

UP AND OUT

Oregon Tsunami Wayfinding Research Project

Final Project Report & Guidance Document

Prepared by: PUARL (Portland Urban Architecture Research Lab)
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For: The Oregon Office of Emergency Management OEM



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Portland, OR 97219
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Figure 1.1

UP AND OUT

OREGON TSUNAMI WAYFINDING RESEARCH PROJECT

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FOREWORD

ALTHEA RIZZO

The Cascadia Subduction Zone runs off shore of western North America for about 600 miles from northern California to British Columbia. It is capable of producing megathrust earthquakes over 9.3 magnitude and creating a tsunami possibly over 100 feet. Oregon is working to becoming more prepared for the inevitable temblor and ensuing tsunami.

One of the best ways to survive is to be able to get out of the tsunami inundation zone quickly. In order to do this, it is imperative that escape routes are clearly marked no matter the time of day or weather conditions. As Oregon has been a leader in tsunami hazard mitigation, we are continuing this tradition with this “Up and Out” wayfinding project.

The Oregon Office of Emergency Management is very happy to partner with the Portland Urban Architecture Research Laboratory to seek creative solutions that will save lives during a tsunami event. Their work in other disaster prone areas, especially in hard hit Japan, makes them an excellent choice for this project.

It is hoped that this is the first phase in creating a much safer Oregon by putting in place wayfinding systems that will help our residents and visitors escape to safety. This report can be used by communities to evaluate and re-invigorate how they create routes to safety.

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PREFACE AND ACKNOWLEDGEMENTS

HAJO NEIS

The tsunami evacuation wayfinding project was a rather unusual challenge for the Portland Urban Architecture Research Laboratory (PUARL). Mostly, our projects are urban design, architectural design, and research projects that deal with investigating, designing and improving urban structure and buildings with architectural, urban design and planning methods. To work on a town and urban project in order to help to prevent or mitigate disaster situations is a first in our research and planning series in Portland.

In terms of teaching, PUARL has covered this critical new field of disaster recovery and prevention for four years with projects in different parts of the world, including several tsunami projects (two in Japan from the 2011 tsunami and one in India from the 2004 Indian Ocean tsunami). Dr. Hajo Neis, who has conducted three thesis studios with the topic of “Regenerative Design for Urban Neighborhoods in Buildings Destroyed by Natural Disasters and Catastrophic Human Failure,” has experience with tsunami disaster planning and rebuilding in Japan, and in particular a government workshop in Fukushima, Japan, in the summer of 2013. Srivarshini Balaji is the only person on our team who has actually experienced a tsunami event in 2004 in Chennai, India; as a consequence she has made a disaster recovery and prevention housing project for the same area in India the site and topic of her master thesis at the University of Oregon in 2014.

Given that this was our first research and planning project in this series in Oregon, we had the opportunity to study, research, and learn a large amount of new material about tsunami disasters, evacuation, and escape wayfinding in particular. We have succeeded in carrying out the two main objectives of this project, first to conduct a charrette on evacuation wayfinding with stakeholders, citizens, and professionals in August of 2014 and, second, to prepare and deliver a guidance document for wayfinding in tsunami situations in this final report.

Overall, we believe that the work on these projects is important for several reasons. First, it is critical for the creation of awareness of a possible major tsunami at the Oregon coast. Second, it is important for preparation of escape in a tsunami event. Third, it is important for actually carrying out a successful escape wayfinding act to reach higher ground during a tsunami. And fourth, it is important to be able to survive and organize life after a tsunami event in an ‘island condition,’ in total isolation from help from other communities along the coast.

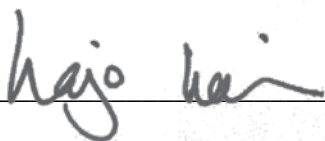
ACKNOWLEDGEMENTS:

We want to thank all of the people who helped us in this work, especially the citizens and city officials in the coastal town of Cannon Beach that served as our test study city. We would be delighted to return for further work on particular aspects of this wide field of investigation into tsunami preparedness in design.

First we would like to thank Dr. Althea Rizzo for placing her trust in us, and for this service-learning research opportunity with the Oregon Office of Emergency Management. We would also like to thank the many institutions and private citizens who were helpful with our investigation, research, and design.

We are grateful to the many experts and citizens who offered advice on current efforts and innovative approaches to tsunami wayfinding across the Oregon coast. In Cannon Beach, we are especially grateful to Daniel Grassick, Les Wiersen and Bill Brehm, and the many committed volunteers and city officials working together to prepare for disaster without a roadmap. Thank you to the many stakeholders who participated in our Astoria charrette, including city officials, first responders, CERT volunteers, parks departments, ODOT engineers, planners, emergency managers, committee members, and interested citizens from the communities of Gearhart, Warrenton, Astoria, Nehalem, Cannon Beach, Tillamook, Hammond, Seaside, Portland, Oceanside, Clatsop County, Pacific City, Sandlake, and Neskowin.

Thank you to Howard Davis for his research insights. And finally, thanks to the team of students and young designers for their curiosity, creative energy, and commitment to putting their skills to use in service of people impacted by disasters worldwide.



Dr. Hajo Neis (PI), August 2014



Figure 1.2

TABLE OF CONTENTS

OREGON TSUNAMI WAYFINDING PROJECT

ACKNOWLEDGEMENTS - ALTHEA RIZZO

FOREWORD - HAJO NEIS

1. INTRODUCTION P. 10-33

- 1.1 INTRODUCTION TO PROJECT
- 1.2 EXECUTIVE SUMMARY
- 1.3 THE WAYFINDING PROJECT
- 1.4 THE PROJECT IN CANNON BEACH
- 1.5 THE NEED FOR TSUNAMI ESCAPE WAYFINDING
- 1.6 PROJECT PARTICIPANTS AND STAKEHOLDERS
- 1.7 CANNON BEACH STAKEHOLDERS
- 1.8 EXISTING TSUNAMI RELATED EFFORTS
- 1.9 WAYFINDING GUIDANCE DOCUMENT

2. CANNON BEACH FIELD WORK & OBSERVATIONS P. 34-77

- 2.1 PROBLEM
- 2.2 DEFINITIONS
 - TERM DEFINITIONS
- 2.3 RESEARCH AND DESIGN METHODS
 - LITERATURE & PRECEDENT STUDY
 - INTERVIEWS
 - COMMUNITY MEETINGS
 - SITE VISITS
 - DESIGN
 - ON-SITE TESTING
 - CHARRETTE
- 2.4 OBSERVATIONS, THEORY, & FINDINGS
 - 2.4.1 HUMAN BEHAVIOR IN DISASTER EVENTS
 - 2.4.2 SIGNAGE THEORY & PRECEDENTS
 - 2.4.3 PROCESS AND SEQUENCE THEORY
 - 2.4.4 SEQUENCE THEORY
 - 2.4.5 URBAN LANDMARKS AND IMAGE OF THE CITY
 - 2.4.6 INTERNATIONAL CASE STUDIES & STORIES
 - 2.4.7. EXISTING OREGON TSUNAMI COASTAL SIGNAGE, MAPPING & WAYFINDING SYSTEMS
 - 2.4.8 SITE VISITS, INTERVIEWS, & COMMUNITY MEETINGS
 - 2.4.9 ON-SITE TESTING
- 2.5 FINAL REMARKS

3. A SURVIVAL PATTERN LANGUAGE P. 81-135

INTRODUCTION

- BEFORE: PREPAREDNESS PATTERNS
- DURING: EVACUATION PATTERNS
- AFTER: RESPONSE PATTERNS
- LIST OF ADDITIONAL PATTERN PROPOSALS
- USING THE SURVIVAL LANGUAGE
- FINAL REMARKS

4. PROCESS AND SEQUENCE: P. 135-154

- 4.1. INTRODUCTION
 - 4.1.2. THE URBAN GAME - OVERVIEW
 - 4.1.3. PREPARE TO PLAY
- 4.2. RULES OF THE GAME
- 4.3. CANNON BEACH EXAMPLE GAME
- 4.4. RESULTS AND RECOMMENDATIONS

5. CONCLUSIONS & RECOMMENDATIONS P. 155-163

- 5.1 OVERALL RECOMMENDATIONS
- 5.2 DETAILED FINDINGS AND RECOMMENDATIONS
 - BEFORE-DURING-AFTER
- 5.3 FINAL COMMENTS

6. BIBLIOGRAPHY P. 164-169

7. APPENDIX: P. 170-259

- 7.1. PROJECT TEAM
- 7.2. SITE VISIT ONE
- 7.3. SITE VISIT TWO
- 7.4. SITE VISIT THREE
- 7.5 BERKELEY SITE VISIT
- 7.6. CANNON BEACH FIELD STUDY AND PROJECT RESEARCH
- 7.7. POST TSUNAMI REDEVELOPMENT, INDIA
- 7.8. POWERPOINT EXERCISE: POMPEII WARM-UP
- 7.9 CANNON BEACH TESTING AND PROPOSAL PRESENTATION
- 7.10 ELECTRONIC GUIDANCE DOCUMENT AND ONLINE PRESENTATION



Figure 1.3



1. INTRODUCTION

- 1.1 Introduction to Project
- 1.2 Executive Summary
- 1.3 The Wayfinding Project
- 1.4 The Project in Cannon Beach
- 1.5 The Need for Tsunami Escape Wayfinding
- 1.6 Project Participants and Stakeholders
- 1.7 Cannon Beach Stakeholders
- 1.8 Existing Tsunami Related Efforts
- 1.9 Wayfinding Guidance Document

1.1 PROJECT INTRODUCTION

Coastal communities enjoy many of the wonderful qualities that the ocean offers its neighbors. But order to live with the sea, it is important to not underestimate its unpredictable nature and extreme power. Although the date is unknown, a local or distant earthquake leading to tsunami inundation is a constantly present, yet distant threat that residents always live with in their everyday lives. While some efforts are already being made by state, city, and local groups, every coastal community should be asking themselves, “are we ready for the big one?”

Tsunami readiness can be broken down into three phases: *prepare, evacuate, respond*; or more simply put: *before, during, and after*. Preparation is perhaps the most easily accessible stage of tsunami readiness because it can be done now. It should focus its efforts on awareness and education because the most common cause of a failed evacuation is evacuees not knowing what to do. Evacuation is the moment when preparation efforts are put into practice; it is when the clarity of routes, signs, and symbols help people get up and out quickly. If signage is not visible, clear, and intuitive, it is ineffective and can interfere with speedy evacuation from the inundation area. The response phase begins the minute that the safety threshold is crossed, but continues on for many years after disaster strikes. It requires effective planning because it must aid the immediate needs of survivors while considering the long term needs of a city. The concepts of *before, during, and after* allows coastal communities to break down their evacuation plan into its parts, and begin to observe the tsunami experience as a whole.

Tsunami readiness is addressed across many scales; by individuals, families, groups, communities, neighborhoods, towns, cities, and states. Families should have evacuation packs prepared and plans for each member for what to do in a variety of scenarios. Neighborhoods should strengthen their network by creating an evacuation and response plan that relies on cooperation and leadership. Businesses should take pride in making their visitors and tourists aware of the tsunami readiness plan and be prepared to lead these people on to the evacuation route. While all of these efforts are pivotal elements of tsunami readiness, city and state planning are responsible for giving all of their residents, visitors, and tourists the best possible chance to find their way out of an inundation area and up high ground as soon as the earth stops shaking, and before the oncoming wave. By observing the problems that impact a lack of preparation, a confusing evacuation route, or a weak response effort, cities can incrementally implement solutions that begin to establish a comprehensive tsunami evacuation wayfinding system.



Figure 1.4

1.2 EXECUTIVE SUMMARY

A tsunami caused by a high magnitude earthquake on the Cascadia fault line (last experienced in 1700 and most recently on a smaller scale in 1964) forms an imminent threat that may impact thousands of people on the Oregon Coast sometime in the near future. An intelligible and comprehensive system for tsunami evacuation wayfinding that also works well intuitively, has not yet been fully realized.

This study focuses on evacuation wayfinding before, during and after a severe tsunami event. Coastal residents and visitors need a more robust wayfinding system that provides them with the tools to prepare, evacuate, and respond to a life threatening tsunami. The PUARL team studied the conditions of a variety of different coastal communities and disaster precedents through research, stakeholder input, and site testing. However, one particular town was used as a case study with the intention to evaluate the specific conditions that could help establish general conclusions useful for other towns along the Oregon coast. The town that was studied in detail with regard to tsunami evacuation wayfinding was Cannon Beach at the Oregon coast. The city's dedication to tsunami readiness, geographic conditions, and high summer tourist population made Cannon Beach an ideal place for studying tsunami evacuation planning and designing a new wayfinding system.

In cooperation with the Oregon Office of Emergency Management (OEM), the team delivered a tsunami wayfinding charrette in the city of Astoria with key stakeholders from the northern Oregon coastal cities. The work done before the charrette resulted in this guidance document for the municipality of Cannon Beach, which can also be used by other communities.

The following working tasks were undertaken by the PUARL:

Task 1: Project Management and Administration

Task 2: Inventory and Collect Existing Tsunami Evacuation Materials/Facilities

Task 3: Identify Community Stakeholders

Task 4: Design and Deliver a Community Stakeholder Charrette

Task 5: Draft Guidance Document

Task 6: Finalize and Publish Guidance Document

The following major steps demonstrate the process, strategies, and testing that were applied by the PUARL team:

1. A cooperative working arrangement between Althea Rizzo from OEM and the PUARL Team was formed in order to prepare the two main tasks of the project; to carry out a charrette with stakeholders, and to prepare and deliver a guidance document for wayfinding in tsunami situations.
2. Community and local expert contacts were made early on with Mark Barnes: Cannon Beach City Planner, Tiffany Brown: Emergency Manager for Clatsop County, Jenny Demaris: Emergency Manager for Lincoln County, and Daniel Grassick: City of Cannon Beach Public Works Director.
3. A number of site visits to Cannon Beach helped the team study its existing tsunami evacuation plan. These visits were used to carry out site tests of wayfinding elements as well as explorations of how to implement design ideas. Visits to other sites such as Seaside, Astoria, and Newport helped to create a comparative understanding of tsunami wayfinding systems in different communities.
4. The 'Up and Out' Tsunami Wayfinding Project in Cannon Beach was approached by directly studying, testing, designing, and improving a number of detailed wayfinding infrastructure urban elements. These included innovative strategies such as vertical evacuation in low lying areas, and new types of wayfinding signage devices such as lights on the ground. A night testing exercise was particularly helpful in understanding the difficulties with nightly evacuation situations that might be worsened by bad weather conditions, especially when there is only 18-22 minutes.
5. Based on the study of these detailed design elements and social situations, the team decided to develop an 'umbrella' process that structures all problems and solutions in a more general framework. This framework is useful for wider understanding of tsunami wayfinding as a system and might be more helpful to other communities in deriving their own particular system. The team applied the Pattern Language method as a way of organizing both general and specific recommendations.
6. The process of escape from tsunami is sequential: each step toward safety is tied to the next. Recommendations for improving elements of the sequence are expressed in both general forms (through patterns in the pattern language), and specific (through the project in Cannon Beach).
7. For officials, community groups, and private citizens who want to organize and improve their city with tsunami evacuation escape infrastructure, we have developed a set of tools to guide groups in design thinking and discussion between stakeholders. This includes the urban game for tsunami escape planning, an historic discussion warm up game, and stakeholders



Figure 1.5

Tsunami Evacuation: Pedestrian Route Maps

worksheet.

8. A charrette with stakeholders was carried out in Astoria to test and present our work in the context of professional expertise and citizen input. Over the course of two days of workshops, presentations, and networking between city leaders, we began to understand the various needs and priorities in different communities in regards to wayfinding. Case studies of innovative prototype solutions were collected and shared between participants. The event was a creative, interdisciplinary method of working that empowered citizens and community leaders to collaborate with design thinkers to quickly generate many solutions to address their most pressing wayfinding concerns.

9. The final product of the work is a final report that also contains the essential elements of the Guidance Document. Chapter 2 of this document outlines the process, research, and observations undertaken by the PUARL team in the course of this project. Chapters 3-5 provide an initial wayfinding pattern language, design concepts, recommendations, and process that leaders of different cities can use to develop their own custom tsunami escape wayfinding system.

10. A series of conclusions and recommendations for future projects is provided at the end of the report in order to supply coastal communities with some straightforward methods for improving their wayfinding system. These conclusions were drawn from a variety of different sources including stakeholder input, site testing, and the process of pattern development. It is important to integrate these recommendations into a site specific tsunami evacuation plan in order to make the information included in this report come to life in cities threatened by tsunami inundation.

1.3 THE WAYFINDING PROJECT

A tsunami escape wayfinding system informs people of what to do and when to do it. The system is designed to make the process clear and efficient before, during, and after a tsunami. A diverse palette of creative design strategies using a strong visual language is the central task of this project. A system of urban wayfinding strategies has been developed that works together in order to make wayfinding easier and save lives in the case of a necessary tsunami evacuation. These design strategies provide options in the five categories:

An Urban Escape Tsunami Wayfinding System

An initial system of urban escape and wayfinding strategies has been developed to make escape and wayfinding more reliable in the Cannon Beach community but also for other coastal towns. These initial design elements, strategies, sequences, and innovative sign systems are placed together in what can be called an *urban escape wayfinding system*. Prime elements include awareness kiosks, tsunami hazard zone signs, tsunami evacuation route signs, zone thresholds, and assembly areas.

A Pattern Language for Escape and Wayfinding

The development of such a Pattern Language became the central area of emphasis in which all or most strategies, ideas, and innovations are included and expressed in a very particular format that permits the understanding of general as well as detailed points in an overall system. A Pattern Language is proposed here that provides critical escape and wayfinding information in the form of individual patterns and sequences of patterns, that together form a Pattern Language or a system of interrelated strategies for escape and wayfinding. The Pattern Language is written in a problem/solution format and includes a number of detailed design proposals, precedents, and illustrations to bring the general concept to life with a few real examples. See Section 3 for patterns and real examples.

Escape and Wayfinding Sequences for Particular Populations

For different populations, such as people with handicaps and the many unprepared tourists during the summer season, special escape sequences and patterns provide wayfinding for tsunami escape within the 18-22 minutes calculated for Cannon Beach. These populations include the elderly, handicapped, children, visitors in hotels, RV park visitors, etc.

Electronic Guidance Document and Online Presentation

Through the in-depth study of the Cannon Beach community and its infrastructure system, the document provides a model and example of how these elements can work together to create a comprehensive wayfinding system in a tsunami situation for other affected towns as well. These various wayfinding escape strategies are compiled as the Guidance Document in this report. It will be provided in a publicly accessible digital format on the PUARL website. It is hoped that this document can be used by any community to assist with the formulation of a tsunami readiness plan and tsunami escape wayfinding improvements.

Implementation

For implementation of any or all parts of the urban escape wayfinding system, we consider the following aspects as relevant: cost, ease of construction/implementation, aesthetic style, complexity of technological requirements, media, purpose. Cities can select a combination of these options that fit their urban conditions, stakeholder needs, and resources available. The guidance document outlines each of these design solutions together as a whole, and implementation may be phased over time.

1.4 THE PROJECT IN CANNON BEACH

The PUARL team studied the coastal town of Cannon Beach as a case study project in order to understand existing wayfinding systems and analyze critical points that may need improvement. The team came up with design solutions that can improve the wayfinding system not only in Cannon Beach but also in other towns along the coast with similar issues and problems.

Most information was provided by the town of Cannon Beach with regards to documents, meetings, interviews, and site visits. Cannon Beach is our primary source of direct local research. Here it was possible to examine the details of efforts such as a privately organized neighborhood with safe houses for helping neighbors and citizens in case of a tsunami event.

Cannon Beach is a small Oregon coastal city in Clatsop County, located approximately 80 miles west of Portland and 25 miles south of Astoria. It is 1.54 square miles in area, with a population of 1,705 (US census/Cannon Beach website). It is a popular tourist destination along the Oregon coast and home to the iconic “Haystack Rock.”



Figure 1.6

The city's history begins with Native American settlement. The Lewis and Clark Expedition travelled to the area in 1806, followed in the late 1800's by American settlers. The city was incorporated in 1957 and retains much of its historic character. Aesthetics are important to the people of Cannon Beach; they pride themselves on their small town character. A rigorous design review process is required even for small renovations. There is an abundance of weathered wood shingles on most homes, businesses, and even the civic buildings such as the city hall and fire station. Though this material gives an overall architectural flavor to the city, it also makes it difficult to distinguish important buildings as landmarks. Chain stores and fast food have been discouraged from building in Cannon Beach, in favor of small establishments with a more local character. Unique art installations, hand-carved benches, and custom garbage cans give the downtown a recognizable sense of place.

GEOGRAPHY

The city of Cannon Beach is approximately 4 miles in length, from north to south along the Pacific Ocean. It is reached via Highway 101, with sloping hills along its east side. Elk Creek is an inlet that cuts into the northern edge of the city and is crossed by a small bridge. The main downtown tourist area is located in this zone, with a few public beach access points. The sewage treatment facility, a series of open ponds, takes up much of the land to the east of downtown and makes pedestrian passing impossible. Further south, the land slopes up to a tall hill, which separates the city into two areas. Tolovana Beach State Recreation Site is located to the south, and is the second main beach access point. Hemlock Street is the main street, situated a few blocks east of the beach. Most shops, restaurants, hotels, and city landmarks line this street. Ecola State Park is a significant recreation destination, just north of the city limits.

INDUSTRY

The only significant industry in the small city of Cannon Beach is tourism. There is an abundance of small hotels, rental homes, and tourist amenities such as restaurants and retail.

DEMOGRAPHICS

With only 1,705 full-time residents in Cannon Beach, many of the homes are second homes or rental properties. The city hosts over 750,000 visitors annually and on special event days, such as the June Sandcastle Contest, which was inaugurated as a result of the 1964 tsunami, the number of visitors can exceed 15,000. The average median income is relatively high for the area at \$39,271.

For a description of Cannon Beach's innovative disaster preparedness and awareness efforts, see community meetings notes in section 2.4.



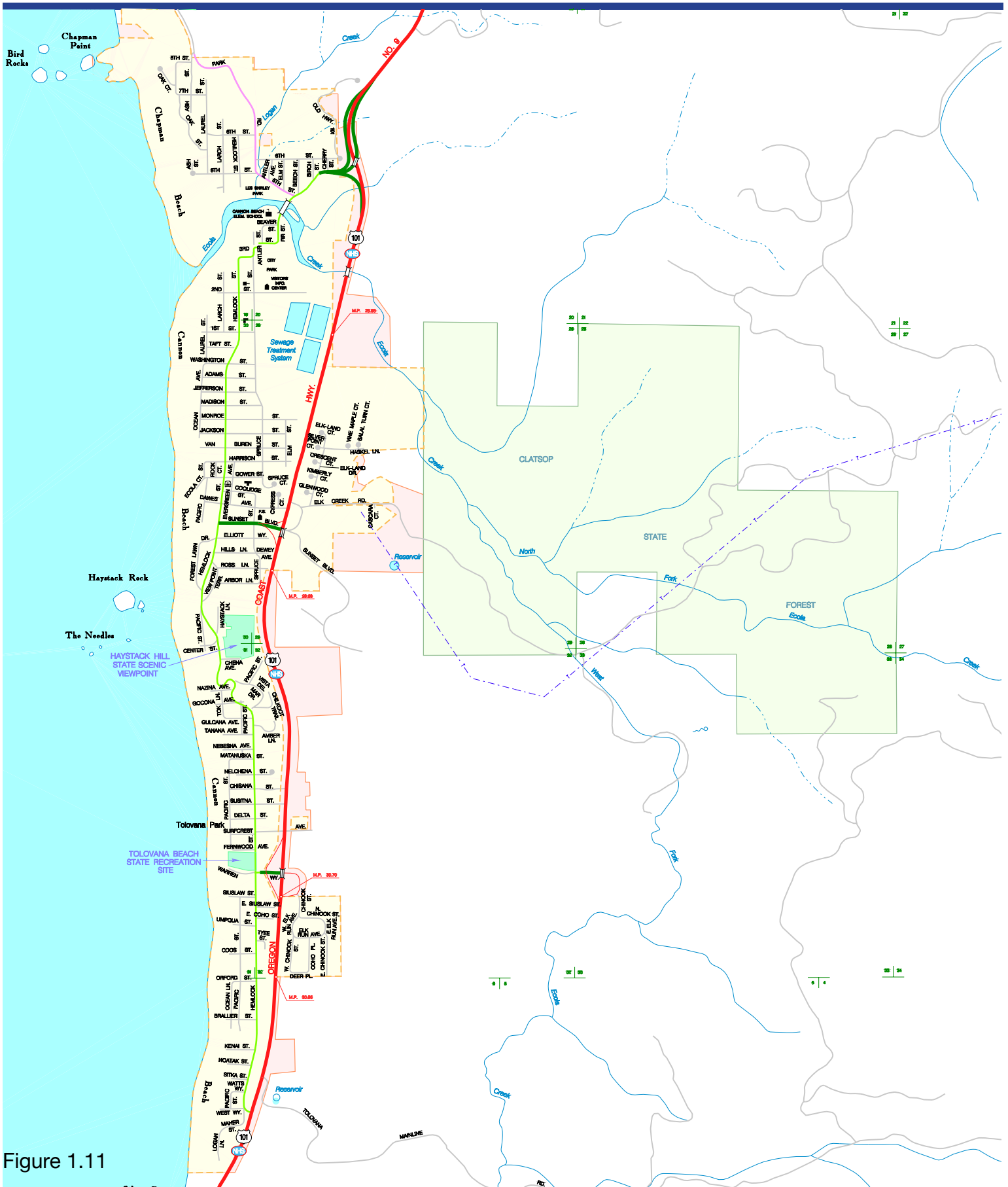


Figure 1.11

1.5 THE NEED FOR TSUNAMI ESCAPE WAYFINDING

Cannon Beach like many other coastal towns along the West Coast of the US along the Pacific Ocean is in danger of a tsunami event that may occur any time. Since two major tsunami events occurred recently in the Indian Ocean (2004) and more recently in Japan (2011), many officials and concerned citizens have become acutely aware that such an event will hit the Oregon Coast and that many of the cities such as Cannon Beach are unprepared. Oregon is currently in the midst of preparing itself for a large tsunami that could be caused by a major subduction zone directly in front of the coast, where two tectonic plates meet in active movements, thereby creating small to sometimes very big earthquakes and consequently tsunamis in a similar range of scales.

Although conditions cause different cities and organizations to have mixed feelings about how to properly address some of these issues, it can generally be agreed that there needs to be a greater push for these cities to become tsunami ready. This complex issue does not have to be solely addressed through updated signs and louder sirens, but will take an interdependent network of public and private organizations working together to implement a more robust evacuation plan and wayfinding system.

Cannon Beach is a small town on the Oregon Coast, with a vested interest in improving a well established plan, public infrastructure, and wayfinding/signage system to ensure an effective evacuation during the event of a tsunami. It has undertaken effective studies to evaluate evacuation routes and times and has done well to provide resources at points of safety. Engaged community members meet monthly to work on awareness and preparedness and the city conducts at least two evacuation practices each year. While the city believes itself to be tsunami ready, they seem to have a strong desire to evaluate and exercise their plan in order to find opportunities for improvement as well as innovate to inspire other coastal towns to follow suit.

Again, tsunami readiness can be thought of in three phases: prepare, evacuate, rebuild, or more simply put: before, during, and after. Preparation is possibly the most important stage, and should focus its efforts on awareness and education. The most dangerous threat to an evacuation is not knowing what to do. Evacuation during an earthquake and tsunami event requires clarity of routes, signs and symbols. If signage is not visible, clear, and intuitive, it is ineffective and potentially a hindrance to safe evacuation. Rebuilding after an event is what helps a city to move forward and grow after a disastrous event; it starts the minute after people reach safe ground. All too often, communities are held in disrepair for many years after experiencing one of mother nature's most serious phenomena.

By working in these stages, a series of moves can start to become a complex and robust system, instead of being a conglomeration of individual practices that may or may not work together. Some proposals in this report were designed to fit the needs of Cannon Beach, but their formation into a system that addresses tsunami readiness before, during, and after the event can be used to improve tsunami evacuation wayfinding for any city.

This report and guidance document includes an evaluation of existing conditions, a series of designs

based on precedent study and on-site research, a documentation of tests to evaluate effectiveness, and a range of proposals that are intended to improve tsunami evacuation and wayfinding. Tsunami readiness goes beyond wayfinding, it goes beyond a package of self help survival, it goes beyond a safe assembly area, but it rather addresses the city and its infrastructural system as a whole and all of the necessary things that go into effectively getting people up and out to safety.



Figure 1.12

1.6 PROJECT PARTICIPANTS AND STAKEHOLDERS

The Up and Out project is a team effort, made possible by the joint efforts of many, who each served a specific role. The PUARL project team is a group of designers, researchers, faculty, and graduate students from the University of Oregon's School of Architecture. They serve as the investigators and authors of this guidance document. Collectively they bring a background in urban design, disaster response architecture, process thinking, and pattern language to the topic of tsunami escape wayfinding. For biographies and roles of the team, please see appendix section 7.1.

The project was greatly influenced by input from a diverse group of stakeholders from many Oregon cities. Their stories, advice, and feedback on the design and pattern development shaped the final guidance document and the focus of research throughout the project. This varied group of citizens, city government officials, private business representatives, tourists, and experts served as advisors. They helped in the design team's refinement and understanding of the real world problems that get in the way of effective tsunami escape wayfinding.



Figure 1.13

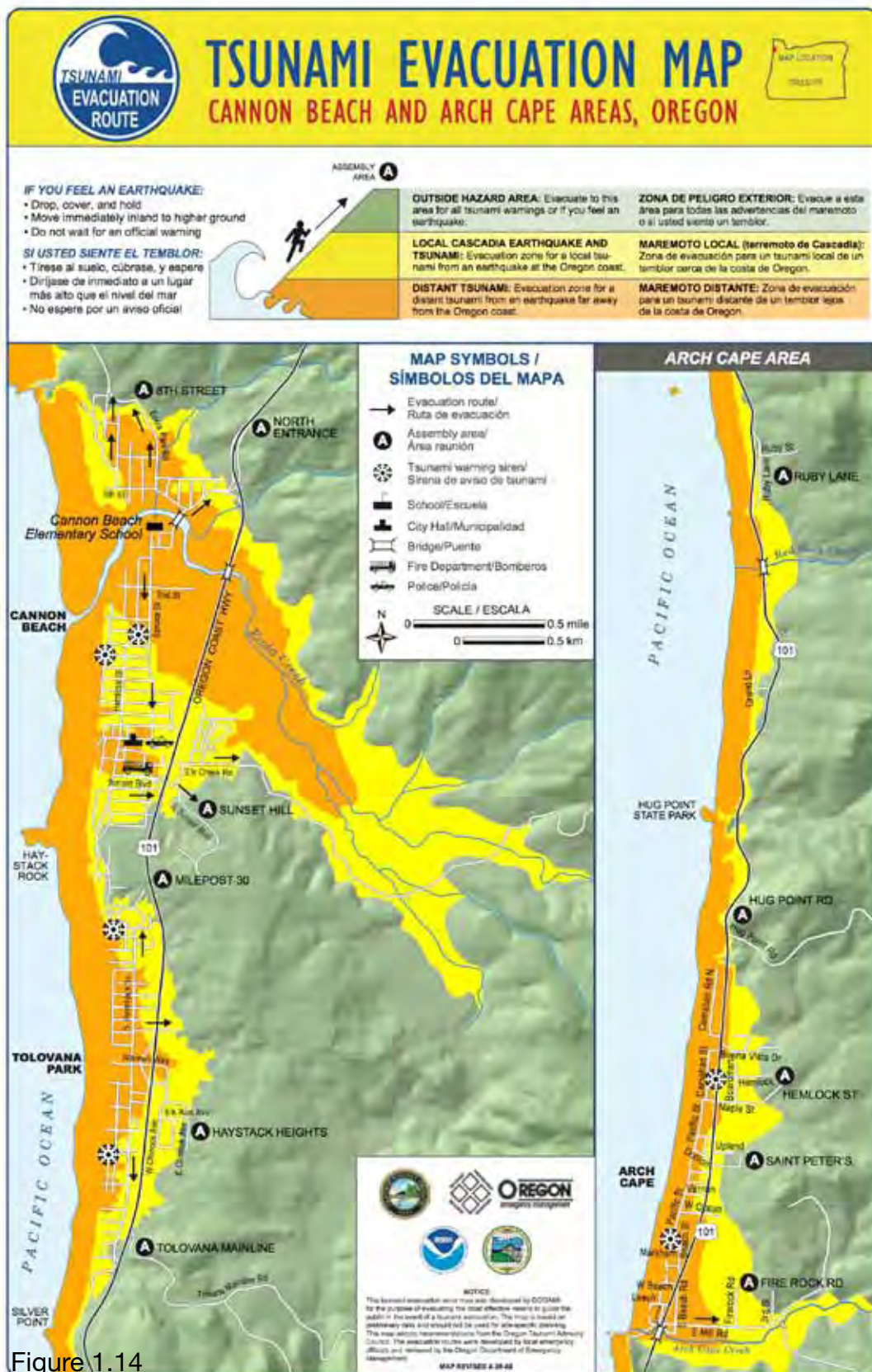


Figure 1.14

1.7 CANNON BEACH STAKEHOLDERS

Cannon Beach is the coastal city that served as a case study location for the project; a place to understand the specifics of a wayfinding system through analysis and test designs for a small city. Participants from this city include city officials, experts, citizen volunteers, and tourist passersby who gave opinions for on-site testing for signage and wayfinding elements. As an especially small-scale, affluent, and organized city, many of the wayfinding elements in this project reflect advances made by the partnership between private and public planning efforts in Cannon Beach.

The chart to the right describes the team's understanding of the groups of people in Cannon Beach that have a stake in improving the tsunami escape wayfinding system. It is a tool that helps analyze the strengths and weaknesses of each group in regards to quickly escaping from a tsunami. The last column notes how the specific design proposal responds to each. For example, in this city there is a significant population of tourists who need to be able to understand how to escape. These people have different needs than residents, because they don't already know the best routes, and rely more on signage (during an event) or overt awareness campaigns or information stations (before an event) to build up their cognitive maps. Most of the anchors of the community such as schools and hospitals have already been relocated to safer ground.

The 'Relocate to High Ground' strategy would be a lower priority than creating recognizable wayfinding signage and awareness for tourists. Stakeholders such as the Cannon Beach city government, ODOT, and local chamber of commerce have ongoing responsibilities for upkeep, street improvements, and mechanisms in place for communicating with citizens. Therefore, there is an opportunity for wayfinding improvements to dovetail with existing efforts these people are doing to make some of the suggested changes come to life. As a result of thinking in this way, the custom combination of design elements for Cannon Beach were able to make a more robust system that considers the needs of many different types of people.

See section 4.4 for a blank stakeholders chart and instructions on how to use it to analyze the project participants in other coastal towns.

Type of People	Subtype/ Description	Your city's specific groups or locations	(When Impacted) Before	During	After	Notes/Description (What priorities or special considerations will you take in your wayfinding design element selection and use of the pattern language)
Residents	Live on the hill				x	Organize cache sites and private safe houses to provide extra supplies to survivors
	Live in the city			x	x	Follow the leader, train to lead tourists
	All residents when at the beach		x	x		My personal escape route, tsunami app, information station kiosks
	2nd homeowners			x		Empty houses act as safe houses
	Animals/ pets			x	x	
Tourists, Employees, & Visitors (T.E.V.'s)	Daytime visitors		x	x		City-funded cache supplies
	Overnight visitors		x	x		Night time wayfinding, primary route lighting
	Business employees, truck delivery		x	x		Businesses as leaders/ follow the leader.
	Large venues or assembly structures	Christian Retreat Center			x	Prepared with supplies and triage elements
	Special events visitors	5k fun run, castles event	x	x		Tsunami App, awareness at the beach, awareness for cognitive mapping
	From Portland			x	x	Islands of survivors
	From rest of Oregon			x	x	
	From international or out of state		x	x		Considerations for new signs including symbols over words where possible
Industry	Business owners	Cannon Beach Chamber of Commerce	x		x	Considerations for public/private partnerships, multi-purpose infrastructure
	Tourists	Visitor's Center	x		x	Vertical evacuation tower as tsunami preparedness center or visitor information center
	Rental property owners		x		x	Provide personal map information to renters
	Hotels		x	x		Follow the leader
	RV parks			x		Follow the leader
	Campground	Wrights for Camping		x		Follow the leader
City Agencies and Groups	City officials and representatives from	Emergency Preparedness Committee, including container sub-committee	x		x	Emergency preparedness sites, cache sites
	Tourism and Arts Commission		x		x	
	Fire & Police		x	x	x	
	State Parks	Ecola State Park			x	
Vulnerable Populations	Children	CB Children's center and preschool	x	x		Relocate to high ground/ land use
	Elderly	Senior centers/ retirement facilities.	x	x	x	Relocate to high ground/ land use
	Poverty	Clatsop Community Action, (community food services)		x	x	City-funded cache supplies
	ESL	Many service employees: Spanish language	x	x		Considerations for new signs including symbols over words where possible
	Blind		x	x		Multi-sensory signage
	Deaf		x	x		Multi-sensory signage
	Wheelchairs		x	x		Relocate to high ground/ land use
	In the hospital	No hospital in CB				N/A
	Homeless, transient, churches, soup kitchens		x	x	x	
	Native American population		x		x	Land rights to the area near the school. (Considered for berm). Undevelopable.
Aesthetics	City Planning, Design Review Board		x		x	Multi-purpose infrastructure
	Architecture firms		x		x	
	Artists groups, galleries		x		x	
Environment	Wetlands, Dunes, Beaches	Friends of Haystack Rock	x			Information Station, provide info with tsunami info
	City Parks & Trails	Public Works: Parks Department	x			Multi-purpose infrastructure
Infrastructure	City Public Works		x	x	x	Implementation of preparedness efforts
	ODOT/ Roads Commission		x	x	x	Signage
	Wastewater Treatment Plant				x	Route planning
	Electrical			x	x	Preventing route debris by placing lines underground can ensure route safety and lessen the need for repairs to infrastructure after a disaster
	Bridges/ Civil Engineering		x	x	x	Construction of pedestrian bridge to allow for access to high ground from vulnerable downtown locations

1.8 EXISTING TSUNAMI RELATED EFFORTS



Figure 1.15

Several different agencies are actively involved in preparedness for the Cascadia subduction zone earthquake and subsequently the possible occurrence of a tsunami due to this earthquake. They are working together to help Oregonians become ready for emergencies by bringing diverse skill sets, and a passion for helping communities and families, to send their message of disaster preparedness.

Efforts currently underway by the Oregon Office of Emergency Management (OEM) and other government agencies and city administrations relevant materials and documents that helped us to quickly understand the problem and also find the state of various current efforts in relevant signage layout, tsunami escape and evacuation, and other types of documents from other states, such as the 'Safe Haven Document,' from Washington State.

Department of Geology and Mineral Industries (DOGAMI)

DOGAMI has been working with coastal communities on tsunami awareness and preparedness for over a decade, making Oregon a national leader in tsunami education and mitigation. (DOGAMI) in Portland has a wealth of recent scientific reports and historical information on tsunamis and earthquakes in Oregon. DOGAMI is also leading a technical team of researchers and scientists using the latest technology in terrain mapping (lidar) and computer simulation to produce new tsunami inundation and evacuation maps for the entire Oregon coast and relative earthquake hazard maps for most larger coastal communities. Cannon Beach served as the initial test site for this effort. Below are Cannon Beach inundation and evacuation maps. DOGAMI is continuing to expand on the important ongoing research and mitigation efforts that will help minimize the effects of coastal geologic hazards.



Figure 1.16

Oregon Office of Emergency Management (OEM)

The Oregon OEM has established a Distant Tsunami Response Working Group to create a standardized response to a distant tsunami on the Oregon coast. The goal of this group is to look at current processes and produce recommendations for state agencies and local communities to better react to a distant tsunami warning, watch or advisory. The purpose of the Oregon Coast Visitor Tsunami Awareness project is to improve the visitor's awareness of the tsunami hazards and to support the hospitality industry on the Oregon coast in becoming more prepared for tsunami events. This tsunami brochure is a part of this local awareness campaign (fig 1.15).

Federal Emergency Management Agency (FEMA)

FEMA is a member of the National Tsunami Hazard Mitigation Program (NTHMP) Coordination Committee, which is chaired by NOAA and includes representatives from federal, state, local and tribal governments. FEMA also coordinates tsunami efforts with NOAA and the U.S. Geological Survey through the National Earthquake Hazards Reduction Program. FEMA also advocates and assists with multi-state projects and activities where appropriate in scope. The products and activities include assisting at-risk communities to become "Tsunami Resilient Communities."

FEMA's training programs for emergency managers address issues such as planning, community warning, evacuation, and public awareness. These are important elements in addressing tsunami risk. FEMA works with other Federal agencies and the States to provide technical assistance to local jurisdictions. Depending on the needs and resources of each community, this assistance ranges from guidance on evacuation planning to information on how to assess and mitigate the risk from tsunamis and other hazards. FEMA's technical manuals provide design and construction

guidance for reducing damage to coastal structures caused by flooding, much of which is applicable to tsunamis. FEMA is responsible for mapping flood hazards in communities across the country. To help link flood mapping to the tsunami hazard, FEMA's National Flood Insurance Program (NFIP), NOAA, and USGS, FEMA produces public education materials on tsunami preparedness, mitigation, and response.

National Oceanic and Atmospheric Administration (NOAA)

NOAA is an agency whose mission is to improve life through science. Their tsunami related efforts aim to improve Detection, Warning, and Awareness. As part of NOAA's responsibility as head of the NTHMP, NOAA's National Weather Service (NWS) manages a 24-hour tsunami detection and warning system that issues tsunami warnings to government authorities and the public. The agency operates two tsunami detection and warning centers that continuously monitor data from seismological and tidal stations for the Pacific Rim.

Tsunami Ready Program

The TsunamiReady Program, developed by NOAA's National Weather Service in 2001, is another integral part of our nation's preparedness for a catastrophic disaster. This program is designed to help cities, towns, counties, universities and coastal areas more broadly reduce the potential for disastrous tsunami-related consequences. TsunamiReady has helped community leaders and emergency managers strengthen their local operations with clear readiness guidelines, making communities better prepared to save lives through better planning, education and awareness. For example, one of the guidelines for a community to become TsunamiReady is to have multiple ways of receiving Tsunami Warnings, such as utilizing FEMA's National Warning System (NAWAS).

National Tsunami Hazard Mitigation Program (NTHMP)

The NTHMP is a partnership between NOAA, the United States Geological Survey (USGS), FEMA, and 28 U.S. coastal states, territories, and commonwealths to raise tsunami awareness in coastal communities. Analyzing the earthquakes and tsunamis that has occurred over the years brought to light the general lack of tsunami preparedness and hazard assessment for the U.S. west coast and the need for significant improvement in tsunami detection and forecasting. The NTHMP is designed to reduce the impact of tsunamis through hazard assessment, warning guidance, and mitigation. NTHMP Hazard Assessment works toward the production of tsunami inundation maps, based on long-term tsunami forecasts, for use in community planning, standardized data archives, and the understanding of historical tsunami events.

Oregon Tsunami Hazard Mitigation Program (OTHMP)

This program provides the next generation of tsunami inundation maps along the state's 362 mile long Pacific coastline. The primary goal of Oregon's five-year plan (2009 to 2013) is to reduce loss of life and property damage from tsunamis. Two other components of the program involve development of mitigation products that promote community preparedness and implementation of a coast-wide, volunteer-driven education and outreach initiative to support the National Weather Service's TsunamiReady program.



Figure 1.17



Figure 1.18



Figure 1.19

Sources:

OEM, http://www.oregon.gov/OMD/OEM/Pages/about_us.aspx

FEMA, <http://www.fema.gov/>

NOAA, <http://www.noaa.gov/>

OHTMP, <http://www.oregongeology.org/tsuclearinghouse/thmp.htm>

NHTMP, <http://nws.weather.gov/nthmp/>

DOGAMI, <http://www.oregongeology.org/sub/default.htm>

1.9 WAYFINDING GUIDANCE DOCUMENT

The final outcome of this community oriented service project and research work will be presented as a Guidance Document. It is intended that the Guidance Document helps local communities, neighborhoods, and citizen to learn more about tsunami evacuation wayfinding, and to take initiative and prepare for the event of a tsunami.

“Utilizing comments and edits provided by OEM and local staff, PUARL will prepare a final Guidance Document. Once complete, PUARL will provide digital print and web ready versions of the plans. In addition, PUARL will upload a final version of the plans to the PUARL website and will submit the plans (and report) to the UO Scholars Bank for posting. Participants from OEM and PUARL may use the information gathered during this process for publication and presentation purposes, in coordination with other participants. The final document will be considered to be in the public domain. OEM will print a one-time limited amount of 500 copies of the final document for distribution.”

The Tsunami Evacuation Wayfinding Guidance Document consists of a final report and an online presentation. The essential elements of the Guidance Document are contained in the following three sections of the report:

- The Cannon Beach Field Study and Project Research
- The Tsunami Escape Wayfinding Pattern Language
- Process and Sequences: The Urban Game
- The Astoria Charrette

The Cannon Beach Field Study and Project Research

The coastal Municipality of Cannon Beach served as our main field study project to learn and understand the existing tsunami escape and wayfinding arrangements, provisions, infrastructure, and organization. Cannon Beach also served as a place to understand what works and what does not work with regard to escape wayfinding and signage, critical points, and bottlenecks. It also served as a place of developing ideas for improvement of existing arrangements, and coming up with totally new and unusual design ideas of how to improve evacuation and wayfinding in a tsunami situation.

The Tsunami Escape Wayfinding Pattern Language

In order to generalize specific problems and solutions in a way that one can understand these problems and solutions in an archetypal fashion, a Survival Pattern Language was developed. A Pattern Language is a collection of patterns that describe archetypal (general) situations that is repeated in the world, and proposes a solution to such an archetypal situation. Once an archetypal solution has been found, their solutions can be expressed in many different phenotype (specific) formations.



Figure 1.20

Process and Sequences: The Urban Game

Process and Sequences are important in the Guidance Document because of several reasons. First of all, wayfinding is a process in sequence, and second, they provide a network of wayfinding and escape that can also be understood as a process and sequence. In particular, our Urban Game will show a kind of design process in which particular urban elements can be introduced one by one, thereby creating the infrastructure for urban tsunami escape and wayfinding.

The Astoria Charrette

The Astoria Charrette was critical in this process in connecting up with various representatives of municipalities along the Northern Oregon Coast, stakeholders, citizen, officials, and government agencies, to test and develop ideas and improvements for evacuation wayfinding. Much of the presentation was provided in a PowerPoint format, that will form the basis for an improved website presentation.

Electronic Guidance Document

In addition to the essential elements of the Guidance Document in the Final Report, an online, electronic presentation will complement and complete the documentation.



Figure 2.1



2. Cannon Beach Field Work & Observations

- 2.1 Problem
- 2.2 Wayfinding Definitions
 - Term Definitions
- 2.3 Research and Design Methods
 - Literature & Precedent Study
 - Interviews
 - Community Meetings
 - Site Visits
 - Design
 - On-Site Testing
 - Charrette
- 2.4 Observations, Theory, & Findings
 - 2.4.1 Human Behavior in Disaster Events
 - 2.4.2 Signage Theory & Precedents
 - 2.4.3 Process & Sequence
 - 2.4.4 Sequence Theory
 - 2.4.5 Urban Landmarks & Image of the City

- 2.4.6 International Case Studies & Stories
- 2.4.7. Existing Oregon Tsunami Coastal Signage, Mapping and Wayfinding Systems
- 2.4.8 Site Visits, Interviews, & Community Meetings
- 2.4.9 On-Site Testing
- 2.5 Final Remarks

2.1 *PROBLEM*

A tsunami caused by a large earthquake on the Cascadia fault line is an imminent threat that may impact thousands of people on the Oregon Coast sometime in the near future. While extensive efforts are constantly exercised on a community, city, and state level, an intuitive and comprehensive system for tsunami evacuation wayfinding has not yet been realized. Coastal residents and visitors need a more robust wayfinding system that provides them with the tools to prepare, evacuate, and respond to a life threatening tsunami.

Oregon lacks an intuitive and comprehensive wayfinding system that aids both residents and visitors to escape to safety from a Cascadia tsunami event. Though some resources exist, they are not sufficient to adequately prepare for escape from a tsunami disaster. These standardized wayfinding-related resources include the Oregon Department of Geology and Mineral Industries [DOGAMI] evacuation route maps for coastal cities, and general 2D signage standards for evacuation routes and assembly areas. However, widespread tsunami awareness efforts, signage, and other wayfinding strategies are not coordinated between cities, regions or states. Individual efforts and innovations are not shared between municipalities. Resources for implementation of design ideas to improve poor wayfinding conditions are scarce, and the burden often falls on individual municipalities to fundraise or self-build. The tourism industry is a major force in coastal communities and can slow improvement of tsunami awareness since escape tools are often perceived as fear-inducing. Overall, the wayfinding challenges facing coastal towns are widespread and varied.

To solve these complex problems, a wide array of creative alternatives to signage are needed to best reach the diverse populations that live, work, and play on the Oregon Coast. To create an effective evacuation path, the PUARL group recognized that a tsunami event needs to be broken up into the three most crucial phases: before an event, during an event and after an event. In order to address the wayfinding proficiency on the Oregon coast, current systems needed to be tested, stakeholders needed to be consulted and overarching issues needed to be distilled into universal solution proposals that can lead to specific innovations.

Through a series of tests, public interviews and design charrettes, the team produced a diverse palette of creative design strategies that create a visual language to convey an evacuation path. These solutions provide a range of options in cost, ease of construction/ implementation, aesthetic style, complexity of technological requirements, media, and purpose: (escape route, temporary safety, awareness).

The remainder of this section addresses the methods used in our study, a summary of research process, and conclusions drawn that influenced the design of our proposals.

2.2 DEFINITIONS

Wayfinding and Tsunami Escape Wayfinding

To understand the problem of wayfinding in the event of a tsunami, it is important to first see how the human mind and environment work together to guide us from one place to another. The definition of these terms describe our project's specific moment of intervention into the much larger topic of tsunami disaster awareness, response, and recovery.

*"**Wayfinding** is the process of determining and following a **path** or **route** between an origin and a destination. It is a purposive, directed and motivated activity."* In a Tsunami Escape Wayfinding event limited time to escape in a known or not known environment becomes the critical additional factors. Night and bad weather conditions may add to the critical time condition.

*"**Wayfinding** may be observed as a **trace** of sensorimotor actions through an environment. The trace is called the route. The route results from implementing a **travel plan**, which is an a priori activity that defines the sequence of segments and turn angles that comprise the path to be followed."* In a Tsunami situation these paths become evacuation paths. They have to be especially well prepared before a coastal tsunami event for wayfinding and evacuation.

*"The **legibility** of a route is the ease with which it can become known, or the ease with which relevant cues or features needed to guide movement decisions can be organised into a coherent pattern. **Legibility** influences the rate at which an environment can be learned."* Legibility must be very clear in tsunami situations. (signage).

*"**Legibility** influences the rate at which an environment can be learned (Freundschuh 1991). Repeated path following facilitates remembering the path components recalling them for later use."* Feasible evacuation paths should be learned by all citizens and visitors of a town before a tsunami event actually occurs.

*"Paths or routes are represented as one-dimensional linked segments (in maps) or, after integration with other paths, as **networked configurations** (i.e. in maps)....along with landmarks, the spatial relations among them.... make up the remembered layout of an experienced environment."*

*"The **non-verbal wayfinding** process requires two kinds of information, the ability to create a '**mental map**' about the environment, and feedback on one's current location within that mental map during the trip." (Smitshuijzen) This feedback might take the form of visual cues or reference points to ensure a traveller that he is going in the right direction."*

*"**Route learning** and route following strategies help build up **cognitive maps**. Cognitive maps are the internal representation of perceived environmental features or objects and the spatial relations among them."* Cognitive maps are very critical for residents of a tsunami location to learn and build up mentally, while visitors have to rely primarily on actual maps and legibility of clearly marked tsunami escape routes.

Wayfinding and Tsunami Escape Wayfinding are fundamentally very similar, but they are also very different. For human wayfinding, when traveling over roads or tracks, either physical maps or cognitive maps can be used. Other instruments or techniques are generally not used unless a trip is planned through an unfamiliar area.

Tsunami Escape Wayfinding is Human Wayfinding in high stress situations that requires additional instruments, means, and techniques to find safe grounds in a very limited period of time, potentially at night or difficult weather conditions or both.

In conclusion, these terms and elements should be used to guide the design of a robust and redundant tsunami escape wayfinding system.

Key design considerations include:

- Cognitive maps are essential for residents of a tsunami danger zone
- For visitors, physical maps and public posting of clear information is critical
- For tourists and visitors clearly legible escape routes are critical
- For different kinds of disadvantaged populations, residents and visitors alike, clearly established and legible escape routes are essential for having a chance to escape the local coastal tsunami.

Source: Wayfinding after Reginald G. Colledge (see Bibliography)

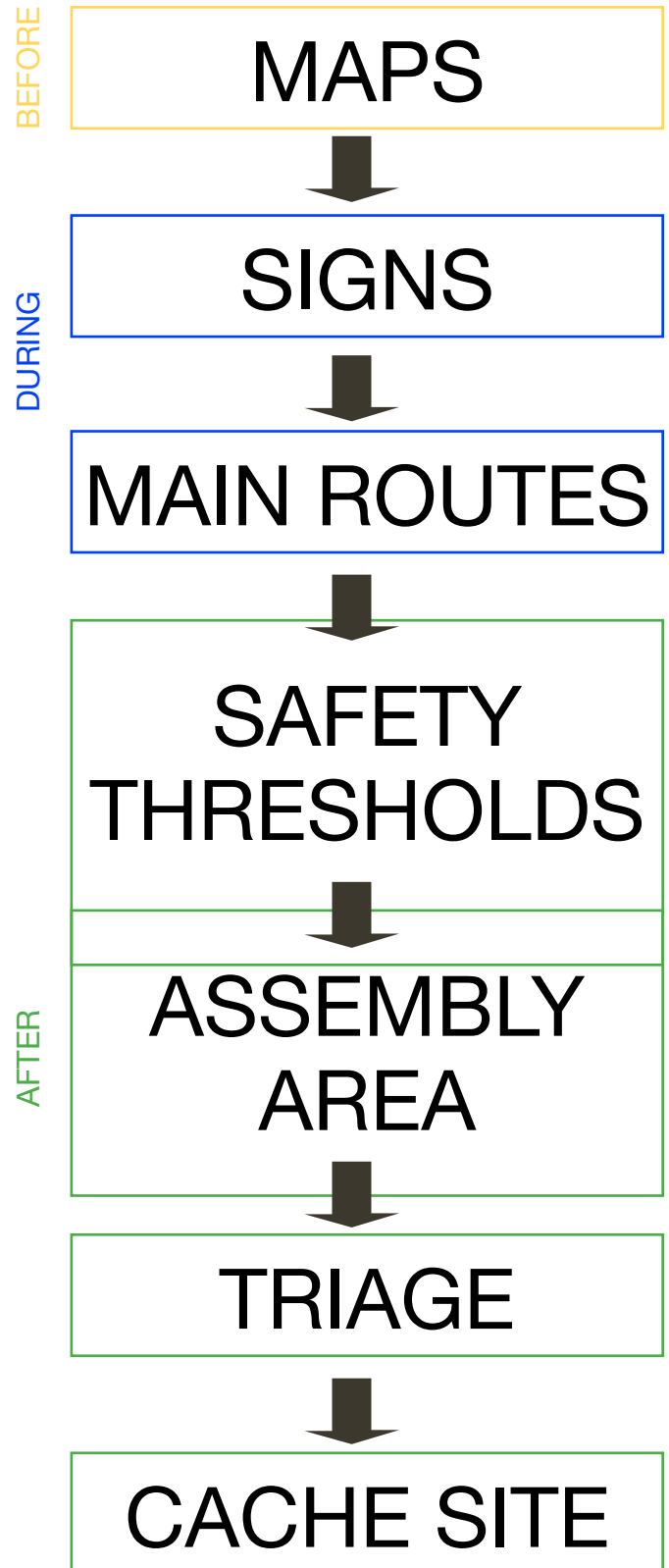
TERM DEFINITIONS

The Wayfinding Chain

The wayfinding chain is a series of elements in the environment that aid an evacuee in the process of moving from a starting point to safety during a tsunami event. For the purposes of this project, the PUARL team has broken the process of tsunami escape wayfinding down into before, during, and after phases. (For more on phases, see section 2.6). Within each of these phases, there are particular design elements that are traditionally thought of as wayfinding aids, such as signs. We have expanded beyond signs to include many other elements, it is also adaptable for expansion to include any other creative elements that help a person escape quickly and safely.

They are organized by time. Rather than moment of implementation (the time when it is installed or planned) the chain is arranged by moment of impact (the time when a person would interact with the element on their way to safety after an event). The wayfinding chain is a logic tool that cities can use to guide their group of decision makers' thinking about the process of wayfinding in a tangible way, and beyond 2D signage alone.

As a whole, we emphasize the importance of the connections between these wayfinding elements, their legibility as a system, and the idea of redundancy. That is the idea that if one part fails, which is likely in the chaotic situation after a disaster, some other element can back it up. This is what we mean by 'a robust tsunami escape wayfinding system'.



TERM DEFINITIONS

Tsunami Event:

A destructive wave that is caused by a local or distant earthquake. Damage is caused by both the outward and inward flow of water, the shaking of the earthquake itself, and the liquefaction of the earth. The combination of these elements in sequence from the moment the ground starts shaking to the moment the wave recedes, make up the tsunami event.

Stakeholder:

A person, group of people, or organization with a vested interest in a topic. People who will be impacted by decisions or actions made. In our case, stakeholders are those who will be affected by tsunami escape wayfinding in the before, during, or after phases. Examples include residents, tourists, business owners, land owners, city and state officials.

Community:

All of the people that live, work, or play in a place. Together they can find the power to make changes in their environment. Beyond geography alone, community has a social aspect. Strong communities are made so by diversity and intensity of bonds between people. In this way, community is both intentional and unintentional. A healthy sense of community is most important to develop in the time before a tsunami strikes, and can make the difference between life and death.

Pattern:

A pattern is a careful description of an open-ended solution to a recurring problem within a context. Each pattern describes a problem that occurs over and over again in our environment, and then describes the core solution to that problem in such a way that you can imagine many iterations with endless variation.

Pattern Language:

A series of patterns that are selected and composed as a system. Like a language, each pattern is like a word that fits into a larger sentence to express a unique thought. A pattern language is a tool that non-design professionals can use to solve local design problems. It is a process that orchestrates the needs and ideas of many community members into a unique design solution with many parts.

Intuitive:

The ability to understand something immediately, without the need for conscious reasoning. In wayfinding, this is a factor in human behavior and cognitive mapping.

Redundancy:

The inclusion of extra components that are not strictly necessary to functioning, in case of failure in other components. For example, the weaves of a basket are redundant. If a few weaves fail, the basket can still serve its function because others can pick up the slack.

2.3 RESEARCH & DESIGN METHODS

While methodology deals with the logic and reasoning of methods applied, methods are the application of ways and approaches to find out about a particular subject or ways to design a particular project. In our wayfinding escape tsunami project we applied a variety of methods in the analytical phase as well as in the synthetic or design phase.

Literature & Precedent Study

In the initial phase we studied books and reports that were relevant to both the analytical as well as the design phases. We collected and reviewed local sources from Oregon OEM, FEMA's general tsunami resources, and the work of local municipalities. Experiences and precedents from other countries were also reviewed, including the recent 2011 triple disaster of earthquake, tsunami and nuclear disaster in Japan and the 2004 Indian Ocean earthquake and tsunami, which impacted countries around the Indian Ocean.

Interviews

Another key method of exploring tsunami evacuation and wayfinding consisted of talks with numerous people of different types. These included professionals, specialists, citizens, and people with different kinds of needs. Because much of the efforts currently underway on the Oregon coast are locally driven and implemented by municipalities themselves, this method resulted in the collection of a range of interesting solutions that have never previously been compiled in one place.

More organized discussions with various kinds of earthquake and tsunami specialists were conducted either in person or by phone. In these discussions we experienced a wealth of knowledge that helped us in our work. These experts were professionals in the emergency management field, professions related to urban design and the built environment, or were long-time volunteers in the local efforts related to tsunami preparedness on the Oregon coast.

The team asked each expert a series of standardized questions, followed by open conversation:

1. Tell us about your work/ role.
2. How you see the problem of emergency Tsunami wayfinding on the Oregon Coast.
3. Who else should we talk to on the topic?
4. Do you have any specific Cannon Beach design considerations?
5. Are you aware of any interesting strategies for tsunami wayfinding, locally or otherwise?

Much anecdotal and informal information was gathered via this method, especially instances of signage and small-scale grassroots interventions that cities are doing on their own to improve their wayfinding system. However, our information may be skewed by our focus on Cannon Beach which is much smaller and more affluent than the average coastal town, and is economically reliant on tourism as their only industry. They are also more advanced in their tsunami response program, and have a high level of coordination between the public and private sectors, and have a remarkably well-established tsunami preparedness citizen committee.

Despite efforts to prevent this, our interview data is influenced by the types of people we were able

to contact. Most disadvantaged populations are underrepresented in our discussions. See section 1.6 for a detailed taxonomy of stakeholders, or people to consider in the design of a customized tsunami escape wayfinding system. Future work should target more of these representatives for a more well-rounded understanding of the problem and potential solutions to the problem of tsunami escape wayfinding.

Community Meetings

The PUARL team attended public community meetings for two important, citizen-led committees for the city of Cannon Beach: the emergency preparedness [EPREP] committee, and the Preparedness Container [PRECON] sub-committee meeting for the month of July. Many of the same community members participated in each of these meetings, and are committed voices for the tsunami preparedness effort in the city of Cannon Beach. At the end of these events, we got a chance to discuss our project, and present preliminary ideas for their review and comment.

Site Visits

Another main method of study and design consisted in a number of site visits to our main locus of study, the town of Cannon Beach at the Oregon coast. On these visits we observed the current tsunami wayfinding and escape situation in Cannon Beach, and investigated experimental measures that this small, affluent city is currently testing.

We also went to other places to learn differences and similarities between different coastal towns. Visits included Astoria, Seaside and Newport, Oregon. Special attention was paid to current signage conditions, geographic barriers, and user populations. Whenever possible, we conducted informal interviews with local residents and visitors on the city's preparedness plan and unique wayfinding-related conditions and strategies being tried in their area. Precedent study from cities in California and Washington were also collected.

Design

Design methods applied include brainstorming and envisioning new ideas in wayfinding and providing infrastructural elements for improving such wayfinding. Simulation of process and sequences is another method that we applied successfully in various situations of wayfinding and escape. The Urban Game for the Cannon Beach is one kind of simulation of process and sequence that we report about in this document. An important design method in our work is described as the pattern language approach. Here we work with a problem – solution method that helps us to cover a large range of cases from more general to highly specific solutions. The results are reported in section 2 of our report.

On-Site Testing

Experiments and tests took up a large part of our work as methods of determining signage systems, and new designs of signage with regard to various aspects as color, form, shape, size element spacing, and other issues such as lighting methods on streets. These efforts often included full scale mockups of proposed physical interventions with actual properties represented. Whenever possible, we solicited opinions from passersby to help inform our understanding of how the signs will be

received by future users. Locations were chosen based on tourist popularity, nearby landmarks such as beach entrances or parks, and proximity to primary escape routes.

Experiential testing helped the team understand the emotional stresses and specific spatial context of the escape paths in our case study city of Cannon Beach. This included night testing, as described in 2.4.9.

Charrette

Finally, the charrette that we conducted at the end of this study can be called a method in itself. This event contained many other methods within it such as lectures, discussions, working with stakeholders and professionals on problems and solutions related to tsunami preparedness.

The community stakeholder charrette was a two-day event, held in Astoria, Oregon on July 29-30, 2014. It was administered and facilitated by architecture professionals and students from the Portland Urban Architecture Lab and the Office of Emergency Management. The purpose of this event was to educate, listen to concerns, get feedback on the team's design ideas, and generate new solutions for signage improvements and alternative strategies for wayfinding in the event of a tsunami event on the Oregon coast. The event's goals were to promote awareness of tsunami evacuation, specifically on the many urban design strategies that communities can implement to help people find their way to safety in a disaster event. We aimed to understand various stakeholder needs and priorities in different communities in regards to wayfinding, and worked together to generate design solutions that address these concerns.

Unlike a traditional design charrette for one specific site, our event targeted stakeholders from many different cities and rural areas along the Oregon coast. The city of Cannon Beach was used as a case study to explain concepts. Stakeholder participants included city officials and committee members, first responders, CERT volunteers, parks departments, ODOT, planners, emergency managers, and interested citizens. The communities of Gearhart, Warrenton, Astoria, Nehalem, Cannon Beach, Tillamook, Hammond, Seaside, Portland, Oceanside, Clatsop County, Pacific City, Sandlake, and Neskowin were represented.



Figure 2.2



Figure 2.3



Figure 2.4



Figure 2.5



Figure 2.6

2.4 OBSERVATIONS, THEORY, & FINDINGS

2.4.1 HUMAN BEHAVIOR IN DISASTER EVENTS

Individual people's experiences and reactions to a catastrophe impacts their chances of survival as much as the effective implementation of an evacuation plan. Each person and group differs in their natural response to an event. It is important to consider all of the human factors when creating evacuation and response plans in order to reach all types of people.

In a disaster situation the process of decision making, and the speed of subsequent actions make a big difference in human survival. Each disaster experience can be broken up into stages. The first stage is denial where people can often emotionally convince themselves that they don't have to evacuate. These feelings can often cause great delay and loss of important time needed to evacuate. Other times people weigh their risks and let denial tell them that it is better sit tight then try and leave. The second stage is deliberation where people have to decide what course of action to take. Some people let fear take over, causing a state of paralysis. This physiological response is an actual survival technique and can be successful when appropriate. Others are resilient and do not let the chaotic events cloud their judgement. Finally, some rely on groups or the actions of others to help them make decisions, even when it goes against their judgement. The final stage is the decisive moment in which people take action. Panic can cause people to make rash decisions. Paralysis is when people freeze and take no action at all. While an act of heroism can make an individual feel like they can save a whole group. These are examples of emotive responses are natural human reactions; innate survival instincts that kick in when faced with the terrifying experience of a natural disaster. Each stems from a chemical response, naturally ingrained through evolution, to cope with life threatening situations.

Stories and research help to make sense of survivor's experience with disasters. While it is hard to incorporate people's individual experiences, taking lessons from repeated actions in particular situations can in fact help planners take the human experience into account when designing systems for preparation, evacuation and response.

Through this research into human behavior in disaster situations, the PUARL team gained insight into the natural reactions of people who are escaping in the wake of the dual disasters of earthquake and tsunami. By factoring these behaviors in the design process, wayfinding improvement efforts will go farther to saving lives.

Source: Amanda Ripley (see Bibliography)

2.4.2. SIGNAGE SYSTEMS & INFORMATION GRAPHICS DESIGN

Definitions

A signage system is a series of signs that work together to guide users from one place to another. Information graphics are a visualization of knowledge in such a way that it helps people to quickly understand content and intuit patterns. Infographics are a type of information graphics. Symbols are distinct and separate graphic devices, and have the potential to graphically reach more viewers than language alone.

Basic Signage Functions

1. Info for orientation and preparation of a 'travel plan'
2. Facilities provided to guide along the way
3. Final destination clearly marked
4. Instructions that make the journey as easy, entertaining, and safe as possible
5. A hierarchical system of destinations with unique identities
6. Consistency and repetition in directional information
7. Surplus info or additional ways of conveying info is helpful (Smitshuijzen)

Elements of Signage

1. Size of the message matters
2. Basic products, materials, and techniques
3. Typography and typefaces
4. Pictograms and symbols
5. Illustrations and maps
6. Systems of measurement; the grid
7. Color
8. Interactive design

Types of Signage

The basic functional aspect providing wayfinding/navigational information.

1. Orientational: provides maps, directories, simple path structures, enhancing area recognition and transitions, erecting landmarks
2. Directional: all signs bearing an arrow
3. Instructional: legal, mandatory, security, and other instructions along the way
4. Destination identification: confirms arrival at final destinations

Signage is generally thought of as a two-dimensional, static way of delivering information, but it can also include technological elements such as sound, light, or other sensory signals. Considering signage as both two-dimensional and three-dimensional interventions may increase their effectiveness. Examples of alternative signage types include:

1. Inserts
2. Mechanical
3. Electronic display boards

4. Interactive touch-screens
5. Screen display
6. Digital signage

Sign Type Selection

When selecting a sign as a part of a signage system, the following elements should be considered.

1. Basic function of sign
2. Signage technology applied
3. Position in space, method of fixing
4. Size in relation to reading distance
5. Illumination
6. Requirements for impaired users
7. Level of vandal resistance

Sign Content

Signs must be visible but not distracting, informative but not unwieldy, and concise but not confusing. Color, typography, pictograms, and icons are all elements that can be varied and exploited to encapsulate as much information as possible and fit the job's requirements. The signage for a hospital, an airport, or a conference center may have little in common, and solutions must always be tailored to fit the location. According to signage and wayfinding design research, we learned that the shape, color, placement, size, and location of signs all play a pivotal role to their success as wayfinding tools.

Consider the sign's particular color combination, typography and size. In designing a particular sign, elements to consider include:

1. Text in one language
2. Text in multiple languages
3. Pictographic
4. Illustrative
5. Visual
6. Tactile
7. Audible
8. Olfactory
9. Electromagnetic signals

Sign Shape

1. Circle denotes regulation: prevention of an action
2. Triangle denotes warning: hazard/caution
3. Square denotes information: first aid+fire protection+emergency

Color

1. Red denotes prohibition

2. Green denotes danger, emergency, fire
3. Yellow denotes caution
4. Blue denotes information or miscellaneous
5. Black denotes obligation

Typography

A crucial factor in signage design & information graphics is the selection of typography. Typeface is essential in a signage system's clarity and functionality. The size and color of text in relation to other signage elements should also be considered.

Symbols

For an effective sign, symbols and icons should occupy no more than 50% of the color field.

Maps

Maps are a specific type of sign that describe one's location in space. When designing maps that are easily understood, the general signage recommendations such as typography, size of content, color, and placement apply. There are additional considerations for the design of maps for public posting or use, including. In map design, the most important thing is that the compass direction on the map matches that of the viewer. An 'exploded' or 'birds eye' views provide more visual info.

Signage Systems

A signage system is much more than just a set of signposts and symbols. It contributes a unique character to its surroundings and has the potential to enhance any built environment. Visual design concept is a theme or metaphor can be used as visual link between all the designs.

The systems concept considers the signage as a part of a larger system that impacts every facet of the built environment: site, parking, building, elevators, floor information etc. Developing locations for signs is an important concept that is essentially achieved through an on site walk through to identify where signage may be necessary for a new user. It is important to locate signs perpendicular to the direction of movement or traffic.

Consideration of multiple signs together, their spacing and relationship to each other is as important as the design of the signs themselves. In designing a system as a whole, the security created by using familiar forms should be combined with the excitement and attention generated by novelty. This balance will help the wayfinding system reach more people and save more lives.

Sign Placement

Sign placement into the environment are key elements in the design of a working signage system. According to Smitshuijzen, there are two spatial aspects to consider when placing signs. The first is the sign's position or location in a plane. That is, which direction a two-dimensional sign faces. Directly on the axis of traffic flow is best, but just next to the flow is a good alternative. Second, the placement, or position in elevation is important. This is placement in the cone of view of the average viewer relating to the sign. There are two major standard virtual bands are created for vision cone,

one around eye level of average visitor and other just above standard door height. For outdoor or

Process

When beginning the process of designing a signage system, first consider who the signage is for. What is the general physical or mental condition of users. Is the system primarily geared toward tourists, or residents? Are the people under stress because of a disaster situation in progress, or is the intention to catch public attention prior to a disaster? Consider the profession, function, and background of the users.

The signage decisions should use the “team concept” for graphic communications in the built world, where the process involves many affected individuals in the use, production, and execution of the signage. Consider signs in reference to as many of the contributors as possible: Owner, Architect, Engineer, User, Landscape Architect, Fiscal Administrator, Graphic Designer, Maintenance Manager, Space Planner, Builder, Environmental Psychologist, Fabricator, and Social Psychologist to name a few.

One method for determining the ideal types, locations and spacing of a signage system is to complete an imaginary walk through the site. In the case of designing a local tsunami evacuation wayfinding system, a real walk-through and the installation of mock-ups is one option for generating public excitement and community buy-in.

Implementation and Upkeep

In the process of designing a signage system, implementation factors such as method of , and method of fabrication, mounting or positioning in space, and maintenance and upkeep of signs should be considered. If vandalism or weathering is a problem for signs or wayfinding elements, install hardware or protective coatings. Once the system is in place, it is good practice to create and maintaining a comprehensive signage manual and database. This is important for knowing what signage is part of the system and to keep track of updates. A comprehensible signage manual should be produced that describes details on all the sign types. This document can be used by those involved in making updates to the system, and should contain accurate data on the locations, specifications, and sign types.

Source: Smitshuijzen

2.4.3 PROCESS AND SEQUENCE

Process and sequence is an important topic that was taken up by Christopher Alexander in his four volume treatise 'The Nature of Order.' In book II on the nature of process (The Process of Creating Life) he approaches process, and the flow of things as an essential part of our existence and life, quoting the ancient Greek philosopher Heraklith with such deep insights as: 'You cannot step into the same river twice.' Also the insight that we are always fundamentally placed in front of the question what to do next in our lives are important aspects of process. In a tsunami situation we are not only placed in front of such a question but we have to respond and act fast and precise in order to escape the tsunami and bring ourselves and possibly other to safety.

In terms of architecture and urban design, the book that works with insights from 'The Nature of Order' and is directly relevant for our topic is called 'A New Theory of Urban Design' that Alexander authored with Hajo Neis, Artemis Anninou and Ingrid King as co-authors. In this book processes and sequences of designing and building are the essential focus of investigation. Designing urban infrastructure for example, signage, streets and escape paths in a way that people can actually escape is the critical issue that needs to be addressed in our context.

Essential principles for the placement of urban infrastructure and urban design as well as architectural elements for effective evacuation and wayfinding include the following:

1. Step by Step Formation or Piecemeal Growth
2. Structure Preserving Transformations

While the principle of 'step by step formation' is the prerequisite of any process or sequence, principles such as 'structure preserving transformations' are bringing in qualitative and structural important aspects of organic growth and order. The Urban Game that we present in section IV of this report has been directly developed from essential principles in 'A New Theory of Urban Design.'

With each addition of a new element, the next person has to consider the new situation before they develop the next element. This idea of a series of transformations influenced our thinking on the Urban Game described in section 4.



Figure 2.7



Figure 2.8



Figure 2.9

2.4.4. SEQUENCE THEORY

From an individual person's point of view, the process of wayfinding from starting point to moment of safety is experienced as series of moments, or a sequence. In architectural and urban design theory, this phenomenon has been explored in depth by Bernard Tschumi, who categorizes and analyzes these unfolding experiences as type of design process. The sequence can be expressed or represented by a series of snapshots of key moments, each considering space, events, interactions, and movement of the individual user. The designer's role is analogous to choreographer, envisioning the experience and orchestrating all aspects through the shaping of physical things along the way.

According to Tschumi, "spatial sequences are generally structural; that is they can be viewed or experienced independently of the meaning they may occasionally evoke" (160). Not all architectural sequences is this formal series. Many cities and buildings have meaning derived from order of experience unfolding over time, not from an order of composed spaces. In other words, sequences can be either orchestrated, or accidental.

Types of sequences include:

- **Transformational sequences.** Layering of actions to create incremental change from one thing to another.
- **Spatial sequences.** A "family of spatial points linked by continuous movement," (155). This sequence is the unraveling of a formal story, as one moves through a series of spaces/ rooms/ episodes/ frames.
- **Programmatic sequences.** The social life and symbolic uses in a space. These events become patterns that can contribute to spatial sequence, be indifferent, or detract from it.

The Up and Out project's concept of the wayfinding chain is directly evolved from Tschumi's concept of sequences. This guidance document is a tool to help leaders of coastal Oregon cities act as choreographers, or designers of their own comprehensive wayfinding system. The design process of a whole system of wayfinding incorporates spatial sequences (such as information stations to signage to cache sites), and programmatic sequence elements (such as awareness programs, multipurpose sites). The space between wayfinding elements and aesthetic considerations to unify the whole chain of wayfinding as a recognizable whole is an example of transformational sequences.

Generally, sequences can be either closed or open types. If the operation has a logical conclusion, then it is likely to be closed. In the case of the tsunami evacuation wayfinding chain, it is a closed type. Unlike most architectural sequences, it has a fixed beginning at the moment the earthquake begins to the moment you reach safe camp. Experience is closely tied to travel time. Overall, we used the sequences theory and line of thinking to inform the design process of our proposal elements, and the links between them to form a whole. We believe this method to be a useful one for understanding wayfinding in an urban context, for those attempting to improve their cities. (See section 2.2 for information on the wayfinding chain and terminology definition for the purposes of this document.)



Figure 2.10: University Campus Map



Figure 2.11: Theme Park Map

2.4.5. URBAN LANDMARKS & IMAGE OF THE CITY

The concept of identifying landmarks is a wayfinding strategy for tsunami evacuation. Public buildings like the city hall, the library, government buildings, schools, hospitals, churches, etc, could be easily incorporated into a wayfinding route map. This type of map helps individuals to easily navigate to landmarks during a disaster event. With the help of signage, people can move to a safer place; i.e. to higher ground or an assembly area. Landmarks can also become a signal to reinforce an evacuee's perception that they are moving in the right direction. An interactive aerial map showing important landmarks helps people orient themselves in the right direction quickly and gives them a preconceived notion of where to travel in a disaster event.

This idea can be better understood from the book 'Image of the city' by Kevin Lynch who formulated the concept of imageability, where an urban system can either be perceived as stable or in constant image where the most noticeable effect is influenced by external factors of the environment. He makes an argument that people perceive cities as consisting of city form elements where each individual image constitutes a connection between urban forms and the public image. Each of those images is constructed and relying on the 5 elements already mentioned, which are:

1. paths, the channel of the observer
2. edges, breaking in continuity with the surrounding areas
3. districts, 2d elements within which we spot a common character

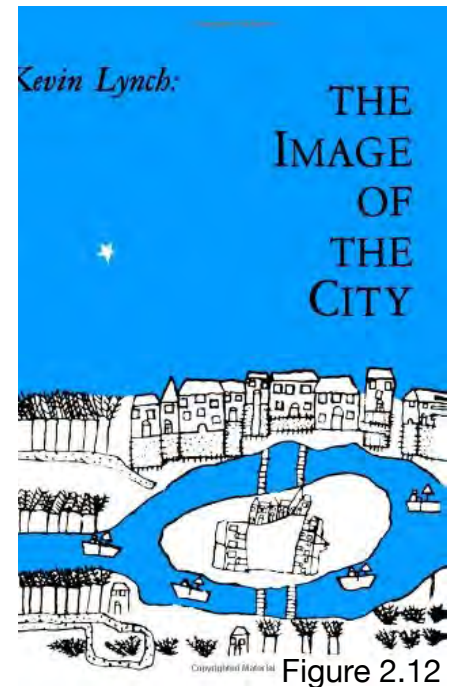


Figure 2.12

4. nodes, strategic points
5. landmarks, external references

Landmarks are simple physical elements that are a considered point reference for an observer that may vary in scale. Landmarks are more easily identifiable and most likely to be chosen as significant when they have a clear form. One can understand the relation between environmental images and urban life, at the basis of urban design principles form this book.

2.4.6. INTERNATIONAL CASE STUDIES & STORIES

International Case Study 1 - India

During Sri's site visit to India in April 2014 for her M. Arch design thesis, she had the opportunity to visit the tsunami-affected areas and understand the post tsunami community redevelopment. People are now very prepared for a future tsunami and understand what exactly needs to be done to get to safety. She also observed a lot of coconut trees, more abundant than ever being planted along the escape route. During her interviews with tsunami survivors she found out that, these palm trees actually help in vertical evacuation in case of an event. People and children of the community are trained to climb palm trees and evacuate safely in case of a sudden tsunami as often tsunami come without warning when the epicenter of the earthquake is thousands of miles apart which was the case in the 2004 Indian ocean tsunami.



Figure 2.13

Though not much signage or tsunami warning systems are in place, there is a lot of awareness among people today, to survive a tsunami and get to safety quickly, gained from this experience. This is especially true in the lower income sections and people who live in the informal settlements by the coast. This was achieved by training the local people of the community and devising a strategy and escape plan tailor-made to for what works best for the community and every single member and family of the community is aware of this plan. NGOs play an important role in training these people and help them devise their own strategy for an escape plan. The chance of survival in such cases is high, as each person knows what exactly to do and where exactly to get to and not depend on others to get to safety.

International Case Study 2 - Japan

The word tsunami is a Japanese word and means harbor wave, implying that a harbor is normally peaceful and calm without waves. But in this case the wave is so strong and powerful that it also continues to make a splash in a harbor that is facing a tsunami wave.

Another story from Japan is related to the structure of social organization. In Japan like in other Asian cultures society is organized around social groups compared to Western culture where society is organized around individuals. One assumes that in Japan the social organization of groups is so strong that it also affects cohesiveness and effectiveness in disaster situations such as earthquakes and tsunamis. It is for this reason that many more people can be saved in disaster situations, sometimes more than 50%.



Figure 2.14



Figure 2.15-2.42

2.4.7. EXISTING OREGON TSUNAMI COASTAL SIGNAGE, MAPPING & WAYFINDING SYSTEMS DEVELOPED BY PARTNERSHIP OF SEVERAL AGENCIES.

SIGNAGE

The most perceivable method to inform the public about the dangers of tsunami is to post signs. There are many types tsunami warning signs existing currently:

- Tsunami hazard zone,
- Tsunami evacuation route,
- Tsunami evacuation site,
- Entering/leaving tsunami hazard zone.

All of these signs were originally created in Oregon. As a beginning to the Up and Out Project research, the PUARL Team studied these signs and below is the conglomeration of all information collected regarding the existing signage, placement and wayfinding.

Guidelines For Tsunami Signage And Placement

DOGAMI, The Oregon Department of Geology and Mineral Industries has developed a set of standards for Tsunami signage, signage placement, wayfinding maps, and evacuation routes to create awareness for both the residents as well as the visitors of the pacific coast to prepare for the possible tsunami from the Cascadia subduction zone earthquake. These standards were mainly created to insure consistency of signage and sign placement.

Tsunami Hazard Zone Sign

This sign comes in two sizes – 22” x 18” and 30” x 24”. The size of the sign to be used depends on the place where it is being installed. It is imperative that the sign are noticeable, particularly when placed in areas where many people gather (parks, beaches, etc.). This sign is to be placed at places within the tsunami hazard zone that are defined by the local evacuation maps or tsunami inundation maps.

Tsunami Evacuation Route

This sign comes in two sizes: 18” and 24” dia. This sign has been modified to comply with Federal standards, where the sign will be square with the round evacuation route design placed inside the square. This sign should be placed along the streets that are designated as tsunami evacuation routes that direct people to safe zone. In some occasions an arrow sign is used in conjunction with the evacuation route sign. The acceptable orientations for the signs are

- the arrow sign points skyward with the evacuation route sign above it where both signs are perpendicular to the route.
- Both signs are parallel to the route
- The evacuation route sign is perpendicular and the arrow sign below it is parallel.

Tsunami Evacuation Site

This sign is rectangular and also comes in two sizes: 18” x 22” and 24” x 30”. This sign is to be placed in the tsunami safe zone as defined by the tsunami inundation maps where it indicates that people need not go further uphill or inland. It is primarily placed in an assembly area or a pre-designated area which may contain emergency supplies.



Figure 2.43-2.47

Entering And Leave A Tsunami Hazard Zone

This sign comes in only one size: 42" x 48 and is larger than other signs which makes it visible to motorists travelling at highway speeds. The signs are placed on main state or county roads where



Figure 2.48



Figure 2.49



Figure 2.50

the road enters and leaves the tsunami hazard zone. They are to be placed on both sides of the road and at both ends of the stretch that is within the tsunami hazard zone.

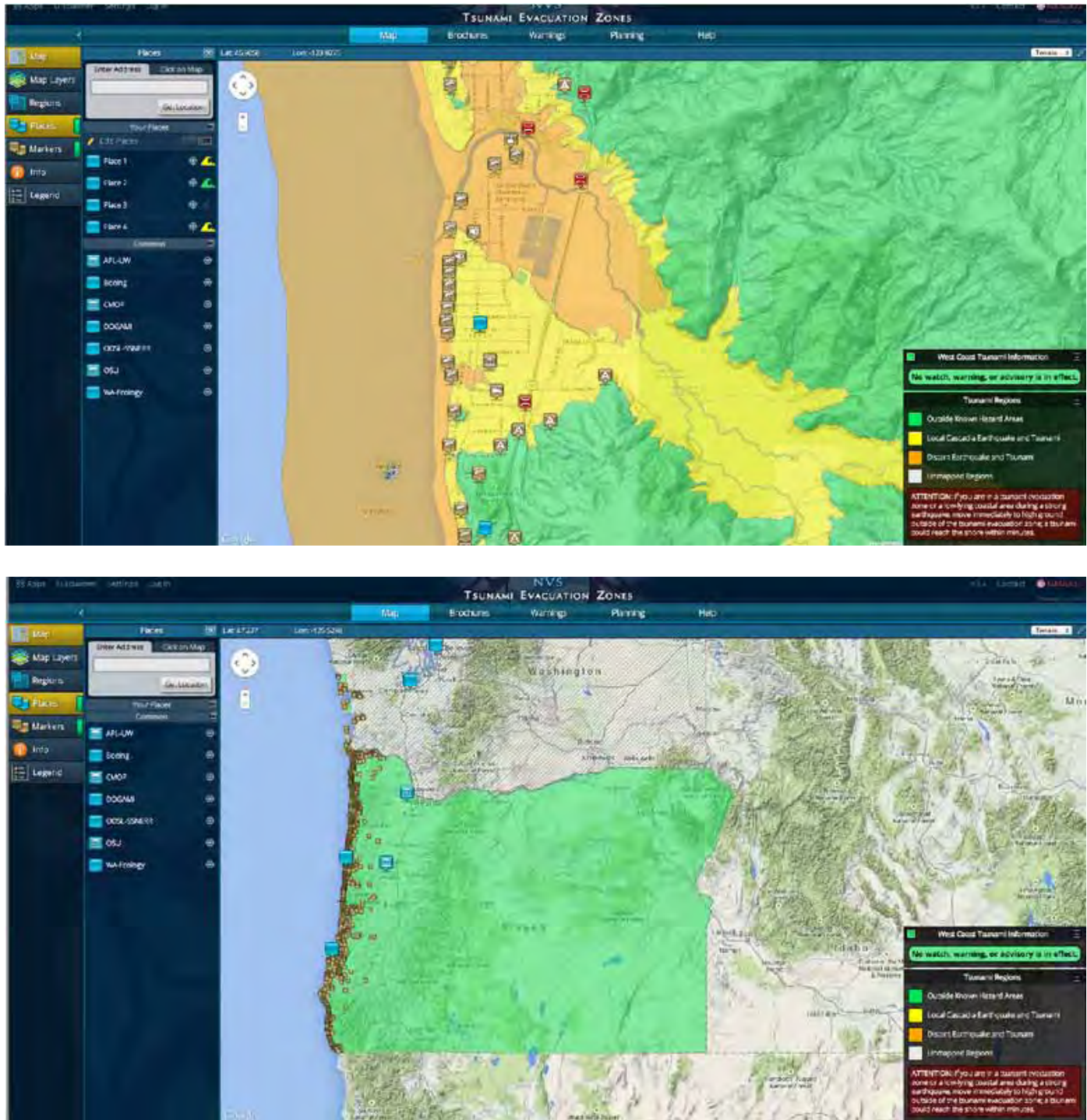


Figure 2.51

Evacuation Zone Map Viewer

The Evacuation Zone Map Viewer gives instantaneous information about the existing and updated evacuation routes by simply typing in the location or address.

TsunamiEvac-NW

By NANOOS

Open iTunes to buy and download apps.

[View More by This Developer](#)



[View on iTunes](#)

Free

Category: Utilities

Updated: May 17, 2011

Version: 1.3

Size: 1.0 MB

Language: English

Seller: NANOOS

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Rated 4.5

Compatibility: Requires iOS 5.0 or later. Compatible with iPhone, iPad, and iPod touch. This app is optimized for iPhone 5.

Customer Ratings

We have not received enough ratings to display an average for the current version of this application.

All Versions

★★★★ 4 Ratings

More iPhone Apps by NANOOS



NVS

[View on iTunes](#)

Description

TsunamiEvac-NW is a tsunami evacuation zone map developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) and the Washington Department of Natural Resources (WADNR).

TsunamiEvac-NW app developed by the Northwest Association of Natural Ocean Observing Systems (NANOOS).

[NANOOS Web Site](#) | [TsunamiEvac-NW Support](#)

[More](#)

What's New in Version 1.3

Updated: Bulletins. Fixed bug that caused bulletins to be missed.

iPhone Screenshot



Figure 2.52

Smart Phone Apps

Smart phone apps are developed and intended for knowing and practicing the evacuation plan in advance as there is a possibility for cell phone towers to be damaged after an earthquake or tsunami.

Warning / Oregon State Emergency Alert System

The Oregon State Emergency Alert System (EAS) notifies the public of a possible approaching tsunami via announcements on radio and TV. Turning on radio or television during such times can provide emergency information and instructions. Specific radio stations have been chosen as primary sources for information as there is a possibility that some radio and television stations may not be able to transmit signal during an event. This method is most effective for a distant tsunami, as the time it takes for this type of wave to reach the coast is much longer than a local wave.

Sirens

Local sirens are manually activated, and are installed on a city by city basis, usually near the densest populations of residents and development. This attention alert signal is a steady three-minute siren. Due to the time it takes to activate, this system is most effective for distant tsunami.



Figure 2.53

Interviews:

Informal interviews with experts, citizen volunteers, staff, and passersby on the Oregon Coast were an important source of information for our design team.

The comments below reflect the opinions of these people interviewed:

- Mark Barnes, City of Cannon Beach Planning Director
- Jenny Demaris, Emergency Manager, Lincoln County
- Front desk staff, Cannon Beach Chamber of Commerce Visitor Center
- Dan Grassick, Public Works Director, Cannon Beach
- Tiffany Brown, Emergency Manager, Clatsop County
- Les Wiersen, Cannon Beach Emergency Preparedness Committee

Interview responses are compiled according to question topic.

1. Most Pressing Issues Of Emergency Tsunami Wayfinding On The Oregon Coast.

- Wayfinding is a combination of signage, awareness, timing to escape, tourist vs. resident populations, especially at night.
- There is a lack of continuity in programs between states for signage, awareness, preparedness. Travellers between HI, WA, OR, and CA don't have continuous experience. There are no federal level tsunami brochures.
- According to DOGAMI LIDAR studies land without trees, whole coast is susceptible to landslides. This will impact access along Route 101.
- Oregon coast has an aging population. It has shifted from an economic focus on fishing, canning, and forestry industries and is now highly dependant on tourism. After a big tsunami event most aging populations won't return to coastal communities, which will significantly impact the economics of the coast.

2. Cannon Beach Context and Considerations

- Cannon Beach has a strong aesthetic compared to Seaside, and people are proud of the place's "village character". Pride themselves on having no stoplights. To protect this, most building here is architecturally designed, and even renovations go through design review process. There are a few architects in the area that serve on the board, including some who come in from Portland.
- Process for installing new signs, design review triggers, approvals required: Takes 1 mo.-6 weeks, or 2-3 months for the whole process.
- Seasonal population shifts: There is a 1700 person permanent population in CB. In the summer, there are an additional 5,000 in town. On special events, it grows to 10,000+. (Compared to the 20,000+ that come to Seaside).
- Fear vs. preparedness: Most industry here comes from tourism. How to communicate danger, preparedness, and what to do to those people, without scaring them away from staying here.
- Overall, there isn't much resistance in the Cannon Beach community to safety measures.
- 2/3 of homes in Cannon Beach are second homes or vacation rentals.
- Too much signage, or "signage saturation" is a problem in Cannon Beach. On the same

pole, there is competing information. A good example can be seen at 5th and Fir.

- In Cannon Beach, E-Prep committee has lots of citizen led efforts. City government accepts lots of experimental grants, but doesn't really follow through after they run out.
- Signs: Some down south on the coast would pull signs down because they scare tourists. Some are stolen because surfers like them.
- Cannon Beach has weekly meetings and hold semi-frequent town wide practice evacuations that only some people attend. The city also provides the residents with a series of locked up containers that were located in safe areas. Security of cache sites is a problem.
- Cannon Beach E-prep committee: Did project on routes as determined by individual neighborhoods. Made new maps from outreach program.

3. Stakeholders and Major Players

- Hotels, and single family vacation rental owners. Hold the key to systematically reaching tourists. (Evacuation walks don't help these people).
- Emergency preparedness committee at the City of Cannon Beach does good work, most effectively at reaching permanent residents.
- Schools, vulnerable populations (homeless/transient, housing assistance organizations, public health organizations, non-English speaking groups), parents, 18-25 year olds, 26-65 year olds, seniors, seasonal residents, businesses (vacation rentals, traditional, hotel/motel).
- People move to the coast to retire from Oregon, and the Midwest. Lots of seniors with varying mobility.
- Vulnerable populations and most impoverished are not directly on the coast. This is usually the more expensive real estate.
- People on the Oregon coast are aware and interested, and more comfortable talking about it than in San Francisco or other markets.
- Some people think that in case of "The Big One" (a common saying along the coast), everything in town would be destroyed so what is the point of being so prepared in the first place.

4. Examples from Other Places

- The town of Manzanita requires that posters of the tsunami evacuation route maps are posted in each hotel room.
- Structured assembly areas as points of interest. "tsunami awareness viewpoints". Like "interpretive walk" series of points of interest in Newport.
- Evacuation art challenge: Make a fun awareness symbol, then encourage people to tour the neighborhoods/cities to see different options. Ex: Tillamook County used patchwork quilts. Ex: Portland's painted cows.
- Coordinate with hotels to train their staff/ do city-run evacuation walks to serve as leaders for visitors in case of an event. Like Cannon Beach.
- Yachats, Nehalem, and Manzanita are doing a good job.
- Study from Tohoku, survival rates from tsunamis: wasn't from physical interventions.

Significant correlation with social cohesion. To spread readiness to communities, first ask what they are concerned about... then figure out how earthquakes can work into those existing problems. Social bonds component is equal or more important than physical.

- Evacuation towers. Nashiki tower is a spiral ramp that goes up. (See FEMA P-646.)
- Painted banding on telephone poles as a way to mark paths.
- Flagpoles and buildings marked at the height of inundation during previous tsunami events raise awareness of tsunami's reach. In Cannon Beach in front of city hall.
- Tohoku stone: "future generations not to build houses lower than this stone". Didn't listen.
- Clatsop Plains: native tribes had stories about the 1700 tsunami event. Haystack Rock in those stories is remembered as a landmark as an overturned basket, and has a theme of tsunami awareness. Stories like this are a traditional example of how to tie the lesson of tsunami knowledge into a geographic place. Similarly, in the Indian Ocean tsunami, few native people impacted. Stories told about what you do in tsunami. Need to develop modern folklore on the Oregon coast that does the same thing.
- Seaside needs a building because they have a red zone. Turnaround is the worst spot, red zone. Geography of island/ distance to high ground makes it impossible to escape.
- Hotel key card cover with evacuation info on it.
- Business registry program: employees have gone through training, in an event they can guide people, supplies on hand.
- Mass notifications text alerts, easy through FEMA system.
- Ad council preparedness campaign: funny print ads, living room with a family. What was happening the day before a big terrible tornado.
- KMUN radio/ OPB: Gave away go bags to donors as an option. Nobody wanted it. But people wanted flashlights, radios, etc. = People don't want to think about scary things, but they might take steps to be prepared in small doses.
- Race the Waves Fun Run: people from all over Oregon come to run the evac route.

5. Design Recommendations & General Considerations

- Design solutions should use "off the shelf technology".
- Consider both physical and digital means of wayfinding. New technologies, digital signage, phone app, solar powered railway lights.
- Simplify signage, or consider other ways of communication. Consider landmarks, geographic symbols, sky, ground.
- Generate solutions that are sponsored by individuals for bigger impact. Tourist-friendly.
- Balance between educating people and scaring them. Fear
- All hazards approach. Chip away at it. Don't tell specifics, tell them what to do to stay safe. Softer approach. Still ready, not scared.
- Study what people do naturally. Reach them where they are. Understand how they already communicate, what direction they naturally want to escape.

2.4.8 SITE VISITS, INTERVIEWS, & COMMUNITY MEETINGS

Cannon Beach

The PUARL team visited Cannon Beach a total of four times. Each visit enabled the designers to talk to and learn from locals and tourists, test various signs and wayfinding techniques, and test existing wayfinding techniques/infrastructure and evacuation routes. This section describes the research and design process undertaken that informed our final recommendations.

SITE VISIT 1:

On March 13th, 2014, we visited the city of Cannon Beach for the first time as an unofficial group. Our general agenda was to gain a better notion of what types of signage and infrastructure existed, the quality of its existence, and opportunities for improvement. The trip consisted of a series of observational walks around the beach and around the town in order to understand the current tsunami evacuation infrastructure as well as the context of Cannon Beach.

During the first part of the walk the size, type, quality, and protection of existing seawalls were observed. While on the beach we located the existing tsunami evacuation maps which show the local tsunami zone, distant tsunami zone, the safe zone as well as the evacuation routes. While there is a variety of information with fairly attractive graphics, we decided that we felt little if any better equipped or prepared to know exactly what to do, where to go, and how to get there in the case of an event. Additional things that were noted on the beach were the elevated sirens placed on top of poles, that supposedly take up to 5 minutes to activate in the case of a tsunami. Near the entry/exit of the beach there were informational signs with information regarding life safety yet very little information about tsunamis or information that would raise awareness or aid in evacuation in the event of a tsunami.

After the walk along the beach we took our walking journey to the streets of Cannon Beach where we were able to observe the tsunami evacuation signs and walk a few of the actual evacuation routes to test the difficulty of following the signs and routes to the areas of safety, otherwise known as the “assembly areas”.

Without asking any residents for directions, paired with small bouts of confusion, we were in fact able to locate the assembly areas. While this indicates that the signage works, we were not convinced by the clarity of current wayfinding approach. Other concerns included the fact that the assembly areas do not seem to support the amount of people that would be evacuating to the area. There is no additional information, call box, or suggestion as to what to do after everyone has gathered in a place of safety.

Overall this initial site visit helped us to understand the overall wayfinding and signage system that is currently in place and helped us to realize how little awareness and information there is available to help prepare residents and visitors what to do in the event of a tsunami.

SITE VISIT 2:

While the first site visit was about getting introduced to the place, this second visit on May 28, 2014 was about understanding what and how people thought and using them to critique and test our new signs. After our initial site visit and learning that while the existing signage and wayfinding worked sufficiently we began to imagine how much more effective the system could be. With the information gathered from literature reviews and our understanding of the context we set out to push the idea of what the signs could look like and how if they were different they might raise more awareness and attention. Prior to the visit we prepared various iterations of the existing signs where we changed the color, size, shape, and even the graphics and information conveyed. We took these various signs to Cannon Beach to test them in context as well as ask residents and visitors about their thoughts and reactions to the changed signs.

The majority of the site visit was allocated to the testing of these new signs. To test the new signs we placed them over the existing signs and documented them by taking photos allowing us to look back at them and critique the pros and the cons of each sign. As people walked by we would provide them with multiple signs and ask them which one caught their eye the most or what the color made them think. This was a powerful exercise because it offered us with honest unbiased opinions and taught us which signs worked and which signs did not.

Through the sign testing we found quickly learned which colors worked and which colors did not. We also learned which sizes worked best as well as the need for more signs that create awareness about being in a tsunami hazard zone. It was surprising to us just how many of the people we stopped were either unaware that they were in a tsunami hazard zone or did not know what earthquakes had to do with tsunamis. We asked many people what they would do if a tsunami were to happen. We found that the residents all had a decent plan whereas the visitors and tourists did not have much of an idea.

SITE VISIT 3:

Our third visit, on June 21st, 2014 was used to begin to generate ideas through design charrettes and sketches. This enabled us to record our ideas and create multiple design iterations. We began our design sessions by first observing and critiquing an existing assembly area. Together we discussed what the assembly area was lacking and began to sketch out and list opportunities to make the assembly area more visible, functional, and informative. A series of ideas were discussed, some wild and some more feasible. The purpose of the exercise was to find a way to make the assembly areas have a stronger sense of place in order for them to be a stronger destination.

Near the North entrance to the beach is the Fir Street Bridge, which was identified as a piece of infrastructure that will not make it through an earthquake or tsunami. The majority of the North Side evacuees rely on this bridge to reach high ground in a timely fashion. When this bridge fails many people will have to travel south to reach high ground, resulting in long evacuation times. In hopes of creating an alternative solution we envisioned an evacuation tower that would provide quick and

timely refuge for the population of the North that will be affected by the failure of the bridge. In an attempt to visualize the idea of an evacuation tower we all sketched out some feasible designs near the Fir Street bridge that would provide a place of refuge in times of a tsunami but would also have a different use throughout the rest of the year.

After a good morning of sketching, brainstorming, and designing we set the afternoon aside to test more design solution mock-ups that were prepared in our time since the last site visit. The group split into smaller groups in order to test multiple things at once. One group tested new evacuation routes signs by placing them over the existing, taking pictures and surveying passing pedestrians. Informational and awareness kiosks were tested by using a six foot slab of cardboard with an hazard zone sign, a hazard zone map, and other resources attached. We then placed the cardboard around very popular and accessible areas around town where people would be able to be read about and become informed about tsunamis. Photos were taken of the kiosks to test the size and scale the kiosks could be.

The second group walked the secondary streets that feed into the main evacuation route. They observed what problems might occur as people try to follow the evacuation route. It was found that the signs and directions were not very clear on all the secondary streets. Ideas including more signs, painted strips with directional arrows, and even a secondary spine of lights were generated.

SITE VISIT 4:

This final site visit to Cannon Beach took place on July 24-25, 2014 with a group of four PUARL team members. To experience what it is like to visit the city as a the tourist, we stayed overnight at two downtown locations on Hemlock Street, the Cannon Beach Hotel and the Haystack Inn.

First we visited City Hall to sit in on the container sub-committee meeting. It was the budget review meeting for outfitting the containers with systems, shelters, contents, and preparedness supplies. After the meeting, Daniel Grassick, Public Works Director for the City of Cannon Beach was interviewed. We also visited the general emergency preparedness committee meeting at the City Hall, and interviewed Les Wierson and Bill Brehm, long-time citizen volunteer members of the committee. (As described in section 2.4.7, and in interview and community meeting notes). Overnight, we did experiential night testing with a timed practice evacuation scenario. (See section 2.4.9 for description of the methodology and results).

The next day, we visited several locations to finalize places where we envisioned placement of prototype designs. This included all assembly areas, night light locations on Hemlock, awareness kiosk intersections, burm, and pedestrian bridge. Photos were taken to prepare for renderings of design element installations. To support our proposed pattern of container sites as memorable, multi-functional places, we re-visited all 3 container sites to generate design alternatives and photograph for future visualization work.

Through sketches and design brainstorming, we came up with the following ideas:

- Community or Food-Producing Garden: for community awareness of place, in addition to providing food in an emergency.
- Edible landscapes: plant blackberries, fruit trees, wild lettuces, etc. that require no maintenance.
- Music, theater, or event space. Flexible, simple shelters for performance that convert to emergency use. May include auxiliary services: restrooms, food cart, storage, parking lots, shade structures, tie-downs.
- Building blocks of shelter: city storage of mulch, sand, building materials, decommissioned vehicles, empty containers etc. could be stored here and used in an event to build shelters.
- Ground treatment and leveling should consider tent camping.
- Build out water access to the springs.

With input from the community, this site visit helped the team clarify the differences between design prototypes for Cannon Beach, and patterns for general use on the Oregon Coast. We also generated new prototype concepts for triage & registration area, berm landscape or structure, and throwaway pedestrian bridge.

See Section 7, Appendix, for detailed reports of Cannon Beach site visits, design work, and testing.

Other Oregon Coastal City Site Visits

SEASIDE:

The visit to Seaside occurred early in the project, on March 30, 2014. The two cities of Seaside and Cannon Beach share a school system, shopping, and hospitals, and are located very close to each other. Seaside is geographically much larger, and is approximately six times the population of Cannon Beach at 6,450 people. It is less aesthetically controlled than Cannon Beach, and contains more types of industry beyond tourism. Geographically, it is located on a peninsula, which is physically connected to the land by a series of bridges. Most of the city sits at 17' above sea level, and is much further from high ground than in Cannon Beach. We noticed a series of tsunami evacuation route signs in the downtown area and on the way into town from Route 101. These were the same type found in Cannon Beach, and were often lost among other signage downtown. Landmarks and primary routes were more difficult to locate in this city than in others we visited. We didn't contact any stakeholders, or talk to any users about this city's preparedness plan, wayfinding conditions, or strategies unique to the area.

NEWPORT:

Compared to Cannon Beach, Newport is a larger coastal town roughly at the mid-point of the Oregon Coast and about 100 miles south of Cannon Beach. We visited Newport early August 2014 because it was recommended to us as a place with a number of tsunami-related installations and also urban wayfinding infrastructure. Overall most of the city is located on high ground and needs less signage than other towns like Cannon Beach that is largely located on lower and tsunami hazardous ground. Newport has a rather magnificent harbor area. It also has a large, iconic bridge as the entrance gate to the harbor from the Pacific Ocean. It is this harbor area that is at the edge

of the hills adjacent to a significant area of lower ground that needs special attention with regard to tsunami wayfinding escape and evacuation. The Japanese word tsunami, which literally translates as 'harbor wave,' shows its full meaning in this harbor area as the only place where a large tsunami wave might easily occur, while the rest of the town is mostly tsunami safe on higher ground.

In Newport, special attention is not only paid to a preparedness plan, current signage conditions, geographic barriers, and user populations, but Newport also has a number of agencies and educational exhibition places directly dealing with earthquake, tsunami and evacuation issues. Oregon State University's Hatfield Science Marine Center is a very informative interpretation and exhibit place in the harbor flatlands worthwhile to visit because of two tsunami related installations. The first installation is showing exclusively tsunami evacuation efforts of the various agencies, towns, and citizen in Oregon emphasizing awareness and also preparedness options. The second larger installation is focusing on the power of ocean water with regard to various aspects such as plans and ideas for electric ocean power plants, but also including tsunami aspects. In particular a tsunami power test station lets kids build lego structures that can be tested in a water wave machine in a hands on fashion, thereby making smaller and bigger kids aware of the destructive power of a large tsunami wave.

With regard to signage and tsunami escape unique wayfinding-related conditions and strategies are being tried in their town. In particular one notices one very well structured tsunami escape route from the Hatfield Center to higher ground. This escape route has an excellent signage structure. Starting with the first sign, one clearly sees the second sign, so that one clearly knows where to go. This clear wayfinding structure continues until one reaches higher ground on the south side of the bridge.

ASTORIA:

The team's visit to Astoria on July primarily focused on administering the charrette, but we took some time to understand it as a comparison city. We observed that the main routes uphill were clearly organized according to the street grid. The streets are wide, and easy for visitors to understand as a primary route to safety. Many of the homes are located on the hill, not on the shore. Previously used as a working waterfront, the direct connection to the Columbia River and the Pacific Ocean were more industrial than residential. The downtown core is more inland, running east to west. Some open spaces, infrastructure, and landmarks are at the top of the hill, including the Astoria Column. The reservoir, middle school, and community college are both located in a safe zone, and could potentially be used as cache sites or response camps in case of a tsunami. Through discussions with Astoria citizens, we found out that the sudden influx of visitors from cruise boats in the summer pose a unique problem for preparedness planning. Hotels and infrastructure assets located in the bridge 'fall zone' are another issue specific to this city, worth studying further in future projects. Overall, this is a good example of a coastal city whose geography, urban

planning, and land use facilitate its wayfinding.

BERKELEY & OAKLAND, CA:

In one of our early brainstorming sessions in May 2014, the team explored new options for wayfinding on a. the ground, b. posts and walls, and c. in the air. One of our team members mentioned in one of our brain-storming session the possibility of employing light escapes similar to the light escape linear light chains in airplanes in case of emergency.

This visit to the San Francisco bay area on July 2nd investigated a mechanism used in pedestrian crossings with blinking lights that may be close to this idea and usable for tsunami escape wayfinding. These pedestrian crossovers have blinking lights on the two sides of the crossing path and help to get pedestrians on particular wide and difficult streets such as San Pablo or Sacramento streets in Berkeley on the other side of the streets. There are at least one of these pedestrian crossings on San Pablo Avenue, and at least one other on Sacramento Avenue. These pedestrian crossings are apparently experimental in nature since there are just a few of these crossings.

Photos were made and the nature of these lights were explored at day and at night in a few subsequent visits. They seemed to work very well day and night even in sun-light. The technical exploration of these lights turned out to be more challenging. Although we made several attempts with city engineers and private companies, we did not succeed in making actual progress in understanding technical implementation and detailed technical design aspects. Nevertheless it seems to be a worthwhile component to explore further for practical application.

Community Meetings

The team attended two tsunami preparedness related community meetings in the city of Cannon Beach to better understand their current preparedness efforts. The group of citizen volunteers in attendance were similar for both of these meetings. Both were chaired by the Public Works Director, Dan Grassick with help from representatives from the fire department who contribute labor for implementation and sharing of ongoing resources. Overall, we were impressed by the long standing and sophisticated level of collaboration between citizen volunteers and city government. It was evident that this was a key to the success of Cannon Beach's preparedness, awareness, and experimental tsunami readiness efforts.



Figure 2.54



Figure 2.55

CANNON BEACH EMERGENCY PREPAREDNESS (E-PREP) COMMITTEE MEETING

This meeting on July 25, 2014, was a general discussion between long standing volunteers and city employees. They happen on a monthly basis. During this EPREP meeting at City Hall, the PUARL team heard the details of current efforts and initiatives in progress in Cannon Beach. City disaster planning topics at this discussion ranged from the before, during, and after levels.

Awareness efforts, or elements targeted at the before phase, in Cannon Beach included outreach events such as the 4th of July Parade, door-to-door canvassing, farmers market booths, and a “Race The Wave” 5K fun run along the evacuation route. The city holds monthly practice evacuations, which are not well attended.

There are a few mapping projects currently in progress, and the city has a GIS consultant that does visualizations as needed. The committee members described roll-out for a series of specialized maps of the 12 sub-regions of Cannon Beach that reflect community feedback on preferred evacuation routes beyond the DOGAMI modelling recommendations. The overall keymaps for this series reflect the committee’s preference for focusing on only the Cascadia fault, or worst-case scenario, represented as a blue filter. There are separate maps, trainings, and outreach efforts for a distant tsunami, which will have hours of warning rather than 12-18 minutes. Spot elevations shown along the high water mark help people make their own decisions about their level of safety. Cache sites are shown on these maps as a vague “information” location, supposedly to prevent thefts during normal times and mobbing during an event.

To prepare for action in the during phase, there were several efforts related to preparedness trainings for disaster response. Working with the statewide CERT volunteer program, individuals receive vests and trainings to act as leaders during and after a tsunami. A unique Cannon Beach effort is the business leadership program, which designates and trains employees to secure business paperwork and assets (a go-bag) and lead customers to safety. They have vests and flashlights, and tsunami-ready businesses are identified in the shop window with a recognizable sticker.

There were also discussions of assembly area improvements, preventing road debris, and using nature trails as evacuation routes. Connection between assembly areas and cache sites were identified as a weak point in the wayfinding process.

A few infrastructure related topics were discussed, such as the berm, evacuation tower, and throwaway bridge. In response to our questions about these large-scale investments, the people of Cannon Beach preferred to get people to nearby high ground over more engineered safety options such as the tower. They mentioned other cities that could benefit from this solution. Because almost everyone is within 15 minutes walk of high ground, an evacuation tower is not right for Cannon Beach. It was clear that they need to put alternative methods of crossing the creek in place instead.

There is a robust pilot project with cache sites, but since there is a sub-committee that handles the planning and outreach of this program it was not discussed in detail.

CANNON BEACH PREPAREDNESS CONTAINER (PRECON) SUB-COMMITTEE MEETING

This event, held on July 24, 2014, was a meeting of a sub-committee of the general Emergency Preparedness Committee for the city of Cannon Beach. Their purpose is to organize the new cache site container program which allows private citizens to stash goods in a secure location on high ground. The intent is to host enough goods to sustain a post-disaster camp with 7-10 days of supplies without outside intervention. A percentage of the storage is city-sponsored to provide T.E.V. (tourist, employee, visitor) response kits. These kits include food, tents, and personal items. City provided shared resources for all survivors include registration supplies, tools, open space and tents for shelter, toilet facilities, clean water, and propane/natural gas for electric lights, communication and space heat. This is a pilot program, with 3 sites currently in place in Cannon Beach.

This particular meeting was an in-depth budget allocation discussion. It was evident from this meeting that both the physical and social elements of preparedness for response are of equal importance to the group. It was also clear that resources in Cannon Beach are not scarce, and that both public and private sides are willing to contribute freely to the effort of tsunami response. Wayfinding was not discussed, but tsunami awareness and cache program awareness were both mentioned.

Charrette

Event participant feedback has been synthesized into this report's recommendations for actionable, well-defined design options that will be useful to the many different communities that we are serving. We used the information gathered at this event to inform our project language for Cannon Beach, patterns, and the overall guidance document for recommendations to improve the tsunami wayfinding system in communities across the Oregon coast. This method was the most effective at making practical progress with regard to actual tsunami escape wayfinding process, sequence and infrastructure.

The general themes of discussion centered around the following topics:

- The realities of human behavior: In emergency situations, in planning processes, in fear, safety.
- Difficulties of solution implementation, regulation, and decision-maker's jurisdiction. Disconnections in public/private partnerships.
- Maintenance of interventions
- Clarity of messages, and how best to communicate with different people.
- To prevent the worst disaster impact, consider the importance of planning now to incorporate resilient construction in the course of natural city growth. Could be through zoning overlay, multifunctional sites, infrastructure planning.
- How to share examples of good wayfinding projects and programs between cities. There is a need for a case study clearinghouse.

Section 3 describes patterns and additional pattern proposals written with and by charrette participants through this two-day workshop process. See the Appendix in Section 7 for detailed exercises, problem and solution notes, and community feedback on our design proposals.



Figure 2.56

2.4.9 ON-SITE TESTING

Much like in science and other fields experiments and tests are necessary to understand and develop theories. The same is true for design. No matter what is being designed, be it signs, buildings, logos, or clothes, a simple drawing or plan is not enough. Physical tests must be made to understand the form, materiality, and scale. Tests help designers to see whether what looks good in theory and on paper looks good and function properly in reality.

In order to fully understand the theories and designs for signage and wayfinding, physical tests or mock-ups needed to be made. The mock-ups of signs, kiosks, and other physical wayfinding techniques allowed us to not only place them within context but also to test the size, color, and shape of various signs.

Experiential Night Testing

On July 22, 2014, a special test was done during nighttime to understand the difficulties of wayfinding at night and tsunami escape in 18-22 minutes. We hypothesized that by conducting a night time practice evacuation, walking the route in real time, it would be possible to find the weaknesses in the existing wayfinding system from a first person tourist perspective. Special attention was paid to the visibility and legibility of signs, and the overall directional clarity of route. Our team of 4 people stayed in the downtown tourist area in two different guest houses a few blocks apart. We simulated a 5 minute local Cascadia, high magnitude earthquake as if we were asleep. We prearranged between the teams to begin the simulated earthquake at 11:45 pm. We got dressed, gathered essential items, and looked around the hotel room for resources. In this scenario, DOGAMI model calculations projected 12-15 minutes to reach safety from our location. Testing of bad weather at night could not be accomplished and should be done in the future.

Group 1 were new to town and didn't know the routes. They found a tsunami map, instructions, and reference to an emergency light kit, and brought these tools on the walk. They followed the map to

the most logical assembly area, choosing to turn onto Highway 101 following the marked pedestrian path. Group 1 reached the safety point at 12 minutes, walking a brisk pace. Not understanding what to do next but vaguely knowing about a container site nearby, they continued uphill along 101 until they reached the top and were unable to locate the containers. Group 2 were visitors who knew the town. After a brief state of confusion following the earthquake, the team was slower than expected in gathering essentials and choosing the best route. They did not have a flashlight. They first searched for friends and then followed Hemlock to Sunset toward the underpass route, which they knew to be the highest assembly point. This group found their intended assembly point after 17 minutes of walking.

Final Observations & Findings:

- New moon made it very dark, impossible to navigate without flashlights if streetlights failed.
- Difficult to see small reflective signs from afar, especially without a flashlight.
- Distance between signs seemed too far, causing additional stress from second guessing the route.
- Essential left turn sign can't be missed.
- Signs at assembly areas don't indicate what to do next. No instructions, lights, sense of place, no feeling of safety.
- In our design solutions, considerations need to be made for signposts that fall down, and can facilitate passing quickly over broken ground in the dark.

Landmarks Testing

We hypothesized that some people find their way in Cannon Beach according to significant landmarks. If so, we thought that investing energy in strengthening the maps and awareness tools to increase tourist recognition of these landmarks would help tourists and visitors to quickly follow cognitive maps to safety. This tactic would especially reach those who are more predetermined to follow relative maps over paper maps. To test this theory, we did initial walkthroughs in Google Earth, and then followed along designated evacuation routes in person.

When tested on site, landmarks at Cannon Beach are not easily identifiable and are often not different from any other building or residences around. They all have the same fabric and style, which makes it hard to decipher the building typology and understand these larger civic buildings as a landmark in wayfinding routes. It was challenging to locate the City Hall and accept the existing building as a landmark since it breaks the image of a typical City Hall.

In Cannon Beach, natural landscapes such as the hill and Haystack Rock are more effective landmarks when compared to the various buildings. One can easily navigate towards the hill, as it is visible from the coast and could be the easiest possible way to navigate through the streets of Cannon Beach.

In conclusion, although this strategy was not successful at Cannon Beach, it could be effective in other coastal cities that have less strict aesthetics and size restriction rules on their buildings, or fewer natural landmarks.

Wayfinding Concept Testing

We tested a series of our proposals for adding, improving, or replacing existing tsunami signs in order to develop a better understanding of different possibilities for these proposals. Using full-scale mock ups, the team explored alternative options in color, shape, size, and combinations of 2D signs. Some new, creative wayfinding elements that go beyond a traditional sign design were also tested. Throughout the testing process, we asked for opinions on clarity, consistency, and legibility from passers-by in the real context of Cannon Beach. Larger, 3D wayfinding concepts were tested through site visits to potential sites and sketching exercises.

On-site design tests were conducted on the following wayfinding concepts:

BEFORE:

1. Informational Kiosk
2. New Tsunami Hazard Zone Sign

DURING:

3. Evacuation Route Sign Update
4. Individual Sign Posts
5. Spine Lights
6. Bridge Renovation
7. Evacuation Tower

AFTER:

8. Assembly Area Update
9. Emergency Preparedness Site

The results of these tests informed the design recommendations and patterns outlined in Section 3 of this report. The methodology and results of these tests can be found in the Appendix in Section 7.



Figure 2.57

2.5 FINAL REMARKS

In this ‘Cannon Beach Field Work and Observations’ chapter, research and planning methods in tsunami escape wayfinding are presented through variety of approaches and field experiments. Each target area that exists within the wayfinding chain for tsunami evacuation was approached using the most simple form of problem and solution. Each stage of tsunami readiness, before, during, and after, present a multitude of pressing issues and potential opportunities that exist when designing a wayfinding system that essential role is to effectively get people up and out safely. This chapter presents the project focus of research, methods, observations, and findings that have all help lead to a wealth of possible solutions and design recommendations.

In the following chapter 3 of this guidance report, the designs and recommendations that come out of these observations are compiled into an actionable framework for cities to use. These findings are presented through an organized tsunami evacuation wayfinding chain that raises awareness before, guides people during, and supports survivors after the catastrophic event. Each specific problem/solution proposal is considered within a larger system of moving parts, developing a strategic generative process called a Pattern Language. This system presents two advantages. First, each ‘pattern’ is formulated as a general problem that can generate, and is accompanied, by a rich number of different practical solutions; they are not site specific, but allow for anyone to apply them within their own context. Second, this system begins to connect different problems that were once treated topically, through integrated solutions that begin to develop a a Pattern Language. The pattern language approach helps different coastal communities to establish a lattice network of wayfinding elements which generates a robust system for effectively evacuating cities in the event of a tsunami.

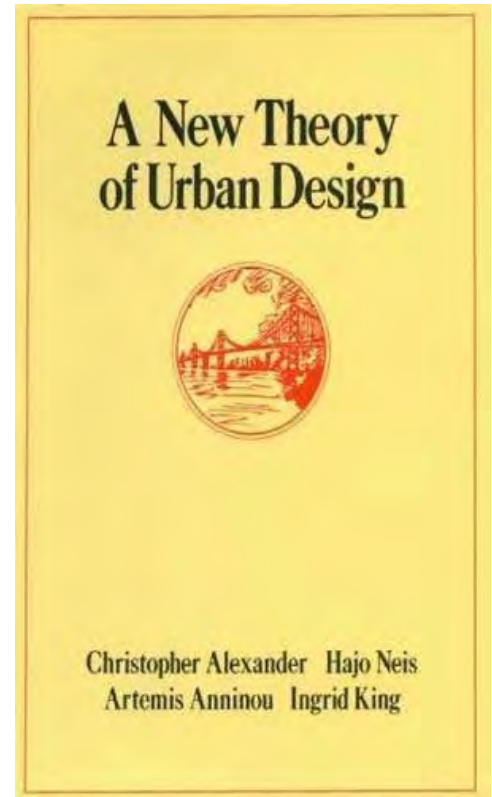


Figure 2.58

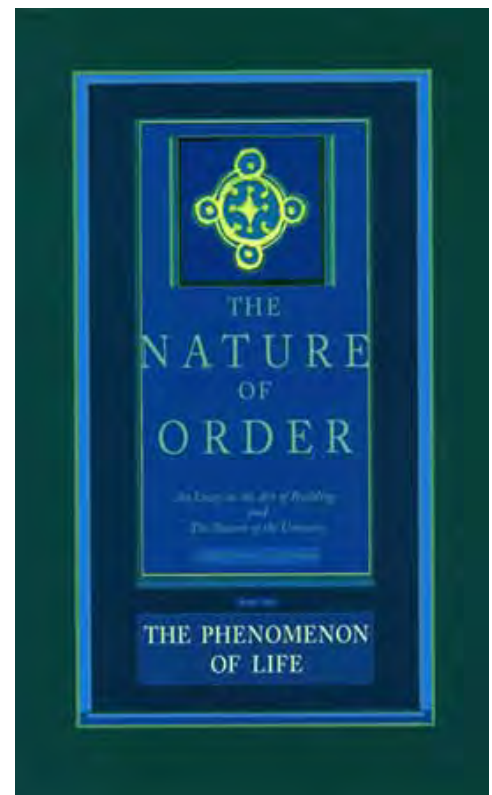


Figure 2.59



Figure 3.1 CHRIS YOUNG LAUNCHES OFF OF BROKEN PAVEMENT AFTER THE 6.1 CALIFORNIA EARTHQUAKE. - NOAH BERGER/AP

A SURVIVAL PATTERN LANGUAGE

A Wayfinding Escape Pattern Language for Surviving Tsunamis and Accompanying Earthquakes

The idea for this survival pattern language stems from two sources. First, PUARL works in the tradition of pattern and pattern languages with close connection to its origins and the non-profit organization the Center for Environmental Structure (CES) in Berkeley. Dr. Hajo Neis is a long-time member of this organization and has many years of experience with pattern language research and development. Professor Neis has encouraged students to use the pattern language as a generative process that supports architectural and urban solutions for rebuilding cities, neighborhoods, and homes in areas affected by disaster. Second, a '*Survival Language: A Pattern Language for Surviving Earthquakes*' was formulated by a Takashi Iba and a group of Japanese scholars at Keio University in Tokyo. This language provides a toolkit that people living in earthquake prone cities can use to prepare for and survive the effects this natural disaster. Takashi Iba and Iba Laboratory have a long history of studying pattern languages and recently published a newly developed series of pattern language books for learning, collaboration, and presentation. He travelled to Portland to present his work on patterns at the 2013 University of Oregon PUARL conference. This research has transitioned pattern languages into the new field of disaster survival, and has inspired the PUARL to develop a new pattern language for surviving an earthquake with an accompanying tsunami on the Oregon Coast.

PURPOSE

A Survival Pattern Language for earthquakes and accompanying tsunamis was created in order to provide coastal communities with a new tool for assessing their current tsunami readiness, and proposing changes to improve their wayfinding chain.

PATTERN LANGUAGE FORMULATION

These patterns were created based on the “design thinking” formula which states that a particular context is examined to find specific problems and propose possible solutions. In this study, the context is the wayfinding systems of coastal communities. Problems are issues that may prevent successful wayfinding along specified evacuation routes. Solutions are methods that any city can use to improve existing or design new conditions that address each concern.

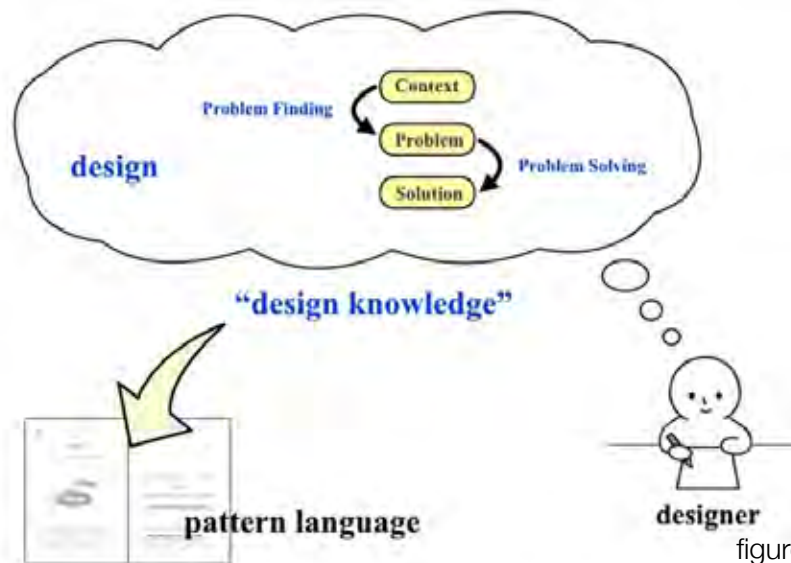


figure 3.2

PATTERN LANGUAGE APPLICATION

Pattern Languages are comprehensive design manuals for any type of system. This process can advance physical forms such as architecture and urban design, non-physical forms such as software or organization, and human actions such as learning or collaboration. These different languages give users ways to examine, design, and improve their own context using universal or ‘archetypal’ patterns. A series of these patterns can be applied into distinct projects which generate a project language. Different project languages should use the pattern language as a general guideline for their creation, while each becoming a unique system that reflects the qualities of its users and characteristics of its context.

PATTERN LANGUAGE DEVELOPMENT

Although patterns are written in order to support the development of many project languages, they must first be formulated by a designer who observes an opportunity for enhancing his or her own environment. Due to the long history of earthquakes in Japan, Dr. Takashi Iba and his coworkers found the need to provide individuals with a personal toolkit for surviving and escaping major earthquakes. They applied personal experience and creative design based off of these experiences to establish a language that can be used by any group of people living in a place threatened by earthquakes.

In this particular context, invested government and city officials recognized the need for a more robust tsunami evacuation wayfinding system. Through the examination and evaluation of the coastal communities, the PUARL team was tasked with developing a pattern language that any city threatened by an earthquake and accompanying tsunami could use to become more tsunami ready. In particular, the wayfinding system in the city of Cannon Beach was studied in detail through observation, testing, and evaluation. City officials, first responders, disaster preparedness volunteers, residents, visitors, and business owners were interviewed to gain a better knowledge of the city's relationship with the wayfinding system. A design charrette was held to incorporate the opinions and ideas of key stakeholders from many coastal communities and backgrounds. Research was conducted in order to gain detailed understanding of local, state, and international tsunami experiences and initiatives.

Each of these channels provided distinct opportunities for finding problems with the existing condition. Site analysis presented a series of obvious downfalls of the current system. Speaking with members of the community, ranging from fully engaged to completely unaware, provided a set of problems from an experienced perspective. Collaborating with tsunami stakeholders from up and down the Oregon coast helped categorize issues that are pervasive and ones that are site specific. An expansive and diverse set of problems were found based off of these different approaches of evaluating the context.

The wide range of concerns and issues brought to light in current wayfinding system means that there are many opportunities for improvement. Solutions were developed by team members and stakeholders through a collaborative process at the design charrette. This survival language exists because of the input and involvement of a variety of invested members, which means that the people that this document was intended for were all active participants in its production.



figure 3.3

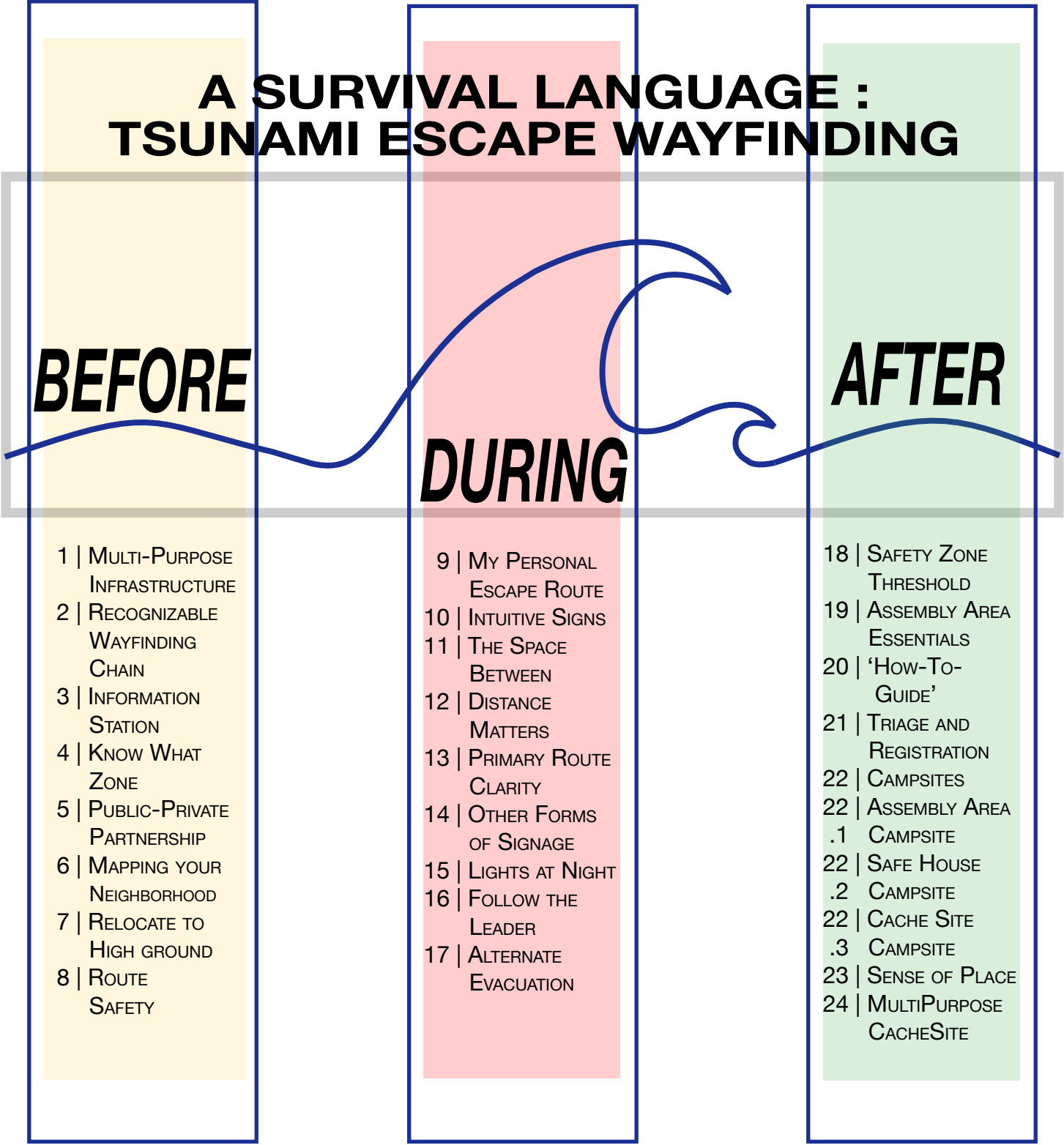
THE SURVIVAL PATTERN APPROACH

It is important to note that this report, and this language were written for cities as the primary users. These patterns were therefore evaluated, developed, and proposed to be addressed by larger tsunami planning organizations. While all of these solutions would have to be implemented by a city before the event, it is important to note that patterns are written for the problem's moment of impact. For example, maps are studied before an event, route signs are followed during an event, and assembly areas are filled after the event.

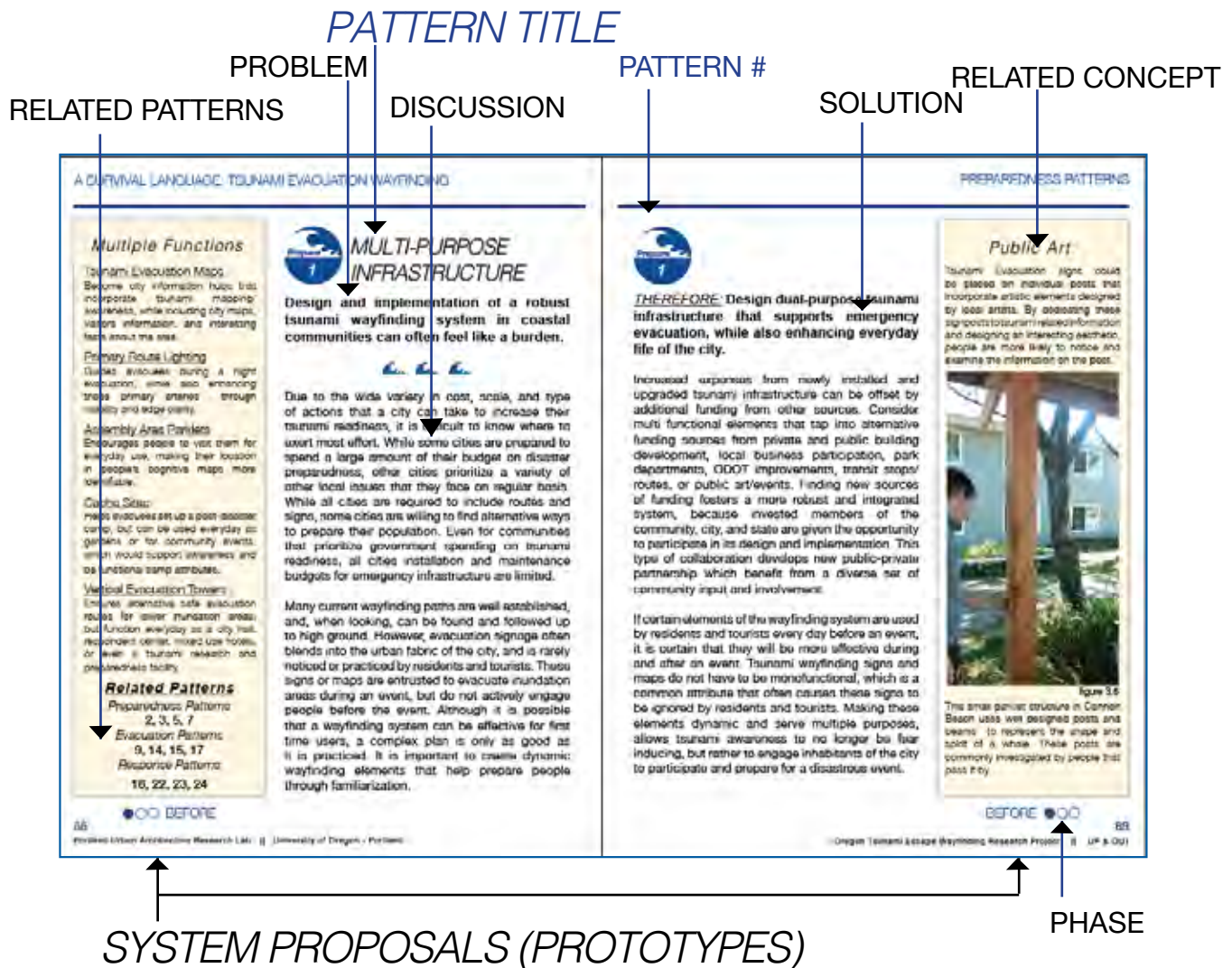
A successful wayfinding system encourages preparation, assures evacuation, and supports response. Therefore, the survival language incorporates three pattern chapters dedicated to the before, during, and after stages of an event. Each chapter provides a series of patterns that address a different aspect of the wayfinding system. Preparedness patterns aim to improve infrastructure that raise awareness. Evacuation patterns focus on developing the clarity of evacuation routes. Response patterns aim to guide assembly, organization, and utilization of campsites. The language is written in 24 sequential patterns that establish the tsunami evacuation wayfinding chain based on the full tsunami experience; a story that starts today and continues for many years after the disastrous event occurs.



figure 3.4



WAYFINDING PATTERN LANGUAGE KEY



The survival language consists of 24 individual patterns, numbered and divided into Preparedness, Evacuation, and Response Patterns. The pattern titles are used to describe the topic, and are followed by a problem, solution, and discussion that considers the issues and opportunities that apply to that specific pattern. Side bars are used as applied concepts that include precedent studies, site testing, creative ideas, and designed proposal to demonstrate how these patterns are implemented as projects. Each pattern includes a list of other related patterns that demonstrate how a comprehensive wayfinding system becomes more robust when the different elements begin to work together.

A SURVIVAL LANGUAGE : TSUNAMI ESCAPE WAYFINDING

BEFORE

DURING

AFTER

- 1 | MULTIPURPOSE
INFRASTRUCTURE
- 2 | RECOGNIZABLE
WAYFINDING
CHAIN
- 3 | INFORMATION
STATION
- 4 | KNOW WHAT
ZONE
- 5 | PUBLIC-PRIVATE
PARTNERSHIP
- 6 | MAPPING YOUR
NEIGHBORHOOD
- 7 | RELOCATE TO
HIGH GROUND
- 8 | ROUTE
SAFETY

PREPAREDNESS PATTERNS



The Preparedness Patterns chapter includes patterns that happen ***BEFORE*** a disastrous event. Preparation is perhaps the most accessible stage of tsunami readiness because it targets issues that are happening now. These patterns focus on raising awareness and creating community resilience so that each city is prepared when disaster strikes.

Multiple Functions

Tsunami Evacuation Maps

Become city information hubs that incorporate tsunami mapping/awareness, while including city maps, visitors information, and interesting facts about the area.

Primary Route Lighting

Guides evacuees during a night evacuation, while also enhancing those primary arteries through visibility and edge clarity.

Assembly Area Parklets

Encourages people to visit them for everyday use, making their location in people’s cognitive maps more identifiable.

Cache Sites

Helps evacuees set up a post-disaster camp, but can be used everyday as gardens or for community events, which would support awareness and be functional camp attributes.

Vertical Evacuation Towers

Ensures alternative safe evacuation routes for lower inundation areas, but function everyday as a city hall, respondent center, mixed use hotels, or even a tsunami research and preparedness facility.

Related Patterns

Preparedness Patterns

2, 3, 5, 7

Evacuation Patterns

9, 14, 15, 17

Response Patterns

18, 22, 23, 24



MULTI-PURPOSE
INFRASTRUCTURE

Design and implementation of a robust tsunami wayfinding system in coastal communities can often feel like a burden.



Due to the wide variety in cost, scale, and type of actions that a city can take to increase their tsunami readiness, it is difficult to know where to exert most effort. While some cities are prepared to spend a large amount of their budget on disaster preparedness, other cities prioritize a variety of other local issues that they face on regular basis. While all cities are required to include routes and signs, some cities are willing to find alternative ways to prepare their population. Even for communities that prioritize government spending on tsunami readiness, all cities installation and maintenance budgets for emergency infrastructure are limited.

Many current wayfinding paths are well established, and, when looking, can be found and followed up to high ground. However, evacuation signage often blends into the urban fabric of the city, and is rarely noticed or practiced by residents and tourists. These signs or maps are entrusted to evacuate inundation areas during an event, but do not actively engage people before the event. Although it is possible that a wayfinding system can be effective for first time users, a complex plan is only as good as it is practiced. It is important to create dynamic wayfinding elements that help prepare people through familiarization.



THEREFORE: Design dual-purpose tsunami infrastructure that supports emergency evacuation, while also enhancing everyday life of the city.

Increased expenses from newly installed and upgraded tsunami infrastructure can be offset by additional funding from other sources. Consider multi functional elements that tap into alternative funding sources from private and public building development, local business participation, park departments, ODOT improvements, transit stops/routes, or public art/events. Finding new sources of funding fosters a more robust and integrated system, because invested members of the community, city, and state are given the opportunity to participate in its design and implementation. This type of collaboration develops new public-private partnership which benefit from a diverse set of community input and involvement.

If certain elements of the wayfinding system are used by residents and tourists every day before an event, it is certain that they will be more effective during and after an event. Tsunami wayfinding signs and maps do not have to be monofunctional, which is a common attribute that often causes these signs to be ignored by residents and tourists. Making these elements dynamic and serve multiple purposes, allows tsunami awareness to no longer be fear inducing, but rather to engage inhabitants of the city to participate and prepare for a disastrous event.

Public Art

Tsunami Evacuation signs could be placed on individual posts that incorporate artistic elements designed by local artists. By dedicating these signposts to tsunami related information and designing an interesting aesthetic, people are more likely to notice and examine the information on the post.



figure 3.5

This small parklet structure in Cannon Beach uses well designed posts and beams to represent the shape and spirit of a whale. These posts are commonly investigated by people that pass it by.

Evacuation Symbol: The Wave



figure 3.6

Tsunami Evac. Map Sign



figure 3.7

Tsunami Evac. Route Sign



figure 3.8

Tsunami Assembly Area Sign



RECOGNIZABLE WAYFINDING CHAIN

People are not aware of the many aspects of a tsunami evacuation system and the connections between them.



Most evacuation wayfinding systems incorporate the use of signs and maps to help people identify their route before an event, follow their route during an event, and assemble after an event. These signs and maps, as well as the public literature that is sometimes provided from time to time, are often designed at different times, and are not always recognizable as a coherent series of parts. This makes it difficult for people to easily recognize what elements they are supposed to utilize at what times, especially in a highly stressful environment.

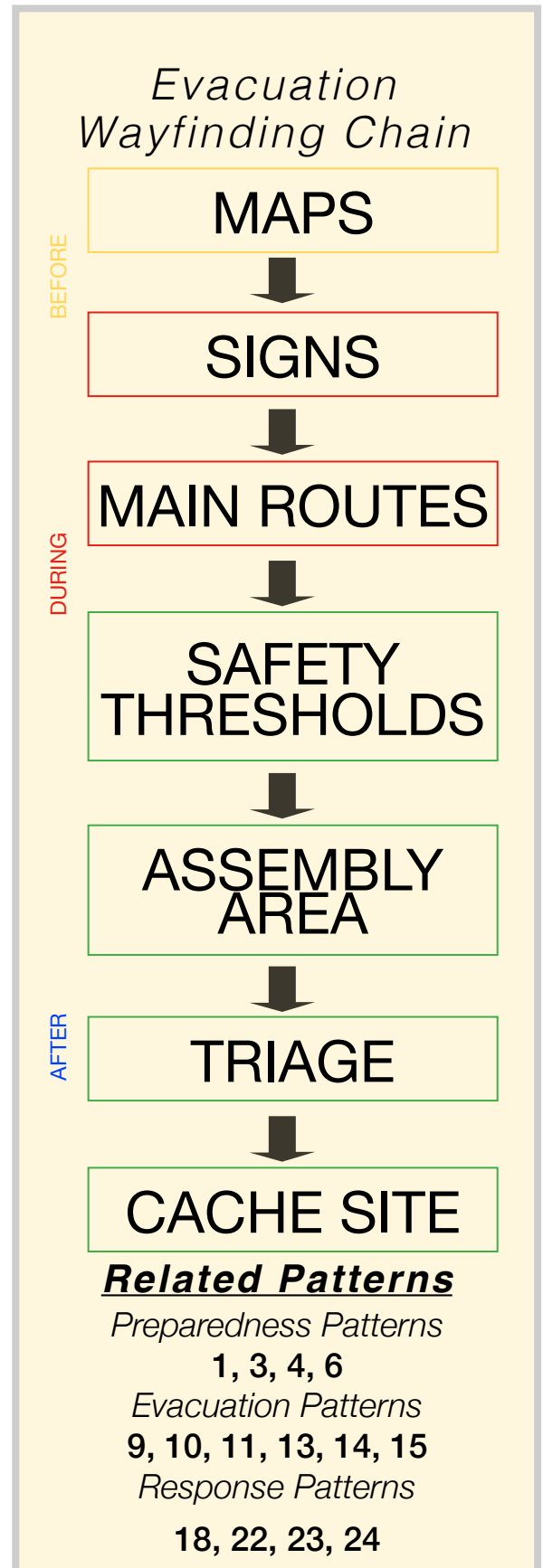
Although Oregon designed a tsunami evacuation logo that is used international coastal communities, the symbol does not always translate in the use of different signs. Tsunami evacuation maps often use three shades of color to differentiate the different hazard zones. These colors are found nowhere on tsunami evacuation or assembly area signs. Furthermore, pedestrian signs are often placed under evacuation signs to indicate that these routes are for pedestrians only. However, the color shade and placement with other types of street signs often makes it difficult to identify whether these signs are tsunami related. These type of confusing typology changes make the system less streamlined and intuitive for users.



THEREFORE: Design a consistent wayfinding chain that functions as a system. Establish recognizable and streamlined relationships between each element of the system.

When reassessing and developing tsunami evacuation wayfinding systems, consider ways to help users find commonalities between different wayfinding elements. If updated physical installations to the current system of maps and signs (awareness kiosks, signposts, lighting, assembly areas, and cache sites) are going to be implemented, they should be designed in unison as a recognizable system both in form and function. If people can both actively and subconsciously connect wayfinding elements that address preparation, evacuation, and response, the transition between the each phase becomes more seamless.

Consider using the same material, shape, configuration, lighting, or color when designing different elements of the system. Evacuation related information on maps, signs, printed material, websites and apps should have consistent branding, in order to make the system recognizable. Consistency of both 2D and 3D forms should make maps and signs come to life throughout the urban fabric of downtown areas and along evacuation routes. These types of moves can be used to create a brand that a city can advertise to residents, tourists, and other coastal communities that they are ready for the threat of a tsunami.



Awareness Kiosk

An Awareness Kiosk is a 3D physical station that provides useful tsunami preparedness, evacuation, and response information. This concept can be implemented with many designs, but should always include maps, slogans, instructions, and access to additional resources.



figure 3.9

3 map scales

State: A coastal map showing the Oregon coast with relation to the Cascadia fault line, major highways, and different coastal cities.

City: A city map that shows current location, major landmarks, general evacuation routes, and tsunami hazard zones.

Neighborhood: An evacuation route map that shows the current location and the clear path to the nearest assembly point.



INFORMATION STATION

Public tsunami evacuation maps do engage users or provide substantial information about the threat of tsunami and how to evacuate.



Although current tsunami evacuation maps are visually attractive, they are not being fully utilized by tourists to learn about tsunami evacuation. This may be due to their lack of clarity, their placement around the city, or their inability to engage users. These maps are the most accessible resource that tourists have, even though it seems that they are not fulfilling their purpose: to raise tsunami awareness, indicate proper evacuation routes, and convey the city's emergency plan.

Most commonly these maps are too impersonal, making it difficult for people to identify their location and their personal escape route. Because of the multitude of different types of signs around the beach, these evacuation route maps suffer from “sign fatigue” and are overlooked by the people who need the information the most. When placed in locations with a lot of movement, they do not incorporate a comfortable place to be studied, making most people glaze over the sign for a short period of time before continuing their route to the beach. Because these signs are often the only resource that visitors will see, it is essential that they do a better job of preparing them through information, mapping, and additional resources.



THEREFORE: Establish designed ‘places’ at high traffic pedestrian areas that include clear and engaging tsunami evacuation information.

Public tsunami evacuation route maps should incorporate engaging informational graphics about the history of the Cascadia Fault line, different inundation zones, and precise evacuation routes. They should include enough information to prepare visitors with no prior knowledge of the threat of an earthquake with an accompanying tsunami, and the tools and instructions of how and when to evacuate to high ground.

These maps can be placed with other features and public amenities such as benches, ATM’s, and tourist information in order to make them more attractive. Although people may not be drawn to a 2D evacuation route map on a sign post, a comfortable place to relax with interesting maps and infographics about tsunamis and the city that will engage passerbys in a way that 2D signs will not.

Placing these stations in high traffic areas such as beach entrances and other popular public places (bus stops, retail corridors, urban squares, viewpoints, parks and recreation, etc), will increase the number of people that will see the signs. By increasing passerbys and providing usable space and signs, more people who have never been exposed to the information will engage with and become more prepared for possible evacuation.

Mapping Displays



figure 3.10



figure 3.11



figure 3.12

Related Patterns

Preparedness Patterns

1, 2, 4

Evacuation Patterns

9, 10, 12, 13, 15

Response Patterns

18, 19, 22

Tsunami Hazard Zone Sign Testing

Tsunami hazard zone signs are commonly omitted within the city limits. Placing them alongside other tsunami related signs will get people's attention and let them know that they are currently located in an inundation zone.



figure 3.13

Although the color blue is used in the current system's signage, it is important to consider the color implication in sign design. Most cities use these guidelines for signage:

- RED: prohibition
- GREEN: emergency, fire
- YELLOW: caution
- BLUE: miscellaneous
- BLACK: obligation

Related Patterns

- Preparedness Patterns
2, 3, 7
- Evacuation Patterns
10, 14
- Response Patterns
18, 22



KNOW WHAT ZONE

Tourists are often unaware of a potential tsunami threat and may not even know that they are located in a tsunami inundation zone.



THEREFORE: Increase the number of 'Tsunami Hazard Zone' signs within the city to let inhabitants know that they are located in an inundation zone and that they should get to high ground in case of an earthquake.

Many people are unaware of when they are located in an inundation zone, let alone knowing what causes a tsunami. Although tsunami evacuation maps and signs are dispersed throughout a city, the information included on these types of signs do not directly educate people about the threat of an earthquake with an accompanying tsunami.

Tsunami preparedness starts with awareness! Assembly areas are pointless unless the evacuation routes can get people there and evacuation routes are useless if people are unaware of why they will have to evacuate. Although tsunami hazard zone signs are more alarming then the evacuation route signs, its message must be more effective at getting peoples attention and making them aware of the threat they face when visiting the beach.



PUBLIC-PRIVATE PARTNERSHIP

Different groups of constituents do not work together when formulating a wayfinding system for their city.



THEREFORE: Foster participation and buy-in from both private and public entities when forming a city's emergency preparedness plan.

A variety of different public and private entities are involved in the decision making and planning process with regards to tsunami readiness. These organizations range from local and regional governments, to nonprofit organizations, community groups, businesses, and private homeowners. Members of this network commonly have conflicts of interest with regards to intention, focus, money, time, scale, programs, etc.

Social networks of private and public partners are capable of establishing a robust wayfinding system that is supported, and therefore maintained, by everyone in the community. Private businesses can gain advantages when working with public groups through advertising and outreach, while public entities can gain additional sources of revenue to have a larger impact. Evacuation plans are only as good as their planners, which is why these systems will benefit through collaboration of different invested members of the community.

Possible Partnerships

Motel/Hotels & City Officials

A motel can have anywhere from 20 - 100+ unaware guests in any given night. These establishments should provide all guests with literature, have trained leadership staff, and pay a small fee for the upkeep of tsunami infrastructure. In turn these businesses might receive tax benefits or other incentives for participation.



figure 3.14

Cruise Liners & Cache Sites

A cruise that docks in a coastal town can increase the population by a significant amount. If a tsunami were to strike when they were docked, no resources would be stored accounting for these additional people. Cruise liners should pay a small fee to account for the potential increase in disaster victims.

Related Patterns

Preparedness Patterns

6, 7, 8

Evacuation Patterns

16, 17

Response Patterns

19, 22, 24

Regional Evacuation Groups

By establishing different regional areas within the city, evacuees that will rely on the same routes and the same assembly points can be grouped based on location. When grouped, planning and preparing can be done on a more localized scale by neighbors and businesses that exist in each zone.

Tsunami Evacuation Zones



figure 3.15

Related Patterns

Preparedness Patterns

2, 5, 8

Evacuation Patterns

13, 16

Response Patterns

20, 22



MAPPING YOUR NEIGHBORHOOD

Neighborhoods are not prepared to respond to a devastating tsunami together.



THEREFORE: Map resources and foster community wide social networks before an event, in order to support effective evacuation and response.

Responding to a devastating tsunami event takes a group of people working together. Preparedness plans are often created by individual families or city officials. However, these plans rarely account for regional groups of people. Members of the neighborhood groups living close to assembly areas are most likely going to be the ones in charge of assisting disabled members of the community, distributing scarce resources, and sheltering large groups of evacuees.

Rebuilding comes with a certain amount of trust and communication. These relationships will be tested during and after an event, which is why they need to be strengthened before the event. It is important for neighborhoods to elect leaders that can begin to map needs and resources for their community. Walks, meetings, events, literature, and practice are all methods to map individual neighborhoods. This process will help to raise awareness as well as establish a sense of trust and collaboration of the community.



RELOCATE TO HIGH GROUND

Civic buildings that are destroyed by a tsunami leave a city without its essential functions.



THEREFORE: Relocate important buildings to high ground so the city's essential resources can support rebuilding post-disaster.

Institutional functions lay the groundwork for cities. Without government, fire and police departments, schools, hospitals, and community forum, a city loses its ability to function. If an earthquake and accompanying tsunami were to destroy these buildings, they in turn cripple a city's ability to respond to an event, relying only on outside help for survival. Currently, most of these institutions reside in the heart of these coastal communities, and in danger of being destroyed by a tsunami.

If these institutions can survive a disastrous event, the city has an established framework for civic response and rebuilding. The presence of these buildings and their functions will quickly enact plans, retain law and order, fight fire, provide aid, and shelter the newly homeless. Additionally, they provide a reassuring sense of calm to evacuees that their society is still in tact. While it is not realistic to move all of these functions out of city limits immediately, it is important to consider the impact of post-disaster response without them.

Moving Schools

Recently, the city of Cannon Beach moved its elementary school out of one of the most difficult inundation zones to evacuate. The youngest and potentially most vulnerable population spent much of their time in the most dangerous inundation area and farthest point from the safety.



figure 3.16

The students were relocated to Seaside, a neighboring city in which its school is located much closer to high ground. Due to the extra distance they would have to travel everyday, and the separation between family members, the decision was strongly debated and opposed by some residents and parents. However, the city realized that having this institution located in the most dangerous inundation area was not worth the risk, and decided to make the move to safer ground.

Related Patterns

Preparedness Patterns

4, 5

Evacuation Patterns

17

Response Patterns

18, 24

Telephone Wires Underground

Consider potential fallen debris that could impede evacuation. Downed power lines, though not active, can block routes and slow down escape. Precedents from Katrina and other events show the difficulty of navigating roads with these power lines impeding movement. This becomes a hazard both for evacuation, but also for relief and rebuilding of the area post disaster.



figure 3.17

Many cities around the country have completed large public projects that bury power lines underground, usually to improve the views and quality of the street. Also, if these lines and utilities are buried underground, they will not impede evacuation, or need to be cleared after the event.

Related Patterns

Preparedness Patterns

5, 6

Evacuation Patterns

13, 17

Response Patterns

21, 22



ROUTE SAFETY

Major earthquakes may make primary evacuation routes difficult or impassable for escaping a tsunami.



Most tsunami evacuation routes rely on primary streets for evacuation. Because a tsunami follows a major and most likely destructive earthquake, these roads must be able to function after the ground stops shaking. However, these major streets are often exposed to many threats that could prevent evacuees from using them efficiently.

These roads are often abutted by some of the largest buildings, fixed with power lines, or exposed to large trees. These routes often cross bridges when leading uphill. Sometimes there are gas lines underground or gas tanks at stations. Paving may be exposed to the threat of landslides or liquefaction. An excess of car parking and car use may create bottlenecking.

It is impossible to make any road completely earthquake proof. To attempt to do so would be a waste of time and resources that could be allocated for other tsunami evacuation related programs. However, these potential failures threaten the ability for effective evacuation, and therefore must be considered during the planning process of routes. Future development of infrastructure that is connected with these routes should be built to specific guidelines and restrictions that can help prevent additional threats to these routes.



THEREFORE: When making routine infrastructure improvements, consider the durability of primary evacuation routes and the impact of the surrounding built environment.

Overlay infrastructure maps and primary escape routes in order to understand the potential failures that may occur during an event. By realizing all of the potential threats that could impede evacuation, it becomes easier to pick and choose where to make improvements. This pattern can be implemented as a precautionary measure, during renovations of existing infrastructure, or when planning for future routine upgrades. Establishing guidelines for businesses and homeowners to follow is the first step in creating the positive change overtime.

Although establishing safe evacuation routes important, it is most likely not priority to making expensive infrastructural changes. These developments, while decreasing the potential failures that threaten safe evacuation, provide opportunities to enhance the livability of the built environment. Therefore, these problems do not have to be solved by tsunami based budgets and efforts alone, but undertaken by business developers, ODOT improvements, and city initiatives. Don't think of tsunami preparation as an individual problem too large to address, but rather consider the threat and its safeguards as an important aspect of all future growth and development of the city.

Quake Safe Pedestrian Bridge

In the event of an earthquake, the Fir Strèet Bridge in Cannon Beach will be destroyed, cutting off the vulnerable downtown population from reaching high ground. Since it is assumed that the bridge would be destroyed by an earthquake, none of the evacuation routes lead to the bridge, but instead almost two miles farther in the opposite direction. This bridge makes evacuation next to impossible for one of the densest areas in the city, and is one of the reasons that the elementary school was relocated to a neighboring city.



figure 3.18

Instead of renovating the current vehicular bridge to be quake safe, it makes more sense to build an engineered pedestrian bridge to survive an earthquake, even if it were to get wiped away by the tsunami. This bridge could provide the downtown evacuees with the shortest route to safety and a much better chance of reaching high ground before the tsunami were to destroy the bridge. Also, pedestrian bridges will have a clear path to safety, without obstructions by car traffic.

A SURVIVAL LANGUAGE : TSUNAMI ESCAPE WAYFINDING

BEFORE

DURING

AFTER

- 9 | MY PERSONAL
ESCAPE ROUTE
- 10 | INTUITIVE SIGNS
- 11 | THE SPACE
BETWEEN
- 12 | DISTANCE
MATTERS
- 13 | PRIMARY ROUTE
CLARITY
- 14 | OTHER FORMS
OF SIGNAGE
- 15 | LIGHTS AT NIGHT
- 16 | FOLLOW THE
LEADER
- 17 | ALTERNATE
EVACUATION

EVACUATION PATTERNS



The Evacuation Patterns chapter includes patterns that happen ***DURING*** a disastrous event. Evacuation is the moment when preparation efforts are put into practice; it is when people have to find their way up and out to safe ground. These patterns focus on creating an intuitive wayfinding system that relies on the clarity of signs and routes to evacuate inundation areas before the incoming tsunami arrives.

3D City Evacuation Route Maps

2D maps are used less and less by the general public. These maps often take time to figure out before they can be understood, which is why they are usually glossed over rather than studied by people that pass by.



figure 3.19

However, with models (i.e. three dimensional maps), people are able to create a better cognitive understanding of where they are in space, especially when it comes to determining elevation. A 3D interpretive model of a city that shows a “YOU ARE HERE” location marker, evacuation routes, major landmarks, problem locations, assembly zones, and cache sites, is a dynamic way to engage tourists and residents to learn their evacuation route.

Related Patterns

Preparedness Patterns

1, 2, 3

Evacuation Patterns

10, 12, 13, 16

Response Patterns

18, 19, 22, 23



MY PERSONAL ESCAPE ROUTE

People want to know their personal escape route in an earthquake and tsunami situation.



Most tsunami evacuation maps are never seen by residents and tourists alike. When these maps are noticed, they are rarely in depth enough for someone to quickly locate themselves, and identify their exact route to safety. The growing dependency on digital maps for wayfinding is decreasing people's ability to efficiently use 2D maps. However, even for the tenured map finder, current tsunami evacuation 2D signs are ineffective and too vague to serve their purpose. Ideally, awareness programs would ensure that everyone would know their exact route to safety before an event. Realistically, these tools will be overlooked and needed for the first time during an event.

One of the biggest issues maps is the over excess of information. Users may be unable to process the entire map while the only thing needed is a locator, a reference to landmarks/topography, and their evacuation route from their personal location to their assembly point. Map scales imply different uses, which is why it is important to consider which scale is needed by residents, visitors, and tourists. Information stations, motels/businesses, and assembly areas should include different scales of evacuation route map depending on the intended use.



THEREFORE: Use location markers on city and neighborhood maps so that people can quickly identify their location, the closest assembly area, and the evacuation route that will lead them there.

Maps need a way of guiding people, unfamiliar with the place, to safe ground. These maps should help individuals quickly identify where they are, where they need to be, and the fastest path from point A to B. Maps can utilize a “You Are Here” marker, a highlighted red path with arrows, and a large ‘A’ to represent assembly areas. Maps of malls, which are some of the most confusing buildings to navigate, use these types of markers and symbols to help people quickly find their way.

Consider ways to implement locational maps in different neighborhoods so that people can use the maps when they need them most. Information stations should include maps that are used to raise awareness before the event, and should be both informative and engaging. These stations might include regional maps of the Oregon coast city maps, local evacuation route. Motels need to provide guests more specific routes to use during an event which should show current location, evacuation route, and assembly point. Consider other engaging map types that are either three dimensional or can be downloaded as a plug-in on cell phones. These types of maps have an ability to reach users in ways that current 2D signs can not.

Tsunami Map App

Tsunami Evacuation NW is a cell phone application that includes maps of different cities in the northwest, inundation zone levels, and tsunami warning alerts. This free app, as well as others, are generally underdeveloped and rarely used by coastal community residents and visitors.



figure 3.20

A disaster evacuation application could be implemented through major map sites like Google or Bing. This app could be downloaded and used to show the nearest evacuation routes, provide tsunami warning signals, and include interactive education. QR codes (a quick response matrix barcode) can help integrate technology with the physical signage of a wayfinding system

Cell phones towers will likely collapse during an event, so this app will need to be used without service. A clever design might constantly update evacuation routes based on location with cell phone service. When towers go down, the precise route will already be programmed into the phone.

Route Sign Existing Conditions

Tsunami evacuation route signage needs to be clear, concise, and intuitive. This is one example where the information location, and placement of the sign can become confusing. The use of an old and new sign facing in two different directions (leading to two different assembly areas) will make people stop and try to figure out where to go. It is unclear whether the pedestrian sign indicates a scenic route or directs tsunami evacuation as walking only. The use of blue, while successful, can begin to look like other city signs such as handicapped parking, landmark markers, or highway information. The placement among other street signs makes the sign less important and identifiable.



figure 3.21



INTUITIVE SIGNS

The graphic design, position, and presentation of tsunami related signage lack directional clarity for users.



On any given day, current tsunami evacuation route signs can generally be followed from any point in a city to an assembly area. Sometime decisions are delayed for which sign to follow when two different routes meet a cross roads. Other times it is difficult to understand the relationship between pedestrian symbols and their accompanied route signs. The arrows are not always clear and when turns are necessary, the signs sometimes do not exist. However, with a little bit of patience, these signs do in fact work.

During a highly stressful evacuation, with large groups of people, and a limited time frame, these signs need to be clear and concise. The symptom of panic often makes the interpretation of a symbol, direction, or in phrase difficult to follow. Decision making is often skewed and dangerous during an evacuation. This is why the design and placement of these signs might be the most important aspect of a successful wayfinding system.

***Intuitive:** wayfinding definition*

the ability to understand something immediately, without the need for conscious reasoning.



THEREFORE: Design simple, clear, and legible signs that assure immediate recognition and action by evacuees.

When designing the graphic layout of 2D signs consider a variety of different things that impact the way people interact with and quickly interpret sign's instructions:

Color: Different colors are interpreted to mean different things. The color blue is often associated with miscellaneous signs.

Shape: Different shapes are often correlated with particular types of instruction. A rectangle is instructive, where a circle is prohibitive.

Text: Too much text is often disregarded on wayfinding signage. People often read titles or distances, but not instruction.

Symbols: Symbols can often be effective means of describing things, but can also confuse users if not clear.

Size: The size of the sign often dictates how important people interpret the sign to be.

Although the current tsunami evacuation route sign may be the best design, it is important to test its features with regards to these different graphic elements. These signs are often the only thing a city relies on besides people, to help evacuate inundation areas. Therefore, the utmost importance should be placed on designing consistent, legible, and intuitive tsunami evacuation route signs.

Sign Design



figure 3.22

This was one possible design solution for a new tsunami evacuation route. The existing circle within a square replaced the original circle because of the new sign regulation decisions about the use of circles. Circles represent prohibitive actions such as a railroad crossing sign, while rectangular shapes dictate information or direction. Placing the symbol of the pedestrian on the one sign, better informs evacuees and everyday people they must evacuate on foot, possibly must be done on foot, which could possibly preventing some vehicle evacuations.

Related Patterns

Preparedness Patterns

2, 3, 4

Evacuation Patterns

9, 10, 11, 12, 13, 14, 15

Response Patterns

18, 19, 22

DURING ○●○

Sign Visibility

Two scenarios describe particular issues that may arise when placing signs on tsunami evacuation routes.



figure 3.23

When located on a trail or winding path, certain obstructions may require route signs to be placed closer together.



figure 3.24

Downtown areas sometimes have multiple evacuation routes, which may be disorienting because too many route signs are visible from any one location.

Related Patterns

Preparedness Patterns

2

Evacuation Patterns

10, 12, 13, 14, 15

Response Patterns

18, 19



THE SPACE BETWEEN

There are periods of time along tsunami evacuation routes where no visual marker can be seen.



THEREFORE: Establish a standard tsunami evacuation route sign placement so that when one marker is passed, the next one is visible.

Tsunami evacuation route signs are the primary guides along escape paths. As an evacuee moves along a route, they depend on the sequential placement of signs in order to know when to turn or to continue straight along the same path. Without clear instructions, people may attempt to chart their own course. If no signage is visible it is likely that people will start questioning the route that they are on, and may turn on a dead end street if it seems to lead to high ground.

Unique geographic conditions, user populations, and local factors can cause problems with route continuity. In some cases, there is too much space between tsunami evacuation route signs. In others, obstacles such as overgrown trees, or winding routes lead to confusion. At night, visibility conditions worsen. Older populations, or visually impaired people may have trouble with sign visibility that is placed too far apart. Consider augmenting evacuation route signs with alternative forms of signage that can be visible at any point on the evacuation route.



DISTANCE MATTERS

Tsunami Evacuation Route signs describe direction, but too often do not inform where they lead or include the distance to safety.



THEREFORE: Tsunami evacuation route signs should include the distance from the current point to the nearest safety threshold.

During an event, signs help guide people, but provide little to no additional information. Although too much information can get confusing, signs that expect people to follow them blindly do not empower users, which causes them to question the route that they are following.

By including distance markers on these signs, people begin to get a sense of where they are going and how long it will take them to get there. When the distance decreases from one sign to the next, evacuees are assured that they are on the right path. Similar to travelling along a highway, distance markers help drivers to their destination. Also, placing distance markers on signs, will force cities to follow a sign placement system. This will help to assure that evacuation routes are up to date and that sign locations are documented. Although this method will take a certain amount of time and resources, it will help establish a new systematic approach to evacuation routes and sign placements that does not exist in most coastal communities.

Meter Markers



figure 3.25

These tsunami evacuation route signs in Thailand and New Zealand have used Oregon's route sign design format. The simple addition of the distance mark makes the sign feel more informative and assuring to a nervous evacuee.



figure 3.26

Related Patterns

Preparedness Patterns

3

Evacuation Patterns

9, 13

Response Patterns

18, 22

DURING ○●○

Evacuation Route Connectivity

Use alternative methods of signage to help define the relationship between secondary and primary streets. Alternative methods of guiding people along their route other than 2D signs might include reflective paint in the ground or flashing lights along the sidewalk at important intersections



figure 3.27

Pedestrian Traffic Control:

Clearly indicate when to turn off of secondary onto primary streets.

Emphasize a primary route turn to ensure that the right street is taken to high ground.

Prevent people from turning onto secondary streets that will not take them up to a designated assembly area.

Related Patterns

Preparedness Patterns

2, 3, 6, 8

Evacuation Patterns

9, 10, 11, 12, 14, 15

Response Patterns

18, 23



PRIMARY ROUTE CLARITY

Primary arterial streets too often lack elements that distinguish themselves as tsunami evacuation routes.



Downtown areas and regions located closer to sea level require the greatest distance to be traveled by evacuees. Most routes intend to guide people from whatever secondary street they are located onto the closest primary artery. These streets sometimes, but do not always have evacuation signs adjacent to them to indicate that people should turn if they are coming from a secondary street. Signs that instruct evacuee continuation are often placed too far apart or are lost on a post with other graphics.

The primary arteries often run north-south, parallel to the beach. East-west streets often run into problematic crossings, bridges, or highways, which is why the primary artery directs evacuees to a specific street that will take them east, away from the ocean and to higher ground. Inconsistencies in signage along primary routes increase the chances for people to follow their own intuition, moving away from the beach. This may cause them to turn down dead end roads that will not take them to safety. Even when signs function correctly, these types of human interventions may cause hundreds of people to go the wrong way. These primary routes should clearly be highlighted through the proper placement of maps, signs, and other forms of wayfinding signage to prevent evacuees from straying off course.



THEREFORE: Establish multiple forms of signage that make these streets clearly identifiable as the route that should be taken in order to reach high ground.

These primary evacuation routes have been studied and laid out to be the most effective, and sometimes only path to high ground. In order to make people follow them intuitively, there needs to be a greater sense of importance, directional clarity, and memorability of the primary evacuation arteries.

This can be achieved through effective and legible signage. Differentiating turning route signs from those that instruct continuation is pivotal, and should not be placed on the same sign post. All turns from secondary to primary streets should clearly be marked with signage. The most important turn, away from the north-south artery, going east away from the ocean needs to be clearly visible from both directions and from afar.

However, evacuation route signs are not the only method of guiding evacuees on the paths. Lighting the signs, the edges, or the middle of the street is one method of establishing these streets as important arteries for tsunami evacuation. If lights are flashing up and down the street, but not along a secondary route, it will be less likely for individuals to stray away from the path. Establishing boundaries with paint or reflective tape along street edges may help prevent unwarranted turns.

Solar Roadways



figure 3.28

Based upon the concept of electric racing roadways as well as the durability of airplane black boxes, Solar Roadways aim to solve multiple environmental problems. Solar Roadways are composed of recycled materials as their primary support system, solar panels and led's. These panels can provide clean energy, help with water filtration and reuse many different forms of solid pollutants. Solar Roadways make safer roads by providing better wayfinding. They can be used both as interactive signs, delivering messages to direct people out of town during an emergency, and also as an incredible aid during a night time evacuation. Since each panel is individual hardwired, and are powered by solar, they would function even during a disaster event. These roadways can eliminate the threat of downed power lines by eliminating the need for above ground utilities.

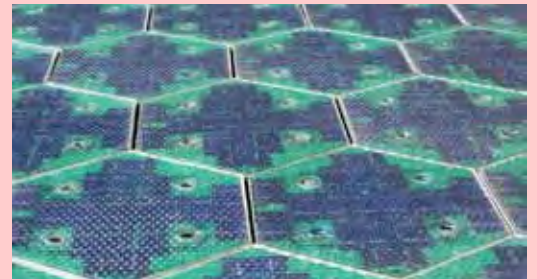


figure 3.29

DURING ○●○

Primary Spine of Lights

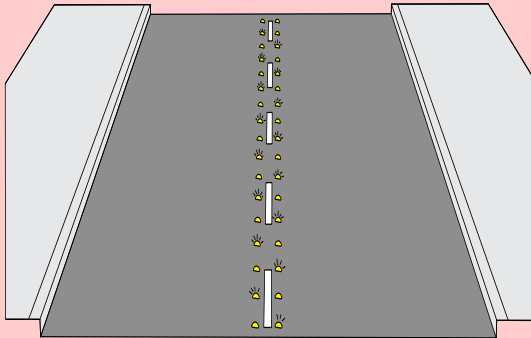


figure 3.30

Lights that are placed in the ground through the center of the road or along the edges to establish barriers can be strategically placed along primary evacuation routes in order to create better tsunami evacuation wayfinding.

Their ability to illuminate paths at night both improve the quality and safety of dark street, while clearly indicating the evacuation route during an event. Highlighting certain conditions can help emphasize important directional turns or to indicate a safe zone.

These lights can run on a timed system connected underground and powered with solar energy. With advanced enough technology, they could flash, change color, or become brighter during an event.



figure 3.31



OTHER FORMS OF SIGNAGE

The destruction of an earthquake will create unexpected conditions that may make the wayfinding signage system fail.



Currently, most cities rely on a series of signs as their primary wayfinding system. If everyone stays calm, the event happens in the middle of the day, and the earthquake is relatively mild in its destruction, these signs may be designed well enough to evacuate a city before the incoming tsunami. Even if people have never used the routes before and have no idea what to do, there is a chance that these signs will be effective.

However, like most disastrous events, plans rarely go to plan, and chaotic and unexpected situations are a certain. If the event happens at night these signs will not be seen. If the earthquake knocks the sign posts over, there will be no way to use them. If the sign post gets turned, they might even direct people in the wrong direction. Even if the signs stay in tact, trusting people to be able to intuitively use a fairly simple system in a chaotic situation is a lot to expect.

These are few of the intangible forces that could prevent the signs from functioning, and leave out endless other missteps, failures, or unforeseen things that could occur during an evacuation. If one or more of these failures were to render the signage system useless, there is no other physical wayfinding elements that will help people find their route.



THEREFORE: Provide a series of redundant wayfinding typologies that will increase the chances for effective evacuation.

Most systems are constrained to the conditions in which they are designed. New evacuation wayfinding systems should consider all unforeseen failures that might prevent the system from working. If one sign happens to fail, there needs to be other elements that let people know where they need to go. If one type of sign is not helping to prepare unaware tourists, the city should use other informational strategies that will. By creatively incorporating different forms of wayfinding elements into the urban fabric of the city, the system starts to become redundant. In this context, redundancy is not meant to induce fear or unnecessarily repeat the same message over and over, but rather to establish a robust system that can withstand the known and unpredictable shocks of disasters.

Other types of signage can come in a variety of forms depending on different needs. Wayfinding should not be constrained to 2D metal signs on 4 x 4 wooden posts, but include different types of visual, auditory, and social evacuation indicators. Consider ways of lighting routes or using reflective paint or tape on the ground. Update sirens and include using other types of calls at assembly areas. Rely on residents and business owners to take charge of signaling and leading unprepared tourists and visitors on the right route to safety.

Redundancy

Engineering Definition:

the inclusion of extra components that are not strictly necessary to functioning, in case of failure in other components.

“a high degree of redundancy is built into the machinery installation”



figure 3.32

A variety of types of wayfinding signage establish redundancy; this generates a robust system, able to withstand the unforeseen shocks of disaster. Consider using:

- Blinking lights in the ground
- Lights on or under signs
- Markers in the ground
- Reflective paint on street edges
- Blinking lights at assembly area
- Earthquake proof sign posts.
- Using landmarks for mapping
- Batman skylight at assembly....

Related Patterns

Preparedness Patterns

1, 2, 4

Evacuation Patterns

10, 11, 13, 15, 16

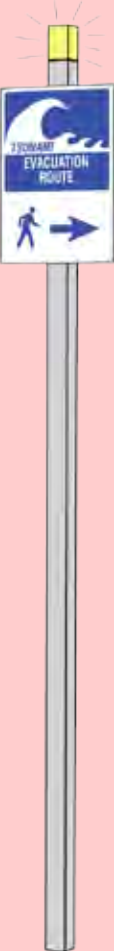
Response Patterns

18, 19, 24

DURING ○●○

Tsunami Evacuation
Sign Post

Most evacuation route signs are made out of reflective material, and placed on a 4 X 4 wooden post along with other common street signs.



A sign post that is solely dedicated to tsunami evacuation could include:

Light to illuminate the reflective sign and let people find their way in the middle of the night

Earthquake stable post that will not fall down due to the ground shaking.

Tsunami related signs only that are more easily identifiable before and during an event.

Well designed by a local artist that carves posts out of wood or welds them from steel.

figure 3.33

Related Patterns

Preparedness Patterns

1, 2, 3

Evacuation Patterns

10, 11, 13, 15, 17

Response Patterns

19, 22, 23



LIGHTS AT
NIGHT

A nighttime event will decrease people's ability to identify signs and follow evacuation routes.



THEREFORE: Use independently powered lights along primary evacuation routes to reassure evacuees that they are on the right path.

Nighttime evacuations are disorienting, reduce sign visibility, and result in slower escape times. Difficulty in identifying signs from a significant distance contributes to an increased risk of evacuees steering off course. Current tsunami evacuation route signs are made of reflective material, but if people are not driving or do not have a flashlight, the reflective material will not be illuminated in the dark.

In the case of nighttime evacuation, lighting can solve many of these problems. These lights may be placed on top of tsunami evacuation route signs or more frequently on the edge of the route essentially creating a boundary that guides citizens on the correct path. These lights could blink, change color, increase in intensity, or stay constant depending on the conditions in which they are set. Selected locations could light up brighter at places such as assembly areas or key intersections where you need to change direction. Creative use of lighting can also help make safer streets in everyday life by creating edge boundaries for dark streets or lighting pedestrian crossings.



FOLLOW THE LEADER

The physical wayfinding system might fail to guide evacuees to safety for a variety of unforeseen reasons.



THEREFORE: Make evacuation route leaders an integral part of the wayfinding system.

Visitors, tourists, and residents who are unaware of their tsunami evacuation route or of what to do in case of a tsunami, may not be able to intuitively use the wayfinding system in order to evacuate. Many people rely on others during disasters/catastrophes, a phenomenon known as groupthink. If the leader of a group of evacuees is not properly trained or informed, they have the potential to mislead others. Because people survive disasters together, townspeople and business owners need to support the needs of tourists that are unaware of what to do.

Develop a preparedness program that identifies, trains, and supplies individuals to act as evacuation route leaders. Designate leaders who can loudly instruct everyone around to follow them on the evacuation route to safety. These people might be business or hotel employees, CERT volunteers, or city officials. A training supply package should be kept on hand, and might include easily identifiable reflective vests, evacuation route maps, a flashlight, a whistle, and how-to guide.

Tsunami Certified

Motels that host tourist can account for a 300% increase in the city's population during the summer. These businesses should be responsible for preparing and helping evacuate their guests during an event.

Information: All motels should politely make people aware of the tsunami zone that they are in and include evacuation maps and packets somewhere in the room.

Tools: Motel rooms should be equipped with tsunami evacuation kits that include a laminated map, flashlight, whistle, matches, and basic instructions for evacuation.

Leadership: Business owners or workers should be trained to quickly send a message to all of the rooms and lead their customers out of the building and on the quickest evacuation route.



figure 3.34

Related Patterns

Preparedness Patterns

5, 6

Evacuation Patterns

9, 14, 17

Response Patterns

20, 21, 22

DURING ○●○

Nikishi, Japan Evacuation Tower



figure 3.35

“An impressive five-story, 22-m-tall reinforced concrete structure resembling a lighthouse. Founded on a 4-m-deep layer of sand and gravel, the tower is supported on concrete piles extending 6 m below grade. It was designed to withstand the impact of a 10-ton ship at a velocity of 10 m/sec. For day-to-day use, it features public restrooms, a meeting room, firefighting equipment storage space, and 73 square meters of refuge space for evacuees.”

www.asme.org

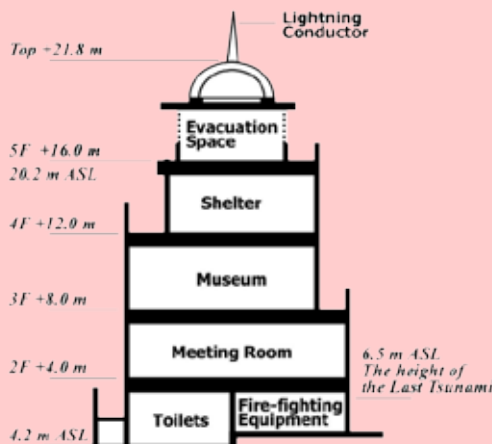


figure 3.36



ALTERNATIVE EVACUATION

Timely evacuation may not be possible in some areas that are too far away or geographically blocked from safe ground.



It is estimated that after a large local earthquake, there is approximately a 15-21 minute time window in which to evacuate. Most evacuation routes have been studied and tested to allow enough time to reach high ground if people stay calm and move quickly. However, almost every city has certain routes where evacuation is less realistic.

This may be because of the extreme distances that people would need to travel, requiring them to run at a pace that they are either not trained, or capable of doing. Even if the time allotted would allow for a people to evacuate at a brisk pace, the studies rarely account for panic or confusion. These routes obviously require incline, but some have such a steep incline that elderly or disabled people will not be able to climb them. If large buildings surround routes, the earthquake might cause them to fall over into the road, making them impassable. Other barriers that might prevent evacuation could include bridge collapse or liquefaction of roads.

Many different types of failures are possible and likely to occur during an earthquake. If certain areas in a city exist where high ground can not be reached in time, the people in those areas are given little to no chance of surviving the tsunami.



THEREFORE: Build alternative methods of vertical evacuation for people who are unable to reach high ground otherwise.

If it is decided that certain vulnerable populations have little to no chance of survival, consider implementing man made structures that will provide these groups with an alternative evacuation escape plan. These structures are usually in the form of simple, yet well engineered tsunami evacuation towers, which have to be able to withstand the effects of a major earthquake, and be built tall enough to rise above an oncoming wave. They also have to account for holding the estimated number of people that are located in those high risk areas.

These towers can be used as prominent buildings for a variety of purposes. City hall and first responder departments might inhabit them everyday, to assure their survival during an event. The tower could become a tsunami preparedness center for learning and research that monitors sea level change and supports community awareness. Other ideas include mixed use buildings that include traveler accommodations and ground floor retail to support the tourist economy of the town.

A berm that acts as a public park could support evacuation as well as slow the wave, to provide people with extra time along their evacuation route. More natural forms of vertical evacuation include precedents from India where people found refuge in climbing palm trees.

Occupiable Berm

A berm is either a natural or artificial embankment that is meant to slow the surge of the wave through steering or blocking the water. If shaped like the bow of a ship, a constructed wall could guide the water around an important area to protect such as a tsunami evacuation tower or a pedestrian bridge, giving people a longer time to get to high ground and safety before the oncoming wave.



figure 3.37

Instead of implementing giant seawalls that obstruct view of the ocean, find ways to integrate elevated slopes into public parks for gathering, public events, and tsunami awareness. By including elevated lookouts, berms can provide new views of the ocean and great places to watch sunsets.

Related Patterns

Preparedness Patterns

1, 5, 7, 8

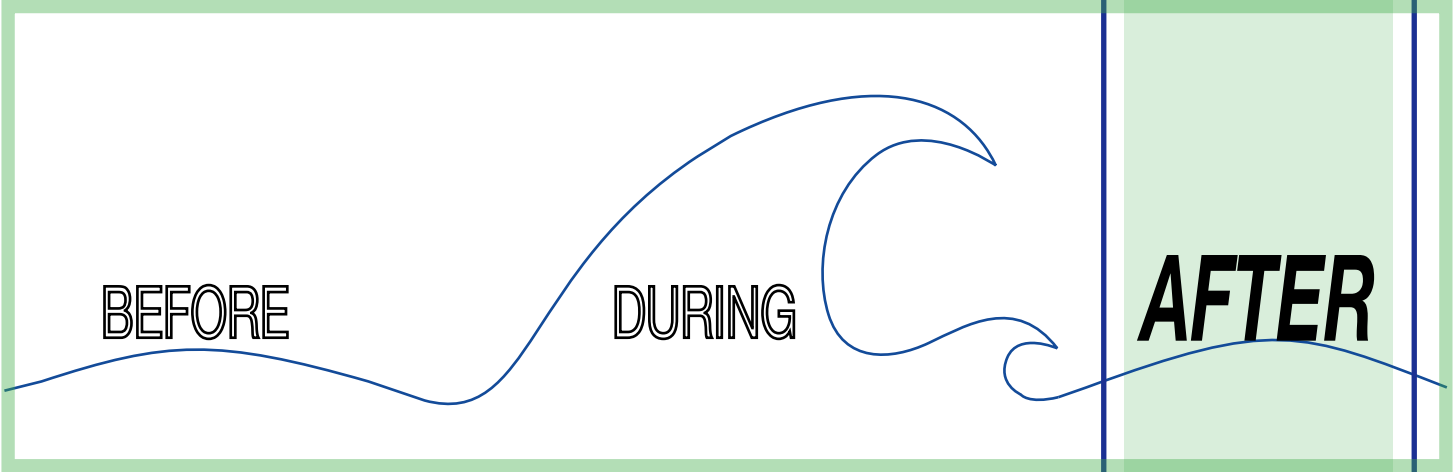
Evacuation Patterns

15, 16

Response Patterns

18, 20, 21, 23

A SURVIVAL LANGUAGE : TSUNAMI ESCAPE WAYFINDING



- 18 | SAFETY ZONE THRESHOLD
- 19 | ASSEMBLY AREA ESSENTIALS
- 20 | HOW TO GUIDE
- 21 | TRIAGE AND REGISTRATION
- 22 | CAMPSITES
- 22 | ASSEMBLY AREA
 - .1 CAMPSITE
- 22 | SAFE HOUSE
 - .2 CAMPSITE
- 22 | CACHE SITE
 - .3 CAMPSITE
- 23 | SENSE OF PLACE
- 24 | MULTIPURPOSE CAMPSITES



RESPONSE PATTERNS

The Response Patterns chapter includes patterns that happen ***AFTER*** a disastrous event. The response phase begins the minute that the safety inundation threshold between danger and safety is crossed, but continues on for many years after disaster strikes. These patterns focus on effective planning of campsites that will be able in order to support the immediate needs of survivors while also considering the long term needs of a city.

Wellington, 'Tsunami Safe Zone'



figure 3.38

The community of Wellington, New Zealand uses markings on the road to indicate a transition between hazard and safe zones. This painted line clearly informs people when they are safe, while also promoting awareness and cognitive mapping of escape routes before and event. The same symbol and a slightly lighter color blue has been used in recognition of the Oregon tsunami evacuation design logo. These blue safety threshold lines help to establish the recognizable wayfinding chain along the evacuation routes.



figure 3.39

Related Patterns

Preparedness Patterns

1, 2, 3, 4, 7

Evacuation Patterns

9, 10, 11, 12, 13, 14, 17

Response Patterns

19, 20, 22



SAFETY ZONE THRESHOLD

There is no signal that clearly informs evacuees that they are out of the inundation zone.



THEFORE: Design a wayfinding element that informs people that they have reached safe ground, and should continue moving to the assembly area.

When evacuees reach an assembly area, a rather small and uninformative sign exists to let them know they should assemble. Some of these signs are at the approximate safety threshold, but do include the word safe. If people have no clear indication that they have in fact reached safety, they will question whether they need to keep going and what they should do. The lack of information causes stress rather than supporting response.

The safety zone threshold represents the transitional juncture between evacuation and response. This instantaneous moment paves the way for a long, tragic post-disaster experience. Establish an early path for gathering, organizing, and surviving in group isolation by clearly notifying evacuees when they are safe. A new sign, paint in the ground, or a softer light are all visual markers that people can see when approaching to let them know that they have almost made it to their destination.



ASSEMBLY AREA ESSENTIALS

Assembly areas are unassuming places that leave evacuees with no useful instructions or resources at their initial gathering point.



THEREFORE: Provide useful information and essential tools at assembly areas that will help evacuees respond appropriately.

Most assembly areas consist of a sign at the side of the road that says Assembly Point. Although some are close to cache sites or safe houses, they all lack the necessary information, tools, and space to address the immediate need of survivors. Current areas rely on someone who knows the plan to help gather people into a group. If no designated leader is present, panicked people are left with no other instructions.

Assembly areas should all be equipped to address the immediate needs of a potentially large and traumatized group of people. Lighting, paving, and sheltered elements establish a sense of place where people can gather and collect themselves. Clear signage and a set of instructions will assure people that they are safe, inform them of the current situation, and help them start to respond as a group. Tools such as maps, a call box, base medical supplies, and a method for evaluating the evacuees are things that can serve a group's immediate needs.

Assemble!

Most assembly areas are made up of the following sign, and include no other information or resources for evacuees once they have reached safe ground.



figure 3.40

Information:

How to guide, sign instructions, trained neighbors

Resources:

Maps, call box, medical supplies, registration, water supply

Place:

Light, seating, paving, clearing with view of ocean, natural protection (wall, tree, etc)

Related Patterns

Preparedness Patterns

3, 5

Evacuation Patterns

9, 10, 11, 14, 15

Response Patterns

19, 20, 21, 22, 23

Storage Container Security

Providing how-to-guides is not as easy as it may seem. This guide informs people how to access valuable resources in locked containers or people's homes. Figuring out a safe place to store how-to-guides and the keys to access the stocked resources is a matter of security and trust in a network of neighbors near the site.



figure 3.41

Due to a theft at a cache site in Cannon Beach, these sites have been securely locked and monitored by the city. However, these methods of security rely on neighborhood leaders to provide evacuees with keys to access the container buildings. Develop creative ways of administering access to 'how-to-guides' and camp site resources after an event that do not rely on assigned leaders.

Related Patterns

Preparedness Patterns

6

Evacuation Patterns

16, 17

Response Patterns

18, 19, 21, 22, 24



'HOW TO GUIDE'

Members of the general public don't know how to organize themselves when they arrive at response sites.



THEREFORE: Provide a how-to guide with precise, location-specific instructions that evacuees can follow in order to gather, organize, and respond.

When survivors reach high ground and begin to assemble, they have no way of knowing how they should use different types of sites. If there is no neighbor prepared to lead people or provide instructions, people will begin to react to the tragedy, making potentially poor decisions in the highly stressful environment.

People need to decisively assemble, gather, and organize themselves. This requires leadership and instructions. For each assembly point, multiple pre-designated response leaders that live close should be elected to take charge of implementing the instructions. However, if for some reason none of these response leaders are present, there needs to be some way for the group to learn the site response plan. A clear set of instructions of how to operate different assembly areas and campsites will make people aware of their resources and the best method for setting up campsites that can support their needs for 3-10 days.



TRIAGE AND REGISTRATION

Some survivors arrive at a response site in a state of panic, disoriented and potentially injured.



THEREFORE: Equip response sites with a triage + registration station that can document survivors present, assess urgent needs, and account for available human & material resources.

When the crowd has assembled they will have urgent demands. Certain individuals will be looking for family or friends. Others will need medical attention for injuries or health conditions. Conversely, some people will have training or resources that they are willing to offer to others. Without a way to count what families and individuals are present and evaluate their needs / resources, supplies and shelter will not be distributed evenly.

Establish a method of triage and registration that can assess health, count evacuees, and control the flow of people into the proposed campsite. This process might consist of a few clipboards with forms to fill out, or a fully sheltered station that can be used to register people and administer medicine to evacuees. Depending on the resources at each site, these stations could include a covering, with seating and a table for registration, and blankets/tarps for triage.

Controlling the Flow of Campsites

Create a control point between the assembly area and the campsite. Use available infrastructure to provide evacuees with instructions to register and evaluate people's conditions as they move from initial response phase to establishing campgrounds. Each station should have resources to document survivors present, assess urgent needs, and account for available human & material resources. Depending on the size and speculated number of evacuees, provide sites with enough resources to account for survivors. This process might be as simple as a clipboard with paper and instructions, or might have to include a table and chairs, shelter, a dry lockbox with a how-to guide, lights, tarps and medical supplies.



figure 3.42

Related Patterns

Preparedness Patterns

8

Evacuation Patterns

16, 17

Response Patterns

19, 20, 22

AFTER ○○○●

Rule of 3

Limited funding and lack of planning will always prevent certain campsites from being stocked with enough resources to support the possible number of evacuees. If survivors are truly subject to isolation with no outside help for up to 3-10, days, then following the rule of 3 should be considered when allocating funds for these sites.

In any extreme condition, an average person could survive for:

- 3 minutes without **AIR**
- 3 hours without **SHELTER**
- 3 days without **WATER**
- 3 weeks without **FOOD**



figure 3.43

Related Patterns

Preparedness Patterns

1, 2, 3, 4, 5, 6, 8

Evacuation Patterns

9, 10, 12, 15, 16

Response Patterns

18, 19, 21, 23, 24



Groups of people that have evacuated will need to shelter-in-place on high ground for a minimum of 3-10 days.



After the initial response phase of site arrival, needs assessment, and planned organization, groups of people will require the basic amenities for survival. There will likely be no electricity, no running water, and few resources to support up to hundreds of people. Depending on landslides, roadway collapse, and extreme weather, these camps could be isolated from one another, and from outside help for up to 3 - 10 days. Each site needs a planned strategy for setting up camp to provide a minimum of shelter, water, and food while also covering other needs like sanitation, electricity, fuel, power tools, medicine, etc

Each campsite will be different depending on the intended scale, proximity to private homes, and access to public and private resources. Some camps may be near a well stocked cache site, others will rely on homes of volunteers who are willing to stock supplies, and many assembly areas will serve as the campsites themselves. Each type of site has its own weaknesses and advantages, but all should be stocked before an event with the necessary resources to set up a camp that will help large groups survive.

This particular problem can be resolved by one of the three following possible pattern solutions.



ASSEMBLY AREA CAMPSITE

THEREFORE: Strategically locate well designed assembly campsites with the ability to provide the basic survival needs of shelter, food, and water to a small group of evacuees.

All assembly areas should provide basic resources and the instructions for how to organize and set up camp. However, some of these areas are not equipped with any access to supplies and shelter. The assembly areas that have to accommodate a campground of people are often not prepared to do so. People that end up at these sites get stranded in a location with limited shelter, water and food.

It is important to consider which assembly areas will also serve as campgrounds. These sites should provide better information, resources, and shelter than the sites connected to cache sites or safe houses. Provide more detailed instructions that will let evacuees know what resources they have at their disposal. This packet may include outdoor survival strategies such as how to purify water, start fires, and make shelter. If possible, include small service or red-cross vehicle that can store the very basic necessities for survival. These vehicles might be paid for by city and state agencies due to the lack of resources at these designated assembly points. Strategically locate these assembly camps under trees or behind natural barriers to reduce the effect of rain and wind. Consider connecting these sites to small public parklets that incorporate seating, paving, and lighting that can be useful for assembling camp.

Assembly Area Park Grounds

Assembly areas lack sense of place, resources, and memorability to encourage gathering. These places should be used before an event so they can easily found by someones cognitive map. If possible, find locations for assembly areas like this one in Cannon Beach that can also serve as public parks.



figure 3.44

Try to incorporate the following features in assembly area camps:

Define the boundaries of the area with grass, trees, and hills. These features can be used to set up campsites on flat ground with protection from harsh elements like sun, rain, and wind.

Provide a view of the ocean to attract users. This view can also be used to monitor the ocean for oncoming waves or first responder assistance by ocean.

Include built elements like paving, seating, and lighting. to provide a place to rest. Creative placement of well designed elements can help survivors set up more comfortable campsites.

Seismic & Network Upgrades

This Cannon Beach resident's shed is located right at the safety zone threshold. Along with a fellow neighbor, these long time residents have dedicated their property to help support people that evacuate to this area. He recently upgraded his workshop with new walls and footing to resist earthquake effects and provide functional spaces for storage of supplies and shelter for survivors.



figure 3.45

In a different location, a network of community members have all exchanged keys and instructions for accessing and using the tools at each other's homes. This network creates trust and support between neighbors that is vital for effective response. This system of safe houses is resilient because the network still functions if one leader is not present at the assembly or if one home cannot withstand the effects of an earthquake. Dedicated safe houses above the safety threshold, as well as all homes in earthquake zones, should consider making seismic upgrades to assure that their home can withstand the shocks of an earthquake and remain standing after the event.



SAFE HOUSE CAMPSITE

THEREFORE: Organize a group of safe houses whose owners are willing to store and provide leadership, shelter, and resources to evacuees.

Some assembly areas do not have large areas to set up camp, but are in close proximity to many private homes. These residents of the city have the potential to play a big role in effective response. Homes can store a large amount of food and water as well as provide plenty of indoor shelter for evacuees. Additional resources might include a backup generator and other useful tools for building shelters or clearing debris. Furthermore, the people that will volunteer to offer up their homes will be prepared with enough knowledge and information to be camp leaders. These homes will often have a dedicated group of neighbors that believe in preparing for tsunami events, and can establish networks of relationships that people can rely on during and after an event.

Although these homes hold many advantages, they are not as reliable as cache sites. Volunteers need to offer up their private homes and can not be mandated by government and planning agencies. These homes will also have to withstand a major earthquake, which means they will most likely need structural retrofits. While these homes have fallbacks, they also provide opportunities for public/private partnerships and for creating communal response teams that are well prepared for the event before it happens.



CACHE SITE CAMPSITE

THEREFORE: Provide publicly organized cache sites beyond assembly areas that can support a large campground of evacuees with basic survival necessities.

Cache sites are predetermined places that are designed on flat clearing with ample space for a campground. These depots often include a large shed type building that is structurally sound and stocked with a wealth of survival tools. They include a water tank, fuel supplies, a clean method of sanitation. They should be memorable, with natural barriers to protect from rain and wind, and flat space next to trees or buildings up setting up shelter. While each cache site will be different depending on location and funding, it is important to consider how many people could need space, shelter, and resources for survival and design a place that can accommodate their needs.

These sites are run publically and privately by prepared residents and city groups. They often lack enough involvement and funding to be fully functional. Resources go bad over time, and upkeep of the cache site is an expensive task. These sites are also commonly located in remote locations, which is why security is important to prevent theft. In order for the sites to be effective, they require greater participation by all groups who intend to use them during a disaster. Increased community and government investment can be supplemented by motels, businesses, and cruise ships that profit by bringing tourism into these cities.

Cache not Cash!



figure 3.46

Cannon Beach has broken assigned three key target areas located at the lower, middle and upper area. Each site includes containers that hold barrels that are rented by residents each year stocked food, medicine, clothing, and other survival tools. These sites also contain additional resources for people not renting a barrel, but have limited participation from residents.

Site incorporate built and natural features along with space to set up camps for a large amount of people. They also include valuable tools that can be used to cook food, contact outside help, and set up clean sanitation. This particular site is currently in the process of acquiring a gas and water tank to provide fuel and clean water to the camp site.



figure 3.47

Tsunami Parklet



figure 3.48

Replace a parking spot on a main downtown street or crossroads with a tiny park that serves as an area for gathering and educates the public about tsunami escape.

These spaces can be clustered with art, bike parking, seating, lighting, planters, and any other amenities. A parklet will make the street more friendly to pedestrians, encourage discussion about planning for escape, and will make the way finding system more memorable and multi-purpose with a sense of place. Make sure they are accessible for people of all ages and abilities, and that they are easy to maintain.

Related Patterns

Preparedness Patterns

1, 2

Evacuation Patterns

9, 13, 15, 17

Response Patterns

19, 22, 24



Response sites and assembly areas are often remote, utilitarian, and unfriendly.



THEREFORE: Design tsunami camp sites as friendly gathering spaces that have a sense of place.

A sense of place is the feeling that a location is special or memorable. People are naturally drawn to these places, are attached to them, and form positive relationships with them. In a disaster event, people rely more on their intuition or cognitive map to find their way rather than following a physical map. Sites with a sense of place make them more likely to be remembered in a state of panic. This pattern applies specifically to cache sites, assembly areas, and information stations, but should be considered when implementing any new wayfinding elements.

For assembly areas and cache sites, a survivor's sense of arrival at safety should be intuitive. They don't need to rely on signs to understand that this is a place of gathering, but should be naturally drawn spatial characteristics that the sign accompanies. Sites should have a unique character depending on their function, city, context, and location within the city. Options for improvement might include lighting, benches, tables, shade, grass, foliage, sunshine, a view of the ocean, trail access, informational maps, and public art.



MULTI-PURPOSE CAMPSITES

Cache sites are too often in remote locations unknown to most people.



THEREFORE: Design cache sites to encourage everyday use through enlivened community participation, in turn raising awareness of site location and functions.

Cache sites are sited in remote locations unused or unknown by citizens in their everyday lives. Community participation and citizen interest in cache programs is low in relation to capacity. Multi-functional sites strengthen evacuation wayfinding by increasing people's knowledge of these areas. In a disaster, people rely more on their cognitive understanding of a route than following a physical map. By making cache sites vibrant multi-purpose places with more people visiting on a regular basis, these areas will no longer be a faraway storage site, but the local community garden or music stage, easily found and recognized. Examples of dual-purpose design concepts include a community farm or garden, botanical garden, or amphitheater. Auxiliary services such as restrooms, food carts, storage, parking lots, and shade structures serve as useful infrastructure in both disaster and non-disaster times. If designed as landmarks, event venues, or camp sites, this effect can make tourists, visitors, and residents more aware of the campgrounds and the evacuation route to get there, in turn preparing them with the tools and knowledge to survive a future disastrous event.

Cache Plus +

This cache site in Cannon Beach includes an abundance of space that can be utilized for a variety of everyday purposes:



figure 3.49

Community Gardens can bring members of the together in order to take responsibility over sites as well as provide the site with extra food for the survivors at the campsite

Social Events such as fun runs or musical events can attract residents and visitors while raising awareness about cache sites.

Public Landmarks attract tourist and when visiting new cities. Placing buildings and structures at these cache sites encourage tourists to know where these sites are located.

Related Patterns

Preparedness Patterns

1, 2, 5, 7

Evacuation Patterns

14

Response Patterns

19, 22, 23

List of Additional Pattern Proposals

It is important to realize that only 24 patterns were chosen to illustrate the problems and solutions that exist within the framework of this wayfinding chain. This language addresses the system or plan implemented by a city, but leave out the endless other patterns that would be useful for tourists, residents, individuals, families, businesses, or community groups. The following is the original list of pattern proposals. It includes all of the different varieties of ideas, concepts, problems, and solutions that did not necessarily fit the framework for this particular survival language. Although they were not input into the language, the list is a useful tool for cities to brainstorm other possible pattern ideas, as well as to demonstrate that any pattern language can and should continue to be updated and developed by its users.

- 10 day post disaster preparation
- Neighborhood organizational structures
- Alternative method for communication
- 'How to Guide' at cache
- Vertical evacuation
- Distance matters
- Lights at night
- Safety threshold
- Route safety
- Mapping awareness
- Cognitive mapping
- Business leaders
- Multi functional (faceted) wayfinding tools
- Redundancy
- Triage/Registration
- Up and Out
- Help and Out
- Cognitive Evacuation Map
- Rule of 3
- Awareness Events
- Gateway to Cache
- Assemble!
- Who controls the assembly and cache
- Allow no dead ends.
- Relocate to high ground
- Alternate evacuations
- Drop Point Resupply
- Technology reduces anxiety
- Cache site awareness
- Folklore
- Whose cache is it anyway? (Rosemary Johnson)
- Prevent route debris
- Dead ends marked negatively
- Mapping Awareness
- Community Awareness Events
- Chain of Memorable Places
- Social Web of Neighborhood Resources
- Pedestrian Recreation Trails as Escape Route
- Businesses as Leaders
- Bridges Designed for Collapse
- Regional Island of Survivors
- Responding Safely
- Case Study Clearing House

- Engage New Volunteers
- Universal Branding
- Market City Preparedness
- Ground Stability
- Prevent Car Evacuation
- Elect Disaster Aware Officials
- 6 People vs. 600 People
- Evacuation Route Connectivity
- Bolt Cutters
- Cache Supply Rotation
- Cache Ventilation
- What Map (Tiffany Brown)
- Visual Clarity of Maps
- Awareness Kiosk (Kevin Cupples)
- Color Coding (Jeremy Goldsmith)
- Dead Ends (Bryan Paul)
- Communication and Outreach
- Informed Homeowners
- Opening the Bottleneck
- Don't put all your Eggs in one Cache (Rosemary Johnson)
- The Space Between (Dan Grassick)
- Mapping Assembly Areas (Teri Wing)
- You can't get to the there from here? (Rosemary Johnson)
- Map App (Gordan McCraw)
- FolkLore((Pat Corcoran)
- Lock, Stock, and Barrel (Rosemary Johnson)
- Plan for Participation (Kris ?)
- Flexible Assembly Configuration
- Anticipate Pathway Debris
- Prioritize Preparedness Resources
- Government - Citizen Collaboration
- Land Use Development
- Hide in Concrete's Shadow
- Self Sufficient for 7-10 Days
- Activate Alternative Communications
- Redundant Acess Information
- Edible Landscapes
- Building Blocks of Shelter at Cache Sites
- T.E.V.'s as Labor Resource
- Rebuild the Essentials Uphill



Figure 3.50

USING THE SURVIVAL LANGUAGE

INDIVIDUAL PATTERNS

Although problems and solutions are objective recommendations, patterns were formulated by, and can be applied to many Oregon coastal community contexts, with a multitude of different design solutions. Each pattern can be exercised within the context of a city's current wayfinding system. Think about the pattern topic and evaluate how that pattern's application exists or does not exist in the city. Through careful analysis, choose the patterns that address the city's most pressing issues. Use the discussion portion and sidebar analysis to assist in turning the pattern into a designed site specific urban wayfinding project. Each of these patterns when implemented into individual projects have the ability to improve an aspect of any current tsunami evacuation wayfinding system.

PATTERN SEQUENCES

The survival language is broken up into 3 chapters: Preparedness, Evacuation, and Response. Chapters are written sequentially to reflect how the wayfinding system exists as a chain of elements that moves people up and out in the event of a tsunami. Each of these patterns when implemented into individual projects have the ability to improve an aspect of any current tsunami evacuation wayfinding system. However, choosing patterns that establish a sequence of solutions for problems that occur before, during, and after the event allow for a robust system that considers the wide range of issues that each stage presents to coastal communities.

PATTERN LANGUAGE

Although patterns can be chosen individually and put in to sequences, they are strengthened when they begin to work together. A resilient system is capable of adapting to chaotic and uncontrollable situations because of the interdependent nature of its structural organization. If unanticipated shocks cause one wayfinding element to fail, than the other members exist for reinforcement. Consequently, a successful pattern language is a sequence of individual patterns that are designed as a complex network of interdependent parts. Establish the necessary relationships between the sequential patterns that are chosen. When implementing patterns, design projects that work together in form and function. The related patterns section references which elements are directly related to one another, and can be appropriately arranged into a robust pattern language.

FINAL REMARKS

A survival language should be used by cities as a tool to create a robust wayfinding system, by developing a site specific project language, which solves critical problems through effective design and implementation. It is important to not rely on the individual patterns as written, but rather to establish new patterns, sequences, and relationships that strengthen a city's specific context. Instead of becoming discouraged by the extensive issues that exist when planning for tsunami readiness, use this resource to make step by step, incremental changes. Overtime, with a consistent effort, a community can realize a comprehensive wayfinding system that assures escape and survival from the 'Big One'.



Figure 3.51



Figure 4.1



4. Process and Sequence: The Urban Game

4.1. Introduction

4.1.2. The Urban Game - Overview

4.1.3. Prepare to Play

4.2. Rules of the Game

4.3. Cannon Beach Example Game

4.4. Results and Recommendations

4.1 INTRODUCTION

Chapter 3 introduces many problems, solutions, and examples of ways to improve a city's tsunami evacuation wayfinding system. But without a way to apply these concepts in real life, it's not useful to the many coastal cities in need of a better system. Even the smallest, simplest cities are complex things. Often, the people who volunteer to work on improving their community's preparedness efforts are not professionals in urban design, group facilitation, or emergency response. Even for those with the best intentions, these committed groups of people can have conflicting ideas on what aspects of tsunami preparedness are the most important or appropriate for their city.

This chapter describes 'the urban game,' a fun way to solve these challenges and allow for everyone's voices to be heard. The urban game is one method for a diverse group of stakeholders or decision makers to work together to choose the right elements for their city, and understand how they combine to make a redundant system that can adapt to changing conditions. Because in a disaster event, there is no predicting which elements will succeed and which will fail. Because the topic of disaster preparedness, awareness, and response is so multi-faceted, this process also helps keep big groups focused on the task of wayfinding in particular. It frames the conversation towards what concrete steps can actually be done to make changes, and how the city will look with a series of changes working in tandem. It also ensures that all members of a group have equal input, which brings a more balanced final vision that of which everyone feels ownership.

4.1.2 THE URBAN GAME OVERVIEW

An urban game is a sequential way of designing a whole system as a team, piece by piece, and then giving a clear picture at the end for players to evaluate its outcome. The results of each game is a scenario of what a place would look like with a series of improvements that work together as a system. If it is played more than once, the results from each scenario can be compared and contrasted. For a potentially confusing and theoretical topic like wayfinding design, the results of the urban game, grounded in the context of a familiar map, can help committee members put their proposed wayfinding improvements in context for the wider community for approval.

The urban game was originally developed in the book 'A New theory of Urban Design' by Christopher Alexander, Hajo Neis, Artemis Anninou, Ingrid King. This method provides a new theoretical approach to solving complex urban problems. First, problems are discussed and solutions explored. The book proposes a preliminary text of seven rules which expresses the practical design process and which are consistent with day-to-day demands of urban development. The urban game for wayfinding design described here follows a similar approach, only more specific to the Oregon Coast and the problem of tsunami escape. After extensive research about the urban area, and the many problems relating to wayfinding, and discussion of proposed solutions, the game is ready to be played.

The PUARL team used this method for our case study city of Cannon Beach. The description of how we played this game describes a typical process that anyone can follow to get similar results in their own city.

As part of designing and improving the infrastructure for tsunami escape wayfinding, all members of the team participated in the game to contribute ideas in a systematic way. After researching and understanding a number of aspects on the existing conditions, initial proposals for new wayfinding design elements, and understanding the unique problems of this place, we played the game. The game helped us to see how these various infrastructure elements would work together and create a workable system could help people to navigate a quicker and easier escape to safety.



Figure 4.2

4.1.3 PREPARE TO PLAY

First, organize your group. An ideal group size is 4-10 people. If you have more interested participants than 10, split into multiple groups and then present and compare your results at the end of each game. The most successful groups are those who are diverse, respectful of other players, and well-prepared about the topic and the context of the city.

All members of the group should meet around a big table. Print a large scale plan of the city as a base drawing. Overlay it with trace paper, or print multiple copies of the plan if you want to play more than once to produce multiple scenarios for comparison. Have someone take good notes of each of the steps.

Have a facilitator read the rules of the game, and agree on a time limit for each turn. The rules of the game are very simple. All members of the group were meeting around a big table, where we had a plan of Cannon Beach on as the base or working board.

4.2 RULES OF THE GAME

Rule 1: Everybody contributes to creating a new and improved urban tsunami wayfinding plan by proposing a sequence of new elements, designs, and ideas.

Rule 2: Every player takes a turn by proposing an idea, which should be introduced by the player and discussed by the team for clarity or improvement.

Rule 3: Each proposal should be marked in some way on the map referencing where it will go and marking with a symbol.

Rule 4: Each player can make only one proposal at a time, which is tied to a specific location in the city. The game is played in a circle, where the each turn passes to the person sitting to the left.

Rule 5: All proposals should begin to naturally build on previous proposals, establishing new relationships that help create a more robust tsunami escape wayfinding system.

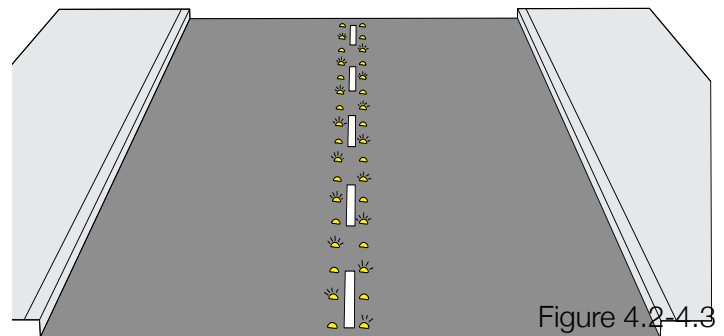
CANNON BEACH EXAMPLE GAME:

The illustrations below show an example of how the PUARL team played the urban game in the case study city of Cannon Beach. The participants of this game were students and professionals in architecture and urban design who had visited the city and studied wayfinding, signage, and tsunami events. In an ideal world, we would have included some residents or other stakeholders to improve the quality of our output.

All players were encouraged to make proposals in a sequence. Each person took one turn selecting a “move,” and where it should be placed in the city. Some elements were located in just one place, while others were placed in a series.

The following illustrations describe each person’s play, and how they stack on each other and combine into a comprehensive wayfinding system. The following pages describe the actual sequence of the example Cannon Beach game with the particular steps that created this initial plan.

4.3 CANNON BEACH EXAMPLE GAME



PLAY 1 : SPINE OF LIGHTS

The Spine of lights along the primary route (Hemlock St.) was the very first proposal made by one of the team members. This was a very feasible proposal as it was important to discuss and analyze the evacuation strategy incase of an event during the night. The main streets in Cannon beach - Hemlock St., Spruce St. and Highway 101 - lack indications that they are the main routes to be taken to safety. Adding lights on the ground along the main route can clearly communicate this to the visitors and tourists during evacuation. These ideas further lead to additional tests on site and finally a pattern.



Figure 4.4-4.6

PLAY 2 : EVACUATION TOWER

As the next step to the game, the next team member, thinking of the progression out of the downtown area after the Spine of Lights, proposed an evacuation tower next to the bridge. Due to a probable bridge collapse during the earthquake, it was important to consider congestion during evacuation and it forced the team to think different alternatives to evacuating safely. The location of this tower was crucial. There is a possibility for people to get trapped and not evacuate safely as the bridge would not be able to withstand an earthquake. This proposal of having an evacuation tower in proximity to the bridge allowed people to be safe and prepare for the oncoming tsunami after the earthquake. This tower could hold different functions and host other activities before and after a tsunami.



Figure 4.7-4.8

PLAY 3 : INFORMATIONAL KIOSK

An Informational Kiosk was an important proposal when thinking about how visitors would know that an Evacuation Tower was an option in case of a Tsunami. This idea was developed further later but was originally generated and brainstormed in the urban game session. It is important to have a kiosk that could be located in key areas and could effectively spread awareness among visitors, tourists and residents about the danger of a tsunami. It would further explain how to evacuate safely as well as include interactive and more in depth maps with different escape routes that include a “you are here” indication to help people orient towards the closest assembly area.



Figure 4.9-4.11

PLAY 4 : SECONDARY ROUTE SPINE

Thinking of the maps that the informational kiosks would display brought up the need to connect the route spines clearly. A secondary route spine of lights along Spruce street would help people direct themselves to the primary street. People coming from tertiary streets and cul-de-sac could then orient and navigate quickly to the secondary street and eventually the primary route. Though, it was a good proposal, after testing this was identified unnecessary and efforts were further made on developing the Spine of Lights on the primary route more coherently.



Figure 4.12-4.13

PLAY 5 : ASSEMBLY AREA

The next player in line thought about the end destination after the primary or secondary route spines. It was proposed that the existing assembly areas need improvement in order for the space to function more effectively after the tsunami. It is confusing when approaching different assembly areas to what their purposes are. A better designed assembly area space could effectively help in the rebuilding process post tsunami. They need to effectively communicate through signage and direct people what to do when they arrive at the assembly area. This proposal was further developed on site during the next site visit where a lot of creative proposals and strategies were developed individually for each of the 7 assembly areas.

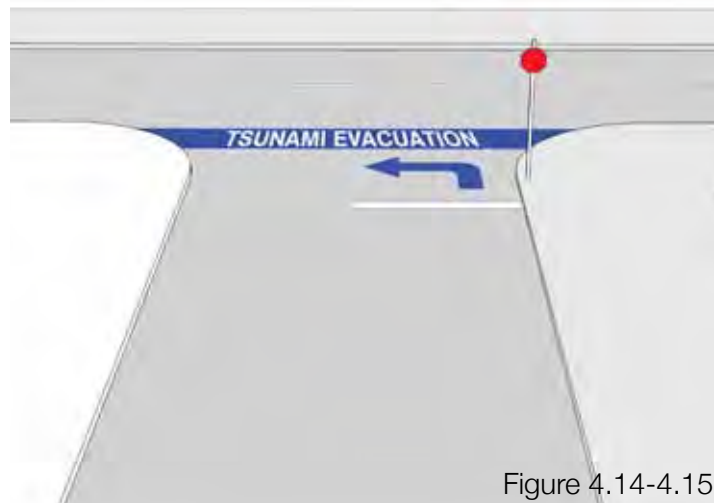
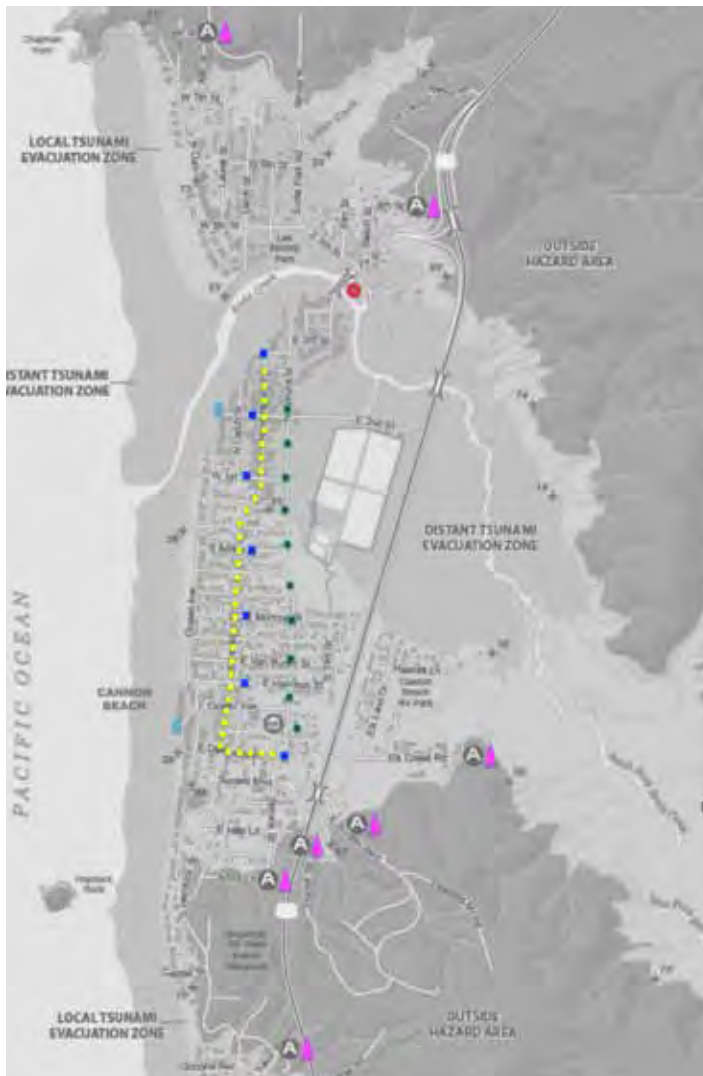


Figure 4.14-4.15

PLAY 6 : TSUNAMI HAZARD SIGN

The next player proposed that there could be improvements and opportunities for updating the existing tsunami hazard sign such as clarifying the continuity of pedestrian vs. automobile routes, establishing consistent distance between signs, establishing consistent visual heights that support identification, color companions, shape comparisons, etc. This idea came from the thinking of placing lines in the street near assembly areas where one had reached a safe height but was carried over to the idea of updating hazard zone signs.

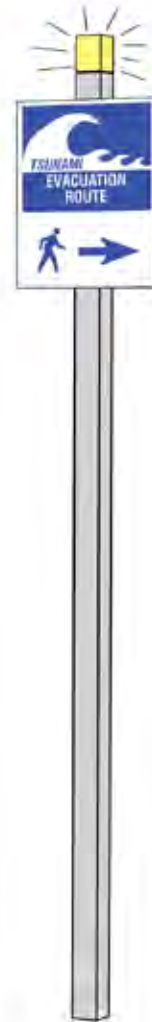
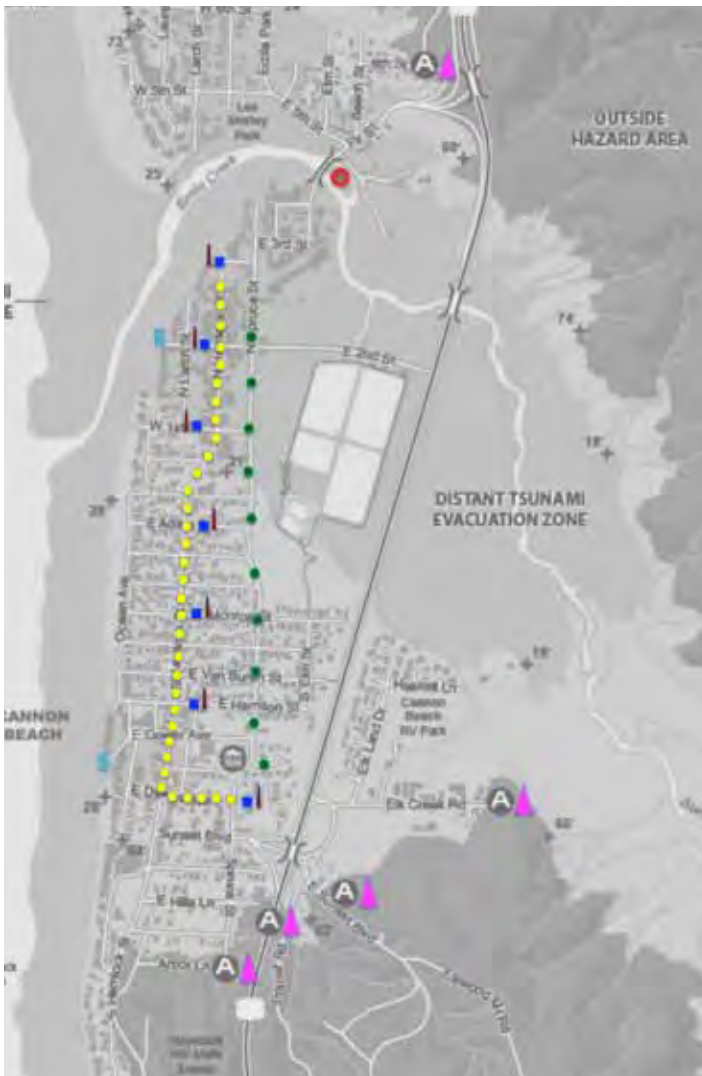


Figure 4.16-4.17

PLAY 7: INDIVIDUAL SIGN POST

Individual Signposts were the final proposal made by the last player which was spurred by the idea that even with improvements of signs there is still an issue with clarity and continuity. Currently, the tsunami signs are placed on 4x4 wooden posts, which are often in conjunction with many other informational and directional signs. Creating an eye-catching and dedicated signpost just for tsunami signs and routes maps where the signs are consistent in placement, sizing, information and design could help avoid confusions and inconsistencies.

4.4 RESULTS AND RECOMMENDATIONS:

The urban game is an effective way to get a group of people into the mode of designing and making proposals for improving the wayfinding process with infrastructure elements. It could be the first step of design approach, after your group has completed the research phase. One of the advantages of this game is that various problems could be identified and immediate possible solutions to those problems can be formulated.

It involves a simple strategy to improve wayfinding in one's town or neighborhood to use the same or similar urban games as these planning games help to engage each member in an intense way to actively help to create a larger communal system that improves wayfinding in tsunami escape situations.

This process provides an opportunity for a variety of creative ideas to be generated and help save lives.

Therefore, this game could be very useful to develop strategies and methods in devising a workable plan for tsunami wayfinding and escape. It is recommended for each coastal city to consider this as a strategy to improve and resolve its urban issues.



Figure 4.18

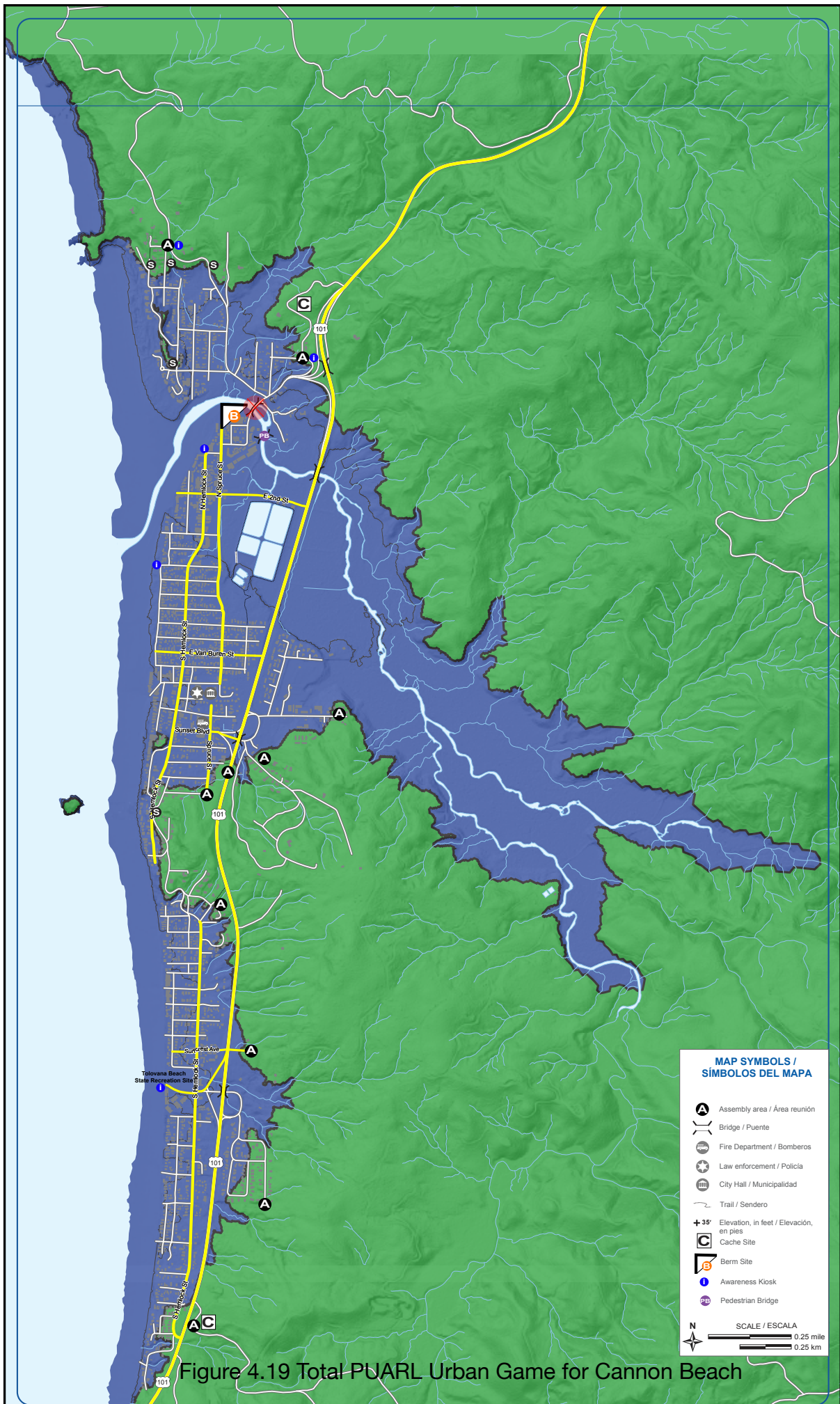


Figure 4.19 Total PUARL Urban Game for Cannon Beach

4.4 Stakeholders Worksheet Tool

This worksheet can be used by groups of decision makers to identify and prioritize the needs of the groups of stakeholders that are affected by the wayfinding system in any coastal area. It can help start conversations about who is and is not represented in the decision making process so far. It can assist in putting yourself in someone else's shoes, and make your final design more inclusive.

First, list the groups of people in your city. Who puts on events, does outreach, or offers services? Examples include private entities such as churches or business associations, types of people such as cruise boat tourists or university students, or official groups like local government committees and schools. Next, think about when these types of people are most vulnerable in a tsunami event. Is it because they can't walk fast enough to the safety zone? Are they too far from any safe location? What if they can't hear the alert, or understand the directions to safety? After that, think what groups or types of people have the resources, responsibility, or interest to improve the existing wayfinding system. Consider who makes decisions about the way your city looks or works. Who is already building, fixing, improving, or investing in your area? Add any additional categories or groups that are missing. Think of all of the people who live, work, and play in your specific area. How might any of these groups be changing in the future?

Once completed, use this worksheet as a reference when considering the most important patterns and design elements to improve your city's custom wayfinding system. The last column is for notes about which parts of the guidance document fit together to make the most impact in getting your neighbors to safety and escaping from a tsunami.



Figure 4.20

Stakeholders Worksheet

Type of People	Subtype/ Description	Your city's specific groups or locations	(When Impacted) Before	During	After	Notes/Description (What priorities, or special considerations will you take in your wayfinding design element selection and use of the pattern language)
Residents	Live on the hill					
	Live in the city					
	All residents when at the beach					
	2nd homeowners					
	Animals/ pets					
Tourists, Employees, & Visitors (T.E.V.'s)	Daytime visitors					
	Overnight visitors					
	Business employees, truck delivery					
	Large venues or assembly structures					
	Special events visitors					
	From Portland					
	From rest of Oregon					
	From international or out of state					
Industry	Business owners					
	Tourists					
	Rental property owners					
	Hotels					
	RV parks					
	Campground					
City Agencies and Groups	City officials and representatives from citizen committees					
	Tourism and Arts Commission					
	Fire & Police					
	State Parks					
Vulnerable Populations	Children					
	Elderly					
	Poverty					
	ESL					
	Blind					
	Deaf					
	Wheelchairs					
	In the hospital					
	Homeless, transient, churches, soup kitchens					
	Native American population					
Aesthetics	City Planning, Design Review Board					
	Architecture firms					
	Artists groups, galleries					
Environment	Wetlands, Dunes, Beaches					
	City Parks & Trails					
Infrastructure	City Public Works					
	ODOT/ Roads Commission					
	Wastewater Treatment Plant					
	Electrical					
	Bridges/ Civil Engineering					

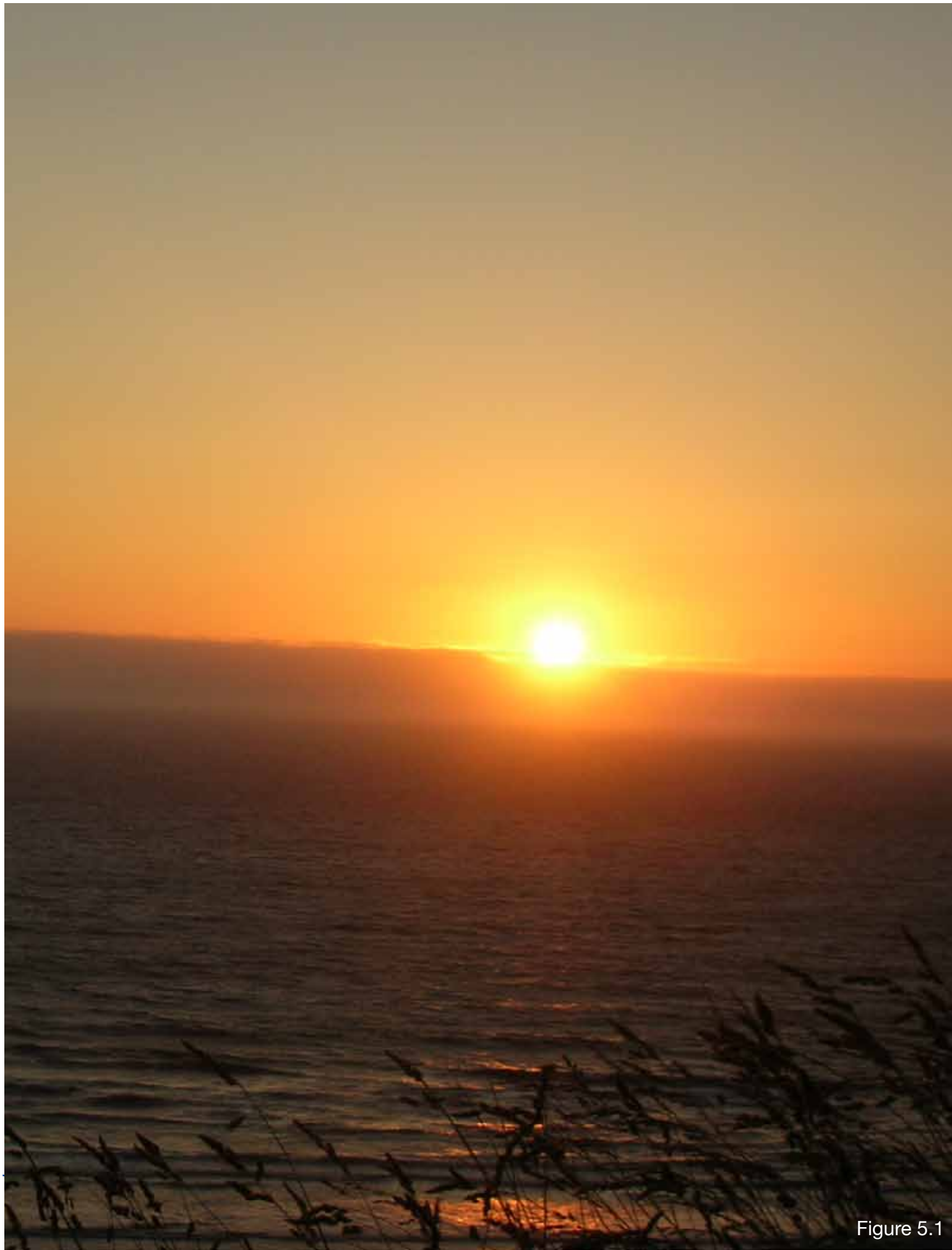


Figure 5.1



5. Conclusions and Recommendations

- 5.1 Concluding
- 5.2 Overall Recommendations
- 5.3 Detailed Recommendations
- 5.4 Final Comments

5.1 CONCLUDING STATEMENT

We want to begin these conclusions and recommendations the way we started this research and planning project altogether by reminding ourselves of the main problem we are facing here: We need to understand and recognize an imminent danger of a tsunami event, that may be caused by an earthquake of 9+ Richter scale (last experienced in 1700 and most recently experienced on a smaller scale in 1964 in on the West Coast of the US). A tsunami caused by such a large earthquake on the Cascadia fault line forms an immediate threat that may impact thousands of people on the Oregon Coast, especially in the low lying coastal communities such as Cannon Beach. Extensive efforts are constantly exercised on a community, city, state, and federal level, with regard to all aspects of tsunami evacuation and preparedness. In this research and planning study we have focused our attention on wayfinding in tsunami situations before, during and after a severe tsunami event.

Pioneers in disaster modeling have worked with different Oregon coastal cities to evaluate and test the most efficient tsunami evacuation routes. These cities worked with DOGAMI to establish assigned routes that include evacuation route signs, which, if everything goes according to plan, will guide people up and out in time. However, science is one thing, while people and disasters are another. The harsh reality is that no matter how well of a developed plan exists, when exposed to catastrophic situations, the plan will demonstrate its weaknesses.

A resilient tsunami evacuation wayfinding system is capable of withstanding the unpredictable shocks of earthquakes, tsunamis, and even human beings. However, achieving a robust system that can certify a city to be tsunami ready is no small task, requiring a dedicated community investment and intricate planning effort. Organizing the tsunami event into a wayfinding chain of elements that people interact with before, follow during, and use after the event can help guide a generative design process that does not solve one issue at a time, but rather strengthens the system as a whole with each move.

A resilient tsunami evacuation wayfinding system requires redundancy.

First, redundancy hammers home the point. You are in fact in an inundation zone; the safety of your life relies being able to know and find way to high ground in a matter of minutes. If designed well, tsunami awareness elements do not have to induce fear. Increased tsunami awareness is a priority simply because not nearly enough people are aware of the threat, and therefore are unprepared for the event.

Second, redundancy provides buffers. If one aspect of a basic system fails or is exposed to conditions that were not considered, then the whole system will fail. A diverse set of wayfinding elements in different urban conditions establish a more robust system, but are more importantly able to support an aspect of the system that is failing.

To accomplish this goal of redundancy, this guidance document and pattern language provides a toolkit, or a palette of options. While we like to think that the system works as a whole, we understand that each coastal community has different conditions, concerns, and opinions on how to improve their system, and that every one of our proposals may not suit every cities needs.

5.2 OVERALL RECOMMENDATIONS

As conclusion and recommendation for future projects, we see several major areas in which work should be done. This list outlines the most important additional areas of work that should be tackled next.

1. Establish Overall Umbrella Pattern Language

The first recommendation is to establish an overall umbrella Pattern Language that gives structure to the larger theme, topic, problems and solutions of tsunami escape wayfinding and evacuation. This would have to be done as a larger and comprehensive project with professionals from various fields to cover the terrain with problems and solutions in an interdisciplinary fashion.

2. Establish A Tsunami Evacuation Project Repository

The second recommendation is closely related to the first point, that is to create a repository for the sharing of project case studies between Oregon coastal cities and beyond. This could take the form of a research project and publication, or live website and digital forum with user-generated content, augmented by live events and symposia and charrettes.

3. Detailed Wayfinding Evacuation Projects

The third area of recommendation is to pursue detailed urban design wayfinding projects for particular towns with specific needs and specific conditions. Similar to the study of Canon Beach this could be done by focusing on particular towns in a focused, planning-oriented fashion.

4. Individual Architecture and Urban Escape Projects

A fourth area of projects could focus on very specific issues that need solutions for very specific problems. Here for example, the focused topic of vertical evacuation could be studied and re-searched in detail in towns that might need vertical evacuation in part of the towns, where other kind of evacuation is difficult to provide in the time available before a tsunami might hit. Equally, evacuation sites after a tsunami are of interest here. Once people successfully have escaped the disaster and reached higher ground, the question becomes how to organize life in 'island conditions' for a certain time.

5. Social Organization Projects For Evacuation And Survival

A fifth area of investigation seems to be the social organization of tsunami escape and wayfinding. As the study of Cannon Beach suggests, the social organization with safe houses and private neighborhood organization seems to be as critical and important as public forms of organization by the city administration. At least they can help in a complementary way to organize wayfinding, evacuation, and survival more efficiently in a private-public partnership kind of arrangement.

Overall, we believe, that the work on these projects is critical for the creation of awareness of a possible major tsunami at the Oregon Coast, it is important for preparation of escape in a tsunami event, it is important for actual successfully carrying out an escape wayfinding act to higher ground, and it is important for being able to survive and organize life after a tsunami event in an 'island condition'. As the advanced tsunami escape wayfinding and warning organization in Japan shows, many more lives can be saved by being well organized and prepared for a tsunami event.

5.3 DETAILED RECOMMENDATIONS

As a result of the research and design efforts we have compiled a series of recommendations for the design and implementation of a comprehensive, robust wayfinding system. These takeaways have guided the development of this guidance document. They are the distillation and results of our many methods of research and design and may be useful for Canon Beach and other cities and towns in the process of designing their own custom system for tsunami escape wayfinding.

These recommendations have been parsed into categories of before, during, and after a tsunami event. All of these elements, processes, and physical designs would technically be implemented prior to an event as a preventative measure, we divide them according to the moment of impact in the wayfinding chain.

Signage and wayfinding need to occur in all three phases of a tsunami (BEFORE, DURING, and AFTER) to work together as a system to ensure education/awareness before an event as well as clarity, efficiency and safety during and after an event of a tsunami. When you are on a journey, or vacation trip, and a tsunami occurs, you must first know where you want to/need to go (BEFORE), how you are going to get there (DURING), and what you are going to do once you get there AFTER).

A Robust wayfinding and escape system' is a system in which all these three main phases of escape work well together are integrated and make it possible to move with understanding and ease from one phase into the next phase. For a successful escape and evacuation process it is critical to not only understand but also being able to carry out the before, during, and after phases and how the success of the signage and wayfinding for each of those phases is critical for escaping in a given time of 18-22 minutes when a local tsunami takes place.



Figure 5.2



Figure 5.3

BEFORE

With warnings and reminders that in the near future an earthquake along the Cascadia Fault and a resulting tsunami is imminent, there is no better time than now to plan and prepare at any level, whether that be on a personal or a community level. As with any natural disaster, it is too late to plan and prepare once a tsunami is on its way. Before an event is an integral part of making sure that one actually can escape to higher ground in a given situation and from a particular place.

Understanding of infrastructure, signage, and other material elements help educate and raise awareness among citizens and visitors of Cannon Beach and other places ‘before’ a tsunami. Photographs, communication and interviews with local residents, and other relevant information received during site visits explain and illustrate the existing conditions and success or shortcomings of the current signage and wayfinding elements ‘before’ a tsunami. Analyzing the current state of affairs of organized wayfinding and signage in any town is the start of practical investigation into this topic. Cannon Beach for example, has one of the most developed signage and wayfinding systems in any town along the Oregon coast, but there is still space for improvement and innovation in the current system. And there are still a number of problems with the current signage system that is in place, which affects the education and awareness of tsunami escape ‘before’ an actual tsunami event. There is little signage or infrastructure currently in Cannon Beach to educate people, especially visitors during the summer time, on what a tsunami is, what to do in case of a tsunami, and there is little information of hazardous zones and assembly areas.

First, we need to acknowledge successes in Cannon Beach: a. Successes: Signs at beach exits and entrances; b. Supplies at safe houses near assembly areas; c. Containers with supplies at assembly area. But we also have to acknowledge some of the problems: Main problems with the ‘before’ phase are awareness and preparedness. Particular problem points include: a. Little awareness and no mandatory information for tourists; b. Limited informational signs, (mapping, evacuation routes, signage post overloads); c. Balance between creating awareness and instilling fear.

LIST OF BEFORE PHASE RECOMMENDATIONS:

- Practice evacuations (fun, doesn’t instill fear, differentiated from actual siren)
- Supplies at safe houses near assembly areas - Create more safe houses
- Sense of calm and humor is important!
- Use an outreach matrix/ communications strategic plan. Understand your target audience, media, message, goals. Be strategic.
- Make the Chamber of Commerce and tourism industry your friend. They can make or break your work. If you are scaring their customers away from the coasts, they will kill your initiatives. They know influential people. The goal is education and a “slice of reality”, not fear.

DURING

A very important principle in our work is the principle of redundancy in all three phases, but most critically in the “during” phase of a tsunami. Redundancy in this case simply means that there are multiple tsunami evacuation systems and elements that work together. If one element does not work or fails, there are other elements that will make up for the failure of one element. When lights do not work and the electric grid fails, there will be other guidance elements that can take up the slack, such as reflecting signs, or smart phones that are programmed to quickly lead one to safety.

Tsunamis are created by earthquakes in the oceans. Distant earthquakes still can create dangerous tsunami waves, even after several hours, as we have seen in the 2004 Indian Ocean tsunami that hit several countries hours after the earthquake occurred. Hundreds of thousands of people died because there was no warning system installed. This is obviously a huge problem of not being prepared for a tsunami event by providing the appropriate warning systems. In Malaysia and India these warning systems have now been installed at least to some degree.

The situation in a local earthquake close to the coast is usually much more direct, because the tsunami waves are created immediately as we have seen in the recent 2011 earthquake in the Tohoku region in Japan. Here the death toll was much less than in the distant tsunami in the Indian Ocean from 2004 because in Japan warning systems are installed, in almost all cities, towns and villages along the coast, saving many lives.

The most critical element in what is called a local earthquake and tsunami is the time available for evacuation and getting on to safe higher grounds. For Cannon Beach this time is calculated at about 18-22 minutes. It is a very short window for escape and evacuation that makes the during phase so critical in terms of developing appropriate systems and aspects for immediate wayfinding for evacuation.

With the vast amount of visitors at Cannon Beach it will be important that the evacuation routes be very clear to allow for quick and efficient evacuation in the event of a tsunami. While there is a sufficient amount of evacuation route signs, their placement among many other signs makes the signs confusing and hard to see. Photos and information retrieved during site visits show these problems discussed. i.e. photos of an evacuation route sign on a post with tons of other signs. New evacuation route signs, spine of lights in road marking evacuation routes. All evacuation route signs to be on one post with light that ties into spine of lights, secondary spine, and painted lines on road which mark the evacuation routes.

LIST OF DURING PHASE RECOMMENDATIONS:

- Provide more consistent and frequent signage
- Ground materials should be designed to facilitate passing quickly over broken ground in the dark in the event of earthquake damage or ground liquefaction.
- Clarify a different way to indicate a needed turn versus a continuation along the same street.
- Bound the street with signage reminders so that people do not feel the need to turn before it is time.
- Indicate that the street is the primary evacuation route.
- Light the street and signs better so they can be useful at night.
- Consider construction techniques and redundancy efforts for signposts that might fall down.
- In very dark conditions, such as the new moon, it is impossible to navigate without personal light sources if streetlights fail. Design signage accordingly. Create signs close enough and with light reflective material.
- Additionally, the distance between signs on this route is sometimes quite far apart, and it might not be out of the ordinary for people to feel like they should be turning away from the beach before they are actually supposed to, where lighting the ground assures people of the path they are on. Because there is a long major artery that acts as the primary escape route brought on itself.
- When you are in fact supposed to turn off of this street to continue on the evacuation route up-hill, there is no sign that stands out more than any other, in fact it is hidden with a series of other informational signs.



Figure 5.4

AFTER

Time after escape from an actual tsunami event needs to be considered seriously, especially at the Oregon Coast. Once you made it to safety the question is what to do next and how to survive to the next phase. After the tsunami survival phase is rather critical along the Oregon Coast because of what is called the 'island effect.' This means that for a period of time people might have to survive on their own without actual help from outside, such as military and other disaster help organizations. It is anticipated that in a heavy earthquake and a large tsunami event, outside help from military and other federal agencies may take considerable time to reach all places affected. This means that people who made it to safety, now have to find ways to survive for two weeks or more on their own and based on their own preparation in such an event.

This might be particularly difficult during summer time when towns are full of tourists, and visitors in fact outnumber local inhabitants by 5:1 or more. To prepare different groups of people for survival after a tsunami, and be able to succeed in survival, is indeed the prime task of organizing for the phase after. Cannon Beach is a particular case in question for the after phase organization because of the reasons above.

With so many tourists it is important to have assembly areas that visitors will be able to recognize as a safe place. Overview of infrastructure, signage, and other materials/things that show the current conditions of assembly areas and other elements which affect citizens and visitors of Cannon Beach 'after' a tsunami. The current assembly areas are safe but lack a sense of place that helps people to know that they have made it to the safe place. Also the assembly areas lack information and basic medical supplies. Photos and information retrieved during site visits show these problems discussed, i.e. show the assembly areas in the middle of nowhere with nothing more than the sign to tell you that one has reached the assembly area. Signs at assembly areas don't indicate what to do next. No instructions, lights, sense of place, no feeling of safety.

Therefore it is critical to store enough supplies, educate key members as leaders, provide emergency access. Creation of sense of place is critical together with practical support. Establishing sequential hierarchy between assembly points: Assembly Area is point 1 as a stop (rest, figure out next step), and Support Area is point 2 for longer term recovery (medical, sleep, support, access)

LIST OF AFTER PHASE RECOMMENDATIONS:

- Educate and determine key leaders who can guide the process of survival after a tsunami
- Create Assembly Areas as recognizable areas of arrival so that people start to feel safe. This could be done in the form of small parks and other forms that indicate a sense of place.
- Establish Assembly Area 1 as a short stop and rest in a safe zone with first help and support.
- Establish Support Area 2 as a second area with more support for medical help, sleep support, food and social help.



Figure 5.5

GENERAL RECOMMENDATIONS FOR COASTAL TOWNS:

- Create a menu of ideas for different cities, conditions, populations.
- Consider differences between dense and rural conditions. Cities, neighborhoods, towns, and rural areas. Rural villages have less power to organize, execute plans, \$ for implementation. Ex: in Lincoln Beach/ Gleneden Beach, few assembly area signs, gravel lane to 30 houses, no neighborhood association.
- Design some affordable options on the menu. Communities have to pay for their own signs/ pursue own grants to implement our design. Put up by volunteer firefighters, small business associations, citizens, who knows who else. Make it simple/ intuitive. Easily sold.
- Understand this project as one component of a larger strategic effort
- Consider implementation roadblocks for different communities. Ideas that can't be carried out aren't helpful to anyone.
- Create a consistent marketing/ brand that conveys a simple message. Be strategic.

5.4 *FINAL COMMENTS*

The concluding product of our work is a final report that also contains the essential elements of the Guidance Report, in particular the section on the 'Wayfinding Pattern Language as Strategy and Guidance.' The Pattern Language as the main Guidance Document segment uses the pattern language approach in terms of general patterns that also contain numerous specific examples of possible expressions and detailed strategies for applications.

This Guidance Document will be posted on the PUARL website as information for all stakeholders and people in Oregon to use as a resource and tsunami evacuation wayfinding help. Concurrently the Guidance Document will also be placed on the OEM website for information communication. It is intended to also provide a PowerPoint presentation of the guidance document as part of the website presentation.

We want to thank all the people that helped us in this work, in particular the people in the coastal town of Cannon Beach that served as our main location of study. In particular, we would like to thank all the officials and private citizen alike.

Here we want to conclude with a more philosophical outlook. On the one hand we have to look at earthquakes, tsunamis, and other kinds of natural events as dangerous disasters that we have to fight, avoid, master and conquer. But on the other hand these events are part of nature and such part of the eternal flow of life. It might be wise therefore to try to better understand nature in all its aspects including the understanding of earthquake, tsunami, and coastal land structure, and the geological land structure along the coast, and then work together with nature rather than fighting it.

The understanding of settlement, town and city patterns along the coast is of course the essential part where tsunami escape wayfinding takes place. To organize towns, neighborhoods and buildings in a way that they are part of nature and its unpredictable events in such a way that people can live and enjoy the benefits of a coastal life, and at the same time know what to do in a tsunami event and have an infrastructure that helps them to do this, is how we understand the work on this fascinating challenge and project.



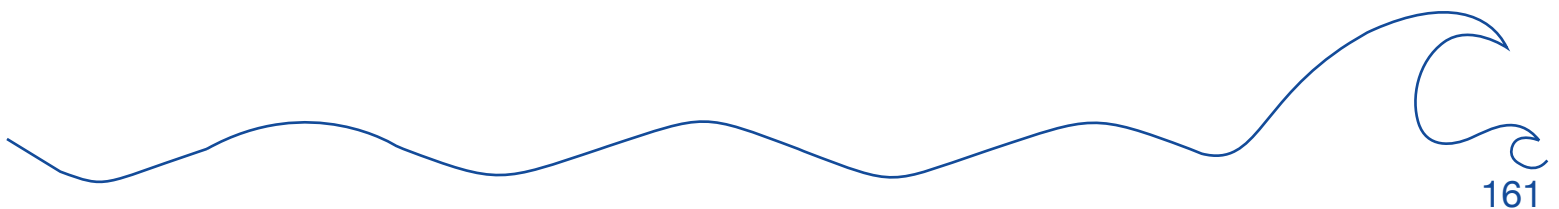
Figure 5.6



Figure 6.1



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Figure List

Section 1:

- 1.1 Cannon Beach, Oregon- PUARL
- 1.2 Astoria, Oregon -PUARL
- 1.3 Cannon Beach Residence, -PUARL
- 1.4 Oregon Coast
- 1.5 Cannon Beach Neighborhood Evacuation Map, -City of Cannon Beach
- 1.6 Haystack Rock, Cannon Beach -PUARL
- 1.7 Highway 101 Bridge over Ecola Creek -PUARL
- 1.8 Cannon Beach where Ecola Creek meets Pacific Ocean -PUARL
- 1.9 Hawthorn Street, Cannon Beach -PUARL
- 1.10 Highway 101 Bridge over Ecola Creek -PUARL
- 1.11 Map of Cannon Beach
- 1.12 Oregon Coast -PUARL
- 1.13 PUARL team: From Left to Right: Jacob Simonson, Hannah Pempus, Annie ledbury, DR. Hajo Nies, Dr. Althea Rizzo, Kaeli Nolte, Srivarshini Balaji, Perrin Wright
- 1.14 Cannon Beach Tsunami Evacuation Map - DOGAMI
- 1.15 -1.16 Tsunami Preparedness Pamphlet -OEM
- 1.17 -1.19 Astoria Charrette -PUARL
- 1.20 Sand Castle Competition, Cannon Beach -PUARL

Section 2:

- 2.1 Cannon Beach Road Signs -PUARL
- 2.2 -2.6 Astoria Charrette -PUARL
- 2.7 Cape Blanco Light House -PUARL
- 2.8-2.9 Oregon Coast -PUARL
- 2.10 University Campus Map
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- 2.12 Image of the City Cover
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- 2.13 Kadalur periyakuppam village in Chennai, India -PUARL
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- 2.56 Hawthorn Street Cannon Beach at Night -PUARL
- 2.57 Cannon Beach Signs -PUARL
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- 3.1 Chris Young skates 6.1 California earthquake wreckage
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- 3.2 Pattern Language Design Knowledge
- 3.3 Cannon Beach view and tsunami evacuation map-PUARL
- 3.4 View of the Oregon Coast between Cannon Beach / Seaside-
<http://www.clishmaclavering.com/travel/index.html>
- 3.5 Cannon Beach public art-PUARL
- 3.6 Cannon Beach tsunami evacuation map-PUARL
- 3.7 Tsunami evacuation route sign-PUARL
- 3.8 Tsunami evacuation assembly area sign-PUARL
- 3.9 Awareness kiosk proposal diagram-PUARL
- 3.10 University of N. Carolina at Pembroke Informational Kiosk
http://www2.uncp.edu/map/information_kiosk.htm
- 3.11 BoyScouts Trail Marker, Mayfield Preserve
<http://mayfieldpreserve.org/eagle-scout-projects/>
- 3.12 Green Circle Trail Map Kiosk, Stevens Point WI
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- 3.13 Tsunami hazard zone awareness signs diagram-PUARL
- 3.14 Stephanie Inn, Cannon Beach, OR
<http://www.stephanie-inn.com/>
- 3.15 Cannon Beach Tsunami Evacuation Zones
- 3.16 Abandoned Cannon Beach elementary school
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- 3.19 Brass 3D relief map at Astoria column, OR
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- 3.20 NW tsunami evacuation app
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- 3.21 Cannon Beach evacuation route sign-PUARL
- 3.22 Proposed tsunami evacuation route sign-PUARL
- 3.23 Cannon Beach evacuation route signs-PUARL
- 3.24 Cannon Beach evacuation route signs-PUARL
- 3.25 tsunami evacuation route sign, Phuket, Thailand
<http://www.phuketparadise.net/tag/phuket-memory/>
- 3.26 Tsunami evacuation route ground sign, Wellington, New Zealand
<http://blissandtheretiree.blogspot.com/2013/06/hiking-at-last.html>
- 3.27 Evacuation route connectivity diagram-PUARL
- 3.28 Solar roadways diagram
<http://www.solarroadways.com/intro.shtml>
- 3.29 Solar roadways material
<http://inhabitat.com/solar-roadways-smart-parking-lot-harvests-energy-captures-stormwater-and-melts-snow/>
- 3.30 Primary route spine of lights diagram-PUARL
- 3.31 Solar roadways highway night lighting
<http://www.solarroadways.com/intro.shtml>
- 3.32 Tsunami evacuation route ground sign, Matsushima Japan
<http://airtower.wordpress.com/2011/01/08/visit-to-matsushima/>
- 3.33 Individual sign post with a light diagram-PUARL
- 3.34 Follow the leader ducks-PUARL
- 3.35 Vertical evacuation tower, Nishiki, Japan
<http://us.stormsmart.org/2012/05/01/new-video-on-tsunami-vertical-evacuation-shelters/>
- 3.35 Description of Nishiki tower
<https://www.asme.org/engineering-topics/articles/manufacturing-processing/tsunami-forces-debate-over-vertical-evacuation>
- 3.36 Nishiki cross section showing multipurpose building
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- 3.37 Landscape berm integrating residences into the hill
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- 3.38 Safety zone threshold ground sign, Wellington, New Zealand
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<http://www.pbase.com/image/133206553>
- 3.40 Tsunami evacuation assembly area sign
<https://www.flickr.com/photos/redbeardmathpirate/3265158161/>
- 3.41 Security camera
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- 3.42 Registration tent
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- 3.43 Rule of 3 symbol
<http://teamclinch.com/2011/10/>
- 3.44 Cannon Beach assembly area-PUARL

- 3.45 Cannon Beach safehouse-PUARL
- 3.46 Cannon Beach emergency preparedness site sign-PUARL
- 3.47 Cannon Beach northern cache site-PUARL
- 3.48 Cannon Beach northern cache site-PUARL
- 3.49 Cannon Beach southern cache site-PUARL
- 3.50 Astoria Charrette -PUARL
- 3.51 Cannon Beach local business entrance sign-PUARL
- 3.52 tsunami evacuation route sign, Krabi, Thailand
<http://www.phiphi.holidayinn.com/>

Section 4

- 4.1 Haystack Rock, Cannon Beach - PUARL
- 4.2 Charrette Exercise
- 4.2 Cannon Beach Map Spine Lights-PUARL
- 4.3 Spine Lights-PUARL
- 4.4 Cannon Beach Map Quake Safe Pedestrian Bridge-PUARL
- 4.5 Evacuation Tower-PUARL
- 4.6 Quake Safe Pedestrian Bridge
- 4.7 Cannon Beach Map Information Kiosk- PUARL
- 4.8 Information Kiosk -PUARL
- 4.9 Cannon Beach Map Secondary Route of Lights- PUARL
- 4.10 Road Light - PUARL
- 4.11 Road Lights, Oakland California -PUARL
- 4.12 Cannon Beach Map Assembly Area - PUARL
- 4.13 Assembly Area Sketch -PUARL
- 4.14 Cannon Beach Map Hazard Signs -PUARL
- 4.15 Hazard Sign - PUARL
- 4.16 Cannon Beach Map Individual Sign Post -PUARL
- 4.17 Individual Sign Post with Light - PUARL
- 4.18 Cannon Beach Three Zone Urban Game Result - PUARL
- 4.19 Cannon Beach Two Zone Final Urban Game Result - PUARL
- 4.20 Charrette Exercise

Section 5

- 5.1 Oregon Coast -PUARL
- 5.2 Cannon Beach -PUARL
- 5.3 Bench Art, Steamboat Springs Colorado, -PUARL
- 5.4 Hawthorn St, Cannon Beach -PUARL
- 5.5 By-the-wind Sailor, Cannon Beach -PUARL
- 5.6 Cannon Beach -PUARL

Section 6

- 6.1 Sign Post Cannon Beach - PUARL





7. Appendix

1. Project Team
2. Site Visit One
3. Site Visit Two
4. Site Visit Three
5. Berkeley Visit
6. Cannon Beach Field Study and Project Research
7. Post Tsunami Redevelopment, India
8. Powerpoint Exercise: Pompeii Warm-Up
9. Charrete Results and Notes
10. Electronic Guidance Document and Online Presentation

7.1 PROJECT TEAM



DR. HAJO NEIS, PHD (PI)
Associate Professor, University of Oregon
Director, PUARL

The work of Associate Professor Hajo Neis examines the concepts of quality and value in architecture and urban structure. The director of the University's architectural studies program in Portland, he teaches design studios, courses, and seminars in urban architecture and theory with an emphasis on the art of building.

Neis has practiced architecture and planning in Frankfurt, Tokyo, Berkeley, and Borken (Germany). His design and oversight of the Eishin Campus, completed with the Center for Environmental Structures in Japan, received honors from the Japan Institute for Architects, the Japanese Association of Architectural Journalism, and the Prefecture of Saitama, and served as the subject of a documentary film. His work has appeared in many publications including *Nikkei Architecture*, *Architecture and Urbanism*, *Progressive Architecture*, *Baumeister*, *Kenchku Bunka*, *Shinkenchku*, and the *Journal of Urban Design*, as well as Christopher Alexander's *The Nature of Order* (Oxford University Press), *Dwelling, Seeing, and Designing* (D. Seamon, ed., State University of New York Press), and D. Kemmis' *The Good City and the Good Life: Renewing the Sense of Community* (Houghton Mifflin). He has also collaborated with the Center for Environmental Structures on a new town in Venezuela and a mixed-use urban housing project in Frankfurt, and with Thomas Kaestner on numerous competition entries selected for publication.

Throughout his career, Neis has taken on small projects—an experimental office building with two apartments in Tokyo, stepped library furniture in Berkeley—that demonstrate theoretical ideas in physical detail. He collaborated with W. Rang on “More Ethics and Less Aesthetics,” selected as a finalist in the architecture competition and exhibition for the Venice Biennale 2000 and exhibited on the Biennale website. Most recently he collaborated on the design of a platform and stair, now under construction, that transform a water tower in Germany into a memorial.

Neis's yearly comprehensive thesis studio topic is titled (Re)generative Design: redesigning and rebuilding cities, towns, neighborhoods, streets, buildings and gardens, destroyed by natural disaster, and/or catastrophic human failure. Under his guidance, Neis's students have investigated architectural design solutions to myriad disasters across the globe.



SRIVARSHINI BALAJI

PUARL GRADUATE RESEARCH FELLOW – FALL 2012

M. ARCHITECTURE

Srivarshini recently graduated with Master of Architecture degree from University of Oregon and is currently working as an Architectural Intern at OTAK Inc, Portland. She has been working with Prof. Hajo Neis since Fall 2012. Her interests include disaster management and mitigation, shaping light and color, and design-build projects. Having a personal history in the 2004 Indian coast Tsunami, she has been actively involved in disaster management and emergency response since 2006. Her M.Arch thesis topic “Tsunami Rehabilitation Village – India” directly ties in with the “Up and Out” project. She is a licensed architect in India and has 3 years of work experience in Architecture and Interior design.



ANNIE LEDBURY

PUARL ADMINISTRATIVE ASSISTANT

M. ARCHITECTURE & NONPROFIT MANAGEMENT CERTIFICATE

Annie holds a Masters of Architecture from the University of Oregon, with certificate studies in nonprofit management. Her B.S. in architecture is from the University of Michigan, and she is a LEED accredited professional BD+C. She was awarded the 2013 Hatfield scholarship from the Architecture Foundation of Oregon for design excellence and public service. Annie’s research interests include public interest design, pro-bono architecture in professional practice, and design-build service learning education. Her experience directly engaging communities in the process of design and construction comes from her years of service at Habitat for Humanity with the AmeriCorps program in New York City, and as the Managing Director of the New York office of Architecture for Humanity. She has experience with project management, event planning, marketing, and public speaking.



KAELI NOLTE

B. ARCHITECTURE

Kaeli holds a Professional degree in Architecture and Honors Degree from the Clark Honors College from the University of Oregon. Growing up in the Rocky Mountains, Kaeli developed a passion for nature. This passion combined with her high school travels to 10, largely developing countries, caused her to become increasingly aware of how people interacted with their environment. Her passion for architecture grew from these experiences. Kaeli’s Honors thesis focused specifically on architecture’s role in disaster relief and poverty alleviation around the world. Throughout her time at the University of Oregon, Kaeli has been involved in several groups including CASL (Center for the Advancement of Sustainable Living), HOPES (Holistic Options for Planet Earth’s Sustainability) and has worked as a glass technician at the University of Oregon’s Craft Center, as a Exhibit Evaluator for the Museum of Natural and Cultural History, as a researcher with the Environmental Workforce Program and as a Gallery Assistant and Graphic Designer at the White Box Gallery.



HANNAH PEMBUS

M. ARCHITECTURE GRADUATE STUDENT

Hannah holds a Bachelor of Art in Architecture degree from Miami University with focuses in Arts Management and Global Perspectives on Sustainability. She completed the university honors program and was awarded the Fanning and Howey Presidential Scholarship in Architecture two consecutive years.

Her experience working for the Cleveland Urban Design Collaborative sparked her interest in pursuing a graduate degree with a focus in urban architecture and urban design in Portland. Completed studies in cities around the world and specifically design studios in Florence, Italy and London, England, led to a developed interest in a variety of applications of sustainable urbanism. This Fall, her thesis will explore the Willamette Falls Legacy Project and how to transform this 23-acre historical industrial site in Oregon City. Her professional experience includes commercial and healthcare architecture with projects throughout the Midwest.



JACOB SIMONSON

M. ARCHITECTURE GRADUATE STUDENT

Jacob holds a Bachelor of Science in Architecture degree from the University of Idaho and graduated Cum Laude.

His interests include urban design and urban architecture. In order to further and expand this experience and knowledge he is currently pursuing a specialization in this from the University of Oregon, Portland Campus. His scholarly experience includes studies in urban theory, sustainable urbanism, and urban design studio projects in Coeur d'Alene, Seattle, and Portland. His interests stem from a two year volunteer mission in Belgium, France, and the Netherlands. His thesis studies over the next year will explore the Willamette Falls Legacy Project and how to transform this 23-acre historical industrial site in Oregon City. His professional experience includes construction and professional architecture office experience with works in higher education, libraries, commercial retail, and multi-family housing.



PERRIN WRIGHT

B. ARCHITECTURE

Perrin Wright holds a Professional degree in Architecture with a minor in business administration from the University of Oregon.

He recently finished his fifth year of the program at the White Stag Block in Portland studying Regenerative Design. His thesis studio project attempted to support local grassroots organizations by designing complex food systems ecology in the heart of West Oakland's old industrial area. He is interested in systems thinking and discovering ways to strengthen systems through resiliency and adaptive processes. During his time in Eugene, Perrin had the opportunity to diversify his education, and get a wide range of skills and experience. He helped publish two papers and presented their findings at a Solar Conference in North Carolina and a HVACR conference in Chicago. He was a construction team manager for a student design build project for a local middle school. Perrin's background in construction led him to tailor some of his architectural education to construction methods and management. He aspires to become a construction manager that employs innovative ways of using integrated design methods.



ELI ROSENWASSER

M. Architecture

Eli received his Bachelor of Arts from the University of Pittsburgh in Architectural Studies with a Minor in Studio Arts. His approach to design is firmly rooted in the manual creation of physical things. Eli is passionate about creating strong interactions and meaning through design by considering the full spectrum of sensory experiences which stem from a culture of making based in the collaboration and intersection of people, process, and context.

Independent research is the catalyst in his design approach. While conducting an independent study abroad, he encountered examples of architecture and urbanism that propelled his interest in the idea of user awareness through digital interfaces. The integration of digital interfaces and infographic communication are forms of design that are prominent in his work.



HOWARD DAVIS

M.Arch., UC Berkeley, 1974

M.S., Physics, Northwestern University, 1970

B.S., Physics, The Cooper Union, 1968

Distinguished Professor, ACSA—Association of Collegiate Schools of Architecture

Professor Howard Davis researches the social frameworks within which buildings are built as a path to the IMPROVEMENT of the built world as a whole. Through design studios, lecture courses, and seminars that examine architectural contexts of culture and place, with a focus on the social and cultural sustainability of cities and urban districts, his students view architecture as strongly anchored in the world of people and society. Howard Davis's current work on sustainable cities deals with the relationships between urban morphology, building typology and the emergence of new forms of the urban economy.



7.2.SITE VISIT ONE

3.13.2014

Following the Tsunami Evacuation Signs and overall site visit.

Following the Tsunami Evacuation Signs

First Group Site Visit to Cannon Beach

On March 13th, 2014, we visited city of Cannon Beach for the first time as an unofficial group. Our general agenda was to gain a better notion of what types of signage and infrastructure existed, the quality of its existence, and opportunities for improvement. A somewhat sunny to foggy day allowed for our observation of a semi busy town in motion.

We started the trip off by taking a walk on the beach to better understand the types of seawalls, or lack there of, that provided protection to the town as well as get a view of the iconic haystack rock. Placed every quarter of a mile or so exist a sign that diagrams a map of the region and uses a 3 color code system to explain the 3 different zones that break up potential hazards. The 3 zones are as follows: The orange inundation zone titled, "Distant Tsunami" which most if not all of the northern part of the city is located. The lime green inundation zone titled "Local Cascadia Earthquake and Tsunami" which a majority of the residential areas of the city are located. The forest green safety zone titled "Outside Hazard Area" which basically includes everything east of the 101. While there is a variety of information with fairly attractive graphics, we decided that we felt little if any better equipped or prepared to know exactly what to do, where to go, and how to get there in the case of an event.



Hajo & Perrin Studying Tsunami Evacuation Map

Farther along the walk we saw occasional short but lengthy sea walls that were built in front of beach front motels, most likely built by the motels for their own protection. A shallow pitched hill was in front of the following series of residences, that may or may not have been enough to protect them in the case of a distant tsunami. Additional things that were noted on the beach were the elevated sirens placed on top of poles, that supposedly take up to 5 minutes to activate in the case of a tsunami. The beautiful series of rocks called Haystack take up the primary focus, although the cypress trees along the residences are quite interesting, seeming to be blown back as if they were a drawn cartoon of someone with long hair getting greatly surprised.



Hajo Avoiding Waste While Observing Evacuation Map



Trees Blown Back by Fierce Ocean Winds (not a windy day)

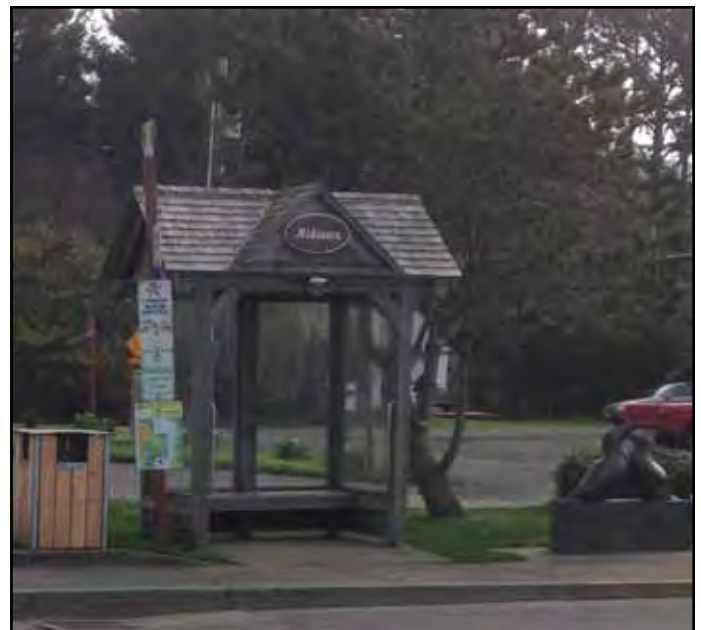
At the beach exit, there conglomeration of signs that are all placed on one large board that say more about ecological impacts, beach use, and general safety than they do about tsunami hazards. The character of the buildings that are along the beach are pleasant and beach like, with wood shingles, some heavy timber, and large western facing windows looking out to the ocean. While the architecture is attractive, there is no obvious construction techniques made apparent that let us know these whether or not these beach front buildings were constructed to withstand seismic or tsunami forces.



After walking along the beach, we made our way into the main road of town, Hemlock Street, and began to follow the signs that were labeled, Tsunami Evacuation Route. The signs directing inhabitants along the route are small and blue, noticeable but not eye catching. They include a graphic of a wave crashing over a running man, the words, "Tsunami Evacuation Route" and an arrow. The signs are located anywhere from approximately a quarter to a half mile apart. We were only able to locate one of the signs that are scattered about the beach along this road, which means what little information that is included on this sign, is fairly unavailable to the public.



Wayfinding Along Hemlock Street



Evacuation Map Along Hemlock Street



follow, follow, follow, follow.... Follow the Tsunami Evac. Signs

This road led us parallel to the ocean for quite some time, before taking us east on another flat road. Very little upward slope in the roads occurred until a very sudden pitch upward begins to make you feel as if you may be leaving the "Local Cascadia Earthquake and Tsunami" zone into "Outside Hazard Area." The signs continued up the hill in between small residences and public buildings, and end up in what is called an assembly area. One of these areas is located directly on the 101, with little to no shoulder or space for gathering. The other area is located through a series of trees that is set right beside a series of houses and gives no extra room for gathering, let alone a series of benches. The assembly areas have a blue and white rectangular sign with an (A), titled "Assembly Area" with a running man above a wave and a series of three figures holding hands. Only a piece of paper in a plastic folder that is nailed onto the post indicates the route that should be taken to get to this location.



Perrin Trying to Hitch a Ride Along the 101 Assembly Area Site



Hajo & Perrin Observing Signage at Second Assembly Area Site



Assembly Area Sign

Without asking any residents for direction, paired with small bouts of confusion, we were in fact able to locate the assembly areas. While this indicates that the signage works, we were not convinced by the clarity of current wayfinding approach. Other concerns include the fact that the assembly areas do not seem to support the amount of people that would be evacuating to the area. There is no additional information, call box, or suggestion as to what to do after everyone has gathered in a place of safety.

After we made our way back into town, we grabbed lunch at a local seafood joint, and chowed down while reflecting on our first response to our 'practice evacuation'. After lunch we visited the visitor and information center. The woman working was more than willing to discuss her opinions, but did not seem to have a very clear understanding of the city's exact plan in the case of an event. This is not to say that they do not have a plan, in fact they have weekly meetings and hold semi-frequent town wide practice evacuations that only some people attend. The city also provides the residents with a series of locked up containers that were located in safe areas. She did partake in locking up an evacuation pack with food, clothes, and supplies, but told us that they had recently been broken into by thieves that sifted through the variety of packs and barrels, stealing money and supplies. The woman seemed to indicate that in the case of "The Big One" (a common saying along the coast), she felt that everything in town would be destroyed so what is the point of being so prepared in the first place.



Storage Containers Outside the Hazard Area



The Cannon that Cannon Beach is Named After



HayStack Rock



7.3. SITE VISIT TWO

5.28.2014

Tsunami Evacuation Route Sign Update

Tsunami Hazard Zone Signs

Current Evacuation Route Sign

Current Evacuation Route Sign with Pedestrian Route

Tsunami Evacuation Route Sign Update

Through signage and wayfinding design research, we have learned that the shape, color, placement, size, and location of signs all play a pivotal role to their success as wayfinding tools. Some of the most important guidelines are defined by their shape and their color.

Symbols

- circle = regulation -> prevention of an action
- triangle = warning -> hazard/caution
- square = information -> first aid+fire protection+emergency

Colors:

- red=prohibition
- danger green=emergency, fire
- yellow=caution
- blue=misc
- black=obligation

Tsunami Hazard Zone Signs

One proposal is the need for signs that inform you what zone you are in.

Current Evacuation Route Sign with Tsunami Evacuation Map

All of the signs on this post are tsunami, this is good, but none of them look very good together. The blue needs to be repeated more in the map, or the map colors used in the sign. Figure ground of pedestrian and evacuation routes make them feel that they are not part of the same explanation

Current Evacuation Route Sign With Pedestrian Route

- Why is the sign repeated
- Is the pedestrian sign indicate that this is always a pedestrian path, or more specifically a pedestrian tsunami evacuation route
- Multiple street signs and names confuse what sign means what.
- Either bring all the tsunami signs onto one post, or all the tsunami information onto one sign.





7.4. SITE VISIT THREE

6.21.2014

URBAN GAME

BEFORE:

1. Kiosk

DURING:

1. Tsunami Evacuation Route Sign Update
2. Individual Sign Posts for Tsunami Information
3. Primary Escape Route Spine Lights
4. Secondary Escape Route Spine and Hierarchy of Routes
5. Evacuation Tower
6. Bridge Update

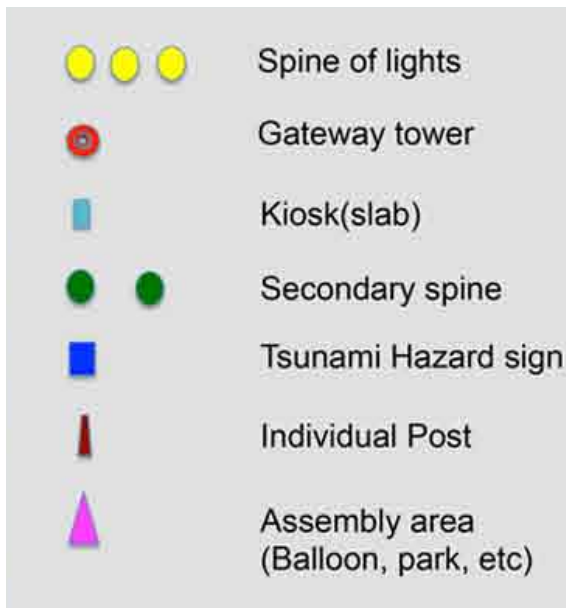
AFTER:

1. Assembly Area A
2. Assembly Area B
3. Other Ineffective Assembly Areas
4. Zone Threshold

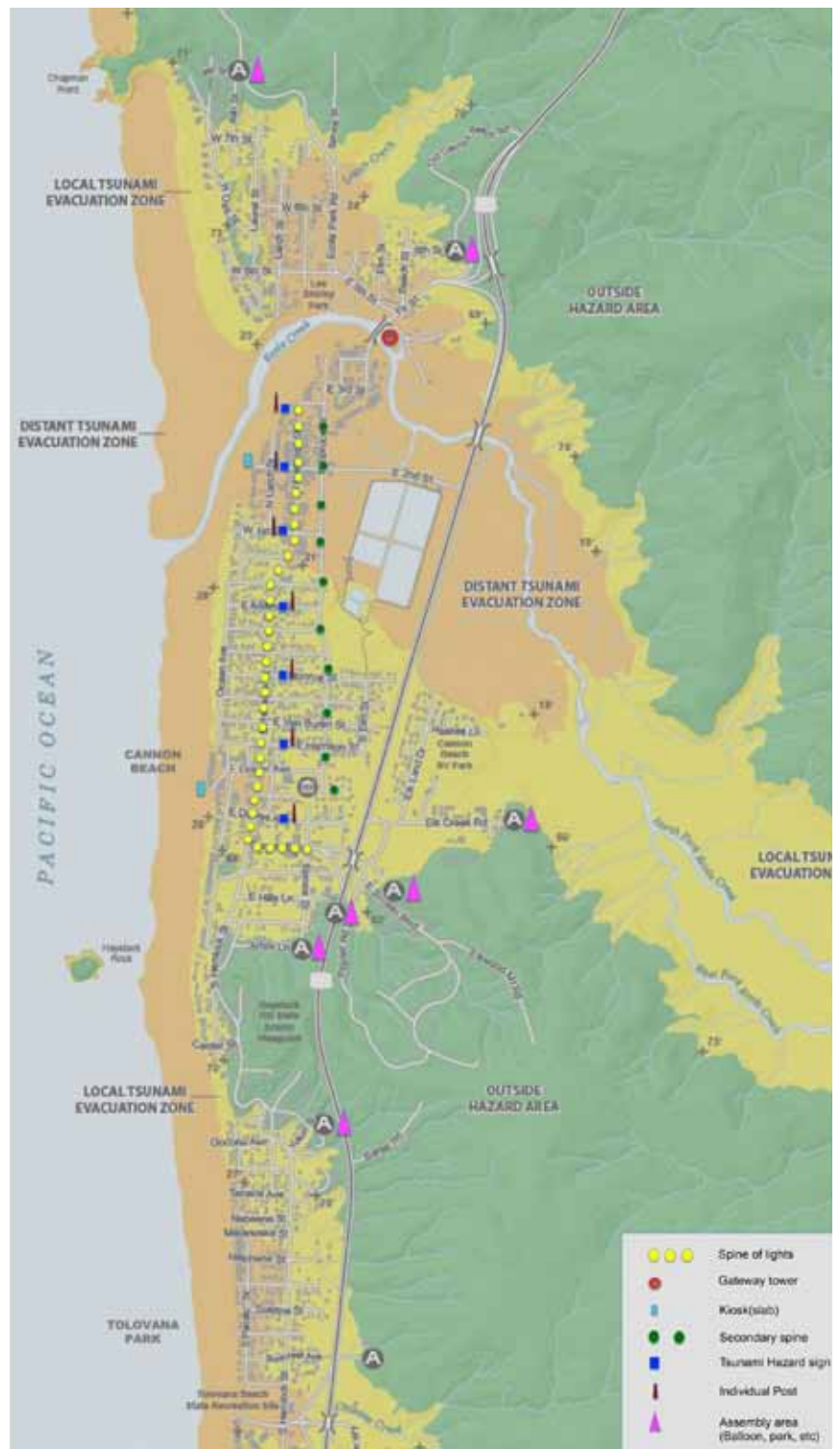
Listening Sessions

The following report summarizes the evaluations, tests, and conclusions that were made during our site visit on June 21st. The team proposed several good ideas during a charrette (Urban game – see pg 14) as part of the weekly team meeting. These ideas were developed into possible tests for the site visit to check the feasibility of the conceptual ideas developed in the charrette

We were able to test a series of our proposals in order to develop a better understanding of different possibilities for these proposals. The following tests that were accomplished are as followed:



Urban Game



Before Phase:

1. KIOSK



Tsunami Evacuation Map signs are only located in a few, but potentially key, areas around Cannon Beach. We feel that the signs effectively get peoples attention, but have the following opportunities for improvement:

Engage passerby by using clear images, words, and information

Provide a better sense of the danger of tsunami inundation without inducing fear

Convey an understanding of location on a state, city, and neighborhood scale

Convey proper route that they would need to take in order to evacuate to safety

Provide resources that inform you what to do during an evacuation

Provide links/places that you can get more resources if interested.



Current Evacuation Route Maps and their placement



We determined from our tests that the kiosk in key areas around the downtown area could greatly benefit tsunami awareness. These locations seem to generally be gathering places that incur a lot of movement and therefore increased interaction with the informational kiosk.

During Phase:

1. Tsunami Evacuation Route Sign Update

When walking evacuation routes, we have found that the tsunami evacuation signs functionally get you to where you need to go. However, we believe that certain aspects of the sign are not designed to achieve absolute clarity. These opportunities for improvement include:

- Clarity and continuity of pedestrian versus automobile routes

- Using the shapes that are coherent to their specific meaning.

- (Reference Appendix of Test 1 and book review: Infographics And Visual Communication Theory)

- Establishing consistent distance between signs

- Establishing consistent visual heights that support identification

This second version of tests took the lessons learned from the first testing period and include the following variables

- Circle vs. Rectangle Shape comparison

- Words vs Symbols comparison

- Blue vs Yellow color comparison

- Color and White figure ground comparison.



Circle:

- Lack of immediate clarity
- Wave figure gets lost in the white color of the rectangle part of the sign



Rectangle:

- The blue filled rectangle is more eye catching
- The wave stand out more

Test 1: Circle vs Rectangle Shape Comparison



Words:

- Take a little more time to read and comprehend quickly
- Seems to muddy up the sign with too much writing

Symbols:

- They are clear and can be understood quickly without needing additional words to describe their meaning
- They are subtle and do not take away from the words 'Tsunami Evacuation Route' or from the wave symbol
- They tell a linear story
 1. Evacuation Route
 2. Vehicle or Pedestrian
 3. Direction towards safety

Test 2: Words vs Symbol Comparison



Blue:

- Still effective
- Stays consistent with the signage throughout the city and the entire coast
- People are used to the blue
- Feels more friendly
- Could come across as purely informational rather than cautionary
- Is it eye catching enough?
- Does it strike urgency? Should it strike urgency?

Yellow:

- Seems to catch the eye more
- Feels more cautionary
- Potentially more intimidating

Test 3: Blue vs Yellow



Blue with white wave:

- Seems to have more balance on the sign
- Breaks up the three parts more distinctively
- Potentially causes you to see the amorphous blue shape not the white wave

White with blue wave:

- Seems less eye catching
- Blue wave stands out more than everything on the sign
- Does not break up the different pieces as clearly

Test 4: Figure Ground Comparison

Tsunami Evacuation Sign Update Conclusions:

1. The color blue provides consistency not only in the town but across the state and is effective enough at getting people's attention without using a cautionary color
2. A symbol describing what type of route you are on seems more effective than a word, which does not balance well with the arrow or the tsunami evacuation route words
3. Circle or Square??
4. Figure Ground is better with as is, with the a blue rectangle/circle and a white wave

2. Individual Sign Posts for Tsunami Information

Currently the tsunami signs are placed on 4 x 4 wooden posts, often in conjunction with a variety of informational or directional signs. This sometimes seems to be okay, but other times feels as if it is lost in translation. Especially when a variety of similar and dissimilar colors are used. Through observations of the existing conditions we feel that the opportunities for improvement include:

- Clarity of tsunami evacuation information signs
- Eyecatching and informative placement
- Consistency in placement, sizing, information, and design
- More thoughts?

Although we were not able to duplicate all of the different signs and place them on an individual post for testing, we were able to observe where certain existing conditions seemed to be successful and others that did not. Here are some examples evacuation route signs that stand alone versus some of the inconsistencies between tsunami signs and when placed together alone or with other unrelated signs.

Current Posts dedicated to Evacuation Route Signs



Signs stand mostly alone and therefore stand out
Effective because they have limited information on them
Blue color seems to pop more when not against reds and yellows

Current Posts with lot of Tsunami Sign Information



Left:

- Why is the sign repeated
- Having two signs indicating two different potential routes makes it very confusing do decide which way to go.
- Is the pedestrian sign indicate that this is always a pedestrian path, or more specifically a pedestrian tsunami evacuation route
- Multiple street signs and names confuse what sign means what.
- Either bring all the tsunami signs onto one post, or all the tsunami information onto one sign.
- Different heights of different signs indicate they were placed there at different times and not in a calculated manner, make them feel less reassuring and effective.

Right:

- All of the signs on this post are tsuanmi, this is good, but none of them look very good together.
- The blue needs to be repeated more in the map, or the map colors used in the sign.
- Figure ground of pedestrian and evacuation routes make them feel that they are not part of the same explanation

Beach Entrance Group of Many Informational Signs:



- Tsunami Sign is insignificant
- Too many signs make none of the signs legible, therefore less useful
- Too many signs placed like this seem more intimidating, although most of the signs are generally informative.
- Red comes off as a harsher color, and seems to be the first thing to catch your attention.

- Tsunami Sign is insignificant
- This is the sign that is perhaps most important turn you have to take to safety, leading you away from hemlock onto sunset.
- Too many signs make none of the signs legible, therefore less useful
- So much information is hard to process.
- Naturally look for the sign that you need, this may be an advantage when needing to identify the tsunami evacuation route sign, but if not looking for it, it seems to disappear.

Individual Sign Posts for Tsunami Information Conclusion

This test was not physically accomplished by bringing an individual post, but has been discussed and diagramed on site when evaluating the existing conditions. We feel that it is worth exploring the following solutions to these problems.

1. Design a different type of post with or without some sort of tsunami design that is strictly meant for signs that provide information or direction regarding tsunami zoning, routes, or education. The reason for this would be to achieve clarity and also bring attention to this group of signs.
2. Create rules and guidelines that place tsunami signs with other signs in a well balanced rhythm of shape, color, size, and eyeline.
3. Establish consistency between different tsunami signs so it does not feel as if three different signs were thought up and designed at three different times.

The general goal of this exercise is to try and find some sort of consistency and rhythm between tsunami signs on a particular route that will give passerbys and potentially evacuees a better understanding of what to expect from the next sign that they see when taking the evacuation route. By achieving this rhythm, clarity, and visibility (eye catching, stands out) these signs will help do two things. First is to repetitively teach people the way to safety so that it is ingrained before an actual event. Second is to be as clear as possible during the actual event so there is absolutely no second guessing the signs causing to delayed evacuation times.

3. Primary Wayfinding Lights

The way that the evacuation routes are set up are by individual neighborhoods. Some of the smaller which are often farther up the hill and are residential do not require returning to a major artery before arriving at an assembly area. However downtown and midtown, places located closer to sea level, require a greater distance to be traveled. The routes intend to guide people along whatever secondary street they are and get onto a primary artery. Those major arteries are the major streets used to get people from place to place in town without getting back onto the highway. Depending on location the streets to be taken run parallel from lowest to highest. Hemlock st, Spruce St, and the 101 highway. These streets have evacuation signs both along it and adjacent to it, to indicate that people should turn on to it if they are coming from a smaller street. However, the clarity of this system is sometimes in question and the streets seems to be lacking a way to indicate that it is in fact the route to be taken to safety. This may cause people to turn away from the street before they are indeed supposed to and hit a dead end. Additionally, when you are in fact supposed to turn off of this street to continue on the evacuation route uphill, there is no sign that stands out more than any other, in fact it is hidden with a series of other informational signs. Therefore we believe that improving the clarity of the primary evacuation route spines is an important move and that the opportunities for improvement are:

Providing more consistent and frequent signage

Clarifying a different way to indicate a needed turn versus a continuation along the same street.

Bounding the street so that people do not feel the need to turn before it is time

Indicating that the street is the primary evacuation route

Lighting the street and signs better so they can be useful at night



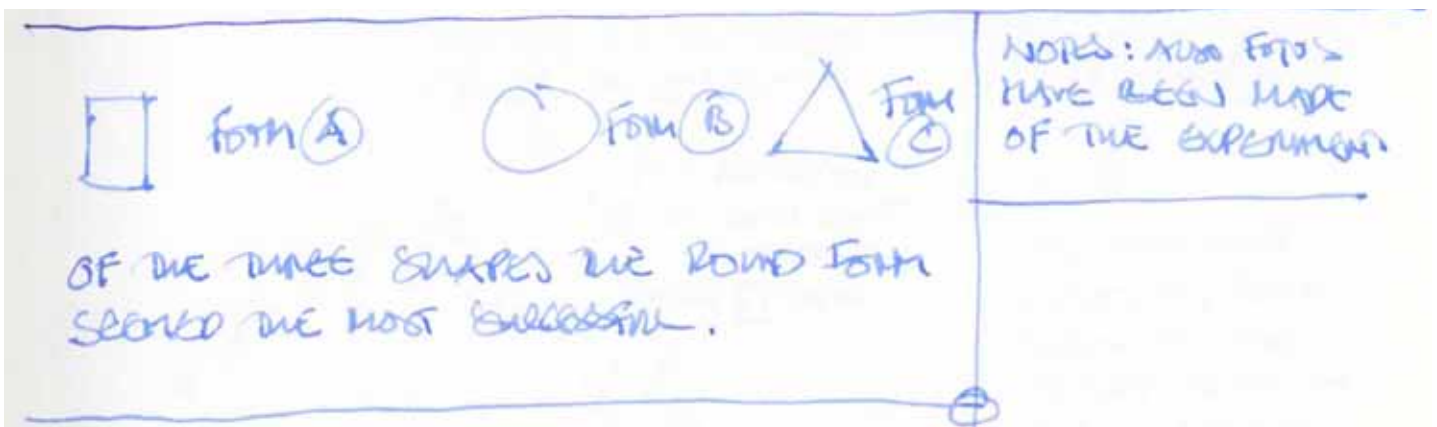
One of our proposals includes a series of lights that are placed on the ground along the primary escape route. The concept stems from lights that are placed in the ground for pedestrian intersections as well as streets that's edges are not well lit up at night. These precedents are being adapted to fit the need of bounding the evacuation route, especially at night time when locating signs in the dark would be difficult. Additionally, the distance between signs on this route is sometimes quite far apart, and it might not be out of the ordinary for people to feel like they should be turning up away from the beach before they are actually supposed to, where lighting the ground assures people of the path they are on. Because there is a long major artery that acts as the primary escape route for many people, that route should have more attention brought on itself.

One street that has a potential for solution to all the above-discussed ideas is the Hemlock street which has its own identity and character among other parallel streets.

Several tests were made in this regard to test the lights on ground. The following tests were based on

1. Shape of lights
2. Distance between the lights
3. Location of the lights on the road(spine)

1. Shape of Lights:



Test: Three different forms were tested,

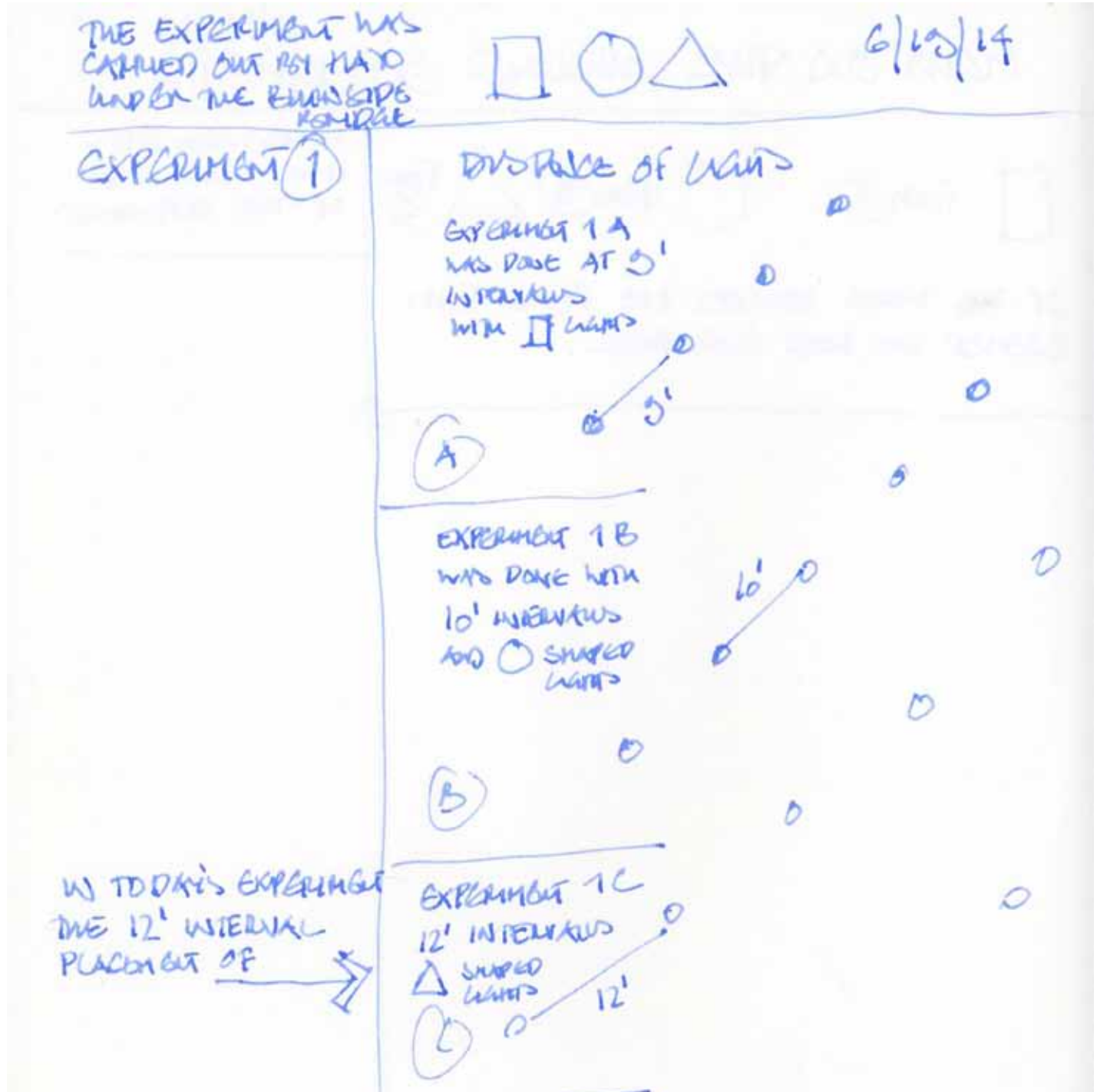
- Square lights
- Round lights
- Triangular lights

Conclusion: Of the three shapes tested, the round form was successful when compared to the other two shapes.

2. Distance Between the Lights:

Three tests were carried out with lights at 9' apart, 10' apart and 12' apart.

The lights at 12' distance seemed to be the most practicable.

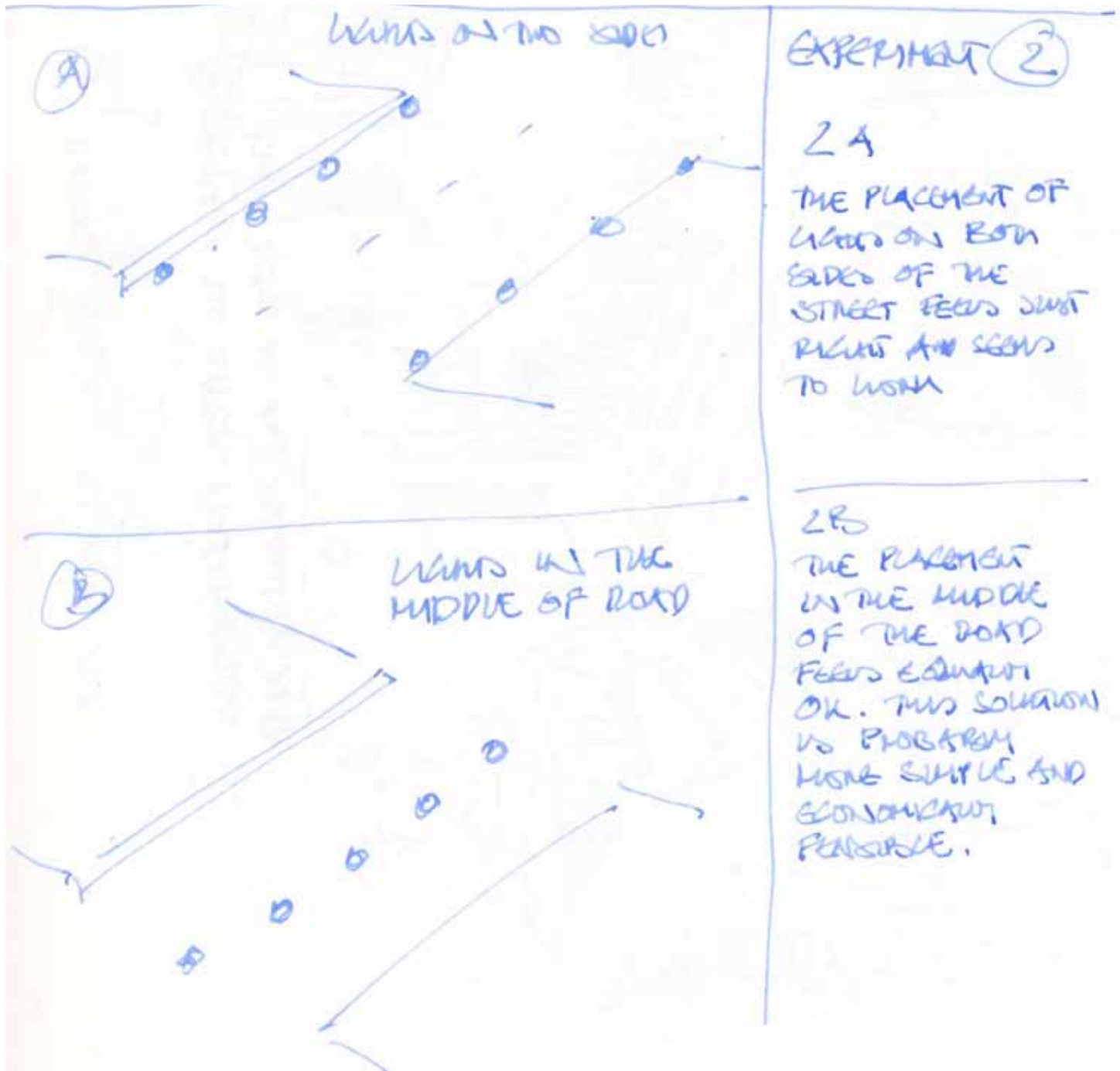


3. Location of the lights on the road

Two experiments were tested to determine the location of the lights on the spine.

- Edges of the road
- Centre of the road

The lights on the Centre of the road are the most simple and economically feasible when compared to having them on the edges, considering parking on edges where the lights could get hidden



Primary Escape Route Spine Lights Conclusion

The idea of Lights on the ground is pretty successful. The one aspect that needs to be worked or developed further is the practical/technical setup and installation of these lights on the primary street.

Circular shaped lights give a clear sense of direction when compared to the square and triangular lights

Placing the lights on the centre of the road is probably the most simple and feasible when compared to placing them on the edges

The distance between the lights(when tested on site) is 20'(6 m)

4. Secondary Wayfinding Lights and Hierarchy of Routes

The secondary route spine (Spruce St) is well connected and most times do not require returning to the main artery although it could be improved in connecting to the assembly area. In areas where there are potential opportunities for dead ends of the street to be connected in highway pedestrian walkway directly which is the safe zone.

The opportunities for improvement are:

Clarifying and establishing connection to the highway in places where the dead ends could be easily connected



Alternate to signage, lights on the ground with longer distance between the light and could probably be of a different colour to distinguish it from the primary street.

Some assembly areas that are in close proximity need to be connected.
The assembly area on the highway needs benches/picnic tables.

Objectives:

- Identify the most important routes leading from the beach to Hemlock St.
- Do Hemlock and its parallels function fully?
- Which routes would also have the lights, if any? And how would those lights be placed to encourage movement to Hemlock yet not interfere with lights on Hemlock?
- Write about the connections, how clear they are, what works, what doesn't. Does it work as a system? What could be changed?



Secondary Escape Route Spine and Hierarchy of Routes Conclusion

Proper connection to highway required wherever necessary

Assembly areas in connection to Spruce street needs more improvement

Setting up Beacons/balloons in the assembly areas of this street would not work due to the landscape and wild vegetation.

Alternate signage like lights on ground is required for navigation

If Lights on Road, then they need to be placed along the center of the road

5. Evacuation Tower

The downtown population is in the lowest inundation area, and is the most at risk for a variety of reason. Due to a probable bridge collapse and an almost impossible distance needing to be travelled in the opposite direction, there is a need for an alternative escape route for this exposed population. It has been a point of contention, but certain invested members of the community have proposed building a tsunami shelter building in this area. Because of the open land provided by the abandoned school, there is an opportunity to design and build a vertical evacuation tower or tsunami shelter in this area. We believe that this area provides the city with a variety of opportunities for improvement:

Using this as an opportunity to make a key attraction/monument for the town entrance

Creating a safe alternative for evacuation to the most vulnerable population

Create a new facility for tsunami readiness that encourages awareness.



Above are two panoramic views of the proposed site. A variety of ideas went around for what type of building would work best for this area. In general, we believe that the tsunami evacuation tower could hold a variety of functions before and after a tsunami. Some of these programmatic functions could include:

Tsunami Readiness Tower:

First Responder Access

Coastal Commission Response

Evacuation Preparedness and Awareness Center

Tsunami / Earthquake Research Facility

City Hall / Government Offices

OEM / FEMA offices

Hotels / Motels

Store Front

Raised Park Balconies

ETC

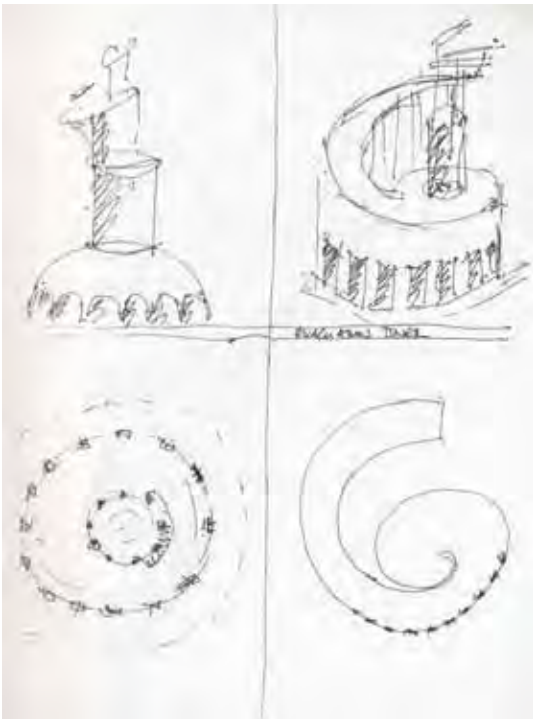
With some of these different ideas and mind along with a variety of precedent buildings that look or function in a similar fashion, so we spent 30 minutes behind the school looking at one of these two views and sketching in charrette form some of our ideas.

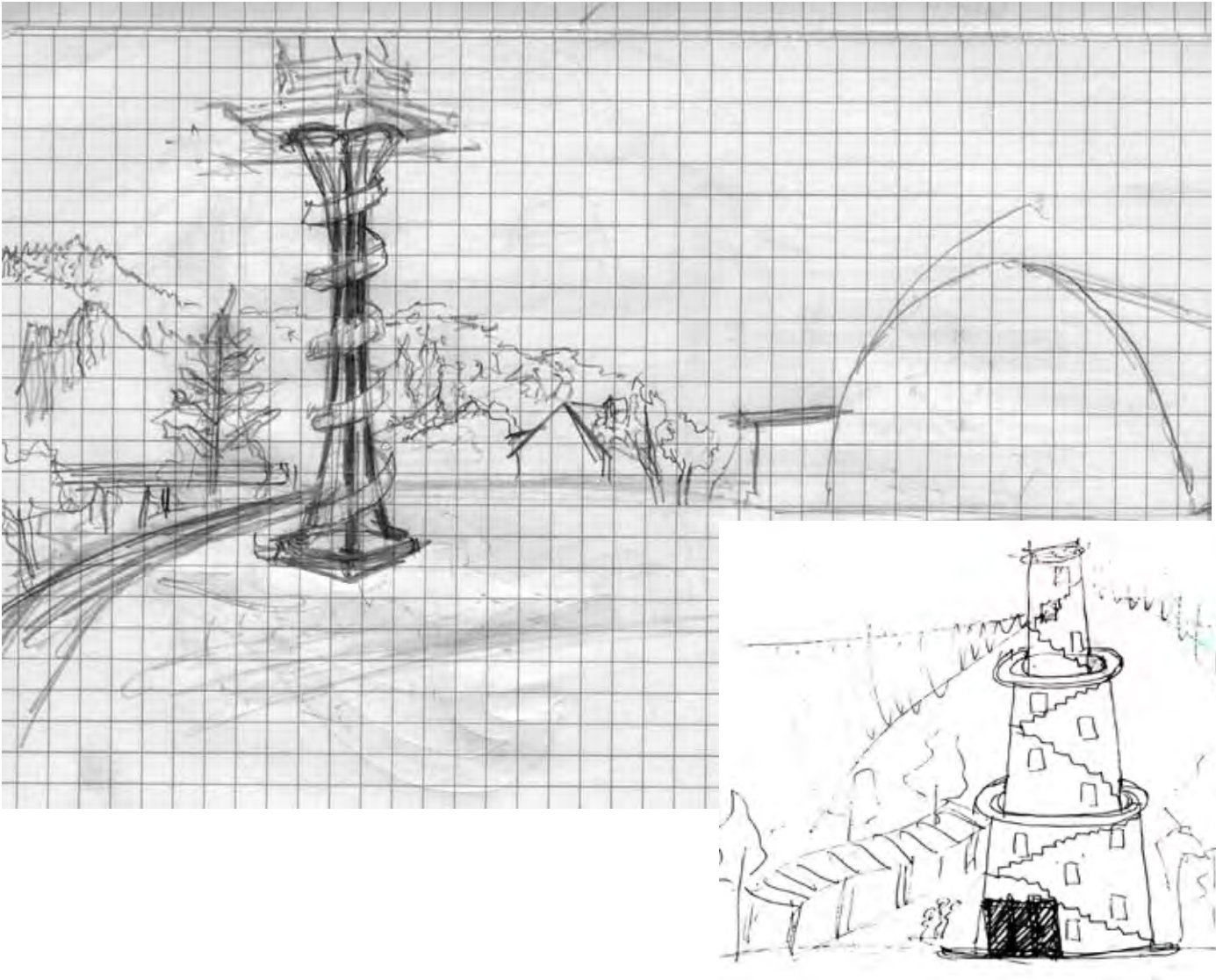


Tower Sketch Design : Evacuation tower with observatory decks

The tower could be a part of the park space with pergola walkways and play areas. In case of an event, the tower can be used for vertical evacuation. It could function as a watch tower where there are observatory decks on multiple levels. The external stairs lead directly to top and the tower can have elevators on the interior. It also has the possibility to include restaurants as part of the observatory deck. The tower could serve as a lighthouse to direct the people towards the tower as well as be used for siren systems.

- Location at the Fir Street bridge behind the old Cannon Beach Elementary School Tower seems to be a needed location
- The tower could have a function beyond that for use in a Tsunami
- Height of tower should be 100ft for safety





Vertical Evacuation Tower Conclusions:

It is assumed that a vertical evacuation tower is somewhat out of the scope of this research and design proposal, which is why spending time designing an actual building would not be an efficient use of time. However, the fact that the city has proposed a tsunami safety shelter before, and that this specific site provides the city with an opportunity to ensure their most vulnerable population with a safe evacuation, means that this proposal could in fact be the glue that ties all of these different ideas together. Oregon has always been a leader in tsunami preparedness, and by designing a facility that is dedicated to this theme, could put them on the forefront of future coastal communities with regards to tsunami readiness.

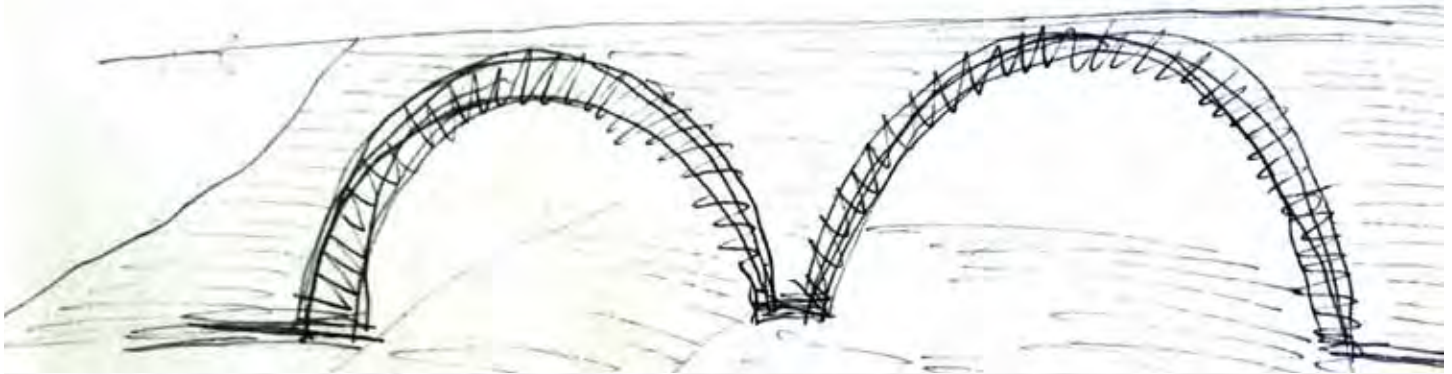
6. Bridge Update



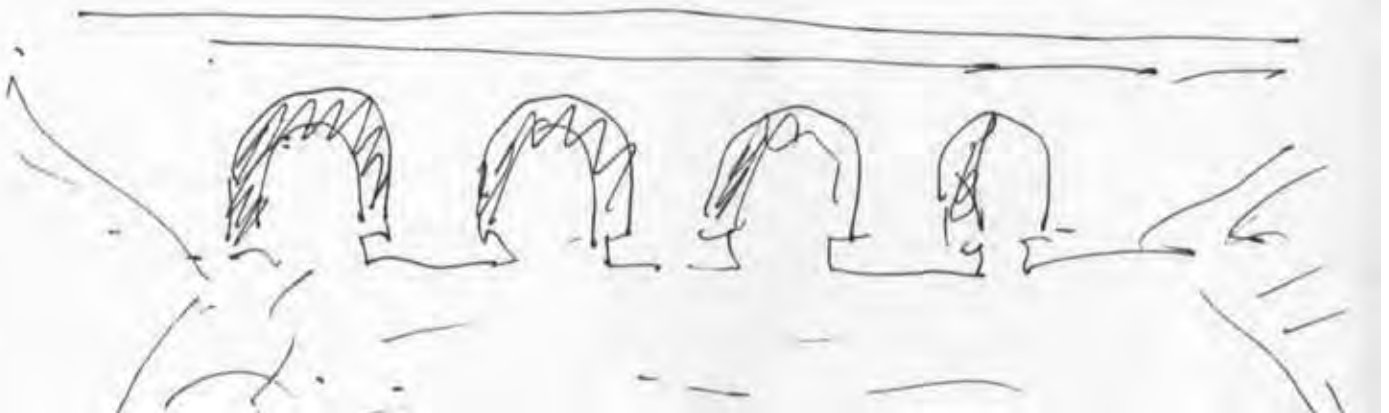
The fir street bridge is the primary entrance and exit to the town. It is rather unassuming with no overhead structure or signage, but it is passed by almost every person coming into Cannon Beach. In the event of a large earthquake, it will definitely be destroyed which is a major issue because it would be the shortest route to safety for the downtown population. Because the downtown population is where all of the motels are, and where all the least informed would be, the bridge breaking causes these people to have the longest and most difficult route to safety. Because it is assumed the bridge would be destroyed by the earthquake, none of the evacuation routes lead you to the bridge, but instead almost two miles in the opposite direction. Therefore renovating the bridge would be a sure way to potentially save a lot of lives. The opportunities for improvement on this bridge are:

Renovating the bridge for lateral earthquake loads
Using this as an opportunity to make it a gateway into town

We decided to take a look at the current state of the bridge, which is essentially 4 rows of 12 vertical posts supported laterally by two cross bracing 2 diagonally 2 x 10 posts. The only structural system that runs parallel to the bridge is in the concrete decking itself.



BRIDGE: THE EXISTING BRIDGE IS IN BAD SHAPE AND NEEDS A NEW BRIDGE DESIGN FOR SAFETY AND EVACUATION REASON



Bridge Renovation Conclusion

It is generally agreed that the bridge being unsafe causes the whole downtown area's evacuation success to be in jeopardy. It should therefore be considered to renovate the bridge or provide some sort of alternative means of safety to the downtown population.

After Phase:

1. Assembly Area A

It is sometimes confusing when approaching different assembly areas what their purpose are. At first we were under the assumption that this would be where people would congregate for a significant period of time and that houses close by volunteered to hold extra provisions for these people. However, each of these assembly areas is rather unassuming, and except for the 'A' sign, there are few indications or spaces that would support a significant amount of people. Through further investigation, we realized that these signs are commonly the 100' above sea level threshold at which citizens are ensured safety, and that there are sometimes spaces above them that have more supplies and better designed space to support the rebuilding process post tsunami. While these point A / point B system may be the intention for evacuation plan, it is not communicated through the sign or the area and there needs to be a clarification of where you are and what you are supposed to do when you get there. Some of the opportunities for improvement are:

- A new sign that informs what an 'Assembly Area' even is
- New organization of space to make it support gathering (park?)
- Establish difference between Assembly Area / Emergency Response area
- Provide information on where to find evacuation plan
- Provide more storage and sheltered buildings
- Include lights so the space can function at night
- Placing storage containers at assembly area
- Placing some amount of seating
- Create a different paving type around the assembly point to designate it as its own space
- Include signage/information for what to do in an emergency and Emergency Preparedness Site location

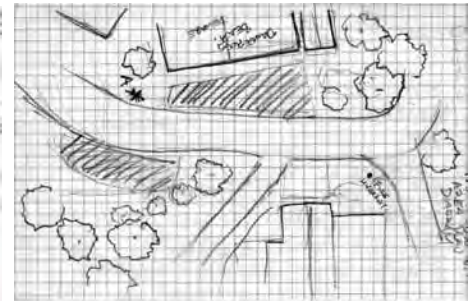
With some of these ideas in mind, we spent some time at the "North Entrance" Assembly Area on 6th & Old Cannon Beach Rd. discussing and conceptualizing potential areas for improvement and ways to make the space serve its purpose more effectively.



Sketch of Existing Assembly area



Sketch Design of a Proposed assembly area with improvements(Hajo)



2. Assembly Area B

This unofficial secondary Assembly Area is marked with a sign on a fence that reads “City of Cannon Beach Emergency Preparedness Site North,” an American Red Cross trailer, an enclosed storage building, smaller sheds, and concrete slabs that can be hooked to for generators. This area is higher than the 100’ Assembly Area A. This area has more supplies and is a better designed assembly space than Assembly Area A. It seems that what is missing is some link between the two areas.

Some of the opportunities for improvement are:

A new sign at Assembly Area A that informs that there is a second assembly area located further up the road

More seating for gathering

Establish difference between Assembly Area / Emergency Response area

Provide information on where to find evacuation plan

Provide more storage and sheltered buildings

Include lights so the space can function at night



Emergency Preparedness Site

- Three picnic tables
- Red Cross storage trailer
- Storage building
- Shed
- Concrete pads for generator connections



3. Other Ineffective Assembly Areas

Maybe in a different site report but this could section talks about the other ineffective assembly areas and the other shipping container site that is too far remote

Introduction of Problem

opportunities for improvement

Tests to be taken or observations to be made

Photographs

Diagrams

(Perrins are in Hannah's Folder)

Conclusion

4. “North Entrance” Assembly Area: – 6th & Old Cannon Beach Rd.

Assembly area at 100ft elevation

- No seating or special designation for the assembly area
- Homeowner next to assembly area is converting part of garage into shelter incase of a tsunami
- Land surrounding the assembly area is privately owned
- No signage exists telling people about Emergency Preparedness Site up the road
- Opportunities to make assembly area more visible, more attractive, more functional, more informative

Placing storage containers at assembly area

Placing some amount of seating

Create a different paving type around the assembly point to designate it as its own space

Include signage/information for what to do in an emergency and Emergency Preparedness Site location

Zone Threshold:

- Instead of markings on the road for different zones it could be the standard blue color with a line through the street pointing in the direction of the evacuation route, example of the look: <http://www.getprepared.org.nz/tsunami-blue-lines>



-Another idea is that to mark the zones, the addresses of the businesses and residences could be painted onto the curbs in a certain color denoting what zone you are in.

Listening Session Notes

Site Visit: May 20, 2014
 Mark Barnes, City of Cannon Beach Planning Director
 barnes@ci.cannon-beach.or.us
 503-436-8040

Questions:

- Tell us about your work/ role at the City of Cannon Beach
- Oversees all planning and zoning matters, including design review. This is a wealthy community.

How you see the problem of emergency Tsunami wayfinding in Cannon Beach.

- *Seasonal population shifts:* There is a 1700 person permanent population in CB. In the summer, there are an additional 5,000 in town. On special events, it grows to 10,000+. (Compared to 20,000+ that come to Seaside).
- *Fear vs. preparedness:* Most industry here comes from tourism. How to communicate danger, preparedness, and what to do to those people, without scaring them away from staying here.

What stakeholders should we talk to?

- *Hotels, and single family vacation rental owners.* Hold the key to systematically reaching tourists. (Evacuation walks don't help these people).
- *Emergency preparedness committee* at the City of Cannon Beach does good work, most effectively at reaching permanent residents.

Tell us about design aesthetic regulations and community opinion here.

- Cannon Beach has a strong aesthetic compared to Seaside, and people are proud of the place's "village character". To protect this, most building here is architecturally designed, and even renovations go through design review process. There are a few architects in the area that serve on the board, including some who come in from Portland.
- Pride themselves on having no stoplights.
- Process for installing new signs, design review triggers, approvals required: Takes 1 mo.-6 weeks, or 2-3 months for the whole process.

Other discussion facts:

- The town of **Manzanita** requires that posters of the tsunami evacuation route maps are posted in each hotel room.
- Overall, he doesn't find much resistance in the community to safety measures.
- Design solutions should use "off the shelf technology".

Recommendations:

Simplify signage, or consider other ways of communication. Too much signage is a problem in Cannon Beach. Case of "Signage Saturation". On the same pole, there is competing information. Review academic studies on saturation point for signage. (Example: at 5th and Fir, near the park).

Coordinate with hotels to train their staff/ do city-run evacuation walks to serve as leaders for visitors in case of an event.

May 28, 2014
Virginia “Jen” Demaris, Emergency Manager, Lincoln County (Newport, OR)
Casey, Public Information Officer, Lincoln County

Questions:

Tell us about your work/ role

- Outreach, awareness for 7 cities and surrounding rural areas in Lincoln County. (It’s the county south of Cannon Beach).
- They get the word out in various ways: “there is a danger. know where to go”

How you see the problem of emergency Tsunami wayfinding on the Oregon Coast.

- Signage, awareness, timing to escape, tourist vs. resident populations (especially at night)

What stakeholders should we talk to?

- Schools, vulnerable populations (homeless/transient, housing assistance orgs, public health orgs, non-English speaking groups), parents, 18-25 year olds, 26-65 year olds, seniors, seasonal residents, businesses (vacation rentals, traditional, hotel/motel). (See matrix attached).
- People move to the coast to retire. From OR, the Midwest. Lots of seniors with varying mobility.

Design recommendations/ considerations?

- **Structured assembly areas as points of interest.** “tsunami awareness viewpoints”. Like “interpretive walk” series of points of interest in Newport.
- Consider both physical and digital means of wayfinding. New technologies, digital signage, phone app, solar powered railway lights.
- Consider landmarks, geographic symbols, sky, ground.
- **Evacuation art challenge:** Make something fun, then encourage people to tour the neighborhoods/ cities to see different options. Ex: Tillamook County used patchwork quilts all around the area as an awareness symbol. Ex: Portland’s painted cows. Embraced and sponsored by individuals for bigger impact. Tourist-friendly.

Other discussion facts:

- There is a lack of continuity in programs between states for signage, awareness, preparedness. Travellers from HI, WA, OR, and CA don’t have continuous experience. There are no federal level tsunami brochures.
- Vulnerable populations and most impoverished are not directly on the coast. (More expensive real estate).

Recommendations:

- Use an outreach matrix/ communications strategic plan. She included a pdf copy of the matrix they did for Lincoln County’s Inundation Map dissemination project. Understand your target audience, media, message, goals. Be strategic.
- Create a menu of ideas for different cities, conditions, populations.

- *Consider differences between dense and rural conditions. Cities, neighborhoods, towns, and rural areas. Rural villages have less power to organize, execute plans, \$ for implementation. Ex: in Lincoln Beach/ Gleneaden Beach, few assembly area signs, gravel lane to 30 houses, no neighborhood association.*
- *Design some affordable options on the menu. Communities have to pay for their own signs/ pursue own grants to implement our design. Put up by volunteer firefighters, small business associations, citizens, who knows who else. Make it simple/ intuitive. Easily sold.*
- *Sense of Humor is important!*
- *Make the Chamber of Commerce/ tourism industry your friend. They can make or break your work. If you are scaring their customers away from the coasts, they will kill your initiatives. (They know influential people). Your goal is education and a “slice of reality”, not fear.*
- *Consider implementation roadblocks for different communities. Ideas that can’t be carried out aren’t helpful to anyone.*
- *Create a consistent marketing/ brand that conveys a simple message. Be strategic.*
- *Understand this project as one component of a larger strategic effort that includes tsunami preparedness, response, supplies.*

Follow up:

- *Come to Lincoln county for a tour/ see what they’re up to!*
- *Once we’re done, send results to her.*
- *Invite to charette event. Lots of people in her county that would go.*

Conclusions:

The people that live there and visitors are used to the blue color and changing that might get confusing or be rendered ineffective in the event of an actual emergency

Something that people are also used to is the fact that the “moo” is for testing and that the siren is a serious warning. The couple we spoke with did not think that using the “moo” in the case of an actual emergency would be effective because people would not take it seriously.



7.6 CANNON BEACH FIELD STUDY AND PROJECT RESEARCH

Awareness Kiosk
Tsunami Hazard Zone Sign
Downtown Awareness (3D Map)
Tsunami Hazard Zone Sign
Tsunami Evacuation Map
Occupiable Berm
Vertical Evacuation
Evacuation Route Sign
Quake Safe Pedestrian Bridge
Primary Route Light Spine
Evacuation Route Connectivity
Safety Zone Threshold
Assembly Area (include mini parks)
Triage

Awareness Kiosk



WAYFINDING CONCERN

Visitors aren't familiar with the danger of tsunami, what to do in an event, and the best path to safety.

DESIGN PROPOSAL

Install map kiosks in prominent tourist locations. Incorporate seating, lighting, shelter, sculpture or other design elements according to need.

PRECEDENTS



RESEARCH AND FINDINGS

Tsunami Evacuation Map signs are only located in a few, but potentially key, areas around Cannon Beach. The signs may effectively get peoples attention however, they do not provide enough information or engaging words and images to actually get a sense of the danger of a tsunami. The signs also do not inform people of the current zone that they are located in or the proper route that people need to take in order to evacuate to safety.

A series of kiosks located in key public areas that will get the attention of visitors and provide them with a much clearer understanding of what to do before, during, and after an event.

In order to be more effective than the current evacuation route maps, these kiosks should include a series of 3 maps

1. A coastal map showing the Oregon coast with relation to the cascadia fault line, major highways, and different coastal cities.
2. A city map that shows current location, major landmarks, general evacuation routes, and tsunami hazard zones.
3. An evacuation route map that shows the current location and the clear path to the nearest assembly point.

Awareness Kiosk

These kiosks should also inform people of things that they can do to be more tsunami ready.

Prepared (education of what the tsunami threat is with relation to an earthquake, what the potential dangers are, the importance of having a plan with your family or those you are with, and where to go both in the city and online in order to get more information)

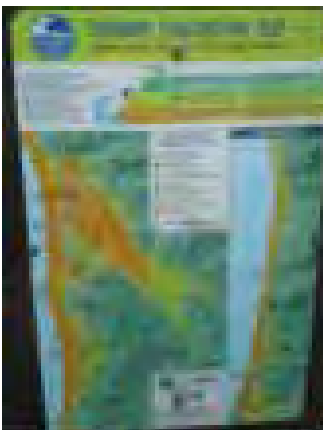
During (knowledge of what would be heard if a tsunami occurs, what may be seen on the route, how to walk the route rather than drive, appropriate clothing and necessary belongings, and clear understanding of the route)

After (understanding of what an assembly area is, why it is there, what type of access it has with first responders, and how those gathering points of safety have contact with other assembly areas as well as emergency responders)

Tsunami Evacuation Map signs are only located in a few, but potentially key, areas around Cannon Beach. We feel that the signs effectively get peoples attention, but have the following opportunities for improvement:

1. Engage passerby by using clear images, words, and information
2. Provide a better sense of the danger of tsunami inundation without inducing fear
3. Convey an understanding of location on a state, city, and neighborhood scale
4. Convey proper route that they would need to take in order to evacuate to safety
5. Provide resources that inform you what to do during an evacuation
6. Provide links/places that you can get more resources if interested.

CURRENT EVACUATION ROUTE MAPS AND PLACEMENT



TESTS



Left: Kiosk test in front of covered public space with ocean look out
 Middle: Kiosk test in front of major beach entrance on (2nd avenue?)
 Right: Kiosk test in front of businesses on Hemlock St.



Left: Observational test of public parking area (kiosk omitted)
 Right: Observational test of visitor and information center

Conclusion

It was determined from our tests that the kiosk in key areas around the downtown area could greatly benefit tsunami awareness. These locations seem to generally be gathering places that incur a lot of movement and therefore increased interaction with the informational kiosk.

Quake Safe Pedestrian Bridge



WAYFINDING CONCERN

In the event of an earthquake, the Fir Street bridge will be destroyed, cutting off the vulnerable downtown population from reaching higher ground.

DESIGN PROPOSAL

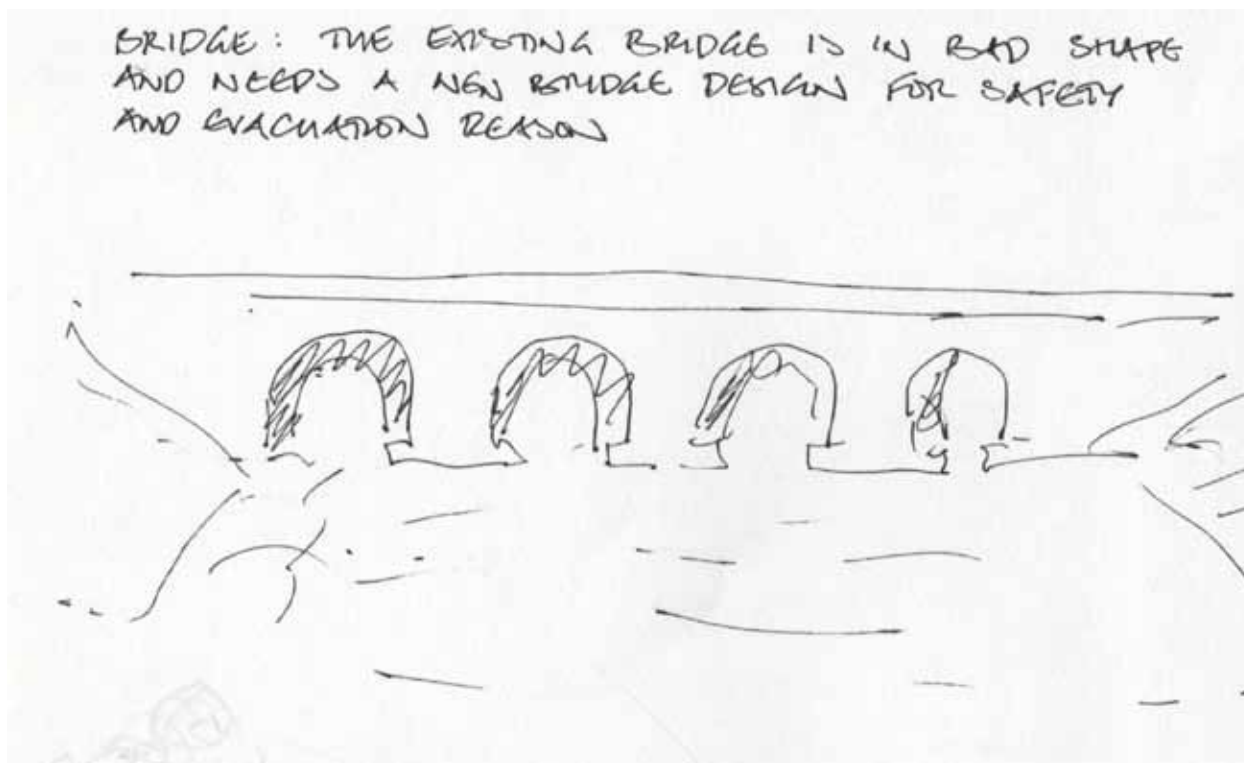
Build an engineered pedestrian bridge to survive an earthquake, not a tsunami, that will provide downtown evacuees with the shortest route to safety.

RESEARCH AND FINDINGS

In the event of a large earthquake, the bridge in Cannon beach will definitely be destroyed which is a major issue because it would be the shortest route to safety for the downtown population. Because the downtown population is where all of the motels are, and where all the least informed would be, the bridge breaking causes these people to have the longest and most difficult route to safety. Because it is assumed the bridge would be destroyed by the earthquake, none of the evacuation routes lead you to the bridge, but instead almost two miles in the opposite direction. Therefore renovating the bridge would be a sure way to potentially save a lot of lives. The opportunities for improvement on this bridge are:

Renovating the bridge for lateral earthquake loads
Using this as an opportunity to make it a gateway into town

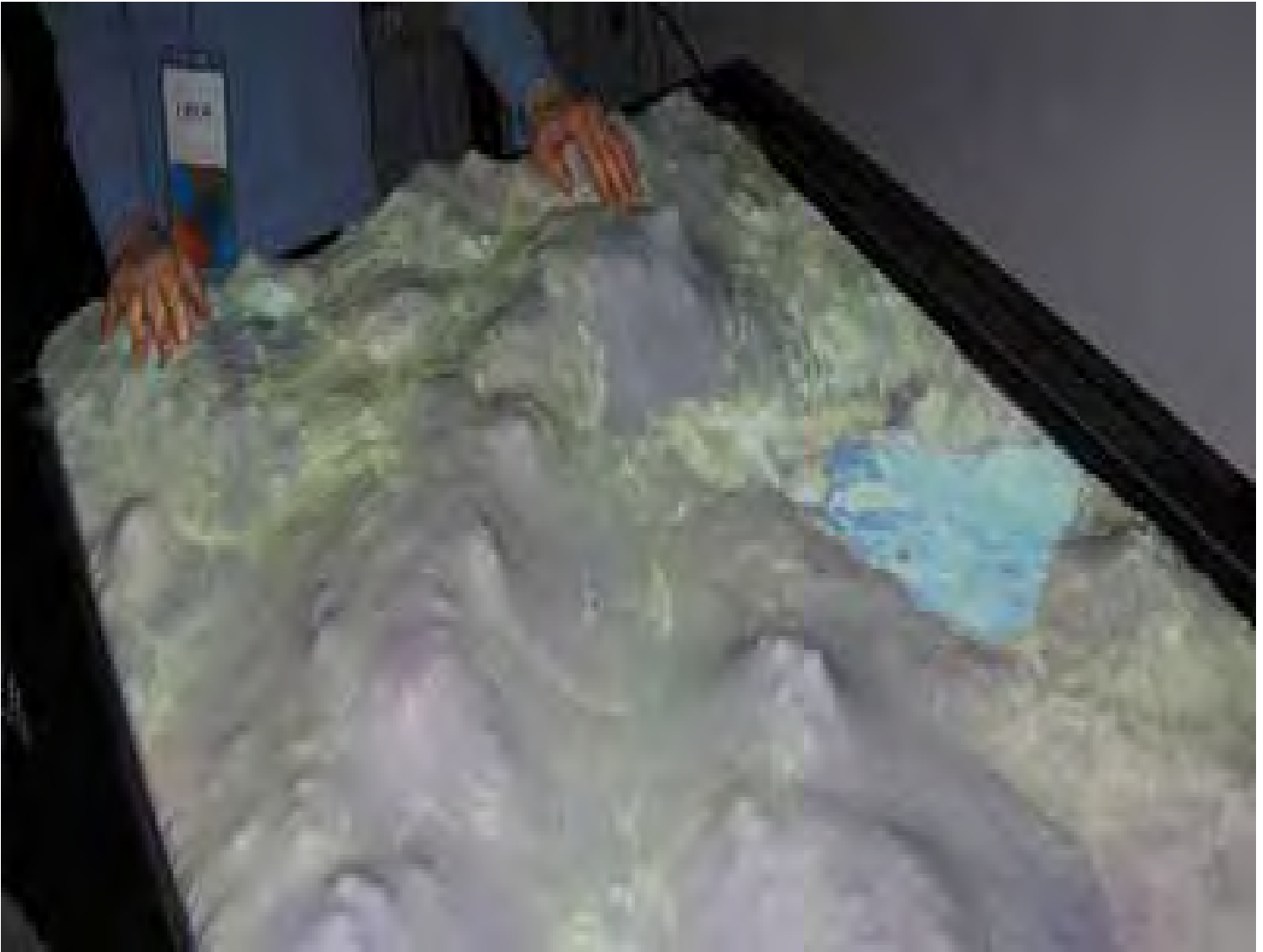
SKETCH DESIGN PROPOSAL FOR CANNON BEACH



CONCLUSION

Pedestrian Bridges are a great solution to timely evacuation in case of a tsunami warning.

Downtown Awareness(3D Map)



WAYFINDING CONCERN

Current Tsunami Maps do not engage people enough to make them pause and determine where they are, where they should go in the event of an earthquake and tsunami.

DESIGN PROPOSAL

Construct a 3D interpretive map (model) of the community, showing evacuation routes, major landmarks, problem locations, assembly zones and cache sites starting with a “YOU ARE HERE” sign.

PRECEDENTS



RESEARCH AND FINDINGS

It is no secret that 2D maps are used less and less by people today and that these maps often take a certain willingness to figure them out before they can be understood. However, models are much more engaging to unfamiliar users than maps. People seem to be able to create a better cognitive understanding of the area when learning from a 3D visual form.

CONCLUSION

3D Maps are an excellent tool to help understand a large area of land that we cannot easily visualize.

Vertical Evacuation



WAYFINDING CONCERN

In the event of an earthquake, timely evacuation may not be possible in some areas and circumstances due to congestion and debris after the earthquake, cutting off the vulnerable downtown population from reaching higher ground.

DESIGN PROPOSAL

Create alternative evacuation that allows people to evacuate vertically by retrofitting existing multi-storey structures to include vertical evacuation and allowing public access where possible tsunami hazards.

RESEARCH AND FINDINGS

The downtown population in Cannon beach is in the lowest inundation area, and is the most at risk for a variety of reason. Due to a probable bridge collapse and an almost impossible distance needing to be travelled in the opposite direction, there is a need for an alternative escape route for this exposed population. It has been a point of contention, but certain invested members of the community have proposed building a tsunami shelter building in this area. Because of the open land provided by the abandoned school, there is an opportunity to design and build a vertical evacuation tower or tsunami shelter in this area. We believe that this area provides the city with a variety of opportunities for improvement:

Using this as an opportunity to make a key attraction/monument for the town entrance

Creating a safe alternative for evacuation to the most vulnerable population
Create a new facility for tsunami readiness that encourages awareness.



Above are two panoramic views of the proposed site. A variety of ideas went around for what type of building would work best for this area. In general, we believe that the tsunami evacuation tower could hold a variety of functions before and after a tsunami. Some of these programmatic functions could include:

Tsunami Readiness Tower:

First Responder Access

Coastal Commission Response

Evacuation Preparedness and Awareness Center

Tsunami / Earthquake Research Facility

City Hall / Government Offices

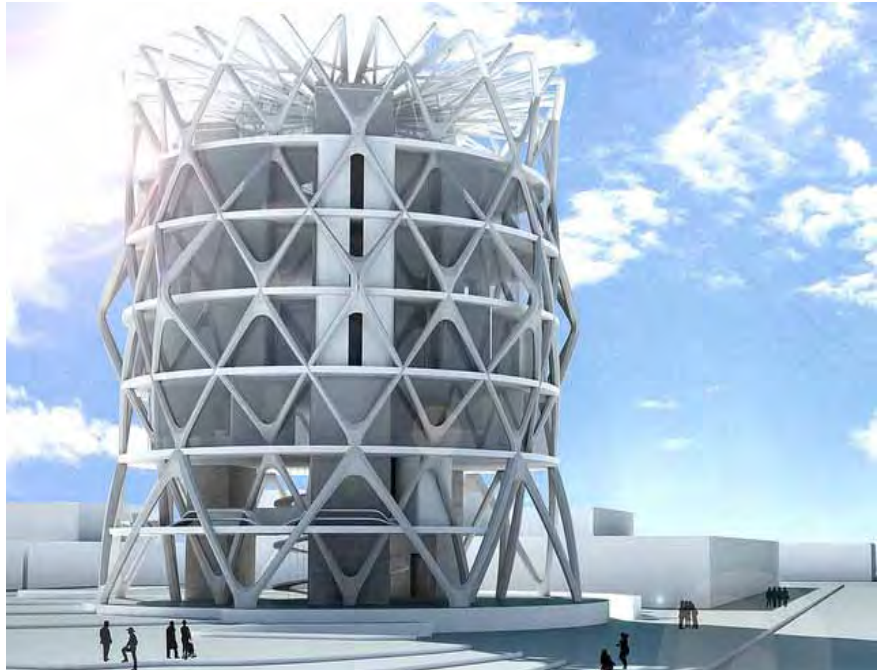
OEM / FEMA offices

Hotels / Motels

Store Front

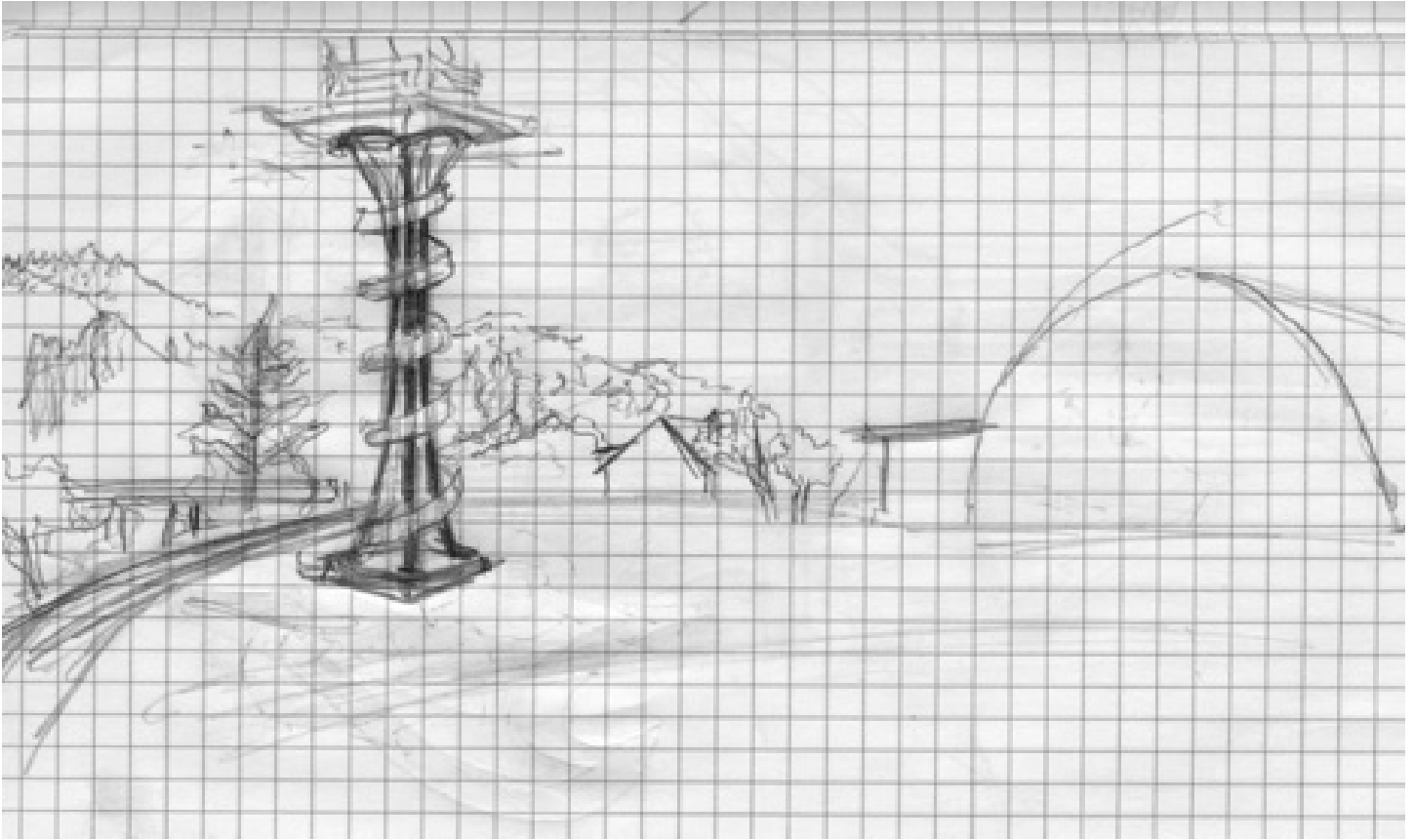
Raised Park Balconies

Vertical Evacuation **PRECEDENTS**



SKETCH DESIGN PROPOSALS FOR CANNON BEACH

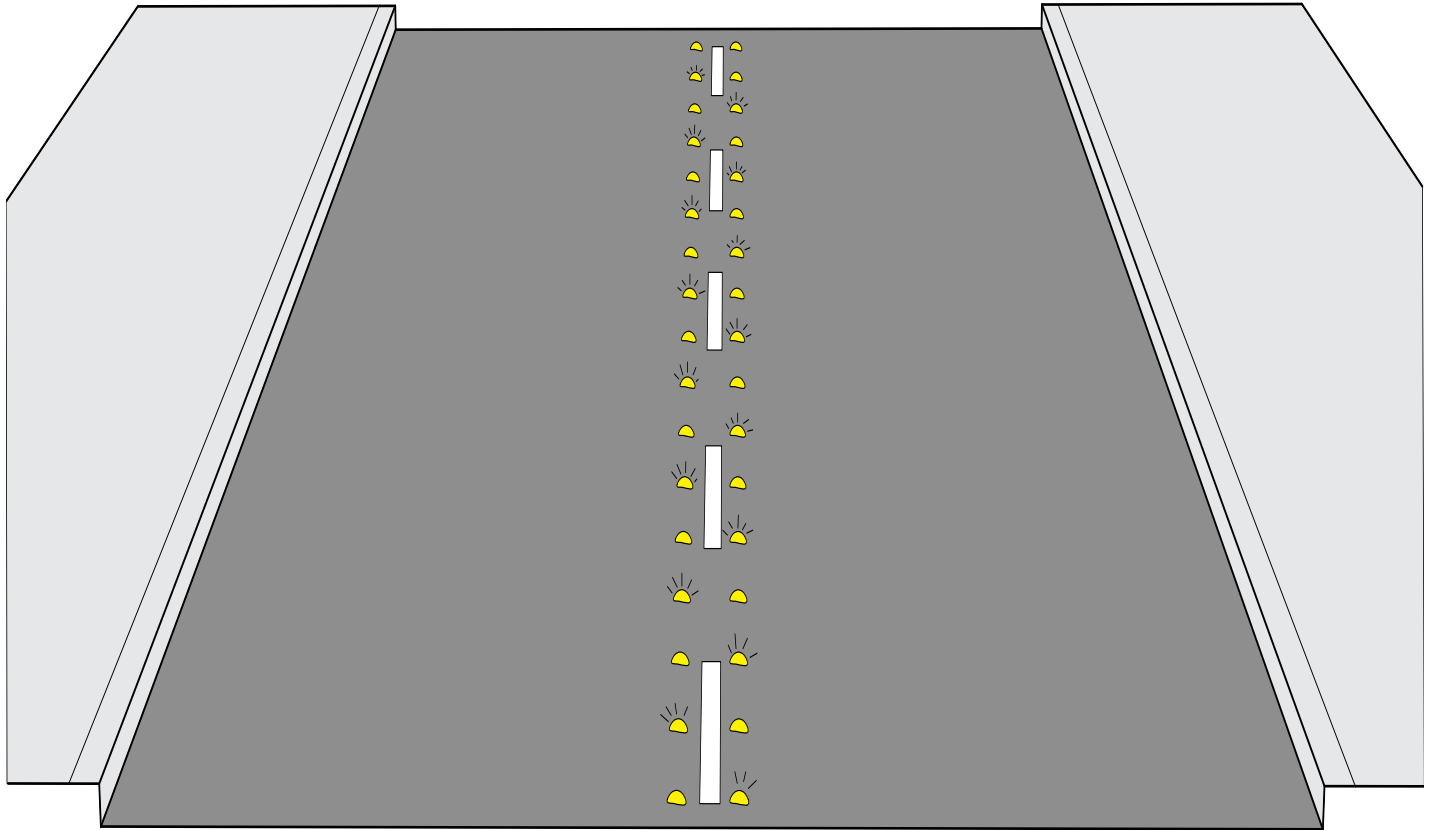




CONCLUSION

It is assumed that a vertical evacuation tower is some what out of the scope of this research and design proposal, which is why spending time designing an actual building would not be an efficient use of time. However, the fact that the city has proposed a tsunami safety shelter before, and that this specific site provides the city with an opportunity to ensure their most vulnerable population with a safe evacuation, means that this proposal could in fact be the glue that ties all of these different ideas together. Oregon has always been a leader in tsunami preparedness, and by designing a facility that is dedicated to this theme, could put them on the forefront of future coastal communities with regards to tsunami readiness.

Primary Route Light Spine



WAYFINDING CONCERN

The primary evacuation routes lack a sense of importance, directional clarity, and memorability..

DESIGN PROPOSAL

Add a spine of lights to primary routes that help keep people heading along the right path and in the right direction, as well as make the routes stand out more in low light conditions.

RESEARCH AND FINDINGS

The way that the evacuation routes are set up are by individual neighborhoods. Some of the smaller which are often farther up the hill and are residential do not require returning to a major artery before arriving at an assembly area. However downtown and midtown, places located closer to sea level, require a greater distance to be traveled. The routes intend to guide people along whatever secondary street they are and get onto a primary artery. Those major arteries are the major streets used to get people from place to place in town without getting back onto the highway. Depending on location the streets to be taken run parallel from lowest to highest. Hemlock st., Spruce St., and the 101 highway. These streets have evacuation signs both along it and adjacent to it, to indicate that people should turn on to it if they are coming from a smaller street. However, the clarity of this system is sometimes in question and the streets seems to be lacking a way to indicate that it is in fact the route to be taken to safety. This may cause people to turn away from the street before they are indeed supposed to and hit a dead end.

Additionally, when you are in fact supposed to turn off of this street to continue on the evacuation route uphill, there is no sign that stands out more than any other, in fact it is hidden with a series of other informational signs. Therefore we believe that improving the clarity of the primary evacuation route spines is an important move and that the opportunities for improvement are:

Providing more consistent and frequent signage

Clarifying a different way to indicate a needed turn versus a continuation along the same street.

Bounding the street so that people do not feel the need to turn before it is time

Indicating that the street is the primary evacuation route

Lighting the street and signs better so they can be useful at night

One of the proposals includes a series of lights that are placed on the ground along the primary escape route. The concept stems from lights that are placed in the ground for pedestrian intersections as well as streets that's edges are not well lit up at night. These precedents are being adapted to fit the need of bounding the evacuation route, especially at night time when locating signs in the dark would be difficult. Additionally, the distance between signs on this route is sometimes quite far apart, and it might not be out of the ordinary for people to feel like they should be turning up away from the beach before they are actually supposed to, where lighting the ground assures people of the path they are on. Because there is a long major artery that acts as the primary escape route for many people, that route should have more attention brought on itself.

Primary Route Light Spine PRECEDENTS



TESTS

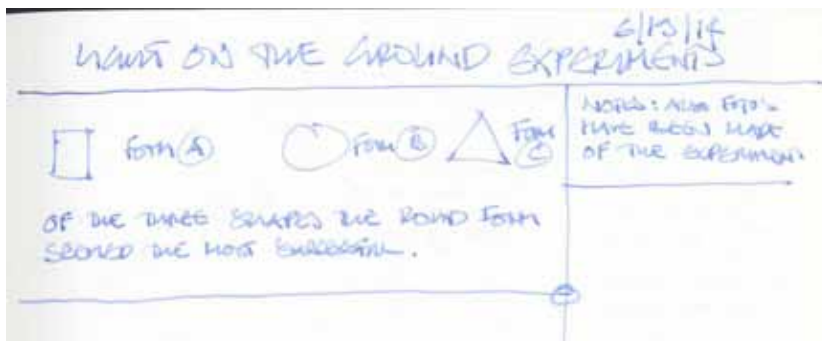
Several tests were made in this regard to test the lights on ground. The following tests were based on

1. Shape of lights
2. Distance between the lights
3. Location of the lights on the road(spine)

1. Shape of Lights:

Test: Three different forms were tested,

- a. Square lights
- b. Round lights
- c. Triangular lights



Conclusion: Of the three shapes tested, the round form was successful when compared to the other two shapes.

2. Distance Between the Lights:

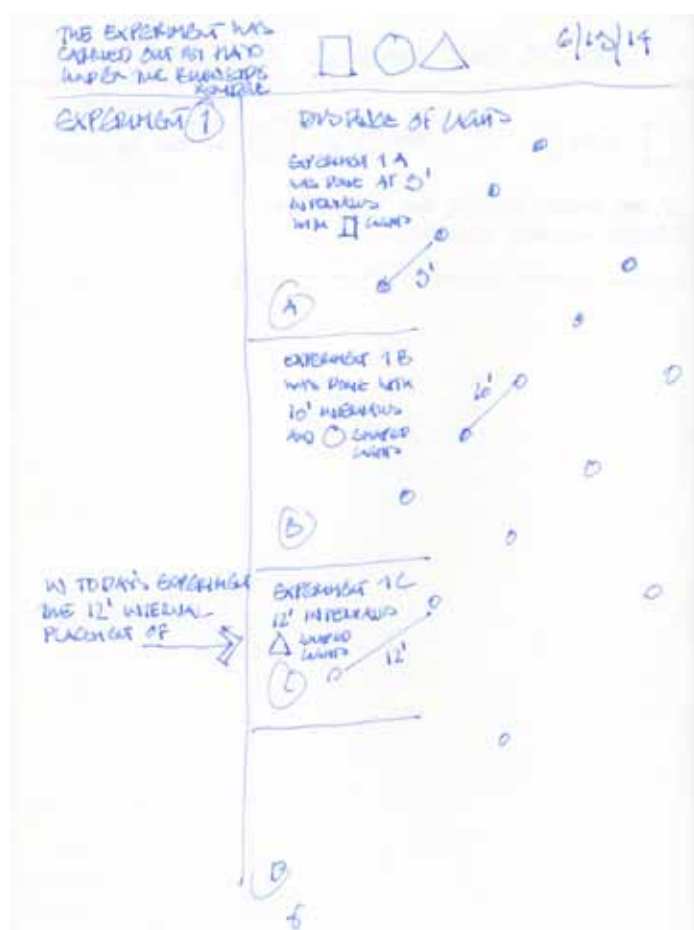
Three tests were carried out with lights at 9' apart, 10' apart and 12' apart. The lights at 12' distance seemed to be the most practicable.

3. Location of the lights on the road

Two experiments were tested to determine the location of the lights on the spine.

- Edges of the road
- Centre of the road

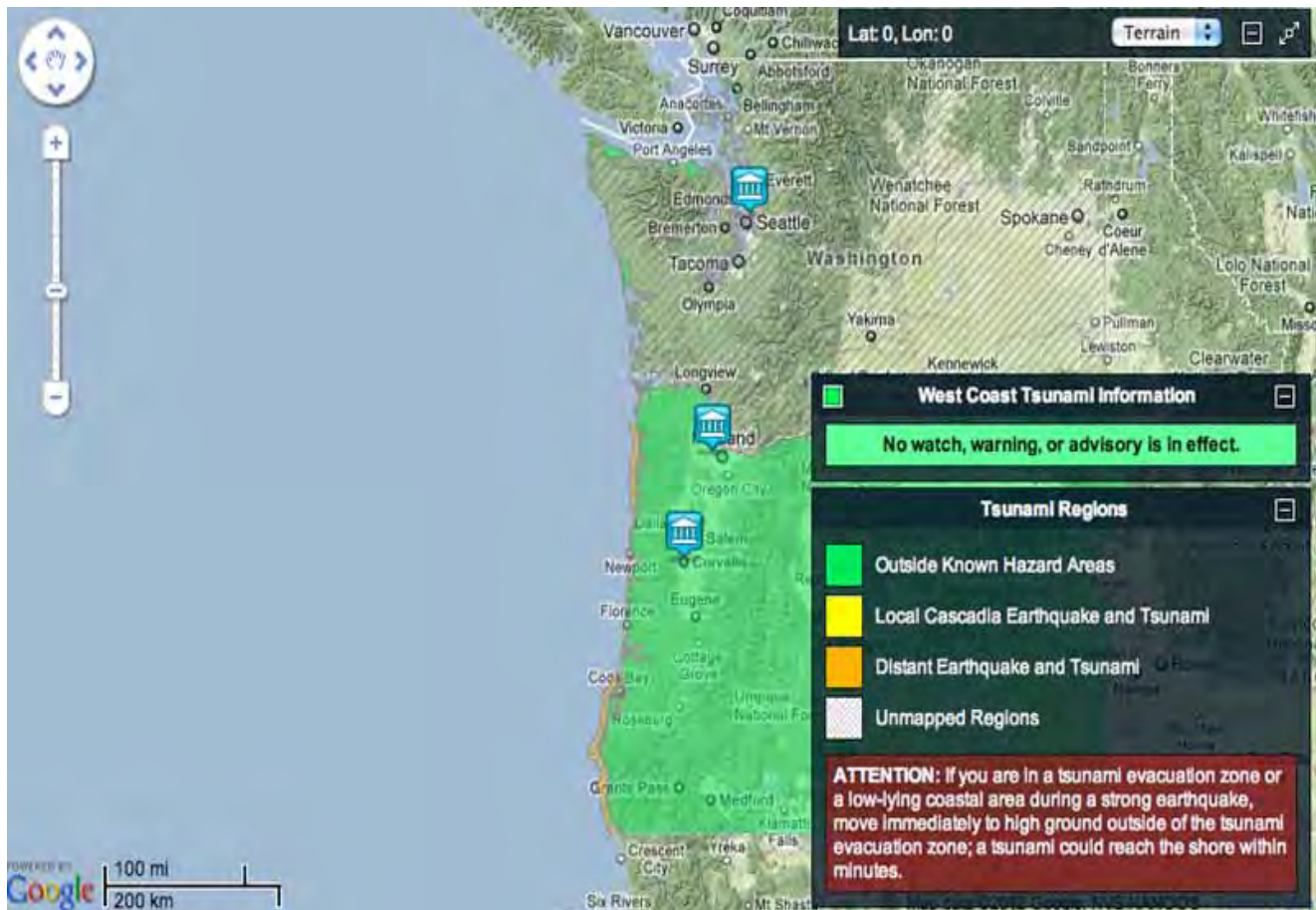
The lights on the Centre of the road are the most simple and economically feasible when compared to having them on the edges, considering parking on edges where the lights could get hidden



CONCLUSION

The idea of Lights on the ground is pretty successful. The one aspect that needs to be worked or developed further is the practical/technical setup and installation of these lights on the primary street. Circular shaped lights give a clear sense of direction when compared to the square and triangular lights. Placing the lights on the centre of the road is probably the most simple and feasible when compared to placing them on the edges.

Tsunami App



WAYFINDING CONCERN

Existing tsunami cell phone apps are underdeveloped and under used by coastal community residents and visitors.

DESIGN PROPOSAL

Clarify and update FEMA tsunami app to create downloaded evacuation routes which tie into current location, alert users to current threats, and do provide interactive education. Tie into physical signage and wayfinding system with QR codes.

Occupiable Berm



WAYFINDING CONCERN

The downtown population is in a high hazard tsunami inundation zone that's evacuation route relies on a pedestrian bridge which will be swept away by a tsunami.

DESIGN PROPOSAL

Build a multi-purpose occupiable berm that integrates a public urban park or building that raises tsunami awareness. Engineer the berm to slow down the surge to protect the bridge and provide additional time for evacuation to high ground.

Evacuation Route Connectivity



WAYFINDING CONCERN

There exists a lack of clarity between the connections of arterial streets to the main evacuation routes of Hemlock St., Spruce St., and the 101 Highway.

DESIGN PROPOSAL

Create wayfinding that allows for people to be certain they are turning onto the correct route and are still on the way to safety.



7.7. Post Tsunami Redevelopment, India



Post Tsunami Redevelopment, Chennai, India

M.Arch Thesis, University of Oregon

Architecture and Allied Arts, Architecture Dept

Tutor(s): Prof.Hajo Neis, Joshua Hilton, Vanessa Cass; Advisors :

Lloyd Lindley, Jim Pettinari; Mentors : Ashley Koger, Balaji Venugopal

The rising number of homelessness in India is a major social problem. The primary cause for this problem is due to natural and man made catastrophes that happen frequently. There are about 45 million homeless individuals in India today, who are being banished by several natural and man made catastrophes every year. These victims are generally transferred from camp to camp post any disaster where they are being housed in less than minimal livable conditions. They are subjected to a transitional phase where they have just survived the disaster and it is extremely challenging for them to live in such conditions.

When a disaster occurs, people in the low-income group (primarily fishermen and worker class) become homeless and unemployed. The government helps them by providing permanent shelter, but due to lack of employment and poverty, the victims rent out the spaces provided to them to make a living and in turn they choose to live in slums. Since, the most affected people are fishermen and they live by the coast, the slum population increases rapidly along the coast, which changes the urban fabric of the city and the Marina coastline (the second longest continuous coast in the world).

This Thesis project - Incremental Housing Township for Tsunami victims, is a Tsunami Rehabilitation Village that particularly addresses the victims of the 2004 Indian Ocean Tsunami. It aims at improving the lifestyle of the fisherman community by developing the 'Periyakuppam' slum area - my thesis site that currently has informal settlements occupied by the fishermen families. It includes the proposed permanent shelter modules along with a community core (community hall, administration and training and activity centers for women employment). Temporary informal settlements have converted into longtime homes for many tsunami victims. Living conditions are dense, overcrowded and often do not support community life. Integrating community spaces and strategically placing the community center in the urban plan where it is accessible to all neighborhoods in turn promotes community life, which is a key component of post trauma recovery.

The social community will benefit from the on-site market for fish sale and drying facilities, park spaces, community center, urban farming, learning/activity center, meeting spaces, etc. These spaces create an opportunity for psychological healing through community support and social harmony. Additionally, constructing permanent community infrastructure will help in community redevelopment that facilitates transition from informal settlements into permanent settled neighborhoods.

The primary design objectives include, providing compact permanent shelter that has a possibility to grow horizontally and vertically to adapt to the constant changing needs of the family, which is climate responsive, cost effective and sustainable. Creating the opportunity to allow potential growth of the allocated parcel where each family develops a sense of responsibility to modify the property according to the growing needs of the family.



Master Plan showing the community infrastructure placed on high ground and 150 meters away from the ocean.

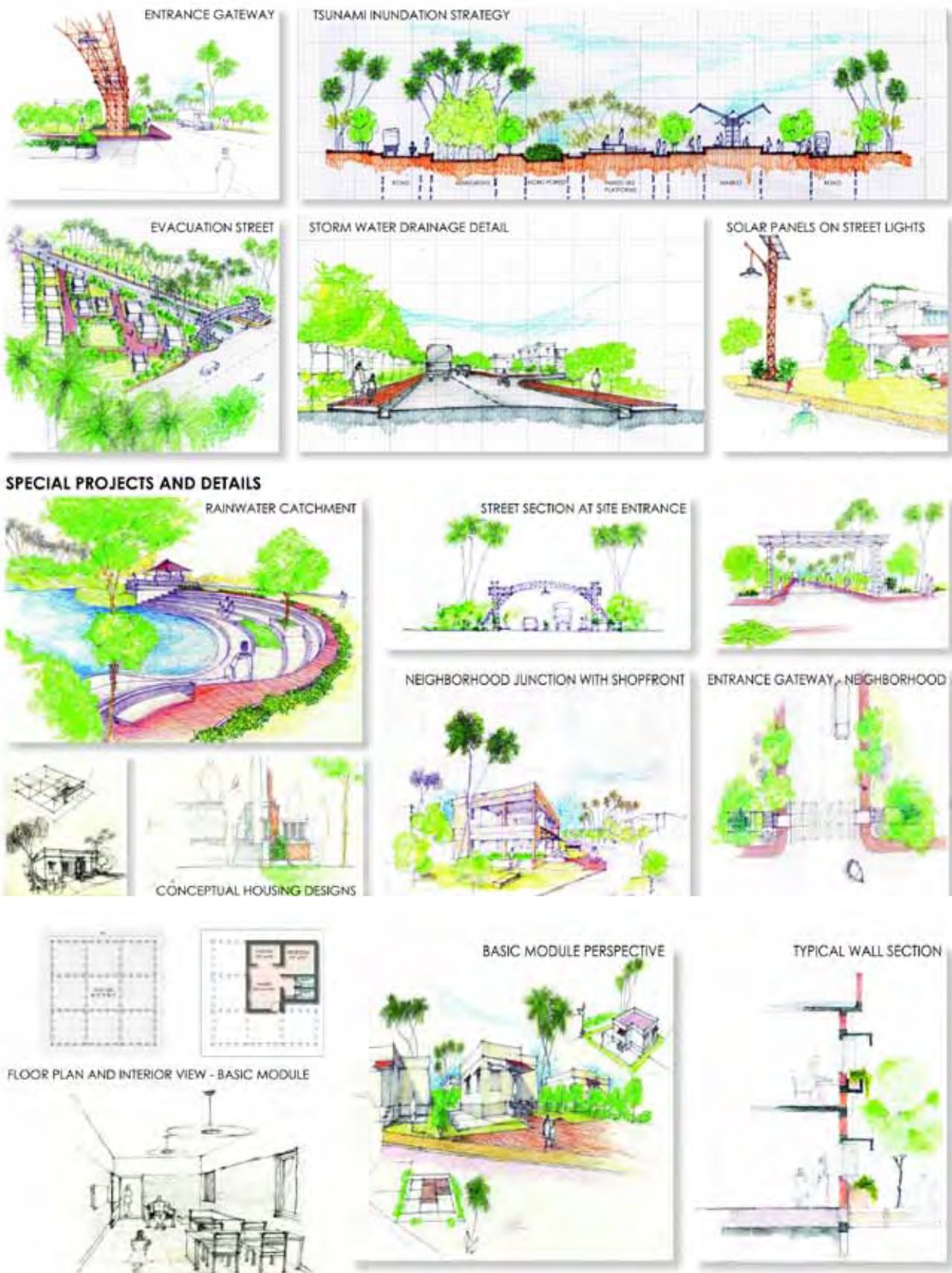
COMMUNITY CORE (COMMUNITY HALL, ADMINISTRATION, ACTIVITY CENTERS FOR TRAINING AND WOMEN EMPLOYMENT)



There are four different scenarios (Shop-owner, Gardener, Growing family or a combination of all the three) that are considered here in this project on how the module can grow over time. This will bring in a good impact and create positive changes to the lifestyle of the fishermen to strive for a better life and to help the community grow stronger, allowing them to re-discover the essence of life. The proposed community design is self-sustaining that will incorporate solar panels and wind energy units to generate power and also a rainwater catchment system to provide potable water for its residents. The produce from the agricultural fields and urban farming will be sufficient to feed the entire township throughout the year.

This project also complements the city's effort at Slum eradication as it addresses the growing needs of the families and the growing population of the neighborhood.



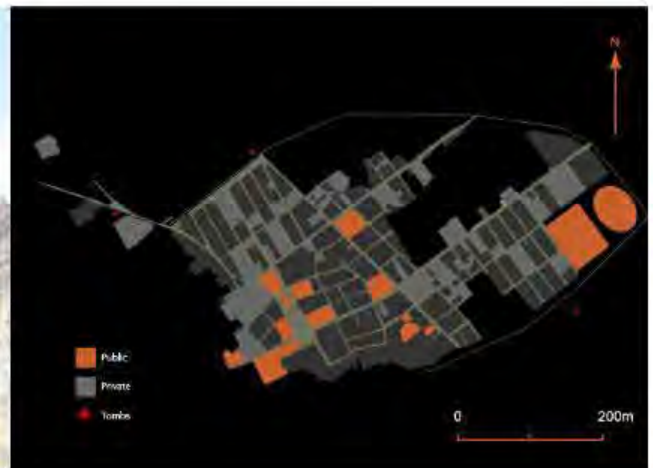


7.8 Powerpoint exercise: Pompeii Warm-Up

This game can be utilized as a way to break into wayfinding design thinking. Much like a tsunami event, the residents of Pompeii had to make some critical wayfinding decision when Mnt. Vesuvius erupted.

WARM-UP

URBAN DESIGN THINKING



Imagine you are a citizen of Pompeii in the year 79 AD. Life is prosperous. It is the height of the Pax Romana (or 200 year peace) and you live in a close knit community of about 20,000. You have a villa with a courtyard garden, stables and running water near the center of town.

QUESTION 1:

WARM-UP

URBAN DESIGN THINKING

On what starts as a lovely day in late August, you notice that Mount Vesuvius is spewing large amounts of black smoke and great balls of fire! You:

A. Grab a urn and fill it with wine before running out of the house

B. Run to the stables and saddle up your horse and chariot

C. Make sure that everyone is on their way out of the house

D. Panic and decide to make a sacrifice to the gods to abate their anger



QUESTION 2:

WARM-UP

URBAN DESIGN THINKING

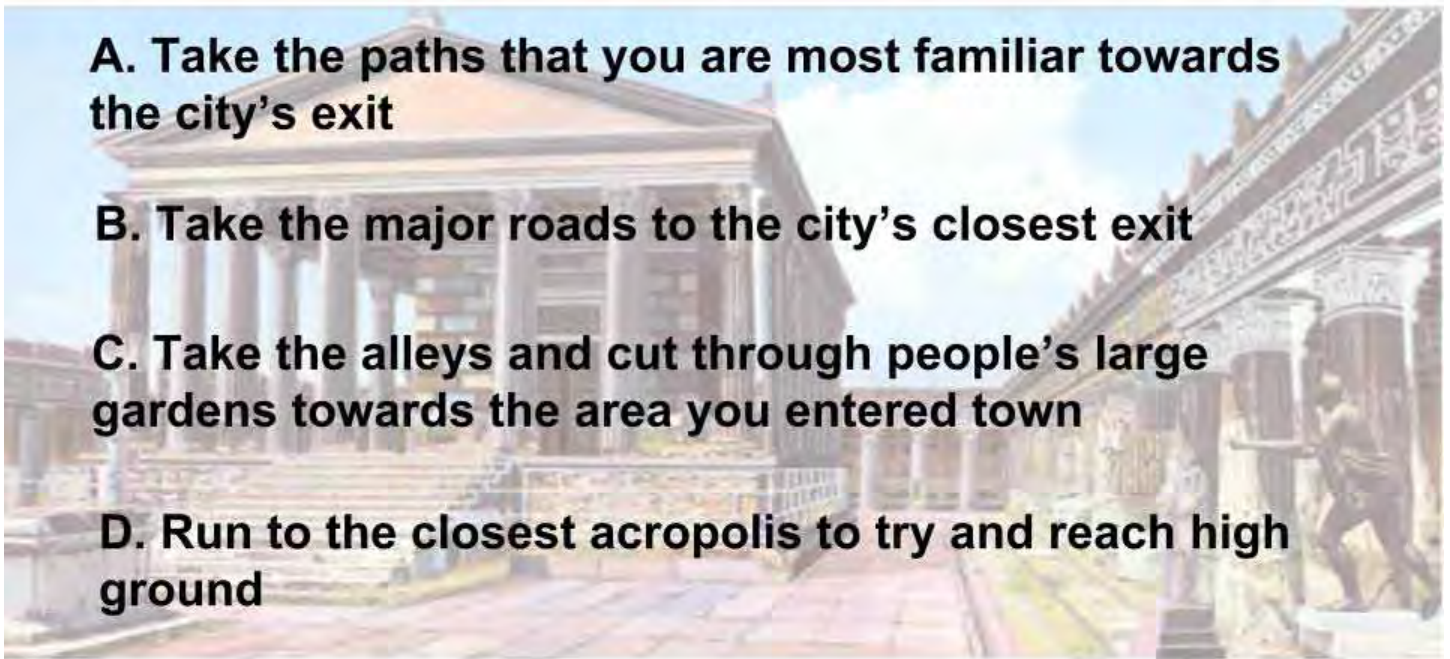
Now imagine you are a visitor in Pompeii, you must decide where to run, you:

A. Take the paths that you are most familiar towards the city's exit

B. Take the major roads to the city's closest exit

C. Take the alleys and cut through people's large gardens towards the area you entered town

D. Run to the closest acropolis to try and reach high ground



QUESTION 3:

WARM-UP

URBAN DESIGN THINKING

You escaped the volcano, but after the eruption is finished, you realize there are a lot of people missing, you::

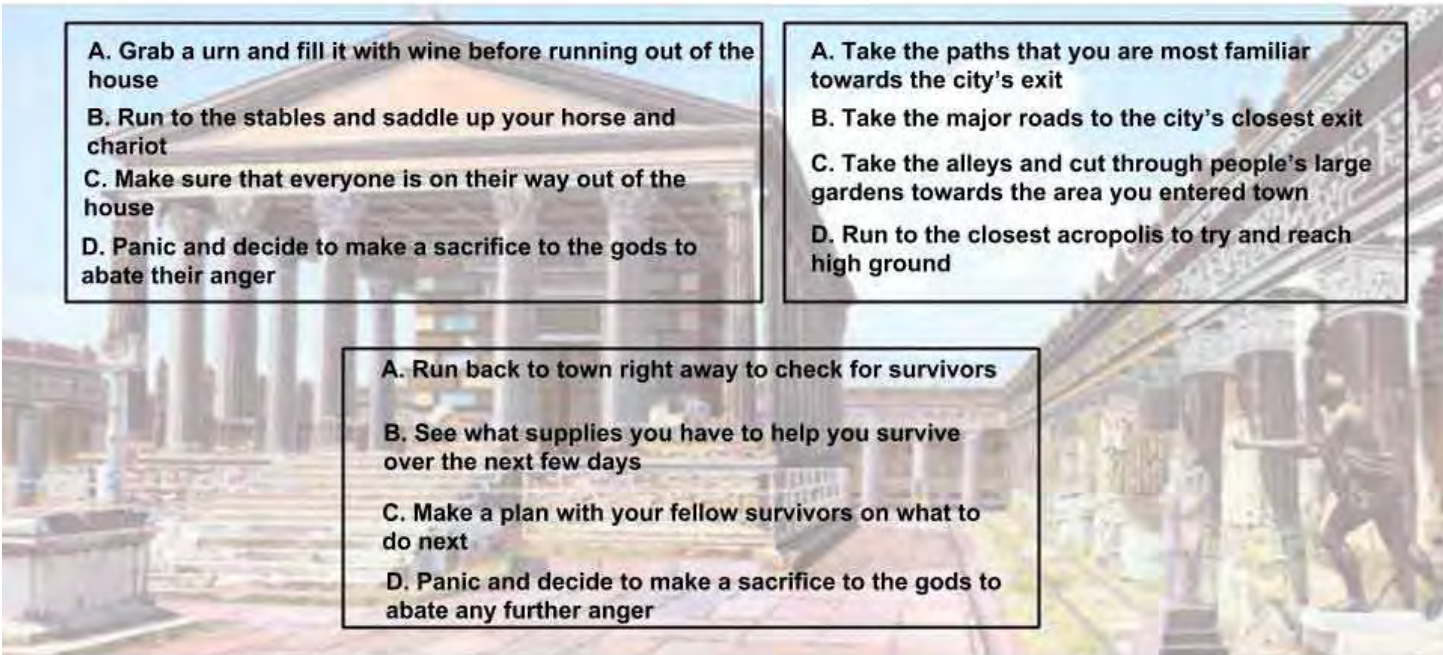
A. Run back to town right away to check for survivors

B. See what supplies you have to help you survive over the next few days

C. Make a plan with your fellow survivors on what to do next

D. Panic and decide to make a sacrifice to the gods to abate any further anger

RESULTS**WARM-UP****URBAN DESIGN THINKING****WAYFINDING RECAP:**

- 
- A. Grab a urn and fill it with wine before running out of the house
 - B. Run to the stables and saddle up your horse and chariot
 - C. Make sure that everyone is on their way out of the house
 - D. Panic and decide to make a sacrifice to the gods to abate their anger

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- A. Run back to town right away to check for survivors
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7.9 Charrette Feedback Notes

Community Responses - day 1

Cannon Beach testing presentation and proposal presentation

Bridges fail, What can you do?

Swim across the river

Inflatable bridge

Awareness/ cognitive maps:

- People not using maps or paying attention to physical maps. Signs are subordinate to awareness. "Put \$100 bills under the rocks at assembly areas".
- If you're new to town, which way would you intuitively go? Mental map of arterials.
- Tom Horning does a good example of downed powerline mapping.
- Outreach to eastern Oregon, other states
- Coordinate with international.

Awareness signs:

- Back of urinal/ stall doors
- "People don't even know where the beach is." Keep is super simple. Just an arrow.

Design Considerations/ Advice:

- Color blindness in sign design
- Jazz vs. Classical music. Poetry and Prose. A different approach to mapping. (Move toward cognitive).

Spine of Lights:

- \$, maintenance,
- regulations between resident sidewalks, local, state and federal highways. Regimented colors, standards.
- What if it's a private trail? City clears private land for evac route.
- Fire department adds red reflector to center lines to depict the fire hydrant at
- Reflectors are more feasible than lights. Especially during breaking
- Lincoln city has taken round evac. sign and painted it on the road. By Chinook Winds.
- Dark sky ordinances are being developed across the state.

Routes:

- What about new sign: do not go for dead end roads.
- Paint on the roads: maintenance required. Driving along 101, you go in and out over and over again. Need to limit it.

Assembly Areas:

- Locations chosen near woods.
- Safehouses nearby.

- Fireplace area, picnic, parklet.
- Newport's safe haven hill: near bridge. Developing knob of high ground into a park like area. (Owned by odot, but can put parklike facilities in phased over time).
- As end point of Running race: assembly areas social anchors as well.
- Like the kiosk reused at the assembly area. Should look the same throughout the system.
- Design is different for each city.
- CCC BV beams: triangle for storage, with canvas walls that come down.

Cache Sites

- Controlling flow of people.

Stories:

Human behavior: Nelham, when we had a scare, everyone in town got in their cars to Portland even though they know not to.

General Notes:

- The reality of people using cars. Consider those already in cars.
- Move from individualized to standardized. Visitors come here from all over the world. Standardization is coming. Internationally, it's a small triangle yellow and black.
- People love to steal the little round signs. Cemented, special screws.
- Power lines are not going to be on for 30 days, 5 states around will all be dead. (After Katrina)
- Tourists will want everyone to do everything for them. Residents will have a plan.
- If you give people something to do, you'll have more time before the riots start. Someone needs to step up and look like they are reestablishing structure.
- Its not worth killing someone to protect yourself.
- Tillamook county police: New Orleans experience won't apply. More cows than people, fish, etc.

We'll be fine in the rural place

- Tiffany: Tillamook county. People think of us as highly trained and highly inexperienced. PGE sister. When the big one happens, people won't help their neighbor. Months to restore power.

Patterns Presentation and Open Discussion Community Responses - Day 2

Pattern Critique Comments

- follow the leader - les (make the cache person the leader)
- safe zone thresholds althea (newport marks good zone from bad zone by tape on the stop signs green or red reflective tape)

Other New Patterns discussion:

1. How to share case studies of these efforts between cities?

Kevin: Look up and down the coast to see how some of the communities have solved some of these problems. i.e. Cannon Beach addressed this problem this way.

Les: Could be shared on cities' web pages

Tiffany/ Althea: Networking events, or simply call each other.

A separate project? Database, or report?

2. Plan how to deal with problem/violent people (guns), how do we socially take care of the problem? Prevention?

Neighborhood mapping. Build social networks now. Have enough resources.

New Patterns Brainstorm:

Before

- Case study clearinghouse
- public private partnership
- map your neighborhood
- engage new volunteers
- night practice evacuations
- lots of people at practice evacuations
- universal branding
- market city preparedness
- elect disaster-aware officials
- business training program

During

- other forms of signage
- connectivity of evacuation routes (primary to secondary, know how to stay on primary routes)

After

- bolt cutters
- cache supply rotation

cache ventilation (don't let it get too hot or supplies will go bad)
 safe house
 cache site

Exercise 1 generated the following concerns with the existing wayfinding system.
 (Starred topics were selected as the most important priorities overall.)

Maps & Awareness

Concerns:

Too general seems like there are better ways to get to safety
 Downtown mapping. too far to travel legibility for visitors- not intuitive
 *Not simple enough, too many arrows
 Map legend
 Map doesn't relate to me (no you are here)
 *Signs, maps, kiosks are ugly
 *Map app
 Difficult to make 1 route if there are 2 conditions: local vs. distant
 no slogans, easy to gather people around a concept

Solutions:

Get people to care about their loved ones
 Get kids to care
 Get aids to care.
 Research project
 Stop drop and roll
 Fun wave games.

Signs

Concerns:

*Consistency. (Design, color, shape, international symbols, etc.)
 *Essential Information and Clarity (Rethink content of info on sign, where safe areas are, only include essential info on signs, don't over-educate, too much focus on minutia)
 Don't know where or when you are safe
 *Location/ Distance between signs (visibility at all times when dark+stormy)
 High # of signs/ "sign clutter" (need quality, not quantity)
 Legibility (Language, color, symbols, type)
 Jurisdictional issues (Fed State, local laws, ODOT)
 Policy laws (dissemination of info and communication between jurisdictions)
 Blue color= no urgency. Means info-based. Not as important
 Connectivity of signs together in a pattern/ on a route

Solutions:

1. For Consistency

- Use international symbols and symbology instead of words
- Simplification of signs

2. For Essential Information and Clarity

- Eliminate or limit number of words
- Make signs intuitive, instantly recognizable
- Assembly area sign: Transition from symbology to words. Add A indicator. Make it more informative. Use comforting/ reassuring colors.

3. For Location/ Distance Between Signs

- Incorporate markers for distance to assembly area on route signs (creates comfort)
- Draw attention to assembly areas through distance indicators
- Design the spacing and route in response to the local built/ natural environment

Routes & Connectivity

Concerns:

- *Congestion: Main entrances to local landmarks (campgrounds, beaches) cause bottlenecking by people trying to escape.

- Long distances to assembly area

- No lighting at night

- *Ability impairment

- *Not enough leaders to oversee evacuation

- Lack of continuity and connectivity

- lot of water/wetlands get in the way

- debris from earthquakes/landslide zones

- flooding, flatland, liquefaction, force

- *Effective communication about routes. (cell phones get jammed, batteries, networks down)

- Move concern/ influx on transient visitors/ tourists. triple population

- No substantial building in high ground. Relocate urban renewal plan.

Solutions:

1. For effective communication

- flyer given out while registering,
- hotels to include in email confirmation,
- OEM electronic widget/ app,
- reverse 911: USGS text message system

2. For congestion

add shoulder room to roads

educate people on leaving their cars behind in an earthquake.

3. For not enough leaders to oversee evacuation

Train all uniformed staff to be leaders in addition to police. (hotels, shops, galleries, etc.)

Distribute vests as part of business program to legitimize.

Train kids, vulnerable populations to follow uniformed person. “Junior Ranger” program.

Thresholds

Concerns:

How to know to keep going til safe

*How do we know where the threshold is? How to mark it?

No elevation markers

What happens when the “line” changes? (Science, remapping, infrastructure improvements)

Understanding the marking: consider people’s interpretations

Standardize the markings

How to mark route/ site with transient population in mind

Solutions:

1. Threshold: how to identify?

markings on road, roadway sign poles

educate-maps included in utility bills reach residents

elevation markers, localized signage (climb to high ground)

Assembly Areas

Concerns:

*Cost: who pays for installation/ upkeep?

*What should be included in an assembly area? Minimum supplies.

Should an assembly point be only a moment to gather, or also a shelter? Should some be both?

Environmental/ topographical location: consider for all types of weather

Community/land use issues: allowable uses.

*Sites aren’t socially known

*Do we have a sufficient # of assembly areas/ supplies for the # of people? Water/sanitation requirements?

How to staff the assembly sites? Succession planning in case leaders don’t arrive.

Solutions:

1. # of assembly areas

Planning, assumptions, data, modeling

Drills, practice along routes

2. Facilities, amenities of assembly area

define differences between assembly area vs. cache site

short term vs. long term response

land use, environmental regulations? (exceptions needed?)

portable caches, stored elsewhere (safe houses)

3. Cost:

Park user fees

volunteer, community service projects

public financing (it's not that expensive, comparatively).

Cache & Rescue

Concerns:

Fire chief, officials are against cache sites (not that many, because of maintenance requirements)

*Participation: Not enough people are using existing cache sites. Not aware.

Cost: Individuals can't afford fee structure: pay for barrel + yearly fee. (like cannon beach) or city pays (like seaside)

Who does maintenance and rotation of goods?

People have firearms w/o other preparedness plans.

Enough supplies for 30-90 days of camp? (if 101 goes out, response priority is Portland, debris in waterways, roadway, makes rescue difficult)

Large community structures destroyed (schools, hospitals, fire stations, bridge repair equipment).

Can't rebuild essentials quickly.

Access vs. Security requirements

*Tourists don't have stuff at cache sites.

Solutions:

1. Cache components and supplies:

Should have shelter, food, water, sanitation, plan in common languages, security/order/distribution method, tools, way to communicate to the outside world.

7-10 days of supplies on hand. Plan B for 30-90 days.

Get people evacuated fast, to reduce need for lots of supply cache. (coordinate with other regions, states, federal agencies).

Plan to drop supplies in via helicopter (NV, Spokane), boat (there will be a dam across the Columbia), airport + road.

2. Implementation:

Government involvement/ responsibility to take care of tourists. And residents maybe too. (civil defense concept)

Private involvement/ responsibility to take care of tourists. (Cruise boat companies, conference cen-

ters, RV parks, etc. have their own caches.)

Outreach/ educate people on individual risk and preparedness options

Strengthen social networks

Map and marshall existing resources. (Ham radio club)

Use existing buildings as caches. (Safe houses, relocate government buildings).

Zoning overlay to rebuild city for preparedness: (no critical facilities, no assembly uses, street design, land division ordinances, major routes oriented, subdivision design for connectivity.)

3. Public awareness and participation of cache sites and programs:

signage between AA and cache

map caches

tell people before they get here: websites, reservations,

make caches multi-functional, destinations where people go. (parks, event spaces, campground).

Equip with showers, gas, supplies that get rotated out regularly.

Awareness events.

7.10 Electronic Guidance Document and Online Presentation

The guidance document provides a model of how these elements can work together to create a comprehensive wayfinding system in a tsunami situation. This document can be used by any community to assist with the formulation of a tsunami readiness plan and tsunami escape wayfinding improvements.

The various wayfinding escape strategies created for the Cannon Beach Guidance Document are compiled in this report. It is accessible as a digital PDF on the PUARL website.

The powerpoint used for the Astoria Charrette, this document and further information about PUARL can also be found on the PUARL web site.

www.puarl.uoregon.edu/tsunami

