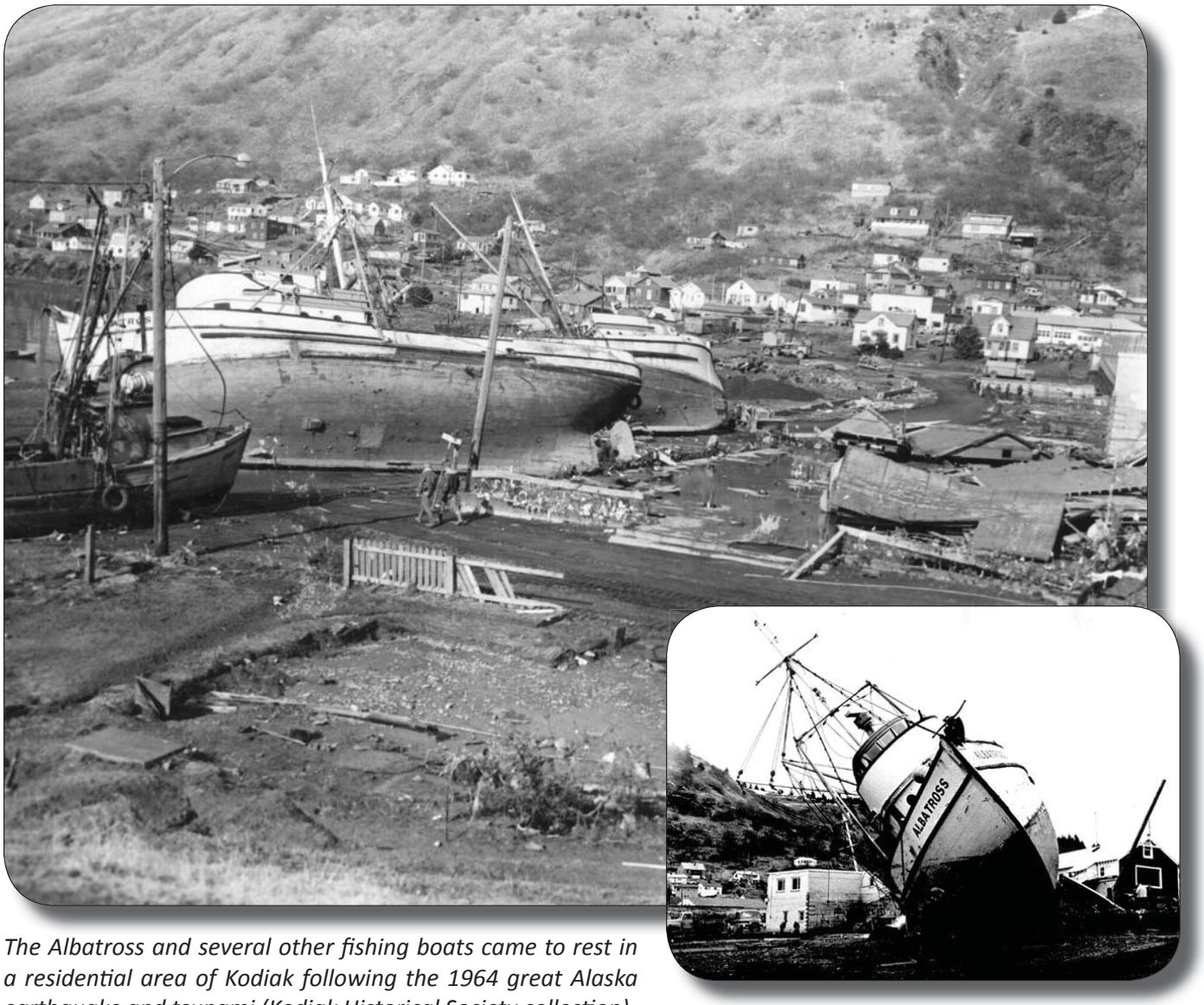
Alaska Seismic Hazards Safety Commission

Report to the Governor and State Legislature
FEBRUARY 2012



The Albatross and several other fishing boats came to rest in a residential area of Kodiak following the 1964 great Alaska earthquake and tsunami (Kodiak Historical Society collection).

ASHSC Alaska Seismic Hazards Safety Commission

ALASKA SEISMIC HAZARDS SAFETY COMMISSION
REPORT TO THE GOVERNOR AND LEGISLATURE
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EXECUTIVE SUMMARY

This annual report to the Governor and Legislature from the Alaska Seismic Hazards Safety Commission (ASHSC) reiterates the priority issues and goals of the Commission and summarizes its 2011 activities. The report updates the history and status of the Commission, identifies the current membership, describes various committee functions, and presents Commission Policy Recommendations to improve seismic safety in Alaska.

The Federal Emergency Management Agency (FEMA) has estimated in FEMA 366-*HAZUS MH Estimated Annualized Earthquake Losses in the United States* that with the present infrastructure and policies, Alaska will have the second highest average annualized earthquake-loss ratio (ratio of average losses to infrastructure) in the country. Reducing these losses requires public commitment to earthquake-conscious siting, design, and construction. The Alaska Seismic Hazards Safety Commission is committed to addressing these issues. Earthquake-risk mitigation measures developed by similar commissions in other states have prevented hundreds of millions of dollars in losses and significant reductions in casualties when compared to other seismically active areas of the world that do not implement effective mitigation measures.

The Commission operates under the powers and duties prescribed by its enacting legislation (Appendix A) and is guided by its Charter (Appendix B) which provides a clear understanding of the Commission's roles and expectations, empowers Commission members, and provides operating guidelines agreed to by all members.

During the past year the Commission has invited numerous governmental and private organizations to give presentations describing their approaches to seismic risk mitigation. These briefings have provided the members of the Commission with opportunities to gain an understanding of current programs and various approaches to seismic risk mitigation, identify areas of concern, and to focus initial mitigation efforts in these areas. Most of these briefings are available for viewing on the Commission web site (http\\:www.seismic.alaska.gov).

The Commission also underwent a "sunset review" by the State of Alaska Legislative Budget and Audit Committee. Suggestions were made to increase the Commission's effectiveness and efficiency and a recommendation was made to extend its termination date to June 30, 2016. The Commission is currently addressing the LB&A Committee's suggestions including developing a Strategic Plan for its future operations.

The Commission's efforts in 2011 continue to reinforce its belief that seismic risk mitigation issues can be addressed in an economical way that will result in improving the quality of life and public safety in Alaska. A major first-quarter effort in 2012 will be completion of the Commission's Strategic Plan.

MAJOR ACCOMPLISHMENTS OF THE COMMISSION TO DATE

- Collaborated with the Department of Education and Early Development to develop new procedures allowing and encouraging school districts to apply their capital improvement funds to the safety evaluation, prioritization, and rehabilitation of school facilities with highest earthquake risks
- Developed eight policy recommendations for consideration by the state administration and legislature to improve seismic safety in future design, construction, and major renovation of public school facilities
- Partnered with the Kodiak Island Borough to initiate an earthquake planning scenario of the area, including coordination of involvement by FEMA, U.S. Coast Guard, City of Kodiak, and the private sector. Results of the scenario, which is currently in progress, will be used as a tool for developing local seismic risk mitigation policies and response plans.
- To promote public education on seismic-risk mitigation, members developed a two-day public training course on Post-Earthquake Safety Assessment of Facilities. Approximately 100 people were trained in 2011 and the Commission will continue to offer at least two classes per year.
- Assisted the Division of Homeland Security & Emergency Management in revising the seismic hazard section of the State Hazard Mitigation Plan for 2010.

POLICY RECOMMENDATIONS

The Commission presents the following policy recommendations:

Policy Recommendation 2010-1:
Given that schools in Alaska serve not only as educational facilities but also as gathering places for the general public, and that many are designated as emergency shelters in case of a natural disaster, the Commission recommends that the State appropriate the resources necessary to identify those school facilities most at risk from earthquakes.

Policy Recommendation 2010-2:
The Commission recommends that all future school design, construction, and major renovations project funding include monies allotted for seismic risk mitigation tasks to include:

- *Seismic design by a structural engineer proficient in the design and detailing required for earthquake engineering tasks.*
- *An independent peer review of seismic design calculations and detailing by a qualified structural engineer.*
- *On-site observation of as-constructed earthquake engineering details during construction by a qualified inspector to ensure they are constructed in accordance with the contract documents.*

Policy Recommendation 2011-1:
Alaska is the most seismically active State in the union, yet active fault locations and characterization are the least understood., Therefore the Commission recommends that the legislature consider means to fund appropriate State governmental agencies in their on-going efforts to characterize these faults.

Policy Recommendation 2011-2:
Considering that Alaska is the most seismically active state, the safety of Alaska's populace and economy require that the design and construction of infrastructure adequately consider the seismic hazard. Therefore, the Commission recommends that applicants for registration as a Professional Engineer practicing civil engineering in Alaska be required to have completed a university level or equivalent course addressing earthquake engineering.

Policy Recommendation 2011-3:
Perform FEMA Rapid Visual Screening of Existing Buildings to identify and prioritize all seismically vulnerable State of Alaska owned buildings. Establish a mitigation plan to reduce risk imposed by those buildings, including structural and nonstructural elements, equipment, and contents. The most essential buildings should be addressed as the highest priority.

Policy Recommendation 2011-4:
Given that the Alaska Seismic Hazard Safety Commission (ASHSC) and the Alaska Division of Homeland Security and Emergency Management are sponsoring training for qualified individuals to serve as volunteer post-earthquake safety evaluators of buildings and infrastructure, the Commission recommends that the State provide relief from liability for qualified and trained volunteers who are assigned by a jurisdiction to serve following a damaging earthquake.

Policy Recommendation 2011-5
There is consensus among the U.S. and western state geological surveys and within the scientific community that the next great devastating earthquake in North American may likely occur in the Pacific Northwest region, along the Cascadia subduction zone or on a shallow Puget Sound fault. While such an earthquake would not likely cause physical damage to Alaska's infrastructure or directly pose a safety hazard to Alaska's population, it would, however, have a significant effect on Alaska's economy given the importance of the Pacific Northwest region to Alaska's commerce, shipping, oil exports, fishing and tourism industries, and communications. Therefore, the Commission recommends that the appropriate Alaska government agencies investigate potential impacts and develop contingency plans to prepare for and mitigate the possible detrimental effects of a great Pacific Northwest earthquake on Alaska.

These, and other, policy recommendations continue to be addressed by the following Commission Standing Committees:

- Insurance
- Schools
- Earthquake Scenarios
- Education and Outreach
- Hazards Identification
- Response and Recovery
- Partnership

The 2011 activities of these committees are described in more detail in subsequent paragraphs.
Our basic public-policy goal areas remain unchanged from the 2010 Commission report:

- Education
- Guidance
- Assistance
- Implementation

INTRODUCTION

The Alaska Seismic Hazards Safety Commission ("the Commission") is charged by statute (AS 44.37.067; Appendix A) to recommend goals and priorities for seismic hazard mitigation to the public and private sectors; recommend policies to the governor and the legislature, including needed research, mapping, and monitoring programs; review the practices for recovery and reconstruction after a major earthquake; recommend improvements to mitigate losses from similar future events; and to gather, analyze, and dissemi-

nate information of general interest on seismic hazard mitigation, among other duties to reduce the state's vulnerability to earthquakes. The Commission consists of eleven members appointed by the Governor from the public and private sectors for three-year terms. It is administered by the Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS).

Commission members include: A representative from the University of Alaska, three representatives from local government; a representative from the Department of Natural Resources; a representative of the Department of Homeland Security and Emergency Management; a representative from an appropriate federal agency; a representative of the insurance industry; and three members of the public who are experts in the fields of geology, seismology, hydrology, geotechnical engineering, structural engineering, emergency services, or planning. Six members constitute a quorum. The Commission membership elects its own chair and vice-chair. There is no executive director, although DGGS provides administrative, travel, and publication support.

HISTORY AND STATUS OF THE COMMISSION

In 2002, the 22nd Alaska Legislature passed, and the Governor signed into law, House Bill 53 establishing the Alaska Seismic Hazards Safety Commission with nine members. The legislation originally placed the Commission in the Office of the Governor, but in January 2003, Governor Frank Murkowski issued Executive Order Number 105 transferring the Commission to the Department of Natural Resources. Governor Murkowski appointed the first nine members to the Commission in 2005.

In 2005, the House of Representatives passed House Bill 83 to extend the Commission to June 30, 2008, add tsunami risks to its purview, and provide two additional Commission positions representing local government. In 2006, the Senate passed a substitute version of HB 83 including the two additional local government positions but omitting specific mention of tsunamis in the Commission's powers and duties. The Senate bill extended the Commission through June 30, 2012. The House concurred with the Senate version and Governor Murkowski signed the bill into law at a Commission meeting on June 16, 2006. Although the revised statute does not specifically include tsunami hazards in the Commission's powers and duties, the definitions in AS 44.37.069 include tsunami inundation as a seismic hazard. Consequently the Commission addresses tsunamis in its discussions and recommendations. As a result of passage of HB 83, the Commission currently has 11 members.

The Commission first met on October 28, 2005, at which time it elected a Chair and Vice Chair, listened to briefings from the California Seismic Safety Commission and various state and local agencies in Alaska with responsibilities in earthquake-risk mitigation, and began developing goals and priorities for its activities. There were twelve meetings of the Commission through December 2006, six of which were via teleconference. Since 2006, the Commission has held eight to ten meetings annually, generally all but two of which have been via teleconference.

The Commission published its first annual report to the governor and legislature on April 18, 2006, and has since published reports annually during the state legislative sessions. A Commission Web site posts basic information about its mission, earthquake risk in Alaska, meeting agendas, minutes, presentations, and appropriate links. The Web site address is http://www.seismic.alaska.gov.

COMMISSION MEMBERSHIP

Name	Representation	Contact information
John L. Aho	Chair, Public member	CH2M HILL 949 East 36th Avenue Suite 500 Anchorage, AK 99508 Phone (907) 230-2432 John.Aho@ch2m.com
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Gayle L. White	Insurance industry	State Farm Insurance Co. 3340 Spinnaker Drive Anchorage, AK 99516 Phone: 907-261-3871 gayle.white.cpnv@statefarm.com

Alaska Seismic Hazards Safety Commission members (clockwise from lower left): John Aho (Chair), Gary Carver, Buzz Scher (Vice-Chair), JoAnne Bennett (Insurance Committee Ad-Hoc member), Dave Miller, Roger Hansen, Mark Roberts, Rich Koehler, Laura Kelly, Gayle White, Rob Witter (USGS-Guest), Bud Cassidy, April Woolery (DGGS Staff Support).

EARTHQUAKE RISK IN ALASKA

> **"It's snowing still," said Eeyore gloomily.**
> **"So it is."**
> **"And freezing."**
> **"Is it?"**
> **"Yes," said Eeyore. "However," he said, brightening up a little, "we haven't had an earthquake lately."**
>
> **— A.A. Milne**

Alaska has more earthquakes than any other region of the United States and is, in fact, one of the most seismically active areas of the world. The catastrophic April 2011 magnitude 9.0 Tohoku Earthquake in Japan is a grim reminder of why it is important for a society to be prepared for the furies of nature. The second largest earthquake ever recorded occurred on the Prince William Sound portion of the Alaska-Aleutian megathrust in southern Alaska on March 27th, 1964, with a moment magnitude of 9.2. The largest on-land earthquake in North America in almost 150 years occurred on the Denali fault in central Alaska on November 3rd, 2002, with a magnitude of 7.9. In January through mid-November 2011, the Alaska Earthquake Information Center (AEIC) recorded 22,096 earthquakes, for an average of 2,100 monthly, including 189 events with magnitude 4.0 or greater, 36 events of magnitude 5.0 or greater and 4 events of magnitude 6.0 or greater. The largest event during this period was a magnitude 7.3 in the Fox Islands area of Alaska. It is not possible to predict the time and location of the next big earthquake, but the active geology of Alaska guarantees that major, potentially damaging earthquakes will continue to occur. The risks to public safety and infrastructure from these future events can be greatly reduced through proper planning, design, and construction.

Alaska has changed significantly since the great 1964 earthquake. The population has more than doubled, but many new buildings are designed to prevent collapse during intense shaking. Some older buildings have been reinforced, and development has been discouraged in some particularly hazardous areas. However, despite these improvements, and because practices to reduce vulnerability to earthquakes and tsunamis are not applied uniformly in regions of high risk, future earthquakes may still cause life-threatening damage to buildings, cause items within buildings to be dangerously tossed about, and disrupt the basic utilities and critical facilities that we take for granted.

In addition to the 1964 and 2002 ruptures, there are other sources of potentially damaging earthquakes in Alaska. These include the Castle Mountain fault in lower Matanuska-Susitna valley, the Wadati-Benioff zone beneath Anchorage, the active belt of faulting and folding in northern Cook Inlet, the Fairbanks seismic zone, and the Yakataga seismic gap near Yakutat, among others. While the seismic provisions of current Alaska building codes are largely geared toward preventing collapse from the types of shaking that occurred in 1964, earthquakes on these other sources may affect structures differently, in ways that may or may not be ameliorated by the current codes.

Earthquakes of magnitudes that could cause major structural damage and injury to residents continue to occur in Alaska. The interested reader is directed to Appendix C for additional information concerning Alaska earthquake activity in 2011.

SOME EARTHQUAKE STATISTICS FOR ALASKA

- Eleven percent of the world's recorded earthquakes have occurred in Alaska.
- Alaska has more frequent earthquakes then the entire rest of the United States.
- Three of the eight largest earthquakes in the world were in Alaska.
- Seven of the ten largest earthquakes in the United States were in Alaska.

Since 1900, Alaska has had an average of:

- One "great" (magnitude 8 or larger) earthquake every 13 years.
- One magnitude 7 to 8 earthquake every two years.
- Six magnitude 6 to 7 earthquakes per year.
- Fifty magnitude 5 to 6 earthquakes per year.
- Three hundred magnitude 4 to 5 earthquakes per year.
- Approximately 2,000 earthquakes recorded in Alaska each month.

It is not possible to predict the time and location of the next big earthquake, but the active geology of Alaska guarantees that major potentially damaging earthquakes will continue to occur. Scientists have estimated where large earthquakes are most likely to occur, and the probable levels of ground shaking to be expected in the state. With this information, as well as information on soil properties and landslide potential, it is possible to estimate earthquake risks in any given area. It is also possible to estimate the potential for earthquakes to generate tsunamis, and to model the extent to which tsunamis will inundate coastal areas.

COMMISSION ACTIVITIES IN 2011

2011 Activities

1. Held five telephonic and three face-to-face (two day) meetings of the Commission.
2. Participated in the following briefings on seismic risk mitigation from the following agencies and discussed the Commissions activities as they relate to work being accomplished elsewhere:
   a. New Zealand Earthquake Update-Dr. Gary Carver (ASHSC)
   b. American Institute of Architects (AIA) Evaluation of Buildings-Michael Thompson (Rim Architects)
   c. Social Media Influence Discussion-Mark Roberts (ASHSC)
   d. Interesting Aspects of the Japanese Tohoku Earthquake-Dr. Roger Hansen (ASHSC)
   e. Earthquakes-What Will We Do, How, and Why?-Sean Dewalt, Alaska Municipal League/Joint Insurance Association (AML/JIA)
   f. Japanese Tohoku Earthquake Emergency Response-Mark Roberts (ASHSC)
   g. Geology of the 2011 Japanese Tohoku Earthquake-Dr. Rob Witter (USGS)
   h. Paleoseismic Studies in the Region of the 2011 Japanese Tohoku Earthquake-Dr. Rich Koehler (ASHSC)
   i. Use of Real-time GPS Seismograms for Identifying Tsunamigenic Earthquakes-Dr. Roger Hansen (ASHSC)
   j. Recent Paleoseismic Studies in the Region of the Denali Fault-Dr. Rich Koehler (ASHSC)
   k. Fire Marshall's Role as the State Building Official-Kelly Nicolello (State Fire Marshall's Office)
3. The Commission Chair Dr. John Aho gave a 1-hour earthquake briefing presentation to the Alaska Society for Industrial Security (ASIS).
4. The Commission Chair Dr. John Aho prepared the training material for a 2-day, Commission sponsored, course on Post-disaster Safety Assessment of Facilities to be given February 23-24 and December 6-7, 2011.
5. ASHSC, along with the Alaska Division of Homeland Security & Emergency Management (ADHS&EM), sponsored and participated in two 2-day training workshops on Post-disaster Assessment of Buildings during which a total of 104 people were trained in safety evaluation of buildings after a damaging earthquake.
6. Commission Chair Dr. John Aho and members Buzz Scher and Mark Roberts served as instructors for Item 5 above.

7. Developed and published the sixth annual report to the Governor and Legislature in January, 2011.
8. The ASHSC, through Commission member Laura Kelly partnered with NOAA's Alaska Sea Grant College Program and Kodiak Island Borough in their community outreach presentation of the tsunami video, *Ocean Fury: Tsunamis in Alaska,* in response to aftermath of the March 11, Japan earthquake and tsunami.
9. Commission Chair Dr. John Aho and member Dr. Roger Hansen gave earthquake briefings to the Alaska State Senate Community and Regional affairs Committee in Juneau, Alaska.
10. Commission member Dr. Rich Koehler gave an invited presentation at the Tsunami Operations Workshop in Sitka, Alaska: The Fairweather fault and recently glaciated terrain: Potential sources for local tsunamis in Southeast Alaska, Tsunami Operations Workshop, Federal Emergency Management Agency, Sitka, Alaska, Westmark Hotel, September 13, 2011.
11. Commission member Dr. Rich Koehler published seven peer reviewed papers related to characterizing active faults in Alaska.
12. Commission members continued to be active in the Western States Seismic Policy Council (WSSPC).
13. Responded to the State of Alaska Legislative Budget and Audit Committee resulting in a report by them which recommends Commission extension to 2016.
14. Began development of the ASHSC Strategic Plan as recommended in Item 13 above.
15. Developed four new policy recommendations for consideration.
16. The Commission continues to work with the Kodiak Island Borough (KIB), ADHS&EM, and the Federal Emergency Management Agency (FEMA) to develop an Earthquake Planning Scenario for the KIB.
17. The Commission, ADHS&EM, the Alaska Division of Geological and Geophysical Services (DGGS), and the Alaska Earthquake Information Center (AEIC) contributed to the WSSPC tsunami report.
18. Nine Commission members completed the National Incident Management System (NIMS) Incident Command System Course ICS 100.
19. The Commission continued to have representation with the Alaska Partnership for Infrastructure Protection (APIP).
20. Commission member Laura Kelly has been selected to participate on the Project Review Panel for ATC-71-4, Update of Rapid Visual Screening Guidelines (FEMA 154) during 2012.

COMMITTEE ACTIVITIES

The Commission's standing committees continued to be active in 2011. Sam Kito from the Alaska Department of Education and Early Development (ADEED) continued to assist the Schools Committee and Joanne Bennett from the Alaska Division of Insurance has also continued as an active participant on the Insurance Committee. Both of these individuals bring a wealth of experience to committee activities.

Schools Committee

The Commission remains focused on assessing and minimizing loss due to structural instability of critical facilities in the event of a major seismic incident. Schools are a primary concern, but so are other critical facilities. These include hospitals, clinics; fire, rescue and police stations; as well as jails and detention facilities. Other important infrastructure at potential risk also includes military bases, airports, college complexes, harbors, and utility system lifelines (communications, electric, oil, transportation, water, and wastewater). Schools remain a major focus, however, due to the number of facilities within the state, their high occupancies and common designation as emergency shelters.

In an effort to begin mitigating earthquake risk to critical facilities, the committee continues utilizing the following approaches to address the issue:

- Advocate for the prioritization of identifying and mitigating at-risk facilities; initially focusing on schools, due to high occupancies and common use as emergency shelters (***Policy Recommendations 2010-1, 2010-2, and 2011-3***).
- Develop work plan(s) in collaboration with state and local agencies/governments.
- Advocate cost benefit analyses for both existing and new construction.
- Identify current legislation/programs; including those adopted by other states/countries. Foster contacts with successful proponents.
- Identify pertinent code and construction requirements and potential limitations.
- Recommend improvements including policy changes, legislation, and public outreach.

The Commission upholds the belief that focusing on schools in high-risk seismic zones provides the greatest potential cost/benefit to the State (see fold-out map, *Public Schools and Earthquake Hazards in Alaska*). Schools, especially in smaller communities, tend to be some of the most heavily occupied and important structures. Collapse during an earthquake would not only be devastating to the occupants, but also to the recovery of a community if the structure could no longer be used for emergency shelter in Alaska's harsh climate. Globally, schools remain the main focus for prioritizing structural mitigation, especially given wide-spread collapses during large earthquakes in China (2008) and Haiti (2010). The more recent 2011 Japan quake highlighted the effectiveness of proper seismic design, but also illustrated the impact of vulnerability to tsunami inundation.

Schools Committee Activities in 2011:

- Continued collaboration with the Alaska Board of Education and Early Development (of the ADEED) regarding its new capital improvement project application form that specifically addresses seismic issues. Schools are now applying for funds that specifically identify seismic hazards, and mitigate seismic risk via investigation, design and special construction inspections for any major project involving a school facility.
- Continued working with ADEED to prioritize identifying schools at greatest seismic risk.
- Communicated with other state seismic hazard safety commissions, including an ad hoc working groups organized by Earthquake Engineering Research Institute and Mike Griffin, PE, of the Missouri Seismic Safety Commission's Committee for Education. Committees collaborate to identify best means for reducing the effects of damaging earthquakes on schools and associated loss of life, property, and social continuity. Topics include legislation, identification, prioritization, funding, and retrofit.
- Identified Alaska's Parent-Teacher Association (PTA) as a key future partner in reducing school seismic risk.

Schools Committee Plan for 2012:

- Continue working with ADEED to identify existing at-risk school structures, and prioritize seismic mitigation.
- Maintain and foster relationships with other organizations and commissions involved with improving school seismic safety, with a focus on developing a new partnership with state PTAs.
- Further review state policies and procedures related to constructing and maintaining critical facilities and infrastructure, with a focus on identifying and improving resiliency in the event of a major earthquake. On-site construction inspection remains a key concern.

PUBLIC SCHOOLS AND EARTHQUAKE HAZARDS IN ALASKA

This map shows locations of communities with public school facilities in relation to potential ground-shaking as a percent of gravity, taking into account known earthquake sources. The colors represent peak bedrock ground acceleration (PGA) that has a 10-percent probability of being equaled or exceeded in a 50-year period, or an average of once every 475 years. PGA is useful for identifying general areas of low and high earthquake hazard. The PGA value of 10% g is considered the approximate threshold at which damage occurs to buildings not constructed to resist earthquakes. These values are represented on the map by the areas of yellow, orange, red, and brown. However, PGA cannot be used to directly predict the damage potential of an earthquake for specific structures without considering the duration and frequency of the ground motion, the proximity to the epicenter, and various site and building characteristics. Geologists also believe that unidentified active faults exist in many areas of Alaska. The scale of this map is not adequate for determining bedrock PGA at any given site. It should not be used in place of site-specific assessment of earthquake hazards by appropriately qualified professionals.

LEGEND

- City School District Location
- Borough School District Location
- Regional Educational Attendance Area (REAA) District Headquarters
- REAA or Borough School Location
- Closed School Location
- SCHOOL DISTRICT BOUNDARY
- MAIN ROADS

Peak Ground Acceleration (% g)
475-YEAR AVERAGE RETURN PERIOD

- 80 to 100
- 60 to 80
- 40 to 60
- 30 to 40
- 25 to 30
- 20 to 25
- 15 to 20
- 10 to 15
- 9 to 10
- 8 to 9
- 7 to 8
- 6 to 7
- 5 to 6
- 4 to 5
- 3 to 4
- 2 to 3
- 1 to 2
- 0 to 1

ALEUTIAN ISLANDS (CONT.)
-- NO SCHOOLS AT PRESENT

DATA SOURCES:

INFORMATION COMPILED FROM THE "SEISMIC-HAZARD MAPS FOR ALASKA AND THE ALEUTIAN ISLANDS," US GEOLOGICAL SURVEY, 1999, THE "PROBABILISTIC SEISMIC HAZARD MAP OF ALASKA," US GEOLOGICAL SURVEY (OPEN FILE REPORT 99-36), THE ALASKA DEPARTMENT OF EDUCATION & EARLY DEVELOPMENT DIVISION OF SCHOOL FINANCE AND FACILITIES SCHOOL DATABASE, 2007, AND THE "ALASKA SCHOOL MAP," ALASKA DEPARTMENT OF EDUCATION AND EARLY DEVELOPMENT, REVISED 2003.

THE ACCELERATION VALUES CONTOURED ARE THE RANDOM HORIZONTAL COMPONENT. REFERENCE SITE CONDITION IS FIRM ROCK, DEFINED AS HAVING AN AVERAGE SHEAR-WAVE VELOCITY OF 760 M/SEC IN THE TOP 30 METERS, CORRESPONDING TO THE BOUNDARY BETWEEN NEHRP SITE CLASSES B AND C. IN SOME SITUATIONS, PARTICULARLY IN AREAS OF HIGH GROUND-MOTIONS (E.G. ALONG THE COAST OF SOUTHEAST ALASKA) THERE ARE DISCONTINUOUS CHAINS, OR ISLANDS, OF HIGH GROUND MOTION VALUES. THIS IS AN ARTIFACT OF THE GRID SPACING USED IN THE CALCULATIONS. IN MOST CASES THESE CHAINS SHOULD BE REPLACED WITH CONTINUOUS BANDS OF HIGH GROUND-MOTION VALUES ENCLOSING THE CHAINS.

ADDITIONAL INFORMATION, INCLUDING GRIDDED VALUES AND ARC/INFO COVERAGES USED TO MAKE THE MAPS IS AVAILABLE AT: HTTP://EARTHQUAKE.USGS.GOV/RESEARCH/HAZMAPS/. ALASKA STATE BOUNDARY, MAIN ROADS AND SCHOOL ARC/INFO COVERAGES WERE OBTAINED FROM THE ALASKA STATE GEOSPATIAL CLEARINGHOUSE AT HTTP://WWW.ASGDC.STATE.AK.US/ ON APRIL, 2007.

MAP PROJECTION: ALBERS EQUAL AREA CONIC, STANDARD PARALLELS 55° N AND 65° N, CENTRAL MERIDIAN 160°W.

SEE ABOVE INSET FOR CONTINUED COVERAGE OF THE ALEUTIAN ISLANDS

Policy Recommendation 2010-1:
Given that schools in Alaska serve not only as educational facilities but also as gathering places for the general public, and that many are designated as emergency shelters in case of a natural disaster, the Commission recommends that the State appropriate the resources necessary to identify those school facilities most at risk from earthquakes.

Policy Recommendation 2010-2:
The Commission recommends that all future school design, construction, and major renovation project funding include monies allotted for seismic risk mitigation tasks, to include:

- *Seismic design by a structural engineer proficient in the design and detailing required for earthquake engineering tasks.*
- *An independent peer review of seismic design calculations and detailing by a qualified structural engineer.*
- *On-site observation of as-constructed earthquake engineering details during construction by a qualified inspector to ensure they are constructed in accordance with the contract documents.*

ASHSC Alaska Seismic Hazards Safety Commission

ADEED SCH-PGA.dwg
11/15/2007 (REV. 11/24/2009)

- Continue seeking funding to identify and retrofit critical structures at risk of damage or collapse during a major seismic event. Estimating the cost to perform Rapid Visual Screenings (or a similar approach) has been identified as an important first step.
- Advocate for policy changes, legislation, and public outreach that mitigates earthquake risk. This includes the recent agreement by Schools Committee Chair, Laura Kelly, to participate on the Project Review Panel for ATC-71-4, Update of Rapid Visual Screening Guidelines (FEMA 154) during 2012.
- Examine Alaska Science Education Standards, and identify potential opportunities for enhancing existing curricula. Support teacher training and development of materials that address earthquake science, school preparedness and individual safety.

Insurance Committee

As part of the Alaska Seismic Hazard Safety Commission's Charter, the Insurance Committee seeks to bring awareness of issues concerning availability and its importance to Alaskans through ongoing education. The committee set three goals at the outset of the year. These were:

- Provide basic information on the ASHSC website that is easily accessible to the above audience concerning earthquake exposures, insurance availability, and personal safety measures. Consider links to other State of Alaska sites.
- Publish an informational brochure for the public about earthquake and tsunami risks, insurance and choice. Find venues for distributing this information.
- Work with the Division of Insurance to provide information on hazards throughout the state, steps that can mitigate those hazards, and assist as needed to attract additional carriers to the Alaska market who will provide affordable earthquake insurance to citizens throughout the state.

Insurance Committee Activities in 2011:

- A draft earthquake insurance brochure titled "Earthquake Insurance and You" was initiated and is currently under review.
- The brochure is drafted and in approval stages with the Division of Insurance and DGGS. We anticipate publication will occur in early 2012.
- Continued link with the Division of Insurance to their publication: 2009 Homeowners Insurance Guide, which includes a section on earthquake insurance. It will be updated when the Guide is updated.
- Worked with our liaison with the Division of Insurance to deepen our relationship. A staff member of the Division is now a member of the committee and is able to attend some of our Commission meetings.
- Worked in support of other committee efforts in developing informative white papers.

Insurance Committee Plan for 2012:

- Complete the earthquake insurance brochure titled "Earthquake Insurance and You".
- Recommend methods of distributing the earthquake brochure to Alaskan residents.
- Continue to work with other committees in the development of informational "white papers" on a variety of earthquake risk mitigation tasks.

Earthquake Scenario Committee

An earthquake scenario is a planning tool that helps people understand earthquakes and plan for the future. Earthquake scenarios have been used successfully in several areas of the U.S. to identify weaknesses in the built environment as well as vulnerable interdependencies among utility and transportation systems

that could result in multiple or cascading failures even if only one system fails. Communities, state and federal agencies, private industry, and emergency response organizations use scenarios as tools to increase public awareness, develop risk-reduction strategies, and for response and mitigation planning. The Western States Seismic Policy Council, in its adopted Policy Recommendation 09-1, recommends "that each member state, province, and territory establish an active program to produce Earthquake Planning Scenarios for areas with high risk of earthquake losses."

Earthquake scenarios begin by defining a hypothetical but geologically realistic earthquake suitable for the purpose of the scenario. Depending on the complexity and desired results, a scenario may describe the types and severity of shaking and ground breakage likely to result; the likely impacts to facilities, including types and extent of damage to buildings according to building type and age; and disruptions to utilities and transportation systems. A scenario may also describe secondary effects such as tsunamis, fire, and toxic materials release; estimate the numbers of deaths, injuries, and dollar value of losses by building type; and estimate the long-term business losses and socioeconomic consequences. The resulting information provides the basis for planning earthquake-response exercises, prioritizing and pre-locating response resources, and developing mitigating measures for reducing vulnerability to future earthquakes.

Developing an earthquake scenario requires assembling pertinent geologic and seismologic data for a realistic event, compiling and updating building and utility system inventory information for the affected region, assigning seismic fragilities to the building stock, and assembling current data on population demographics. Loss-estimation technology such as FEMA's HAZUS software is often used to model the event, incorporating all the compiled data. The results are then documented in one or more reports and presentations to all interested groups. If done effectively, a scenario helps decision makers visualize specific impacts that are based on currently accepted scientific and engineering knowledge, providing a powerful tool for private industry, government officials, and the general public to develop effective mitigation policies and programs.

Earthquake Scenario Committee Activities in 2011:

The Earthquake Scenario committee is working on ways to promote the development of scenarios that help identify and mitigate seismic risk in Alaska. During 2010, the committee performed the following tasks:

- The Committee was successful in obtaining the Kodiak Island Borough's (KIB) commitment to work with the Commission in developing an Earthquake Planning Scenario for the affected communities.
- The Committee was successful in enlisting FEMA's assistance, at no charge to the State or Borough, in running HAZUS Level 2 loss estimation for the KIB.
- The Committee is currently helping to coordinate and oversee development of a scenario as described above.
- The Committee initiated an assessment of the impacts of a major earthquake in the Pacific Northwest on Alaska. Two scenario earthquakes are considered, a Magnitude 9 subduction earthquake on the Cascadia Subduction Zone and a large shallow earthquake on one of several active faults traversing Puget Sound. The committee is drafting a policy statement regarding identification, characterization and mitigation of the impacts of a Pacific Northwest earthquake on Alaska.

Shaking damage in the U.S. Weather Bureau office at Anchorage International Airport during the 1964 earthquake. Note the failure of unreinforced concrete masonry unit (CMU) walls and extensive nonstructural damage. Photo by A.L. Comiskey.

Earthquake Scenario Committee Plan for 2012:

- Completion of the KIB Earthquake Planning Scenario in 2012.
- Continue to help coordinate a community approach to development of an earthquake scenario for the KIB.
- Work with the Kodiak Island Borough, U.S. Coast Guard, FEMA, and other interested parties to develop the input data needed for a HAZUS Level 2 loss estimation for Kodiak and surrounding area including the Coast Guard Base.
- Identify other Alaskan communities that are willing to partner in the development of earthquake scenarios for their communities.
- Consider submitting proposals to the National Earthquake Hazard Reduction Program and Earthquake Engineering Research Institute for support in developing other scenarios.
- Complete a White Paper on the impacts of and mitigation strategy for a Cascadia Subduction zone or large shallow Puget Sound earthquake.

Hazards Identification Committee

Seismic hazards include a number of physical phenomena generated by earthquakes that have the potential to cause damage to the state's infrastructure and compromise the safety Alaska's residents and visitors. The most common and widespread seismic hazard is strong ground motion. Surface fault rupture, seismically triggered landslides and snow avalanches, ground failure including liquefaction, ground settlement, and subsidence and seiches and tsunamis are also significant seismic hazards in many regions of the state. Identification and characterization of seismic hazards is fundamental to developing mitigation strategies and reducing losses from earthquakes.

Hazards Identification Committee Activities in 2011:

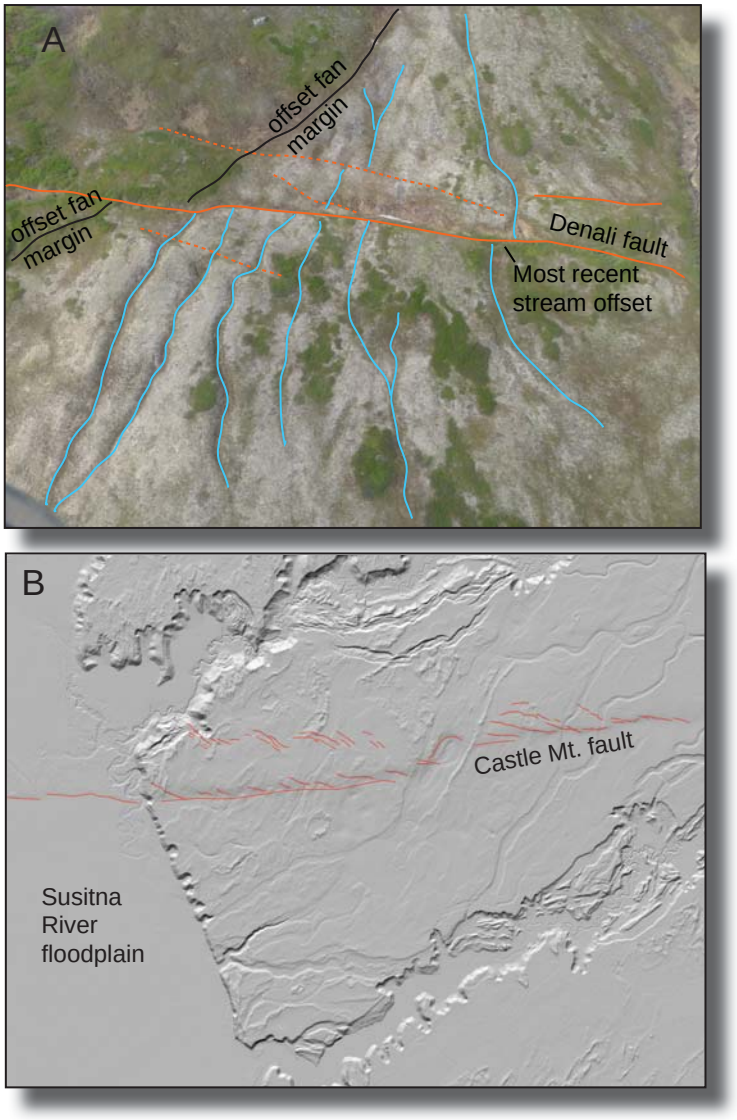
- Continued its efforts to better understand seismic hazards in Alaska by participating in projects and conferences focused on the state's seismic risks. The committee continued to gather information related to seismic sources and secondary effects of earthquakes in an effort to identify regions of the state most vulnerable to seismic hazards. Additionally, the committee focused on developing ways to raise awareness of seismic hazards in the general public and the legislature.
- An essential component in the reduction of future earthquake losses in Alaska is knowledge of the locations and style of deformation associated with sources of potentially damaging earthquakes. To facilitate dissemination of this information to engineers, policy planners, and the general public, committee members participated with the Alaska Division of Geological & Geophysical Surveys (DGGS) in a comprehensive inventory and database of active faults in the state. The database was compiled in conformance with standards defined by the U.S. Geological Survey for the national Quaternary fault and fold database and includes fault specific information such as name, age, type, and slip rate. The database represents an accurate, up to date, user-friendly resource and will soon be publically available via the DGGS website. The Hazards Identification Committee also worked with DGGS to establish a field fault evaluation protocol and define areas to acquire high-resolution lidar data along major existing and proposed pipeline infrastructure.
- In Southeast Alaska, hazards related to strong ground shaking including submarine landslides, liquefaction, lateral spreads, and associated local tsunami are poorly documented and generally underappreciated. To increase awareness of these hazards, the Hazards Identification Committee participated in a tsunami operations workshop led by the Alaska Division of Homeland Security and Emergency Management in Sitka.
- The chair of the Hazards Identification Committee attended the Association of Environmental and Engineering Geologists (AEG) annual national meeting in Anchorage and presented new data from geologic studies along the Castle Mountain fault. Because of the proximity of the Castle Mountain fault to the Anchorage area, this data will help more accurately characterize the behavior of the fault and improve seismic hazards assessments. Additional seismic hazards related symposiums at the AEG meeting focused on engineering geologic characterization of hydroelectric dams and oil and gas pipelines, directly applicable to current large infrastructure projects in the state.
- A white paper describing the current state of knowledge of earthquake sources and their associated seismic hazards and risks in different regions of the state was completed and is currently under review. The committee is presently discussing the most appropriate venue for publication.

Hazards Identification Committee Plan for 2012:

To further address its goals the committee is encouraging the State Geologist and DGGS to instigate a program to compile detailed descriptions of each seismic source to eventually be linked as a companion product to the Quaternary fault database map released in 2011. Draft descriptions from a previously initiated program exist for many faults, however due to advances in knowledge over the last decade a tremendous amount of new information is available and the descriptions need to be updated. The Committee envisions a product in which all of the available information for a particular fault can be linked to the on-line Quaternary fault database and easily obtained by users.

The Quaternary fault database is a major step forward in the identification and characterization of active faults in the state. However, new faults are found every field season. The earthquake science and engineering community still does not have enough information in many areas to accurately characterize the hazard. Thus in 2012, The Hazards Identification Committee will continue to encourage collaboration between DGGS, USGS, university researchers, and the consulting community in efforts to identify, map, and characterize active earthquake sources.

(A) Displaced stream channels along the Denali fault west of the 2002 rupture. This section of the fault has not ruptured in over everal hundred years and is capable of a large magnitude event that could affect the Parks Highway, proposed gas pipelines, Denali National Park, and other infrastructure. (B) New lidar data from the Susitna lowlands used to refine the location of the Castle Mountain fault.



Response and Recovery Committee

Among the powers and duties assigned to the Commission by enacting legislation are to "offer advice on coordinating disaster preparedness and seismic mitigation activities of government at all levels, review the practices for recovery and reconstruction after a major earthquake, and recommend improvements to mitigate losses from future similar events." The Response and Recovery Committee was established to address these tasks.

Response and Recovery Committee Activities in 2011:

- Provided an annual review of the seismic sections of the State Hazard Mitigation Plan goals that related to the Seismic Safety Hazards Commission.
- Co-sponsored Postearthquake Safety Evaluation of Buildings training twice in 2011.
- Co-sponsored earthquake structural and non-structural mitigation training in Fairbanks in 2011.
- Co-sponsored a rapid visual screening course for earthquake building hazards in Fairbanks in 2011.
- Supported planning efforts for the 2014 anniversary of the 1964 great Alaskan earthquake to include training and outreach on earthquake and tsunami emergency response.
- Continued the Commission's availability for review of seismic sections of community emergency operations plans.

- Continued the Commission's availability for consultation on emergency response exercises to seismic events.
- Encouraged all Commissioners successfully complete the ICS 100 course. Achieved 75% by 2011.

Response and Recovery Committee Plan for 2012:

- Refine the Commission's role one month and six months following a significant seismic event in the State including draft legislation and policy recommendations that can be proposed.
- Draft a "Continuity of Operations" (COOP) plan to provide for continuing critical Commission functions in the event of an interruption of standard Commission operation.
- Develop a post earthquake data clearinghouse process that sets in place a procedure, structure and organization to capture – for Alaska State use – all data, photos, records and notes produced from post earthquake investigations conducted in Alaska following a significant seismic event.
- Test the Commission's significant earthquake incident procedure during the March 2011 tsunami warning "live code" test during Tsunami Awareness week – the week of the anniversary of the 1964 great Alaska earthquake.

Education and Outreach Committee

The committee continues its focus on developing information for the Governor's office, legislators, administrative agencies, local governments, local emergency planning groups, and industry groups. Activities were somewhat limited due to the Committee Chair spending much of his time outside of Alaska. A new Education and Outreach Committee Chair has been appointed with the expectation that this Committee will have increased activity.

Education and Outreach Committee Activities in 2011:

The Committee Chair was unavailable for a major part of the year due to work commitments so planned goals for 2011 were not met. A new Committee Chair has been appointed and it is anticipated that the group will become much more active.

Activities included:

- Delivered earthquake briefing presentations to several public, private, and Federal agencies.
- Continued to work with the Earthquake Engineering Research Institute on sponsorship of the 2014 National Conference on Earthquake Engineering to be held in Anchorage, Alaska.

Education and Outreach Committee Plan for 2012:

The committee will continue to address the following items:

- Develop Committee goals and measures of success for 2012
- Participate in the Post-earthquake Safety Evaluation of Buildings Training Program.
- Continue to schedule briefings from outside interests that are concerned with seismic risk mitigation issues.
- Continue to give earthquake briefing presentations as requested.
- Develop an informative brochure that describes the Commission and its activities.
- Develop an Alaska Seismic Hazards Safety Commission (ASHSC) Glossary of Terms
- Work with the University of Alaska Anchorage and the Earthquake Engineering Research Institute to invite the 2011 Joyner Lecturer to Anchorage for their presentation.

Partnership Committee

Enacting legislation charges the Commission to "establish and maintain necessary working relationships with other public and private agencies". The purpose of the ASHSC Partnership Committee is to investigate and develop potential relationships.

The basic goals of developing partnerships are to:

- Promote combined efforts to reduce the loss of life and property
- Conduct education efforts to motivate key decision makers to reduce risks associated with earthquakes
- To foster productive linkages between scientists, critical infrastructure providers, businesses, and government agencies in order to improve the viability of communities after an earthquake event.

Partnership Committee Activities in 2011:

The committee was involved in the following activities:

- Continued to address planning aspects for the 2014 National Conference on Earthquake Engineering.

Partnership Plan for 2012:

The following tasks will be addressed in 2012:

- Continue to seek partnership opportunities with organizations, agencies, and public entities.
- Make formal contact with seismic safety commissions in other areas of the United States.
- Work will continue on the 2014 National Conference on Earthquake Engineering expected to draw 1000-1500 professionals from around the world to Anchorage.
- Continue to develop relationships within the Alaska Partnership for Infrastructure Protection (APIP).

SEISMIC-RISK ISSUES BEING ADDRESSED BY THE ALASKA SEISMIC HAZARDS SAFETY COMMISSION

The following issues relating to seismic risk mitigation continue to serve as a guide to developing the path forward for the Commission and for the formation of standing committees.

1. **Assess the Structural Stability of Critical Facilities**
   Description of the Issue: Some existing critical buildings in the state may not be constructed in a manner to withstand future earthquake and tsunami events. A specific concern is school buildings. Hospitals, clinics, and fire, rescue and police stations across the state are also vulnerable to failure. Also at possible risk are large Federal, State and private complexes such as military bases, Coast Guard stations, airports, college campuses, harbors, power-generating stations, communication centers, water and waste-water treatment facilities, jails and detention facilities, pipelines, and highways and bridges.

   Importance of the Issue: If attention is not brought to bear on this issue before a damaging earthquake or tsunami, communities in the State could see massive structural failure of important community facilities, resulting in human casualties, economic loss, and environmental damage. Furthermore, Alaska's remote nature and extreme weather conditions can cause delays in response efforts and put displaced building occupants at severe risk from exposure. Adequate preparedness is imperative to timely rapid response and recovery from a significant seismic event.

Benefits of Addressing the Issue: Some private and public entities have taken important steps to improve the seismic resistance of key facilities and infrastructure. For example, prior to constructing the Trans-Alaska Pipeline System, Alyeska hired geologists and engineers to specifically address seismic hazards. The resulting design and earthquake-resistant construction prevented the spillage of any oil during the M7.9 Denali fault earthquake of November 3, 2002. The Alaska Department of Transportation and Public Facilities is undertaking a seismic retrofit program for State-owned bridges, and is focusing on upgrading bridges that provide critical access to communities. Some boroughs and cities across the State have taken the initiative to identify and begin retrofitting seismically vulnerable school buildings and other essential facilities.

Despite the newness of most construction in Alaska and implementation of modern building codes, many buildings and key infrastructure remain vulnerable due to proximity to seismic hazards, some of which are known and others of which are poorly understood. Building codes continue to change and have been significantly upgraded in the period between 1976 and 1997. The Federal Emergency Management Agency (FEMA) and earthquake consortia such as the Cascadia Regional Earthquake Workgroup (CREW) in the Pacific Northwest have long recognized that addressing the problems prior to a catastrophic event can have long-standing benefits in the future. However, building codes are often inadequately implemented and recommendations of advisory bodies are often ignored.

How the Commission Can/Will Address the Issue: The Commission will encourage mitigation efforts by presenting information about earthquake hazards and risk and suggesting approaches to addressing the strengthening of at-risk critical facilities. Public education must include the correct mix of information on potential damage and suggestions of effective actions to be taken.

2. **Address the Importance of Earthquake Insurance**

Description of the Issue: Catastrophic natural perils, particularly earthquakes, are unpredictable, relatively infrequent, and can be financially disastrous. Earthquake risk is especially difficult to insure against because insurers are unable to accumulate adequate reserves for such high severity, low frequency losses.

Importance of the Issue: Insurers are unwilling to provide insurance in a market where premium rates are inadequate to create the reserves necessary to pay for damages in the event of a major earthquake. This can create a severe deficiency in availability of insurance as existing insurers withdraw from the market and new insurers are unwilling to enter.

Benefits of Addressing the Issue: Improved pre-loss mitigation efforts, such as retrofitting existing structures; emergency planning to speed post-loss recovery; and actuarially sound earthquake insurance rates encourage additional insurers to enter the market. This in turn improves availability of insurance products and results in more competitive premiums.

How the Commission Can/Will Address the Issue: The Commission can encourage development of public-private partnerships that provide education and mitigate the potential impact of future events. We will examine the seismic-hazard information needs of the insurance industry and provide recommendations for improvement.

3. **Approaches to Seismic Risk Mitigation in Future Building Construction**
Description of the Issue: Sustainable development entails maintaining environmental quality, improving a community's quality of life, and fostering social equity while maintaining a healthy economy. Therefore, sustainable development includes incorporating disaster resilience and mitigation into a community's decisions and actions. Building codes normally have a performance goal of life safety, which is considered a minimum safety level, but are typically the maximum level to which buildings are designed. Codes do not appropriately address the effects of ground failure, ground-shaking amplification, or provide guidance to designers and construction contractors.

Importance of the Issue: Communities need to know the potential earthquake risk and impacts at a structure site and should implement appropriate standards to mitigate the identified risk so new buildings are not subjected to the effects of massive ground failure and strong ground shaking.

Alaska Sales and Service automobile dealership under construction in Anchorage. The precast concrete wall, column, and roof structural system was toppled by ground shaking during the 1964 earthquake. Photo by A.L. Comiskey.

Benefits of Addressing the Issue: The results of addressing the issue are more effective mitigation and an assurance that countermeasures are not only adequate but the cost of implementation is not prohibitive.

How the Commission Can/Will Address the Issue: The Commission will encourage continued Federal, State, and private partnerships in updating ground failure susceptibility mapping of Anchorage, ground shaking characterization in high-risk Alaskan communities, and determination of structural response of buildings and bridges. We will work with the technical community and the construction industry to inform, educate and work with communities to provide guidance to improve building and land-use codes.

4. **Response and Recovery Practices to Mitigate Future Seismic Risk**
Description of the Issue: Communities don't have a good understanding of the costs and resources needed for response and recovery. First responders to a damaging earthquake in one of Alaska's

major cities will be overwhelmed in the initial hours following the event. Damage to transportation systems will make movement of people and goods difficult. Demand for emergency shelter, food, and water will strain community's resources. Disruptions to lifeline systems will complicate recovery.

Importance of the Issue: An understanding of response and recovery issues is critical to assessing the impacts to State and local resources.

Benefits of Addressing the Issue: Implementing effective response and recovery practices will reduce economic and social costs of recovery and will help mitigate risks from future events.

How the Commission Can/Will Address the Issue: The Commission will promote and assist in the development and use of "earthquake planning scenarios" to define the impact of future damaging earthquakes and will communicate lessons learned from past events to provide guidance to communities on recovery planning and preparation.

5. **Hazard Identification and Public Education**

Description of the Issue: A damaging earthquake has not affected a major population region in Alaska since 1964. The majority of the population is unaware of the consequences of a major seismic event. The 2002 magnitude 7.9 Denali fault earthquake, which occurred in remote areas of the Alaska Range, resulted in relatively minor damage to smaller rural communities but had little effect in larger communities such as Anchorage and Fairbanks. It was evident, during damage assessment evaluations after the Denali fault event, that the residents of the smaller at-risk communities had little understanding of the earthquake hazard, had not implemented measures to mitigate damage, and were unprepared to respond to the consequences of damage. It is important that the population of Alaska be aware of the earthquake hazard and be informed of the measures that can be taken to mitigate risk.

Importance of the Issue: There is a high probability that Alaskans will experience the results of a damaging earthquake in the future. All Alaskans will be better prepared to take measures ahead of time to reduce losses and casualties and to respond to the event if they are informed of, and truly understand, the hazard and the resultant risk.

Benefits of Addressing the Issue: An educated public has a greater potential of responding appropriately before, during, and after a damaging earthquake. Improved knowledge and public awareness of hazard and risk can change behavior and lead to more cost-effective mitigation.

How the Commission Can/Will Address the Issue: The Commission will examine the need for greater public investment in identification and assessment of earthquake hazards, and the most effective ways of communicating this information to the public. The Commission will examine and promote the concept of seismic resilience of communities, addressing reduced failure probabilities, reduced consequences of failure, and reduced time to recovery.

6. Recommended Public-policy Goals of the Commission

a. Education
   - Develop an effective public education and outreach program.
   - Convey scientific and technical information from credible authorities.
   - Communicate information in a manner that is understandable by the public.

b. Guidance
   - Provide advice on seismic risk mitigation and recommend policies to improve preparedness.
   - Recommend goals and priorities for risk mitigation to public and private sectors.
   - Recommend needed research, mapping, and monitoring programs.
   - Offer advice on coordinating disaster preparedness and seismic risk mitigation.

c. Assistance
   - Review seismic and tsunami hazard notifications and recommend appropriate response.
   - Review predictions and warnings and suggest appropriate responses.

d. Implementation
   - Establish and maintain working relationships with other private and public agencies.
   - Gather, analyze, and disseminate information.
   - Conduct public hearings.
   - Appoint committees from Commission membership and/or external advisory committees to address risk mitigation issues.
   - Accept grants, contributions, and appropriations.

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APPENDIX A
ALASKA SEISMIC HAZARDS SAFETY COMMISSION STATUTE

Sec. 44.37.065. Commission established; membership.

(a) The Alaska Seismic Hazards Safety Commission is established in the Department of Natural Resources. The Department of Natural Resources shall provide staff support to the commission.

(b) The commission is composed of 11 members appointed by the governor for terms of three years. A vacancy is filled for the unexpired term.

(c) The governor shall appoint to the commission

(1) a representative from the University of Alaska;

(2) three representatives, each from a local government in a separate seismically active region of the state;

(3) a representative from the Department of Natural Resources;

(4) a representative from the Department of Military and Veterans' Affairs;

(5) a representative from an appropriate federal agency;

(6) a representative of the insurance industry; and

(7) three members from members of the public who are expert in the fields of geology, seismology, hydrology, geotechnical engineering, structural engineering, emergency services, or planning.

(d) The commission shall elect annually from its members a chair and vice-chair. A majority of the commission may vote to replace an officer of the commission.

(e) Six members constitute a quorum.

(f) Members of the Alaska Seismic Hazards Safety Commission serve without compensation but are entitled to per diem and travel expenses authorized for boards and commissions under AS 39.20.180.

Sec. 44.37.067. Powers and duties.

(a) The commission shall

(1) recommend goals and priorities for seismic hazard mitigation to the public and private sectors;

(2) recommend policies to the governor and the legislature, including needed research, mapping, and monitoring programs;

(3) offer advice on coordinating disaster preparedness and seismic hazard mitigation activities of government at all levels, review the practices for recovery and reconstruction after a major earthquake, and recommend improvements to mitigate losses from similar future events;

(4) gather, analyze, and disseminate information of general interest on seismic hazard mitigation;

(5) establish and maintain necessary working relationships with other public and private agencies;

(6) review predictions and warnings issued by the federal government, research institutions, and other organizations and persons and suggest appropriate responses at the state and local levels; and

(7) review proposed seismic hazard notifications and supporting information from state agencies, evaluate possible socioeconomic consequences, recommend that the governor issue formal seismic hazard notifications when appropriate, and advise state and local agencies of appropriate responses.

(b) The commission may
(1) advise the governor and the legislature on disaster preparedness and seismic hazard mitigation and on budgets for those activities and may recommend legislation or policies to improve disaster preparedness or seismic hazard mitigation;
(2) conduct public hearings;
(3) appoint committees from its membership and appoint external advisory committees of ex-officio members; and
(4) accept grants, contributions, and appropriations from public agencies, private foundations, and individuals.

Sec. 44.37.069. Definitions.
In AS 44.37.065 - 44.37.069,
(1) "commission" means the Alaska Seismic Hazards Safety Commission;
(2) "disaster preparedness" means establishing plans and programs for responding to and distributing funds to alleviate losses from a disaster as defined in AS 26.23.900 ;
(3) "seismic hazard" means an earthquake-induced geologic condition that is a potential danger to life and property; in this paragraph, "geologic condition" includes strong ground shaking, landslide, avalanche, liquefaction, tsunami inundation, fault displacement, and subsidence;
(4) "seismic hazard mitigation" or "mitigation" mean activities that prevent or alleviate the harmful effects of seismic hazards to persons and property, including identification and evaluation of the seismic hazards, assessment of the risks, and implementation of measures to reduce potential losses before a damaging event occurs;
(5) "tsunami" means a large ocean wave produced by an earthquake, landslide, or volcanic eruption.

ASHSC Alaska Seismic Hazards Safety Commission

Charter

Purpose

To provide a vehicle through which statewide seismic risk issues can be addressed and solutions can be proposed that will reduce life and property losses from a future damaging earthquake.

Vision

Eliminate losses from future earthquakes and tsunamis. Promote public and government awareness of Alaska's seismic hazards and seismic risk mitigation.

Mission

Make recommendations to the governor and legislature for reducing the State's vulnerability to seismic hazards. Advise the public and private sectors on approaches for mitigating earthquake and tsunami risk.

Act in an Advisory Capacity

Advise the Governor, the Legislature, and the public on Alaska's seismic hazards and risk mitigation.

Provide Information and Technical Guidance

Recommend studies, policies, and programs that will mitigate the risks associated with seismic hazards.

Recommend Educational Programs

Recommend and participate in programs that will disseminate information to government agencies and the public.

Encourage Seismic Hazards Risk Mitigation Efforts

Encourage efforts to address issues related to seismic hazards risk mitigation.

By achieving this mission, we create an opportunity to be an effective body in mitigating the potential damaging effects of major seismic events.

Core Values

- *Honesty*
- *Integrity*
- *Trust*
- *Diligence*
- *Service to the State*
- *Responsibility for One's Own work*
- *Support to Other Commission Members*
- *Commitment to Complete Accepted Assignments*
- *Provide Value to Stakeholders*
- *Be Objective and Reasonable*
- *Advocate for Seismic Risk Mitigation Efforts*
- *Recognize Exemplary Seismic Risk Mitigation Efforts*

KEY SUCCESS FACTORS AND MEASURES OF SUCCESS

SUCCESS FACTOR	MEASURE
Stakeholder Satisfaction	• Facilitate governor and legislature understanding of seismic risk mitigation issues; • Meet or exceed SOA expectations; • Advice is sought; • Advice is accepted; • SOA endorsement; and; • Positive feedback from staff.
Advocate of Risk Mitigation	• Provide advocacy for seismic risk mitigation programs; • Create opportunities for seismic risk mitigation advocacy; • Become familiar with current existing programs; and • Develop stakeholder support.
Advocate Public Outreach Programs	• Encourage social environment where seismic risk mitigation is accepted; • Examine existing programs within the State; and • Be available for public education presentations.
Promote Development of Earthquake Scenarios	• Complete earthquake scenarios for realistic events in high-risk areas; • Use scenario results to reduce earthquake risk; and • Seek community involvement in scenario development and application of results.
Facilitate Partnerships for Seismic risk Reduction	• Identify potential partners to assist in addressing Commission goals; and • Involve Federal, State, Municipal, and Private sector in addressing goals.
Critical Facilities Earthquake Risk Reduction	• Assist in prioritizing and identification and mitigation of facilities with life safety issues; • Develop work plans in collaboration with State and local agencies/governments; • Identify current legislation/programs adopted by other states/countries; • Foster contacts with proponents who have had seismic risk mitigation successes; • Identify pertinent code and construction requirements and potential limitations; and • Recommend improvements including policy changes, legislation, and public outreach.
Earthquake Insurance in Alaska	• Review current trends and provide advice; • Review existing “white paper” and update as appropriate; and • Develop “pros and cons” brochure describing earthquake insurance issues.
Promote Seismic Hazard Identification	• Identification and characterization of seismic risk hazards; • Definition and description of seismic risks; • Seismic risk and hazard research; and • Dissemination of seismic risk and hazard information to State and local governments, the public, and industry and scientific and professional community.

APPENDIX C
EARTHQUAKE ACTIVITY IN 2011

Alaska Earthquake Information Center (AEIC) personnel at the University of Alaska Fairbanks continue to monitor and process data from the combined Alaska regional seismic network (fig. 1). Over the past year we have implemented a number of changes to the processing system at AEIC to improve performance in many ways.

Last year we upgraded our ShakeMap (SM) system to version 3.5, with real-time SM production controlled by the Antelope seismic monitoring system. During this reporting period we have been working to improve AEIC-produced ShakeMaps by refining how our attenuation models and event magnitudes are chosen. We continue to maintain the Anchorage Strong Motion stations through partnerships and agreements with the school district, municipality, various churches and fire departments, and now the Alaska Volcano Observatory. We are currently improving the network by upgrading 19 K2 stations with ARRA-funded, NSMP-provided Basalts with external EpiSensors. In February 2011, AEIC staff performed the first 2 of these upgrades and provided training to AVO staff on installation procedures. The responsibility for on-site work now rests with AVO, who resumed the installations in October 2011. Altogether, 5 stations have been upgraded and 14 remain to be done.

In the past year we have continued upgrading and expanding the broadband seismic network. Eight sites with short-period sensors were upgraded with 3-c broadband and 3-c strong motion sensors. Two other analog short-period stations were upgraded with digital 3-c broadband sensors only.

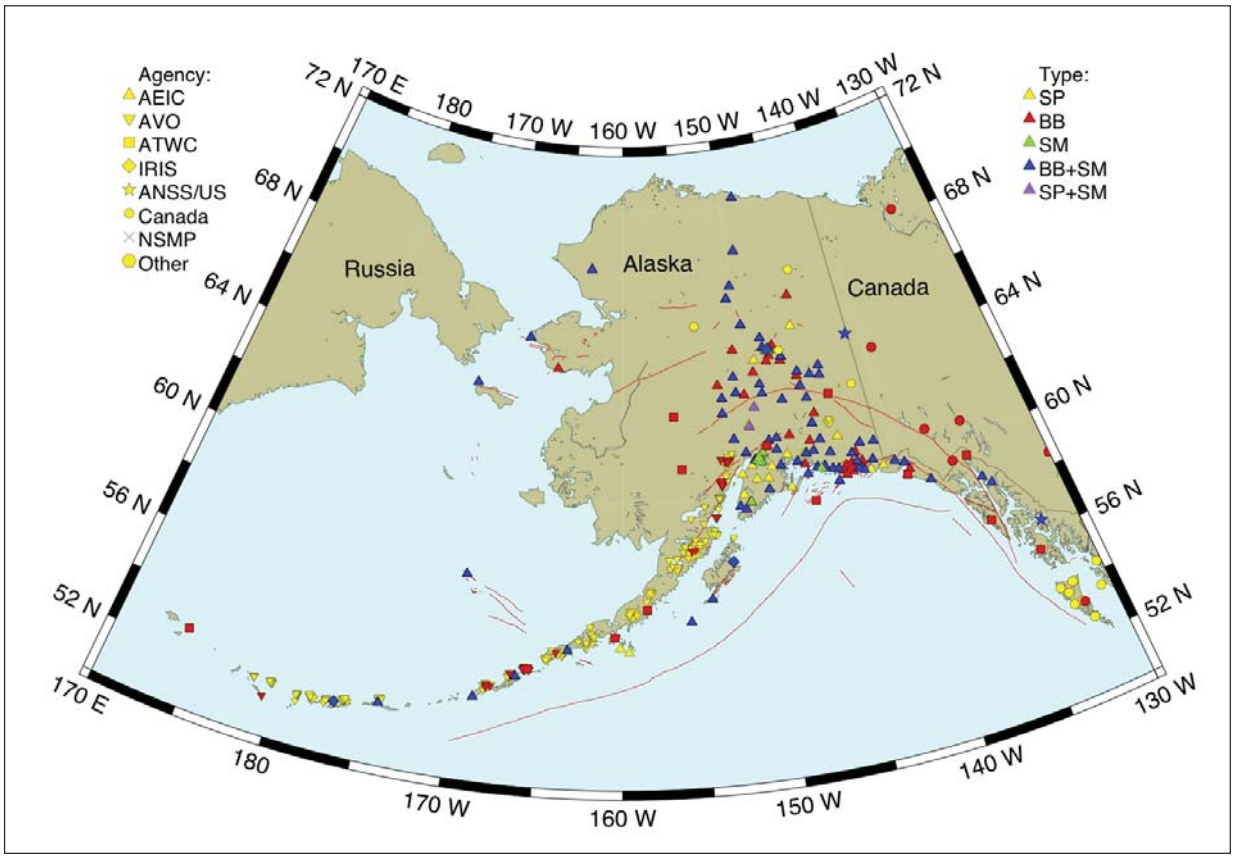

Figure 1. Map of seismic stations.

We have also strengthened our telemetry by adding three new 56K circuits, two of which are replacements for analog circuits, and by installing Marmot field processors at three critical hubs, improving compression and reliability at a total of 20 stations. Finally, we improved our telemetry at the Ragged Mountain hub by changing frequency keys to minimize interference.

Summary Statistics for Regional/Urban Seismic Network	Number	Station Response Information in dataless SEED volume(s)
Total no. of stations operated and/or recorded	567	
Total no. of channels recorded	2051	
No. of short-period (SP) stations	259	
No. of broadband (BB) stations	323	
No. of stations maintained & operated by network	164	Station response information for 90% of stations (all except short period stations) submitted to IRIS DMC in dataless SEED files (see below)
No. of stations maintained & operated as part of ANSS	81	

CONTINUITY OF OPERATIONS AND RESPONSE PLANNING

The continued operation of the AEIC seismology lab, telemetry, recording and analysis during an earthquake crisis depends on communications, electrical power and access to the facilities. Unlike Anchorage or Palmer facilities, the Fairbanks operations are removed from the great earthquake region of the state, where the likelihood of a facility-damaging quake is higher. However, we have taken steps to secure our critical equipment by providing backup electrical power with a 35kW diesel generator and a 12.5kW uninterruptible power supply located on site. The computer facilities are redundant.

We rely on a diverse data communications system, with leased circuits from multiple carriers, VSAT systems, the public internet, and local data radios. We began using cell phone modems at a number of sites in interior and southern Alaska for data delivery in real time. There are plans to add a VSAT at AEIC as an additional independent route to the internet in time of crisis. For voice communications we have access to an Iridium satellite telephone.

Some of our data is provided to us from the West Coast and Alaska Tsunami Warning Center and the Alaska Volcano Observatory, Anchorage office. Both of these network operators receive and record data prior to sending it to our facility. This arrangement allows continuity of data recording in the event of a serious power or communications outage.

AEIC completed a draft Continuity of Operations Plan (COP) in March 2010. We will finalize this plan after receiving updated COP guidelines from USGS. Additionally, the Geophysical Institute issued a new Emergency Action Plan in 2010 for the Elvey Building, which houses the AEIC facility.

2011 EARTHQUAKE ACTIVITY

From January 1, 2011 to November 16, 2011, AEIC reported a total of 22,096 events within the combined seismic network (fig 2.). The events range in depth from 0 to 270 km, with the deepest earthquakes located in the central Aleutian arc. The magnitude range of reported events is between -0.2 and 7.3. There were 189 events with magnitude 4.0-4.9 (~20 events per month on average), 36 events with magnitude 5.0-5.9 (~4 events per month on average) and 4 events with magnitude 6.0 or above. The largest earthquakes (MW 7.3) occurred on June 24, 2011 in the Fox Islands region of Aleutian Islands. The magnitude of completeness of the AEIC earthquake catalog for the reported time period is estimated to be 1.4 for the authoritative region and 2.5 for the Aleutians.

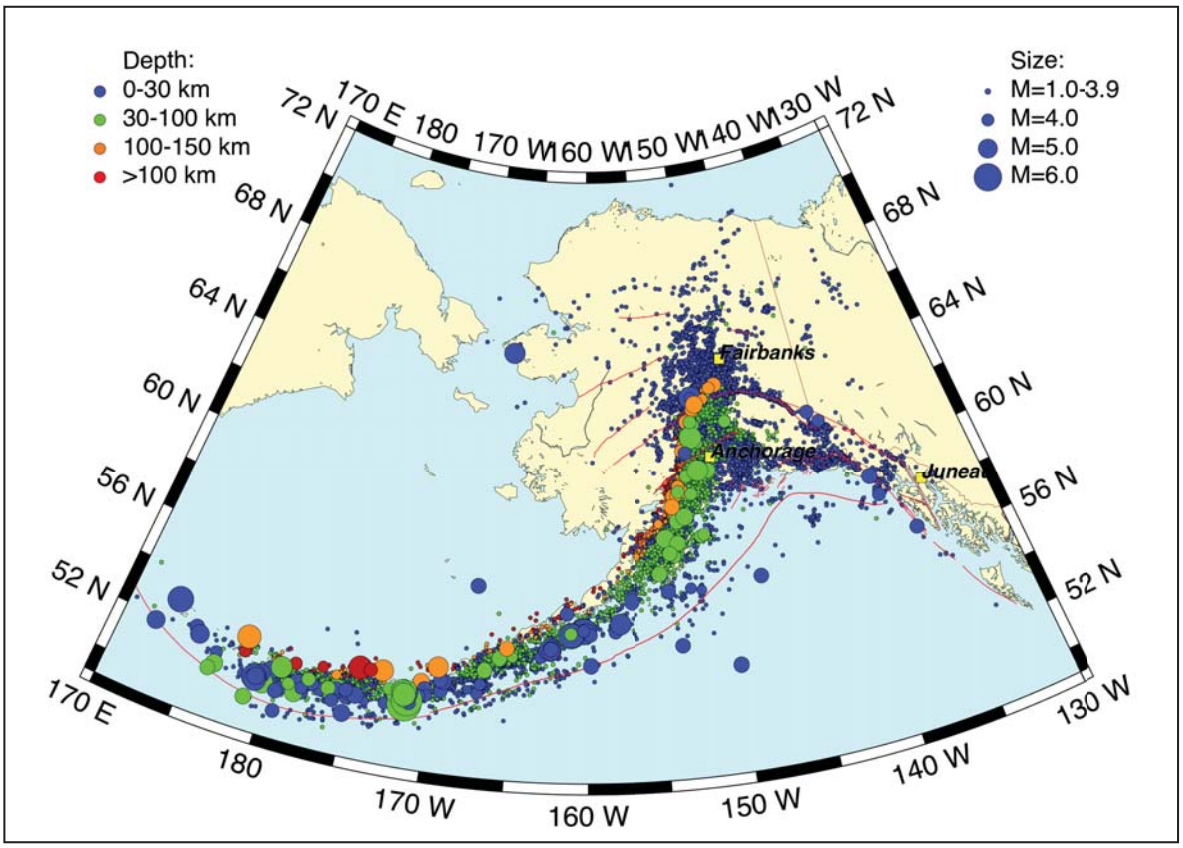

Figure 2. Earthquakes reported by AEIC between January 1 and November 16, 2011. The box outlines AEIC's authoritative region for earthquake submissions.

NOTABLE EARTHQUAKES FROM THIS REPORTING PERIOD

January 23, 2011 M5.2 Kantishna Earthquake

Mainshock and aftershocks

A moderate earthquake occurred in the central region of Alaska and was located 7 km (5 miles) E of Kantishna and 93 km (58 miles) W of Cantwell (fig 3.). About 80 aftershocks were located in the first 24 hours after the mainshock with magnitudes as small as 0.4. The largest aftershock, of magnitude 3.9, occurred about 21 hours after the mainshock. This event was located inside Denali National Park. The area is instrumented with a dense array of high quality seismometers, which allowed AEIC to detect and locate small aftershocks.

Felt reports

This event was felt widely in central Alaska, as far as Fairbanks in the north and Anchorage in the south. The largest intensity of shaking (IV, light) was reported in Cantwell, Clear and Talkeetna.

Source mechanism

Both the mainshock and largest aftershock are strike-slip earthquakes. The faulting can be associated either with the right-lateral motion on W-E trending fault or the left-lateral motion on N-S trending fault.

Tectonic summary

This event was located within the Kantishna seismic cluster. It is a very active source of crustal earthquakes located between the NNE-trending Minto Flats seismic zone to the northeast and the Denali fault to the south. This cluster is believed to accommodate deformation caused by interaction between these large crustal tectonic structures. Dozens of small earthquakes occur in the cluster every week. This is the largest event in the cluster since the magnitude 5.2 earthquake on December 8, 1984.

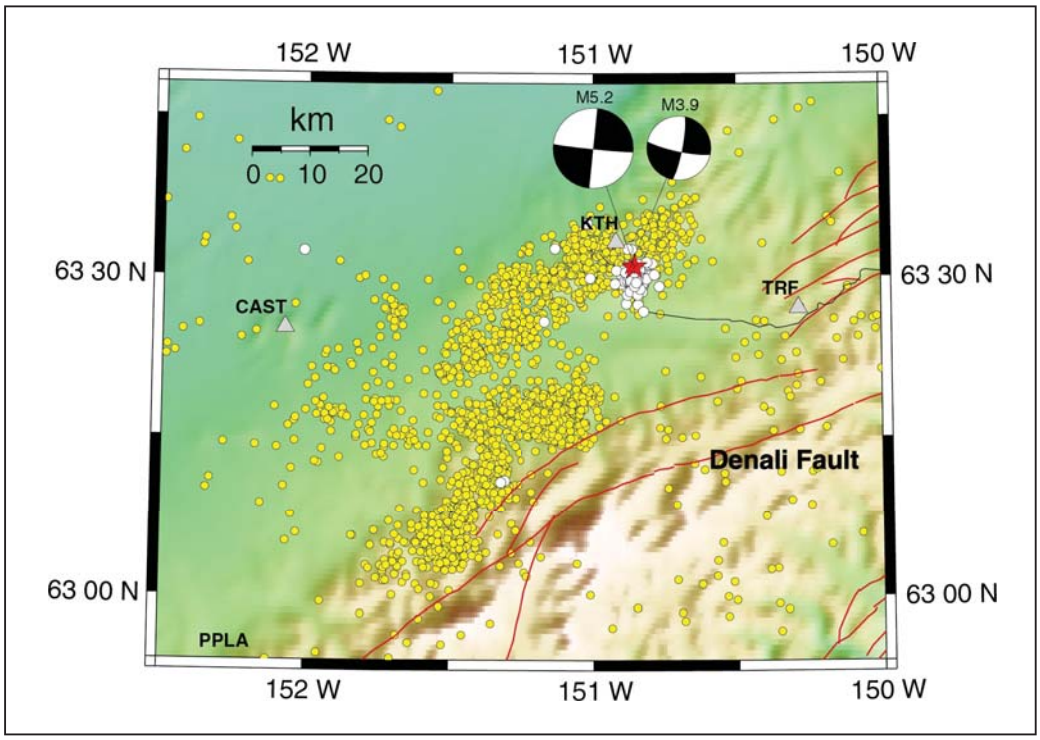

Figure 3. January 23, 2011 M5.2 Kantishna Earthquake (yellow circles - crustal seismicity for the past 12 months; red stars - M5.2 mainshock and M3.9 aftershock; white circles - 04/30/2010 aftershocks; grey triangles - seismic stations; red lines - faults; black lines - roads).

June 24, 2011 M7.3 Fox Islands earthquake

Mainshock and aftershocks

A magnitude 7.3 earthquake occurred on Thursday, June 23, 2011 at 6:09 pm AKDT (June 24, 03:09 am UTC) in the Fox Islands region of Alaska (red star on fig. 4). It was located 195 km (122 miles) ESE of Atka and 236 km (148 miles) SW of Nikolski. AEIC located about 500 aftershocks (white circles on fig. 4) through end of October 2011. About 50 aftershocks have magnitudes 4.0 or greater. The largest aftershock of magnitude 6.8 occurred on September 2 at 10:55 UTC (2:55 am AKDT). Due to the lack of seismic instrumentation in the region, only aftershocks of magnitude about 3 and above can be detected.

Felt reports

The mainshock was felt in many Aleutian Island communities, with the strongest intensity of shaking reported in Nikolski (intensity VI, strong).

Tectonic summary

The Aleutian Islands region, where the Pacific plate is being forced under the North American plate, is one of the world's most active seismic zones. In 1957, a magnitude 8.6 Andreanof Islands earthquake ruptured a ~600 km-long portion of the plate boundary in the central Aleutian Islands. The June 24, 2011 M7.3 earthquake is located in the central part of the 1957 rupture zone. In 1986, a portion of the western half of the 1957 zone failed in an earthquake of magnitude 7.9. In 1996 another magnitude 7.9 earthquake appears to have completed the re-rupture of the western end of the 1957 zone, immediately westward of the 1986 region. No other major (magnitude 7 or greater) earthquakes occurred within the 1957 rupture zone up until June 24 event. The depth and faulting type of the June 24 earthquake are consistent with it being an intraslab earthquake, i.e. it occurred inside the subducting Pacific plate rather than on the plate interface.

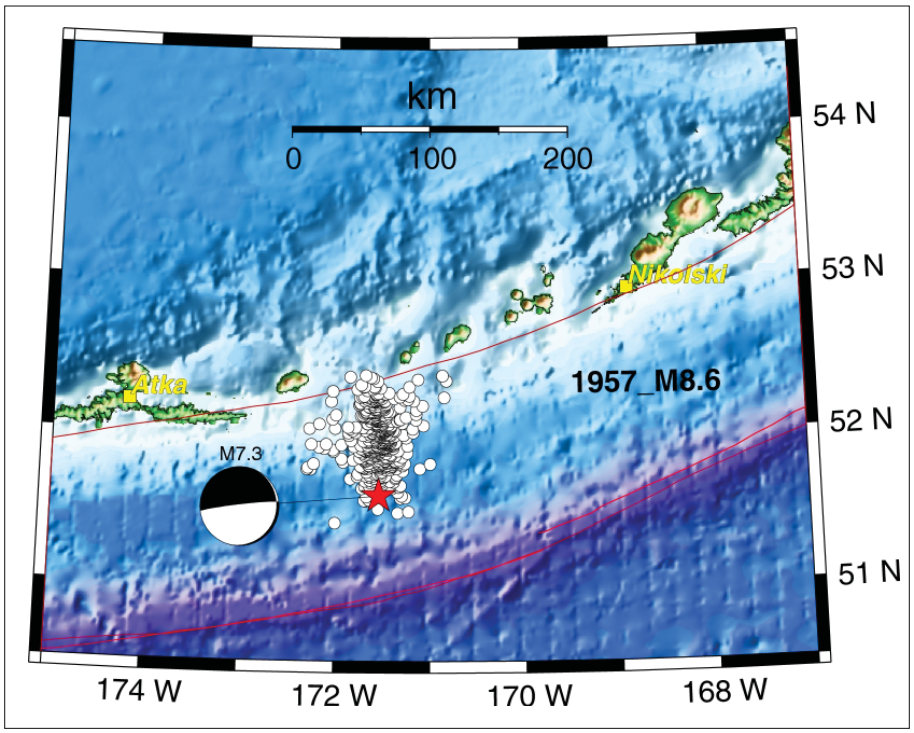

Figure 4. M7.3 June 24, 2011 Fox Islands earthquake.

September 2, 2011 M6.8 Fox Islands earthquake

Mainshock and aftershocks

A magnitude 6.8 earthquake occurred on Friday, September 2, 2011 at 2:55 am AKDT (10:55 am UTC) in the Fox Islands region of Alaska (red star on fig. 5). It was located 182 km (114 miles) E of Atka and 211 km (132 miles) WSW of Nikolski. This is an aftershock of the magnitude 7.3 earthquake that occurred on June 24 (yellow star on fig 5.). AEIC located about 300 aftershocks of the magnitude 6.8 event through the end of October, 2011 (white circles on fig. 5). About 20 aftershocks have magnitudes of 4.0 or greater. The two largest aftershocks, both of magnitude 5.7, occurred on September 19 and October 25. Due to the lack of seismic instrumentation in the region, only aftershocks of magnitude about 3 and above can be detected.

Tectonic summary

The Aleutian Islands region, where Pacific plate is being forced under the North American plate, is one of the world's most active seismic zones. In 1957, magnitude 8.6 Andreanof Islands earthquake ruptured a ~600 km-long portion of the plate boundary in the central Aleutian Islands. Both the June 24 M7.3 and September 2, M6.8 earthquake are located in the central part of the 1957 rupture zone. In 1986, a portion of the western half of the 1957 zone failed in an earthquake of magnitude 7.9. In 1996 another magnitude 7.9 earthquake appeared to have completed re-rupture of the western end of the 1957 zone, immediately westward of the 1986 region. No other major (magnitude 7 or greater) earthquakes occurred within the 1957 rupture zone up until June 24 event. Depth and faulting type of the June 24 and September 2 earthquakes are consistent with them being intraslab earthquakes, i.e. they occurred inside the subducting Pacific plate rather than on the plate interface.

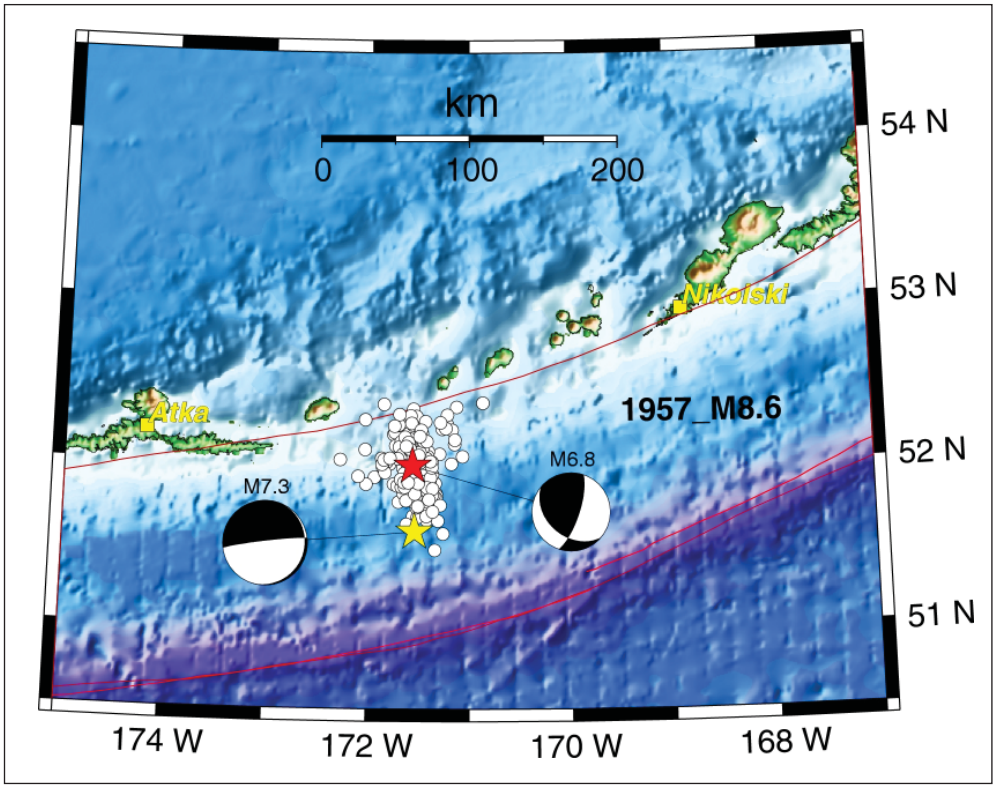

Figure 5. M6.8 September 2, 2011 Fox Islands earthquake.