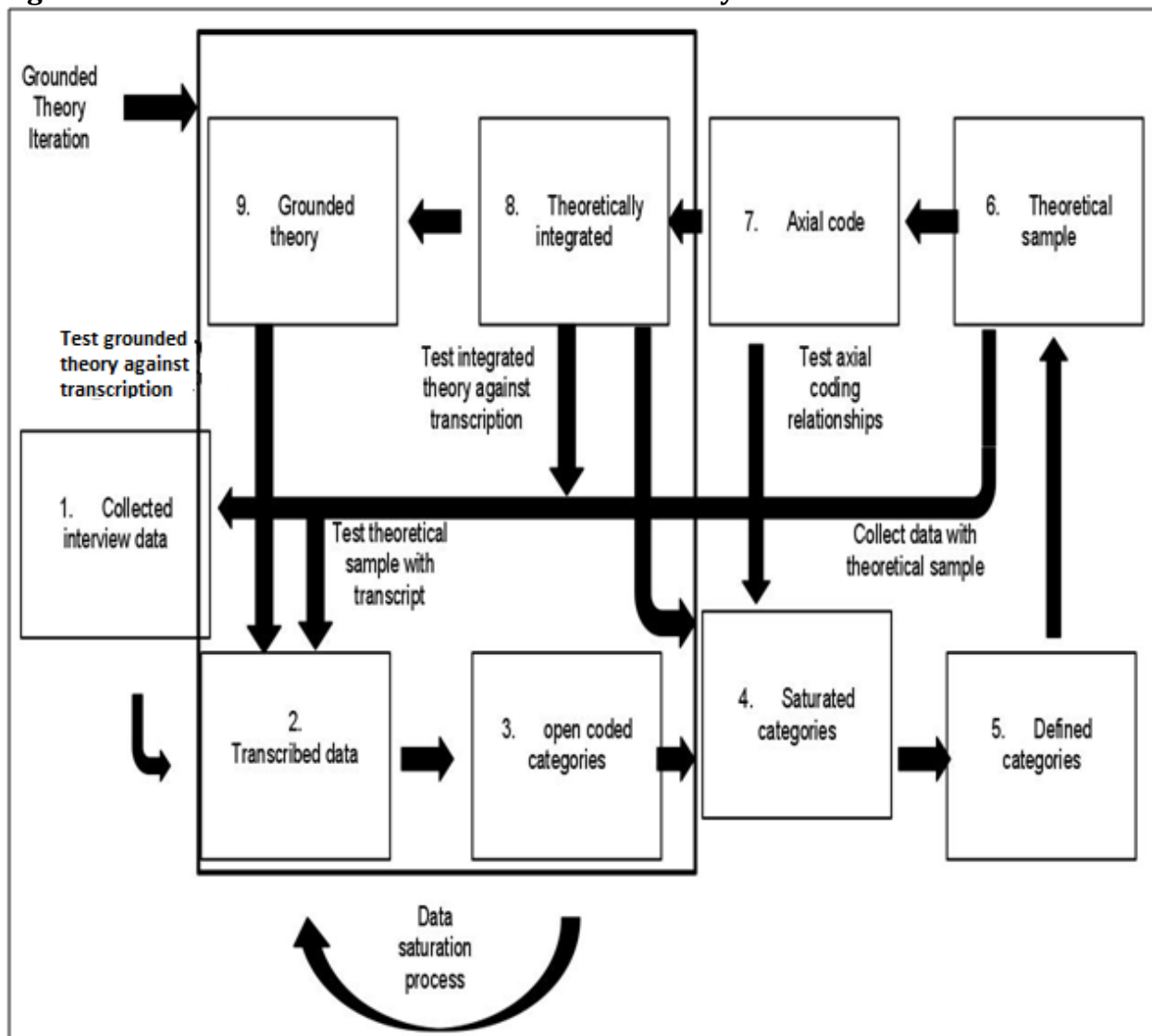
3.7 Pre – Grounded Theory Analyzes

While all the previously discussed steps to formulating a grounded theory provide a pre-analysis, Dey (1993), suggests that a matrix of the qualitative data can provide additional help in reducing the amount of variables within the dataset to a list of more significant variables. This process is conducted by analyzing frequencies of categories and then reducing the categories. The resulting matrix is useful for determining how to formulate categories for further analysis (Appendix P). Similarly, this process is can provide insight into narrowing the range of formulating a grounded theory. To construct the matrix, Dey (1993) suggests using the categories presented in the saturated data (Appendix C). The question remains as to how or what constitutes categories as having meaning?

3.8 Grounding the Theory

The pre-grounded theory analysis provided a useful interpretation of the data to allow a transition into Bartlett and Payne's (1997) approach to grounding the theory. This process is the last iterative step before a grounded theory emerges and is tested. Figure 3.4 displays the last iterative process of Bartlett and Payne's (1997) method for establishing a grounded theory in qualitative data.

Figure 3.4 – The Iterative Process of Grounded Theory



3.8.1 Theoretical Integration from the Axial Coding

According to Bartlett and Payne (1997) theoretical integration is when a primary category is related to all subcategories that has explanatory meaning. In other words, meaning is established between links of existing theory provided by theoretical sampling and axial coding.

3.8.2 Grounded Theory Data Analyses

The last step in Bartlett and Payne's (1997) grounded theory procedure is to produce a grounded theory and test it against actual segments of transcription, therefore cementing the relationships within the data. This step, similar to previous steps, involves creating meaning in the grounded theory that is inscribed into the data provided by the research participants, as shown in Figure 3.4. The accumulation of knowledge from the coded interviews allows certain recommendations to be concluded.

3.9 Research Rationale

Combining these two series of questions infuses resiliency capacity and vulnerabilities concepts of airports to the needs of a community. This combination leads to several positive results. First, airports' can identify precisely what their role is and what their role needs to be. The identification of their role before a hazard strikes will lead to the diminishing effects of the likelihood of a disastrous experience. For example, FEMA officials and airport officials both have their ideas as to what the role of an airport is during hazard and disaster prevention, response, and recovery. However, these ideas may not coincide with each other. The various perceptions of defining the airports' role for disaster adaptation and preparedness has never been examined before and therefore could lead to outcomes that help decrease disaster fatalities and increase recovery response. Second, identifying the role of the airport can lead to recognizing its operational and infrastructural weakness. Therefore, appropriate adaptation policies can be recommended for creating a more resilient airport when encountering disasters. Additional research data provides a framework for how supportive the airport's role is or should be for a surrounding community. The resulting information is further described in the data analysis chapter.

3.10 Limitations to the Methodology

While qualitative data analysis contains rich information, it does possess certain intrinsic limitations. First, not all interviewees possess the same knowledge about the subject. Therefore, some interviews are richer with data, while others respond to the question naively (Marshall, 1996). Second, the interpretation of the research participants' responses may be questioned due to the process of interpretation being subjective. Third, despite interviewing 13 research participants, the view of the airport's role may have been different if the number of research participants had increased or decreased because, the categories, their meaning, and their relationship may have been different. Lastly, the theoretical coding is based on the sequential categories developed in one data series and tested in another data series. Depending on the perspective of the research participants in the initial data series

3.11 Chapter Summary

Chapter 3 provides a framework for executing the research. It states that the research is conducted by first determining how airports are vulnerable to hurricane hazards. Research participants were selected based on their employment sector: government, airport, or consultant and their exposure to hurricanes, blizzards, or tornadoes. Once determined, a grounded theory was constructed. The grounded theory was produced using Bartlett and Payne's (1997) approach for analyzing qualitative data to formulate a theoretical grounding. These authors suggest that the researcher use the following proceeding steps:

1. Collecting the data through interviews
2. Transcribe the data
3. Develop open coding categories

4. Saturate the categories
5. Defining categories
6. Theoretical sampling
7. Axial coding
8. Theoretical integration
9. Grounding the theory

Questions for the selected research participants involved two types of questions: “is” and “should” questions in a semi-structured, counterpoised interview process. The “is” questions provide information on the current role of the airport. The “should” questions provide information on what the potential role of the airport could be. This information was coded or categorized and saturated based on those questions and sub-categories of adaptation concepts. Then the coded information was analyzed by finding linkages and relationships among the categories through theoretical sampling and axial coding. One qualitative method was used to provide background information on the interviews by using Dey’s (1993) suggestion of a matrix to locate and determine significant variables. Utilizing the aforementioned procedures, a grounded materialized.

Chapter-4

RESULTS

4.1 Introduction

After the data was recorded into Word and Excel, it was analyzed using Bartlett and Payne's (1997) approach for analyzing qualitative data. The quantitative data was analyzed by creating a matrix (Dey, 1993). This matrix provided useful background information on the categories within the interviews. After the categories were extrapolated from the matrix, a grounded theory could be constructed. This was based on the theoretical work of Strauss and Corbin's (1990 and 2007) grounded theory approach but applied using Bartlett and Payne's (1997) step-by-step approach.

4.2 Pre-Grounded Theory Analysis Results

Using a suggestion derived from Dey (1993), results of the pre-analysis can be viewed in Appendix P. These results were allocated to the appendix for the sake of data communication simplicity. Dey (1993), suggests that pre-analysis data, which is often sifted through numerous times to extrapolate underlying themes, is too complex to be effectively communicated. The complexity derives from the pre-analysis in its entirety; because it contains large quantities of categories to be analyzed. Therefore, a large portion of the pre-analysis has been placed within the appendix of this thesis. However, the main categories that emerged include: the relationship between the airport and the surrounding community, airport infrastructure, evacuations, and disaster recovery. More specifically, the categories include:

- The airport and surrounding community in partnership for hazard and disaster response and recovery;

- The airport and surrounding community working without a partnership for hazard and disaster response and recovery;
- The vulnerability of airport infrastructure in hazard and disaster response and recovery;
- The use of airports for evacuations from hazards and disasters; and
- The airport as a means to provide disaster recovery.

Each one of the aforementioned categories was a reoccurring theme of the pre-analysis, which supports the grounded theory result produced by Bartlett and Payne's (1997) procedure for analyzing qualitative data.

4.2 Research Participant Profile

The interviews were composed of 13 individuals that are professionals in either aviation, government, or consultant sectors that specialized in emergency preparedness and/or response and airports. Table 4.1 displays the research participants, their occupation, and their occupation location.

Table 4.1 – Research Participant Profile

Research Participant	Occupation	Location	Specialization
Tim Philips	Consultant	Montana	Owner: Critical Path Inc.
Don Griffith	Consultant	North Carolina	Airport Operations Manager: Innovative Emergency Management
Stephanie Ward	Consultant	Michigan	Aviations Manager: Mead and Hunt
Hud Hopkins	Airport Official	Texas	Airport Manager: Scholes International Airport

Table 4.1 (Cont'd)

Research Participant	Occupation	Location	Specialization
Jim Smith	Professor and Consultant	West Virginia	Researcher: American Public University
Jeff Copeland	County Government Emergency Planner	Florida	Interim Director: Hillsborough County of Emergency Management
Anthony Williams	Airport Official	Louisiana	Chief of Police Department of Baton Rouge Airport
James Duncan	Federal Government Emergency Planner	FEMA Region IV (IL, IN, MI, MN, OH, WI)	Federal Preparedness Coordinator: FEMA Region IV
Robert Guevara	Airport Official	Texas	Airport Operations Manager: Hobby International Airport
John Glass	Airport Official	Pennsylvania	Airport Operations Superintendent: Philadelphia Airport
Andy Singhas	Airport Official	Georgia	Airport Operations Manager: Savannah International Airport
Derrec Becker	State Emergency Manager	South Carolina	Public Information Officer: South Carolina Emergency Management Division
Allen Porter	City Emergency Manager	Texas	Emergency Planner: City of Houston

Data regarding the aviation perspective of airports and disasters was composed of 6 research participants (46%) whom specialized in airport manager/director, airport operations director. Data regarding the governmental perspective of airports and disaster was composed of 4 research participants (30%) whom stemmed from city managers, FEMA region directors, county emergency planning director, and state emergency management director and specialized in emergency preparedness and/or response. Data regarding the consult perspective of airports and disaster were composed of 3 research participants (24%) that

specialized in aviation and disaster planning. Once the interviews were completed, they were transcribed.

4.3 Transcribing the Interviews

The data was transcribed according to the recorded questions asked from the researcher and responses from the participants. The transcriptions ranged from 6-15 pages, depending on length of answers the participants provided or the need for further questions from the researcher. For the sake of report length, the transcriptions have been removed from the thesis.

4.4 Developing Open Coded Categories

Open coded categories were assigned based on themes and meaning present in the interviews after the transcriptions were viewed. The open coded categories are based on the overall meaning of the interview not necessarily a specific sentence. Table 4.2 contains the open code results. The open coded categories were determined after several passages through the transcriptions. More bluntly, the open coded categories relate to the research question of determining what the airport's role is before, during, and after a disaster. Therefore, the open coded categories revolve around the main questions asked to the research participants, as shown in Table 4.2. However, as discussed in Chapter 3.5.2, these questions are centered on two concepts of knowing the airport's role in a given situations; that is, what the airport's role "IS" and what the airport's role "SHOULD BE".

Table 4.2 – Open Coded Categories

The airports role in response to a natural hazard	The airports role in response to a natural disaster	The airports role in recovery from a natural hazard	The airports role in recovery from a natural disaster
---	---	---	---

While there only appears to be 4 categories for the open coded questions, the reality these questions represent two sets of qualitative information; the “is” and the “should be” datasets of information. Therefore, the open coded categories in Table 4.2 can be further coded into the “is” by using what the current role of the airport is before, during, and after a disaster. Likewise, the categories in Table 4.2 can be further coded into the “should be” by relating the information to what the research participant believes the airport’s role needs to be. Table 4.3 and 4.4 show the open coded category for the “is” and the “should”, respectively.

Table 4.3 – Open Coded Categories for the Current Role of the Airport

Airport’s current role in response to a natural hazard	Airport’s current role in response to a natural disaster	Airport’s current role in recovery from a natural hazard	Airport’s current role in recovery from a natural disaster
--	--	--	--

Table 4.4 – Open Coded Categories what needs to be the Role of the Airport

What needs to be the airports role in response to a natural hazard	What needs to be the airports role in response to a natural disaster	What needs to be the airports role in recovery from a natural hazard	What needs to be the airports role in recovery from a natural disaster
--	--	--	--

However, after several passages through the data, additional meaning emerged that represented diverging ideologies of viewing the airports’ role. These two ideologies are based on if the research participant believed the airport acted in an independent nature before,

during, and after a disaster or hazard or if the research participant believed the airport would actively seek cooperation and coordination with the surrounding community. Therefore, another open coded category was examined on the bases of the aforementioned. Themes continued to be identified within the data through a process called data code saturation (Chapter 3.5.1).

4.5 Saturated Data

Data saturation involved utilizing the open codes (categories) and expanding on them until no further data was identified. The saturated data can be viewed in Figure 4.1. Then the saturated code book was utilized to find that particular meaning within the research participant's response. The saturated datasets for each research participant can be viewed in Appendix D – P.

Figure 4.1 – Saturated Code Book

1. What is the airport's role in response to a natural hazard?
 - a. The airport to act dependently
 - i. Coordination
 1. local government
 - a. Establish communication
 - b. Use local resources
 - c. act independently
 2. State government
 - a. establish communication
 - b. Use state resources
 - c. act independently
 3. Federal government
 - a. establish communication
 - b. Use federal resources
 - c. act independently
 - d. Limited Role
 4. Airlines
 - ii. Evacuations
 - iii. Bring in Supplies
 - iv. Shelter
 - b. The airport to act independently
 - i. To act as a first responder
 - ii. Deal with the hazard
 1. In a systematic approach
 2. In accordance to fed regulation
 - iii. Protect the airport
 1. Infrastructure
 - iv. Evacuations
 - v. Keep flying until they no longer can
 - vi. Evacuations
 - vii. Shelter
 - viii. Communication
 - c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice
2. What is the airport's role in response to a natural disaster?
 - a. The airport to act dependently
 - i. Act as a staging area for recovery efforts

Figure 4.1 (cont'd)

- i. Bring in recovery supplies
 - ii. Become operational quickly after the storm
 - iii. As a lifeline for a community but with normal operations problem due to recovery efforts
 - iv. Mutual Aid between airports
 - v. Evacuations
 - vi. Dependent on airport infrastructure
 - vii. Coordinate with governments
 - 1. Local
 - 2. State
 - 3. Federal
 - viii. Respond to any disaster needs
 - ix. Shelter
 - b. Act in an independent role
 - i. Assess airport
 - ii. Restore facility
 - iii. Mutual Aid
 - iv. Dependent on airport infrastructure
 - v. Shelter
 - vi. Planning
 - 1. Adaptive Use
- 3. What is the airport's role in prevention of a disaster?
 - a. Act Dependently
 - i. Provide supplementary roles
 - 1. Evacuation
 - 2. Communication towards passengers
 - ii. To operate as an airport
 - iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Practice disaster scenarios
 - v. Shelter
 - b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick "bounce-back" from disaster to become operational
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter

Figure 4.1 (cont'd)

- a. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure
 - iv. Dependent on airport
 - v. Shelter
- 4. What is the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies
 - a. Dependent on airport infrastructure
 - ii. Dependent on the airport's infrastructure system
 - iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure
 - iii. Communicating
 - iv. personnel stuff
 - v. Getting the airport operational as quickly as possible
 - vi. Dependent on the airport's infrastructure system
 - vii. Act as a morale booster for citizens
 - viii. Shelter
 - c. Limited Role
 - i. Infrastructure Problems
- 5. What should be the airport's role in response to a natural hazard?
 - a. Act dependently
 - i. Communicate Information
 - 1. Local governments
 - 2. State governments
 - 3. Federal governments
 - ii. Resume operations as quickly as possible
 - iii. Evacuations
 - iv. Shelter
 - b. Act independently
 - i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
 - ii. Improve/fix critical infrastructure
 - iii. Adaptive use for infrastructure

Figure 4.1 (cont'd)

1. Concerns
 - ii. Resume operations as quickly as possible
 - iii. Communicate Information
 - iv. Preparation
 - v. Mutual Aid
 - vi. Shelter
4. What should be the airport's role in response to a natural disaster?
 - a. Act dependently
 - i. To be a tool for surrounding communities
 1. Dependent on type of airport
 2. Dependent on governmental requirements
 3. Operational Ultimatum
 - ii. Acting as a staging area
 - iii. For incoming delivery
 - iv. Evacuation
 - v. Take lead role in recovery
 - vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - iv. Assessment
 - c. Limited Role
 - i. Dependent on airport
5. What should be the airport's role in prevention of a Disaster?
 - a. Act dependently
 - i. Provide supplementary roles to the community
 1. Deliver goods and services
 2. Act as a staging ground
 3. Evacuations
 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government
 1. Local
 2. State
 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptative use for infrastructure
 - iii. Work with other forms of government

Figure 4.1 (cont'd)

- i. Utilizing available resources
 - ii. Become operational as quickly as possible
 - iii. Update Emergency plan (Preparation)
 - iv. Shelter
- 4. What should be the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
 - b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
 - c. To act as
 - d. Limited/unknown roll

Data beyond the detail of Figure 4.2 does little to explain further meaning of the dataset. It is apparent from Figure 4.2 that certain categories were saturated more than others. For example, category 1ai (The airport should act dependently through coordination) contains numerous sub-categories (ie., coordination with local, state, and/or federal governments), which suggests that the research participants could describe detailed information in category 1. Conversely, category 8a and 8b do not entail as much detail in the saturated data because no further meaning could be derived out of the data. The category with more detail or saturation usually contains more meaning behind the data (Lyons and Coyle, 2007) in comparison to a category that is less saturated. After the categories are saturated they can be compared to each other.

4.6 Revised Codes and Axial Coding

After the open coded categories were identified, each transcription was examined for information and meaning regarding each saturated code. The meaning found within each interview was more comprehensive than the saturated coded category yet; its meaning is not disconnected with the saturated coded category. For example, a section of the saturated code contains interviewee information on either the airport should act independently from the community or in cooperation. Therefore, the revised code is simply identifying the relationship. Furthermore, this meaning is not an exact quote from the transcriptions. Table 4.5 displays the revised codes from each transcription in the left column and each interviewee's respective view of the revised code. These tables become useful when constructing relationships between categories within each interview. The views in the proceeding tables have been encrypted to protect the research participants.

Table 4.5 – Revised Coded Categories for Research Participants

Research Participant	1	2	3
Occupation	Consultant	Consultant	Consultant
Airport and Community relationship	Create cooperative relationships	Respond to community	Airports are being forced to coordinate with communities but don't want to participate.
Airport Evacuation	Emergency evacuations	Nothing	Used for evacuations
Airport Shelter	Possible housing	Nothing	nothing
Airport Staging Area	Lifeline for community for recovery supplies; emergency evacuation	Nothing	Get airport operational
Airport's Critical Infrastructure	Airplane and airport cargo mismatch	Minimize physical damage	Protect the infrastructure
Airport Operations	Nothing	Keep flying until impossible	Operations are limited in disaster but still operable
Research Participant	4	5	6
Occupation	Airport Manager	Airport manager	Airport Manager
Airport and Community relationship	As a lifeline for the community	Community can take care of itself after a disaster	To have the community get the airport up and running
Airport Evacuation	Evacuate vulnerable groups	Only for outbound passengers	Emergency flight
Airport Shelter	nothing	Airport vehicles if necessary	Not enough resources
Airport Staging Area	FEMA Uses the airport for supplies introduction and distribution	Do not want to provide FEMA the space necessary for use	Used for federal response
Airport's Critical Infrastructure	Infrastructure needed after disaster	1 st runway and airfield. 2 nd terminal	Runway issues with incoming airplanes
Airport Operations	Resume Operations quickly after disaster	Use the airport for airport business	Can handle the additional flights

Table 4.5 (cont'd)

Research Participant	7	8	9
Occupation	Airport Operations	Airport Operations	Director of County Emergency Management
Airport and Community relationship	As a life line for communities	As a life line for communities	To operate as an airport for morale
Airport Evacuation	Mass Evacuations	No plans exist for airport and community evacuation	Incoming evacuees from hazard areas
Airport Shelter	Employee's families have stayed at an airport but that is it	Not wanted but could happen in extreme situations	Hindered by need to be operational
Airport Staging Area	As a center for supply distribution	Used for emergency vehicles; supply distribution site	Use available resources for staging recovery supplies
Airport's Critical Infrastructure	The airport is a resource filled with critical infrastructure for recovery	Power, airfield is clear, Hangers and drainage	Protect infrastructure for aircraft and airport material
Airport Operations	Get back to normal operations as quickly as possible	Restoring operations as quickly as possible	Restoring operations as quickly as possible

Table 4.5 (cont'd)

Research Participant	10	11	12	13
Occupation	Airport Operations	FEMA Region IV Director	City Emergency Management Director	State Emergency Management Director
Airport and Community relationship	Coordinate efforts between all government levels	Coordinate efforts between all government levels	Communication linkages between the two	To operate as an airport for morale
Airport Evacuation	Incoming evacuees from hazard areas	Evacuate survivors	Incoming evacuees from hazard areas; evacuate vulnerable people	Incoming evacuees from hazard areas. Commercial jets not best fit.
Airport Shelter	Nothing	Nothing	Nothing	Business volunteers will house evacuees
Airport Staging Area	Nothing	Not at commercial airports	More for movement of supplies rather than storage of supplies (waypoint)	Nothing
Airport's Critical Infrastructure	Retrofit buildings to make them stronger	Retrofitting buildings. Making sure they have power	The entire airport is critical	Runway's abilities
Airport Operations	Restoring operations as quickly as possible	Restoring operations as quickly as possible	Nothing	Restoring operations as quickly as possible

This research was able to generally compare what the role of the airport is. When categories emerged about the airport's role before, during, or after a disaster, a hypothesis could be formed. When formed, it could be tested in preceding interviews by probing deeper into the subject. For example, interviews in the earlier stages of data collection were centered on the concept of understanding if the airport has a role before a disaster. Therefore, the later stages of data collection were focused on additional probing as to what the aforementioned

role entails. At this stage of the results, it is apparent that certain themes, such as infrastructure play a large role in the airports ability to become resilient. However, a grounded theory still cannot be constructed. Tables 4.6, 4.7, and 4.8 display the sequential axial coding based on the interviews and transcriptions.

Table 4.6 – Initial Interviews with Revised Code (Axial Code Group 1)

Research Participant	2	7	1	4
Occupation	Consultant	Airport Operations	Consultant	Airport Manager
Airport and Community relationship	Respond to community	As a life line for communities	Create cooperative relationships	As a lifeline for the community
Airport Evacuation	Nothing	Mass Evacuations	Emergency evacuations	Evacuate vulnerable groups
Airport Shelter	Nothing	Employee's families have stayed at an airport but that is it	Possible housing	nothing
Airport Staging Area	Nothing	As a center for supply distribution	Lifeline for community for recovery supplies; emergency evacuation	FEMA Uses the airport for supplies introduction and distribution
Airport's Critical Infrastructure	Minimize physical damage	The airport is a resource filled with critical infrastructure for recovery	Airplane and airport cargo mismatch	Infrastructure needed after disaster
Airport Operations	Keep flying until impossible	Get back to normal operations as quickly as possible	Nothing	Resume Operations quickly after disaster

Table 4.7 – Second Set of Interviews with Revised Code (Axial Code Group 2)

Research Participant	3	9	6	11
Occupation	Consultant	Director of County Emergency Management	Airport Manager	FEMA Region IV Director
Airport and Community relationship	Airports are being forced to coordinate with communities but don't want to participate.	To operate as an airport for morale	To have the community get the airport up and running	Coordinate efforts between all government levels
Airport Evacuation	Used for evacuations	Incoming evacuees from hazard areas	Emergency flight	Evacuate survivors
Airport Shelter	nothing	Hindered by need to be operational	Not enough resources	Nothing
Airport Staging Area	Get airport operational	Use available resources for staging recovery supplies	Used for federal response	Not at commercial airports
Airport's Critical Infrastructure	Protect the infrastructure through planning	Protect infrastructure for aircraft and airport material	Runway issues with incoming airplanes	Retrofitting buildings. Making sure they have power
Airport Operations	Operations are limited in disaster but still operable	Restoring operations as quickly as possible	Can handle the additional flights	Restoring operations as quickly as possible

Table 4.8 – Last Set of Interviews with Revised Code (Axial Code Group 3)

Research Participant	8	10	5	13	12
Occupation	Airport Operations	Airport Operations	Airport Manager	State Emergency Management Director	City Emergency Management Director
Airport and Community relationship	As a life line for communities	Coordinate efforts between all government levels	Community can take care of itself after a disaster	To operate as an airport for morale	Communication linkages between the two for coordination of airport services
Airport Evacuation	No plans exist for airport and community evacuation	Incoming evacuees from hazard areas	Only for outbound passengers	Incoming evacuees from hazard areas. Commercial jets not best fit.	Incoming evacuees from hazard areas; evacuate vulnerable people
Airport Shelter	Not wanted but could happen in extreme situations	Nothing	Airport vehicles if necessary	Business volunteers will house evacuees	Nothing
Airport Staging Area	Used for emergency vehicles; supply distribution site	Nothing	Do not want to provide FEMA the space necessary for use	Nothing	More for movement of supplies rather than storage of supplies (waypoint)
Airport's Critical Infrastructure	Power, airfield is clear, Hangers and drainage	Retrofit buildings to make them stronger	1 st runway and airfield. 2 nd terminal	Runway's abilities	The entire airport is critical
Airport Operations	Restoring operations as quickly as possible	Restoring operations as quickly as possible	Use the airport for airport business	Restoring operations as quickly as possible	To be used for assisting the city in preparation of incoming disasters

According to Tables 4.6, 4.7, and 4.8, the progression of information throughout the sequential interviews of axial coding displays certain themes present in the data. It is apparent,

throughout the axial coding, that certain categories are more detailed than others. In table 4.6, the revised categories are fairly vague. This is due to the nature of axial coding being initially general and then becoming more focused on a theory. Therefore, Table 4.8 provides the most specific responses. However, this does not mean the initial interviews can be disregarded or do not provide meaning to the theory. When the final axial coding was completed and the code book was further updated, then all the interviews were examined for categories based on the updated code and the process of generating a grounded theory was restarted. When all the interviews were completed using axial coding, theoretical integration could occur.

4.7 Theoretical Integration on the Role of the Airport using Axial Coding

The revised categories were further explored to identify reasoning for their existence. Tables 4.9 – Table 4.14; identify limitations and promotions of each research participant's perspective on the revised code. This information sheds light onto where airports and communities need additional support for increasing resiliency. For example, one interviewee may believe the relationship of the community and the airport is to act in a partnership before, during, and after a disaster. They may believe it is a necessary role for the airport because airports can fundamentally rebound quicker from a disaster, in comparison to a community. However, they may believe that this role is limited on the bases of the airport's responsibility to foster airline services.

4.7.1 The Airport's Relationship with the Community in Hazardous or Disastrous Events

The relationship between the airport and the community is divided between the airport acting independently from the community, the airport acting in cooperation with the

community, and the airport acting independently but providing benefits when available, as indicated in Table 4.9.

Table 4.9 – Research Participant’s Perspective on the Airport and Community Relationship in Times of Hazards or Disasters

Research Participant	Relationship	Relationship Limitations	Relationship Promotion
1	Create cooperative relationships	Dependent on infrastructure performance and perceptions of community	To help with the recovery effort by bringing in supplies
2	Respond to community	Need to get the airport operational	To take a lead role in recovery efforts
3	Airports are being forced to coordinate with communities but don’t want to participate.	Dependent on perceptions of community and airport	To assist in disaster recovery
4	As a lifeline for the community	Dependent on ability of the airport to operate	To help with the recovery effort by bringing in supplies
5	Community can take care of itself after a disaster	Dependent on the infrastructure damaged	A functional airport provides a sense of security to the community
6	To have the community get the airport up and running but provide aid	Dependent on the infrastructure damaged	A functional airport provides a sense of security to the community
7	As a life line for communities	Dependent on infrastructure. Should be limited to initial recovery	SEADOG can help get airport’s infrastructure fixed for initial recovery
8	To operate as an airport but provide additional services if able	The airport is to operate as an airport unless needed otherwise and can perform those tasks	Can provide empty available space for recovery operations
9	To operate as an airport but provide additional services if able	The airport is to operate as an airport unless needed otherwise and can perform those tasks	Can provide empty available space for recovery operations

Table 4.9 (cont'd)

Research Participant	Relationship	Relationship Limitations	Relationship Promotion
10	Coordinate efforts between all government levels	It is up to FAA for the airports role in the disaster	The airport needs to get back and running
11	Coordinate efforts between all government levels	Non-commercial airports respond to the local need	Working commercial airport stimulates the economy
12	Communication linkages between the two for coordination of airport services	Dependent on ability to communicate	Coordination of evacuations, responses, and recovery
13	To operate as an airport for morale	Dependent on the infrastructure damaged	A functional airport provides a sense of security to the community

Table 4.10 – Research Participant’s Perspective on the Airport and Community Relationship Before, During, and After Hazards or Disasters

Research Participant	Before	During	After
1	Plan on infrastructure adaptation with the community in mind; discuss airport’s operational status	N/A	Coordinate the movement of recovery supplies
2	N/A	N/A	Get airport operational
3	Plan for a relationship before hazard or disaster strikes	N/A	Have the airport be a hub for recovery
4		N/A	
5	Operate as an airport as long as possible	Protect infrastructure	Get the airport operation as quickly as possible
6	Operate as an airport and prep infrastructure; Be part of the OEP with the community	N/A	Get the airport operation as quickly as possible
7	Working with local communities to determine future problems	N/A	Get airport operational; provide additional roles if necessary and able

Table 4.10 (cont'd)

Research Participant	Before	During	After
8	Have a plan in place with local community and tenets	N/A	Get the airport operation as quickly as possible
9	Operate as an airport as long as possible	N/A	Provide space for recover supplies if able
10	Coordinate with all levels of government	N/A	Get the airport operation as quickly as possible
11	Local government and airport mitigate disaster effects	N/A	Get the airport operation as quickly as possible
12	Airport closures.	Infrastructure failures	Coordination of recovery abilities
13	Operate as an airport as long as possible	Protect infrastructure	Get the airport operation as quickly as possible

When airports act independently from the community, they are often viewed selfishly in the sense that their sole concern is to become operational with no additional roles. This is due to several research participants believing that the airport can better provide for the community through the creation of “everyday” normalcy or a sense of security.

When airports are in cooperation with the community, they often require vast amounts of planning and coordination to achieve mutual benefits. Several interviewees felt that an airport-community relationship was a more responsible method for community recovery from a disaster because it immediately brings in recovery supplies. Therefore, they believed that this function would create a sense of normalcy. To achieve this though, airports and communities must plan appropriately to diminish taxing effects of disaster recovery on normal airport

operations; otherwise, adding an additional role to the airport is futile. Similarly, the airport, if planned properly, can have dual roles when confronted with a hazard or disaster.

Lastly, several interviewees believed that the airport could function in dual roles, depending on its aviation capacity. Acting in dual roles, the airport's main objective is still to become operational as quickly as possible but with the potential to become more than just an airport. Before serving dual roles, the airport carefully assesses itself as to whether it is able to provide recovery services to the surrounding community. If the airport is able to provide services to the community, besides normal airline services, it should assess the capacity potential. Some of these airport-community services may include evacuating nearby citizens.

4.7.2 Research Participant's Perspective on the Airport for Evacuation

There are two main themes for the airport acting in favor of evacuations: evacuating the surrounding community and evacuating communities from afar. In both cases, the airport plays a role of which is mostly dependent on the resiliency of the present infrastructure and the capacity of the airports facilities. Table 4.11 and Table 12 display each interviewee's perspective on evacuations via the airport.

Table 4.11 – Research Participant’s Perspective on the Airport for Evacuation

	Evacuation	Evacuation Limitations	Evacuation Promotion
1	Emergency evacuations	Communities poor perception of airports as a tool and vice versa (i.e., airports are independent entities)	Can be vital for people in need of fast evacuation transportation
2	Nothing	N/A	N/A
3	Used for evacuations	People have to be able to get to the airport	Fastest way for people to evacuate
4	Evacuate vulnerable groups	Dependent on if the airport is operational	Can operate quicker than other modes
5	Only for outbound stranded passengers	Dependent on if the airport is operational	Airport can operate more efficiently
6	Emergency flight	Airport may not be functional	Quickest way for evacuations
7	Mass Evacuations	N/A	Precautionary evacuation when airport is not damaged
8	Evacuations with community does not exist	N/A	Might be able to exist if needed
9	Incoming evacuees from hazard areas	Dependent on facilities and operations to handle vast amount of people	Provide asylum to endangered people
10	Incoming evacuees from hazard areas	Dependent on infrastructure and operations to handle vast amount of people	Provide asylum to endangered people
11	Evacuate Survivors	Dependent on infrastructure and ability to operate	Convenient cargo for outbound air traffic
12	Incoming evacuees from hazard areas; evacuate vulnerable people	Dependent on facilities and operations to handle vast amount of people	Provide asylum to endangered people; can operate quicker than other modes
13	Airports for incoming evacuees from hazard areas. Automobile for community evacuees	Dependent on facilities and operations to handle vast amount of people; airport too slow for local community	Provide asylum to endangered people; automobiles are faster for local community

Table 4.12 – Research Participant’s Perspective on the Airport for Evacuation Before, During, and After a Hazard or Disaster

	Before	During	After
1	Planning for evacuation	N/A	Evacuation of medical care people
2	N/A	N/A	N/A
3	N/A	N/A	Evacuate people after the disaster
4	N/A	N/A	Evacuate people after the disaster
5	Evacuate outbound stranded passengers	N/A	N/A
6	N/A	N/A	Evacuations
7	Evacuation of mass groups	N/A	Evacuation of medical care people
8	N/A	N/A	N/A
9	N/A	N/A	Set up facilities for incoming evacuees
10	N/A	N/A	Set up facilities for incoming evacuees
11	N/A	N/A	Evacuate Survivors
12	Evacuate people and businesses	N/A	Set up facilities for incoming evacuees
13	N/A	N/A	Set up facilities for incoming evacuees

The airport evacuating the surrounding community appears to be based on evacuating disaster victims following the disaster. Evacuations after this disaster are based on the infrastructure status of the airport and the community. The failure of one of those infrastructures can yield the airport useless. Few interviewees believed that evacuations should occur before the hazard arrives. This because this portion of interviewees believed that the airport would be too busy preparing itself for the disaster in addition to airline companies evacuating their aircrafts, thus rendering pre-hazard evacuations via airports implausible.

A large portion of the interviewees believed that the airport’s function was to provide asylum for evacuees from disaster areas outside of the immediate airport’s community. Areas under

distress from hazards or disaster are evacuating victims via airplanes and airports for the sake of providing asylum. During this time, the airport needs to present facilities for the processing of evacuees and the necessary infrastructure to handle the capacity. Once people are evacuated from the dangers of the hazard or disaster, through the airport, they are often housed in areas outside the airport.

4.7.3 Research Participant's perspective on the Airport as a Shelter

There are two views the interviewees had on the airport acting as shelter: the airport will house employees and their families for the purpose of providing a quick bounce back from the hazard or disaster and the airport should concentrate solely on airline operations during the disaster. Table 4.13 and Table 4.14 depict the views of the interviewees on the airport as a shelter.

Table 4.13 – Research Participant's Perspective on the Airport as a Shelter

	Shelter	Shelter Limitations	Shelter Promotion
1	Houses employees; Possible housing for community	May not be safe	Can store disaster supplies and has space
2	Nothing	N/A	N/A
3	nothing	N/A	N/A
4	Airport employees	For airport employees	Employees work better knowing family is safe
5	Not desired for the public but ok for employees	Airport wants to be operational and it would require too many resources	Extreme case, a hanger maybe used for public
6	Provide shelter to those who are trapped	Airport wants to be operational and it would require too many resources	Part of their plan for stranded passengers

Table 4.13 (cont'd)

	Shelter	Shelter Limitations	Shelter Promotion
7	Airport employees	Limited staffing	Employees work better knowing family is safe
8	Not desired for the public but ok for employees	Airport wants to be operational and it would require too many resources	Extreme case, a hanger maybe used for public
9	Nothing	N/A	N/A
10	Nothing	N/A	N/A
11	Nothing	N/A	N/A
12	Nothing	N/A	N/A
13	Business volunteers will house evacuees	Businesses may not want evacuees	Provides additional shelters to evacuees

Table 4.14 – Research Participant’s Perspective on the Airport as a Shelter Before, During, and After a Hazard or Disaster

	Before	During	After
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	Maintain airport for 24/7	N/A
5	House employees	Maintain airport for 24/7	Quick bounce back from disaster
6	Part of their plan	Resources available	Shouldn’t exist, too many resources would be tied up
7	N/A	Maintain airport for 24/7	Employees and families housed at airport
8	House employees	Maintain airport for 24/7	Quick bounce back from disaster
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A

Table 4.13 displays each research participant's perspective on the airport acting as a sheltering device. Research participants who believed the airport should act in favor of operations instead of housing evacuees or employees and their families tend to think that the airport as not suitable for any type of shelter. Those interviewees who discussed the airport operating as a shelter for employees and their families believed that this was one method for increasing the airports ability to quickly recover for two reasons. First, employees staying at the airport during the duration of hazard or disaster are able to monitor and assess the airport's infrastructure and operational status. Secondly, employees are able to work more efficiently with the ease of mind knowing their family is nearby and safe within the makeshift shelter of the airport. However, any additional sheltered victims could be detrimental to the quick recovery of the airport following the passage of the hazard event.

4.7.4 Research Participant's Perspective of the Airport as a Staging Area Following the Hazard

Many research participants are torn between the airport acting as only a waypoint for incoming supplies, which are then rerouted towards areas of need, or if the airport is an active player is providing space for command operations following a disaster or hazard. Table 4.15, denotes the perspective outcomes of the airport acting as a staging area. Table 4.16 displays those perspectives, either before, during, or after a hazard or disaster.

Table 4.15 – Research Participant’s Perspective on the Airport as a Staging Area Following the Hazard

	Staging Area	Staging Area Limitations	Staging Area Promotion
1	Lifeline for community for recovery supplies; emergency evacuation	Lack of cargo equipment compatibility	Quicker mode and less uncertainty in damage than ground transportation
2	Nothing	N/A	N/A
3	Get airport operational then provide aid	Aid comes in too fast crippling the airport or aid cannot leave the airport	Fast method for bringing in supplies
4	FEMA Uses the airport for supplies introduction and distribution	Desire to bring in airliners after a disaster	Lots of space and concrete for recovery operations
5	More for movement of supplies rather than storage of supplies (waypoint)	Airport needs the space to operate effectively	Supplies can be stored as long as airport is inoperable
6	Used for federal response	Airport may not be functional after a disaster	May be the only means for incoming supplies
7	As a center for supply distribution	Airport may not be functional after a disaster	Immediate response to the disaster
8	Could become staging area for emergency vehicles and supplies	Airport needs the space to operate effectively	Large amounts of supplies can be organized
9	Use available resources for staging recovery supplies	Resources may not be available	Large amounts of supplies can be organized
10	Nothing	N/A	N/A
11	Not at commercial airports	Airport needs the space to operate effectively	Can be used as a waypoint for distribution
12	More for movement of supplies rather than storage of supplies (waypoint)	Airport may not be functional after a disaster; outside infrastructure may be disabled	Quickly bring in people, resources to get businesses operating again
13	Get airport operational	Airport may not be functional after a disaster	Use other airfields rather than commercial airports

Table 4.16 – Research Participant’s Perspective on the Airport as a Staging Area Before, During, and After a Hazard or Disaster

	Before	During	After
1	House employees; possible housing for community	May not be safe	Can store disaster supplies and has space
2	N/A	N/A	N/A
3	Have plans prepared for post-disaster events	N/A	Get airport operational then provide aid
4	Keep Equipment safe	Employees stay at airport	Establish FEMA command post
5	Let the airport operate as an airport		Operate as an airport if need and available provide resources
6	Prepare the airport by planning	Mitigate and negative impacts	Try to be available for recovery supplies
7	N/A	N/A	Recovery aid at first until airport is operational
8	N/A	N/A	N/A
9	Let the airport operate as an airport	N/A	Operate as an airport if need and available provide resources
10	N/A	N/A	N/A
11	Send equipment and supplies there	Protect equipment and supplies	Distribute supplies and use equipment
12	Coordinate with local government	N/A	Coordinate with local government
13	N/A	N/A	N/A

Some interviewees believed the airport is and should act in favor of providing space and storage for recovery efforts. This is because the airport possesses large open space and the facilities for disaster recovery such as, empty hangers and open tarmac. Additionally, the airport contains a secure environment for the recovery supplies and emergency management personnel.

Those who believe that the airport should provide a waypoint for the distribution of supplies and the not the storage of supplies believe so because the airport’s operational

capacity may be jeopardized. When additional roles are imposed on the airport, facilities and infrastructure become taxed, rendering the main function of the airport useless. The interviewees who shared this opinion believe that the airport does not need to provide such services because other areas are available for distribution but not available for the introduction of supplies to a region.

Lastly, few research participants believed that the airport should not provide any additional service for the community other than normal airport operations. This rational perspective stems from the belief that other transportation avenues are available for the introduction of recovery supplies into a region, such as rail, highway, and marina. Additionally, any introduction of supplies into a region via airport could damper the operations of the airport. Similarly, storing supplies at the airport would be unnecessarily detrimental to the operations of the airport because there are other open spaces available for recovery operations. This suggests that infrastructure plays a critical role in determining the role of the airport.

4.7.5 Research Participant's Perspective of the Airport's Critical Infrastructure

All the research participants believed that the airport should protect its infrastructure to minimize the ensuing damage that may result from the hazard or disaster. However, the method for protecting the infrastructure varies among interviewees. Some believe that retrofitting is the proper approach to ensuring the safety of the equipment and infrastructure of the airport. This method is an active approach to increasing the resiliency of the infrastructure, therefore the resiliency of the airport. However, some interviewees believed that the airport should act as an airport without significant proportions of planning dedicated

to infrastructure protection. Table 4.17 displays the view of each interviewee on the airport's critical infrastructure. Table 4.18 displays those perspectives, either before, during, or after a hazard or disaster

Table 4.17 – Research Participant’s Perspective on the Airport’s Critical Infrastructure

	Critical Infrastructure	Critical Infrastructure Limitations	Critical Infrastructure Promotion
1	It needs to be identified more comprehensively	Staffing absent when attempting to repair or clean the airport; lack of adequate equipment	The ability to store mass amounts of supplies
2	Minimize physical damage	Can only protect what they can conceive	Proper planning can conceive all hazards
3	Protect the infrastructure	When the airport is misused	Quicker bounce back from disaster
4	Infrastructure needed after disaster	Keeping equipment safe and plenty of fuel	Quicker bounce back from disaster
5	Protect infrastructure for aircraft and airport material	Dependent on the capacity of infrastructure	Quicker bounce back from hazard or disaster
6	Protect infrastructure for aircraft and airport material	Damage to runways, taxiways.	ATC not required; large spaces and multiple runways available
7	The airport is a resource filled with critical infrastructure for recovery	Dependent on infrastructure	Movement of supplies to region when regional infrastructure is broken
8	Protect infrastructure for aircraft and airport material	Dependent on the capacity of infrastructure	Quicker bounce back from hazard or disaster
9	Protect infrastructure for aircraft and airport material	Infrastructure can be damaged	Airport has space and buildings which can be converted into recovery needs
10	Retrofit buildings to make them stronger	Dependent on the capacity of infrastructure	Quicker bounce back from hazard or disaster
11	Retrofitting buildings. Making sure they have power	Runway weight restrictions and space limits; inside and outside airport	Quicker bounce back from hazard or disaster
12	The entire airport is critical	Infrastructure needs protection	Can provide a more impactful role for response and recovery to a community
13	Infrastructure for airport operations	Runway’s capacity	Can provide response operations

Table 4.18 – Research Participant’s Perspective on the Airport’s Critical Infrastructure Before, During, and After a Hazard or Disaster

	Before	During	After
1	Do more than plan for airport operations	N/A	Cargo equipment, runway length, airplane equipment such as tires, staff
2	Plan for infrastructure failure	N/A	N/A
3	Plan to protect critical pieces	Minimize damages to fuel systems, runways, taxiways	Minimize damages to fuel systems, runways, taxiways
4	Top off fuel facilities	Have employee monitor the facility	Ration fuel, clear runway and taxiway
5	Plan to protect critical pieces	N/A	Get open quickly for incoming recovery supplies
6	Protect the infrastructure	Mitigate damage	Get open quickly for incoming recovery supplies
7	Plan for infrastructure adaptation and mitigation	N/A	Runway, fuel, electricity, adaptive infrastructure use (morgue, supply storage)
8	Protect equipment and aircraft; mitigate future effects of disaster	House staff during disaster for infrastructure surveillance	Make sure operation can proceed through safety inspection
9	Continue operating as an airport	N/A	If availability exists, provide space
10	Retrofit infrastructure and mitigate effects	N/A	Get open quickly for incoming recovery supplies
11	Retrofit vulnerable buildings and equipment	N/A	Get open quickly for incoming recovery supplies
12	Plan with communities	Keep all disaster players informed of progression	Assess and restore the airport; restore the community
13	N/A	N/A	Assess infrastructure

A majority of interviewees believed that protecting the airports infrastructure will provide a quick bounce back from any negative effects induced by the hazard event. This is because, when protected, less effort would be exhausted on infrastructure recovery therefore, operations would resume much quicker. The interviews also provided some information as to what infrastructure pieces are considered to be critical, including:

- Runway
- Taxiway
- Fuel
- Staff
- Cargo equipment
- Electrical equipment

While many other pieces may need protection or updating, the previously listed components are the most crucial to daily operations and potential recovery efforts.

4.7.6 Research Participant's Overall Perspective on the Airport

When determining the overall perspective on the airports role, Tables 4.19 – 4.20 provide information in rendering the role. Table 4.19 displays the comprehensive role of the airport based on each interviewee's respective response.

Table 4.19 – Research Participant’s Perspective on the Airport’s Operations

	Operations	Operations Limitations	Operations Promotion
1	Use the airport as a resource for community resiliency	Airport needs to be properly planned and prepared for additional roles	Lack of equipment of staff hinders additional roles for the airport
2	Keep flying until impossible; respond to community if possible	Depends on damaged assets	Airport are to act as airports than provide services is needed and able
3	The airport has a role with the community for disaster recovery	Dependent on the airports ability to be operable	Can be the fastest and most reliable tool for recovery
4	Resume Operations quickly after disaster	Understaffed or too much debris to clean; infrastructure problems	Has the potential to bounce back quickly and provide aid
5	Use the airport for airport business	Dependent on infrastructure and availability of airport resources	Airport may be the only means to receive incoming supplies
6	Have airport function as airport then provide limited additional roles	Dependent on infrastructure and availability of airport resources	Airport may be the only means to receive incoming supplies
7	Get back to normal operations as quickly as possible	Dependent on infrastructure	Airports are used for serving airlines
8	Use the airport for airport activates	Airport needs to be protected or improved	Provide a sense of normalcy for community
9	Use the airport only if needed and is available	Airport may not be available	Airport can offer abundant space and storage

Table 4.19 (cont'd)

	Operations	Operations Limitations	Operations Promotion
10	Restoring operations as quickly as possible	Dependent on infrastructure and availability of airport resources	Provide a sense of normalcy for community
11	Restoring operations as quickly as possible	Airport needs to be protected or improved	Provide a sense of normalcy for community
12	To be used for assisting the city in preparation of incoming disasters	Dependent on if the airport can be operational following a disaster	Can provide a quick bounce back for community
13	Restoring operations as quickly as possible	Dependent on airport facilities, resources, and infrastructure.	Provide a sense of normality

Table 4.20 – Research Participant’s Perspective on the Airport’s Operations Before, During, and After a Hazard or Disaster

	Before	During	After
1	Plan for providing additional roles to community	Protect infrastructure	Become operational and provide life line services to communities
2	Plan for infrastructure failure	N/A	Damage assessment and become operational
3	Proper planning and preparation for disaster	Protect equipment and infrastructure	Provide aid to communities
4	Prepare the airport for a potential disaster	House employees and their families	Get airport operational and then help community with recovery.
5	Plan and prepare airport for disaster	House employees for quick bounce back	Attempt to create a quick bounce back
6	Act as an airport and protect infrastructure	Protect and mitigate infrastructure for quick bounce back	Try to provide additional roles but not necessary.

Table 4.20 (cont'd)

	Before	During	After
7	Proper planning and preparation for disaster	House employees and their families	Get airport operational and then help community with recovery.
8	Plan and prepare airport for disaster	Monitor infrastructure	Quick bounce back for commercial airports, use alternative spaces for recovery
9	Operate as an airport	Protect itself	Provide aid only when requested; use as hub for repatriating
10	Plan and prepare airport for disaster through retrofitting and mitigation	N/A	Quick bounce back for commercial airports, use alternative spaces for recovery
11	Plan and prepare airport for disaster	Protect infrastructure	Quick bounce back for commercial airports, use alternative spaces for recovery
12	Communicate with all disaster players	Communicate with all disaster players	Get airport operational and then help community with recovery.
13	Protect infrastructure	N/A	Use sources other than commercial airport for recovery

In Table 4.20, it is apparent that the majority of interviewees agree that the role of the airport is to operate as an airport. This view manifests from the belief that the airport's function is to transport passengers and cargo; any additional role may hinder the ability for the airport to operate at full capacity. This is also reinforced by the airport providing asylum to its critical staff and their families during the hazard event. Such asylum is warranted for the sake of monitoring the airport's infrastructure and operations to decrease the time required for successful reopening of the airport. However, this not the only role the airport can perform.

Many research participants also believe that the airport can serve two roles through the use of cooperative planning with local governments.

Many interviewees believe that if planned correctly, the airport can serve the surrounding community after the airport assesses its infrastructure and becomes operational. This dual role of the airport depends on its infrastructure capacity and resiliency. If the airport's infrastructure is at capacity during the normal airport operations, its role is more limited in comparison to an airport that does not operate at capacity. Similarly, the airport's infrastructure needs to be resilient to the effects of the hazard event. By doing so, the airport has the opportunity to become operational much quicker after the disaster and as previously mentioned, if operations are below capacity airport could play a role. However, there are governmental issues associated with when or how the airport becomes operational following a disaster.

4.8 Government Agencies Role Airport Operations

Throughout the interviews, key government agencies emerged including: Federal Emergency Management Association (FEMA), Federal Aviation Administration (FAA), and Transportation Security Administration (TSA). Table 4.21 identifies the interviewee's perspective on government agencies for hazards and disasters.

Table 4.21 – Research Participant’s Perspective on Government Agencies in times of Hazards and Disasters

	FEMA	FAA	TSA
1	Provide financial support for planning and supplies for recovery	A condition for becoming operational	A condition for becoming operational
2	N/A	N/A	N/A
3	Used to protect the function of the airport	A condition for receiving or closing commercial airspace. Does not understand FEMA (NIMS) system. Some FAA regions require emergency plans	A condition for becoming operational
4	Provide recovery supplies	N/A	N/A
5	As an auditor for after the fact	FAA relies on SEADOG and WESTDOG for airport aid	N/A
6	Provide recovery supplies	Has control over the airliners	N/A
7	Assessing the resiliency of airports	Use FAA grant money to get build additional buildings	N/A
8	N/A	A condition for receiving or closing of commercial airspace	N/A
9	N/A	N/A	N/A
10	The airport should not rely on FEMA	A condition for receiving or closing of commercial airspace. Follow FAA rules for how money is spent. FAA emergency management plan.	A condition for becoming operational
11	Used to protect the facilities of the airport. Use airport for FEMA supplies	N/A	N/A
12	N/A	A condition for receiving or closing of commercial airspace.	A condition for becoming operational
13	To provide assistance	A condition for receiving or closing of commercial airspace.	N/A

There are two main views of FEMA during a time of hazards and disasters. One being that FEMA provides a role in the sense of assessing the airport’s infrastructure and allocating funds to create a more resilient airport. The other centers on the research participants believe

that FEMA does not provide a responsibility to the airport for disaster recovery; because their intention is for financial disaster assistance after the disaster.

The role of the FAA in the time of a hazard or disaster appears to be more focused on the operational functionality of an airport. The FAA will be the final judge in allowing commercial aviation to resume at an airport. Likewise, it will be the agency that determines whether the airspace in and around the airport should be closed. This should not be confused with the airport's role of opening and closing. While the FAA decides if the airspace is open or closed for business and if the airport is suitable for commercial flight, the airport cannot be forced to open by the FAA. Rather, if the airport deems it necessary to close, a support decision does not need to be granted by the FAA.

Finally, the TSA is the least discussed topic within the interviews. The interviews that did discuss the TSA, were focused on it as a condition for which the airport needs to meet to resume commercial operations.

4.8 Views of the Airport's Role based on the Perspectives of Consultants, Airport Officials, and Government Officials

The number and the range of occupations for the interview dataset provided enough information to compare the different views of each occupation, including: consultants, airport officials, and government officials. Table 4.22 displays the consultant's view of the airports role before, during, or after a disaster. It is apparent that the consultants view the airport as more than just an airport but rather a tool for the community in disaster recovery. Additionally, they agree that the airport should become operational as quickly as possible following a hazard or disaster. To achieve the turnaround necessary for the airport to become operational, the

consultants suggest to plan and mitigate any negative effects of the hazard on vulnerable infrastructure. This will ensure that the airport becomes operational quickly and therefore, can assist in the recovery process of the community. The consultant's view of the airports role is much different than the airport officials' view.

Table 4.22 – Consultant's Perspective on the Role of the Airport

	Occupation	Airport View	Before	During	After
1	Consultant	Use the airport as a resource for community resiliency	Plan for providing additional roles to community	Protect infrastructure	Become operational and provide life line services to communities
2	Consultant	Keep flying until impossible; respond to community if possible	Plan for infrastructure failure	N/A	Damage assessment and become operational
3	Consultant	The airport has a role with the community for disaster recovery	Proper planning and preparation for disaster	Protect equipment and infrastructure	Provide aid to communities

Unlike the consultant's view of the airport before, during, and after a hazard or disaster, airport officials have a more conservative perspective. All of the airport officials believe that the airport's role should be to act as an airport by providing normal operations to the community, as shown in Table 4.23. Such operations are believed to be the best option for the community because, as previously stated, it creates a sense of normalcy within the community. Similar to the consultant, airport officials believe that to best prepare the airport for quick recovery from the effects of a hazard, proper planning should occur to protect the infrastructure. Settled between the views of the consultants and the airport officials, are the government officials' view of the airport's role.

Table 4.23 – Airport Official’s Perspective on the Role of the Airport

	Occupation	Airport View	Before	During	After
4	Airport Manager	Resume Operations quickly after disaster	Prepare the airport for a potential disaster	House employees and their families	Get airport operational and then help community with recovery.
5	Airport Manager	Use the airport for airport business	Plan and prepare airport for disaster	House employees for quick bounce back	Attempt to create a quick bounce back
6	Airport Manager	Have airport function as airport then provide limited additional roles	Act as an airport and protect infrastructure	Protect and mitigate infrastructure for quick bounce back	Try to provide additional roles but not necessary.
7	Airport Operations	Get back to normal operations as quickly as possible	Proper planning and preparation for disaster	House employees and their families	Get airport operational and then help community with recovery.
8	Airport Operations	Use the airport for airport activates	Plan and prepare airport for disaster	Monitor infrastructure	Quick bounce back for commercial airports, use alternative spaces for recovery
10	Airport Operations	Restoring operations as quickly as possible	Plan and prepare airport for disaster through retrofitting and mitigation	N/A	Quick bounce back for commercial airports, use alternative spaces for recovery

Unlike the consultants and airport officials, the government officials tend to think of the airport as having dual roles. The first role is to become operational as quickly as possible following the hazard event then if needed by the community and resources are available at the

airport (operating under capacity) then the airport can provide additional roles to the community, as shown in Table 4.24.

Table 4.24 – Government Official’s Perspective on the Role of the Airport

	Occupation	Airport View	Before	During	After
9	Director of County Emergency Management	Use the airport only if needed and is available	Operate as an airport	Protect itself	Provide aid only when requested; use as hub for repatriating
11	Government Official	Restoring operations as quickly as possible	Plan and prepare airport for disaster	Protect infrastructure	Quick bounce back for commercial airports, use alternative spaces for recovery
13	Government Official	Restoring operations as quickly as possible	Protect infrastructure	N/A	Use sources other than commercial airport for recovery
12	Government Official	To be used for assisting the city in preparation of incoming disasters	Communicate with all disaster players	Communicate with all disaster players	Get airport operational and then help community with recovery.

Using all of the previously mentioned information, a grounded theory can be formed from the cohesion of relationships presented in the data.

4.9 Grounded Theory Generation

Through the assessment of the previously mentioned codes, saturated codes, category comparison and axial coding, certain theories began to emerge from the data. First it is apparent that certain roles of the airport exist before, during, and after a disaster. Additionally, information materialized about the airport if it were completely inoperable.

1. Before the hazard or disaster, the airport tends to plan for the immediate effects of the disaster present through passive and active adaptive planning. This should consist of protecting any necessary infrastructure for the quick operational recovery of the airport. Ideally, the airport would actively plan this through retrofitting storage facilities and airport buildings for the storage of vulnerable equipment, such as debris cleaning material. Likewise, the airport needs to retrofit components that are essential to normal airport operations, such as the runway, taxiway, air traffic control tower, and passenger facilities. Passive adaptive planning should be focused on quickly coordinating the movement of equipment and supplies to be readily available following the hazard or disaster, contingent on active adaption failure.
2. During the hazard or disaster, the airport tends to become less active, often only housing critical staff for the quick recovery of the airport following the disaster. Critical staff tends to assess the airport in terms of damage to assist in the management of the airport for the purpose of quickly recovering from the disaster. Any additional roles or non-critical staff tends to interfere with the airport's ability to become operational following a hazard or disaster.
3. After the hazard or disaster, the airport tends to assess any damaged inferred from the disaster and then determine procedures for becoming operational as quickly as possible. Being operational following a disaster allows the airport to not only capture airliner revenue but also provide a sense of security for the community by providing normal cargo and passenger services. Depending on the airport, additional roles can be executed by the airport. If the airport is not operating at capacity, there is an

opportunity for recovery supplies and equipment to not only be distributed through the airport but stored as well. This is because the airport's operations will not be diminished due to operating below potential capacity. Therefore, the additional congestion of the recovery planes, supplies, and equipment will not cause aircraft delay.

4. If the airport were inoperable following a disaster, its role would be still to become operational but with intermediate recovery role. The airport would not be directly involved in the recovery, in the sense of normal operations, but rather as a facility for disaster assistance agencies to execute recovery operations. However, the community disaster recovery operations cannot impede the airport disaster recovery operations. Minimally, the disaster recovery agencies need minimal airport operations and facilities to successfully operate from an airport, such as a debris free runway and adequate open space. Air traffic control tower is not needed for disaster recovery agencies to utilize the airport.

While many of the interviewees expressed the airport as a limited role for before, during, and after a disaster, it does not mean that there is no potential for the role to expand. Several interviews identified examples of successful airports that acted on behalf of their surrounding community for hazard and disaster response and recovery. The interviews were able to provide enough information to formulate methods to increase the resiliency of the airport and therefore potentially increase the resiliency of surrounding communities:

1. The airport needs to identify its own infrastructural risk towards disaster and mitigate and adapt appropriately. This allows the airport to become operational much quicker following a disaster. Some critical infrastructure components as identified in the data analysis include: runway, air traffic control tower, passenger buildings, cargo equipment, and storage buildings. By becoming operational more quickly, the airport is better suited for providing a sense of security through normal flight operations or a sense of security by communities receiving disaster aid.
2. Communities and airports need to communicate the failure of their infrastructure because their infrastructure is dependent upon one and another for recovery. If roads connecting the airport to the community are damaged, supplies chains of recovery material to the community will be severed rendering the airport useless for recovery. If the airport's infrastructure is damaged, recovery supplies to the community are solely dependent on alternative modes.
3. The airport needs to think critically about how and what airport space and buildings can be used for. Numerous interviews discussed buildings being used beyond their intended purpose for the sake of disaster recovery. Therefore, airport buildings need to be examined for additional uses. For example, hangars could be used for morgues.

The grounded theories generated from the analysis provide significant discussion points on the airport's role before, during, and after a hazard or disaster.

4.10 Chapter Summary

Chapter 4 provided the results from the analysis. There are two main views of the airport: the airport acting in an active role with communities during a disaster and the airport acting more independently. Similarly, each main discussion point within the interviews represents outcomes that dissemble information regarding not only the airport's role but additional issues involving operations, infrastructure capabilities, and vulnerabilities before, during and after a disaster. Much of the coded information provided by the interviews also appears to be dependent on the type of occupation of each research participant. Each one of these views has its strengths and weaknesses depending on the type of the airport and hazard they respectively encounter. It is apparent though that current role of the airport before, during, and after a hazard or disaster is to operate as an airport. However, given the right circumstances such as proper planning and the proper infrastructure, the airport could become a more permanent tool for communities to use in disaster recovery.

Chapter-5
DISCUSSION

5.1 Introduction

This research used Bartlett and Payne's (1997) method of constructing grounded theory to answer the research objectives laid forth in chapter 1.5. These include:

1. Identify the airport's role for each before, during, and after a hazard or disaster
2. Identify characteristics of airports that provide the greatest avenues for adaptability to increase its and the communities extreme long term disaster resiliency.
3. Identify airport issues that arise when airports are actively involved in hazard or disaster scenarios.
4. Identify community issues that arise when airports are actively involved in hazard or disaster scenarios.
5. Identify the ability of the airport to act as a sheltering devise for vulnerable people.
6. Identify the ability of the airport to act as a tool for evacuations before, during, and after a hazard or disaster.
7. Identify the infrastructure necessary for the airport to be more resilient.
8. Generate recommendations on avenues for airport adaptation, which are most viable for the airport and community to achieve better extreme long term natural disaster resiliency.

Therefore, Chapter 5 will discuss the results of Chapter 4 are as they relate to the aforementioned research goals.

5.2 The Airport's Role Before, During, and After a Hazard or Disaster

As mentioned in Chapter 4, the analysis proved to be a vital method for producing a grounded theory of the airports role. The current role of the airport is to act as an airport by protecting its critical infrastructure, such as the runway, taxiway, air traffic control tower, and buildings so that airport operations can resume as quickly as possible following a hazard. Many research participants believe this is what the airport's role should be. However, some research participants also believe that the airport can provide additional roles, when planned and prepared to do so.

5.2.1 The Airport's Current Role Before a Hazard or Disaster

Even though airports' role before, during, and after a disaster is dependent on several factors, the first and primary role of the airport is to be a functioning and fully operational airport. Airports are in the business to be airports; moving passengers and cargo from their origin to their destination. Any additional role before the disaster or hazard should not come at the expense of the aforementioned for several reasons. First, airports are financial institutions that need to generate revenue from their tenants to fund expense for operations and personnel. Without financial revenue, the airport's role in disaster response would be limited. Second, when airports are fully utilized for flight departures and arrivals, it can maintain a sense of normality throughout the surrounding community. It may be difficult for the airport to predict when the FAA will close their airspace but adaptation efforts should be conducted internally during the hazard event. This ensures that all FAA guidelines are met quickly after the hazard event, allowing the airport to reopen.

5.2.2 The Airport's Current Role During a Hazard or Disaster

Similar to the airport before the hazard or disaster, the airport desires to be operational as long as possible before the arrival of the storm and as quickly as possible after the storm. Therefore, the airport needs to monitor and prepare its facilities for quick recovery. As identified in Chapter 4, the airport accomplishes a quick recovery response by occasionally housing employees and their families. Such an act allows the airport's operations and infrastructure to be monitored during the storm thus, decreasing assessment time of operations and infrastructure following the storm.

5.2.3 The Airport's Current Role After a Hazard or Disaster

The airport's role after the hazard or disaster is to operate as an airport as quickly as possible. This view stems from the airport being designed to service passengers and cargo as a profitable business, not its design as a repository for recovery supplies. Additionally, the role of the airport is to serve the community as an airport for in and outbound passenger flights thus, providing a sense of normality. For example, the airport also receives various types of cargo including recovery supplies from inbound passenger flights. This cargo is delivered to stores or post offices. Therefore, the community's needs are met at locations where everyday activities occur, such as food at grocery stores rather than congregating around or in the airport.

When a hazard or disaster passes, the community maybe disrupted and can no longer physically or socially exist as a cohesive society. As discussed within Chapter 2, cities and communities can become physically and socially damaged to the point where life necessities are limited or inaccessible, such as water and food. As the physical damage becomes increasing insurmountable, social cohesiveness may dissolve, potentially creating disobedient citizens that

resort to looting, stealing, or murder, as was the case in New Orleans in the aftermath of Hurricane Katrina (Haddow and Bullock, 2006). Therefore, from a disaster management standpoint, a passive approach to recovering a city or community may further escalate the degradation of the social fabric within the city or community. While the airport's role is not to directly mitigate the potential onset of city or community riots or other disobedient events, it could mitigate some effects, as indicated throughout several interviews, by assisting in the introduction of recovery supplies.

5.3 Adaptation Avenues for Airports

While the airport's role is to be a functional airport before, during, and after a hazard or disaster, it can be adapted to perform additional roles. The grounded theories discovered in Chapter 4, provide a framework for establishing adaptation approaches to airports to increase resiliency of the airport and community. These approaches can be viewed and implemented before the hazard approaches, during the hazard or disaster, and after the hazard or disaster passes.

5.3.1 Adaptation when a Hazard Approaches

As previously mentioned, the airport's role before a hazard approaches is to stay operational as long as possible. Federal regulations, including those generated by the FAA and TSA will legally dictate if the airport can stay operational. First, the airport can only legally function if it meets all the FAA guidelines as presented in C-139 requirements. If the airport cannot meet these expectations, then commercial flights are legally grounded until compliance is met. Consequently, the first adaption policies the airport should create are centered on C-139 requirements and the information presented in the interviews.

The FAA requires passing inspections and scenario drills for the airport to become operational such as, fueling stations, pavement conditions, lighting, signs, aircraft rescuing and fire fighting inspection, the level of public and wildlife protection. Adaptation needs to start with the aforementioned inspections and scenario drills because, if adapted correctly, the airport would become operational much quicker following a disaster. Likewise, several research participants acknowledged that the airport's most important infrastructure for recovery operations would be the runway and fueling stations. Therefore, if the airport were to adapt C-139's infrastructural components to withstand the effects of a hurricane, it would recovery from that disaster much quicker. For example, one of C-139's requirements for a commercial airport to operate is that the lighting system needs to be functioning. Therefore, adaptation can occur on two accounts. The first being that the airport can adapt a lighting system to be more resilient to the effects of the hazard by making the bulbs and circuit system stronger; the second being the airport stores numerous light bulbs so when the light bulbs break, they are replaced following the hazard or disaster by staff. The former is a more active approach to adaptation and maybe more suitable for the airport to become operational quicker following the disaster. However, the airport should also have plenty of light bulbs in storage, in anticipation of any bulbs breaking. For that reason, the airport should implement retro fitting on its critical infrastructure and implement passive adaptation policies in case the retro fitted infrastructure fails. Operationally, the airport needs to expand its resiliency partnerships, especially with the local community.

5.3.2 Adaptation during a Disaster

During a disaster, the potential for airport adaptation is the greatest yet the most risky. When the airport is confronted with a disaster, it tends to extinguish the public presence and minimize workforce levels. The rationale for such premises lies in the risk associated with injuring the public in temporary shelters while the outcomes of a disaster are still unknown. Additionally, staff present in the airport are preparing and/or monitoring the facility for quick recovery from the hazard or disaster; therefore, any public intervention could hinder the completion of preparation or monitoring tasks. Therefore, airports are hesitant to house the public during crises. However, the employees housed during the disaster are comforted with various living amenities.

The airport during the disaster can consist of a minimal staff which is afforded a range of different living commodities. When the disaster strikes the airport desires to reach post-disaster operations quickly as possible. This process is usually aided with lodging staff members in the airport to sleep on cots or other arranged accommodations. Depending on the airport, some staff members are fortunate to have hotels donate sleep quarters. These activities give the impression that the airport may have the potential for adapting a shelter during a hazard or disaster.

While the airport does not desire public occupation during a hazard or disaster, there may still be potential for sheltering abilities. As previously mentioned, the airport contains equipment for housing employees. This equipment could be expanded for use by vulnerable social groups. While there is a risk of public interference during disaster operations, proper airport planning could resolve that issue.

The Federal Emergency Management Agency could assist directly and indirectly sponsor airport adaptation during the disaster. While the airport personnel are completing airport operation tasks for quicker recovery from the hazard, FEMA could be in charge of the temporary airport shelter that houses known vulnerable groups. Such a task would require preemptive planning between FEMA, local governments, and the airport that included issues such as, airport shelter capacity, resiliency of airport infrastructure (i.e., hurricane rating, wind rating, flood level capacity, etc.), time required in the airport during the disaster, and medical issues that arise within the shelter. Though not an exhaustive list, it does provide areas of planning that need to occur if an airport were to shelter the public. Likewise, FEMA needs to assure the airport that such shelter operations would not interfere with airport operations during a disaster. The most obvious benefit of the airport as a shelter revolves on vulnerable groups receiving asylum in disastrous situations. Additionally through (but not within the scope of this research), providing large quantities of shelters with small quantities of people versus small quantities of shelters with large amount of people, maybe more successful in terms of diminishing the negative impacts of shelter life such as, poor medical attention, potential lack of provisions, and overcrowding.

5.3.3 Adaptation after the Occurrence of a Hazard or Disaster

As Chapter 4 states, the airport's role following a hazard or disaster is to become operational as quickly as possible. To become operable, the airport must meet the FAA's C-139 requirements. While many research participants stated that the airport's main goal is to become operational following a disaster, many also agree that the airport has potential to provide additional roles, such as a staging area or waypoint for recovery supplies.

Most recovery supplies are funded by government agencies and hence are transported with military vehicles such as cargo trucks and aircrafts. Military cargo planes are often large and heavy and require additional runway strength and length than many aviation aircraft. Some airports have these capabilities while others would need retrofitting to increase capacity. However, large aircrafts are not the only type of aircraft the military employees. Smaller and lighter planes with less cargo capacity means they can land at smaller airports but will require increase flight frequency to meet recovery aid demand from local areas. Once landed, unloading supplies from the aircraft could present an issue for some airports.

Depending on the type of cargo aircraft landed and where it landed, unloading supplies may become problematic. Some airports may have limited or no cargo unloading capacity, creating added job demands on airport personnel for unloading the cargo. Additionally, the personnel may not be trained properly for unloading certain cargo or using available cargo equipment, potentially resulting in physical injury to a potentially short staffed airport. Therefore, airport personnel need to be trained on how to effectively remove material from various types of airplanes. Alternatively, airplanes can be retrofitted with standardized cargo loading and unloading equipment. While government agencies are usually responsible for obtaining, delivering, and allocating supplies, their role is limited.

5.4 Affiliations with the Airport

The research participants also provided information on the role of different government agencies before, during, and after a hazard or disaster and their association with the airport. These agencies include the Federal Emergency Management Agency, Transportation Security Administration, the State, and the County the airport resides in.

5.4.1 Federal Emergency Management Agency and Airport Operation Groups

The Federal Emergency Management Agency's responsibility is to provide disaster assistance. This may be through the form of mitigation efforts such as purchasing property in a flood plan or providing relief and recovery supplies to a disaster area. The former of which provides plans and assistance that help communities prepare, mitigate, and recover from disaster. The latter of which is strictly a response initiative requested from the state governor. While the airport's goal is to reestablish itself as an airport following the hazard or disaster, FEMA should not provide assistance to the airport. This is because the airport should have other disaster recovery players assisting them in their recovery processes, such as the Southeast Disaster Operations Group and West Disaster Operations Group (SEADOG and WESTDOG, respectively). These entities are designed to provide airport to airport aid and recovery assistance, though not financially. Therefore, FEMA can allocate its resources towards introducing recovery supplies into the affected communities. However, the airport may need FEMA for one purpose.

While FEMA responds to local community needs in terms of disaster recovery and financial assistance, FEMA may need to allocate financial assistance to airports. SEADOG and WESTDOG are useful tools for airports that need personnel or operational knowledge neither provide financial assistance. If the airport is damaged and needs repairs, SEADOG and WESTDOG become ineffective. FEMA needs to assess the damage received by the airport and provide financial assistance if deemed necessary. Such assistance could help the airport recover quicker; potentially recovering the community quicker.

5.4.2 State and Local Government

The airport infrequently, if ever, is dictated by the local government in terms of closing the airport. However, the local government takes the “lead role” in disaster preparation and recovery, as stated by many research participants. Often the local government, whether it is the city or the county, will be the hub for communication between state, tribal and local officials, the private sector, non-profits, faith-based groups, and the general public. By acting as a hub, the local government is able to discover information, such as when the airport will close, how long an evacuation will take, and the number of intra-city buses available for evacuation. Similarly, the local government will act in a post-disaster environment as a hub for communication; determining when the airport will open, what road systems are damaged, when power will be supplied to the region. When all of this information is able to be assembled in a central command, decisions can be quickly made that minimize uncertainty between the aforementioned agencies. The local government may request assistance from the airport for certain procedures such as the previously stated evacuations and staging grounds. However, if the airport is city owned and operated, the city may mandate that the airport participate in certain activities.

5.4.3 Airline Companies

In the course of the interviews, few research participants mentioned partnerships between airlines, airports, and communities during a hazardous or disastrous situation. It seems that both communities and airports view airlines as an independent organization not as an independent tool. While it is understandable for airline companies to evacuate their planes outside of a hazardous area, they should be utilized on their last outbound trip for evacuating large masses of people in hazardous situations. Likewise when an airport becomes operational

after the disaster, incoming supplies should be loaded onto commercial airliners, if cargo room is available. However, several research participants recognized that some airports are able to incorporate recovery planes into their daily operations because of large maximum operation capacity that is not utilized. Therefore, airports should communicate with their tenants about the potential to evacuate vulnerable social groups on their last outbound trip. Additionally, airports need to assess their operational capacity to determine whether and at what magnitude, recovery operations can occur.

5.5 Local Government Affiliation Logistics with Airports

As previously identified, the airport operates with the intention of providing exclusive recovery procedures to become operational as quickly as possible. However, throughout the interviews, research participants acknowledged that the airport has the potential to become more than just an airport. However, all these additional roles center on specific infrastructure that has become disabled

5.5.1 Recovery Logistics

After the passage of a hazard, the airport is able to act as a staging area for inbound relief supplies that are needed within the region. While the most beneficial transportation mode for in-bound relief supplies is still debatable, the significance of the airport to introduce large quantities of supplies can be critical to the quick recovery of the region but is dependent on internal and external infrastructure. Figure 5.1 displays the normal transportation logistics of the airport and community with a ground and air transportation connection between the two.

Figure 5.1 – The Infrastructural Relationship between the Airport and Community

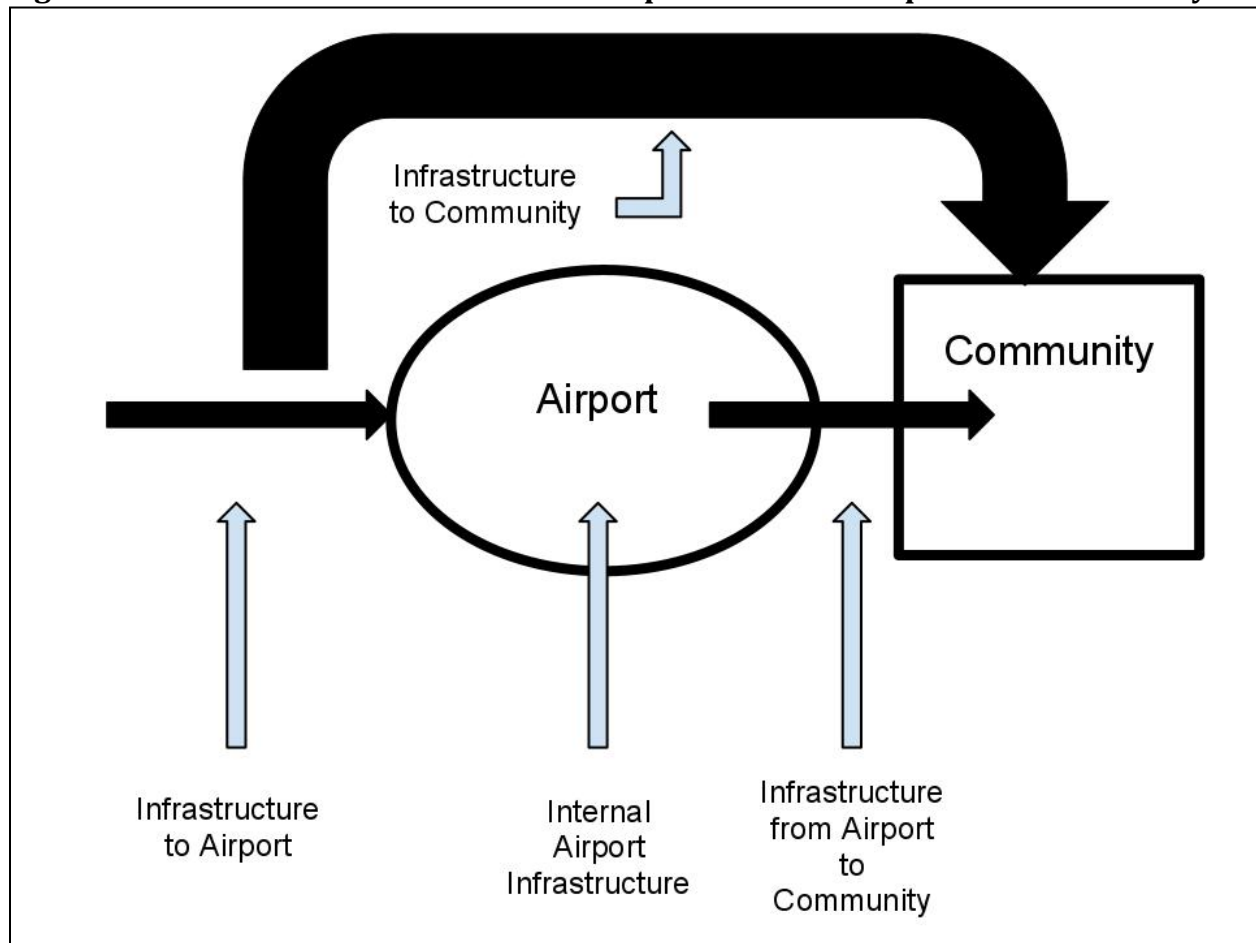


Figure 5.2 displays the infrastructure between the airport and community as being disconnected. This type of situation creates conflicting roles for the airport. On one hand, the airport's role becomes critical when other transportation modes are disabled from the hazard's effects. On the other hand, the airport's disaster recovery and staging area effectiveness diminishes when other transportation modes are disabled. For example, if rail lines entering a city or region are destroyed or flooded beyond the point of accessible or safe traveling, relief supplies cannot enter the city via this mode. Therefore, the airport seems to be pivotal for providing space and logistics for storing and transporting recovery supplies. However, supplies coming into the airport may have difficulty arriving to the disaster areas due to the disabled

transportation modes. This may prelude to the idea of the airport parachuting supplies into a region.

Figure 5.2 – Airport and Community Disconnect from Failed Infrastructure

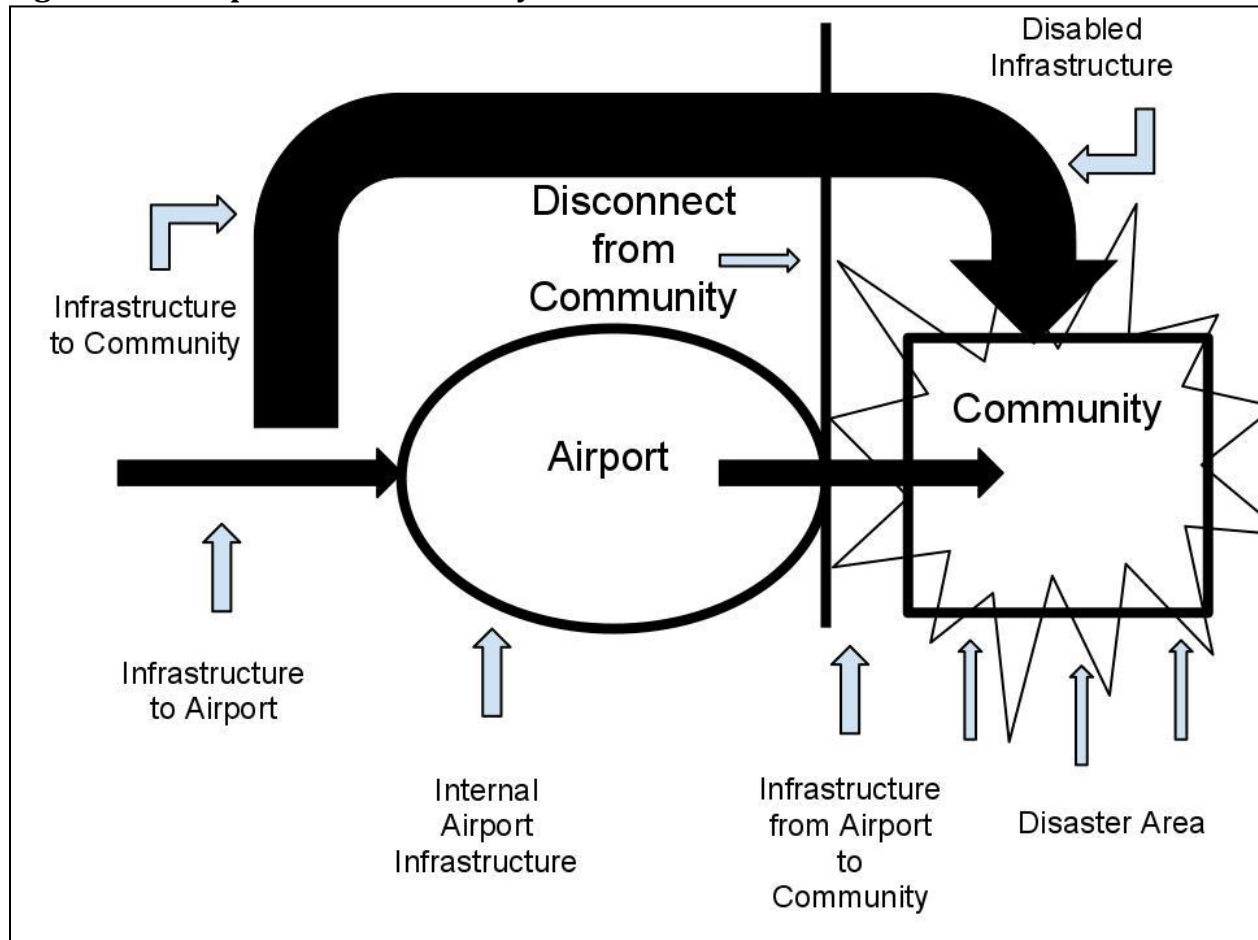


Figure 5.3 displays the transportation network leading to the airport as being disconnected from the hazard or disaster. If the disabled transportation networks are outside of the community, then that disabled infrastructure would not be considered critical as long as the disaster area had an airport, creating an island effect. This is because supplies can come into the airport via aircraft and be shipped to the community on rail lines or highways, as shown in Figure 5.3.

The diagram illustrates the flow of information and infrastructure between a Disaster Area, an Airport, and a Community. The central element is the **Airport**, represented by a circle. To the left is the **Disaster Area**, indicated by a jagged line. To the right is the **Community**, represented by a rectangle. A thick black line connects the Disaster Area to the Airport, and another thick black line connects the Airport to the Community. A large, thick black curved arrow labeled **Disconnect from Community** points from the Community back towards the Disaster Area. Several blue arrows indicate the flow of information and infrastructure:

- Three blue arrows point upwards from the Disaster Area towards the Airport, labeled **Infrastructure to Airport**.
- One blue arrow points upwards from the Disaster Area towards the top left, labeled **Disabled Infrastructure**.
- One blue arrow points downwards from the top left towards the Disaster Area.
- One blue arrow points left from the top of the Airport towards the Disaster Area.
- One blue arrow points upwards from below the Airport towards the Airport, labeled **Internal Airport Infrastructure**.
- One blue arrow points upwards from below the Community towards the Community, labeled **Infrastructure from Airport to Community**.
- One blue arrow points left from the top of the Community towards the top right, labeled **Infrastructure to Community**.

5.5.2 Evacuation Logistics

130

people from the Louis Armstrong International Airport to surrounding cities, such as Houston and Atlanta, as stated by several research participants. However, the airport is only able to act as an evacuation mode if aircraft are still present. Since airline companies act independently from airports, they may leave before the evacuation is ordered, potentially leaving behind vulnerable groups of people. Conversely, if the airliners choose to stay until otherwise mandated by the FAA, airliners may participate in evacuating people and are later reimbursed by FEMA for operation costs. Alternatively, if the hazard's strength is expected to create minimal damage on a community, evacuation orders will exclude the airport and rely on public and private transportation to move people outside of the evacuation zone. For example, if a category 1 or 2 hurricane were to make landfall in Florida, the mayor or governor would issue an evacuation only for areas that are likely to experience a storm surge. The evacuees are required to retreat to an area outside the storm surge area; not another city as, was the case with hurricane Katrina. Therefore, during small natural hazard events the airport's role in evacuations is limited. However, during larger natural hazards the airport has opportunities to participate in the evacuation process given aircraft are still present.

5.5.3 Infrastructure Reuse

Some interviewees discussed various ideas for adapting airports' buildings to aid in disaster recovery. Since airports contain numerous buildings that either house planes, waiting passengers or airport personnel there is a potential to use some buildings other than its intended purpose. In a time of hazard or disaster and the airport is closed from traveling passengers, much space is left unused and in some cases vacant. An example of this is provided by one research participant who stated that a hanger was once used for a morgue following a

hurricane. While this method may seem morbid, it did provide a useful and adaptive strategy for defusing a perceived problem for recovery. The hanger may not be the only adaptable building for the airport in hazardous or disastrous events.

Before, during, or after a disaster, the airport may potentially provide opportunities for adaptive building reuse in the form of a shelter. This is deduced on the premise that airports often house staff during and after a disaster for the purpose of reinitiating airport operations as quickly as possible. This process is accomplished by providing the staff with the necessary equipment such as, bedding, food, and water. If these supplies were increased, the airport may have the potential to house vulnerable individuals. Conversely, if the airport were to execute such a function, it may pose operational difficulties. The greatest potential benefit but probably the least likely to occur, is a sheltering device manifested from the passenger-less terminal. It offers the greatest benefit to surrounding regions as an asylum to evacuees escaping from an encroaching hazard.

5.5.4 Airport Shelters

Since airports are intricate systems of logistics and people, slight mishaps or alterations can lead to operational delays or cancellations making the shelter seem like an unrewarding business opportunity. Groups of individuals that are housed during a disaster crisis may feel comfortable and grateful but issues arise such as the quality of life within the shelter. While these are common issues in any temporary shelter, they are exaggerated in the setting of an airport because the staff is now concerned about the aforementioned housing issues in addition to normal airport operations. Therefore terminals as shelters may hinder the ability of an airport to operate effectively. Consequently, using the airport as a shelter should be avoided

and at the very least approached with caution. Sheltering operations for hazards and disasters should be placed in alternative areas that are not at risk of interfering with disaster recovery. Depending on the airport design, an airport can adapt more quickly to aforementioned recommendations.

5.6 Adapting Different Types of Airports

Despite their most obvious differences, both general and commercial aviation airports may have the potential for adaptation measures creating a more resilient airport and community. While this research discussed the different classes of airports, this section focuses on distinguishing class I airports as commercial airport and class II, III, and IV as general aviation airports. Each one of these entities possesses its own strength and weakness based on the type of adaption and when the adaptation occurs.

5.6.1 Different Classes of Airports

The different classes of airports present different adaptive abilities. As previously discussed, each airport class is cataloged based on if they participate in scheduled flights and the number of seating their aircraft have. This provides some measures of adaptive capacity. For example, Class I airports receive scheduled flights with aircrafts that house more than 30 passengers. These airports would be ideal for short-term adaptation because long-term adaptation would interfere with scheduled flights. However, since this class of airports operates with larger aircraft they have the capacity for larger recovery operations. In other words, the larger the aircraft operating at the airport the more recovery supplies are onboard. Class II airports may provide the greatest opportunity for adaptation because, they are large in nature

but only have scheduled flights for smaller aircraft. This means that recovery operations are less likely to interfere with the normal operations of the airport. Additionally, this class of airports, being large in nature, can introduce more recovery supplies into the region. Class III airports are small and have scheduled flights. This possess a problem when adapting these airports because, recovery efforts could derail airport operations. Additionally, this class of airports cannot introduce the same quantity of supplies into a region as Class I and II. Class IV airports offer large space with unscheduled flights. This along with Class II provides the space and capacity for recovery operations while minimizing the likelihood of interfering with scheduled flights.

5.6.2 General Aviation Adaptation

Since general aviation contains less passenger and cargo enplanement than commercial aviation, any sort of adaptation that does occur is less likely to be at the expense of flight delays, cancellations, or any other sort of aviation “set-back”. On the other hand, adaptation that does occur at a general aviation airport may not be the most suitable location for immediate and unplanned adaptation results.

General aviation may not be the most prepared for immediate adaptation. Being small in nature, general aviation does not have the same access to vital equipment that provides adaptation mechanisms. For example, general aviation may not have the necessary equipment to unload planes carrying recovery supplies or for that matter runway lengths long enough to be considered safe for landing. Additionally, general aviation airports tend to be less staffed than commercial airports thus potentially creating an understaffed airport to deal with a hazard or disaster. General aviation airports would not be ideal for passive adaption because they do

not offer quick and immediate solutions to a hazard with their lack of equipment. To become actively adapted, general aviation airports would require extensive planning on infrastructure capabilities and personnel operations. Operationally, general aviation airports may appear to be less than ideal for immediate adaptation, its commercial aviation counterpart appear much more suitable.

5.6.3 Commercial Aviation Adaptation

Commercial aviation airports, unlike general aviation airports, have the potential to provide more of an immediate impact to adaptation planning but may lack solutions to approaching long-term hazards and succumbing disasters. Contrary to general aviation airports, commercial airports have the potential to provide numerous pieces of equipment for adaptation efforts before, during, or after a disaster. The plethora of equipment arises from commercial aviation airports being large in nature and providing capabilities to numerous types of aircraft. For example, the commercial aviation sector caters to numerous types of aircraft; therefore equipment for unloading material off an aircraft is more likely to be a match to an aircraft providing recovery supplies. Additionally, commercial airports tend to have longer runways, potentially allowing the landing of a multitude of supply aircraft types. Likewise, commercial airports tend to possess larger staffs than general aviation thus, providing plausibly efficient staff for managing an approaching hazard or the aftereffects of a disaster. However, commercial aviation is a complex system and therefore, adaptation may disrupt airport operations which would decrease the airport's overall resiliency. Finally, commercial airports offer much larger campuses containing numerous buildings, such as hangars which are suitable for large scale disaster recovery. Commercial aviation provides an ideal environment for passive

adaptation because the necessary infrastructure and personnel are available for adaption processes. However, to become actively adapted might jeopardize the normal operations of airports.

5.7 Creating adaptation: A Step-by-Step Approach

Assessing the qualitative data through quantitative measures produced results that identified differences among the responded answers. Question 1, in Table 3.2 represents what the airport's role is in response to a natural hazard. If the airport were to add a role it should first begin coordination efforts with the local government before the hazard strikes to eliminate future disastrous outcomes. This approach has the potential to consume operational resources of the airport which could lead to the airport being more vulnerable to the effects of the hazard, increasing the likelihood for a disaster. While not explicitly correlated, some interviewees believe that the airport should deal with the hazard as an airport system, whether that is through a generic emergency plan or some a type of all-scenario plan. However, this approach potentially leaves the city vulnerable to the ill-effects of the hazard, again possibly producing a disastrous situation. Essentially, this could create problems between the local communities and the airport of which each is attempting to become more resilient to the hazard. Therefore, it is crucial that the airport and community interact on disaster coordination well before the knowledge is presented about an approaching hazard to assure that dependency on disaster assistance is not expected from the other entity. This will eliminate any unrealistic or unforeseen disaster assistance expectation one entity may have for the other. Communication using this approach can be applied to all 4 of the "is" questions of the

interview. This is, again, to assure all entities involved in the disaster of any unrealistic expectations for every stage of disaster preparation and planning.

The “should” question presented a philosophical approach as to what the research participants believed the relationship between the airport and the surrounding communities should be. Questions containing such content were viewed with mixed results, probably stemming from each individual's experience, background, and occupation. For example, airport officials tend to believe that the airport's role should be to “operate as an airport,” whereas a government official tended to side with, “airports provide services for post-disaster recovery.” Confronting the two ideological differences has the potential to be problematic for adaptation. Operational adaptation requires mutual understanding of infrastructure vulnerabilities and adaptation. Therefore, certain recommendations can be deduced from such data.

First and preferably, local communities need to determine their risk level from certain hazards and if that risk is great enough to warrant the need for additional adaptation. If adaptation is needed, the local community needs to be aware of the airport as a resource. However, it is not the job of the airport to provide the necessary adaptation or recovery resources to the community. As many interviewees stated, the airport is in the businesses of moving passengers and cargo, not acting as a special agent of adaptation. However, this may not be the case of every single airport, because some airports may possess surplus capacity to provide additional roles to the community, as suggested in several interviews.

Secondly, as briefly implied in the previous paragraph, airports need to address more than regular operations in times of disasters. While many interviewees did suggest that the

airport's role before, during, and after a disaster is centered on normal operations, they also mentioned that airports need to be aware of additional mitigation roles. This process should be when the airport can handle such scenarios. This leads to believe that the airport has the potential for additional roles but needs careful consideration.

Third, many interviewees were concerned of the airport's operations becoming hindered due to relief efforts conducted through federal agencies and any such hindrance is actually more detrimental to disaster recovery. To mitigate hindering effects of inbound recovery efforts, federal agencies need to find alternative transportation modes such as semi-trailers or ships for supplying recovery material to communities. However, certain locations or situations may arise when the airport is the only avenue available for incoming recovery supplies. Therefore, federal agencies and airports should be aware of the maximum amount of recovery supplies the airport can handle while still maintaining normal operations. By understanding the maximum amount of recovery supplies an airport can handle, recovery efforts will still be able to proceed without the negative consequences of normal airport operations. Additionally, when airports cannot operate under the approval of the FAA, recovery supply logistics, if physically feasible, should be maximized during this time and decrease when FAA approval for operations is granted. Also, during the time before FAA reopens flights, federal agencies should be identifying and if necessary, improve alternative transportation modes for the entrance of recovery supplies into a region. Therefore, while an airport may seem like an ideal staging area for disaster recovery it is not an ideal situation, due to interference with airport operations. Consequently, recovery operations occurring in an airport should seek alternative staging areas following the FAA's approval for flights post-disaster.

Fourth, airports should adapt and update critical infrastructure components that are detrimental to airport operations. When airports adapt any critical infrastructure components, it can lead to better resiliency of the airport. For example, several interviewees discussed infrastructure improvements that minimized flooding which would prevent structure damage. However, adapting infrastructure is different than updating the infrastructure. Updating critical infrastructure for airport operations would allow an increase in airport traffic. Doing so could also create more resiliencies for the nearby community because the increase airport traffic capacity would allow federal agencies to supply more recovery material to the area via aircraft.

Fifth, airplanes should adapt necessary components to fit multiple types of loading and unloading equipment. Many interviewees discussed problems with airplanes unloading and loading cargo from airports due to different sizes and types of equipment that were not compatible with the airplane. If an adaptive strategy could create compatible equipment for unloading and loading material from planes, which is one less piece of required planning for airports and recovery agencies. Such compatibility would allow recovery agencies the ability to respond quicker to disaster situations.

Sixth, airports and local communities need to communicate their supplies and demands of disaster planning. A portion of the interviews discuss one particular airport, Baton Rouge Airport, which perhaps is a leading example of adaptation planning but unfortunately could not be contacted for a personal interview. The research participants discussed how Baton Rouge Airport would purposely adapt for the anticipation of a disaster by obtaining funding for mobile homes that are used as disaster operation posts. Additionally, Baton Rouge Airport also

communicates available facilities to the local government of which can be utilized during and after a hazard. These simple techniques should be utilized by all airports that are expected to face a hazardous or disastrous situation.

5.8 Limitations

Adaptation is a difficult process to measure. While it can be simplified into anything that makes a system more resilient to the effects of a hazard, it is difficult to pinpoint exactly what increases the resiliency. Therefore by enacting the previously mentioned discussion points and a community becomes more resilient, it may not be due solely to the adaptation improvements accomplished by an airport. Instead, the increase in resiliency is more probable from a multitude of adaptation procedures enacted.

While airports can enact all the adaptation procedures and infrastructure protection available, they are still limited in their capacity to assist in disaster situations. This research attempts to encompass as many categories and agents of adaptation. However, both categories and agents of adaptation are nearly limitless therefore for an airport or a community to be truly adapted to hazards or disasters, all categories and agents should be enacted. However, the scope and magnitude of hazards and disasters is difficult to comprehend.

Another problem with airports decreasing vulnerability is the uncertainty among the strength of a disaster or future disaster. Adaptation occurs when the vulnerability of a system is known or perceived to be known. Similarly, society can only comprehend the potential of a disaster by examining the worst case scenario, but defining the worst case scenario is difficult and implausible. For example, some interviewees stated that their city or airport practiced and

planned for an all-hazards approach based on worst case scenario. However, the question still remains regarding what exactly is an “all-hazards” approach or “worst case” scenario. More than likely it is defined as to what a group of experts or officials believe to be likely but likelihood does insinuate all possibilities. In other words, unless airports and communities plan for the complete global destruction, an “all-hazards” and/or “worst case” scenario is futile. Therefore, while adapting the airport, it by no circumstances creates a true “all-hazards” or “worst case” protection plan. Instead the airport and community, to a certain extent, are potentially able to create a quicker recovery following a hazard by enacting adaptation procedures.

5.9 Chapter Summary

Chapter 5 presented information on what the airport’s role is and should be before, during, and after encountering a hazard or disaster and suitable adaption approaches. It is apparent that the airport’s first objective is to become operational as quickly as possible following a hazard or disaster. However, there are multiple approaches that decrease the time necessary for the airport to become operational. These include retrofitting and passively adapting the critical infrastructure for operations that are present in the C-139 requirement. Once operational, the airport can begin to resume normal operations. However, the airport may be able to play additional roles in response and recovery of hazard or disaster such as a shelter, avenue for recovery supplies and/or storage of recovery supplies. To provide recovery supplies to the community, the airport would need to adapt the process of loading and unloading material from the airplanes in addition to establishing communication with the local government.

Chapter-6
CONCLUSION

6.1 Introduction

Airports are designed to provide passenger and cargo services, yet they possess the potential to provide additional roles to the community through adaption. These additional roles can help community and airport planners prepare their jurisdiction for incoming hazards. However, disaster and hazard preparedness plans are based on airport's risk, exposure, and adaptation potential to their respected hazard and disaster. The remaining sections of this thesis focus on leveraging the maximum potential of community resiliency from airports.

6.2 Research Benefits

The benefits of this research include a grounded theory based on if, what, and should the potential adaptation procedures should be implemented to airports. This includes examining relationships between local governments, disaster agencies, and other airport to airport aid programs. Additionally, this research identified that adaptation reuse for building that is vacant before, during, and after a disaster. Ultimately, this research suggests that local communities take the lead role in determining the most beneficial means for adapting themselves before, during, and after a disaster. This allows the community to examine all possible avenues of adapting to a hazard and selecting the one that best their goals and needs.

6.3 Planning Lessons

This research brings forth planning lessons on how communities and airports can prepare themselves for natural hazard resiliency. Community and airport planners need to assess and then communicate their likelihood for encountering a natural hazard and their perceived resiliency to airports. Following, communities and airports can discuss and plan future partnerships before, during, and after the disaster. More specifically, planners need to

understand when planning for a disaster the airport can be a vital tool for increasing a community's resiliency. The level of the resiliency is still debatable. However, many research participants have recognized the airport as playing a more active role following the hazard or disaster. Therefore, community planners should at least participate with the airport on formulating procedures and guidelines for the airport's role after the disaster. This does not mean that planners should ignore resiliency planning before or during a hazard or disaster. It simply means that, as demonstrated in this research, the airport has more to offer surrounding communities after the disaster than before or during. This process allows each the airport and community planner to understand what level of participation the other can and should be able to provide. This research helps formulate a different mindset for planners and airport officials by assessing infrastructure and policies that are believed to unilateral roles into multilateral roles. Similarly, this research demonstrated that communities preparing against hazard or disasters have an additional tool.

Airports are often viewed as an independent agency isolated from community relationships which is not entirely accurate, as indicated through this research. Planners, engineers, local officials, and community members need to view the airport not as an independent business but rather as a member of their community. This membership should include a mutualistic interest that is vested in securing, helping, and promoting those that require it. Do accomplish though, a transition in the mindset of airports and communities needs to occur.

6.4 Transitioning Mindsets to View Infrastructure Multilaterally

Conventional thinking regarding the airport as having a minimal role before, during, or after a disaster should be reexamined. Many research participants had the mindset of the airport as a unilateral tool. However, other research participants exemplified cases where certain airports become multilateral in disaster planning and recovery processes. The airport can become multilateral in the sense that dual roles occur; one being normal airport operations and the other being an active player in hazardous or disastrous situations. Yet, why roughly half of the research participants believed the airport should act unilaterally remains a mystery.

Several predictions can be hypothesized about why nearly half of the research participants believed that the airport should act unilaterally. First, some of the research participants may have not experienced a hazardous or disastrous situation and therefore possess little familiarity on the ramifications that results from such events. This may cause their answers to be biased towards the airport operating in a unilateral manner. Second, research participants that believed the airport should act unilaterally maybe facing large financial constraints. Third, research participants may have believed the airport should act unilaterally because they know the airport would be too damaged to participate in any additional role. Regardless of the reason the several interviewees responded with the airport needs to act unilaterally. This mentality needs to change and can be changed following several simple procedures.

Changing the mentality of airport and government officials needs to occur and can be achieved for the sake of increasing airport and community resiliency. First, airport and government officials need to be more open minded to the creative thinking of several airports

that play additional roles in times of hazards or disaster, as mentioned in the interviews. For example, one research participant mentioned that an airport utilized unused hanger space to act as a morgue in the aftermath of a disaster. This type of service is beneficial to the disaster relief cause is disregarded because of the notion of airports are independent organizations. Second, airport and government officials should start creatively thinking of methods to relief the burdens of relief efforts on FEMA and other agencies. Third, airport and government officials need to actively participate with each other for preparing additional roles during times of need. Nearly all the research participants discussed the federal government participating minimally in preparing the airport for future disaster, other than financing. This research has demonstrated that there is potential for the airport to adapt to include additional roles that may provide supplementary resiliency measures to the airport and community. When planning and airport officials begin to view airports as more than simply a conduit for airplanes, certain adaptations are plausible.

6.5 Adaptation Measures

Several adaptation measures can be suggested to airports based on their risk, exposure, and adaptive capacity. Each one of these factors influences the level of adaptation possible and the level of adaptation needed for resiliency. While not quantitatively described, these adaptation measures provide a rudimentary framework for airport officials. Table 6.1 provides varying degrees of adaptation responsibility and capacity based on risk level. Table 6.2 provides information regarding feasible adaptation approaches to airports based on the FAA's airport classification criteria.

Table 6.1 – Adaptation Measures for Airport Officials

	Risk – Low	Risk – Medium	Risk – High
Adaptation Capacity – Low	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery
Adaptation Capacity – Medium	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts
Adaptation Capacity – High	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts - Provide sheltering opportunities for employees - Actively retrofit critical infrastructure 	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts - Provide sheltering opportunities for employees - Provide sheltering opportunities for vulnerable populations - Actively retrofit critical infrastructure

Figure 6.1 bases the adaptation capacity on not only the physical logistics of the airport but also the transportation logistics. Adaptation capacity for physical logistics includes such items as: supplementary physical space, abundant staff, and structural strength for the buildings. However, the aforementioned become useless if the airport is too concentrated on

inbound and outbound flights. Therefore, high capacity airports need to be under capacity for daily flights. More specifically, adaptation capacity can be attributed to the four airport classes as recognized by the FAA.

Airport classes as defined by the FAA are based on flight capacity and scheduling of that specific airport and therefore offer insight into their adaptation capacity. Table 6.2 displays recommended adaptations for each airport class.

Table 6.2 – Possible Adaptations for Different Classes of Airports

Airport Class	Possible Adaptations
Class I	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts until operations resume - Provide sheltering opportunities for employees until operations resume - Provide sheltering opportunities for vulnerable populations until operations resume - Actively retrofit critical infrastructure to perceived risks
Class II	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts - Provide sheltering opportunities for employees - Actively retrofit critical infrastructure to perceived risks
Class III	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts
Class IV	<ul style="list-style-type: none"> - Create disaster plan - Communicate plan with community officials - Assess land and air traffic capacity for recovery - Provide space for recovery efforts - Provide sheltering opportunities for employees - Provide sheltering opportunities for vulnerable populations - Actively retrofit critical infrastructure

The class of the airport dictates the capacity for adaption. Despite a lack of adaptation interference with inbound and outbound flight operations, smaller airports do not have the physical capacity to for all the necessary adaptation measures. This is conversely true for larger airports. Larger airports, as previously discussed, possesses larger areas for adaptation yet they run into the probability of adaptation measures interfering with inbound and outbound flight operations. Therefore in this context, airports, such as class III, which has small unscheduled aircraft occupy their airspace and facilities as long-term adaptation centers.

6.6 Future Areas of Research

Since this research provides a foundation for future research from a ground theory, numerous pieces of prospective research can be conducted. First, the concept of adapting airports based on their class needs to be examined closer as to the short and long term benefits and how those temporal differences affect the outcome of adaptation. Second, airports have buildings that may not be used before, during, or after a disaster. Therefore, the vacancies of such buildings may pose an opportunity for adaptation, especially during post-disaster recovery. However, research needs to be conducted on the likelihood of such undertakings' effects, benefits, consequences on adaptation planning and airport operations at the different classes of airports.

APPENDICES

Appendix A - Interview Participant Consent Form

Research Participant Information and Consent Form Josh Vertalka and Eva Kassens

“The Resilience of Airports: Assessing their vulnerability to hazards for adaptation planning”

IRB #: i037417

Explanation of Research

1. You are being asked to participate in the research study of determining an airports roll during a natural disaster and for natural disaster recovery.
2. The airport and FEMA participants must go into detail discussing what airport’s roll is in during and after a disaster.

Your Rights to Participate, say no, or withdraw.

1. Participation in this research project is completely voluntary. You have the right to say no. You may change your mind at any time and withdraw. You may choose not to answer specific questions or to stop participating at any time. This interview will be recorded with a tape recorder.

Contact Information for Questions and Concerns

1. If you have any concerns or questions about this study, such as scientific issues, how to do any part of it, conclusions, etc., please feel free to contact the researchers. If you have any questions or concerns about your role and rights as a research participate, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact anonymously if you wish, the Michigan State University’s Human Research Protection Program

Josh Vertalka
Protection Program
Vertalk2@msu.edu
989-400-6213
217 E. Point Ln.
East Lansing,
MI 48823

Dr. Eva Kassens-Noor

ekn@msu.edu
517-432-8085
201E Human Ecology
Michigan State University
East Lansing MI, 48824

MSU Human Research

irb@msu.edu
517-355-2180 (p)
517-432-4503 (f)
207 Olds Hall
Michigan State University
East Lansing, MI 48824

Documentation of Informed Consent

By beginning this phone interview, you have voluntarily agreed to participate in this research.

This interview will be recorded with a tape recorder.

Appendix B – Code Book

3. What is the airport's role in response to a natural hazard?
 - a. The airport to act dependently
 - i. Coordination
 1. local government
 - a. Establish communication
 - b. Use local resources
 - c. act independently
 2. State government
 - a. establish communication
 - b. Use state resources
 - c. act independently
 3. Federal government
 - a. establish communication
 - b. Use federal resources
 - c. act independently
 - d. Limited Role
 4. Airlines
 - ii. Evacuations
 - iii. Bring in Supplies
 - iv. Shelter
 - b. The airport to act independently
 - i. To act as a first responder
 - ii. Deal with the hazard
 1. In a systematic approach
 2. In accordance to fed regulation
 - iii. Protect the airport
 1. Infrastructure
 - iv. Evacuations
 - v. Keep flying until they no longer can
 - vi. Evacuations
 - vii. Shelter
 - viii. Communication
 - c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice
4. What is the airport's role in response to a natural disaster?
 - a. The airport to act dependently
 - i. Act as a staging area for recovery efforts

- ii. Bring in recovery supplies
 - iii. Become operational quickly after the storm
 - iv. As a lifeline for a community but with normal operations problem due to recovery efforts
 - v. Mutual Aid between airports
 - vi. Evacuations
 - vii. Dependent on airport infrastructure
 - viii. Coordinate with governments
 - 1. Local
 - 2. State
 - 3. Federal
 - ix. Respond to any disaster needs
 - x. Shelter
 - b. Act in an independent role
 - i. Assess airport
 - ii. Restore facility
 - iii. Mutual Aid
 - iv. Dependent on airport infrastructure
 - v. Shelter
 - vi. Planning
 - 1. Adaptive Use
5. What is the airport's role in prevention of a disaster?
- a. Act Dependently
 - i. Provide supplementary roles
 - 1. Evacuation
 - 2. Communication towards passengers
 - ii. To operate as an airport
 - iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Practice disaster scenarios
 - v. Shelter
 - b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick "bounce-back" from disaster to become operational
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter
 - c. There is an unknown/limited role
 - i. Dependent on ownership

- ii. Dependent on function
 - iii. Dependent on infrastructure
 - iv. Dependent on airport
 - v. Shelter
- 6. What is the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies
 - a. Dependent on airport infrastructure
 - ii. Dependent on the airport's infrastructure system
 - iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure
 - iii. Communicating
 - iv. personnel stuff
 - v. Getting the airport operational as quickly as possible
 - vi. Dependent on the airport's infrastructure system
 - vii. Act as a morale booster for citizens
 - viii. Shelter
 - c. Limited Role
 - i. Infrastructure Problems
- 7. What should be the airport's role in response to a natural hazard?
 - a. Act dependently
 - i. Communicate Information
 - 1. Local governments
 - 2. State governments
 - 3. Federal governments
 - ii. Resume operations as quickly as possible
 - iii. Evacuations
 - iv. Shelter
 - b. Act independently
 - i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
 - ii. Improve/fix critical infrastructure
 - iii. Adaptive use for infrastructure
 - 1. Concerns
 - iv. Resume operations as quickly as possible
 - v. Communicate Information
 - vi. Preparation

- vii. Mutual Aid
- viii. Shelter
- 8. What should be the airport's role in response to a natural disaster?
 - a. Act dependently
 - i. To be a tool for surrounding communities
 - 1. Dependent on type of airport
 - 2. Dependent on governmental requirements
 - 3. Operational Ultimatum
 - ii. Acting as a staging area
 - iii. For incoming delivery
 - iv. Evacuation
 - v. Take lead role in recovery
 - vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - iv. Assessment
 - c. Limited Role
 - i. Dependent on airport
- 9. What should be the airport's role in prevention of a Disaster?
 - a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government
 - 1. Local
 - 2. State
 - 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptative use for infrastructure
 - iii. Work with other forms of government
 - iv. Utilizing available resources
 - v. Become operational as quickly as possible
 - vi. Update Emergency plan (Preparation)
 - vii. Shelter
- 10. What should be the airport's role in recovery from a natural disaster?
 - a. Act dependently

- i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
- b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
- d. Limited/unknown roll

Appendix C - Coded Interview for 1

11. What is the airport's role in response to a natural hazard?

- a. The airport to act dependently
 - i. Coordination
 - 1. local government
 - a. establish communication
 - b. Use local resources
 - c. act independently
 - 2. State government
 - a. establish communication
 - b. Use state resources
 - c. act independently
 - 3. Federal government
 - a. establish communication
 - b. Use federal resources
 - c. act independently
 - 4. Evacuations
 - a. Citizens

ii. Shelter

- b. The airport to act independently
 - i. To act as a first responder
 - ii. Deal with the hazard

Typically they are often best prepared to help deal with that because their facilities (1:03) being kind of isolated from the perspective of airplanes coming in and out because you don't have to worry about transportation system etcetera.

- 1. In a systematic approach

2. In accordance to fed regulation

iii. Protect the airport

1. Infrastructure

iv. Evacuations

v. Keep flying until they no longer can

vi. Evacuations

vii. Shelter

viii. Communication

The airport can't force any of them to do certain thing because they are independent contractors but the one that I think do it best form a more cooperative relationship with them and say hey we're all going to be in this together so we all need to thinking through it and be prepared and be thinking of it.

, the staffing I know in Minneapolis for example, in the winter time, they staff higher, everything internal and external (12:39) Both the airport related staff and all the people who are inside running the concessions and ticket agents and things like that. The airport can't force any of them to do certain thing because they are independent contractors but the one that I think do it best form a more cooperative relationship with them and say hey we're all going to be in this together so we all need to thinking through it and be prepared and be thinking of it.

c. An unknown/limited role

i. Can't get proper personnel their

The airports themselves can still function but they cannot often get their staff there to make them function.

ii. Infrastructure is vulnerable, hence limited role

But I know from the work we have done they have to rely on those other infrastructures systems to get their people there

But more importantly, they couldn't get the staff in to the airport because of the roads being shut down because of vehicular traffic so they work out how could we get people there.

iii. Equipment issues

We just saw it with weather systems out at JFK a lot of reasons they had to shut down a lot of the airport infrastructure was physically they could not keep up with the snow because of the amount of equipment they had.

iv. Poor geographical location

Doesn't help that a lot of airport are built on swamps, landfills, undesirable areas or around lakes, streams, rivers, that have the potential to for all those kinds of natural disasters to happen on the airport; so that complicates it a little bit as well. But that's where most of our airports got built anyways so we are used to dealing with that. Underwater is not an uncommon event in an airport

v. Shelter

vi. Practice

Doing mock disasters, which I think a lot of them do, most of them those are more focused on an airplane crash or accident more than an event that might shut down an airport. I don't know a lot of people that go through a full event scenario if you will that's more natural hazard base. It's more crash base but I think a lot of the tools and techniques they take away help with that

12. What is the airport's role in response to a natural disaster?

a. The airport to act dependently

i. Act as a staging area for recovery efforts

My personal opinion is to be that portal. Again, it's one of those that is fairly, I think contained, if it's intact to the point to where it can still operate. It's usually viewed as one of the lifelines in and out of a community when something happens. I think there goal is to act as a staging facility

ii. Bring in recovery supplies

iii. Become operational quickly after the storm

iv. As a lifeline for a community but with normal operations problem due to recovery efforts

v. Mutual Aid between airports

- vi. Evacuations

- vii. Dependent on airport infrastructure

I know a lot of the airports we've worked with that do any type of full blown planning that goes beyond checking the box for their 139 certification are looking at things like where could we put cargo, where could we store things

- viii. Coordinate with governments

- 1. Local

- 2. State

- 3. Federal

- ix. Respond to any disaster needs

- x. Shelter

- b. Act in an independent role

- i. Assess airport

- ii. Restore facility

- iii. Mutual Aid

- iv. Dependent on airport infrastructure

- v. Shelter

- vi. Planning

- 1. Adaptive Use

any type of full blown planning that goes beyond checking the box for their 139 certification are looking at things like where could we put cargo, where could we store things, we did some work, mead and hunt did as a company, with Valdez Alaska for the Exxon-Valdez accident and they said we want to prepared if it ever happens again.

13. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

- 1. Evacuation
 - 2. Communication towards passengers
 - ii. To operate as an airport
 - iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Shelter
- b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick “bounce-back” from disaster to become operational
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter
- c. There is an unknown/limited role

I would say that most of the airports probably don't think they have much of a role. In the overall prevention I think they are almost as remiss in treating themselves and seeing themselves as their own little entity as the general public is at seeing them as their own little entity. Again, just because of so many players being involved if you boil it down to literally the airport and the people who own and operate the airport, I think you would see that all the activities happening they have, I don't want to say a minimal responsibility, but have only a portion of it that for them to say they could be that actively involved, I think they would find themselves challenged to say they have that big of a role.

- i. Dependent on ownership

Not that they wouldn't want to be. I can't think of many airport managers that wouldn't go if you asked that question would say, “Well, of course

we want to be responsible and do as much as we can but when you boil it down at the end of the day of how much they have the real capacity to do. I don't know if that is within their prevue.

Some of them are, I know general aviation airports, they going to say, "Well, I'm going to do whatever the city tells me to do." So, if the city says, "we're going to close it to aviation and we're going to use it for X, Y, and Z," that's what's going to happen.

ii. Dependent on function

Airports like Lansing where they are an authority in their whole; focus is the aviation element is probably going to have a different response to that. I mean we are all about getting people and cargo in and out of a location. So I think they would take that pretty seriously. If they know something was coming and they could do the best in trying to prepare for it, they would. How much of that can the airport themselves do? I think that is pretty limited. Again, just the nature of how airports work.

iii. Dependent on infrastructure

iv. Dependent on airport

v. Shelter

14. What is the airport's role in recovery from a natural disaster?

a. Act dependently

i. As a lifeline for a community

1. To met FAA guidelines following the disaster

2. Act as a staging area for recovery efforts

Again, that delivery of goods and services on a pretty quick bases. You know bringing it in on ground transportation usually is pretty questionable depending on the type of event that getting in and out with aviation is usually much quicker.

3. To bring in supplies

a. Dependent on airport infrastructure

One of the things that was document through our research with the system plan was if an event like that happened, they all had the runway length available to bring in large cargo, military aircraft that have supplies and people but

we couldn't get off the airplanes because they are general aviation airports that don't have fork truck, they don't have boarding bridges or anything like that to off load or the apron area, Valdez as an example to put it. So one thing that was part of our system plan was to looking at in that kind of instance that we probably should have, if not an airport having a fork truck that just sits there for 365 days a year for who knows how long not getting used; what they identify is we need to identify a business or a company or something in a community we could get access to that because when we went back and approached the FAA and the state aviation department we said, "Ok, here's what we found, you challenged us to say if this happens then what. Well here's what. We can get it in, we've got plenty of runway length but we don't have a place to put things and we don't have a way to offload it. FAA said, "Well, we'll somewhat considering helping build an apron area for the storage side of it because that is aviation infrastructure that is really not going to go to waste but they said no, we are not in the business of buying equipment.

ii. Dependent on the airport's infrastructure system

One of the things that was document through our research with the system plan was if an event like that happened, they all had the runway length available to bring in large cargo, military aircraft that have supplies and people but we couldn't get off the airplanes because they are general aviation airports that don't have fork truck, they don't have boarding bridges or anything like that to off load or the apron area, Valdez as an example to put it. So one thing that was part of our system plan was to looking at in that kind of instance that we probably should have, if not an airport having a fork truck that just sits there for 365 days a year for who knows how long not getting used; what they identify is we need to identify a business or a company or something in a community we could get access to that because when we went back and approached the FAA and the state aviation department we said, "Ok, here's what we found, you challenged us to say if this happens then what. Well here's what. We can get it in, we've got plenty of runway length but we don't have a place to put things and we don't have a way to offload it. FAA said, "Well, we'll somewhat considering helping build an apron area for the storage side of it because that is aviation infrastructure that is really not going to go to waste but they said no, we are not in the business of buying equipment.

- iii. Act as a morale booster for citizens

- iv. Shelter

- b. Act independently

- i. Get disaster assessed

- ii. Dependent on outside infrastructure

- iii. Communicating

- iv. personnel stuff

- v. Getting the airport operational as quickly as possible

- vi. Dependent on the airport's infrastructure system

- vii. Act as a morale booster for citizens

- viii. Shelter

15. What should be the airport's role in response to a natural hazard?

- a. Act dependently

- i. Communicate Information

- 1. Local government

- They are a huge asset to a community and if they truly want to be a team player in the community, they need to be prepared. They should have plans in place and be prepared to take an active role in responding.

- 2. State Government

- 3. Federal Government

- ii. Resume operations as quickly as possible

- iii. Shelter

- b. Act independently

- i. To be informed about the approaching hazard

- 1. Work with local government but act independently

2. To be informed about the approaching hazard

Sometimes they may have access to information at least like weather events, things like that because of the nature of aviation being weather dependent that I think they kind of get a heads up or can if they chose to of what's coming ahead of time or know what's coming and be prepared to respond accordingly.

ii. Improve/fix critical infrastructure

Some of them have gotten more rugged aircraft rescue and fighting ARF (37:09) equipment or more rugged snow removal equipment. Southern states I've heard some who have gotten more different types of tires that can go through mud better, things like that should they get flooded; they could get off and on to unpaved areas, things like that. As a general one, I don't know if there would be a lot of difference. In the example I gave you of the fork trucks and things like that. Some of the airports would have that type of thing. That's more along the lines where they wouldn't have those types of things.

iii. Adaptive use for infrastructure

A lot of the airports, because of the snow events have started looking at how do we turn certain areas into better use.

1. Concerns

If you get away from the SOMETHING snow removal (38:00) that is usually typically owned by the airport. If you start moving things into boarding bridges, or the fork truck into unloading the aircraft, usually that kind of stuff is owned by the airlines or the fixed base operator (FBO) and so getting authority or rights to use those things is usually where we start to run into those issues. So, having some of that agreements for those kind of use is probably a good idea and would play into that. It could be that it's on the field but the right to use it could be something they need to negotiate ahead of time.

iv. Resume operations as quickly as possible

v. Communicate Information

We are seeing more and more of that with the winter events of this year, places where things are going to get snow storms are cancelling flights to keep people out of harm's way ahead of time saying, "Don't even try getting to the airport because when you get here we are not going to be able to deal with you or things like that." So, I think they should be more

involved and take an more active role in it, whether they do or not. Personal opinion is that they should.

vi. Preparation

vii. Mutual Aid

viii. Shelter

They have started to identify and started creating some open areas where they could put people if they need to overnight.

16. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

Commercial service airports is going to be about having the facility to get larger aircraft in; they're going to carry the cargo or good and services in. General aviation airports are going to be probably a little more on the lower end and might have more private uses and activity.

2. Dependent on governmental requirements

I think the big thing is them being an active player, being prepared to say, "We got area that can facilitate this and planning ahead and being able to actively reach out and saying we can accommodate that." Unfortunately that is challenge for a lot of airports with FAA and TSA requirements the way they are, a lot of those airports are hard pressed to be able to be that open and accommodating because of some of the requirements.

3. Operational Ultimatum

So, I think they find themselves where they would like to be more helpful should they need to be but some of those constraints make it hard. Lansing, for example, there would be no way for us to quarantine this large apron area that we have easily, so we could accommodate emergency services there and keep that away from the commercial service side of things without it getting complicated. We could do barricades or then you have to have staff sitting out there kind of keeping eye on things that would make it a challenge. Not that it couldn't be done but, you would have to make a consorted effort.

- ii. Acting as a staging area

- iii. For incoming delivery

In a response situation, they need to be as actively involved as they can, providing that delivery of goods and services and getting people in and out of the community (41:48).

- iv. Evacuation

- v. Take lead role in recovery

- vi. Shelter

Certainly storage of goods and services, distribution center, information with the technology the way it is today is kind of changing things up a little bit. Possibly housing if need be, depending on the type of airport and size. Typically, overseeing it more for goods and services getting in and out.

- b. Act independently

- i. To follow FAA and TSA guidelines to become legally operational

I think the big thing is them being an active player, being prepared to say, "We got area that can facilitate this and planning ahead and being able to actively reach out and saying we can accommodate that." Unfortunately that is challenge for a lot of airports with FAA and TSA requirements the way they are, a lot of those airports are hard pressed to be able to be that open and accommodating because of some of the requirements.

- ii. Shelter

- iii. Hindered by need to be operational

- c. Limited Role

- i. Dependent on airport

17. What should be the airport's role in prevention of a Disaster?

- a. Act dependently

- i. Provide supplementary roles to the community

- 1. Deliver goods and services

- 2. Act as a staging ground

Certainly storage of goods and services, distribution center, information with the technology the way it is today is kind of changing things up a little bit. Possibly housing if need be, depending on the type of airport and size. Typically, overseeing it more for goods and services getting in and out.

3. Evacuations

4. Communication

And we watched a family come in drop grandma off and looked up at the screen and the flights go. They kissed grandma, left her with here bags and they left and we stood there going, "There are no planes going." They didn't ask anyone, they looked up at the screen which I guess if you're not really familiar with the aviation industry, you don't trust any of that because that's never current and we watched grandma walk in to try to get checked into her flight and the gate agent said, "Ma'am, nothing else is going out tonight." She was probably in her 80's, did not have a cell phone. So, the gate agent was kind enough to make a call back to her family who we happened to be there for a meeting, so we did our meeting, came back down an hour and half later because the grandma didn't know the cell phone of the family so they had to call home, get the voicemail, and drive back to get grandma. So, trying to be proactive for that kind of stuff I think is about all the airport can do, in terms of. And we kind of joked with the airport manager we said, "that you need to have someone standing down at the front door because grandma just got dropped off, she looked at the screen" and unfortunately the screen isn't in the airports control, the airlines update that themselves. So he said, "I don't have any control to say it's bad information, as the airport, I'm the one that is going to get blasted in the newspaper article on how could you let us drop grandma off. So, the IT side of things and the social media side things, I think is probably where airports are going to have a bigger role coming in and can continue to grow.

ii. Protect critical infrastructure

iii. Work with other forms of government

1. Local
2. State
3. Federal

iv. Update Emergency plan

Do the local fire department services know that there is this large open area that could be used for staging or for activities, medivac or whatever it is.

v. Shelter

b. Act independently

i. Protect critical infrastructure

ii. Work with other forms of government

iii. Utilizing available resources

iv. Become operational as quickly as possible

v. Update Emergency plan

vi. Shelter

18. What should be the airport's role in recovery from a natural disaster?

a. Act dependently

i. Provide supplementary roles to the community

We did a project in Howell about 10 years ago trying to get their runway extended, the airport chair, the county board chair pretty much viewed that airport as being just something for rich people to keep their toys at. He had a heart attack and got airflighted out of the airport. He came back after his triple bypass surgery and happened to be at the next meeting and he said, "Stephanie, I've completely changed my mind, I know understand the value of this airport." He said, "they've told me that if they couldn't have gotten into the airport and picked me up there, I would've have died. It was because they could get into the airport." So, its information like that you have to get out.

ii. Deliver goods and services

serving as that facility for delivery of goods, services, and people.

iii. Act as a staging ground

iv. Shelter

v. Communication

b. Act independently

- i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
- d. Limited/unknown roll

The airports quite often are not the ones making the decisions or many of the decisions in many cases. So, for them to be proactive, I'd say there is kind of a fine line as to how much they can really do because a lot of the activities, especially if you look at a commercial service airport, are not their decisions to make. By that I mean canceling flights; airports have nothing to do with that, that is a byproduct of the airlines. Diverting airplanes to another airport, the airport has nothing to do with that. That is a byproduct of the airlines and air traffic control. So, the airports themselves are going to have a somewhat limited role in being able to be involved in that process of much probably being; going back to some of our earlier discussion of planning and being prepared should it happen and how could they react after is about the best they could do in most cases.

Appendix D - Coded Interview for 7

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

- a. establish communication
- b. Use local resources
- c. act independently

2. State government

- a. establish communication
- b. Use state resources
- c. act independently

3. Federal government

- a. establish communication
- b. Use federal resources
- c. act independently

4. Evacuations

a. Citizens

So they can be used for logistics and they can be used for mass evacuations. Hurricane Gustuv back in 2008, we evacuated, including the tourists a total of 33, 050 evacuees left New Orleans by aircraft out of the New Orleans airport.

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

- 2. In accordance to fed regulation
 - iii. Protect the airport
 - 1. Infrastructure
 - iv. Evacuations
 - v. Keep flying until they no longer can
 - vi. Evacuations
 - vii. Shelter
 - viii. Communication
- c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role

Being able to fly supplies into one airport that is 50 miles away from the where the supplies need to go to but all the infrastructure between there and airport is destroyed you got to take that into account. If I can't get it off the airport or to the airport, it doesn't do them any good.
 - iii. Equipment issues
 - iv. Poor geographical location

Really depends on what the hazard is and proximity of the airport. Give you an example, like hurricane Katrina when it took out Louisiana, Lois Armstrong was used as a staging base we positioned equipment down there and move it out from there.
 - v. Shelter
 - vi. Practice

2. What is the airport's role in response to a natural disaster?

- a. The airport to act dependently
 - i. Act as a staging area for recovery efforts

Give you an example, like hurricane Katrina when it took out Louisiana, Lois Armstrong was used as a staging base we positioned equipment down there and move it out from there.

- ii. Bring in recovery supplies
- iii. Become operational quickly after the storm
- iv. As a lifeline for a community but with normal operations problem due to recovery efforts
- v. Mutual Aid between airports
- vi. Evacuations

Certainly, precautionary evacuation is accomplished to save citizens lives and airports can certainly assist in that matter.

- vii. Dependent on airport infrastructure
- viii. Coordinate with governments
 - 1. Local
 - 2. State
 - 3. Federal

- ix. Respond to any disaster needs
- x. Shelter

b. Act in an independent role

The airports day to day job is to move people and freight, not preventing disasters on a natural side.

- i. Assess airport
- ii. Restore facility
- iii. Mutual Aid
- iv. Dependent on airport infrastructure
- v. Shelter
- vi. Planning
 - 1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles
 - 1. Evacuation
 - 2. Communication towards passengers
 - ii. To operate as an airport
 - iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Shelter
- b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick “bounce-back” from disaster to become operational

Part of this returning to normal operations is the airlines to return back to commercial traffic (6:34). So, whatever you are doing with that airport, it needs to impede the natural recovery of that area and the airport itself. So, they’ve got to build to return to commercial flights and flow people in and out of there. That’s important, one show stability but also for the economy of local citizens depending on it.
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter
- c. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure

They still require power, they require fuel, they require food, basic stuff that goes to that airport has to be maintained. They are still reliant on the environment they are operating in. Things to take into consideration, fuel is critical, how do they get their fuel? They get it through a pipeline, from a refinery, is that pipeline damaged. How much fuel can they actually store on hand and can they get more fuel? Without that an airport is pretty much reduces its operation capabilities pretty significantly.

iv. Dependent on airport

Some airports are more self sufficient than others. I'll give you an example, the Baton Rouge airport, I think it was following Gustav install generators for all their terminals so if they lose power, they can power their own terminal self sufficiently, not relaying on the Baton Rouge city for power supply; that is fairly resourceful there.

v. Shelter

4. What is the airport's role in recovery from a natural disaster?

a. Act dependently

i. As a lifeline for a community

1. To met FAA guidelines following the disaster
2. Act as a staging area for recovery efforts

Once you get past the initial stages say about the first 2-4 weeks, the airports role in that response, I think starts getting downplayed more as the local infrastructure becomes repaired and you start doing line hauling.(10:13) Keep in mind when you use aircraft, aircraft are expensive that have to have good runway surface to operate. They are great for immediate flexible response, for long term recovery, I think it goes well beyond what the airport has. Outside of airport returning to normal operations.

3. To bring in supplies

a. Dependent on airport infrastructure

ii. Dependent on the airport's infrastructure system

iii. Act as a morale booster for citizens

An airport can help show the flag. An airplane's flies in there with supplies; whether it is one short ton or 80 short tons of cargo and relief supplies. That is an immediate morale booster for everyone. You see that

on TV, see the plane fly, you know life is coming back to normal. The airport can help enhance a speedy recovery in a speedy response

iv. Shelter

b. Act independently

i. Get disaster assessed

ii. Dependent on outside infrastructure

iii. Communicating

iv. personnel stuff

v. Getting the airport operational as quickly as possible

vi. Dependent on the airport's infrastructure system

vii. Act as a morale booster for citizens

viii. Shelter

Staffing issues can certainly come up. Things to keep in mind, and it's not just for airports, it's also for any of your first responders, is that the employees that work at the airport have jobs out at the airport but they have families and other concerns. If a disaster hits locally, the odds are the people working that airport are also impacted either directly or indirectly by that disaster. So, these are things that need to be taken into account. You've got to be able to care for their families if you're going to have those employees stay around and actually do their job. I think it's Arlington Texas actually provides space in the airport for their employee's families so if a hurricane is coming and they have an evacuation order they'll actually have their families come into the airport and stay with their employees and they'll just take care of families for them. This enables them to actually be more responsive if they know their families are taken care of. But any airport or any responder is always going to be affected by that disaster locally they need to take care of what their individual personal needs are if you're going to have them be available to be employees for you.

Yeah, give you an example. Baton Rouge airport, they're, I think Anthony is the deputy airport director there, he's actually a pretty resourceful guy. They are building hangers there, they're building warehouses. When they are not being rented out for other purposes, they make sure the local emergency management knows, that, "Hey, we got storage space here."

So, you can store stuff and position cargo. They're close proximity to rail heads as well as seaports. And they make sure they plug in with Baton Rouge city and the state to let them know, "Hey, we have these capabilities." The airport is great if they can get what's at that airport off the airport. So having those rail heads and ports available, having a highway to close proximity is valuable information. The other thing Baton Rouge airport has been doing, but I haven't checked with them recently in the past year to see how far along they are but they are basically making modular housing and modular office space that is located on airport for use during disasters. So they are taking a lot of the FAA grant money they're getting and saying. "Hey, what can we do with this?" They can lease buildings out to corporations but what about during a disaster. What can they do to help them out? They've been very proactive. I need to get the guys contact information; he'd be an interesting guy to talk to. He's in Louisiana, so he's a hoot to listen to. But he is very smart, he knows how to get it funded, he plugs in. Anthony Marino. I'll forward you his contact information as well.

5. What should be the airport's role in response to a natural hazard?

- a. Act dependently
 - i. Communicate Information
 - ii. Resume operations as quickly as possible
 - iii. Shelter
- b. Act independently
 - i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
 - ii. Improve/fix critical infrastructure

We have a ceep here, one pylon can be damaged and make the entire thing structurally unsound. You can damage part of a runway and as long as it's not dead smack in the middle of it, you can still usually use that runway. Example is an airfield in Afghanistan called Jallalabad, we bombed that runway and we did a lot of damage to it and we shorten its length significantly. And when the US came there, we ended up landing on the parts that weren't destroyed. So, it's really hard to destroy 2 or 3 miles of asphalt or concrete. So its other resiliency is that most airports have backup generators that provide lighting and communications to

radar squads to the ATC facilities. Usually large ramps, they really are their own self contained cities. That yeah, they still rely on power from the neighboring community but those generators tend to make them more resilient. The operators themselves are pretty resourceful folks as well. You give an aircraft mechanic a problem, they can generally solve it. Of course, they do have a way to store their own fuel and depending on how much fuel they are maintaining on hand, that gives you quite a few days of supply of fuel. They've got their equipment correct were they are using diesel powered vehicles you can put Jet A into diesel powered vehicle and run it just fine. You'll have to change out your fuel filter more often but it'll still operate.

iii. Adaptive use for infrastructure

1. Concerns

iv. Resume operations as quickly as possible

v. Communicate Information

vi. Preparation

vii. Mutual Aid

Southeastern Deadsea operations groups that's basically an airport mutual aid group to support other airports and they certainly should be able to lend assistance to other airports to get them operational as soon as possible as well as the community.

viii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

ii. Acting as a staging area

iii. For incoming delivery

iv. Evacuation

- v. Take lead role in recovery
 - vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational

7. What should be the airport's role in prevention of a Disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government

1. Local

Yeah, I honestly think for something like that if the airport is interacting with local and state emergency managers and working together to see where the problem is and how can the airport best engage with the planners in helping out.

2. State

Yeah, I honestly think for something like that if the airport is interacting with local and state emergency managers and working together to see where the problem is and how can the airport best engage with the planners in helping out.

But you also see a tendency on the state side that the state does not want to bring the airports in or just assume they already know the airports capabilities. Seen that quite a bit, more so in the past year that states are trying to do planning without the airports; I think they need to get the airports more engaged. But the states need to let the airports get engaged as well.

I think honestly it's a bit of a castle building or I got my kingdom. You don't get the airports involved, you're not going to get their say in on it which means I don't have to listen to them. The airports have their own concerns and a large part of it is as you've said, returning back to normal business operations as quickly as possible. Why are the airports their? Ultimately, the airports are there to service the airlines. Airlines are there to make a profit anything that interferes with that one is detrimental business. I really think that it's not wanting to SOMETHING, straight to the locals. The state wants to keep a lot of control of that themselves.

3. Federal

iv. Update Emergency plan

v. Shelter

b. Act independently

i. Protect critical infrastructures

ii. Adaptive use for infrastructure

Just know the resources you have with the airport. I think a lot of people are surprised that the airport has hangers; they usually have a lot of warehouses. Can also be temperature control warehouse as well. There's an airport in Abu Dhabi that's on the western coast of Puerto Rico that one of the hangers actually has a refrigerator units in it there; which is nice for storing perishable items, such as blood, and can be used as a makeshift morgue. So, knowing what the resources are, and that's where the airport needs to be an advocate for itself; attend meetings with emergency management agencies and let them know what they have capabilities wise.

iii. Work with other forms of government

iv. Utilizing available resources

v. Become operational as quickly as possible

vi. Update Emergency plan

vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

a. Act dependently

- i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
- b. Act independently
 - i. To meet FAA guidelines following the disaster (to reach operational capabilities ASAP)

That's kind of tough. I think they have a large role in response; immediate and flexible response. Recovery wise, unless they're on an island, even if they're on an island, I think their role is to get back to business as usual. I think what you're looking for is what can they do to help local communities to recover.

I think it is getting back to normal business, getting people their jobs back, get the community running as normal. Aviation is very expensive and in the long haul in recovery, I don't think it has as much of a role as it does during the initial response.

- ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
- d. Limited/unknown roll

Appendix E - Coded Interview for 11

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

a. establish communication

, well I think that I can only speak from the point of the Federal side and have to. Airports are respondent to their local communities and whatever standards and mitigation efforts are being done by their state or local communities.

So, we would encourage state and local governments to make sure that they are working through the communities to take whatever mitigation is appropriate for the risk's the airport would face. So, in a hurricane area is to make sure they can withstand the wind damage and things like that. Again, a lot of that is dependent on the local community is doing and what their standards are then what we from the FEMA side would

b. Use local resources

c. act independently

2. State government

a. establish communication

one of the things we do have is that the States have to do a State mitigation plan that looks at all the hazard they face within the state and then they would look at how they can use mitigation dollars they get from the federal government during disaster to coordinate with the local government to mitigate against those hazards.

b. Use state resources

c. act independently

3. Federal government

a. establish communication

- b. Use federal resources
- c. act independently
- d. Limited Role

From FEMA's point of view, we don't come in and direct any particular organization and that you must take this or that particular action to mitigate or response to whatever hazard they facility would face.

- ii. Evacuations

. At the same time we would try to get if we have to evacuate survivors, that is one of the ways we can do that; bring in aircraft, load up aircraft with survivors on their inbound flight, they bring the response personnel, on the outbound flight they would take survivors out of the area.

- iii. Bring in Supplies

An example of this would be a Louis Armstrong airport in New Orleans. Soon as we could get the airport up, we started bringing in a lot more response folks, especially disaster medical teams, urban search and rescue teams, things like that.

- iv. Shelter

- b. The airport to act independently

- i. To act as a first responder
- ii. Deal with the hazard
 - 1. In a systematic approach
 - 2. In accordance to fed regulation

- iii. Protect the airport

- 1. Infrastructure

- iv. Evacuations

- v. Keep flying until they no longer can

- vi. Evacuations

- vii. Shelter

- viii. Communication
- c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice

2. What is the airport's role in response to a natural disaster?

- a. The airport to act dependently
 - i. Act as a staging area for recovery efforts

We look at a response to a natural disaster. One of the things from the FEMA side use airports for is to bring in before the event will occur we start to bring in the assets we are going to need in the area that maybe personnel and a certain amount of equipment. One of the things about flying in equipment is that you are very limited in what you can fly because of weight. So, we would try to bring in some our initial response people and their equipment so they can honker down and ride the hurricane out and then be ready to come out and start providing information so that we can start to make better decisions (5:30) once the hurricane passes. Once the hurricane passes, we try to get airports up as quickly as possible so that we can once again bring in the personnel and material that is needed
 - ii. Become operational quickly after the storm
 - iii. As a lifeline for a community but with normal operations problem due to recovery efforts
 - iv. Mutual Aid between airports
 - v. Evacuations
 - vi. Dependent on airport infrastructure
 - vii. Coordinate with governments
 - viii. Respond to any disaster needs

- ix. Shelter
- b. Act in an independent role
 - i. Assess airport
 - ii. Restore facility
 - iii. Mutual Aid
 - iv. Dependent on airport infrastructure
 - v. Shelter
 - vi. Planning
 - 1. Adaptive Use
- 3. What is the airport's role in prevention of a disaster?
 - a. Act Dependently
 - i. Provide supplementary roles
 - 1. Evacuation
 - 2. Communication towards passengers
 - ii. To operate as an airport
 - iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Shelter
 - b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick "bounce-back" from disaster to become operational
 - 2. Minimize financial damage
 - iii. Use emergency services

- iv. Communication
- v. Practice disaster scenarios
- vi. Shelter
- c. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure
 - iv. Dependent on airport

And in many cases you are somewhat limited just by just the number of assets in the area, if you're looking at coming in to a coastal area, you may have only a handful of airports that are close by but you've got several others that maybe 100 miles away and bring things and move forward. So, we look at all the different option and coordinate with the state and local governments on how we can bring those things in.

- v. Shelter
- 4. What is the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies
 - a. Dependent on airport infrastructure
 - ii. Dependent on the airport's infrastructure system
 - iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure

- iii. Communicating
- iv. personnel stuff
- v. Getting the airport operational as quickly as possible
- vi. Dependent on the airport's infrastructure system
- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

i. Infrastructure Problems

Also, in the long term on recovery, we have to move most of the material and supplies by surface. Aircraft movement of supplies is very limited because of weight so, we'll be looking at moving a lot of food, water, emergency supplies, generators, and all that, moving those by trucks, vehicles and trailers across the country and get them in that way because we can move much via surface than via air.

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

i. Communicate Information

1. Local governments

That would be coordinated and worked out with discussions with the local government and state. Again, we would coordinate with the state. The state and local government is always in charge of the disaster and we are to support and help them with whatever they need to get done. So, we turn to them, and they tell us what they need. We say where do you want and they tell us where they want it. So, when we start initially looking at where do we bring things in, we coordinate with state and local governments and say which areas do you want us bring it in and where do you put it. If we're going to use this airfield, this is what we are going to bring, this is how much we are going to need, space we're going to need and we coordinate it with them.

2. State governments

That would be coordinated and worked out with discussions with the local government and state. Again, we would coordinate with

the state. The state and local government is always in charge of the disaster and we are to support and help them with whatever they need to get done. So, we turn to them, and they tell us what they need. We say where do you want and they tell us where they want it. So, when we start initially looking at where do we bring things in, we coordinate with state and local governments and say which areas do you want us bring it in and where do you put it. If we're going to use this airfield, this is what we are going to bring, this is how much we are going to need, space we're going to need and we coordinate it with them.

3. Federal governments

ii. Resume operations as quickly as possible

iii. Shelter

b. Act independently

i. To be informed about the approaching hazard

1. Work with local government but act independently

2. To be informed about the approaching hazard

ii. Improve/fix critical infrastructure

iii. Adaptive use for infrastructure

1. Concerns

iv. Resume operations as quickly as possible

v. Communicate Information

vi. Mutual Aid

vii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

- ii. Acting as a staging area
 - iii. For incoming delivery
 - iv. Evacuation
 - v. Take lead role in recovery
 - vi. Shelter
- b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
- c. Limited Role

You can get a lot more semi trucks moving heavy equipment and a lot of supplies in many faster than you can by moving it by air, and a lot cheaper. That's one of the thing we have to look at. Initially, we'll bring a lot of thing by air and once you get that first lift in then you get to that recovery piece, you are trying to move more and more of it by surface. Now if you're in an island environment such as Virgin island or something like that, then you're a little more limited on what you can do and you have to move more of it by air but it also takes longer for that airfield to get able to turn back over to normal air operations, just because we start bringing in a lot of large cargo aircraft, they take a lot of space on the ramp and all of the material they bring in with them because it's just stacked up in various places until we can move it forward into the communities. So, it's a logistical operation that takes a lot of space and a lot of time and if you have to move large amounts of material (14:48) in the long run, its quicker and cheaper and more effective to move it via surface. Whether you are moving it via rail or over truck.

7. What should be the airport's role in prevention of a Disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication

- ii. Protect critical infrastructure

Well again, I think it goes back to some of the thing I've said to your first question. Taking those mitigation steps to strengthen the ability of the facility to withstand whatever that hazard is. We're talking hurricane so, what are steps they can take so that when they face those winds and rains and all that, that they are able to better stand through all that and to be able to get back to a functioning capability as soon as possible after the basic part of the storm has passed. well in think in most cases it would be the facilities they use on normal bases, things like terminal building so that they have power, so the roofs stay on and things like that. The facility they use on a daily bases would have to be something that we would look at using immediately following the storms so mitigation efforts that they take would have to be to their normal facilities so their normal facilities are better able to withstand the storm.

- iii. Work with other forms of government

- 1. Local
- 2. State
- 3. Federal

- iv. Update Emergency plan

- v. Shelter

- b. Act independently

- i. Protect critical infrastructures
- ii. Adaptative use for infrastructure
- iii. Work with other forms of government
- iv. Utilizing available resources
- v. Become operational as quickly as possible
- vi. Update Emergency plan
- vii. Shelter

- 8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently

- i. Provide supplementary roles to the community

- ii. Deliver goods and services

Well once we begin to bring the response personnel in and getting the initial influx of people in, one of the things that is important for an airport to do is to as quickly as possible begin to resume its normal functions.

- iii. Act as a staging ground

- iv. Shelter

- v. Communication

- b. Act independently

- i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)

When we look at places to go, we will normally look at a military airfield as opposed to a commercial airfield because one of the things that we want to be able to do is allow the community into the commercial airfield to get back into operations as soon as possible so the economy can get started again within the community. That's a very key thing to get going. And when we start bringing in a lot of material and equipment, especially by air, we can pretty take up a lot of ramp space by aircraft and staging things like bottle water and food supplies and things like that. So, we need to try to move that as quickly as we can out of the airport so that the airlines can get back into function so they can begin to resume somewhat normal operations and get the airfield back up and running for the local economy.

- ii. Respond to other airports in need

- iii. Assessment

- iv. Work w/ tenets

- v. Shelter

- c. To act as

- d. Limited/unknown roll

Appendix F - Coded Interview for 4

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

a. establish communication

b. Use local resources

c. act independently

2. State government

a. establish communication

b. Use state resources

c. act independently

3. Federal government

a. establish communication

b. Use federal resources

c. act independently

d. Limited Role

4. Evacuations

5. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ok. Well, our first goal is that we're the first response, once our runways and taxiways are clear, especially if we use a hurricane as an example, that way the aircraft can come in here and out quicker than vehicles can. So that is our number one goal as far as natural disaster hitting us.

ii. Deal with the hazard

1. In a systematic approach

What we start doing though actually is that we go and we make sure everything is topped off, all the fuel facilities, that we have supplies for after the storm. That everything is secured as far as are inlets are cleaned out, free of debris, we double check everything. We do another test on our generators. We check all of our emergency supplies so we do our precautionary steps there, we starting bracketing (27:23) everything up in our offices.

2. In accordance to fed regulation

- iii. Protect the airport

1. Infrastructure

- iv. Evacuations

- v. Keep flying until they no longer can

- vi. Evacuations

- vii. Shelter

Well, unfortunately we stay here during the natural disaster. When a hurricane comes in, my staff and myself we go to the hotel which is located on the airport we bunker down there until the storms pass.

- viii. Communication

- c. An unknown/limited role

- i. Can't get proper personnel their

- ii. Infrastructure is vulnerable, hence limited role

- iii. Equipment issues

- iv. Poor geographical location

- v. Shelter

- vi. Practice

- 2. What is the airport's role in response to a natural disaster?**

- a. The airport to act dependently

- i. Act as a staging area for recovery efforts

- ii. Become operational quickly after the storm
- iii. As a lifeline for a community but with normal operations problem due to recovery efforts
- iv. Mutual Aid between airports
- v. Evacuations

Once the storm pass, we clear runways and taxiways get up to as much of normalcy so the aircrafts can come in and out bringing in supplies, food, ice, medical attention which is always very important and also evacuating anyone that needs to be evacuated from the island also

- vi. Dependent on airport infrastructure
- vii. Coordinate with governments
- viii. Respond to any disaster needs
- ix. Shelter

b. Act in an independent role

- i. Assess airport
- ii. Restore facility

Once the storm pass, we clear runways and taxiways get up to as much of normalcy so the aircrafts can come in and out bringing in supplies, food, ice, medical attention which is always very important and also evacuating anyone that needs to be evacuated from the island also

- iii. Mutual Aid
- iv. Dependent on airport infrastructure
- v. Shelter
- vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

- a. Act Dependently
 - i. Provide supplementary roles
 - 1. Evacuation

Once the storm pass, we clear runways and taxiways get up to as much of normalcy so the aircrafts can come in and out bringing in supplies, food, ice, medical attention which is always very important and also evacuating anyone that needs to be evacuated from the island also

2. Communication towards passengers

- ii. To operate as an airport
- iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies

iv. Shelter

b. Act Independently

- i. To operate as an airport
- ii. Protect itself and infrastructure

Sure. One of the ways is that we're building stronger out here. We'll take our terminal for example, and our air filled lighting vault. One of the things we've learned because of the disaster (3:14) so it won't happen again, our first floor of our terminal building is strictly the lobbying area. There is no A/C units down there, there is no electrical other than plugs, our mechanical room has been moved upstairs, HVAC has been moved upstairs. All of our vital equipment has been moved to the second floor built up in pretty much a concrete bunker style facility. So when a storm does come again, we can quickly clean out the bottom floor and get people back in here: passengers and equipment and everything else. Our air filled lighting vault we use to call it a vault because we believed it could withstand anything Mother Nature gave it but we didn't take into consideration our drainage system. The water actually came in through our drainage system filled up our vault and blow out the walls.

So now our air filled lighting vault sits 16 feet in the air. Concrete facility, concrete piling, everything is up in the air the generators, our regulators all the electrical equipment. So, when the storm does come in, it goes right through underneath, no major damage done to the facility and we can get everything lit up again on the runways and taxiways. Those are just some of the lessons we've learned because we are only 4 feet above sea level on our airport. So, we understand that we will flood but some of

the things we're doing is being smarter. All of our navigational aids, and this is the first time actually for our navigational aids, anywhere in the US, they've done this. They have actually put them on the concrete pilings and built them up (5:00) so when the flood does come and the water does come, it just runs underneath it everything else is still operational.

Yes, they are stored in what I call a concrete bunker. It's all four walls are concrete, heavy duty steel doors, you know entrance and exit, concrete roof, so there stout buildings that are built to last.

1. Quick "bounce-back" from disaster to become operational

One of the biggest difficulties is equipment wise: keeping your equipment safe during the storm, to getting it out one taxiways and runways and start to clear it up. Mainly because of hurricanes we get storm surges, high-winds so keeping our equipment dry and safe for recovery is one of our more difficult tasks in hand.

2. Minimize financial damage

- iii. Use emergency services

- iv. Communication

First action, we always keep the rest of our airport informed on what is happening (26:23). We always tell them how out landfall it is and where it is projected to come to come in. So, the tenants out here can make their own precautions and decide if they want to evacuate, they want to shelter in place.

- v. Practice disaster scenarios

- vi. Shelter

- c. There is an unknown/limited role

- i. Dependent on ownership

- ii. Dependent on function

- iii. Dependent on infrastructure

- iv. Dependent on airport

- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

- a. Act dependently

i. As a lifeline for a community

1. To met FAA guidelines following the disaster
2. Act as a staging area for recovery efforts

well, recovery we play a very big part, especially on the island for a natural disaster, its not just the planes and helicopters coming in and out of here. We are also the staging the area for what I call FEMA city, we house over 600 FEMA employees on the airport. One thing great about airports is that we have a lot of concrete out here. We have two runways, we shut down one of our runways so we can put what we call FEMA city on there and the FEMA employees would have a place to stay and they would be able to go out and do their inspections and comeback and have a place to stay and eat. Salvation Army and Red Cross were able to set their facilities up here on our apron area and be able to cook out here and mobile canteen would come in here and form a circle, pick their food up and exit out and then go into the community to feed the public. We have also stored over 58 semi-trucks out here loaded with food and ice. One of the good things about an airport is (7:45) it's a secured area. We are not in the middle of the neighborhood, we are on the outskirts of the island somewhat. So if you are coming out to the airport your coming to the airport, you're not going through, going to somewhere else. So, security wise we are able to contain everything as far as having our local and state police out here, also the military were stationed out here to be able to protect the area and protect all the food because when people need something, they're desiring it, people do things they wouldn't normally do in a natural disaster.

That's one thing the military did, they brought in the C130's and they started unloading equipment and the SOMETHING that came onto the island was littered full of boats (8:53), boats from the gulf of Mexico got washed up and it closed off the highway. You know what they say, "A mile of highway, gets you a mile down the road. A mile of runway can get you anywhere in the world" We clear the runways and we clear 6,000 feet of runway and we can start bringing in heavy equipment versus you know it will take awhile for that highway to get cleaned up.

Well, we knew that was going to happen, we knew we were going to run out of fuel so what we did was we actually started

rationing, I guess you could say, our fuel. So, when we didn't need the control tower working at one time, we would shut down, until they got communication with their handheld and then would power back up on our tower, until we got the fuel back on.

(11:21) I think it was roughly 3 days until we got tankers coming back in here with fuel, not just fuel for generator but fuel for the aircraft also. I forgot to mention, that is another thing. One of the staging areas for all the emergency vehicles for fueling wise was the airport. We have an area here that they could come in with the tanker trucks lined up the vehicle would come in, get fueled up, and go on about their way. Of course this was only for emergency personnel, it wasn't for the public. That was one of the reasons why they kept it out here, at the airport. Again, the military and the police can stop and block off the roads to prevent access from the public to come here. That was one of the problems they were having, especially with the fuel. They were trying to do satellite areas for fuel and once the public sees the fuel trucks and you need fuel, they're going to go to an that just causes problems

3. To bring in supplies

Once the storm pass, we clear runways and taxiways get up to as much of normalcy so the aircrafts can come in and out bringing in supplies, food, ice, medical attention which is always very important and also evacuating anyone that needs to be evacuated from the island also

a. Dependent on airport infrastructure

ii. Dependent on the airport's infrastructure system

You know problems we always have and anytime after a natural disaster, no matter where you are at, the issue you always have is fuel. The generators are great but then getting fuel after the fuel is done in the generator. Once they have used it all not being able to get that fuel fast enough. So that was our only difficult problem we were really actually only having.

iii. Act as a morale booster for citizens

iv. Shelter

b. Act independently

i. Get disaster assessed

- ii. Dependent on outside infrastructure
- iii. Communicating
- iv. personnel stuff
- v. Getting the airport operational as quickly as possible
- vi. Dependent on the airport's infrastructure system
- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

i. Communicate Information

- 1. Local governments
- 2. State governments
- 3. Federal governments

ii. Resume operations as quickly as possible

What we should be doing to prevent is being able to open up and become operational as quickly as possible. That's what we should do to prevent a disaster because that's our main goal. I always tell my staff that our number one goal is to get out there and clear the runways and taxiways of the apron and everything else is second.

Hardwork. Dumptrucks, Frontend Loaders, starting at one end of the runway and going to the next and removing any debris that is on the runways and taxiways and getting it out of harm's way (20:35). Doing a visual inspection as far as making sure none of the pavement has given away; no cracks have formed, no concrete slabs have moved or anything, the drainage is open, the inlets are open as far as water to flow off and then to notify FAA that we are open be it day operations or daytime and nighttime.

iii. Shelter

b. Act independently

- i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard

- ii. Improve/fix critical infrastructure

What we start doing though actually is that we go and we make sure everything is topped off, all the fuel facilities, that we have supplies for after the storm. That everything is secured as far as are inlets are cleaned out, free of debris, we double check everything. We do another test on our generators. We check all of our emergency supplies so we do our precautionary steps there, we starting bracketing (27:23) everything up in our offices.

- iii. Adaptive use for infrastructure

- 1. Concerns

- iv. Resume operations as quickly as possible

- v. Communicate Information

- vi. Mutual Aid

- vii. Shelter

6. What should be the airport's role in response to a natural disaster?

- a. Act dependently

- i. To be a tool for surrounding communities

- 1. Dependent on type of airport
 - 2. Dependent on governmental requirements
 - 3. Operational Ultimatum

- ii. Acting as a staging area

- iii. For incoming delivery

- iv. Evacuation

Yes, what is unusual about Galveston Island is we have a very large hospital district here. It has a very large prenatal facility, a lot of research, a lot of burn patients and not only are we the first responders but actually before the storm we are the main evacuation area for those

patients. Before a storm, our ramp area is full of helicopters and 6 wing evacuating patients out and vice versa; when someone gets injured on the island they are airlifted out of here. They are not taken by ambulance because it takes too long; they are either taken out by helicopter or 6 wing from this airport.

Yes, for evacuation I always tell everyone because my helicopter company is here that are the airport they have bases all up and down the Gulf of Mexico. They have bases all over the world, Nigeria, South America. You name it they have a base there: Antarctica. They're professionals at evacuating. I always tell my county commissioners, they always ask, what can they do to assist the helicopter companies. What we can do is stay out of their way. They are very good at what they do (16:00) they bring in their 18-wheelers, they load up their equipment and everything, they start evacuating as soon as a hurricane enters the Gulf of Mexico.

(16:09)

No matter where its coming in. They start pulling people of the SOMETHING immediately. Then they start moving all their equipment and their personnel out of harm's way. Of course we keep our tenants notified by internet and word of mouth of what the situation is. How many hours away is the hurricane, possibility of evacuation because that way those pilots can get the aircraft off the island and come back to the island and start worrying about their households, persons, their families, their businesses, etc. So, we have our minor exercises that we do as far as, we button down everything in our terminal building or offices upstairs; make sure our fire department they've got their vehicles up on higher grounds as far as their fire trucks and everything. Of course, like the hospital, they are literally the last to decide when to evacuate because it's not only very expensive but it's also very traumatizing I guess you could say for a patient of a baby moved out their hospital loaded on an aircraft and flown away somewhere. You now don't only have to worry about the patient but then you have the family, kinda visiting that patient. So, they are the last ones to know, literally two days before the storm hits, the hospital says ok, we're evacuating now. So, it's literally a mass sky opening up and the planes and helicopters come in and they start this mass evacuation of the hospital.

- v. Take lead role in recovery

What should our response be? We should be the first responders. We can activate, we can open up quicker than anywhere else, as far as access to and from this island. That is always are main role to be first responders.

vi. Shelter

b. Act independently

i. To follow FAA and TSA guidelines to become legally operational

ii. Shelter

iii. Hindered by need to be operational

c. Limited Role

7. What should be the airport's role in prevention of a Disaster?

a. Act dependently

i. Provide supplementary roles to the community

1. Deliver goods and services

2. Act as a staging ground

3. Evacuations

4. Communication

ii. Protect critical infrastructure

iii. Work with other forms of government

1. Local

2. State

3. Federal

iv. Update Emergency plan

v. Shelter

b. Act independently

i. Protect critical infrastructures

That we have started already. Not practically, we took hard look immediately after the storm of how we could prevent this becoming a

disaster like it did before. Like I said, we build higher, which is what we're currently doing right now. We're making sure everything is elevated up that can be elevated up. We know there are somethings, like our lobby; we can't elevate the lobby; it's a 1950 terminal buildings. Our hangers have to be ground level, for the aircraft to be able to get in and out. One of the things we are doing is improving our drainage system out here. We're about to spend 3 million dollars just on our drainage system, get the water off quicker. Once that phase is done, we'll do another phase.

- ii. Adaptative use for infrastructure
- iii. Work with other forms of government
- iv. Utilizing available resources
- v. Become operational as quickly as possible

What we should be doing to prevent is being able to open up and become operational as quickly as possible. That's what we should do to prevent a disaster because that's our main goal. I always tell my staff that our number one goal is to get out there and clear the runways and taxiways of the apron and everything else is second.

Hardwork. Dumptrucks, Frontend Loaders, starting at one end of the runway and going to the next and removing any debris that is on the runways and taxiways and getting it out of harm's way (20:35). Doing a visual inspection as far as making sure none of the pavement has given away; no cracks have formed, no concrete slabs have moved or anything, the drainage is open, the inlets are open as far as water to flow off and then to notify FAA that we are open be it day operations or daytime and nighttime.

- vi. Update Emergency plan
- vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground

For recovering from a natural disaster, we should be the staging area for those emergency personnel and those emergency facilities because we

have the area for, the room for it. Salvation Army, American Red Cross, FEMA, the supplies, because we have the concrete area for it but keeping it in mind that we are one airport and our main goal and responsibility is to bring aircraft in and out after that disaster for relief. We found a good balance between the two.

- iv. Shelter

- v. Communication

- b. Act independently

- i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)

- ii. Respond to other airports in need

- iii. Assessment

- iv. Work w/ tenets

- v. Shelter

- c. To act as

Limited/unknown roll

Appendix G - Coded Interview for 4

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

- a. establish communication
- b. Use local resources
- c. act independently

2. State government

- a. establish communication
- b. Use state resources
- c. act independently

3. Federal government

- a. establish communication
- b. Use federal resources
- c. act independently
- d. Limited Role

4. Evacuations

5. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

We have a pretty well thought out and pretty consistent hurricane readiness and recovery plan here. It's based on 5 opcons or

operational conditions. And we generally, initiate the first opcon about 72 hours before a storm may strike. It's a check list based on each opcon, on what are we doing, what should we be doing at this particular stage of the game. 72 hours out, we're going to start looking at procuring additional supplies, what's the availability of water if we do have to have a ride out crew from the airlines, who's going to be coming over. From the airport who's going to be coming over. We'll put those lists together and as the storm approaches and gets closer and closer we'll elevate the opcon to a 3 or 2 or 1 and the scope gets narrower and narrower. Finally, when we are at opcon 1, we're sending home non-essential staff, we're getting them out in time to evacuate, what the mandated evacuation schedule. So we do have a skeleton crew of airport staff, airport operations folks, just critical workforce that are here to just keep the airport open. Those that are most capable of reacting and getting it back open in a timely manner. And that's to get it open to 139 specifications, not to serve commercial aircraft immediately. Our primary function is to get the lights, the runway lights on and make sure the pavement is ok. Opcon 0 is a rideout, opcon negative 1, negative 2 they are primary financial recovery, repairs, putting the building back together,

2. In accordance to fed regulation

iii. Protect the airport

1. Infrastructure

iv. Evacuations

Not directly, CEMA handles that, the city itself doesn't head up the evacuation plan, the county emergency management agency. They take the helm on that, our only involvement in the evacuation is if there are any stranded passengers here in the airport we will assist them in getting to the prescribed evacuation site, which is Augusta.

v. Keep flying until they no longer can

vi. Evacuations

vii. Shelter

viii. Communication

c. An unknown/limited role

i. Can't get proper personnel their

If we were to get a full scale direct hit from a hurricane a catastrophic hit, the likelihood that delta and US airways would want to be sending in and out of here is pretty slim in the first 48 hours. Beyond that, once we establish our beachhead sort of speak on the east side of the airport, we would be looking to resume commercial services as soon as possible.

ii. Infrastructure is vulnerable, hence limited role

We serve as a critical work force staging location for about 500 utility folk, law enforcement, fire, rescue, that sort of thing. IN the event of a hurricane were to come ashore, Katrina type of situation, were it's a catastrophic type of event, we don't foresee functioning as a 1542 certified airport so we would largely a repository for relief supplies. I mean this is where they would be sent via heavy lift aircraft or helicopter because we are more accessible than hunter airfield is.

Not currently. The nature of the storm there so unpredictable that the most we can do to prepare for it is to work closely CEMA Chatta Emergency Management Agency and make sure that their airplanes are in sync with our own hurricane and rediness and recovery plan and make sure that everyone is on the same page and is prepared.

Ok, the airlines, they're not going to put a multi-million dollar airplane in here if they think there is a hurricane coming, they're going to get all of their critical metal out of here well before it comes in. I'd be very surprise to see if any airline wants to operate with 12 hours of a forecast landfall. The airline would be gone. Each of the airlines will take their heaviest equipment, their critical ground equipment (10:53) or their carts, things that are likely to be caught in the wind and blow, they'll stage those in their respective bag makeup areas, in their lease holds. That would leave tug tunnel, quite a bit of shelter curb side that we would stage the utility trucks, fire and emergency trucks, police vehicles, etc., right up against the building undercover so they are not directly in the path of wind or damaging things caught in the wind. Emergency vehicles, the parking of those is going to be directed by the chief of police, he'll be the primary point of contact for all law enforcement they'd be riding out the storm here at the airport. The fire chief would stage additional fire equipment at some shelter locations across the airport. And all local fire ride out crews would get in touch with the chief warton out at art station.

iii. Equipment issues

iv. Poor geographical location

- v. Shelter

- vi. Practice

2. What is the airport's role in response to a natural disaster?

- a. The airport to act dependently

- i. Act as a staging area for recovery efforts

- ii. Become operational quickly after the storm

- iii. As a lifeline for a community but with normal operations problem due to recovery efforts

- iv. Mutual Aid between airports

- v. Evacuations

- vi. Dependent on airport infrastructure

- vii. Coordinate with governments

- viii. Respond to any disaster needs

- ix. Shelter

- b. Act in an independent role

- i. Assess airport

- ii. Restore facility

We're going to need all hands on deck doing airport things rather than flowing out through the community to make sure things are getting better and bringing the hotels on airport property back up to speed. We are here to operate this airport and the community should be able to take care of itself if the county's plans and the city's plans are all coming together.

- iii. Mutual Aid

- iv. Dependent on airport infrastructure

We want to make sure that after the storm, the terminal is going to be able to be useable for some function. After we get the concrete certified for use, we are going to turn our attention to the terminal building so that we can get Delta Air and US united and get them operating again so we can start making some money. The runway comes first, the airfield comes first and then the terminal is number 2.

- v. Shelter

- vi. Planning

- 1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

- 1. Evacuation

- 2. Communication towards passengers

- ii. To operate as an airport

- iii. Work with government agencies

- 1. Work with local agencies

- 2. Work with state agencies

- 3. Work with federal agencies

- iv. Shelter

- b. Act Independently

- i. To operate as an airport

- We deal with federal regulations that dictate how airports operation and that's our wheelhouse, we've leave the community betterment to the emergency management agencies.

- ii. Protect itself and infrastructure

- 1. Quick "bounce-back" from disaster to become operational

- Chatta Emergency Management they take that role, again our responsibility to best serve the community is to keep those runways open.

- 2. Minimize financial damage

- iii. Use emergency services

- iv. Communication

- v. Practice disaster scenarios

- vi. Shelter
- c. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure
 - iv. Dependent on airport
 - v. Shelter
- 4. What is the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies
 - a. Dependent on airport infrastructure
 - ii. Dependent on the airport's infrastructure system
 - iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure
 - iii. Communicating
 - iv. personnel stuff
 - v. Getting the airport operational as quickly as possible

I hate to keep harping on this central topic, but an airport, airport professionals, only know airport. Most airports, they may have a weather guy but he's probably not a meteorologist, he's probably an amateur weather fan. The airport professionals know how to keep runways open so that airplanes can come and go. It's my conservative opinion the best

way they can assist a community is to keep that runway open. if we were to metal in some other job description or task, that is taking away our core function. Particularly during a storm when we are used to having a 100 people and that's all of a sudden cut down to 30, we don't have a whole lot of time during the disaster, during the rebuilding other than maybe some volunteer work with the staff that wouldn't be needed yet.

- vi. Dependent on the airport's infrastructure system
- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

- i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

- i. Communicate Information
 - 1. Local governments
 - 2. State governments
 - 3. Federal governments
- ii. Resume operations as quickly as possible
- iii. Evacuations
- iv. Shelter

b. Act independently

- i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
- ii. Improve/fix critical infrastructure
- iii. Adaptive use for infrastructure
 - 1. Concerns
- iv. Resume operations as quickly as possible

We're not really in that business. We are here to keep the runways open and to keep the air service coming and going into and out of Savannah. During a hurricane we are kind of greedy in opening ourselves open for the utilities and things like electric, water and gas because we know if those folks are based here, we're going to be turned on first so that we can function as an airbase as an airport so those relief supplies can come streaming in. And, O, by the way, our lights would already be on when Delta and US air are ready to come in. Beyond that we are not immediately interested in providing and serving in a tent city or Red Cross location or anything like that. We're here to be an airport and that's the business we're in.

v. Communicate Information

vi. Mutual Aid

vii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

ii. Acting as a staging area

iii. For incoming delivery

We're not really in that business. We are here to keep the runways open and to keep the air service coming and going into and out of Savannah. During a hurricane we are kind of greedy in opening ourselves open for the utilities and things like electric, water and gas because we know if those folks are based here, we're going to be turned on first so that we can function as an airbase as an airport so those relief supplies can come streaming in. And, O, by the way, our lights would already be on when Delta and US air are ready to come in. Beyond that we are not immediately interested in providing and serving in a tent city or Red Cross location or anything like that. We're here to be an airport and that's the business we're in.

- iv. Evacuation
 - v. Take lead role in recovery
 - vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - c. Limited Role
7. What should be the airport's role in prevention of a Disaster?
- a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government
 - 1. Local
 - 2. State
 - 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptive use for infrastructure
 - iii. Work with other forms of government

- iv. Utilizing available resources
- v. Become operational as quickly as possible

I hate to keep harping on this central topic, but an airport, airport professionals, only know airport. Most airports, they may have a weather guy but he's probably not a meteorologist, he's probably an amateur weather fan. The airport professionals know how to keep runways open so that airplanes can come and go. It's my conservative opinion the best way they can assist a community is to keep that runway open. if we were to metal in some other job description or task, that is taking away our core function. Particularly during a storm when we are used to having a 100 people and that's all of a sudden cut down to 30, we don't have a whole lot of time during the disaster, during the rebuilding other than maybe some volunteer work with the staff that wouldn't be needed yet.

- vi. Update Emergency plan
- vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication

b. Act independently

- i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)

Not one that I've really paid attention to. We're simply, I keep going back to this central theme, but we're a pair of heavy concrete runways for landing airplanes on. We can best serve our communities by keeping those runways open and keeping aviation coming and going into and out of Savannah.

- ii. Respond to other airports in need

We've never really had to do that before. We've always responded to other airport in need and we've not so much worked directly with FEMA

or Georgia Emergency Management. We've worked through SEADOG, southeast aviation disaster operations group; it's kind of an informal arrangement of other airports going to the rescue of an airport in need to get it up and running. We'll get our mission number from the state before going in and we'll do our own airport-centric rescue just to get the airport up and running and then that local, the county local emergency management or state can then take over and then come to the aid of the community at large.

- iii. Assessment
- iv. Work w/ tenets
- v. Shelter

c. To act as

Limited/unknown roll

Appendix H - Coded Interview for 6

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

- a. establish communication
- b. Use local resources
- c. act independently

2. State government

- a. establish communication
- b. Use state resources
- c. act independently

3. Federal government

- a. establish communication
- b. Use federal resources
- c. act independently
- d. Limited Role

4. Evacuations

5. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

We have a pretty well thought out and pretty consistent hurricane readiness and recovery plan here. It's based on 5 opcons or operational conditions. And we generally, initiate the first opcon about 72 hours before a storm may strike. It's a check list based

on each opcon, on what are we doing, what should we be doing at this particular stage of the game. 72 hours out, we're going to start looking at procuring additional supplies, what's the availability of water if we do have to have a ride out crew from the airlines, who's going to be coming over. From the airport who's going to be coming over. We'll put those lists together and as the storm approaches and gets closer and closer we'll elevate the opcon to a 3 or 2 or 1 and the scope gets narrower and narrower. Finally, when we are at opcon 1, we're sending home non-essential staff, we're getting them out in time to evacuate, what the mandated evacuation schedule. So we do have a skeleton crew of airport staff, airport operations folks, just critical workforce that are here to just keep the airport open. Those that are most capable of reacting and getting it back open in a timely manner. And that's to get it open to 139 specifications, not to serve commercial aircraft immediately. Our primary function is to get the lights, the runway lights on and make sure the pavement is ok. Opcon 0 is a rideout, opcon negative 1, negative 2 they are primary financial recovery, repairs, putting the building back together,

2. In accordance to fed regulation

iii. Protect the airport

1. Infrastructure

iv. Evacuations

Not directly, CEMA handles that, the city itself doesn't head up the evacuation plan, the county emergency management agency. They take the helm on that, our only involvement in the evacuation is if there are any stranded passengers here in the airport we will assist them in getting to the prescribed evacuation site, which is Augusta.

v. Keep flying until they no longer can

vi. Evacuations

vii. Shelter

viii. Communication

c. An unknown/limited role

i. Can't get proper personnel their

If we were to get a full scale direct hit from a hurricane a catastrophic hit, the likelihood that delta and US airways would want to be sending in and out of here is pretty slim in the first 48 hours. Beyond that, once we establish our beachhead sort of speak on the east side of the airport, we would be looking to resume commercial services as soon as possible.

ii. Infrastructure is vulnerable, hence limited role

We serve as a critical work force staging location for about 500 utility folk, law enforcement, fire, rescue, that sort of thing. IN the event of a hurricane were to come ashore, Katrina type of situation, were it's a catastrophic type of event, we don't foresee functioning as a 1542 certified airport so we would largely a repository for relief supplies. I mean this is where they would be sent via heavy lift aircraft or helicopter because we are more accessible than hunter airfield is.

Not currently. The nature of the storm there so unpredictable that the most we can do to prepare for it is to work closely CEMA Chatta Emergency Management Agency and make sure that their airplanes are in sync with our own hurricane and readiness and recovery plan and make sure that everyone is on the same page and is prepared.

Ok, the airlines, they're not going to put a multi-million dollar airplane in here if they think there is a hurricane coming, they're going to get all of their critical metal out of here well before it comes in. I'd be very surprise to see if any airline wants to operate with 12 hours of a forecast landfall. The airline would be gone. Each of the airlines will take their heaviest equipment, their critical ground equipment (10:53) or their carts, things that are likely to be caught in the wind and blow, they'll stage those in their respective bag makeup areas, in their lease holds. That would leave tug tunnel, quite a bit of shelter curb side that we would stage the utility trucks, fire and emergency trucks, police vehicles, etc., right up against the building undercover so they are not directly in the path of wind or damaging things caught in the wind. Emergency vehicles, the parking of those is going to be directed by the chief of police, he'll be the primary point of contact for all law enforcement they'd be riding out the storm here at the airport. The fire chief would stage additional fire equipment at some shelter locations across the airport. And all local fire ride out crews would get in touch with the chief warton out at art station.

iii. Equipment issues

iv. Poor geographical location

v. Shelter

vi. Practice

2. What is the airport's role in response to a natural disaster?

a. The airport to act dependently

- i. Act as a staging area for recovery efforts
- ii. Become operational quickly after the storm
- iii. As a lifeline for a community but with normal operations problem due to recovery efforts
- iv. Mutual Aid between airports
- v. Evacuations
- vi. Dependent on airport infrastructure
- vii. Coordinate with governments
- viii. Respond to any disaster needs
- ix. Shelter

b. Act in an independent role

- i. Assess airport
- ii. Restore facility

We're going to need all hands on deck doing airport things rather than flowing out through the community to make sure things are getting better and bringing the hotels on airport property back up to speed. We are here to operate this airport and the community should be able to take care of itself if the county's plans and the city's plans are all coming together.

- iii. Mutual Aid
- iv. Dependent on airport infrastructure

We want to make sure that after the storm, the terminal is going to be able to be useable for some function. After we get the concrete certified for use, we are going to turn our attention to the terminal building so that we can get Delta Air and US united and get them operating again so we can start making some money. The runway comes first, the airfield comes first and then the terminal is number 2.

- v. Shelter

- vi. Planning

- 1. Adaptive Use

- 3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

- 1. Evacuation

- 2. Communication towards passengers

- ii. To operate as an airport

- iii. Work with government agencies

- 1. Work with local agencies

- 2. Work with state agencies

- 3. Work with federal agencies

- iv. Shelter

- b. Act Independently

- i. To operate as an airport

- We deal with federal regulations that dictate how airports operation and that's our wheelhouse, we've leave the community betterment to the emergency management agencies.

- ii. Protect itself and infrastructure

- 1. Quick "bounce-back" from disaster to become operational

- Chatta Emergency Management they take that role, again our responsibility to best serve the community is to keep those runways open.

- 2. Minimize financial damage

- iii. Use emergency services

- iv. Communication

- v. Practice disaster scenarios

- vi. Shelter

- c. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure
 - iv. Dependent on airport
 - v. Shelter
- 4. What is the airport's role in recovery from a natural disaster?
 - a. Act dependently
 - i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies
 - a. Dependent on airport infrastructure
 - ii. Dependent on the airport's infrastructure system
 - iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure
 - iii. Communicating
 - iv. personnel stuff
 - v. Getting the airport operational as quickly as possible

I hate to keep harping on this central topic, but an airport, airport professionals, only know airport. Most airports, they may have a weather guy but he's probably not a meteorologist, he's probably an amateur weather fan. The airport professionals know how to keep runways open so that airplanes can come and go. It's my conservative opinion the best way they can assist a community is to keep that runway open. if we were to metal in some other job description or task, that is taking away our

core function. Particularly during a storm when we are used to having a 100 people and that's all of a sudden cut down to 30, we don't have a whole lot of time during the disaster, during the rebuilding other than maybe some volunteer work with the staff that wouldn't be needed yet.

- vi. Dependent on the airport's infrastructure system
- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

i. Communicate Information

1. Local governments
2. State governments
3. Federal governments

ii. Resume operations as quickly as possible

iii. Evacuations

iv. Shelter

b. Act independently

i. To be informed about the approaching hazard

1. Work with local government but act independently
2. To be informed about the approaching hazard

ii. Improve/fix critical infrastructure

iii. Adaptive use for infrastructure

1. Concerns

iv. Resume operations as quickly as possible

We're not really in that business. We are here to keep the runways open and to keep the air service coming and going into and out of Savannah.

During a hurricane we are kind of greedy in opening ourselves open for the utilities and things like electric, water and gas because we know if those folks are based here, we're going to be turned on first so that we can function as an airbase as an airport so those relief supplies can come streaming in. And, O, by the way, our lights would already be on when Delta and US air are ready to come in. Beyond that we are not immediately interested in providing and serving in a tent city or Red Cross location or anything like that. We're here to be an airport and that's the business we're in.

v. Communicate Information

vi. Mutual Aid

vii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

ii. Acting as a staging area

iii. For incoming delivery

We're not really in that business. We are here to keep the runways open and to keep the air service coming and going into and out of Savannah. During a hurricane we are kind of greedy in opening ourselves open for the utilities and things like electric, water and gas because we know if those folks are based here, we're going to be turned on first so that we can function as an airbase as an airport so those relief supplies can come streaming in. And, O, by the way, our lights would already be on when Delta and US air are ready to come in. Beyond that we are not immediately interested in providing and serving in a tent city or Red Cross location or anything like that. We're here to be an airport and that's the business we're in.

iv. Evacuation

v. Take lead role in recovery

- vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - c. Limited Role
7. What should be the airport's role in prevention of a Disaster?
- a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government
 - 1. Local
 - 2. State
 - 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptive use for infrastructure
 - iii. Work with other forms of government
 - iv. Utilizing available resources
 - v. Become operational as quickly as possible

I hate to keep harping on this central topic, but an airport, airport professionals, only know airport. Most airports, they may have a weather guy but he's probably not a meteorologist, he's probably an amateur weather fan. The airport professionals know how to keep runways open so that airplanes can come and go. It's my conservative opinion the best way they can assist a community is to keep that runway open. If we were to metal in some other job description or task, that is taking away our core function. Particularly during a storm when we are used to having a 100 people and that's all of a sudden cut down to 30, we don't have a whole lot of time during the disaster, during the rebuilding other than maybe some volunteer work with the staff that wouldn't be needed yet.

vi. Update Emergency plan

vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

a. Act dependently

i. Provide supplementary roles to the community

ii. Deliver goods and services

iii. Act as a staging ground

iv. Shelter

v. Communication

b. Act independently

i. To meet FAA guidelines following the disaster (to reach operational capabilities ASAP)

Not one that I've really paid attention to. We're simply, I keep going back to this central theme, but we're a pair of heavy concrete runways for landing airplanes on. We can best serve our communities by keeping those runways open and keeping aviation coming and going into and out of Savannah.

ii. Respond to other airports in need

We've never really had to do that before. We've always responded to other airport in need and we've not so much worked directly with FEMA or Georgia Emergency Management. We've worked through SEADOG, southeast aviation disaster operations group; it's kind of an informal arrangement of other airports going to the rescue of an airport in need to

get it up and running. We'll get our mission number from the state before going in and we'll do our own airport-centric rescue just to get the airport up and running and then that local, the county local emergency management or state can then take over and then come to the aid of the community at large.

- iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
 - d. Limited/unknown roll

Appendix I – Coded Interview for 9

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

- a. establish communication
- b. Use local resources
- c. act independently

2. State government

- a. establish communication
- b. Use state resources
- c. act independently

3. Federal government

- a. establish communication
- b. Use federal resources
- c. act independently
- d. Limited Role

4. Airlines

5. Evacuations

6. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

During the approach of hurricane, their role is to primarily safety of passengers and equipment and aircraft and communication to the public as regard to flight delays and cancellations and things like that.

- ii. Deal with the hazard
 - 1. In a systematic approach
 - 2. In accordance to fed regulation
- iii. Protect the airport
 - 1. Infrastructure
- iv. Evacuations
- v. Keep flying until they no longer can

No, again, I think we have a great relationship with Tampa International Airport, which is the specific one I am referring to. I think they are very good and very well versed and well practiced at taking mitigation efforts to ensure that they are resilient and can return to normal operations as soon as possible. They don't really rely on us to do so. They take these steps on their own devices in order to again, balance the competing demands of economic and passenger convenience and public safety and resiliency.

- vi. Evacuations
- vii. Shelter
- viii. Communication

- c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice

- 2. What is the airport's role in response to a natural disaster?
 - a. The airport to act dependently
 - i. Act as a staging area for recovery efforts

In response as well as recovery, again, the airport falls back to the major role of a transportation provider as well as a large footprint, geographically in the community, they have a large open spaces, large empty hangers that can be used for logistical supplies and equipment

ii. Bring in recovery supplies

In response as well as recovery, again, the airport falls back to the major role of a transportation provider as well as a large footprint, geographically in the community, they have a large open spaces, large empty hangers that can be used for logistical supplies and equipment

iii. Become operational quickly after the storm

iv. As a lifeline for a community but with normal operations problem due to recovery efforts

v. Mutual Aid between airports

vi. Evacuations

Then we have not only exercise and train but we utilized the airport's resource to receive patients from Haiti and most recently and a few years ago, we received patients from the New Orleans area following Katrina.

vii. Dependent on airport infrastructure

viii. Coordinate with governments

ix. Respond to any disaster needs

x. Shelter

b. Act in an independent role

i. Assess airport

ii. Restore facility

iii. Mutual Aid

iv. Dependent on airport infrastructure

v. Shelter

vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

a. Act Dependently

i. Provide supplementary roles

1. Evacuation

Well, the Haiti example is probably the most recent and I was directly involved with that so I can do that. For the most part, we were receiving trauma patients from Haiti and were transferred to local hospitals and trauma centers. Then there follow up care was coordinated through the children's department of families and various non-profit groups. Basically, they were assigned case workers to help them transition from the hospital setting to the assisted living or long term care facilities until their medical needs were such that they could be re-patriated. They were existing facilities. They're hospitals, nursing homes, rehabilitation centers, etc

2. Communication towards passengers

ii. To operate as an airport

iii. Work with government agencies

1. Work with local agencies

2. Work with state agencies

3. Work with federal agencies

iv. Practice disaster scenarios

Again, we participate with the airport in their triennial; they do a full scale response exercise. We just did one back in April, which involved, city, county, federal partners, coast guard, the airport.

v. Shelter

b. Act Independently

i. To operate as an airport

Protecting your infrastructure so when the weather clears you can be more resilient and get back to business as soon as possible.

ii. Protect itself and infrastructure

1. Quick "bounce-back" from disaster to become operational

Protecting your infrastructure so when the weather clears you can be more resilient and get back to business as soon as possible.

2. Minimize financial damage

- iii. Use emergency services
- iv. Communication
- v. Practice disaster scenarios
- vi. Shelter

c. There is an unknown/limited role

- i. Dependent on ownership
- ii. Dependent on function
- iii. Dependent on infrastructure
- iv. Dependent on airport
- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

a. Act dependently

i. As a lifeline for a community

- 1. To met FAA guidelines following the disaster
- 2. Act as a staging area for recovery efforts

they have a large open spaces, large empty hangers that can be used for logistical supplies and equipment

3. To bring in supplies

a. Dependent on airport infrastructure

they have a large open spaces, large empty hangers that can be used for logistical supplies and equipment

ii. Dependent on the airport's infrastructure system

- iii. Act as a morale booster for citizens
 - iv. Shelter
 - b. Act independently
 - i. Get disaster assessed
 - ii. Dependent on outside infrastructure
 - iii. Communicating
 - iv. personnel stuff
 - v. Getting the airport operational as quickly as possible
 - vi. Dependent on the airport's infrastructure system
 - vii. Act as a morale booster for citizens
 - viii. Shelter
 - c. Limited Role
 - i. Infrastructure Problems
- 5. What should be the airport's role in response to a natural hazard?
 - a. Act dependently
 - i. Communicate Information
 - 1. Local governments
 - 2. State governments
 - 3. Federal governments
 - ii. Resume operations as quickly as possible
 - iii. Evacuations
 - iv. Shelter
 - b. Act independently
 - i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard

- ii. Improve/fix critical infrastructure

- iii. Adaptive use for infrastructure

- 1. Concerns

- iv. Resume operations as quickly as possible

- v. Communicate Information

Yeah, I think that's appropriate (the same as the "is" question). They have to balance the economic demands of the airlines and the passengers with the safety considerations with the weather. Here in Florida, we do have sometimes, on a daily bases with our summer thunderstorms. Lots of rain and things like that. We get lots of wild variations of our weather almost daily during our summer. So, our airports, I think are well versed and practiced in implementing those procedures to protect passengers and aircraft while at the same time trying to minimize the economic impact and inconvenience on travelers.

- vi. Preparation

- vii. Mutual Aid

- viii. Shelter

6. What should be the airport's role in response to a natural disaster?

- a. Act dependently

- i. To be a tool for surrounding communities

- 1. Dependent on type of airport

- 2. Dependent on governmental requirements

- 3. Operational Ultimatum

- ii. Acting as a staging area

- iii. For incoming delivery

- iv. Evacuation

- v. Take lead role in recovery

- vi. Shelter

- b. Act independently

- i. To follow FAA and TSA guidelines to become legally operational

You have to take those steps to protect infrastructure and aircraft. Sometimes to the detriment of economic or passengers inconvenience, but in the long term strategic sense, taking those actions keeps your airport up and running and your aircraft flying

- ii. Shelter

- iii. Hindered by need to be operational

- c. Limited Role

- i. Dependent on airport

7. What should be the airport's role in prevention of a Disaster?

- a. Act dependently

- i. Provide supplementary roles to the community

- 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication

- ii. Protect critical infrastructure

You have to take those steps to protect infrastructure and aircraft. Sometimes to the detriment of economic or passengers inconvenience, but in the long term strategic sense, taking those actions keeps your airport up and running and your aircraft flying

- iii. Work with other forms of government

- 1. Local
 - 2. State
 - 3. Federal

- iv. Update Emergency plan

- v. Shelter

- b. Act independently

- i. Protect critical infrastructures

- ii. Adaptative use for infrastructure

Here in local community, we've used empty hangers for relief centers and exercises and things like that. We've used reception lounges for receipt of incoming patients from Haiti. Again, I don't know if there is a shortage of resources, the airport has those resources and there is certainly no roadblock to us as a community to use those resources.

- iii. Work with other forms of government

- iv. Utilizing available resources

- v. Become operational as quickly as possible

- vi. Update Emergency plan (Preparation)

- vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently

- i. Provide supplementary roles to the community

- ii. Deliver goods and services

- iii. Act as a staging ground

- iv. Shelter

- v. Communication

- b. Act independently

- i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)

We need the runways to be open and the aircrafts to be safe and able to fly. We need the airport concourses to be open and operational.

- ii. Respond to other airports in need

- iii. Assessment

- iv. Work w/ tenets

- v. Shelter

- c. To act as

- d. Limited/unknown roll

Appendix J – Coded Interview for 10

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

a. establish communication

Well, our job would be to coordinate with local city of Philadelphia officials, State, Federal and anybody and everybody. And looking at what is coming and the impact Philadelphia and or the surrounding area. So, we are going to work with the airlines and tenants and the FAA control tower and the FAA folk to look at what's coming and probably and possible intax to the airport and the people that work or travel to the airport. And what makes the most sense in an emergency preparedness standpoint. A lot of those decisions are not in our hands.

b. Use local resources

c. act independently

2. State government

a. establish communication

Well, our job would be to coordinate with local city of Philadelphia officials, State, Federal and anybody and everybody. And looking at what is coming and the impact Philadelphia and or the surrounding area. So, we are going to work with the airlines and tenants and the FAA control tower and the FAA folk to look at what's coming and probably and possible intax to the airport and the people that work or travel to the airport. And what makes the most sense in an emergency preparedness standpoint. A lot of those decisions are not in our hands.

b. Use state resources

c. act independently

3. Federal government

a. establish communication

Well, our job would be to coordinate with local city of Philadelphia officials, State, Federal and anybody and everybody. And looking at what is coming and the impact Philadelphia and or the surrounding area. So, we are going to work with the airlines and tenants and the FAA control tower and the FAA folk to look at what's coming and probably and possible intax to the airport and the people that work or travel to the airport. And what makes the most sense in an emergency preparedness standpoint. A lot of those decisions are not in our hands.

- b. Use federal resources
- c. act independently
- d. Limited Role

The airlines are going to make their own decisions on how to change their flight schedules. the FAA is going to decide on what to do as far as the air traffic systems and shutting space down or rerouting planes. So, not all the decisions are our per se but we're kind of the middle man. We're going to work with the information that the local officials are dealing with and how they want the region to prepare for it and help kind of make that happen here with what the airports roles is with the airlines and tenets that operate here.

4. Airlines

Well, our job would be to coordinate with local city of Philadelphia officials, State, Federal and anybody and everybody. And looking at what is coming and the impact Philadelphia and or the surrounding area. So, we are going to work with the airlines and tenants and the FAA control tower and the FAA folk to look at what's coming and probably and possible intax to the airport and the people that work or travel to the airport. And what makes the most sense in an emergency preparedness standpoint. A lot of those decisions are not in our hands.

5. Evacuations

6. Bring in Supplies

ii. Shelter

- b. The airport to act independently

- i. To act as a first responder
- ii. Deal with the hazard
 - 1. In a systematic approach
 - 2. In accordance to fed regulation
- iii. Protect the airport
 - 1. Infrastructure

The airlines are going to make their own decisions on how to change their flight schedules. the FAA is going to decide on what to do as far as the air traffic systems and shutting space down or rerouting planes. So, not all the decisions are our per se but we're kind of the middle man. We're going to work with the information that the local officials are dealing with and how they want the region to prepare for it and help kind of make that happen here with what the airports roles is with the airlines and tenets that operate here.

- iv. Evacuations
- v. Keep flying until they no longer can
- vi. Evacuations
- vii. Shelter
- viii. Communication
- c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice

- 2. What is the airport's role in response to a natural disaster?
 - a. The airport to act dependently

- i. Act as a staging area for recovery efforts
- ii. Bring in recovery supplies
- iii. Become operational quickly after the storm
- iv. As a lifeline for a community but with normal operations problem due to recovery efforts
- v. Mutual Aid between airports
- vi. Evacuations

We've been used a couple of different ways. During hurricane Katrina, we did set up Philadelphia airport as a place to take relief flights. We did take one flight during Katrina about 70 people. We set up a building that we no longer have, we demolished it, we had the Red Cross and all these different agencies here and we set up pretty much when people walked off the flight their medical needs could be met, their housing needs could be met, their financial needs could be met. We had people here to help people go from having total destruction in the New Orleans area to arriving in Philadelphia, not even knowing they were going to Philadelphia until they were almost here. We have also dealt with, back in 2007 when there was the unrest in Lebanon, when they started evacuating people, the state department in that area because of the civil unrest we took dozen of flights. Some were US citizens, some were just people that were flown out of the country and out of the region and were flown to different airports in the county. They call it re-patronizations, they were basically evacuating people from Lebanon and they were bringing them to Philadelphia and other airports to get them out of the war zone. We set up, again the same thing; we had medical people here to evaluate their needs, people here to financial. A lot of people here in Philadelphia airport were coming here to stay, then taking a flight to somewhere in the country to go stay with friends or relatives; we would help them book fights or help them work with the airlines to get what they need to book a flight or find a way to get them where they need to be. We bus people all over the city. Some people we bus to shelters. When the whole earthquake in Haiti happened last year, we set up an entire plan with the federal government. Are you familiar with the national disaster medical system plan?

To basically if they started to evacuate more people out of Haiti, they would come on military planes and come to whatever federal centers that were activated to basically bring these people into the region and

match them up to the proper facility they needed. If they need certain medical treatment, match them up with that. If they needed (40:03) just housing and other things, you do that. They were citizens of Haiti, none of them were really US citizens unlike the re-patronization event we did from Lebanon

vii. Dependent on airport infrastructure

viii. Coordinate with governments

1. Local

Then you obviously get into being prepared for an emergency and having your emergency plans and coordinating with all the local emergency responders on and off the airport. You know and obviously I said in the beginning of this answer it was the short term, you know handling when the emergency would happen (5:00) whatever it would be to save life's and reduce the damage to the facility and other people's equipment and their property

2. State

3. Federal

ix. Respond to any disaster needs

x. Shelter

b. Act in an independent role

i. Assess airport

And you know obviously, at some point when that part ends and you get our search and rescue when evacuation and you get into more recovery mode where you start assessing the damage, what's needed to get the airport open, what's needed to get the employees, whether it be medical counseling or assistance or whatever they need to help them move forward because obviously you know, if it's effect the airport, it's a good chance it's effecting a lot of the personal lives of the people here. People's heads can be at work when you know they may have lost every too in whatever disaster may have happened, depending on, again a natural disaster or man-made and the scope of it.

ii. Restore facility

iii. Mutual Aid

First, short term, we are going to work with the incident commander, whether that would be fire or police to mitigate the actual emergency going on; whether it's an aircraft, security emergency, natural disaster. So, we are going to work to save lives and reduce property damage and go through the process of that part of the response first.

iv. Dependent on airport infrastructure

v. Shelter

vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

a. Act Dependently

i. Provide supplementary roles

1. Evacuation

Whether it is evacuating people from the airport to other parts of the city. Again being that the airport is owned and operated by the city of Philadelphia

2. Communication towards passengers

ii. To operate as an airport

iii. Work with government agencies

1. Work with local agencies

Then you obviously get into being prepared for an emergency and having your emergency plans and coordinating with all the local emergency responders on and off the airport. You know and obviously I said in the beginning of this answer it was the short term, you know handling when the emergency would happened (5:00) whatever it would be to save life's and reduce the damage to the facility and other people's equipment and their property

So, I think our roles is to work with the local officials, being the City of Philadelphia and the surrounding area and help the airport be part of the entire regional planning on how to mitigate people here at the airport;

2. Work with state agencies

- 3. Work with federal agencies
- iv. Practice disaster scenarios
- v. Shelter
- b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick “bounce-back” from disaster to become operational

Then you obviously get into being prepared for an emergency and having your emergency plans and coordinating with all the local emergency responders on and off the airport. You know and obviously I said in the beginning of this answer it was the short term, you know handling when the emergency would happen (5:00) whatever it would be to save life's and reduce the damage to the facility and other people's equipment and their property

So, we are going to look to mitigate and do things around the airport to help reduce the likelihood of injury or facility damage; whether that is how we respond or where we tell people go during an emergency. How we have building standards enacted in a city or at the airport.

Well what we have done obviously is that we have the I think it's called FOCA. I think that's the organization that puts out all the construction standards. We obviously make sure that our construction standards meet federal, state, local guidelines. They have earthquake, I guess earthquake resistant type of construction although that is somewhat false since no building is really resistant but they are designed to withstand it better. Part of it again is building codes and standards making sure as far as life saving requirements for emergency and lighting of exits, all the little things that go in to designing and building. Building structures with the flood plain in mind and what parts of the airport are susceptible to flooding and where do you put your electrical substations. And how do you have your electrical path power in and out of your facility, what kind of redundant power do you have to keep your facility operating if you lose some commercial feed or some commercial power. So, as we go forward with the airport, we are always looking at the data that is available being that we are right next to Delaware River. What areas of the airport floods? What can we do to mitigate that? Is

there anything we can do to mitigate or just know that when we get X amount of feet above the Ohio water mark you are going to have this kind of potential flooding. So, those are the kind of ways we mitigate whether, and mitigated as far as planning to.

I think as far as preventing a hazard is to properly prepare and try to mitigate for what you can plan for. Whether that is how you design your roads, you design your property or your fences to prevent the hazard from happening if possible.

Well obviously being an airport, there are federal regulations that we have to follow. So, the first is assessing the airport, the runways, taxiways, from a FAA standpoint. What do we have available to be able to open.

2. Minimize financial damage

iii. Use emergency services

Did our fire station or ARF station is that available, are the fire trucks available. Obviously without firetrucks to run emergency services, we can't reopen. So, we have to look at what resources we that we need to have functioning to report from a airfield perspective.

iv. Communication

So, those are the kind of ways we mitigate whether, and mitigated as far as planning to. I guess that somewhat fall under preparedness. But also mitigating in making sure that the airlines and tenants that operate here know this information and make sure that their construction and standards adhere to what is required to make sure what they're doing is going to not put that specific company in harm's way or susceptible to problems because they want to build it this way because it is cheaper and easier versus the way that we require because we want to make sure that it's done with the big picture in mind.

v. Practice disaster scenarios

vi. Shelter

c. There is an unknown/limited role

i. Dependent on ownership

ii. Dependent on function

iii. Dependent on infrastructure

- iv. Dependent on airport

- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

- a. Act dependently

- i. As a lifeline for a community

- 1. To met FAA guidelines following the disaster

- 2. Act as a staging area for recovery efforts

- 3. To bring in supplies

- a. Dependent on airport infrastructure

- ii. Dependent on the airport's infrastructure system

- iii. Act as a morale booster for citizens

- iv. Shelter

- b. Act independently

- i. Get disaster assessed

- Obviously starting the assessment of the airport property and what. Looking at, not an insurance standpoint, although that is going to come into play pretty darn quickly, but from a what is the status of the runway. What is the status of our electrical power for the runways? What's the status of the airport buildings, are they safe, is there a gas main break, unknown hazards.

- ii. Dependent on outside infrastructure

- iii. Communicating

- So, we are going to look at public information, trying to get out public information about the airport. You know, "Hey, we're open, we're close, check for your flights before you come here."

- So, our recovery is going to try to be to restore the airport and the local community to the best of our ability to pre-emergency level of condition. So, for recovery we're going to working with the airlines and tenants who have equipment here that may have been (15:00) damage or who lease space from us that may have been damaged. Some airlines rent from us

and they are responsible for all the maintenance in the space they lease. Some of them they are not, the airport is responsible. So, we have look at what is the airliner or tenet responsible for, what resources do they have to effect, to fix those thing even though its their legal responsibility that something had to be the airport, landlord owner of the facility that we kind of take on the big role and do it and work out the financial part of it later. That's something you do with the insurance carriers and insurance risk management, that's something that is probably above my level but you know most of the airlines and tenants are going to look at the airport to say "This part of my space is not useable because of this, I need you to fix it." And then we are going to work with the resources we have; electrical companies, electrical contractors, companies that fix asphalt and concrete, people that fix buildings and repair buildings and roofs. And we are going to work to procure their services to get the airport infrastructure back to a useable point where the airlines can bet back to flying.

iv. personnel stuff

Well, I think in recovery, we are going to look at the individual people. Crisis counseling, the emergency responders, the people that maybe they weren't involved with the emergency response at the airport but they've been affected; you know, maybe their lives have been altered or changed so trying to make sure that we look at the counseling needs of the people; medical assistance, long term needed for people that may have been injured while working.

v. Getting the airport operational as quickly as possible

So, our recovery is going to try to be to restore the airport and the local community to the best of our ability to pre-emergency level of condition. So, for recovery we're going to working with the airlines and tenets who have equipment here that may have been (15:00) damage or who lease space from us that may have been damaged. Some airlines rent from us and they are responsible for all the maintenance in the space they lease. Some of them they are not, the airport is responsible. So, we have look at what is the airliner or tenet responsible for, what resources do they have to effect, to fix those thing even though its their legal responsibility that something had to be the airport, landlord owner of the facility that we kind of take on the big role and do it and work out the financial part of it later. That's something you do with the insurance carriers and insurance risk management, that's something that is probably above my level but you know most of the airlines and tenants are going to look at the airport to say "This part of my space is not useable because of this, I need you to fix it." And then we are going to work with the resources we have;

electrical companies, electrical contractors, companies that fix asphalt and concrete, people that fix buildings and repair buildings and roofs. And we are going to work to procure their services to get the airport infrastructure back to a useable point where the airlines can get back to flying.

vi. Dependent on the airport's infrastructure system

That obviously we need power to have airlines check their passengers for TSA to screen people, to screen baggage, again is there enough space for the airlines and tenants to operate their line of business to be able to operate.

vii. Act as a morale booster for citizens

viii. Shelter

c. Limited Role

i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

i. Communicate Information

1. Local governments
2. State governments
3. Federal governments

ii. Resume operations as quickly as possible

iii. Evacuations

iv. Shelter

b. Act independently

i. To be informed about the approaching hazard

1. Work with local government but act independently
2. To be informed about the approaching hazard

ii. Improve/fix critical infrastructure

iii. Adaptive use for infrastructure

1. Concerns

iv. Resume operations as quickly as possible

I think that is a pretty fair role for us. Realizing that our resources are limited to what revenue is generated on the airport from PFCs or other rates and charges we get from airlines and tenants. We have a responsibility to make sure that the money that the airlines pay to lease space and operate here is used for the most part on airport resources and things for the airport and not say ok and say "hey, we got fire in the city, so let's send them off to go handle something else" (3:00). We have some federal responsibility and requirements to work within the rules of the FAA has set up for how airport money is gathered and spent. So, I think that its a fair role for the airport based on what our line of business really is suppose to be.

v. Communicate Information

I think our role is in a lot of ways like the sharers of information. People look to airports to be the voice for everyone which I don't agree that we are the voice for everyone. But I think we are good rallying point to bring everyone together and as a group decide what is best to move the airport forward and back to why we are here. There is a lot of unknown here, the FAA has the 300 page document on emergency plans and what they should contain and rewrote the airport emergency plan about a year ago waiting for the FAA to comment and send it back.

vi. Preparation

vii. Mutual Aid

viii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport
2. Dependent on governmental requirements
3. Operational Ultimatum

ii. Acting as a staging area

iii. For incoming delivery

- iv. Evacuation
- v. Take lead role in recovery
- vi. Shelter

b. Act independently

- i. To follow FAA and TSA guidelines to become legally operational
- ii. Shelter
- iii. Hindered by need to be operational
- iv. Assessment

Say we have a fire station and say we had an earthquake and it collapsed or something happened and its built and the fire trucks should be able to withstand flooding or hurricane but things happen. You have a hurricane you have wind and things happen and it collapses, the fire station, did it damage your fire equipment. Did it damage the fire hydrates and the fire protection system? What systems may be damaged that you have to functioning or you would like to have function or you reopen knowing that it doesn't function and these are kind of the way you have to deal with it until you can get certain systems back up and running. Again, a lot of this is we are coordinator between other people, businesses and other facilities and other (21:07) government agencies. And a lot of it is bringing everyone together and helping from an airport perspective, meaning all the airlines, tenants, airports, FAA, all the people that have vested interest in the airport, coming up with a group decision.

c. Limited Role

- i. Dependent on airport

7. What should be the airport's role in prevention of a Disaster?

a. Act dependently

- i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication

- ii. Protect critical infrastructure
- iii. Work with other forms of government
 - 1. Local
 - 2. State
 - 3. Federal

. What are the airlines going to do from their schedule standpoint? What is the FAA going to do, are they going to start slowing down airplanes, are they going to shut down certain airspace. Our job it to help be a partner in that and then share the information. The airlines and FAA can make better decisions based on what we're and we can make better decisions based on what they're doing. Honestly, I think sharing of information and being prepared and meeting emergency responders are some of the best things we could do. And just have an open dialogue and try to figure out, what do you have? What don't you have? And what do you think you need from us to help? I think we've been doing a good job the last couple of year in trying to close those gaps. I don't think those gaps are closed by any means but I think, unfortunately some of those natural disasters and hurricane Katrina have brought communities like airports together realizing that we're going to have to rely on ourselves in a lot of ways. And not look for FEMA to show up with all the answers we need, we're going to have to fend for ourselves until that part of it gets in place. I think it's a very interesting topic you are dealing with. It's tough one because I think some right or wrong answers though I think a lot of is again looking at what airports can do. What they can't do and talking with everybody that has an interest in it. Working through your airport individual problems, some of our disasters, we have more planning time than others.

- iv. Update Emergency plan
- v. Shelter
- b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptive use for infrastructure
 - iii. Work with other forms of government
 - iv. Utilizing available resources

- v. Become operational as quickly as possible
- vi. Update Emergency plan (Preparation)

A lot of it was just formalizing a little more detail what we have to offer in the phases of emergency planning; mitigation, preparedness, response, recovery. A lot of that is documenting that into more detail than what we use to. Obviously we all know why with all the disasters happening all over the world; man-made or otherwise. It is becoming more important to that people are on the same page. I'll be honest with you, it has (30:00) been a long time since 9/11 in the aviation world and it's somewhat embarrassing when I talk with federal officials and some of organization, I won't name those organizations, on just how unprepared you are. And I'm just like, your agency would be one of the first in on a major terrorist issue on an airport or any airport. And it seems like they have put very little thought in really being prepared. Now that has all changed because we've really reached out to a lot of different entities to bring everyone to the table and say, "Listen, you're going to be a key player in this emergency, what are you going to do?" You just can't show up and say show up and say, "Hey, we're taking over" and think that the airport is just going to go sit in the corner and wait till you're done and we'll take back over.

- vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
- b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)

I like to think in a perfect world, our role would be to get everything open and running and basically worry about cutting the check and divvying up the fund issues later and getting done and getting the airport reopen for business because the airlines can't really use the work make money

because I'm not sure if any of them actually make money but lose less money if they are flying. Let's face it, every flight they cancel, every passenger that can't get to where they go to be, is costing the airlines money in some form or fashion. Our job is to get the business that use the airport back up and running as a businesses.

ii. Respond to other airports in need

iii. Assessment

I think, what I said is what our role would be, is to assess the facility itself from suit to nuts. And figure out what needs to be fixed and repaired to get the recovery processes started.

iv. Work w/ tenets

I think in general, the airport is like. I get this all the time from an airline perspective. We have airlines here that lease, one gates, or two gates or whatever. We have airlines that lease 50-60 gates, US airways is our hub carrier. Some airports and tenets here have bigger ability to manage and recovery and handle their own problems than others. So when they're emergency plans, US airways is better able to handle their own business because, they have 1000's of employees here and probably lease 2/3rds of the airport. Whereas some of our international carries or smaller domestic carriers have very little resources here and they would be the ones looking for more from the airport or other people than the bigger tenets here because they don't have enough resources to get the job done. I think our goal is to take everybody's wish list and see what we can do to help. Obviously, prioritizing with everyone on what manageable and can be done short term, medium term, and long term. And really keep people informed and try to keep moving forward in the recovery part of it, assuming we are in the point of recovering now. The airport is kind of caught between a rock and hard place because there are things that we can't do because our funding has to be airport related businesses because the grants and insurances that we sign from the legal process.

v. Shelter

c. To act as

d. Limited/unknown roll

Appendix K – Coded Interview for 2

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

- a. establish communication
- b. Use local resources
- c. act independently

2. State government

- a. establish communication
- b. Use state resources
- c. act independently

3. Federal government

- a. establish communication
- b. Use federal resources
- c. act independently
- d. Limited Role

4. Airlines

5. Evacuations

6. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

- 1. In a systematic approach
- 2. In accordance to fed regulation

- iii. Protect the airport

- 1. Infrastructure

- iv. Evacuations

- v. Keep flying until they no longer can

- Airports role is to protect the assets of the airport and try to continue operations at a safe level until it can restore full transportation services

- vi. Evacuations

- vii. Shelter

- viii. Communication

- c. An unknown/limited role

- i. Can't get proper personnel their

- ii. Infrastructure is vulnerable, hence limited role

- iii. Equipment issues

- iv. Poor geographical location

- v. Shelter

- vi. Practice

2. What is the airport's role in response to a natural disaster?

- a. The airport to act dependently

- i. Act as a staging area for recovery efforts

- ii. Bring in recovery supplies

- iii. Become operational quickly after the storm

- iv. As a lifeline for a community but with normal operations problem due to recovery efforts

- v. Mutual Aid between airports

- vi. Evacuations

- vii. Dependent on airport infrastructure

- viii. Coordinate with governments

1. Local

I think the airport has dual roles. Generally the airports are a part of larger network for emergency response including: cities that their associated with or regions or various different disaster agencies. So they participate in that and become part of a larger community response

2. State

I think the airport has dual roles. Generally the airports are a part of larger network for emergency response including: cities that their associated with or regions or various different disaster agencies. So they participate in that and become part of a larger community response

3. Federal

- ix. Respond to any disaster needs

- x. Shelter

- b. Act in an independent role

- i. Assess airport

- ii. Restore facility

- iii. Mutual Aid

- iv. Dependent on airport infrastructure

- v. Shelter

- vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

1. Evacuation

2. Communication towards passengers

- ii. To operate as an airport

- iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Practice disaster scenarios
 - v. Shelter
- b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick “bounce-back” from disaster to become operational

Well I’m not sure they can actually prevent a disaster but it’s mostly an issue of planning. Their proper role is to plan for natural disasters to try to guess what might happen and prepare for that based on local conditions. An example that I gave you before was in Salt Lake we’re in a pretty substantial earthquake zone (3:06). So a lot of planning efforts and resources need to go into looking at “what if” scenarios related to large scale earthquakes and then plan according to respond to that. If during that planning processes they see that there are some things that could be done proactively to minimize the potential damage, they should take steps to do that
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter
- c. There is an unknown/limited role
 - i. Dependent on ownership
 - ii. Dependent on function
 - iii. Dependent on infrastructure

- iv. Dependent on airport

- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

- a. Act dependently

- i. As a lifeline for a community

- 1. To met FAA guidelines following the disaster

- Well they need to be the lead agency to coordinate everyone's efforts to do whatever is reasonable and work on the resources of the airport to get facilities back to operating conditions.

- 2. Act as a staging area for recovery efforts

- 3. To bring in supplies

- a. Dependent on airport infrastructure

- ii. Dependent on the airport's infrastructure system

- iii. Act as a morale booster for citizens

- iv. Shelter

- b. Act independently

- i. Get disaster assessed

- Probably the primary goal there is to coordinate and schedual repairs so that the most critical facilities are addressed first, the ones with the mostly time are attended to early on in the processes.

- ii. Dependent on outside infrastructure

- iii. Communicating

- iv. personnel stuff

- v. Getting the airport operational as quickly as possible

- vi. Dependent on the airport's infrastructure system

- vii. Act as a morale booster for citizens

- viii. Shelter

- c. Limited Role

- i. Infrastructure Problems
 - 5. What should be the airport's role in response to a natural hazard?
 - a. Act dependently
 - i. Communicate Information
 - 1. Local governments
 - 2. State governments
 - 3. Federal governments
 - ii. Resume operations as quickly as possible
 - iii. Evacuations
 - iv. Shelter
 - b. Act independently
 - i. To be informed about the approaching hazard
 - 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
 - ii. Improve/fix critical infrastructure
 - iii. Adaptive use for infrastructure
 - 1. Concerns
 - iv. Resume operations as quickly as possible
 - v. Communicate Information
 - vi. Preparation
 - vii. Mutual Aid
 - viii. Shelter
6. What should be the airport's role in response to a natural disaster?
 - a. Act dependently
 - i. To be a tool for surrounding communities
 - 1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

ii. Acting as a staging area

iii. For incoming delivery

iv. Evacuation

v. Take lead role in recovery

As the landlord of the airport their primary response would be to lead to response and coordinate the activities of all the players for their emergency plan.

vi. Shelter

b. Act independently

i. To follow FAA and TSA guidelines to become legally operational

ii. Shelter

iii. Hindered by need to be operational

iv. Assessment

c. Limited Role

i. Dependent on airport

7. What should be the airport's role in prevention of a Disaster?

a. Act dependently

i. Provide supplementary roles to the community

1. Deliver goods and services

2. Act as a staging ground

3. Evacuations

4. Communication

ii. Protect critical infrastructure

iii. Work with other forms of government

1. Local

- 2. State
 - 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptive use for infrastructure
 - iii. Work with other forms of government
 - iv. Utilizing available resources
 - v. Become operational as quickly as possible
 - vi. Update Emergency plan (Preparation)
 - vii. Shelter
8. What should be the airport's role in recovery from a natural disaster?
- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
 - b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - Getting back to operating, at least on a minimally safe bases and then restore all services.
 - ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets

v. Shelter

c. To act as

d. Limited/unknown roll

Appendix L – Coded Interview for 8

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

and I guess this airport really its first obligation is to maintain itself so it can serve its community in a wider service. So, any planning on that level is going to be an overall city plan. But I think I've got everything well enough covered.

a. establish communication

b. Use local resources

c. act independently

2. State government

a. establish communication

b. Use state resources

c. act independently

3. Federal government

a. establish communication

b. Use federal resources

c. act independently

d. Limited Role

4. Airlines

5. Evacuations

6. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

But the current emergency plan that we have basically ensures that all of our tenants are aware; it's a preparation processes first and we actually have a separate hurricane plan as well and that goes into a lot more detail about how each section needs to prepare. How we notify the tenants and make sure their ramps are prepared and secured and lot of it has to do with securing loss debris and that kind of thing.

2. In accordance to fed regulation

iii. Protect the airport

and I guess this airport really its first obligation is to maintain itself so it can serve its community in a wider service. So, any planning on that level is going to be an overall city plan. But I think I've got everything well enough covered.

Really, as far as any obligation, we are just really trying maintain our own airport and that is incase the need does arise to serve the rest of the community and anything like that. I think that was on target to what you were looking for.

1. Infrastructure

More than anything, just making sure stuff is put away in the hangers or storage areas. Try not to leave anything loose or out in the airfield. Most aircraft if they are not able to be put in a hanger will relocate and it's up to the airline when they decide their last flight is going to be and when they decide to they're going to clear out a ramp and seem thing with all of our general aviation. But as far as physically tying anything down, if there is anything that requires that whatever lashings or straps that we have if there is any construction going on, I know they try to secure those in a certain area and make sure all that is safe and at least stored somewhere else

iv. Evacuations

v. Keep flying until they no longer can

vi. Evacuations

vii. Shelter

viii. Communication

But the current emergency plan that we have basically ensures that all of our tenants are aware; it's a preparation processes first and we actually have a separate hurricane plan as well and that goes into a lot more detail about how each section needs to prepare. How we notify the tenants and make sure their ramps are prepared and secured and lot of it has to do with securing loss debris and that kind of thing. It depends on the airline. It's their aircraft; they make the decision on where they think they need to go. If they have another city where they fly in and out of. The same thing with general aviation just whatever arrangements they make with whatever other airport; we really have no say in that.

c. An unknown/limited role

- i. Can't get proper personnel their
- ii. Infrastructure is vulnerable, hence limited role
- iii. Equipment issues
- iv. Poor geographical location
- v. Shelter
- vi. Practice

2. What is the airport's role in response to a natural disaster?

a. The airport to act dependently

- i. Act as a staging area for recovery efforts

I think it was actually open to general public but also it did serve as a place of staging for emergency vehicles. They basically filled up our garage as a shelter so in case there was some kind of a need for response they would have all their resources intact.
- ii. Bring in recovery supplies
- iii. Become operational quickly after the storm
- iv. As a lifeline for a community but with normal operations problem due to recovery efforts
- v. Mutual Aid between airports
- vi. Evacuations

- vii. Dependent on airport infrastructure
 - viii. Coordinate with governments
 - 1. Local
 - 2. State
 - 3. Federal
 - ix. Respond to any disaster needs
 - x. Shelter
- b. Act in an independent role
- i. Assess airport
 - ii. Restore facility

Our primary role is getting back to restoring operations. Making sure that airports can be function as soon as possible.
 - iii. Mutual Aid
 - iv. Dependent on airport infrastructure

A lot of times, power is going to be out and we are actually pretty high on the priority list for restoring power, we are right behind the hospital and emergency responders. Make sure the airfield is clear of any debris and make sure all the services are safe; runway, taxiway. Make sure they are clear of any fog or anything like that. Make sure our lighting system is working. It is really up to the FAA then to insure that our navigating is functioning. The navigation aids are they responsibilities. Our are electrical. Make sure electrical is powering everything and that we do have lighting. And of course making sure all of our services are free of debris.
 - v. Shelter

Well, we did serve as a point of distribution site, mainly for city employees or airport employees because the airport is manned and maintained 24/7 and so there were people actually stayed here overnight when the storm blew through. So there were a lot of people that really couldn't take care of their businesses. It wasn't that disastrous but they did provide a site for a point of distribution for mainly the airport employees
 - vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

1. Evacuation

We do have an evacuation plan with the terminal incase we had something going on in the terminal we have an evac plan but as far as doing anything with the communities, no I haven't done any sort of exercise like that. I know there was a huge exodus during, I guess it was hurricane Rite because when Katrina had just hit New Orleans and when Rite came around it scared everybody and everybody was just trying to fly out and it was just a packed terminal but really not anything for any exercise or anything like that.

2. Communication towards passengers

- ii. To operate as an airport

- iii. Work with government agencies

1. Work with local agencies

2. Work with state agencies

3. Work with federal agencies

- iv. Practice disaster scenarios

- v. Shelter

- b. Act Independently

- i. To operate as an airport

- ii. Protect itself and infrastructure

1. Quick "bounce-back" from disaster to become operational

2. Minimize financial damage

- iii. Use emergency services

- iv. Communication

But the current emergency plan that we have basically ensures that all of our tenants are aware; it's a preparation processes first and we actually have a separate hurricane plan as well and that goes into a lot more detail about how each section needs to prepare. How we notify the tenants and make sure their ramps are prepared and secured and lot of it has to do with securing loss debris and that kind of thing. It depends on the airline. It's their aircraft; they make the decision on where they think they need to go. If they have another city where they fly in and out of. The same thing with general aviation just whatever arrangements they make with whatever other airport; we really have no say in that.

v. Practice disaster scenarios

I don't know if anybody could, we did just go through our full scale disaster exercise, were we simulate a plane crash on an airfield. We incorporate all the regular responders who would normally respond to a real disaster and try to play out a scenario to actors playing out casualties and having a full response and even involving some of the hospitals but as far as preventing. I don't see anybody be able to do that.

vi. Shelter

c. There is an unknown/limited role

- i. Dependent on ownership
- ii. Dependent on function
- iii. Dependent on infrastructure
- iv. Dependent on airport
- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

a. Act dependently

- i. As a lifeline for a community
 - 1. To met FAA guidelines following the disaster
 - 2. Act as a staging area for recovery efforts
 - 3. To bring in supplies

Of course it didn't as bad as it did in Louisiana after Katrina. I know they used their airport as a sort of a command post were a lot of supplies were coming in and out. For that situation If it

became necessary, this airport would serve that purpose if it had, it just hasn't had to at this point.

a. Dependent on airport infrastructure

Well, I don't know. The airport as it is already serves the community and I could see it doing the same thing it'd just be in and out for supplies for whatever. I know in their extreme example, in Louisiana (14:00) they ended up using one terminal as a morgue but that was pretty extreme disaster and I think they would have to adapt to whatever situation presented itself. But it is a city property and city entity and it would take whatever role it would have to.

ii. Dependent on the airport's infrastructure system

iii. Act as a morale booster for citizens

iv. Shelter

b. Act independently

i. Get disaster assessed

ii. Dependent on outside infrastructure

iii. Communicating

iv. personnel stuff

v. Getting the airport operational as quickly as possible

vi. Dependent on the airport's infrastructure system

vii. Act as a morale booster for citizens

viii. Shelter

c. Limited Role

i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

i. Communicate Information

1. Local governments

2. State governments

3. Federal governments

ii. Resume operations as quickly as possible

iii. Evacuations

At least a[n evacuation] plan should be in place it seems like it could be a realistic situation again because of the. I think people just got scared from Katrina because it was not the same thing during Ike. We had a fairly elevated capacity but I think that was kind of a unique situation. As it is, we are capable of handling most situations that we should reasonable expect, I don't know if it would be necessary.

iv. Shelter

b. Act independently

i. To be informed about the approaching hazard

1. Work with local government but act independently

2. To be informed about the approaching hazard

ii. Improve/fix critical infrastructure

iii. Adaptive use for infrastructure

1. Concerns

iv. Resume operations as quickly as possible

v. Communicate Information

vi. Preparation

vii. Mutual Aid

viii. Shelter

6. What should be the airport's role in response to a natural disaster?

a. Act dependently

i. To be a tool for surrounding communities

1. Dependent on type of airport

2. Dependent on governmental requirements

3. Operational Ultimatum

- ii. Acting as a staging area
- iii. For incoming delivery
- iv. Evacuation
- v. Take lead role in recovery
- vi. Shelter

b. Act independently

- i. To follow FAA and TSA guidelines to become legally operational
- ii. Shelter

That would be more a detriment than anything else; if our air operations had to stop, There are a lot of hanger all over the place. It's possible that some extreme need arose, maybe able to commadeer a hanger and use it as a shelter. But that is another thing I think would be on the level of city level of planning

- iii. Hindered by need to be operational
- iv. Assessment

c. Limited Role

- i. Dependent on airport

7. What should be the airport's role in prevention of a Disaster?

a. Act dependently

- i. Provide supplementary roles to the community

- 1. Deliver goods and services
- 2. Act as a staging ground
- 3. Evacuations
- 4. Communication

- ii. Protect critical infrastructure

I think that probably what's been taking care of. We've done a lot in the last probably 2 years and improving our drainage. We did have an area I guess it was the northeast corner that would go under water if we had

substantially heavy rain and I think even on the south and I know there has been a lot of work to improve drainage it hasn't been tested yet in a while but that are some of the steps that have already been taken is improving our drainage of our airfield. But other than that, nothing else, I don't think there is anything else we can improve on for that purpose.

iii. Work with other forms of government

1. Local
2. State
3. Federal

iv. Update Emergency plan

v. Shelter

b. Act independently

i. Protect critical infrastructures

I think that probably what's been taking care of. We've done a lot in the last probably 2 years and improving our drainage. We did have an area I guess it was the northeast corner that would go under water if we had substantially heavy rain and I think even on the south and I know there has been a lot of work to improve drainage it hasn't been tested yet in a while but that are some of the steps that have already been taken is improving our drainage of our airfield. But other than that, nothing else, I don't think there is anything else we can improve on for that purpose.

ii. Adaptative use for infrastructure

They basically filled up our garage as a shelter so in case there was some kind of a need for response they would have all their resources intact.

iii. Work with other forms of government

iv. Utilizing available resources

v. Become operational as quickly as possible

vi. Update Emergency plan (Preparation)

vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

a. Act dependently

- i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - . It wasn't that disastrous but they did provide a site for a point of distribution for mainly the airport employees and then once we got taken care of, I think it was actually open to general public but also it did serve as a place of staging for emergency vehicles.
 - iv. Shelter
 - v. Communication
- b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need
 - iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
- d. Limited/unknown roll

Appendix M - Coded Interview for 4

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

a. establish communication

b. Use local resources

c. act independently

2. State government

a. establish communication

b. Use state resources

c. act independently

3. Federal government

a. establish communication

b. Use federal resources

c. act independently

d. Limited Role

4. Airlines

5. Evacuations

Ok, then obviously airports would play a role in evacuation; people would be booking flights left and right and also getting resources in.

In the Charleston region, the Charleston International airport also shares its runway with the Charleston air force base and we have actually used the air force base before, actually just last year during the Haitian Earthquake we did repatriation missions, we were flying repatriated Americans from Haiti on US force C-17's into the Charleston airport, just as resources were being deployed to Haiti in relief missions, Americans were allowed board military aircraft and they were flown back to Charleston.

6. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

2. In accordance to fed regulation

iii. Protect the airport

1. Infrastructure

iv. Evacuations

v. Keep flying until they no longer can

vi. Evacuations

vii. Shelter

viii. Communication

c. An unknown/limited role

i. Can't get proper personnel their

ii. Infrastructure is vulnerable, hence limited role

iii. Equipment issues

iv. Poor geographical location

v. Shelter

vi. Practice

2. What is the airport's role in response to a natural disaster?

a. The airport to act dependently

i. Act as a staging area for recovery efforts

ii. Bring in recovery supplies

- iii. Become operational quickly after the storm
- iv. As a lifeline for a community but with normal operations problem due to recovery efforts
- v. Mutual Aid between airports
- vi. Evacuations

They landed here and it wasn't 10,000 people all at once obviously it was in several different flights over a span of a couple of weeks. But once they were here, they were registered, they were taken to a evacuee process center and it was basically a one-stop-shop. They had representation from the red cross, the salvation army, social security administration was here and they could help. We had volunteers helping them find lost loved ones where they had might have ended up. Working with people to get some sort of housing; a lot of people were able to get set up in apartments or hotels. A lot of hotels just donated their empty rooms for the evacuees. So you had that charitable atmosphere about it, and that was great. The people who choose to stay worked with the red cross and the non-profits and some of the faith based organization and were set up with good apartments, they were set up with jobs, they were able to build a life after a very devastating hurricane. But a lot of them choose to go back, so we were able to help them return to their homes in Louisiana as well.

- vii. Dependent on airport infrastructure
- viii. Coordinate with governments
- ix. Respond to any disaster needs
- x. Shelter

b. Act in an independent role

- i. Assess airport
- ii. Restore facility
- iii. Mutual Aid
- iv. Dependent on airport infrastructure

Obviously, depending on the size of the airport, depending on the runway capacity, operations can go hand-in-hand and as commercial flights start to resume, we saw that in Haiti, commercial flights started to resume but response operations were still ongoing.

- v. Shelter

- vi. Planning

- 1. Adaptive Use

- 3. What is the airport's role in prevention of a disaster?

- a. Act Dependently

- i. Provide supplementary roles

- 1. Evacuation

- 2. Communication towards passengers

- The biggest thing that an airport could do would be to simply pass our message along about the impending disaster or approaching storm. Let passengers know about flight delays, help them, assist them in getting alternate flights, or alternate means of transportation out of a evacuation zone should they have passenger or airline customers who are still at the airport when the governor issues a mandatory evacuation. So public education, public awareness, simply paying attention to what is going on would be absolutely crucial.

- ii. To operate as an airport

- iii. Work with government agencies

- 1. Work with local agencies

- 2. Work with state agencies

- Well, we are running into that situation right now. The disaster we are seeing in the gulf coast and varies state throughout FEMA region 4, the southern region of FEMA has been taxed and they've had to pull on different FEMA regions throughout the region. It would be a similar situation, we would go to North Carolina, we would go to Georgia we would go to the federal government and we would continue to put the call back as far back it would go across the nation until someone said yes we are available and we want to help. If we had to get international support, we have a system set up for that as well. It's called the emergency management assistance compact. It's an agreement for all the governors in all 50 states as far as states being able to request resources from other states.

3. Work with federal agencies

The National Guard, our national guard uses several of the airports (11:55) for touch and go's and practice and in fact they are doing some today. Just to see how quickly they can get in, land and drop off resources and take off again and to start that process all over again.

iv. Shelter

b. Act Independently

i. To operate as an airport

ii. Protect itself and infrastructure

1. Quick "bounce-back" from disaster to become operational

2. Minimize financial damage

iii. Use emergency services

iv. Communication

v. Practice disaster scenarios

The National Guard, our national guard uses several of the airports (11:55) for touch and go's and practice and in fact they are doing some today. Just to see how quickly they can get in, land and drop off resources and take off again and to start that process all over again.

I'm not sure what more of an additional role considering we exercise, practice and rehearse with each of our major airports that we have. We do a weapons of mass destruction exercises, we do major disaster exercises, we have several memoradems of understanding with each of our airports for a variety of things. So, I can envision should we get a disaster in my state anyway, the companies, the people involved would step above and beyond anyway.

vi. Shelter

c. There is an unknown/limited role

i. Dependent on ownership

ii. Dependent on function

iii. Dependent on infrastructure

Obviously, depending on the size of the airport, depending on the runway capacity, operations can go hand-in-hand and as commercial flights start to resume, we saw that in Haiti, commercial flights started to resume but response operations were still ongoing.

iv. Dependent on airport

Obviously, depending on the size of the airport, depending on the runway capacity, operations can go hand-in-hand and as commercial flights start to resume, we saw that in Haiti, commercial flights started to resume but response operations were still ongoing.

v. Shelter

4. What is the airport's role in recovery from a natural disaster?

a. Act dependently

i. As a lifeline for a community

1. To met FAA guidelines following the disaster
2. Act as a staging area for recovery efforts
3. To bring in supplies

a. Dependent on airport infrastructure

ii. Dependent on the airport's infrastructure system

iii. Act as a morale booster for citizens

That's a huge factor. One of the hallmarks of recovery operations is getting the community back to some sense of normalcy, so you want to look at how quickly it will take to get the schools back, how quickly will it take to get the people back, get the grocery store operational so people can get the supplies they need so they're not dependent on government points of distribution, things like that. An airport would go right in line with that.

iv. Shelter

b. Act independently

- i. Get disaster assessed
- ii. Dependent on outside infrastructure

Number one, hands down would be the interstate. Car, it's the fastest way, it's the easiest way to get an evacuated population back to their homes. So everybody would be focused on the viability of the roads. Can we get to an affected area? It can also enable our first responders to (7:32) to get to people who may have been in a disaster scene and may not have been able to evacuate and they could have no other means to get out. We have a lot of barrier islands along our coastline. So each one of those are connected via bridge or some other means, so we would have to look at just the passage ways of getting vehicles to and affected area. Would we be using air support? Absolutely. Primarily through military means; commercial jets, commercial airlines they are certainly have made themselves available to states and to government when needs be but it has typically, as far as moving large portions of the population. In the aftermath, obviously the first question that anybody would have is, when can I go home. And the roadways would be the best viable means to do so because if we can clear a road in the aftermath of the storm almost immediately, then that road will typically stay clear, we hope it does anyway.

- iii. Communicating
- iv. personnel stuff
- v. Getting the airport operational as quickly as possible
- vi. Dependent on the airport's infrastructure system

Obviously, depending on the size of the airport, depending on the runway capacity, operations can go hand-in-hand and as commercial flights start to resume, we saw that in Haiti, commercial flights started to resume but response operations were still ongoing.

- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

- i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

- a. Act dependently
 - i. Communicate Information
 - 1. Local governments

2. State governments

That's a very interesting question. That would depend on the type of disaster and it would depend on the category of the hurricane. If we get a category 1, there is not going to be much of a response involve because we might have some minor storm surge and some flooding. But that would be about it. A category 5 would be all hands on deck and international response or should I say a national response from FEMA from multiple states, it would run the gambit, we would need an evacuee processing center, we would need resources, places designated to receive resources and we have some pre-identified.

3. Federal governments

That's a very interesting question. That would depend on the type of disaster and it would depend on the category of the hurricane. If we get a category 1, there is not going to be much of a response involve because we might have some minor storm surge and some flooding. But that would be about it. A category 5 would be all hands on deck and international response or should I say a national response from FEMA from multiple states, it would run the gambit, we would need an evacuee processing center, we would need resources, places designated to receive resources and we have some pre-identified.

ii. Resume operations as quickly as possible

iii. Evacuations

That's a very interesting question. That would depend on the type of disaster and it would depend on the category of the hurricane. If we get a category 1, there is not going to be much of a response involve because we might have some minor storm surge and some flooding. But that would be about it. A category 5 would be all hands on deck and international response or should I say a national response from FEMA from multiple states, it would run the gambit, we would need an evacuee processing center, we would need resources, places designated to receive resources and we have some pre-identified.

iv. Shelter

b. Act independently

i. To be informed about the approaching hazard

1. Work with local government but act independently

- 2. To be informed about the approaching hazard
 - ii. Improve/fix critical infrastructure
 - iii. Adaptive use for infrastructure
 - 1. Concerns
 - iv. Resume operations as quickly as possible
 - v. Communicate Information
 - vi. Preparation
 - vii. Mutual Aid
 - viii. Shelter
- 6. What should be the airport's role in response to a natural disaster?
 - a. Act dependently
 - i. To be a tool for surrounding communities
 - 1. Dependent on type of airport
 - 2. Dependent on governmental requirements
 - 3. Operational Ultimatum
 - ii. Acting as a staging area
 - iii. For incoming delivery
 - iv. Evacuation
 - v. Take lead role in recovery
 - vi. Shelter
 - b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - c. Limited Role
 - i. Dependent on airport

So, that question would be very dependent on what area we would be talking about in our state and what the local community saw as benefiting as having an airport there. We have Shaw Air force base in Sumter, South Carolina. The air force has a very large role in that community of that particular county. I can foresee F-16's and air force support being used if we should get a disaster in that area. We have little airplane communities in some areas where we have enthusiast pilots who live right there on the runway. Similar to living on the golf course only these are all airplane enthusiasts. So, it would run the gambit. We don't have very large airports like, Dallas or O'Hare or even Miami but we do have a couple of International airports and a lot to industry that surrounds those. So, one of the indicators to getting a community back to normal would be our commercial flights resuming.

7. What should be the airport's role in prevention of a Disaster?

a. Act dependently

i. Provide supplementary roles to the community

1. Deliver goods and services
2. Act as a staging ground
3. Evacuations
4. Communication

There could always be more public education and there could always be more agreements.

ii. Protect critical infrastructure

iii. Work with other forms of government

We are always looking to add partners to our network I guess you could say. Just to hope to strengthen and build those relationships right now would be where I would say we need to go.

1. Local
2. State
3. Federal

iv. Update Emergency plan

v. Shelter

- b. Act independently
 - i. Protect critical infrastructures
 - ii. Adaptative use for infrastructure
 - iii. Work with other forms of government
 - iv. Utilizing available resources
 - v. Become operational as quickly as possible
 - vi. Update Emergency plan (Preparation)
 - vii. Shelter
8. What should be the airport's role in recovery from a natural disaster?
- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services
 - iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
 - b. Act independently
 - i. To met FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need
 - iii. Assessment

it would run the gambit in what we would need. It would be very very disaster specific as far as the types of resources we would be requesting. And remember, we may get spontaneous volunteers but in order for it to work in the system, we have to ask for resources in order to get them.
 - iv. Work w/ tenets
 - v. Shelter
 - c. To act as
 - d. Limited/unknown roll

Appendix N – Coded Interview for 12

1. What is the airport's role in response to a natural hazard?

a. The airport to act dependently

i. Coordination

1. local government

a. establish communication

When everything hits the fan sort of speak, the entire city through the mayor and through the departments come together in a unified effort and the airports have their protocols that they have to report. If the EOC's activated we have the liaisons from the airport system or either all three airport in our EOC's to make sure that they know what is going on, if its' a hurricane event, they know what's going on in the hurricane event and we know what's going on from their timeline. As it becomes more compressed and they have to start squeezing down to start bringing operations down to a halt if needed.

Each airport has their own response, they have their own command director and they all have their response teams and they all know what they have to do and they organize as a entity within themselves from a command management and they feed everything up to the airport system and then it is ultimately to the liaison or directly from the director is feed to the office of emergency management

b. Use local resources

c. act independently

2. State government

a. establish communication

b. Use state resources

c. act independently

3. Federal government

a. establish communication

- b. Use federal resources
- c. act independently
- d. Limited Role

4. Airlines

So, depending on the scenario, and how many people whether its voluntary or mandatory evacuation all of that data and intelligence starts to be shared between the coordinated effort of the departments and airport being one, fire, police, public works and all of these departments. So, the airport in turn tells us, communicates back to the city about what happening up stream and when I say upstream that means that everything that happens in Michigan can impact us. Things that are happening in Florida can impact us. Things that are happening in, Mississippi floods can impact us. So, what they start looking at and communicating back to us is flight data, flight information. In other words, when will they start cutting back flights and what will be the trigger that they start cutting back flights back and a lot of that, we know what is going on here but again because the airline industry is so interconnected and it's a domino effect (13:20). So what is happening here is impacting international flights. What's happening north of us in Dallas, middle of day, bad weather is impacting us to be able to get flights out of Houston. So, that has to be a big coordinated effort through the airport systems and the City of Houston. So, they start telling us and giving us information on what the flight information is on what the airport situation is. Sometimes, one will close before the other one because the big is north of Houston and the other is south of Houston. So, they may have a little different shut down timeline and then that information now has to be interpreted and deducted and what we have to communicate to the community. The public information the social media, if you got flights going to LA, are you going to be able to make that flight. So, we try to start getting that information pushed out as much as we can through the media sources. An airline contacts that way people can start adjusting to accommodate to because, they may not be able to fly out during an approaching hurricane. You know that this for a pleasure trip somewhere. So, start coordinating all of that and again, we have liaisons in our EOC that are consistently feeding us updated information, the status, where they are at in their timeline for closing operation or limiting operation or ceasing operation totally, all together. (15:16). So, it's a very coordinated

effort. Its, I think, I can't remember all the people involved that's part of the airport system but you have, your, let me brainstorm here. You have the Houston police department, Houston fire department, these are all support agencies that work with the airport system.

5. Evacuations

Well, when we have an evacuation, we will have a recommended evacuation. How they recommend it or when it comes down to it, we would have a mandatory evacuation. When that happens automatically our emergency operations center for Houston is stood up and probably already stood up way before that decision ever comes. But through a coordinated effort, if there is a recommended evacuation the OC is activated then we have a unified, more or less unified command structure that we start coordinating with the airports and start looking at timelines they have their protocol that automatically, the city has different levels, level 4 is our routine daily operation. We are always marking that. As we get down to a category 2, we learned in Ike, in category 2 or 3 or 4 or 5 then we activate the EOC, then each department, the office of emergency management notifies each of these department even though they know what is going on. We still notify departments, airports being one, where we are at in this timeline as far as H-120 or H-whatever it is from a hurricane landfall or threat. So they start implementing their protocol and then they report (10:01) back into the emergency management coordinator here in the OEM. And through all this dialogue, we are looking at depopulation that is either been you know, not voluntarily but required. In other words, they live on the coast, we have about a million and a half population that lives south of Houston that lives on the coast, pretty much on the coast.

6. Bring in Supplies

ii. Shelter

b. The airport to act independently

i. To act as a first responder

ii. Deal with the hazard

1. In a systematic approach

Well, when we have an evacuation, we will have a recommended evacuation. How they recommend it or when it comes down to it,

we would have a mandatory evacuation. When that happens automatically our emergency operations center for Houston is stood up and probably already stood up way before that decision ever comes. But through a coordinated effort, if there is a recommended evacuation the OC is activated then we have a unified, more or less unified command structure that we start coordinating with the airports and start looking at timelines they have their protocol that automatically, the city has different levels, level 4 is our routine daily operation. We are always marking that. As we get down to a category 2, we learned in Ike, in category 2 or 3 or 4 or 5 then we activate the EOC, then each department, the office of emergency management notifies each of these department even though they know what is going on. We still notify departments, airports being one, where we are at in this timeline as far as H-120 or H-whatever it is from a hurricane landfall or threat. So they start implementing their protocol and then they report (10:01) back into the emergency management coordinator here in the OEM. And through all this dialogue, we are looking at depopulation that is either been you know, not voluntarily but required. In other words, they live on the coast, we have about a million and a half population that lives south of Houston that lives on the coast, pretty much on the coast.

2. In accordance to fed regulation

iii. Protect the airport

1. Infrastructure

iv. Evacuations

So, if we are having an approaching storm they will operate up until the last minute until they can to get people out or to get organization out of here, when I say critical organizations like people that will be needed for infrastructure for after, post an event.

v. Keep flying until they no longer can

So, get them out and fly until they can no longer, until they shut down according to rules.

vi. Evacuations

- vii. Shelter
 - viii. Communication
- c. An unknown/limited role
 - i. Can't get proper personnel their
 - ii. Infrastructure is vulnerable, hence limited role
 - iii. Equipment issues
 - iv. Poor geographical location
 - v. Shelter
 - vi. Practice
- 2. What is the airport's role in response to a natural disaster?
 - a. The airport to act dependently
 - i. Act as a staging area for recovery efforts
 - ii. Bring in recovery supplies
 - iii. Become operational quickly after the storm
 - iv. As a lifeline for a community but with normal operations problem due to recovery efforts
 - v. Mutual Aid between airports
 - vi. Evacuations

But, we received aircraft, I can't really tell you where we all received aircraft from New Orleans and who all flew in from New Orleans with the people that had evacuated New Orleans either their hospital or health care system and nursing home systems and you name it, they were coming in by helicopter. They were coming in from every kind of air source they could find?

We put them in our hospitals if we could find beds for them. Some of those that were not really that bad, they were put in hotels and other facilities but there were about 200,000 at the peak that we absorbed from New Orleans.

The ones that came by aircraft were more hospital, more medical patients that they were trying to find facilities for.

- vii. Dependent on airport infrastructure
- viii. Coordinate with governments
- ix. Respond to any disaster needs
- x. Shelter

b. Act in an independent role

i. Assess airport

We are doing a needs assessment of the community, the city and then at that time we are starting to get a good idea of the impact of the city, from an infrastructure standpoint; our water and our fire, our healthcare, our fire protection and the resources we are going to need in a recovery standpoint.

ii. Restore facility

We are doing a needs assessment of the community, the city and then at that time we are starting to get a good idea of the impact of the city, from an infrastructure standpoint; our water and our fire, our healthcare, our fire protection and the resources we are going to need in a recovery standpoint.

iii. Mutual Aid

iv. Dependent on airport infrastructure

v. Shelter

vi. Planning

1. Adaptive Use

3. What is the airport's role in prevention of a disaster?

a. Act Dependently

i. Provide supplementary roles

1. Evacuation

2. Communication towards passengers

ii. To operate as an airport

- iii. Work with government agencies
 - 1. Work with local agencies
 - 2. Work with state agencies
 - 3. Work with federal agencies
 - iv. Shelter
 - b. Act Independently
 - i. To operate as an airport
 - ii. Protect itself and infrastructure
 - 1. Quick “bounce-back” from disaster to become operational

Well, again it depends on the hazard. But like I said all of our airports have a dedicated what I call ARF, Aircraft fire fighting stations. And they all have their own response teams and operations team, administration level teams, they have a very strong administration direction from a director that actually came from the Atlanta airport system and also worked in the Philadelphia airport system and he is very adamant about each airport facility almost acting independent for his responding rapid identifying, whether it be a hazardous situation or either a terrorist situation or threat or a suspect; is to have enough responders and trained and operated to mitigate it immediately. They’ve also been trained to recognize where its beyond their control and they have to immediately start bringing in support. The fire captain and district chiefs are very good about whatever it takes to mitigate that. But, they train often and how to deal with their passengers.
 - 2. Minimize financial damage
 - iii. Use emergency services
 - iv. Communication
 - v. Practice disaster scenarios
 - vi. Shelter
 - c. There is an unknown/limited role
 - i. Dependent on ownership

- ii. Dependent on function
- iii. Dependent on infrastructure
- iv. Dependent on airport
- v. Shelter

4. What is the airport's role in recovery from a natural disaster?

a. Act dependently

i. As a lifeline for a community

- 1. To met FAA guidelines following the disaster
- 2. Act as a staging area for recovery efforts
- 3. To bring in supplies

So, back to your question on the airports; they're critical, they're a significant part of our infrastructure to keep accesses and also in recovery, rebuilding mode to bring supplies, people, experts and people back to the community to get the businesses going again.

a. Dependent on airport infrastructure

- ii. Dependent on the airport's infrastructure system
- iii. Act as a morale booster for citizens
- iv. Shelter

b. Act independently

- i. Get disaster assessed
- ii. Dependent on outside infrastructure

They may know what is going on in the airport but they may not have a clue on what is going on in accessing that airport. For bridge, road, debris, etc. So, once they get a good idea that they can start receiving flights back, if on a priority bases or a limited bases, that information is communicated back on what is called an initial damage assessment on the city and a status situation and report.

iii. Communicating

So, once we understand what we have, and then we understand what is coming in from the other departments, fire departments, and public

works. From their assessment and also just the impact of the city, from their hurricane because we all have a fantastic relationship with our local weather service here which is right down the street from us, nice.

- iv. personnel stuff
- v. Getting the airport operational as quickly as possible

I mean the airports role in recovering, is getting the airport system back up and running.

- vi. Dependent on the airport's infrastructure system

And they are part of our recovery plan and everything is based on priority and just because it's a high priority doesn't mean it's a priority which means that if you don't have the infrastructure to support that priority than, don't bring them back here. So, the airports and the recovery piece are critical because we try to get them back up, assessed and evaluated and again its not our call because the FAA has a big role in what theses airports do and how they shut down and how they open back up.

- vii. Act as a morale booster for citizens
- viii. Shelter

c. Limited Role

- i. Infrastructure Problems

5. What should be the airport's role in response to a natural hazard?

a. Act dependently

- i. Communicate Information

- 1. Local governments
- 2. State governments
- 3. Federal governments

- ii. Resume operations as quickly as possible

- iii. Evacuations

- iv. Shelter

b. Act independently

- i. To be informed about the approaching hazard

- 1. Work with local government but act independently
 - 2. To be informed about the approaching hazard
- ii. Improve/fix critical infrastructure
- iii. Adaptive use for infrastructure
 - 1. Concerns
- iv. Resume operations as quickly as possible
- v. Communicate Information
- vi. Preparation

So, I think that all hazards, the basic things I'm talking about now needs to be emergency response teams that are trained, prepared, and not one dimensional, they need to be multi-dimensional for all hazards.

- vii. Mutual Aid
- viii. Shelter

6. What should be the airport's role in response to a natural disaster?

- a. Act dependently
 - i. To be a tool for surrounding communities
 - 1. Dependent on type of airport
 - 2. Dependent on governmental requirements
 - 3. Operational Ultimatum

And then there is a COOP, continuity of operations and looking at that and prioritizing the central functions for that department or facility, if it was an airport, it would be an airport facility. And then feeding that information back immediately to decide if it can be repaired, how quick we can get that facility back in service.

- ii. Acting as a staging area
- iii. For incoming delivery
- iv. Evacuation
- v. Take lead role in recovery
- vi. Shelter

- b. Act independently
 - i. To follow FAA and TSA guidelines to become legally operational
 - ii. Shelter
 - iii. Hindered by need to be operational
 - c. Limited Role
7. What should be the airport's role in prevention of a Disaster?
- a. Act dependently
 - i. Provide supplementary roles to the community
 - 1. Deliver goods and services
 - 2. Act as a staging ground
 - 3. Evacuations
 - 4. Communication
 - ii. Protect critical infrastructure
 - iii. Work with other forms of government
 - 1. Local

These airport knowing their role, having a good instant management structure, good response team and really cannot be in isolation. It has to be coordinated through liaison and through whatever format. It has to be tied in with City's office of emergency management or emergency some cities may not have a, severed office but it needs to be really coordinated with all departments and rolled up with the office of emergency management for the city.
 - 2. State
 - 3. Federal
 - iv. Update Emergency plan
 - v. Shelter
 - b. Act independently
 - i. Protect critical infrastructures

I think our Bush airport has three fire stations, those guys can't even leave to go to a house fire in a neighboring community because the airport would have to shut down if they were not there. So, those are things that you've got to have back, I'm probably missing some key ones here but you've got to have highways, transportation and then you've got to have power and water then you've got to have you know some level of communication between all of your responders and your coordinated effort with the departments including airports and then you've got to have some way to protect the responders and people coming back in and people that didn't leave you've got to provide fire protection and EMS and medical and healthcare and all that stuff. And that is not considering all the elderly people and the children stuff you have to deal with.

- ii. Adaptive use for infrastructure
- iii. Work with other forms of government
- iv. Utilizing available resources

So, I think that all hazards, the basic things I'm talking about now needs to be emergency response teams that are trained, prepared, and not one dimensional, they need to be multi-dimensional for all hazards.

- v. Become operational as quickly as possible
- vi. Update Emergency plan (Preparation)

These airport knowing their role, having a good instant management structure, good response team and really cannot be in isolation. It has to be coordinated through liaison and through whatever format. It has to be tied in with City's office of emergency management or emergency some cities may not have a, severed office but it needs to be really coordinated with all departments and rolled up with the office of emergency management for the city.

- vii. Shelter

8. What should be the airport's role in recovery from a natural disaster?

- a. Act dependently
 - i. Provide supplementary roles to the community
 - ii. Deliver goods and services

And then you've got to get your ports or your airports or your rail; transportation, you've got to get them up and running to where they can actually start moving mass supplies and resources and whatever format

that is, in and out because we've learned, nothing new here that those that have been impacted, they can't do it by themselves because they are more than likely.

- iii. Act as a staging ground
 - iv. Shelter
 - v. Communication
- b. Act independently
- i. To meet FAA guidelines following the disaster (to reach operational capabilities ASAP)
 - ii. Respond to other airports in need

All of that is a domino effect, you know your airports, the positive thing about your airports is that a lot of these people can be brought in from other airport to assist or pilots or flight attendants can be brought in from other parts of the country to help.

- iii. Assessment
 - iv. Work w/ tenets
 - v. Shelter
- c. To act as
- d. Limited/unknown roll

Appendix O – Coded Data Input

Person	1	2	3	4	5	6
Occupation	Consultant	Consult	Consultant	Airport	Airport	Airport
Location	Lansing Michigan	Montona	--	Scholes	--	Baton Rouge
1	1	1	1	1	1	1
1a	2	0	0	1	0	0
1ai	3	0	0	1	0	0
1ai1	4	0	0	1	0	0
1ai1a	5	0	0	0	0	0
1ai1b	6	0	0	0	0	0
1ai1c	7	0	0	1	0	0
1ai2	8	0	0	0	0	0
1ai2a	9	0	0	0	0	0
1ai2b	10	0	0	0	0	0
1ai2c	11	0	0	0	0	0
1ai3	12	0	0	1	0	0
1ai3a	13	0	0	0	0	0
1ai3b	14	0	0	0	0	0
1ai3c	15	0	0	1	0	0
1ai3d	16	0	0	0	0	0
1ai4	17	0	0	0	0	0
1aii	18	0	0	0	0	0
1aiii	19	0	0	0	0	0
1aiv	20	0	0	0	0	0
1b	21	1	1	0	1	1
1bi	22	0	0	0	1	0
1bii	23	1	0	0	1	1
1bii1	24	0	0	0	1	1
1bii2	25	0	0	0	0	0
1biii	26	0	0	0	0	0
1biv	27	0	0	0	0	1
1bv	28	0	1	0	0	0
1bvi	29	0	0	0	0	0
1bvii	30	0	0	0	1	0
1bviii	31	1	0	0	0	0
1c	32	1	0	0	0	1
1ci	33	1	0	0	0	1
1cii	34	1	0	0	0	1

1ciii	35	1	0	0	0	0	0
1civ	36	1	0	0	0	0	0
1cv	37	0	0	0	0	0	0
1cvi	38	1	0	0	0	0	0
2	39	1	1	1	1	1	1
2a	40	1	1	1	1	0	1
2ai	41	1	0	1	0	0	1
2aii	42	0	0	1	0	0	1
2aiii	43	0	0	0	0	0	1
2aiv	44	0	0	0	0	0	0
2av	45	0	0	0	1	0	0
2avi	46	0	0	0	0	0	0
2avii	47	1	0	0	0	0	0
2aviii	48	0	1	0	0	0	0
2aviii1	49	0	1	0	0	0	0
2aviii2	50	0	1	0	0	0	0
2aviii3	51	0	0	0	0	0	0
2aix	52	0	0	0	0	0	0
2ax	53	0	0	0	0	0	0
2b	54	0	0	0	1	1	0
2bi	55	0	0	0	0	0	0
2bii	56	0	0	0	1	1	0
2biii	57	0	0	1	0	0	0
2biv	58	0	0	0	0	1	0
2bv	59	0	0	0	0	0	0
2bvi	60	1	0	0	0	0	0
2bvi1	61	1	0	0	0	0	0
3	62	1	1	1	1	1	1
3a	63	0	0	1	1	0	0
3ai	64	0	0	0	1	0	0
3ai1	65	0	0	0	1	0	0
3ai2	66	0	0	0	0	0	0
3aii	67	0	0	0	0	0	0
3aiii	68	0	0	1	0	0	0
3aiii1	69	0	0	1	0	0	0
3aiii2	70	0	0	1	0	0	0
3aiii3	71	0	0	1	0	0	0
3aiv	72	0	0	0	0	0	0
3av	73	0	0	0	0	0	0
3b	74	0	1	1	1	1	1
3bi	75	0	0	0	0	0	0

3bii	76	0	1	1	1	1	1
3bii1	77	0	1	1	1	1	1
3bii2	78	0	0	0	0	0	0
3biii	79	0	0	0	0	0	0
3biv	80	0	0	0	1	0	0
3bv	81	0	0	0	0	0	0
3bvi	82	0	0	0	0	0	0
3c	83	1	0	0	0	0	0
3ci	84	1	0	0	0	0	0
3cii	85	1	0	0	0	0	0
3ciii	86	0	0	0	0	0	0
3civ	87	0	0	0	0	0	0
3cv	88	0	0	0	0	0	0
4	89	1	1	1	1	1	1
4a	90	0	1	1	1	0	1
4ai	91	0	1	1	1	0	1
4ai1	92	0	1	0	0	0	0
4ai2	93	1	0	0	1	0	0
4ai3	94	1	0	1	1	0	1
4ai3a	95	1	0	1	0	0	1
4aii	96	1	0	0	1	0	0
4aiii	97	0	0	0	0	0	1
4aiv	98	0	0	0	0	0	0
4b	99	0	1	1	0	1	1
4bi	##	0	1	0	0	0	0
4bii	##	0	0	1	0	0	0
4biii	##	0	0	0	0	0	0
4biv	##	0	0	0	0	0	0
4bv	##	0	0	0	0	1	0
4bvi	##	0	0	1	0	0	0
4bvii	##	0	0	0	0	0	0
4bviii	##	0	0	0	0	0	1
4c	##	0	0	0	0	0	0
4ci	##	0	0	0	0	0	0
5	##	1	0	0	1	1	1
5a	##	1	0	0	1	0	1
5ai	##	1	0	0	0	0	1
5ai1	##	1	0	0	0	0	0
5ai2	##	0	0	0	0	0	0
5ai3	##	0	0	0	0	0	1
5aii	##	0	0	0	1	0	0

5aiii	##	0	0	0	0	0	0
5aiv	##	0	0	0	0	0	1
5b	##	1	0	0	1	1	0
5bi	##	1	0	0	0	0	0
5bi1	##	0	0	0	0	0	0
5bi2	##	1	0	0	0	0	0
5bii	##	1	0	0	1	0	0
5biii	##	1	0	0	0	0	0
5biii1	##	1	0	0	0	0	0
5biv	##	0	0	0	0	1	0
5bv	##	1	0	0	0	0	0
5bvi	##	0	0	0	0	0	0
5bvii	##	0	0	0	0	0	0
5bviii	##	1	0	0	0	0	0
6	##	1	1	1	1	1	1
6a	##	1	1	0	1	1	1
6ai	##	1	0	0	0	0	0
6ai1	##	1	0	0	0	0	0
6ai2	##	1	0	0	0	0	0
6ai3	##	1	0	0	0	0	0
6aii	##	0	0	0	0	0	0
6aiii	##	1	0	0	0	1	0
6aiv	##	0	0	0	1	0	1
6av	##	0	1	0	1	0	0
6avi	##	1	0	0	0	0	0
6b	##	1	0	1	0	0	0
6bi	##	1	0	1	0	0	0
6bii	##	0	0	0	0	0	0
6biii	##	0	0	0	0	0	0
6biv	##	0	0	0	0	0	0
6c	##	0	0	0	0	0	0
6ci	##	0	0	0	0	0	0
7	##	1	0	1	1	1	1
7a	##	1	0	1	0	0	1
7ai	##	1	0	0	0	0	0
7ai1	##	0	0	0	0	0	0
7ai2	##	1	0	0	0	0	0
7ai3	##	0	0	0	0	0	0
7ai4	##	1	0	0	0	0	0
7aii	##	0	0	1	0	0	0
7aiii	##	0	0	1	0	0	1

7aiii1	##	0	0	1	0	0	1
7aiii2	##	0	0	0	0	0	1
7aiii3	##	0	0	0	0	0	0
7aiv	##	1	0	0	0	0	0
7av	##	0	0	0	0	0	0
7b	##	0	0	0	1	1	0
7bi	##	0	0	0	1	0	0
7bii	##	0	0	0	0	0	0
7biii	##	0	0	0	0	0	0
7biv	##	0	0	0	0	0	0
7bv	##	0	0	0	1	1	0
7bvi	##	0	0	0	0	0	0
7bvii	##	0	0	0	0	0	0
8	##	1	1	1	1	1	1
8a	##	1	0	1	1	0	0
8ai	##	1	0	1	0	0	0
8aii	##	1	0	0	0	0	0
8aiii	##	0	0	0	1	0	0
8aiv	##	0	0	0	0	0	0
8av	##	0	0	0	0	0	0
8b	##	0	1	1	0	1	1
8bi	##	0	1	1	0	1	1
8bii	##	0	0	0	0	1	0
8biii	##	0	0	0	0	0	0
8biv	##	0	0	0	0	0	0
8bv	##	0	0	0	0	0	0
8c	##	0	0	0	0	0	0
8d	##	1	0	0	0	0	0

Person	7	8	9	10	11
Occupation	Airport	Airport	Government	Airport	Govn.
Location	(Tri) NC	Texas	Florida	Pennslyvania	Chicago
1	1	1	1	1	1
1a	2	1	1	0	1
1ai	3	1	1	0	1
1ai1	4	0	1	0	1
1ai1a	5	0	0	0	1
1ai1b	6	0	0	0	0

1ai1c	7	0	0	0	0	0
1ai2	8	0	0	0	1	1
1ai2a	9	0	0	0	1	1
1ai2b	10	0	0	0	0	0
1ai2c	11	0	0	0	0	0
1ai3	12	0	0	0	1	1
1ai3a	13	0	0	0	1	0
1ai3b	14	0	0	0	0	0
1ai3c	15	0	0	0	0	0
1ai3d	16	0	0	0	1	1
1ai4	17	0	0	0	1	0
1aii	18	1	0	0	0	1
1aiii	19	0	0	0	0	1
1aiv	20	0	0	0	0	0
1b	21	0	1	1	1	0
1bi	22	0	0	1	0	0
1bii	23	0	1	0	0	0
1bii1	24	0	1	0	0	0
1bii2	25	0	0	0	0	0
1biii	26	0	1	0	1	0
1biv	27	0	0	0	0	0
1bv	28	0	0	1	0	0
1bvi	29	0	0	0	0	0
1bvii	30	0	0	0	0	0
1bviii	31	0	1	0	0	0
1c	32	1	0	0	0	0
1ci	33	0	0	0	0	0
1cii	34	1	0	0	0	0
1ciii	35	0	0	0	0	0
1civ	36	1	0	0	0	0
1cv	37	0	0	0	0	0
1cvi	38	0	0	0	0	0
2	39	1	1	1	1	1
2a	40	1	1	1	1	1
2ai	41	1	1	1	0	1
2aii	42	0	0	1	0	0
2aiii	43	0	0	0	0	0
2aiv	44	0	0	0	0	0
2av	45	0	0	0	0	0
2avi	46	1	0	1	1	0
2avii	47	0	0	0	0	0

2aviii	48	0	0	0	1	0
2aviii1	49	0	0	0	1	0
2aviii2	50	0	0	0	0	0
2aviii3	51	0	0	0	0	0
2aix	52	0	0	0	0	0
2ax	53	0	0	0	0	0
2b	54	1	1	0	1	0
2bi	55	0	0	0	1	0
2bii	56	0	1	0	0	0
2biii	57	0	0	0	1	0
2biv	58	0	1	0	0	0
2bv	59	0	1	0	0	0
2bvi	60	0	0	0	0	0
2bvi1	61	0	0	0	0	0
3	62	1	1	1	1	1
3a	63	0	1	1	1	0
3ai	64	0	1	1	1	0
3ai1	65	0	1	1	1	0
3ai2	66	0	0	0	0	0
3aii	67	0	0	0	0	0
3aiii	68	0	0	0	1	0
3aiii1	69	0	0	0	1	0
3aiii2	70	0	0	0	0	0
3aiii3	71	0	0	0	0	0
3aiv	72	0	0	1	0	0
3av	73	0	0	0	0	0
3b	74	1	1	1	1	0
3bi	75	0	0	1	0	0
3bii	76	1	0	1	1	0
3bii1	77	1	0	1	1	0
3bii2	78	0	0	0	0	0
3biii	79	0	0	0	1	0
3biv	80	0	1	0	1	0
3bv	81	0	1	0	0	0
3bvi	82	0	0	0	0	0
3c	83	1	0	0	0	1
3ci	84	0	0	0	0	0
3cii	85	0	0	0	0	0
3ciii	86	1	0	0	0	0
3civ	87	1	0	0	0	1
3cv	88	0	0	0	0	0

	4	89	1	1	1	1	1
4a		90	1	1	1	0	0
4ai		91	1	1	1	0	0
4ai1		92	0	0	0	0	0
4ai2		93	1	0	1	0	0
4ai3		94	0	1	1	0	0
4ai3a		95	0	1	1	0	0
4aii		96	0	0	0	0	0
4aiii		97	1	0	0	0	0
4aiv		98	0	0	0	0	0
4b		99	0	0	0	1	0
4bi		100	0	0	0	1	0
4bii		101	0	0	0	0	0
4biii		102	0	0	0	1	0
4biv		103	0	0	0	1	0
4bv		104	0	0	0	1	0
4bvi		105	0	0	0	1	0
4bvii		106	0	0	0	0	0
4bviii		107	1	0	0	0	0
4c		108	0	0	0	0	1
4ci		109	0	0	0	0	1
	5	110	1	1	1	1	1
5a		111	0	1	0	0	1
5ai		112	0	0	0	0	1
5ai1		113	0	0	0	0	1
5ai2		114	0	0	0	0	1
5ai3		115	0	0	0	0	0
5aii		116	0	0	0	0	0
5aiii		117	0	1	0	0	0
5aiv		118	0	0	0	0	0
5b		119	1	0	1	1	0
5bi		120	0	0	0	0	0
5bi1		121	0	0	0	0	0
5bi2		122	0	0	0	0	0
5bii		123	1	0	0	0	0
5biii		124	0	0	0	0	0
5biii1		125	0	0	0	0	0
5biv		126	0	0	0	1	0
5bv		127	0	0	1	1	0
5bvi		128	0	0	0	0	0
5bvii		129	1	0	0	0	0

5bviii	130	0	0	0	0	0
6	131	0	1	1	1	1
6a	132	0	0	0	0	0
6ai	133	0	0	0	0	0
6ai1	134	0	0	0	0	0
6ai2	135	0	0	0	0	0
6ai3	136	0	0	0	0	0
6aii	137	0	0	0	0	0
6aiii	138	0	0	0	0	0
6aiv	139	0	0	0	0	0
6av	140	0	0	0	0	0
6avi	141	0	0	0	0	0
6b	142	0	1	1	1	0
6bi	143	0	0	1	0	0
6bii	144	0	1	0	0	0
6biii	145	0	0	0	0	0
6biv	146	0	0	0	1	0
6c	147	0	0	0	0	1
6ci	148	0	0	0	0	0
7	149	1	1	1	1	1
7a	150	1	1	1	1	1
7ai	151	0	0	0	0	0
7ai1	152	0	0	0	0	0
7ai2	153	0	0	0	0	0
7ai3	154	0	0	0	0	0
7ai4	155	0	0	0	0	0
7aii	156	0	1	1	0	1
7aiii	157	1	0	0	1	0
7aiii1	158	1	0	0	0	0
7aiii2	159	1	0	0	0	0
7aiii3	160	0	0	0	1	0
7aiv	161	0	0	0	0	0
7av	162	0	0	0	0	0
7b	163	1	1	1	1	0
7bi	164	0	1	0	0	0
7bii	165	1	1	1	0	0
7biii	166	0	0	0	0	0
7biv	167	0	0	0	0	0
7bv	168	0	0	0	0	0
7bvi	169	0	0	0	1	0
7bvii	170	0	0	0	0	0

8	171	1	1	1	1	1
8a	172	0	1	0	0	1
8ai	173	0	0	0	0	0
8aii	174	0	0	0	0	1
8aiii	175	0	1	0	0	0
8aiv	176	0	0	0	0	0
8av	177	0	0	0	0	0
8b	178	1	0	1	1	1
8bi	179	1	0	1	1	1
8bii	180	0	0	0	0	0
8biii	181	0	0	0	1	0
8biv	182	0	0	0	1	0
8bv	183	0	0	0	0	0
8c	184	0	0	0	0	0
8d	185	0	0	0	0	0

Person	12	13
Occupation	Government	Government
Location	Houston	South Carolina
1	1	1
1a	2	1
1ai	3	1
1ai1	4	1
1ai1a	5	0
1ai1b	6	0
1ai1c	7	0
1ai2	8	0
1ai2a	9	0
1ai2b	10	0
1ai2c	11	0
1ai3	12	0
1ai3a	13	0
1ai3b	14	0
1ai3c	15	0
1ai3d	16	0

1ai4	17	1	0
1aii	18	1	1
1aiii	19	1	0
1aiv	20	0	0
1b	21	1	0
1bi	22	0	0
1bii	23	1	0
1bii1	24	1	0
1bii2	25	0	0
1biii	26	0	0
1biv	27	1	0
1bv	28	1	0
1bvi	29	0	0
1bvii	30	0	0
1bviii	31	0	0
1c	32	0	0
1ci	33	0	0
1cii	34	0	0
1ciii	35	0	0
1civ	36	0	0
1cv	37	0	0
1cvi	38	0	0
2	39	1	1
2a	40	1	1
2ai	41	0	0
2aii	42	0	0
2aiii	43	0	0
2aiv	44	0	0
2av	45	0	0
2avi	46	1	1
2avii	47	0	0
2aviii	48	0	0
2aviii1	49	0	0
2aviii2	50	0	0
2aviii3	51	0	0
2aix	52	0	0
2ax	53	0	0
2b	54	1	0
2bi	55	1	0
2bii	56	1	0
2biii	57	0	0

2biv	58	0	1
2bv	59	0	0
2bvi	60	0	0
2bvi1	61	0	0
3	62	1	1
3a	63	0	1
3ai	64	0	1
3ai1	65	0	0
3ai2	66	0	1
3aii	67	0	0
3aiii	68	0	1
3aiii1	69	0	0
3aiii2	70	0	1
3aiii3	71	0	1
3aiv	72	0	0
3av	73	0	0
3b	74	1	1
3bi	75	0	0
3bii	76	1	0
3bii1	77	1	0
3bii2	78	0	0
3biii	79	0	0
3biv	80	0	0
3bv	81	0	1
3bvi	82	0	0
3c	83	0	1
3ci	84	0	0
3cii	85	0	0
3ciii	86	0	1
3civ	87	0	1
3cv	88	0	0
4	89	1	1
4a	90	1	1
4ai	91	1	0
4ai1	92	0	0
4ai2	93	0	0
4ai3	94	1	0
4ai3a	95	0	0
4aii	96	0	0
4aiii	97	0	1
4aiv	98	0	0

4b	99	1	1
4bi	100	0	0
4bii	101	1	1
4biii	102	1	0
4biv	103	0	0
4bv	104	1	0
4bvi	105	1	1
4bvii	106	0	0
4bviii	107	0	0
4c	108	0	0
4ci	109	0	0
5	110	1	1
5a	111	0	1
5ai	112	0	1
5ai1	113	0	0
5ai2	114	0	1
5ai3	115	0	1
5aii	116	0	0
5aiii	117	0	1
5aiv	118	0	0
5b	119	1	0
5bi	120	0	0
5bi1	121	0	0
5bi2	122	0	0
5bii	123	0	0
5biii	124	0	0
5biii1	125	0	0
5biv	126	0	0
5bv	127	0	0
5bvi	128	1	0
5bvii	129	0	0
5bviii	130	0	0
6	131	1	1
6a	132	1	0
6ai	133	1	0
6ai1	134	0	0
6ai2	135	0	0
6ai3	136	1	0
6aii	137	0	0
6aiii	138	0	0
6aiv	139	0	0

6av	140	0	0
6avi	141	0	0
6b	142	0	0
6bi	143	0	0
6bii	144	0	0
6biii	145	0	0
6biv	146	0	0
6c	147	0	1
6ci	148	0	1
7	149	1	1
7a	150	1	1
7ai	151	0	1
7ai1	152	0	0
7ai2	153	0	0
7ai3	154	0	0
7ai4	155	0	1
7aii	156	0	0
7aiii	157	1	1
7aiii1	158	1	0
7aiii2	159	0	0
7aiii3	160	0	0
7aiv	161	0	0
7av	162	0	0
7b	163	1	0
7bi	164	1	0
7bii	165	0	0
7biii	166	0	0
7biv	167	1	0
7bv	168	0	0
7bvi	169	1	0
7bvii	170	0	0
8	171	1	1
8a	172	1	0
8ai	173	0	0
8aii	174	1	0
8aiii	175	0	0
8aiv	176	0	0
8av	177	0	0
8b	178	1	1
8bi	179	0	0
8bii	180	1	0

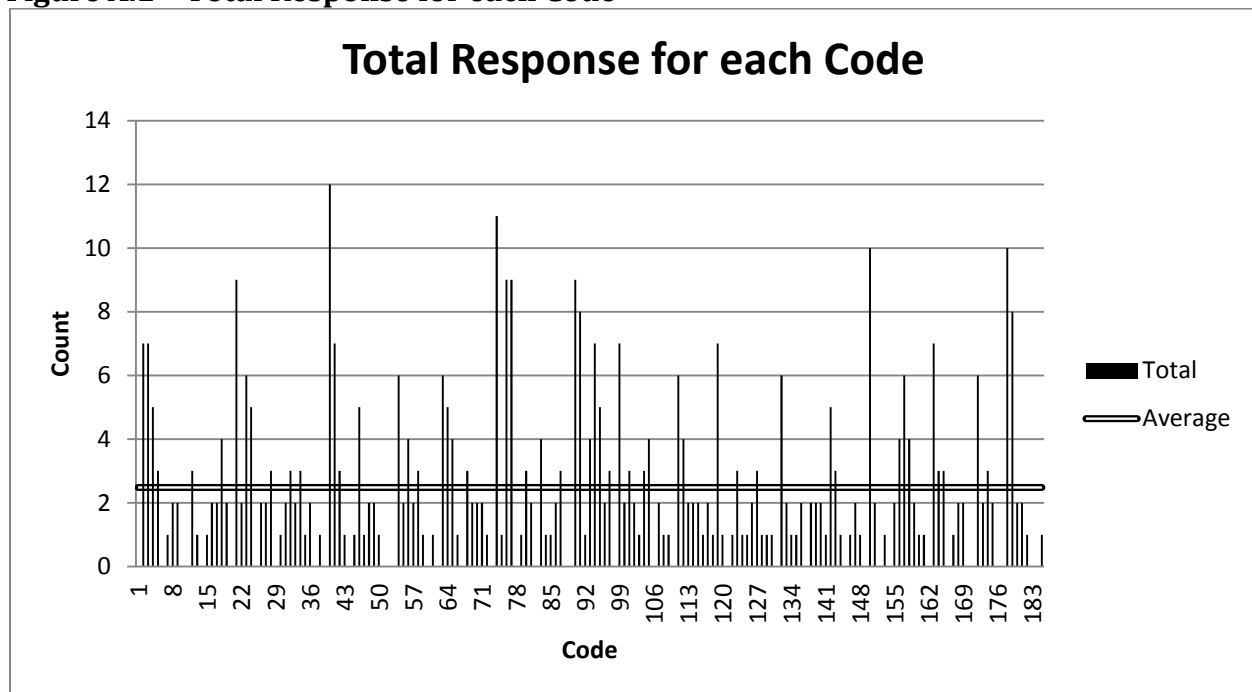
8biii	181	0	1
8biv	182	0	0
8bv	183	0	0
8c	184	0	0
8d	185	0	0

Appendix P – Code Information

Count data centers on the number of responses for a particular code. Each time an interviewee answers a particular code, that code receives a “1”. If the interviewee answers 1 or more sub-codes, the parent code receives only a “1”. For example, if we were concerned about which food is healthy and a respondent said apple, then apple is the sub-code and fruit would be the parent code, thereby both receiving a “1” for their code. If the respondent said apples and oranges, the parent code would only receive a “1” Additionally, a code value maybe assigned to the question. Since the respondent answered the question, healthy food may receive a 1 for its code. Similarly, someone may respond by simply stating that fruit is a healthy option thereby only fruit would receive a 1 for its code and a 0 would be assigned for apples’ and oranges’ code.

Count data was calculated for the entire dataset, based on the total number of responses for a particular code, as shown in Figure 4.1. The total response from each code ranges from 0 to 12, meaning that some codes did not achieve enough information to be coded. Some codes experienced 12 responses, suggesting that nearly all of the interviewees discussed that code. Additionally, Figure 4.1, displays rudimentary data centering on common codes, or themes, throughout the interview process. It is apparent that the data, as shown in Figure 4.1, contains a wide range of results. The decomposition of the dataset by questions provided a more detailed information.

Figure A.1 – Total Response for each Code



The previously mentioned analysis technique can be conducted for each question of the interview process. Figure 4.2, displays the coded results of the first question; that is; what is the airport's role in response to a natural hazard? Table 4.1 provides a key to Figure 4.2. According to Figure 4.2, codes 2 and 20 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-19; likewise in 19-38 in code 20. Code 1 represents how many interviewees successfully responded to that question. Within code 20, lies code 21, which is the most prevalent response within code 20, with 6 responses. This suggests that 6 interviewees believe the airport should respond to a hazard in a by dealing with it in a systematic approach their own emergency plan.

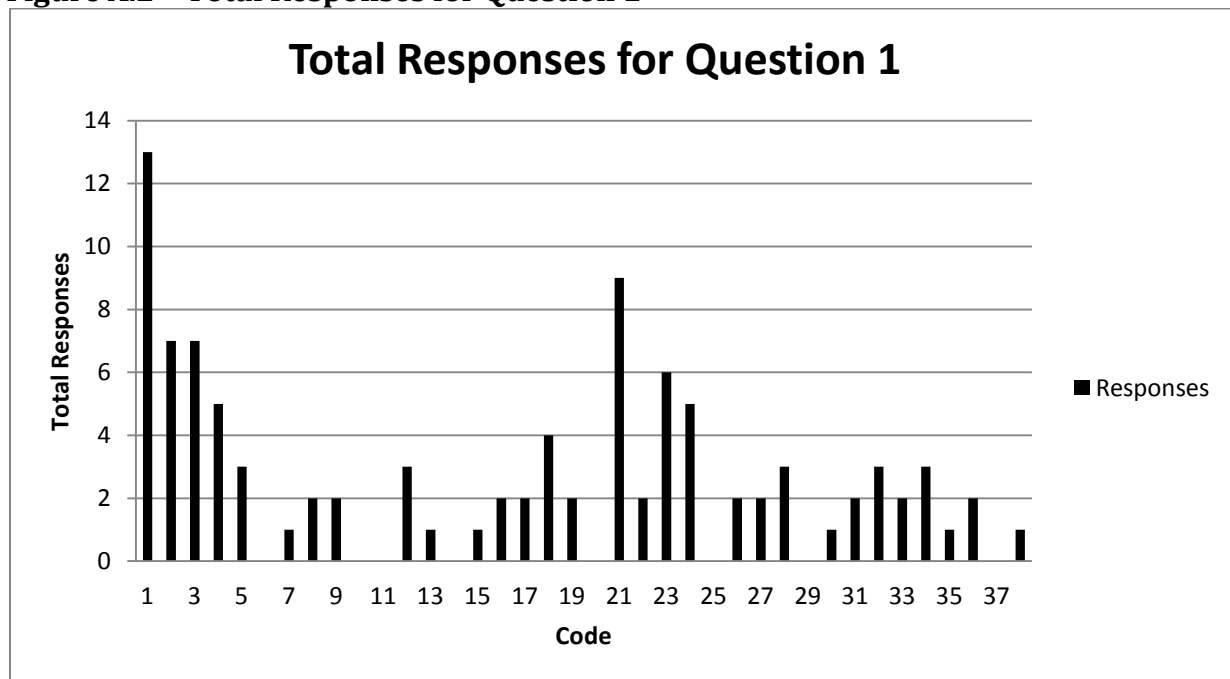
However, 7 responses were recorded for the airport to actively engage the community. This suggests that many of the interviewees agree that the airport's role is to be active in

community engagement for preparation for in incoming disaster. Additionally, these preparation activities are most notably coordinating with local officials and bringing in supplies before the hazard arrives. On the other hand, 9 coded responses were calculated for the airport acting independently, outside of participation with the community. The strongest airport activity within that set belongs to code number 23 at 6 responses. Code number 23 represents that the airport needs to respond to the hazard either systematically through their emergency management plan. A similar approach was conducted to determine question number two.

Table A.1 – Question 1 Key

Code	Detailed Code	Response
1	1. What is the airport's role in response to a natural hazard?	13
2	a. The airport to act dependently	7
3	i. Coordination	7
4	1. local government	5
5	a. Establish communication	3
6	b. Use local resources	0
7	c. act independently	1
8	2. State government	2
9	a. establish communication	2
10	b. Use state resources	0
11	c. act independently	0
12	3. Federal government	3
13	a. establish communication	1
14	b. Use federal resources	0
15	c. act independently	1
16	d. Limited Role	2
17	4. Airlines	2
18	ii. Evacuations	4
19	iii. Bring in Supplies	2
20	iv. Shelter	0
21	b. The airport to act independently	9
22	i. To act as a first responder	2
23	ii. Deal with the hazard	6
24	1. In a systematic approach	5
25	2. In accordance to fed regulation	0
26	iii. Protect the airport	2
27	iv. Evacuations	2
28	v. Keep flying	3
29	vi. Evacuations	0
30	vii. Shelter	1
31	viii. Communication	2
32	c. An unknown/limited role	3
33	i. Can't get proper personnel their	2
34	ii. Infrastructure is vulnerable	3
35	iii. Equipment issues	1
36	iv. Poor geographical location	2
37	v. Shelter	0
38	vi. Practice	1

Figure A.2 – Total Responses for Question 1



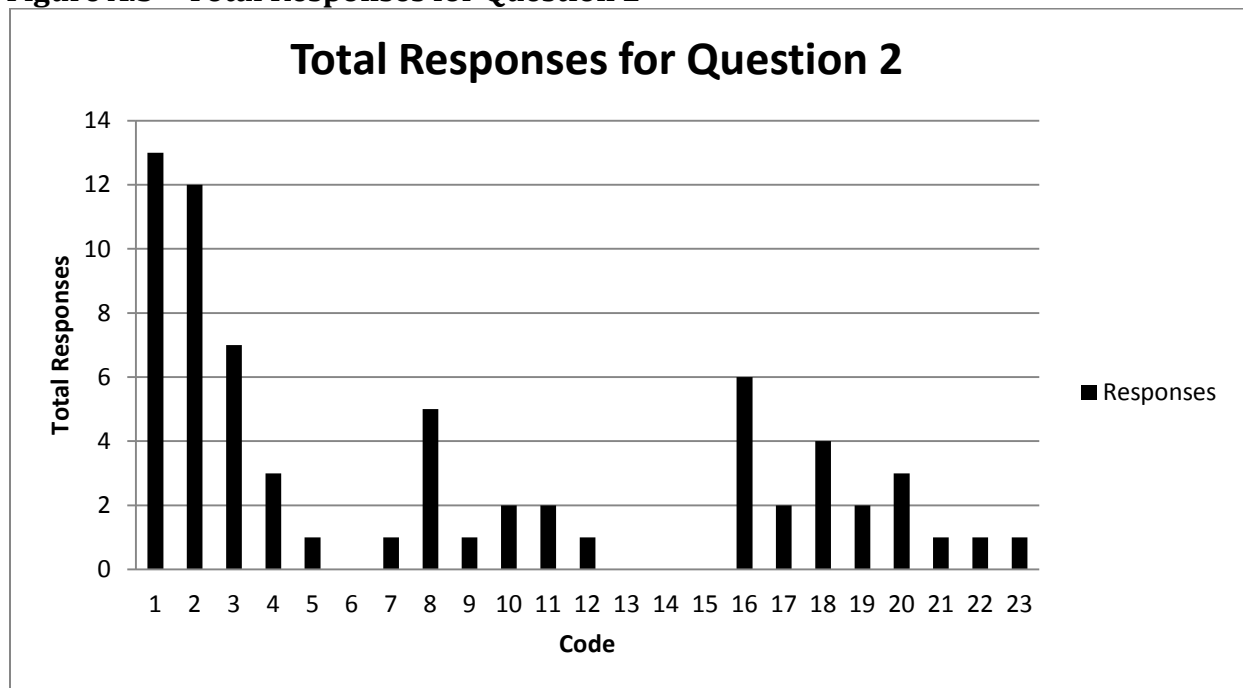
4.4.2 Question 2

Question two of the interviews asked, “What is the role of the airport role in response to a natural disaster?” Table 4.2 represents the key to Figure 4.3. According to Figure 4.3, codes 2 and 16 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-15; likewise in 17-23 in code 16. Code 1 represents how many interviewees successfully responded to that question. Figure 4.3, displays a majority of responses in code 2, with a response of 12. According to Figure 4.3, it is apparent that most interviewees believed that the role of the airport during a response to a disaster is to act as a vessel for incoming recovery supplies as indicated by 7 responses to code 3. Additionally, many interviewees recorded responses for the airport to participate in evacuations for the surrounding community, as indicated in code 8.

Table A.2 – Question 2 Key

Code	Detailed Code	Response
1	1. What is the airport's role in response to a natural disaster?	13
2	a. The airport to act dependently	12
3	i. Act as a staging area for recovery	7
4	ii. Bring in recovery supplies	3
5	iii. Become operational	1
6	iv. As a lifeline for a community	0
7	v. Mutual Aid between airports	1
8	vi. Evacuations	5
9	vii. Dependent on airport infrastructure	1
10	viii. Coordinate with governments	2
11	1. Local	2
12	2. State	1
13	3. Federal	0
14	ix. Respond to any disaster needs	0
15	1. Shelter	0
16	b. Act in an independent role	6
17	i. Assess airport	2
18	ii. Restore facility	4
19	iii. Mutual Aid	2
20	iv. Dependent on airport infrastructure	3
21	v. Shelter	1
22	vi. Planning	1
23	1. Adaptive Use	1

Figure A.3 – Total Responses for Question 2



4.4.3 Question 3

Question 3, revolves around, “What is the airport’s role in prevention of a disaster?”

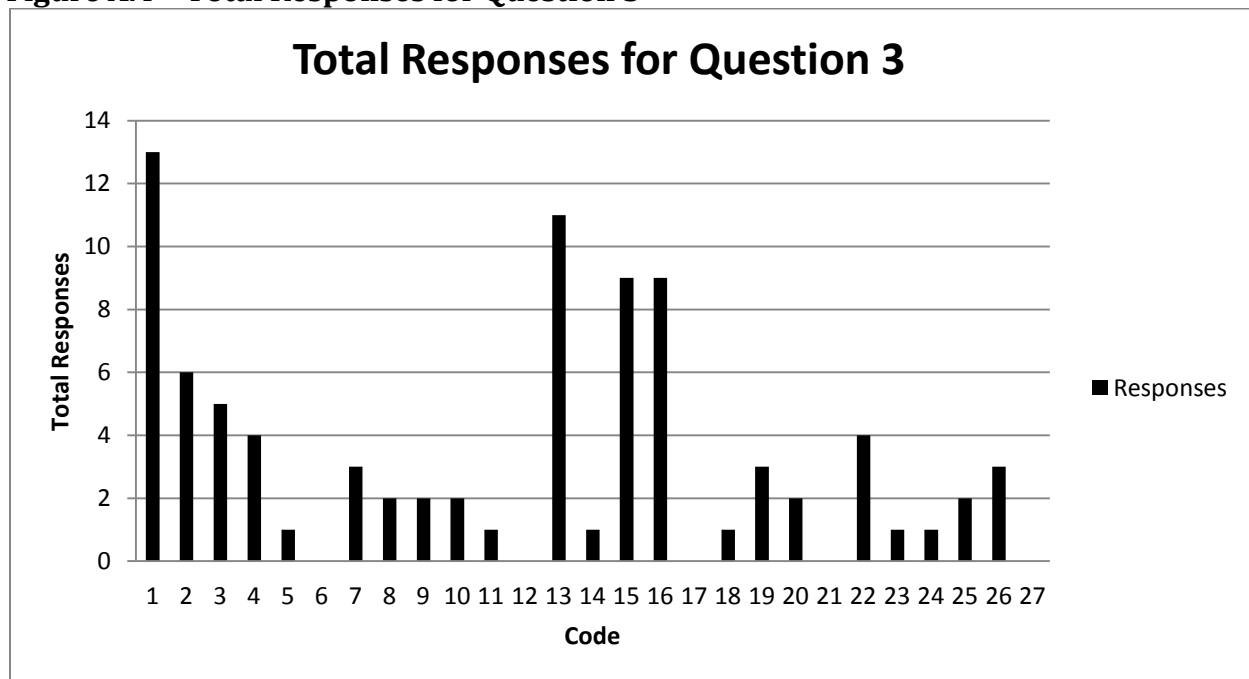
Table 4.3 represents the key to Figure 4.4. According to Figure 4.4, codes 2 and 13 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-12; likewise in 14-27 in code 13. Code 1 represents how many interviewees successfully responded to that question. Figure 4.4, displays a majority of responses in code 13, with a response of 11. The most prominent code within a sub-group belongs to the code 15 and 16, both of which recorded a score of 9. This suggests that 9 interviewees agree that the airport should act independently when attempting to prevent a hazard from transforming into a disaster. Code 15 and 16 represent the airport acting to operate as an airport, meaning to return to normal operations after a hazard, and to protect its infrastructure from being

damaged by the disaster, respectively. In the act of the airport preserving itself, the most common code for the airport's role in preventing a disaster, as acting in a partnership with the community, by providing roles to the community in the form of evacuations and communicating potential airport closings or delays with airline passengers.

Table A.3 – Question 3 Key

Code	Detailed Code	Response
1	1. What is the airport's role in prevention of a disaster?	13
2	a. Act Dependently	6
3	i. Provide supplementary roles	5
4	1. Evacuation	4
5	2. Communication towards passengers	1
6	ii. To operate as an airport	0
7	iii. Work with government agencies	3
8	1. Work with local agencies	2
9	2. Work with state agencies	2
10	3. Work with federal agencies	2
11	iv. Practice disaster scenarios	1
12	v. Shelter	0
13	b. Act Independently	11
14	i. To operate as an airport	1
15	ii. Protect itself and infrastructure	9
16	1. Quick "bounce-back" from disaster to become operational	9
17	2. Minimize financial damage	0
18	iii. Use emergency services	1
19	iv. Communication	3
20	v. Practice disaster scenarios	2
21	vi. Shelter	0
22	c. There is an unknown/limited role	4
23	i. Dependent on ownership	1
24	ii. Dependent on function	1
25	iii. Dependent on infrastructure	2
26	iv. Dependent on airport	3
27	v. Shelter	0

Figure A.4 – Total Responses for Question 3



4.4.4 Question 4

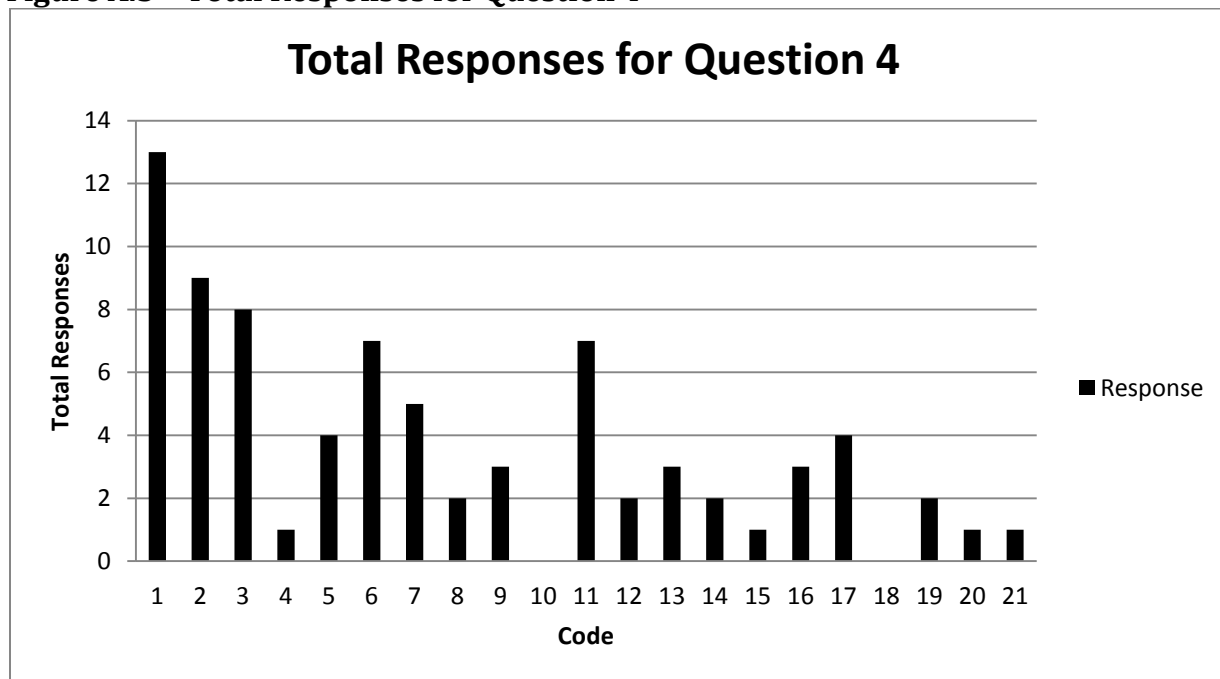
Question 4 is relates to, “What is the airport’s role in recovery from a disaster?” Table 4.4 represents the key to Figure 4.5. According to Figure 4.5, codes 2 and 11 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-10; likewise in 12-21 in code 11. Code 1 represents how many interviewees successfully responded to that question. Figure 4.5, displays a majority of responses in code 2, with a response of 9. This suggests that 9 interviewees believe that the airport has a role in helping the surrounding community before, during or after a disaster. In Figure 4.5, the code 3 and 6 provided the strongest amount of responses. Code 3 suggests that the airport should provide lifelines to the community. Of the code 3, 7 responses believe that the airport’s lifeline to the community is by bringing in recovery supplies. However, 5 interviewees believe that that the

incoming recovery supplies are dependent on the infrastructure of the airport. Similarly, 4 responses were recorded for code 5, suggesting that 4 interviewees believe the airport can act as a staging area for recovery supplies.

Table A.4 – Question 4 Key

Code	Detailed Code	Response
1	1. What is the airport's role in recovery from a natural disaster?	13
2	a. Act dependently	9
3	i. As a lifeline for a community	8
4	1. To met FAA guidelines following the disaster	1
5	2. Act as a staging area for recovery efforts	4
6	3. To bring in supplies	7
7	a. Dependent on airport infrastructure	5
8	ii. Dependent on the airport's infrastructure system	2
9	iii. Act as a morale booster for citizens	3
10	iv. Shelter	0
11	b. Act independently	7
12	i. Get disaster assessed	2
13	ii. Dependent on outside infrastructure	3
14	iii. Communicating	2
15	iv. personnel stuff	1
16	v. Getting the airport operational as quickly as possible	3
17	vi. Dependent on the airport's infrastructure system	4
18	vii. Act as a morale booster for citizens	0
19	viii. Shelter	2
20	c. Limited Role	1
21	i. Infrastructure Problems	1

Figure A.5 – Total Responses for Question 4



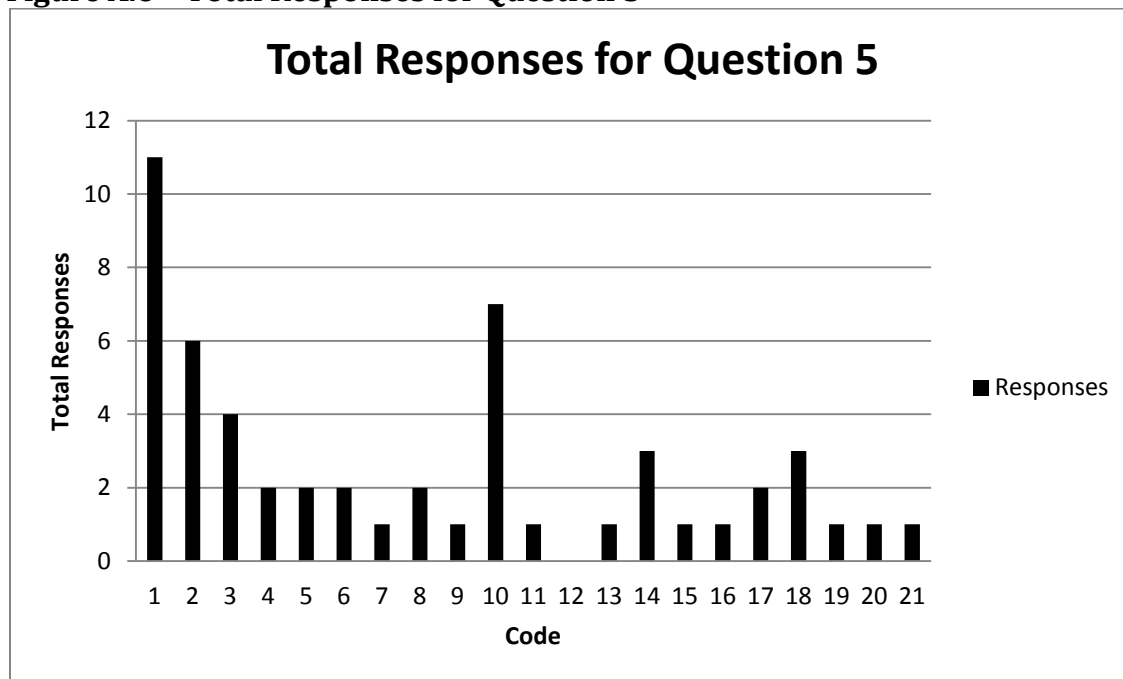
4.4.5 Question 5

Question 5, “What should be the airport’s role in response to a natural hazard,” is the question in a series that attempts to explain what possible roles of disaster management the airport could play. Table 4.6 represents the key to Figure 4.7 According to Figure 4.6, codes 2 and 11 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-10; likewise in 12-21 in code 11. Code 1 represents how many interviewees successfully responded to that question. Figure 4.6, displays a majority of responses in code 11, with a response of 7. However, there this is a wide range of responses in the parent code 11. Unlike parent code 11, code 2 contains 6 responses of which 4 believe that that the airport should communicate information between government officials.

Table A.5 – Question 5 Key

Code	Detailed Code	Response
1	1. What should be the airport's role in response to a natural hazard?	11
2	a. Act dependently	6
3	i. Communicate Information	4
4	1. Local governments	2
5	2. State governments	2
6	3. Federal governments	2
7	ii. Resume operations as quickly as possible	1
8	iii. Evacuations	2
9	iv. Shelter	1
10	b. Act independently	7
11	i. To be informed about the approaching hazard	1
12	1. Work with local government but act independently	0
13	2. To be informed about the approaching hazard	1
14	ii. Improve/fix critical infrastructure	3
15	iii. Adaptive use for infrastructure	1
16	1. Concerns	1
17	iv. Resume operations as quickly as possible	2
18	v. Communicate Information	3
19	vi. Preparation	1
20	vii. Mutual Aid	1
21	viii. Shelter	1

Figure A.6 – Total Responses for Question 5



4.4.6 Question 6

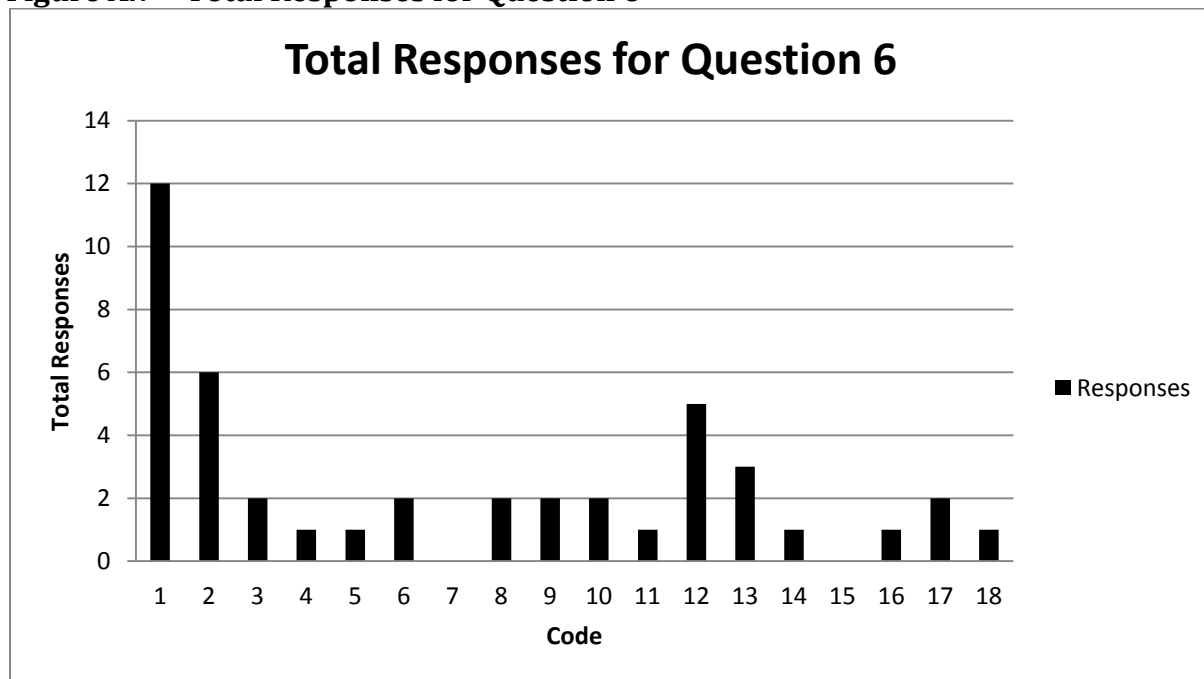
Question 6, “What should be the airport’s role in response to a natural disaster,” attempts to establish information as to what type of joint activities the airport and government agencies play immediately after a disaster. Table 4.6 represents the key to Figure 4.7. According to Figure 4.7, codes 2 and 12 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-11; likewise in 13-18 in code 12. Code 1 represents how many interviewees successfully responded to that question. Code 2 contains numerous sub-codes of which each sub-code contains few responses. Since code 2 contains numerous sub-codes which each contain few responses, it leads to a wide range of possible roles for the airport with little agreement among interviewees. Therefore, a generalized role can be created for question 6. The airport’s role should be to help the community, as indicated

by 6 responses in code 2. Although, as previously mentioned, that type of help or assistance towards communities is ambiguous.

Table A.6 – Question 6 Key

Code	Detailed Code	Response
1	1. What should be the airport's role in response to a natural disaster?	12
2	a. Act dependently	6
3	i. To be a tool for surrounding communities	2
4	1. Dependent on type of airport	1
5	2. Dependent on governmental requirements	1
6	3. Operational Ultimatum	2
7	ii. Acting as a staging area	0
8	iii. For incoming delivery	2
9	iv. Evacuation	2
10	v. Take lead role in recovery	2
11	vi. Shelter	1
12	b. Act independently	5
13	i. To follow FAA and TSA guidelines to become legally operational	3
14	ii. Shelter	1
15	iii. Hindered by need to be operational	0
16	iv. Assessment	1
17	c. Limited Role	2
18	i. Dependent on airport	1

Figure A.7 – Total Responses for Question 6



4.4.7 Question 7

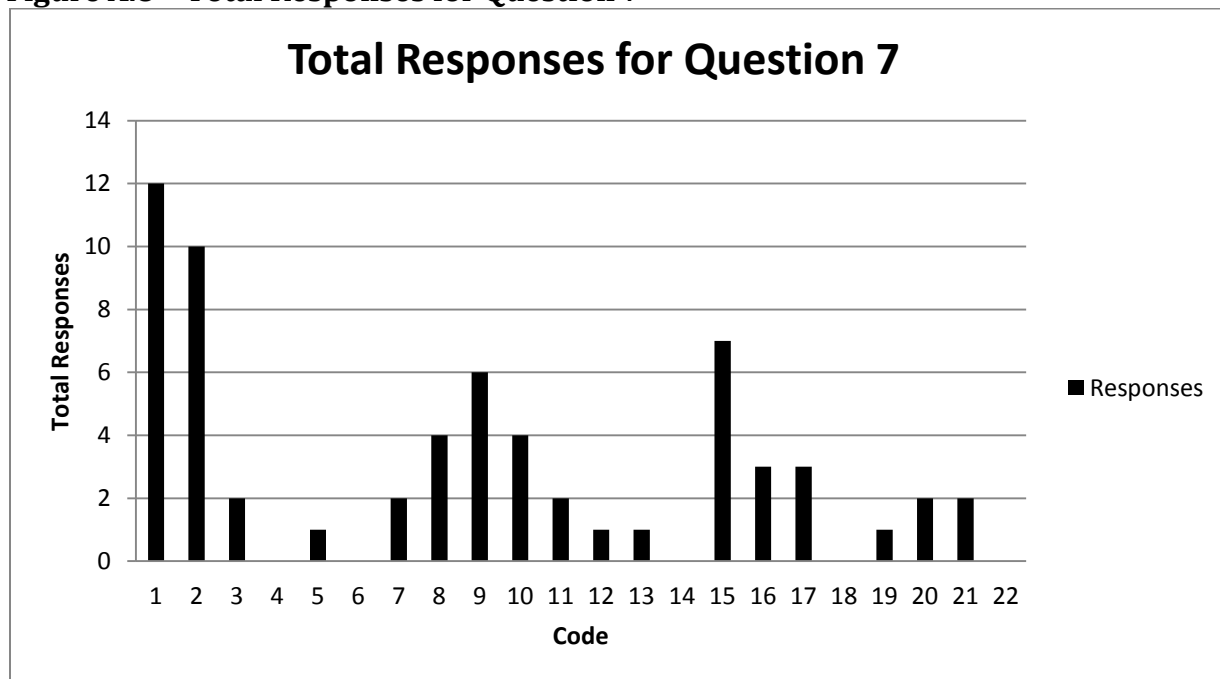
Question 7 is, “What should be the airport’s role in preventing a disaster?” Table 4.7 represents the key to Figure 4.8. According to Figure 4.8, codes 2 and 15 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-14; likewise in 16-22 in code 15. Code 1 represents how many interviewees successfully responded to that question. Figure 4.8, displays a majority of responses in code 2, with a response of 10. This suggests that a majority of interviewees believe the airport should act in partnerships to decrease the likelihood of a hazard transforming into a disaster. Many responded that airport’s partnership should be with government agencies; specifically; 4 responses suggested that the airport partner with local governments (code 10), 2 responses

suggested with state governments (code 11), and 1 response suggested with the federal government.

Table A.7 – Question 7 Key

Code	Detailed Code	Response
1	1. What should be the airport's role in prevention of a Disaster?	12
2	a. Act dependently	10
3	i. Provide supplementary roles to the community	2
4	1. Deliver goods and services	0
5	2. Act as a staging ground	1
6	3. Evacuations	0
7	4. Communication	2
8	ii. Protect critical infrastructure	4
9	iii. Work with other forms of government	6
10	1. Local	4
11	2. State	2
12	3. Federal	1
13	iv. Update Emergency plan	1
14	v. Shelter	0
15	b. Act independently	7
16	i. Protect critical infrastructures	3
17	ii. Adaptative use for infrastructure	3
18	iii. Work with other forms of government	0
19	iv. Utilizing available resources	1
20	v. Become operational as quickly as possible	2
21	vi. Update Emergency plan (Preparation)	2

Figure A.8 – Total Responses for Question 7



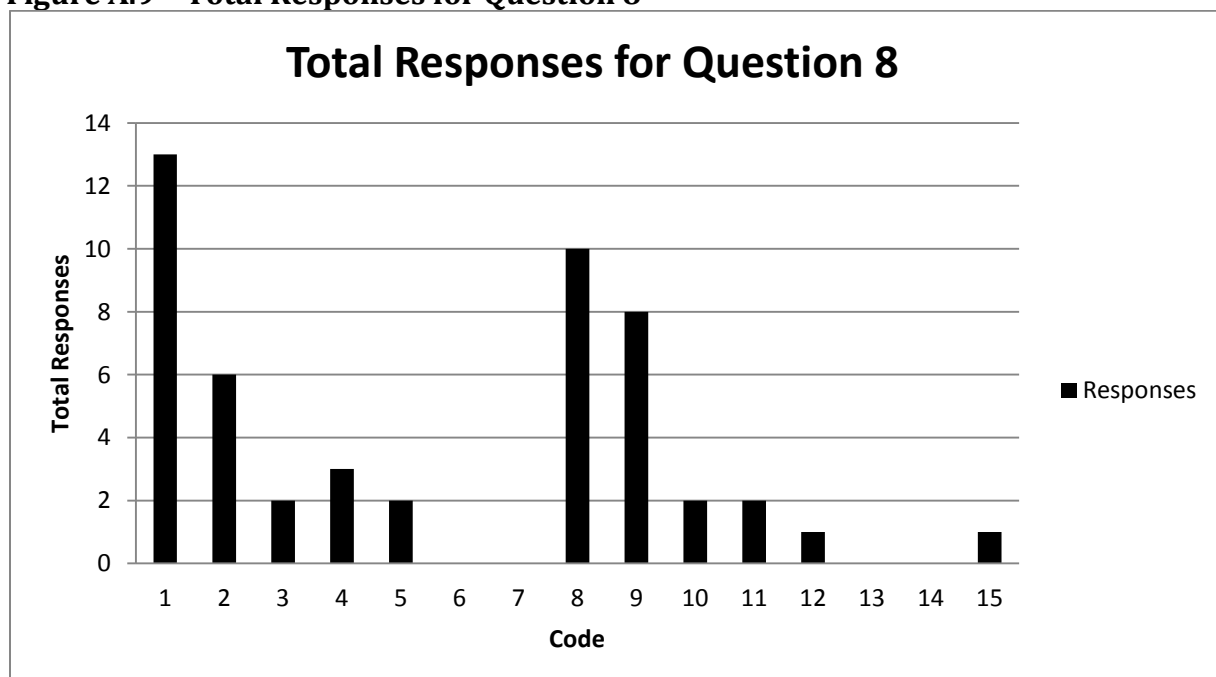
4.4.8 Question 8

Question 8 is, “What should be the airport’s role in recovery from a natural disaster,” and is the last structured main question. Table 4.8 represents the key to Figure 4.9. According to Figure 4.9, codes 2 and 8 represent the two main ideological views of the airport; in partnership with a community and in isolation, respectively. Within each code, lie sub-codes. In this case, the sub-codes for code 2 includes codes 3-7; likewise in 9-15 in code 8. Code 1 represents how many interviewees successfully responded to that question. Figure 4.9, displays a majority of responses in code 8, with a response of 10. This suggests that 10 interviewees had an opinion that the airport should act in accordance to recovering itself from a disaster.

Table A.8 – Question 8 Key

Code	Detailed Code	Response
1	1. What should be the airport's role in recovery from a natural disaster?	13
2	a. Act dependently	6
3	i. Provide supplementary roles	2
4	ii. Deliver goods and services	3
5	iii. Act as a staging ground	2
6	iv. Shelter	0
7	v. Communication	0
8	b. Act independently	10
9	i. Reach operational capabilities	8
10	ii. Respond to other airports in need	2
11	iii. Assessment	2
12	iv. Work w/ tenets	1
13	v. Shelter	0
14	c. To act as	0
15	d. Limited/unknown roll	1

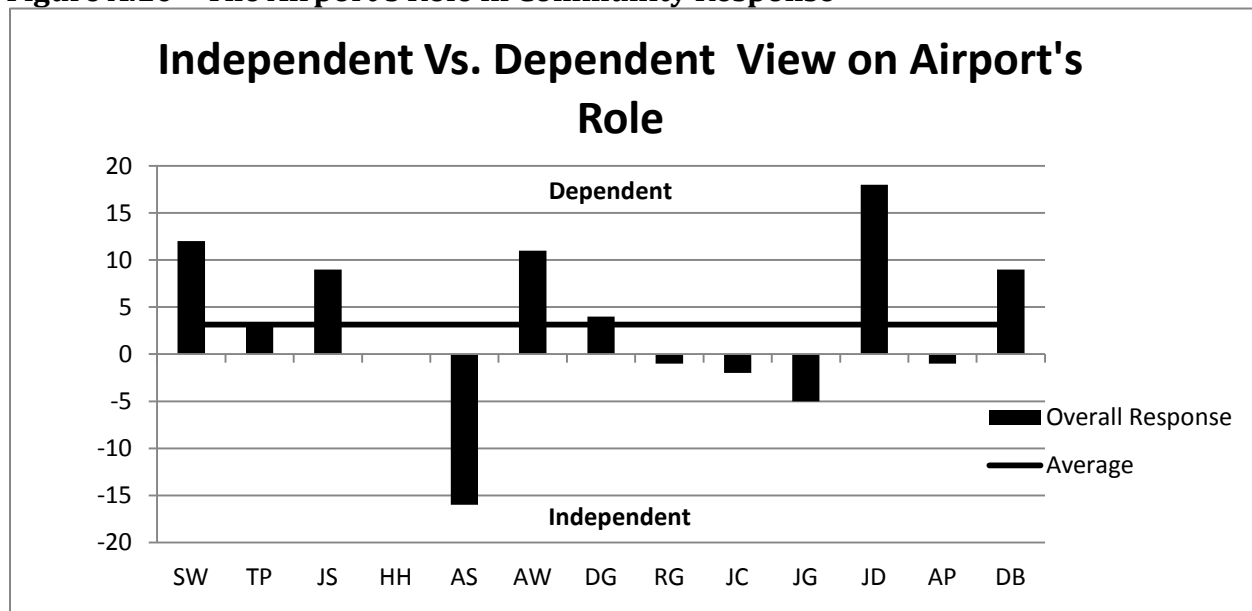
Figure A.9 – Total Responses for Question 8



4.5 Community Engagement and Self Preservation

Another similar style of analysis but with different categories is determining what the overall view of the interviewees is by describing the airports' role as self preservation (independent) or a partnership with a community (dependent). Figure 4.10, displays the results from subtracting the independent coded responses with the dependent coded responses. The figure suggests, as indicated by the mean of 3.15, that overall, the interviewees tend to believe the airport's role is and should be part of a community's adaptation process. The spread of the coded responses also suggests that the data favors a dependent role for the airport with a standard deviation of 8.82. This spread is also reinforced by the figure, which suggests that the interviewees who believe the airport's role is dependent, or should help the community, tend to strongly believe in that role. Research participant 11 recorded over 15 coded responses for the airport's role being dependent or centered on community participation. Conversely, interviewees who believed that the airport's role should be to act independently believe so in a less severe magnitude, in comparison to interviewees who suggested a dependent role. One exception is research participant 5, who strongly believed that the airport should act independently, by having over 15 coded responses.

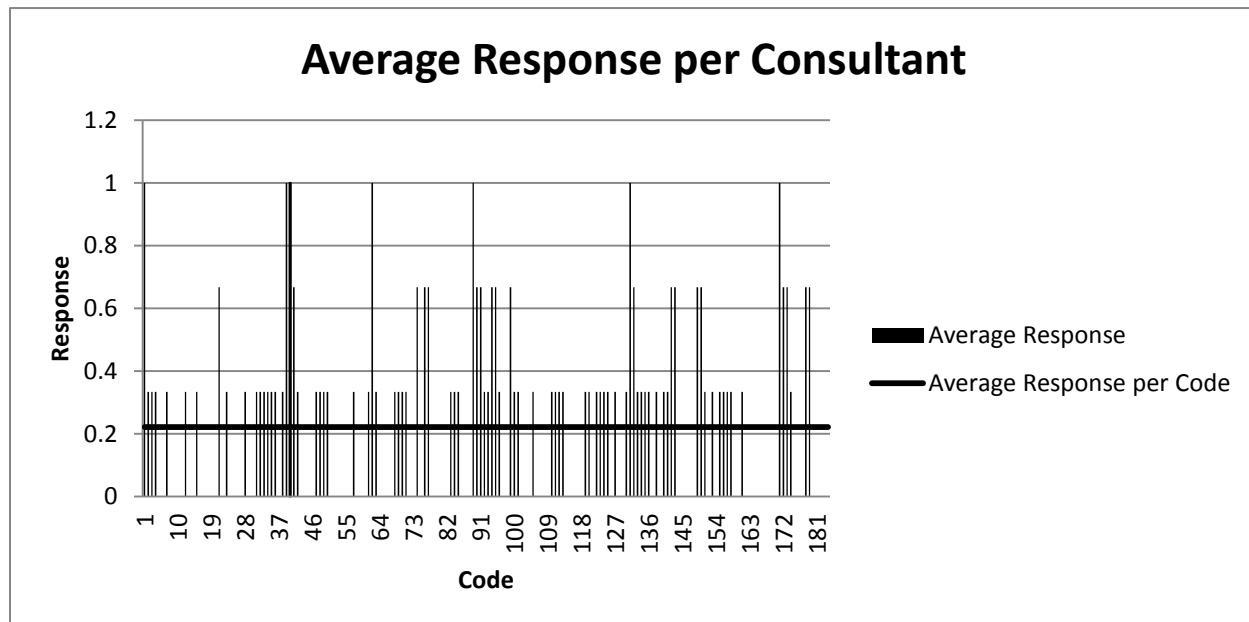
Figure A.10 – The Airport’s Role in Community Response



4.6 Occupational Differences in Responses

However, the airport’s role can also be separated by interviewee’s employment sector of consultant, airport official, or government official. The different responses, through their employment sector, to what an airport’s role is or should be can create patterns within the dataset. Figure 4.11, displays the average code response per consultants.

Figure A.11 – Average Response per Consultant



4.7 Comparing and Contrasting Responses by Employment Type

4.7.1 Government Officials versus Airport Officials

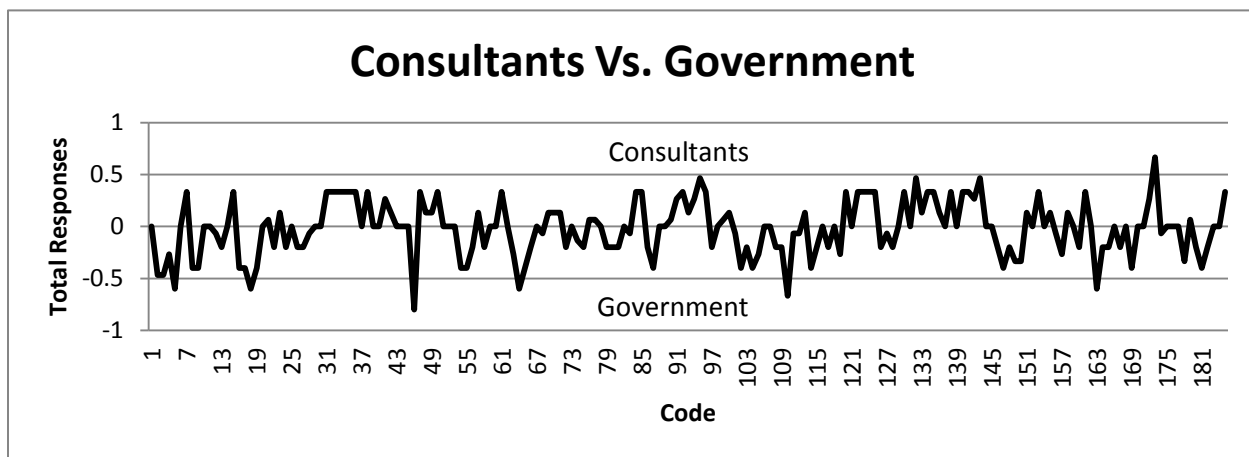
Comparing and contrasting each employment sector with the other displays contrasting views of the airport's role. Figure 4.13 displays the different views government officials have with airport officials. It appears that there are certain codes that government officials feel more strongly about in comparison to airport officials. As shown in Figure 4.13, codes 1-19 favors the government officials more strong. These codes are based on the airport acting in partnership the surrounding community. This suggests but does not imply that government officials, when compared to airport officials, tend to view the airport's role in response to an approaching hazard as a tool for surrounding communities. Likewise, the government averaged a higher code response in codes 169 – 181 in comparison to airport officials, suggesting their view on what the airport's role should be in recovery from a disaster is more conservative in the sense

that the airport should act in self preservation. For example, the airport should be assessed and meet FAA guidelines to become operational as quickly as possible.

Table 4.13 – Statistical Output of Consultants’ versus Government Officials’ Responses

Consultant Vs. Government	
Statistic	Value
Mean	-0.02162
Standard Deviation	0.019026
Skewness	-0.20252

Figure A.14 – Average Response Differences between Government Officials’ and Airport Officials’



4.7.2 Consultants versus Airport Officials

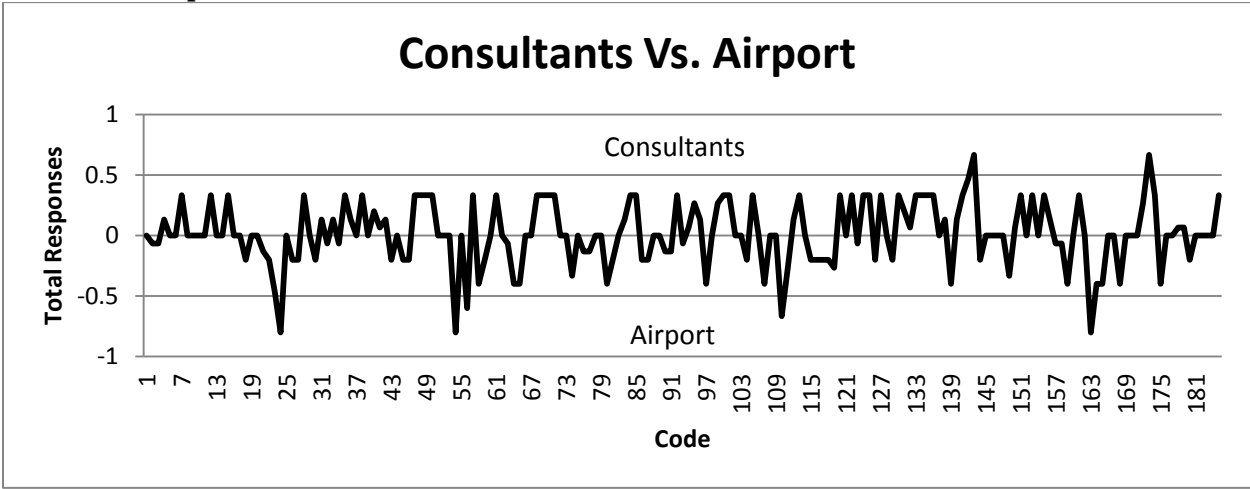
When examining the responses between consultants and airport officials there are noticeable differences in their respective response. Overall, it appears that consultants have a stronger opinion on what the airport’s role should be, as presented in Figure 4.15, with a mean value of 0.014, as shown in Table 4.4. Likewise, a negative skew suggests that a concentration of positive values outweighs the negative values. Therefore, in this scenario of testing the responses between consultants and airport officials, a negative skew further suggests that

consultants had a stronger opinion of the airport. This approach was also applied to the responses between consultants and government officials.

Table A.14 – Statistical Output of Consultants’ versus Airport Officials’ Responses

Consultant Vs. Airport	
Mean	0.014054
Standard Deviation	0.257767
Skewness	-0.46578

Figure A.15 – Average Response Differences between Consultants’ Vs. Airport Officials’ Responses

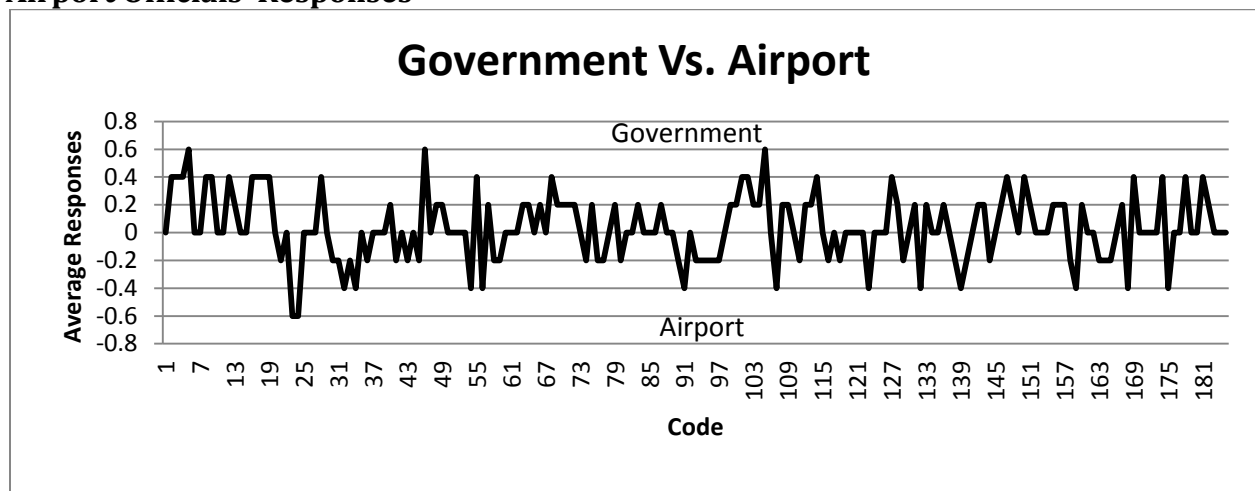


Contradictory to other comparisons, the responses between consultants and government officials led to a smooth response. The mean difference between these two entities is about 0.035, as shown in Table 4.15, suggesting that the average difference weights more towards the consulting sector, indicating that consultants either had more relative opinions about the airport’s role or a higher concentration of responses for a particular code. This is reinforced by a skew score of about -0.039 suggesting that the consultants have either more opinions or stronger opinions about the airport’s role.

Table A.15 – Statistical Output of Government Officials’ versus Airport Officials’ Responses

Government Vs. Airport	
Mean	0.035676
Standard Deviation	0.232713
Skewness	-0.03962

Figure A.16 – Average Response Differences between Government Officials’ versus Airport Officials’ Responses



REFERENCES

REFERENCES

- Bailey, Elizabeth (1986). "Deregulation: Causes and Consequences." Science 234(4781): 1211
- Bailey, Elizabeth, E., (2002). "Aviation Policy: Past and Present." Southern Economic Journal 69(1): 12
- Bartlett, D. and S. Payne (1997). "Grounded Theory: its Basis, Rationale and Procedures."
- Basher, Reid (2006). "Global Early Warning Systems for Natural Hazards: Systematic and People-Centered." Philosophical Transactions: Mathematical, Physical and Engineering Sciences 364(1845): 2167
- Bicknell, J., Dodman, D., & Satterthwaite, D. (Eds.). (2009). Adapting Cities to Climate Change. Understanding and Addressing the Development Challenge. London, Sterling, VA: Earthscan.
- Bratu, Stephane., Cynthia Barnhart (2006). "Flight Operations Recovery: New Approaches Considering passenger Recovery." J Sched 9: 279.
- Brillinger, D. R. (2003). "Three Environmental Probabilistic Risk Problems." Statistical Science 18(4): 9.
- Brooks, N. (2003). "Vulnerability, risk and adaptation: A conceptual framework." 19.
- Church, Richard L. M. P. S., Richard S. Middleton (2004).
- Brueckner, J. K., N. J. Dyer, et al. (1992). "Fare Determination in Airline Hub-and-Spoke Networks." The RAND Journal of Economics 23(3): 14.
- Median and Covering Facility Interdiction Problems." Annals of the Association of American Geographers 94(3): 13.
- Campbell, J. F., A. T. Ernst, et al. (2005). "Hub Arc Location Problems: Part I-Introduction and Results." Management Science 51(10): 15.
- Chang, S. E., D. Ericson, et al. (2003). Airport Closures in Natural and Human-Induced Disasters: Business Vulnerability and Planning. O. o. C. I. P. a. E. Preparedness. Ottawa, ON, CA.
- Church, R. L., M. P. Scaparra, et al. (2004). "Identifying Critical Infrastructure: The Median and Covering Facility Interdiction Problems." Annals of the Association of American Geographers 94(3): 11.

Cogwell, M. T., Ed. (2003). Critical Infrastructure, Nova Science Publishers, Inc. 19

Concannon, R. P., Brooks, H. E, & Doswell III, C, A. (2007). Climatological Risk of Strong and Violent Tornadoes in the United States. American Meteorological Society 21(1), 1-24.

Corbin, J. M. and A. Strauss (1990). "Grounded theory research: Procedures, canons, and evaluative criteria." Qualitative sociology 13(1): 3-21.

Cutter, S. L., B. J. Boruff, et al. (2003). "Social Vulnerability to Environmental Hazards*." Social Science Quarterly 84(2): 242-261.

Cutter, S. L., J. T. Mitchell, et al. (2000). "Revealing the vulnerability of people and places: A case study of Georgetown County, South Carolina." Annals of the Association of American Geographers 90(4): 713-737.

Cutter, S. L. (1996). "Vulnerability to environmental hazards." Progress in human geography 20: 529-539.

Cutter, S. L. a. E., Christopher T (2006). "Moral Hazard, Social Catastrophe: The Changing Face of Vulnerability along the Hurricane Coasts." The Annals of the American Academy of Political and Social Science 604(March): 11.

Flair, J. A., P. Manyem, et al. (2001). "How Airlines and Airports Recover from Schedule Perturbations: A Survey." Annals of Operations Research 108: 18.

Flynn, S. E. and C. o. F. Relations (2007). The Edge of Disaster: Rebuilding a Resilient Nation. New York, Random House Digital, Inc.

Frey, B. S., Luechinger, S., & Stutzer, A. (2007). Calculating Tragedy: Assessing The Costs Of Terrorism. Journal of Economic Surveys, Blackwell Publishing 21(1), 1-24.

Graham, Stephen., (2010). Disrupted Cities: When Infrastructure Fails. New York, Routeledge,: Taylor & Francis.

Glaser, B. G. (1978). "Theoretical sensitivity: Advances in the methodology of grounded theory."

Goetz, Andrew, R., Christopher J. Sutton (1997). "The Geography of Deregulation in the US Airline Industry." Annals of the Association of American Geographers 87(2): 238.

Greenough, G., M. McGeehin, et al. (2001). "The Potential Impacts of Climate Variability and Change on Health Impacts of Extreme Weather Events in the United " Environmental Health Perspectives 109(2): 9.

Gutro, R. (2009). There's Always Something Brewing All Year Around. Worldwide Satellite Magazine Earth Observation and Imagery 5.

Haddow, G. D., J. A. Bullock, et al. (2006). Introduction to Emergency Management, Butterworth-Heinemann.

Henwood, K. and N. Pidgeon (1995). "Grounded theory and psychological research." The Psychologist.

Intergovernmental Panel on Climate Change, the Fourth Assessment Report (2007). M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Klein, Richard J.T., M. J. S., Hasse Goosen, Cornelis H. Hulsbergen (1998). "Resilience and Vulnerability: Coastal Dynamics or Dutch Dikes?" The Geographical Journal **164**(3): 9.

Krishnamoorthy, J. F. C. A. T. E. M. (2005). "Hub Arc Location Problems: Part I-Introduction and Results." Management Science **51**(10): 15.

Labisky, R. F., Miller, Karl E. and Hartless, Christine S (1999). "Effect of Hurricane Andrew on Survival and Movements of White-Tailed Deer in the Everglades." The Journal of Wildlife Management **63**(3): 872.

LaRossa, R. (2005). "Grounded Theory Methods and Qualitative Family Research." Journal of Marriage and Family **67**(4): 20.

Lederer, Philip, J., Ramakrishnan S. Nambimadom (1998). "Airline Network Design." Operations Research **46**(6): 785.

Lyons, E. and A. Coyle (2007). Analysing qualitative data in psychology, Sage Publications Ltd.

Marshall, M. N. (1996). "Sampling for qualitative research." Family practice **13**(6): 522-526.

McCallum, Ewem., Julian Heming (2006). "Hurricane Katrina: An Environmental Perspective." Philosophical Transactions: Mathematical, Physical and Engineering Sciences **364**(1845): 2099.

Morrison, Steven, A., Clifford Winston (1989). "Airline Deregulation and Public Policy." Science **245**(4919): 707.

Moorman, R. W. (2007). "Drawing New Security Lines." United Business Media Aviation.

Moteff, J. C., Claudia ; Fischer, John (2003). Critical Infrastructures: What Makes an Infrastructure Critical? D. o. H. Security.

Neave, E. H. and J. Sullivant (2007). Strategies for Protecting National Critical Infrastructure Assets: A Focus on Problem-Solving, Wiley-Interscience.

Pampel, F. C. (2008). Airport Planning & Management, McGraw-Hill.

Pattillo, D. M. (1998). A History in the Making: 80 Turbulent Years in the American General Aviation Industry. New York, McGraw-Hill Professional.

"Part 139 Airport Certification." - *Classes of Airports*. Federal Aviation Administration. Web. 15 Mar. 2012. <http://www.faa.gov/airports/airport_safety/part139_cert/?p1=classes>.

Pielke Jr, R. A., J. Rubiera, et al. (2003). "Hurricane Vulnerability in Latin America and The Caribbean: Normalized Damage and Loss Potentials." Natural Hazards Review 4(3): 14.

Pielke Jr, Roger A., Daniel Sarewits (2005). "Bringing Society Back into the Climate Debate." Population and Environment 26(3): 255.

Peterson, R. M., R. H. Bittel, et al. (2007). "Using USCAP's Analytical Models, the Transportation Security Administration Balances the Impacts of Aviation Security Policies on Passengers and Airlines " Interfaces; 37(1): 15.

Pidgeon, N. (1996). "Grounded theory: theoretical background." Handbook of qualitative research methods for psychology and the social sciences: 75-85.

Rauber, R. M., J. E. Walsh, *et al.*, Eds. (2008). Severe and Hazardous Weather: An Introduction to High Impact Meteorology, Kendall Hunt Pub Co.

Rennie, D. L. (2000). "Grounded theory methodology as methodical hermeneutics." Theory & Psychology 10(4): 481-502.

Rhoades, D. L. and B. P. Waguespack Jr (2004). "Service and safety quality in US airlines: pre- and post-September 11th." Managing Service Quality 14(4): 307-316.

Robert T. Stafford Disaster Relief and Emergency Assistance Act, as Amended, and Related Authorities. [Washington, D.C.]: Federal Emergency Management Agency, 2007.

Robinson, Peter, J., (1989). "The Influence of Weather on Flight Operations at the Atlanta Hartsfield International Airport." American Meteorological Society 4(Dec): 461

Rupp, N. G., G. M. Holmes, et al. (2005). "Airline Schedule Recovery after Airport Closures: Empirical Evidence since September 11." Southern Economic Journal 71(4): 20.

Rupp, Nicholas, G., George M. Homes (2005). "An Investigation into the Determinates of Flight Cancellations." Economica 73: 749.

Senkbeil, Jason C., Scott C. Sheridan (2006). "A Postlandfall Hurricane Classification System for the United States." Journal of Coastal Research 22(5): 1025.

"Storm Horizons." *U.S. Tornado Climatology*. School of Natural Resources - University of Nebraska-Lincoln, 2012. Web. 15 Mar. 2012.
<<http://snr.unl.edu/data/climate/extremes/ustornadoes.asp>>.

O'Day, Alan (2004). Dimensions of Terrorism, The Cromwell Press.

United State of America. Federal Aviation Administration. *FAA's Nextgen Implementation Plan*. Washington, D.C.: Federal Aviation Administration, 2011.

"U.S. Tornado Climatology." *Tornado Climatology*. National Oceanic and Atmospheric Administration, 12 Mar. 2012. Web. 15 Mar. 2012.
<<http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html>>.

Ward, A. D. and S. W. Trimble (2004). Environmental Hydrology, CRC.

Watson, Robert T. M. C. Z., Richard H. Moss (1998). The Regional Impacts of Climate Change: An Assessment of Vulnerability, Cambridge University Press.

Weichselgartner, Juergen., Jan Sendzimir (2004). "Resolving the Paradox: Food for Thought on the wider Dimensions of Natural Disasters." Mountain Research and Development 24(1): 4.

Wells, A. T. (1996). Disaster Response, New York, Facts on File.

Winston, C. G. d. R. (2008). Aviation Infrastructure Performance: A Study in Comparative Political Economy, Brookings Institution Press.