SCHOOL HAZARD IDENTIFICATION & RISK MANAGEMENT IN ALASKA

Laura W Kelly, PE
US Coast Guard, Civil Engineer, Kodiak, AK – 2000-2013
USCG D17 Supervisory Engineer, CEU Juneau, AK – 2015-Present
Alaska Seismic Hazards Safety Commission, School Committee Chair, 2005-Present
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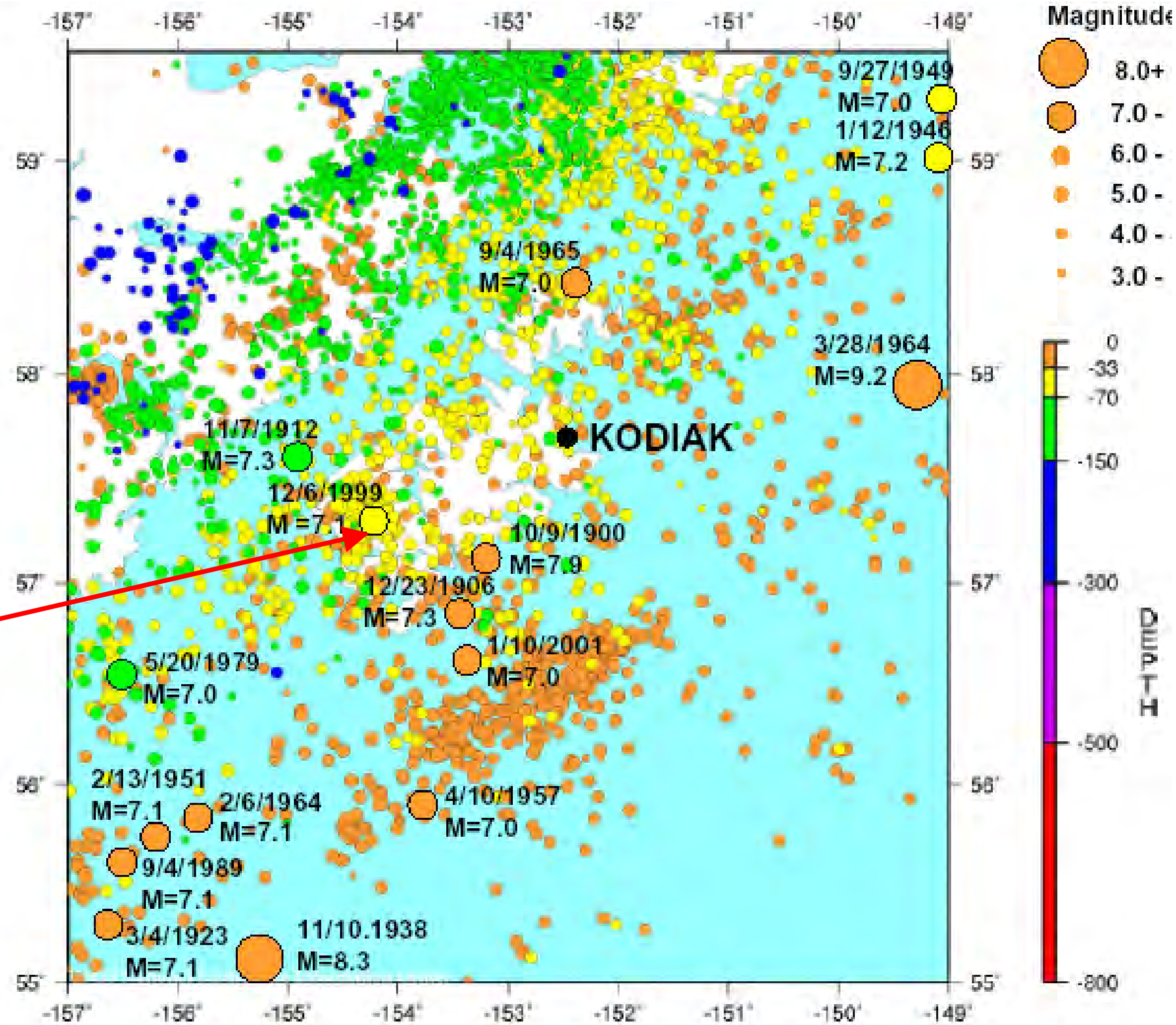
Alaska's Next Big Earthquake and Tsunami:
Mitigating Impacts Workshop
Anchorage, AK - May 09, 2017

Timeline

Year	US Coast Guard (USCG)	Kodiak Island Borough (KIB)	Alaska Seismic Hazards Safety Commission (ASHSC)
1999	LKelly moves to Kodiak, experiences first earthquake. Mw 7.0, 2 pm, Dec. 6th (weekday, school in session). (Local ground forces greater than 1964 earthquake.)		
2000	LKelly starts work in Kodiak Facilities Engineering Division as Federal Employee. Largest USCG Base with 75 commercial facilites, 2000 residents, water/wastewater/steam plants/hangars/piers.		
2001	Meet with Gary Carver, & invite him to present to USCG April, 2002.		
2002	USCG contracts Gary Carver for Hazard Identification Project. (Ground shaking, active faults, liquefiable soils, slope and ground failure, tsunami indundation.) Completed Spring 2003. Numerous problems identified. Nov. 3, 2002 Denali earthquake, M7.0	Carver/Kelly notify Borough of Peterson Elementary findings. (Carver discovers LKelly rec'd Alaska PE, and encourages proactive involvement.) Carver meets regularly with Borough, PTA, and School Boards with LKelly attending critical meetings.	House Bill 53 Establishes ASHSC.
2003	New active fault identified at Spruce Cape LORAN site near State Rocket Launch Facility.	LKelly volunteers in High School earth science classes. Meet with students to discuss seismic risk, careers associated with risk mitigation, and help assess local schools using RVS.	
2004		Local bond narrowly passes by 11 votes to evaluate schools for seismic risk. Staffing and PDM applications made with Legislative Approval, 2004-2006.	
2005		School Seismic Vulnerability Assessment, William Lettis & Associates, G&E Engineering (John Eidinger) and Goettel & Assoc. (Ken Goettel)	Official appointment of 9 members to ASHSC by Gov. Murkowski. First meeting October, 2005. Original members include 3 from Kodiak (Carver, Kelly, and Kodiak City Mngr-Freed).
2006	RVS for all USCG structures (non-residential) in Kodiak. Incorporated with Mission Dependency Indexing. All waterlines now being replaced with HDPE to improve performance in event of an earthquake.	RFP for Seismic Upgrades (Kodiak Middle School and High School), $2.1 Million. Five school retrofit projects continue through 2009.	ASHSC extended to 2012, added language to include tsunamis, added two more members (11 total) - funding remains $10K per year. Standing committees include focus on schools. Write white paper on School Seismic Safety Legislation.
2007			Draft Map - At-Risk Schools in Alaska. Presentation "Successful Implementaiton of Seismic Mitigation for Schools, Sept., 2007"
2008		Peterson Elementary retrofitted.	Contact Commissioner Larry LeDoux, Alaska Dept. of Education & Early Develoment (ADEED). Request appointment of representative (Sam Kito III) to ASHSC. Year of May 12, 2008 Sichuan China Mw 7.9 earthquake.
2009	LKelly, USCG Engineer of the Year; award includes recognition for seismic vulnerability studies and serving on the ASHSC.	KIBSD receives WSSPC Overall Award in Excellence for seismic mitigation of schools, Feb., 2009.	Utah State Office of Education, School Finance Director, Larry Newton – Jan 7, 2008 (presents Legislation model) Kito, ADEED, joins ASHSC School Committee. Obtain data base of schools and year of construction. John Aho/Sam Kito presentation to the State of Alaska Senate Education and Finance Committees, Junueau, AK. Map discussed.
2010		New police station construction completed. Old fire station remains concern.	Collaboration with ADEED results in developing new capital improvement project application form that specifically addresses seismic issues. Enters trial period. Yumei Wang, Oregon DOGAMI, presents information on Oregon's Seismic Rehabilitiation Grant Program. Publish map of Public Schools and Earthquake Hazards in Alaska in ASHSC Annual Report, Feb., 2010.
2011		Bud Cassidy, KIB, joins ASHSC.	Revise annual report map of schools to include policy recommendations.
2012	USCG supports LKelly participation in revision of FEMA 154 RVS as part of working group/review panel. 2012-2013. Final release ATC-71, Fall, 2014.		Recommended ADEED CIP changes formally implemented. Dr. Christine Theodoropoulos, Univ. of Oregon speaks to ASHSC about Oregon's achievements regarding seismic risk mitigation for schools and emergency facilities. Meet with Alaska PTA. Kito leaves ADEED.
2013	USCG supports LKelly transfer to Juneau. In close proximity to other USCG engineers, ADEED, Prof. Engineering organizations, and Legislature.		Apply for HMPG funding for RVS of schools -- funding cut. PTA adds concern to Legislative Issues, stating their support for structurally sound school buildings throughout the state of Alaska, for the safety of our children, parents, teachers and community members.
2014	Seismic awareness in Kodiak results in complete retrofit of 4 Barracks buildings, an RFP for retrofitting the most critical building on base (ComSta), and backlog of other mitigation projects - improperly braced overhead steam pipes in Hangars, replace cast iron waterline crossings, strengthen piers, etc. Bowling alley structurally retrofitted during energy upgrade.		ASHSC extended to 2020. Kito joins AK House of Representatives. Working with EERI on pilot program for RVS screening of Alaska schools. Modeling Utah's "Schools at Risk" RVS program. Suggest policy recommendation to incorporate RVS into Univ. of Alaska Engineering curriculum.
2015	Promoted to Supervisory Engineer - D17 Design & Construction		Fairbanks Next Big EQ Workshop, Nov, 2015. Presentation on Schools. Matanuska-Susitna School RVS Feb 6, 2015. Kenai Borough Schools RVS - Dec 1, 2015
2016	USCG initiates and completes draft study for all hazards based on Kodiak work		Awarded contract to screen Fairbanks schools
2017	May 1, 2017 two EQ M6.1-M6.2 Haines Hwy.		June 1, final RVS due for Fairbanks North Star Borough Schools.

Kodiak Region Seismicity

Mw 7.1, 2 pm, Dec. 6th, **1999**



Kodiak Region Seismicity - NEIC Catalogue
Magnitude 3.0 - 6.9 , 1973 - 2002; Magnitude 7.0 +, 1900 - 2002

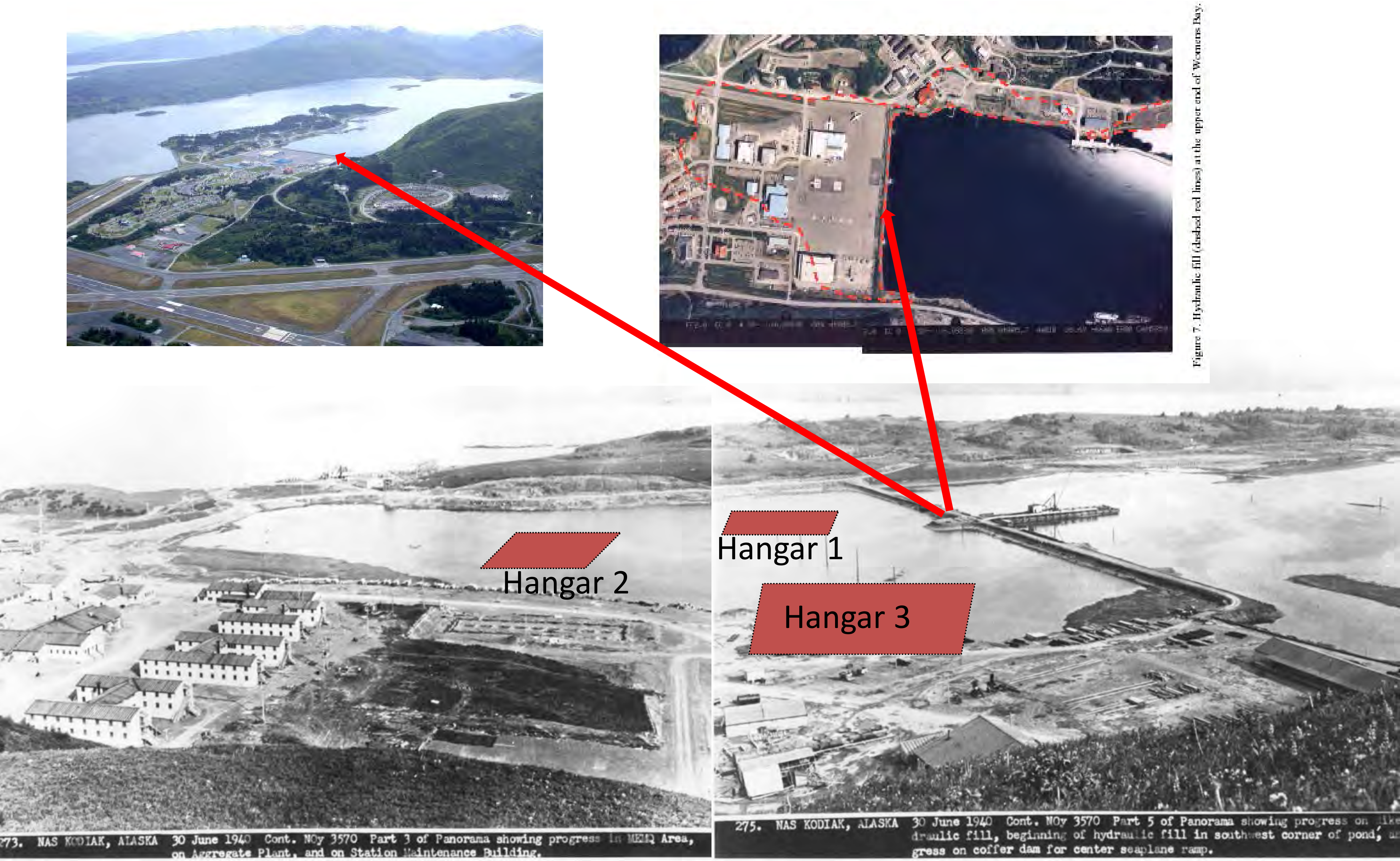
Summer 1999, LKelly moves to Kodiak, & soon experiences first earthquake.
Mw 7.1, 2 pm, Dec. 6th, **1999**, weekday, school in session. (Local ground forces greater than 1964 earthquake.) Start working for USCG Facilities Engineering Division, Feb., **2000**.

2001-2003*,*
Dr. Gary Carver, paleo-seismologist/ geologist works with USCG to identify local seismic hazards.

Figure 7. Hydraulic fill (dashed red lines) at the upper end of Womens Bay.

Hydraulic Fill Area, USCG Base Kodiak

(Hazard analysis reveals that recent seismic retrofits did not take liquefiable soils into consideration)



Historical Panoramic Photograph of Womens Bay, Kodiak, June 1940.

2003 Report to USCG

Gary Carver/William Lettis & Associates formally identify active fault at LORAN Station, Narrow Cape, Kodiak Island (Fault changes predicted ground motions in IBC).

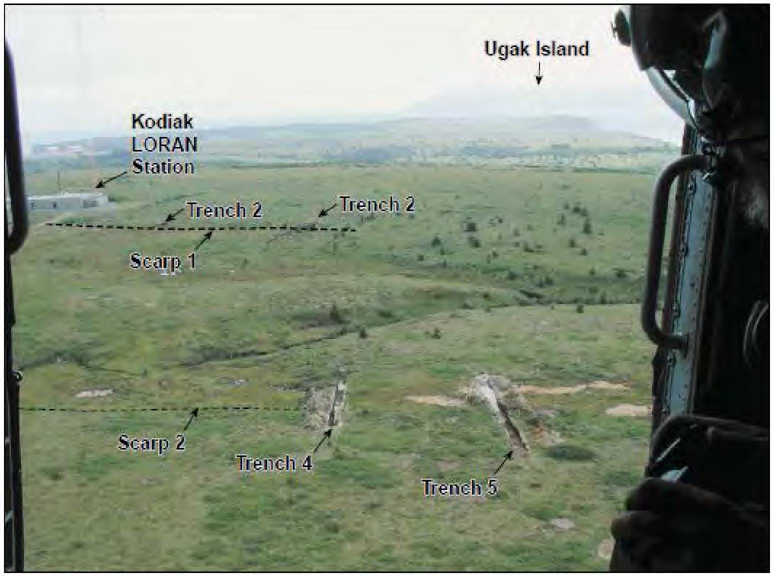


Photo 2. Oblique aerial view of Kodiak LORAN Station and trenches excavated across scarps 1 and 2. Trench 3, located immediately northeast (left) of Trench 1, was excavated after the aerial reconnaissance of the site.

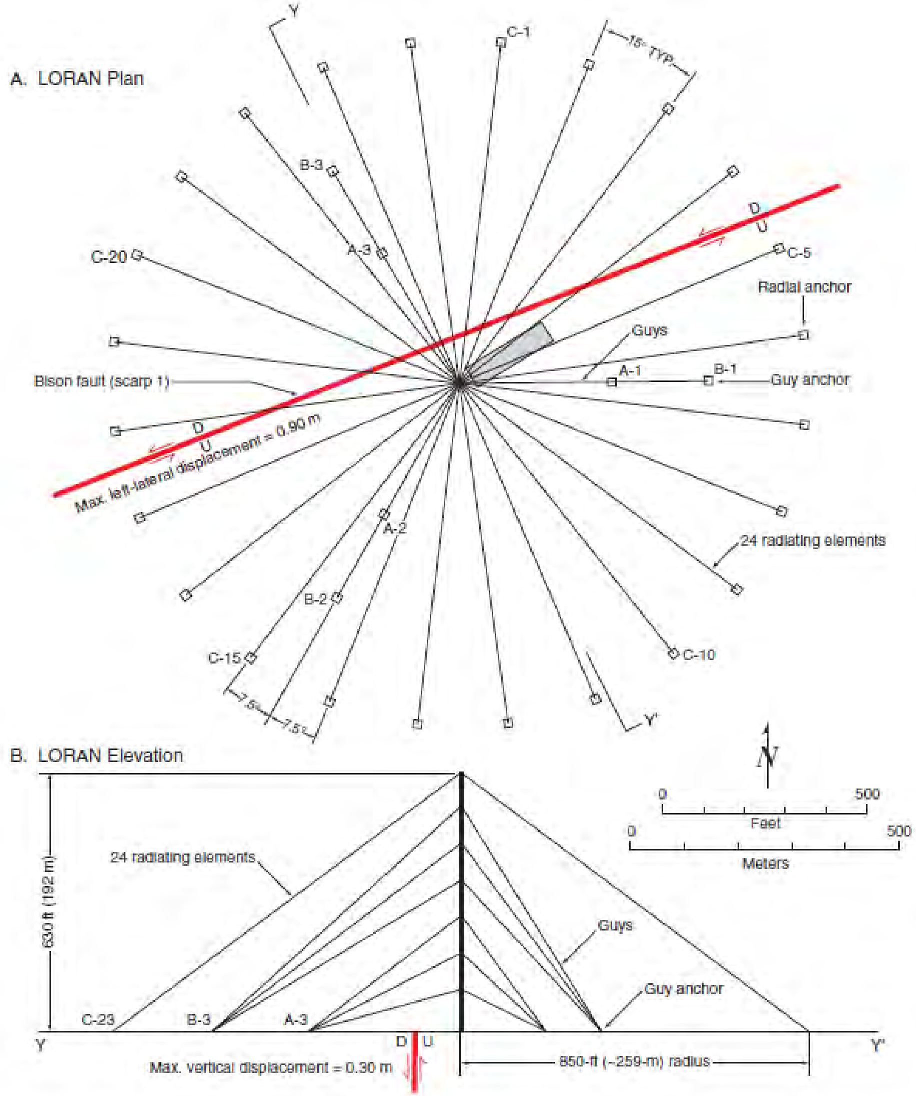


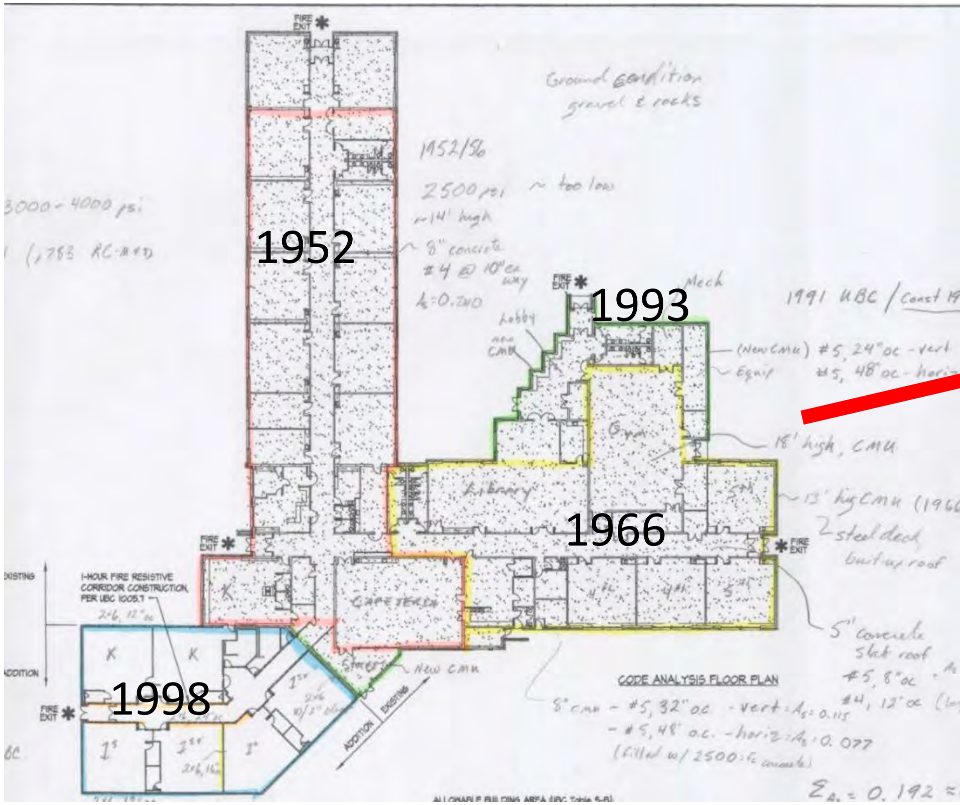
Figure 14. Plan and elevation designs for Kodiak LORAN guy and radial array and anchor system showing location of the Bison fault (scarp 1). Based on paleoseismic trenching of scarp 1, the maximum lateral component of slip (A) assuming a lateral-to-vertical slip ratio of 3:1 is 0.90 m. The maximum vertical component of slip (B) expected is 0.30 m (Table 3).

1499b Kodiak

Lettis & Associates later become involved with school hazard identification in Kodiak. Revised ground forces from LORAN project quantified and incorporated into school analysis.

1499b Kodiak

*(Information excerpted from report to USCG, **2003**.*
Structural Engineer later examines Navy drawings of 1952 school, and identifies flaws in wood ledger board connecting concrete walls to roof.
Formal meeting held to notify school board and PTA, after confirming lack of retrofit with Borough Engineer.)



Peterson Elementary:
280 Students, 40 Staff

(Approx. 200 occupants are USCG family members.)

Peterson Elementary (Borough Property)

Age - This building was constructed by the Navy in the 1950s, and modified by 1966/1993/1998 additions which did not address structural rehabilitation of the original structure that comprises 45% of the total square footage of the building.

Tsunami is a minor threat with a foundation elevation of 48 feet. It was not inundated in 1964.

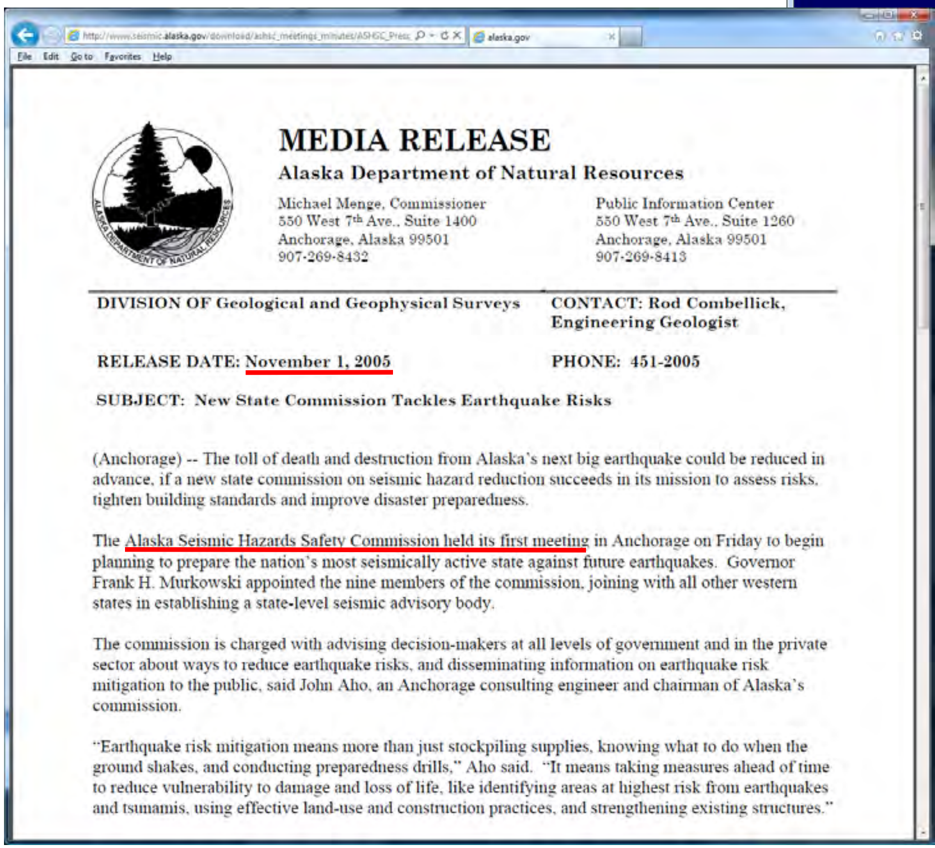
ASHSC Alaska Seismic Hazards Safety Commission

Fall 2005

First meeting held by the ASHSC.

www.seismic.alaska.gov

(11 Members, budget $10K/year)



MEDIA RELEASE

Alaska Department of Natural Resources

Michael Menge, Commissioner
550 West 7th Ave., Suite 1400
Anchorage, Alaska 99501
907-269-8432

Public Information Center
550 West 7th Ave., Suite 1260
Anchorage, Alaska 99501
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DIVISION OF Geological and Geophysical Surveys

CONTACT: Rod Combellick, Engineering Geologist

RELEASE DATE: November 1, 2005

PHONE: 451-2005

SUBJECT: New State Commission Tackles Earthquake Risks

(Anchorage) -- The toll of death and destruction from Alaska's next big earthquake could be reduced in advance, if a new state commission on seismic hazard reduction succeeds in its mission to assess risks, tighten building standards and improve disaster preparedness.

The Alaska Seismic Hazards Safety Commission held its first meeting in Anchorage on Friday to begin planning to prepare the nation's most seismically active state against future earthquakes. Governor Frank H. Murkowski appointed the nine members of the commission, joining with all other western states in establishing a state-level seismic advisory body.

The commission is charged with advising decision-makers at all levels of government and in the private sector about ways to reduce earthquake risks, and disseminating information on earthquake risk mitigation to the public, said John Aho, an Anchorage consulting engineer and chairman of Alaska's commission.

"Earthquake risk mitigation means more than just stockpiling supplies, knowing what to do when the ground shakes, and conducting preparedness drills," Aho said. "It means taking measures ahead of time to reduce vulnerability to damage and loss of life, like identifying areas at highest risk from earthquakes and tsunamis, using effective land-use and construction practices, and strengthening existing structures."

1/5 the size of the "Lower 48"

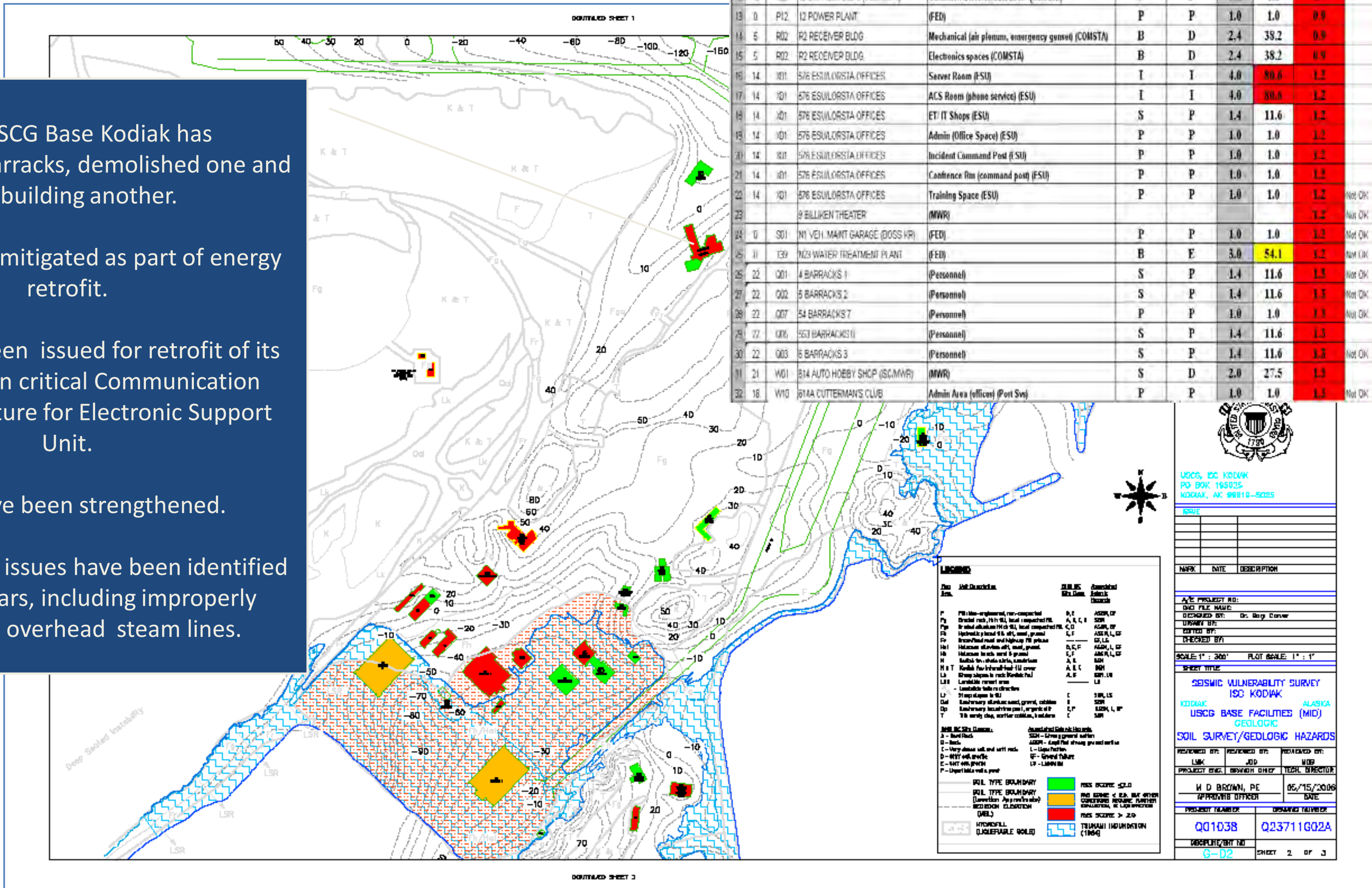
Pop. 735,000
25% under age 18

49th State, 1959

2006: Formal RVS of all USCG critical structures.

Liquefiable soils and tsunami inundation lines clearly mapped.

	Site	RPFN	Facility Name	Functional Element	Question 1 (I,B,S,P)	Question 2 (I,E,D,P)	Matrix Score	MD_W	Seismic Score If < 2.0, Needs Eval.	
3		W05	PIER FUEL (S40)	Shore Power (Port Svs)	S	E	2.6	43.5	1.0	
4		W05	PIER FUEL (S40)	Ships Berthing (Port Svs)	S	E	2.6	43.5	1.0	
5	13	W05	PIER-FUEL (S40)	Loading/Unloading (Port Svs)	P	E	2.2	32.8	1.0	
6	13	W05	PIER-FUEL (S40)	Refueling (Port Svs)	S	P	1.4	11.6	1.0	
7	13	S39	N45 Ready Crew Bldg		P	P	1.0	1.0	0.5	
8	18	W02	PIER-CARGO (613)	Loading/Unloading (Port Svs)	B	E	3.0	54.1	0.5	
9	18	W02	PIER-CARGO (613)	Shore Power (Port Svs)	S	E	2.6	43.5	0.5	Not OK
10	18	W02	PIER-CARGO (613)	Ships Berthing (Port Svs)	S	E	2.6	43.5	0.5	Not OK
11	19	S27	27 DRY STORAGE WAREHOUSE	Storage Area (Commissary)	S	P	1.4	11.6	0.6	Not OK
12	15	T02	T2 SUPPORT BLDG (COMMSTA)	COMMUNICATIONS BUILDING (COMSTA)	P	P	1.0	1.0	0.7	
13	0	P12	12 POWER PLANT	(FED)	P	P	1.0	1.0	0.9	
14	5	R02	R2 RECEIVER BLDG	Mechanical (air plenum, emergency genset) (COMSTA)	B	D	2.4	38.2	0.9	
15	5	R02	R2 RECEIVER BLDG	Electronics spaces (COMSTA)	B	D	2.4	38.2	0.9	
16	14	X01	576 ESU/LORSTA OFFICES	Server Room (ESU)	I	I	4.0	80.6	1.2	
17	14	X01	576 ESU/LORSTA OFFICES	ACS Room (phone service) (ESU)	I	I	4.0	80.6	1.2	
18	14	X01	576 ESU/LORSTA OFFICES	ET/ IT Shops (ESU)	S	P	1.4	11.6	1.2	
19	14	X01	576 ESU/LORSTA OFFICES	Admin (Office Space) (ESU)	P	P	1.0	1.0	1.2	
20	14	X01	576 ESU/LORSTA OFFICES	Incident Command Post (ESU)	P	P	1.0	1.0	1.2	
21	14	X01	576 ESU/LORSTA OFFICES	Confrence Rm (command post) (ESU)	P	P	1.0	1.0	1.2	
22	14	X01	576 ESU/LORSTA OFFICES	Training Space (ESU)	P	P	1.0	1.0	1.2	Not OK
23			9 BILLIKEN THEATER	(MWR)					1.2	Not OK
24	0	S01	N1 VEH. MAINT GARAGE (DOSS KR)	(FED)	P	P	1.0	1.0	1.2	Not OK
25	0	T39	N23 WATER TREATMENT PLANT	(FED)	B	E	3.0	54.1	1.2	Not OK
26	22	Q01	4 BARRACKS 1	(Personnel)	S	P	1.4	11.6	1.3	Not OK
27	22	Q02	5 BARRACKS 2	(Personnel)	S	P	1.4	11.6	1.3	Not OK
28	22	Q07	54 BARRACKS 7	(Personnel)	P	P	1.0	1.0	1.3	Not OK
29	22	Q06	553 BARRACKS 6	(Personnel)	S	P	1.4	11.6	1.3	
30	22	Q03	6 BARRACKS 3	(Personnel)	S	P	1.4	11.6	1.3	Not OK
31	21	W01	614 AUTO HOBBY SHOP (ISC/MWR)	(MWR)	S	D	2.0	27.5	1.3	
32	18	W10	614A CUTTERMAN'S CLUB	Admin Area (offices) (Port Svs)	P	P	1.0	1.0	1.3	Not OK



2014 USCG Base Kodiak has retrofitted 4 Barracks, demolished one and is rebuilding another.

Bowling Alley mitigated as part of energy retrofit.

An RFP has been issued for retrofit of its most mission critical Communication Station structure for Electronic Support Unit.

Piers have been strengthened.

Non-structural issues have been identified in the Hangars, including improperly supported overhead steam lines.

2004-2009
KIBSD Seismically Retrofits Five Schools

"Kodiak has done a truly exceptional job for a small community, from funding the bond to doing the risk assessment to developing a robust hazard mitigation plan, identifying the schools as a priority and then going forth and fixing the major problems - all in an exceptionally short time. I don't know of any community, of any size, that has done a better job and certainly none that has done more or even anywhere near as much on a per capita basis."
-Ken Goettel, Goettel & Associates, Inc., Oct. 10, 2008

2009 Kodiak Island Borough receives WSSPC Overall Award in Excellence for seismic retrofit of schools.

Life Safety Risk

Hazard	Deaths per 1,000,000 people	Statistical Average Deaths Per Year
Vehicle Accident	186	
Middle School	469	0.100
Peterson School	400	0.021
Ouzinkie School	293	0.010
KHS Library	238	0.053
KHS Gym	30	0.001

Life Safety Risk

Hazard	US Deaths per Year	Deaths per 1,000,000 people
Tornado	44	0.18
Lightning	90	0.36
Flood	97	0.39
Assault by knife	2,074	8
Fire	3,380	14
Assault by firearm	11,829	47
Falls	16,257	65
Vehicle Accident	46,466	186

Middle school (old wings) Earthquake Life Safety Risk	
School day occupancy	213
Statistical Deaths per Year	0.0998
Deaths per 1,000,000	469
About 2.5 times vehicle death rate	

Key Findings

School	Cost	Benefits	BCR
Middle	$1,192,000	$8,010,000	6.72
Ouzinkie	$149,000	$975,000	7.55
Peterson	$509,000	$1,862,000	3.66
HS Library	$465,000	$4,453,000	9.59
HS Gym	$410,000	$417,000	1.02
Non-Structural	$363,000	-	
Total	**$3,088,000**	**$15,717,000**	**5.09**

Similar risk correlation to be added to revised FEMA 154 RVS (ATC-71, Fall 2014)

Why Identify and Mitigate????

Proof that Modern Seismic Codes in Schools Can Save Lives:

2008 China Sichuan Earthquake, Mw 7.9 (69,000 deaths, 7,000 schools collapsed)
These two modern school buildings performed well. All occupants survived.

Fault Surface Rupture

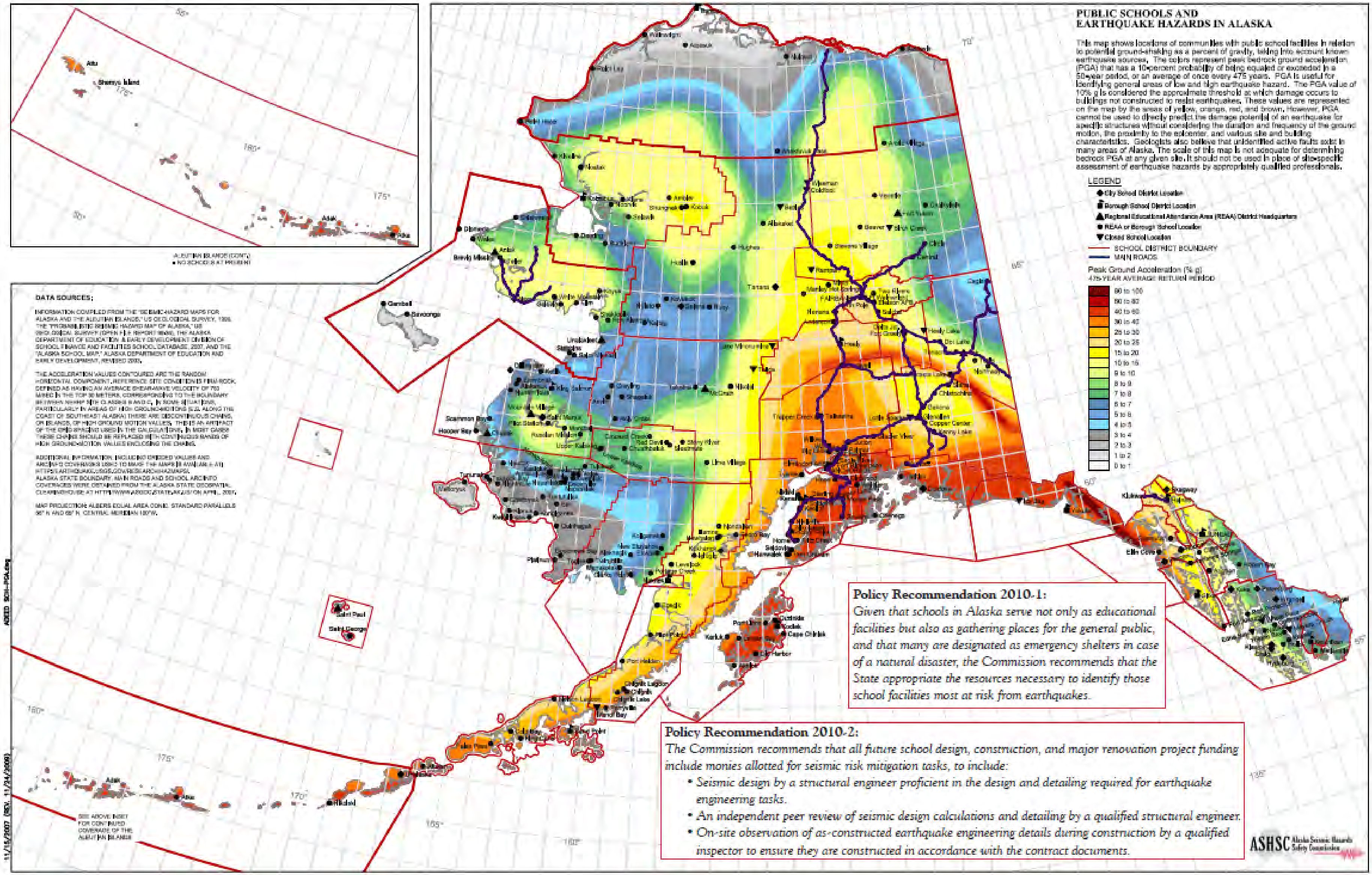
(Note buildings in background collapsed into rubble.)

Diligence Building – almost intact
(5-10 year old construction)

Learning Building – basically intact
(10-15 year old construction)

ASHSC Alaska Seismic Hazards Safety Commission

2010 Map of Schools and Earthquake Hazards appear in ASHSC Annual Report. Presented to members of Legislature by John Aho (ASHSC) and Sam Kito (ADEED)



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.*

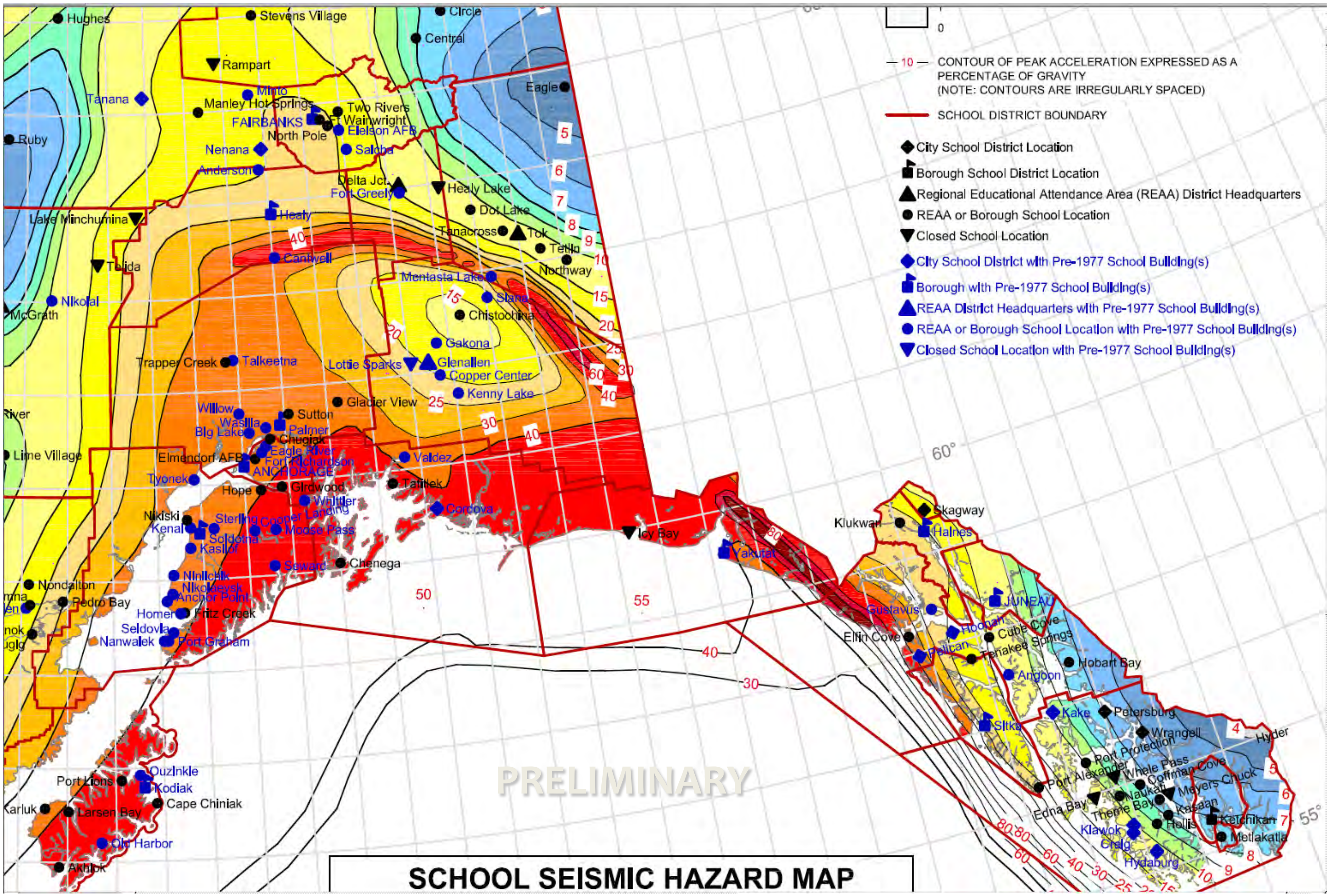
ASHSC Alaska Seismic Hazards Safety Commission

DETAILS OF REGION WITH HIGHEST SEISMIC HAZARDS, AND ASHSC PLAN FORWARD

ASHSC Alaska Seismic Hazards Safety Commission

- Recognition of Problem
- Identification of Structures at Risk
- Prioritization of Mitigation
- Final Determination of Remediation Projects

Communities with Highest Potential Peak Ground Acceleration & Educational Facilities Built Prior to 1976



Spring 2011
Mw 9.0 Earthquake and Tsunami in Japan

"High dwellings are the peace and harmony of our descendants," the stone slab reads. "Remember the calamity of the great tsunamis. Do not build any homes below this point.“ - 600+ year old marker, ANEYOSHI, JAPAN

Through history, this community elected to not allow construction below this marker. Consequently, their homes were spared by the March 11, 2011 tsunami.

In a neighboring community, a school had been constructed 500 feet from the ocean’s edge… the children attending that school were not found.

NOTE: In some communities these markers were submerged.

2012 – After trial period, ADEED officially incorporates seismic work as a line item for school improvement projects.
(Result of partnership of ASHSC/ADEED from 2009-2012)

Application for Funding
Capital Improvement Project by Grant
or
State Aid for Debt Retirement

FY 2016

For each funding request submit one original and three complete copies of this application and two copies of each attachment.

For instructions on completing this application, please refer to the department's Capital Project Information and References website at:

http://education.alaska.gov/facilities/FacilitiesCIP.html

(Note: The department will only score ten projects from each district during a single rating period)

School District: ____________________

Community: ____________________

School Name: ____________________

Project Name: ____________________

TYPE OF PROJECT AND FUNDING REQUEST

1. Type of funding requested *(Choose only one funding source.)*
   ☐ Grant Funding ☐ Aid for Debt Retirement (Bonding)

2a. Primary purpose of project *(Choose only one category, per AS 14.11.013 for grant projects, or AS 14.11.100(j)(4) for debt retirement projects). The department will change a project category as necessary to reflect the primary purpose of the project.*[1]

School Construction:	Major Maintenance:
☐ Health and life-safety (Category A, this category is not available for debt retirement)	☐ Protection of structure (Category C, this category is not available for debt retirement)
☐ Unhoused students (Category B; Category A for debt retirement)	☐ Building code deficiencies (Category D; Category B for debt retirement)
☐ Improve instructional program (Category F; Category D for debt retirement)	☐ Achieve operating cost savings (Category E; Category C for debt retirement)

b. Phases of project to be covered by this funding request *(Indicate all applicable phases)*
   ☐ Planning (Phase I) ☐ Design (Phase II) ☐ Construction (Phase III)

[1] The department's authority to assign a project to its correct category is established in AS 14.11.013(c)(1) and in AS 14.11.013(a)(1) under its obligation to verify a project meets the criteria established by the Bond Reimbursement & Grant Review Committee under AS 14.11.014(b)

COST ESTIMATES

18. Complete the following tables using the Department of Education & Early Development's 13th Edition Cost Model or an equivalent cost estimate. Completion of the tables is **mandatory**. (30 points possible)

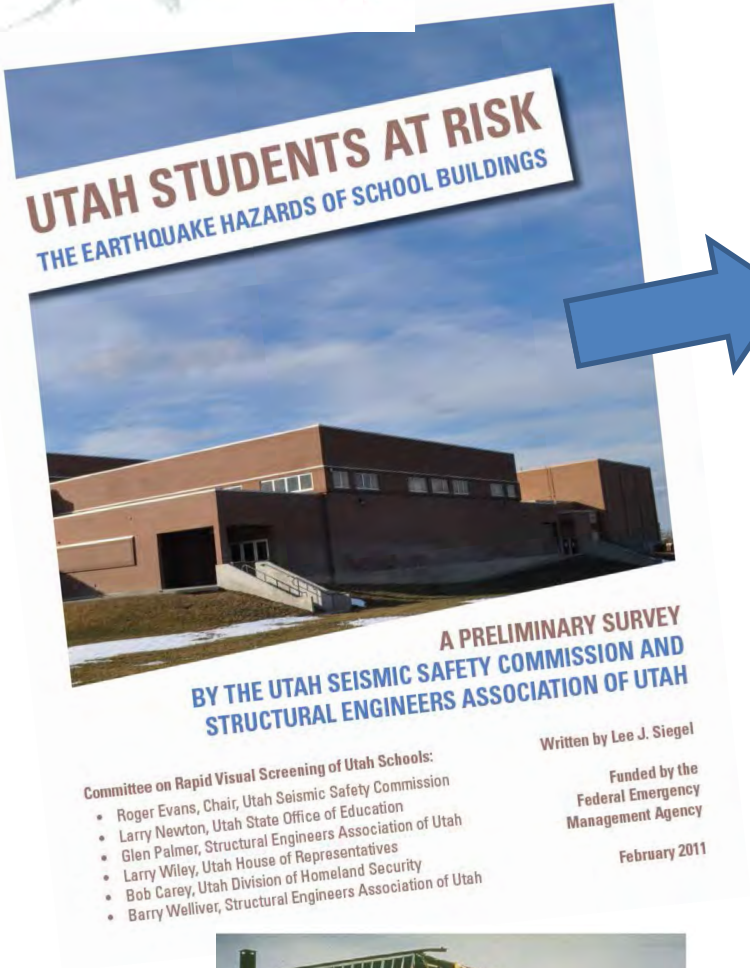
(Percentages are based on construction cost. See Appendix C for additional information. If your project exceeds the recommended percentages, you must provide a detailed justification for each item exceeding the percentage. The total of all additive percentages should not exceed 130%, if the additive percentages exceed 130% a detailed explanation must be provided or the department will adjust the percentages to meet the individual and overall percentage guidelines)

Table 1. TOTAL PROJECT COST ESTIMATE

Project Budget Category	Maximum % without justification	I Prior AS 14.11 Funding	II Current Project Request	III % of Total Construction Cost	IV Project Total
CM - By Consultant [1]	2 - 4%				
Land [2]					
Site Investigation [2]					
Seismic Hazard [7]					
Design Services	6 - 10%				
Construction [3]					
Equipment & Technology [2,5]	up to 10%				
District Administrative Overhead [4]	up to 9%				
Art [6]	0.5% or 1%				
Project Contingency	5%				
Project Total					

1. *Percentage is established by AS 14.11.020(c) for consultant contracts (Maximum allowed percentage by total project cost: $0-$500,000 – 4%; 500,001- $5,000,000 – 3%; over $5,000,000 – 2%).*
2. *Include only if necessary for completion of this project. Amounts included for Land and Site Investigation costs need to be supported in the Project Description (Question 17), and supporting documentation should be provided in the attachments.*
3. *Attach detailed construction cost estimate and life cycle cost if new-in-lieu-of-renovation.*
4. *Includes district/municipal/borough administrative costs necessary for the administration of this project; This budget line will also include any in-house construction management cost.*
5. *Equipment and technology costs should be calculated based on the number of students to be served by the project. See the department's publication, Guidelines for School Equipment Purchases for calculation methodology (2005). The department will accept a 5% per year inflation rate (from the base year of 2005) added to the amounts provided in the Guideline. Technology is included with Equipment.*
6. *Only required for renovation and construction projects over $250,000 that require an Educational Specification (AS 35.27.020(d)).*
7. *Costs associated with assessment, design, design review, and special construction inspection services associated with seismic hazard mitigation of a school facility. This amount needs to be provided by a design consultant, and should not be estimated based on project percentage.*

ASHSC Alaska Seismic Hazards Safety Commission


UTAH STUDENTS AT RISK

THE EARTHQUAKE HAZARDS OF SCHOOL BUILDINGS

A PRELIMINARY SURVEY

BY THE UTAH SEISMIC SAFETY COMMISSION AND STRUCTURAL ENGINEERS ASSOCIATION OF UTAH

Written by Lee J. Siegel

Committee on Rapid Visual Screening of Utah Schools:

- Roger Evans, Chair, Utah Seismic Safety Commission
- Larry Newton, Utah State Office of Education
- Glen Palmer, Structural Engineers Association of Utah
- Larry Wiley, Utah House of Representatives
- Bob Carey, Utah Division of Homeland Security
- Barry Welliver, Structural Engineers Association of Utah

Funded by the Federal Emergency Management Agency

February 2011

Government Hill Elementary School after the 1964 Earthquake

Alaska Seismic Hazards Safety Commission- Pilot Program:
Rapid Visual Screening of Alaska School Buildings

Summer 2014

Alaska Seismic Hazards Safety Commission- Pilot Program: Rapid Visual Screening of Alaska School Buildings

Alaska Seismic Hazards Safety Commission	
Address:	PO Box 25517 Juneau, AK 99802
Contact:	Laura W. Kelly, PE
Phone:	(907) 463-2424
E-Mail:	Laura.W.Kelly@uscg.mil

Earthquake Engineering Research Inst.	
Address:	499 14th St, Suite 220 Oakland, CA 94612-1934
Contact:	Jay Berger, Executive Director
Phone:	(510) 451-0905
E-Mail:	JBerger@eeri.org

Project Name:	ASHSC Pilot Program: Rapid Visual Screening of Alaska School Buildings		
Effective:	6/2/2014	**Ending:**	1/2/2015
Description:	The Alaska Seismic Hazards Safety Commission (ASHSC) respectfully requests the Earthquake Engineering Research Institute (EERI) to hire a consultant with an Alaska PE license to set up and implement a pilot program for conducting Rapid Visual Screenings (RVS) of Alaska schools using FEMA 154/ROVER. As part of a pilot study, identify and work with a supportive school district in or near Anchorage, AK, and screen as many at-risk schools as feasible (approximately 5-10) within allotted budget. Develop protocol for collecting, managing, and reporting final results. Make recommendations for implementing on a district-by-district basis, and potentially at the state-wide level.		

ASHSC Alaska Seismic Hazards Safety Commission

Project Scope/Deliverables

1. Work with the ASHSC to identify a school district willing to participate in a RVS pilot study. The school district must be located in Anchorage or on the adjoining road system in order to minimize travel & per diem costs. Though not required, it is preferred that as-built drawings for the school buildings be available in advance, to improve speed and reliability of screening. Upon request, the ASHSC can provide a map of Alaska school districts and seismic hazards, student attendance numbers, and database of school building information sorted by local peak ground motions, and year of construction.
2. Purchase a laptop and/or mobile device for installation, operation, collection and management of FEMA 154/ROVER software/data. Provide to ASHSC upon completion of pilot study for future use and data collection/management. FEMA ROVER software is free of cost. Upon request, the ASHSC can provide information describing ROVER software applications.
3. Perform RVS of approximately 5-10 schools considered at-risk. If schools are newly constructed and meet modern seismic code, do not screen. Screener shall have an Alaska Professional Engineering license and a strong background in structural and earthquake resistant design. Experience with RVS/ROVER preferred.
4. Compile results in a final report. Final product shall serve as a Proof of Concept, and establish protocols and a cost basis for future work. Refer to the Utah Seismic Safety Commission's pilot test in Salt Lake City as a model. Intent is to utilize final product as an example for justifying and performing RVS in other Alaska school districts. Final report may also be used to persuade state legislators to fund a RVS program on a state-wide basis, or to obtain future grant funding. See Attachment 1, "Utah Students at Risk" by the Utah Seismic Safety Commission.

Estimated Budget	Terms	Cost
Consutlting (including travel & per diem)	40 hours @ $150/hr	$6,000
Hardware (laptop computer/portable device/setup)	1 lump sum	$1,000
Software (ROVER) - Free from FEMA	No Cost	$0
Final Report	5 Hard Copies, 1 Digital CD	$500

Total Cost: **$7,500**

ASHSC Alaska Seismic Hazards Safety Commission

Pilot RVS – Mat-Su School District (14% of Alaska's student base)

February 2015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BBFM Engineers Inc.

Identifying Potential Earthquake Dangers
To Alaska's Students and Schools
A Pilot Project Screening Matanuska-Susitna School District Buildings
February 6, 2015

Study Conducted by: BBFM Engineers, Inc.
Sponsored by:

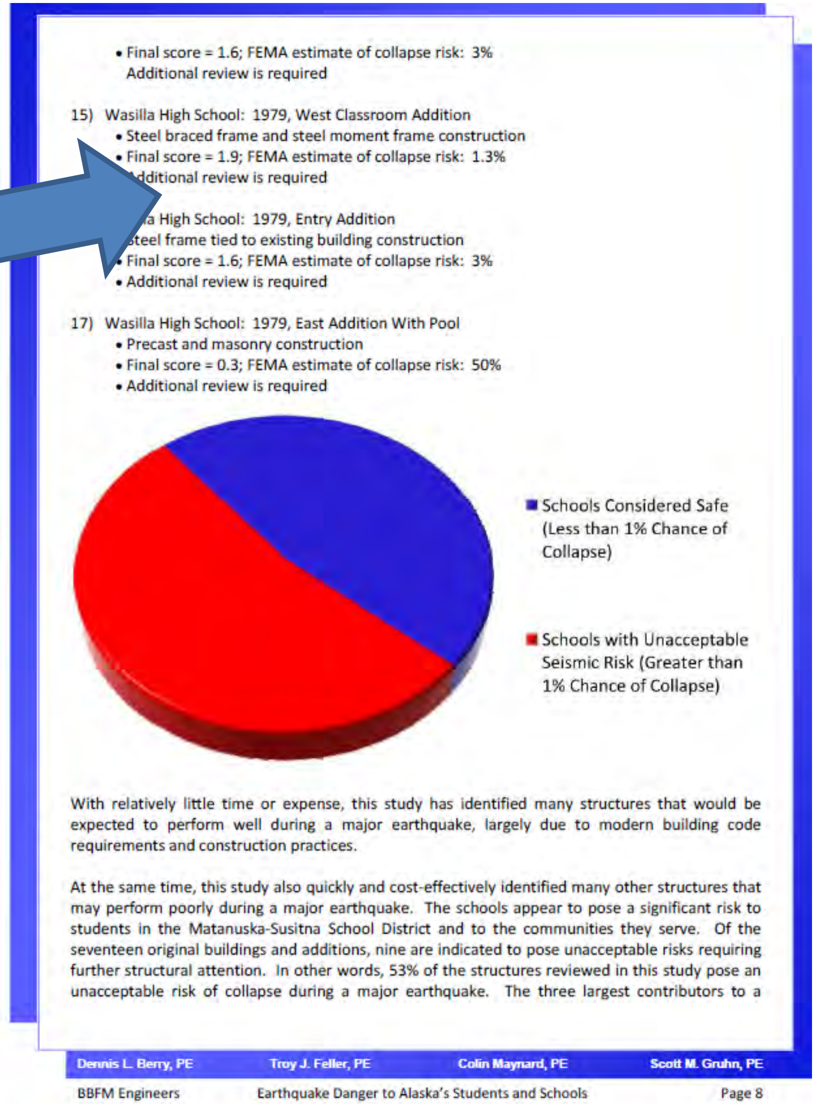
The Federal Emergency Management Agency (FEMA)
The Department of Homeland Security (DHS)
The Earthquake Engineering Research Institute (EERI)
The Alaska Seismic Hazards Safety Commission (ASHSC)

Sites of major earthquakes in the US

Alaskan Seismicity: Alaska is among the most seismically active areas on Earth. Over the past 50 years, the United States Geological Survey (USGS) recorded in the United States more than 3,000 earthquakes more powerful than magnitude 5, with approximately 80% of these occurring in Alaska. Further, of the twelve most powerful earthquakes America has ever experienced, ten were situated in Alaska. These include the 1964 Great Alaska Earthquake, which remains the second most powerful ever measured on Earth.

Alaska's intense seismicity is a result of plate tectonics. The Pacific Plate, moving north 2" to 3" per year, slides below the North American Plate at a fault called the Aleutian Megathrust. This tectonic collision and subduction is able to produce an earthquake up to magnitude 9.2, according to the Federal Emergency Management Agency (FEMA). Many other faults occur around the state, and

Dennis L. Berry, PE | Troy J. Feller, PE | Colin Maynard, PE | Scott M. Gruhn, PE
BBFM Engineers | Earthquake Danger to Alaska's Students and Schools | Page 1


- Final score = 1.6; FEMA estimate of collapse risk: 3%
  Additional review is required

15) Wasilla High School: 1979, West Classroom Addition
- Steel braced frame and steel moment frame construction
- Final score = 1.9; FEMA estimate of collapse risk: 1.3%
- Additional review is required

16) Wasilla High School: 1979, Entry Addition
- Steel frame tied to existing building construction
- Final score = 1.6; FEMA estimate of collapse risk: 3%
- Additional review is required

17) Wasilla High School: 1979, East Addition With Pool
- Precast and masonry construction
- Final score = 0.3; FEMA estimate of collapse risk: 50%
- Additional review is required

With relatively little time or expense, this study has identified many structures that would be expected to perform well during a major earthquake, largely due to modern building code requirements and construction practices.

At the same time, this study also quickly and cost-effectively identified many other structures that may perform poorly during a major earthquake. The schools appear to pose a significant risk to students in the Matanuska-Susitna School District and to the communities they serve. Of the seventeen original buildings and additions, nine are indicated to pose unacceptable risks requiring further structural attention. In other words, 53% of the structures reviewed in this study pose an unacceptable risk of collapse during a major earthquake. The three largest contributors to a

Dennis L. Berry, PE | Troy J. Feller, PE | Colin Maynard, PE | Scott M. Gruhn, PE
BBFM Engineers | Earthquake Danger to Alaska's Students and Schools | Page 8

Cost of this Study:
The total cost of this study was approximately $18,500. Of this, BBFM Engineers was paid $8,500 for this study, resulting in a donated effort of approximately $10,000. Of this, $4,275 was spent on setting up the server and becoming acquainted with the software. Another $8,145 was spent reviewing drawings, visiting the schools, and entering data into the server. Finally, a little over $6,000 was spent preparing this report.

Pilot study proved that an RVS for a school structure in Alaska could be performed for approximately $600 to $800 per original structure or addition, plus costs associated with transportation.

The method used by FEMA P-154 to evaluate a building is quite straightforward. It establishes an initial score for each type of structural system (wood shear walls, steel braced frame, and so forth), with a higher score indicating greater reliability. A given building's initial score is then modified (up or down) based on other factors, including the number of stories, vertical structural irregularities, plan structural irregularities, probable soil type, whether it was designed and constructed before codes were generally enforced, and whether it was designed and constructed under substantially modern codes. The user enters the building information, adding and subtracting from the initial score to obtain the final score. FEMA carefully selected the scores and modifications so the final score could carry some readily understandable information. The Third Edition of FEMA 154 notes, in section 5.2:

> Fundamentally, the final S score is an estimate of the probability (as described in Chapter 1) if an earthquake occurs with ground motions called the risk-targeted maximum considered earthquake, MCE_R, as described in Chapter 2...
> A final score, S, of 3 implies there is a chance of 1 in 10^3, or 1 in 1,000, that the building will collapse if such ground motions occur. A final score, S, of 2 implies there is a chance of 1 in 10^2, or 1 in 100, that the building will collapse if such ground motions occur.

BBFM Engineers makes no statement about these probabilities except to note FEMA's intent in developing the scoring process. Typically a final score below 2.0 is taken as indication that a more detailed investigation is warranted, although that value can be adjusted at the outset of an evaluation project as desired by the owner of the facilities.

Importantly, these scores and risks do not take into account actual member strengths or actual connection reliability, only what is common for similar structural types of similar age. Therefore, the actual building safety may be substantially different from what the scores may indicate. Accordingly, buildings with low scores are noted as requiring further structural investigation to determine whether structural upgrade is warranted. These scores can be used appropriately to identify and rank buildings for their vulnerability to earthquake damage.

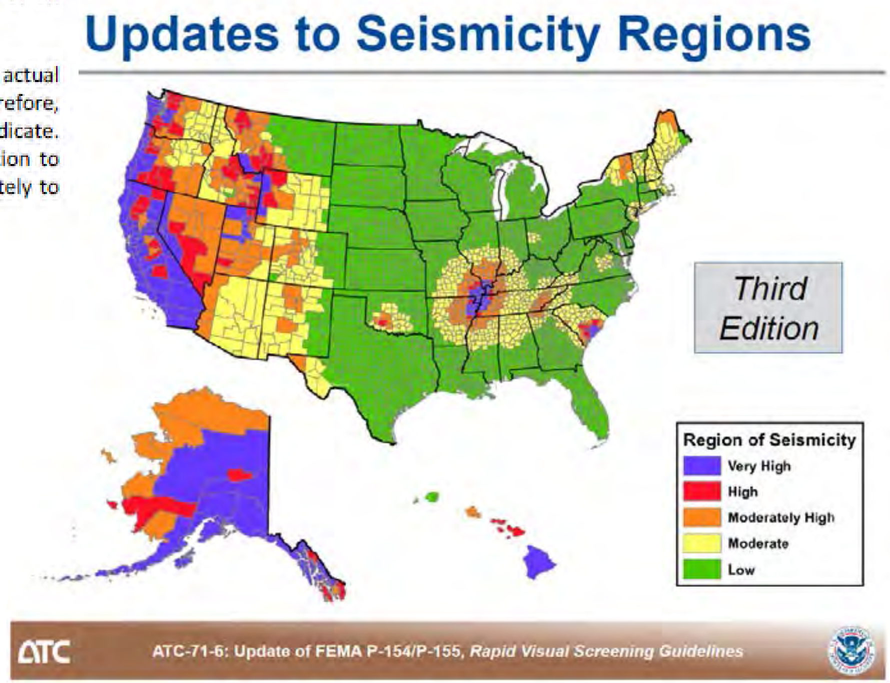


Table 2-3 RVS Benchmark Years for FEMA Building Types (based on ASCE/SEI 41-13)

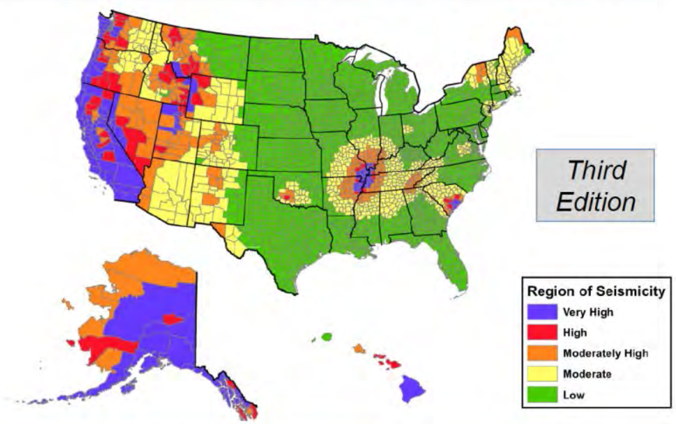
	FEMA Building Type	Model Building Seismic Design Provisions: National Building Code/ Standard Building Code	Uniform Building Code	International Building Code
W1	Light wood frame single- or multiple-family dwellings of one or more stories in height	1993	1976	2000
W1A	Light wood frame multi-unit, multi-story residential buildings with plan areas on each floor of greater than 3,000 square feet	[1]	1997	2000
W2	Wood frame commercial and industrial buildings with a floor area larger than 5,000 square feet	1993	1976	2000
S1	Steel moment-resisting frame buildings	[1]	1994[2]	2000
S2	Braced steel frame buildings	[1]	1997	2000
S3	Light metal buildings	[1]	[1]	2000
S4	Steel frame buildings with concrete shear walls	1993	1994	2000
S5	Steel frame buildings with unreinforced masonry infill walls	[1]	[1]	2000
C1	Concrete moment-resisting frame buildings	1993	1994	2000
C2	Concrete shear wall buildings	1993	1994	2000
C3	Concrete frame buildings with unreinforced masonry infill walls	[1]	[1]	2000
PC1	Tilt-up buildings	[1]	1997	2000
PC2	Precast concrete frame buildings	[1]	[1]	2000
RM1	Reinforced masonry buildings with flexible floor and roof diaphragms	[1]	1997	2000
RM2	Reinforced masonry buildings with rigid floor and roof diaphragms	1993	1994	2000
URM	Unreinforced masonry bearing wall buildings	[1]	[1]	[1]
MH	Manufactured housing	[3]	[3]	[3]

[1] No benchmark year.

[2] Steel moment-resisting frame shall comply with the 1994 UBC Emergency Provisions, published September/October 1994.

[3] The model building codes in this table do not apply to manufactured housing. In California, relevant requirements appeared in the Mobile home Parks Act, the California Health and Safety Code, and the California Code of Regulations. They evolved between 1985 and 1994; the year 1995 is recommended here as the benchmark year for California. In other states, the U.S. Department of Housing and Urban Development's Installation Standards required tie-downs after October 2008. The year 2009 is recommended here as the benchmark year for states other than California.

Updates to Seismicity Regions

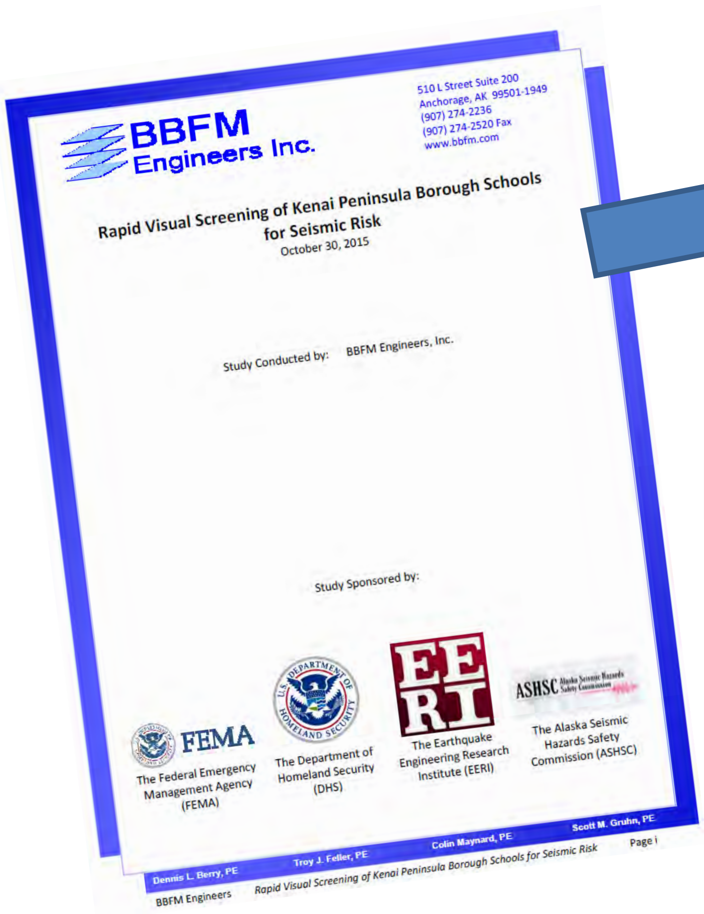


ATC ATC-71-6: Update of FEMA P-154/P-155, *Rapid Visual Screening Guidelines*

ASHSC Alaska Seismic Hazards Safety Commission

2015 RVS – Kenai Peninsula Borough School District (7% of Alaska's student base)

October, 2015



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BBFM Engineers Inc.

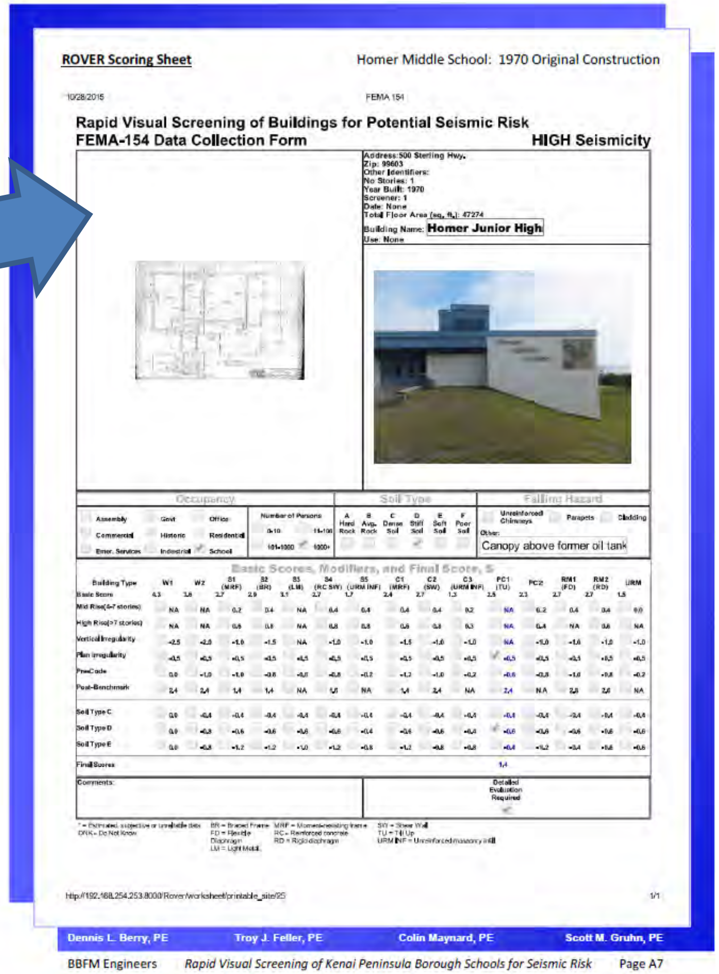
Rapid Visual Screening of Kenai Peninsula Borough Schools for Seismic Risk
October 30, 2015

Study Conducted by: BBFM Engineers, Inc.

Study Sponsored by:

The Federal Emergency Management Agency (FEMA)
The Department of Homeland Security (DHS)
The Earthquake Engineering Research Institute (EERI)
The Alaska Seismic Hazards Safety Commission (ASHSC)

Dennis L. Berry, PE | Troy J. Feller, PE | Colin Maynard, PE | Scott M. Gruhn, PE
BBFM Engineers | Rapid Visual Screening of Kenai Peninsula Borough Schools for Seismic Risk | Page i



ROVER Scoring Sheet | Homer Middle School: 1970 Original Construction

Rapid Visual Screening of Buildings for Potential Seismic Risk
FEMA-154 Data Collection Form | HIGH Seismicity

Building Name: Homer Junior High

Canopy above former oil tank

Dennis L. Berry, PE | Troy J. Feller, PE | Colin Maynard, PE | Scott M. Gruhn, PE
BBFM Engineers | Rapid Visual Screening of Kenai Peninsula Borough Schools for Seismic Risk | Page A7

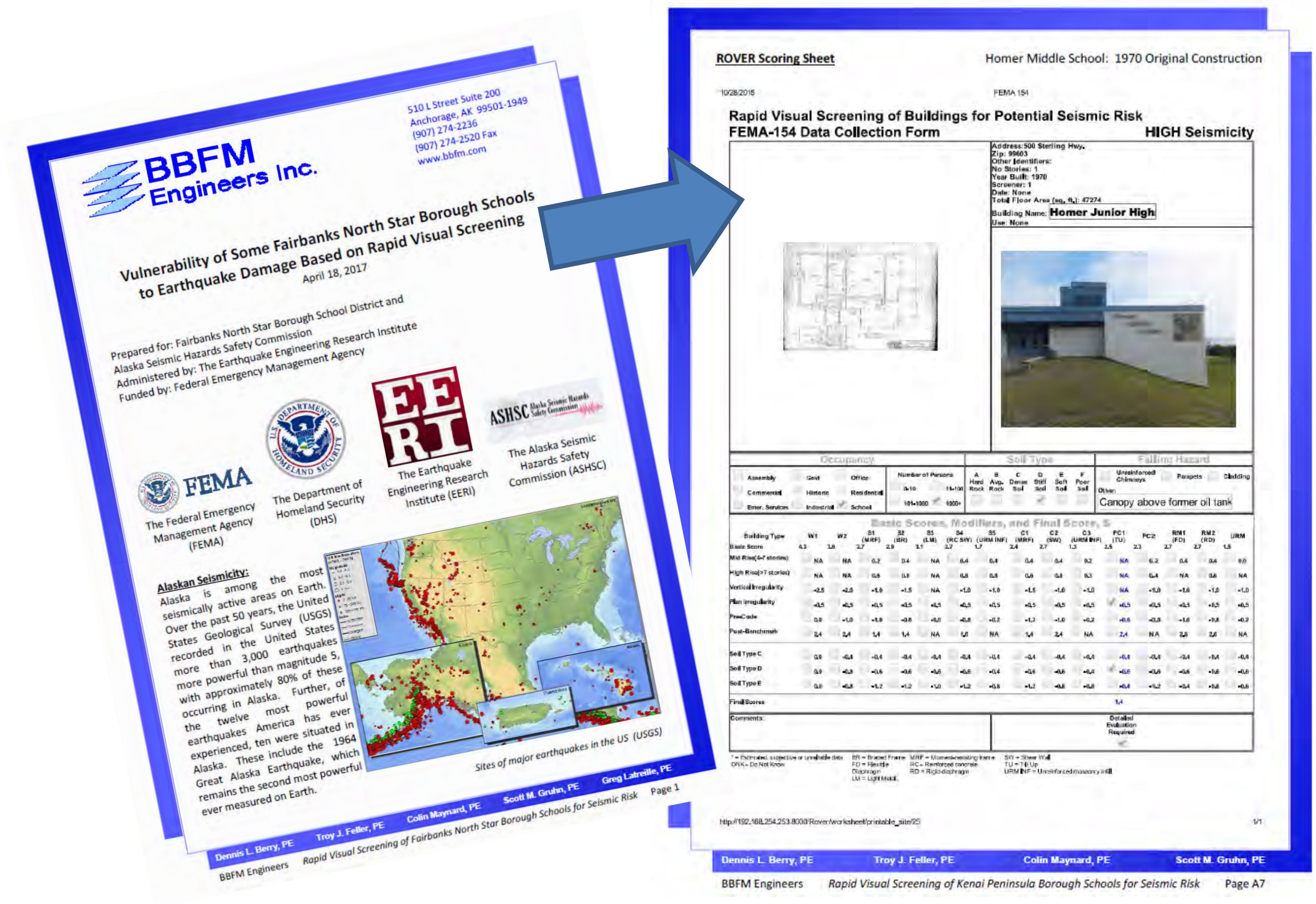
Cost of this Study:
The total cost of this study was $21,250, at a cost of performed for just $500 to $700 per structure.

Schools located in Anchor Point, Cooper Landing, Homer, Kenai, Moose Pass, Nikolaevsk, Ninilchik, Homer, Kenai, Seward, Soldotna, Sterling, Seldovia, Kasilof.

In total, we reviewed 15 schools comprised of 47 structures, including original construction and additions. Nineteen of the 47 warrant a more detailed evaluation, while further review of the remaining 28 schools is not indicated.
In other words, 40% of the structures reviewed in this study may pose an unacceptable risk of at least partial collapse during a major earthquake.

ASHSC Alaska Seismic Hazards Safety Commission

2017 RVS – Fairbanks North Star Borough School District (133,000 students -10.5% of Alaska's student base)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BBFM Engineers Inc.

Vulnerability of Some Fairbanks North Star Borough Schools to Earthquake Damage Based on Rapid Visual Screening

April 18, 2017

Prepared for: Fairbanks North Star Borough School District and Alaska Seismic Hazards Safety Commission
Administered by: The Earthquake Engineering Research Institute
Funded by: Federal Emergency Management Agency

The Federal Emergency Management Agency (FEMA)
The Department of Homeland Security (DHS)
The Earthquake Engineering Research Institute (EERI)
The Alaska Seismic Hazards Safety Commission (ASHSC)

Alaskan Seismicity: Alaska is among the most seismically active areas on Earth. Over the past 50 years, the United States Geological Survey (USGS) recorded in the United States more than 3,000 earthquakes more powerful than magnitude 5, with approximately 80% of these occurring in Alaska. Further, of the twelve most powerful earthquakes America has ever experienced, ten were situated in Alaska. These include the 1964 Great Alaska Earthquake, which remains the second most powerful ever measured on Earth.

Sites of major earthquakes in the US (USGS)

Dennis L. Berry, PE · Troy J. Feller, PE · Colin Maynard, PE · Scott M. Gruhn, PE · Greg Latreille, PE
BBFM Engineers · Rapid Visual Screening of Fairbanks North Star Borough Schools for Seismic Risk · Page 1

ROVER Scoring Sheet · Homer Middle School: 1970 Original Construction

10/28/2015 · FEMA 154

Rapid Visual Screening of Buildings for Potential Seismic Risk
FEMA-154 Data Collection Form · HIGH Seismicity

Address: 500 Sterling Hwy.
Zip: 99603
Other Identifiers:
No Stories: 1
Year Built: 1970
Screener: 1
Date: None
Total Floor Area (sq. ft.): 47274
Building Name: Homer Junior High
Use: None

Other: Canopy above former oil tank

Dennis L. Berry, PE · Troy J. Feller, PE · Colin Maynard, PE · Scott M. Gruhn, PE
BBFM Engineers · Rapid Visual Screening of Kenai Peninsula Borough Schools for Seismic Risk · Page A7

May, 2017 (draft)

Cost of this Study:
The total cost of this study was $21,250, at a cost of performed for just $500 to $1200 per structure.

Barnette Elementary
Hunter Elementary
Hutchison Career Center
Joy Elementary
Lathrop High School
North Pole Elementary
North Pole Middle School
Tanana Middle School
West Valley High School
Woodriver Elementary

In total, we reviewed 10 schools comprised of 20 structures, including original construction and additions. All 20 warrant a more detailed evaluation. In other words, 100% of the structures reviewed in this study may pose an unacceptable risk of at least partial collapse during a major earthquake with a 7 of the schools having 10% or higher risk of significant structural damage.

ASHSC Alaska Seismic Hazards Safety Commission

What CA school retrofits prevented during a M6 EQ.


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BBFM Engineers Inc.

Identifying Potential Earthquake Dangers To Alaska's Students and Schools

A Pilot Project Screening Matanuska-Susitna School District Buildings
February 6, 2015

Study Conducted by: BBFM Engineers, Inc.
Sponsored by:

The Federal Emergency Management Agency (FEMA)
The Department of Homeland Security (DHS)
The Earthquake Engineering Research Institute (EERI)
The Alaska Seismic Hazards Safety Commission (ASHSC)

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Dennis L. Berry, PE Troy J. Feller, PE Colin Maynard, PE Scott M. Gruhn, PE
BBFM Engineers Earthquake Danger to Alaska's Students and Schools Page 1

Sept. 2014

Napa earthquake damage to a building without seismic retrofit

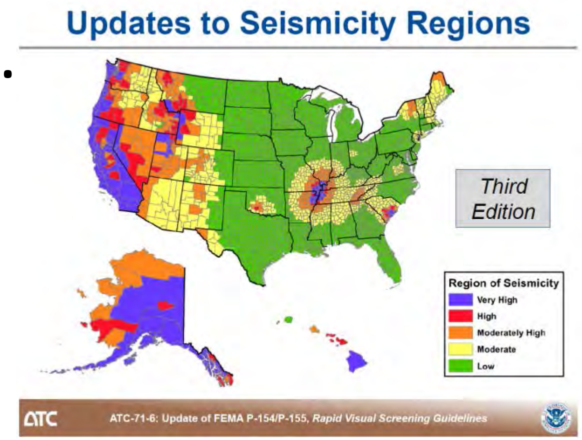
Recent example of a successful school retrofit program was demonstrated during the magnitude 6 earthquake that struck Napa, California in 2014, producing peak ground accelerations of 60% to 100% as strong as the acceleration due to gravity. The earthquake and its aftershocks injured 90 people and caused approximately $1 billion of damage.

Engineering News-Record reported on September 3, 2014:
The epicenter of the American Canyon quake was at the heart of the Napa school district's 30 campuses. Subsequently, three architectural and engineering teams assessed "every room in every school" and observed no structural damage following the quake, says Mark Quattrocchi, principal of Kwok Quattrocchi Architects and one of the survey team members… The schools performed so well because they are built or retrofitted according to much stricter seismic codes than commercial and residential buildings.

"There was no structural damage to any school in the district, even the ones built to older codes in the 1940s, 1950s and 1960s," says Quattrocchi. "Part of this is because seismic upgrades at the schools are treated the same as building an entirely new facility," he adds. Schools fared well for three reasons: seismic building codes that are more stringent than those for commercial buildings, methodical reviews by the Division of the State Architect and "full-time" state inspection on school construction sites, Quattrocchi says."

ASHSC Alaska Seismic Hazards Safety Commission

ALASKA IS BEHIND….



IDENTIFICATION

- Recognition of Problem
- Identification of Structures at Risk
- Prioritization of Mitigation
- Final Determination of Remediation Project

From: eeri-sesi-network@googlegroups.com [mailto:eeri-sesi-network@googlegroups.com] On Behalf Of zoe@eeri.org
Sent: Wednesday, May 03, 2017 3:47 PM
To: EERI SESI Network
Subject: [EERI SESI Network] **$125 million in grants have been awarded to Oregon schools**

Hello all,

A quick update on school earthquake safety in Oregon:

The Oregon seismic retrofit grants for schools were awarded on April 21st with $125 million in total.

* 100% state funding for projects up to $1.5 million, with districts providing matching funds for projects above $1.5 million

* 100 projects funded for 55 school districts.

ASHSC Alaska Seismic Hazards Safety Commission

LESSONS LEARNED:

Earthquakes remain our greatest teacher and exert the most influence. Human nature allows us to rapidly forget; natural disasters spur short periods of action. Clearly document information & efforts – easy to forget.

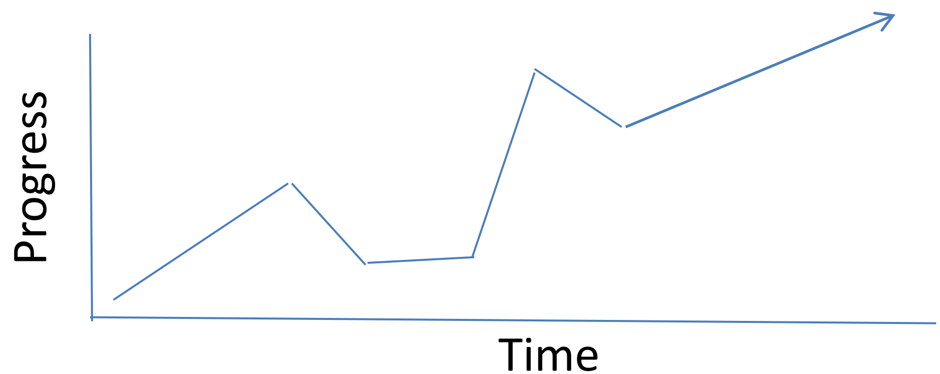
Hidden seismic hazards exist, many of which have yet to be identified – especially in Alaska.

Foster and maintain professional relationships. Encourage professional development and dialog. Encourage inter-agency and cross-state communication.

The average US citizen thinks they don't need to worry about the next earthquake – they assume our codes and engineers have already made everything safe.

Do not underestimate the ability of others to help (or occasionally hinder). Educators, eager students and pro-active PTA members are great allies. Understand that some upper-level leaders will cite concerns over wide-spread alarm and unfunded mandates. Partner with the Departments of Education and School Districts.

The path to success is not always upward or linear. Anticipate sudden successes, unforeseen set-backs, and seeming lack of progress. Be persistent; a worthy idea will succeed over time.

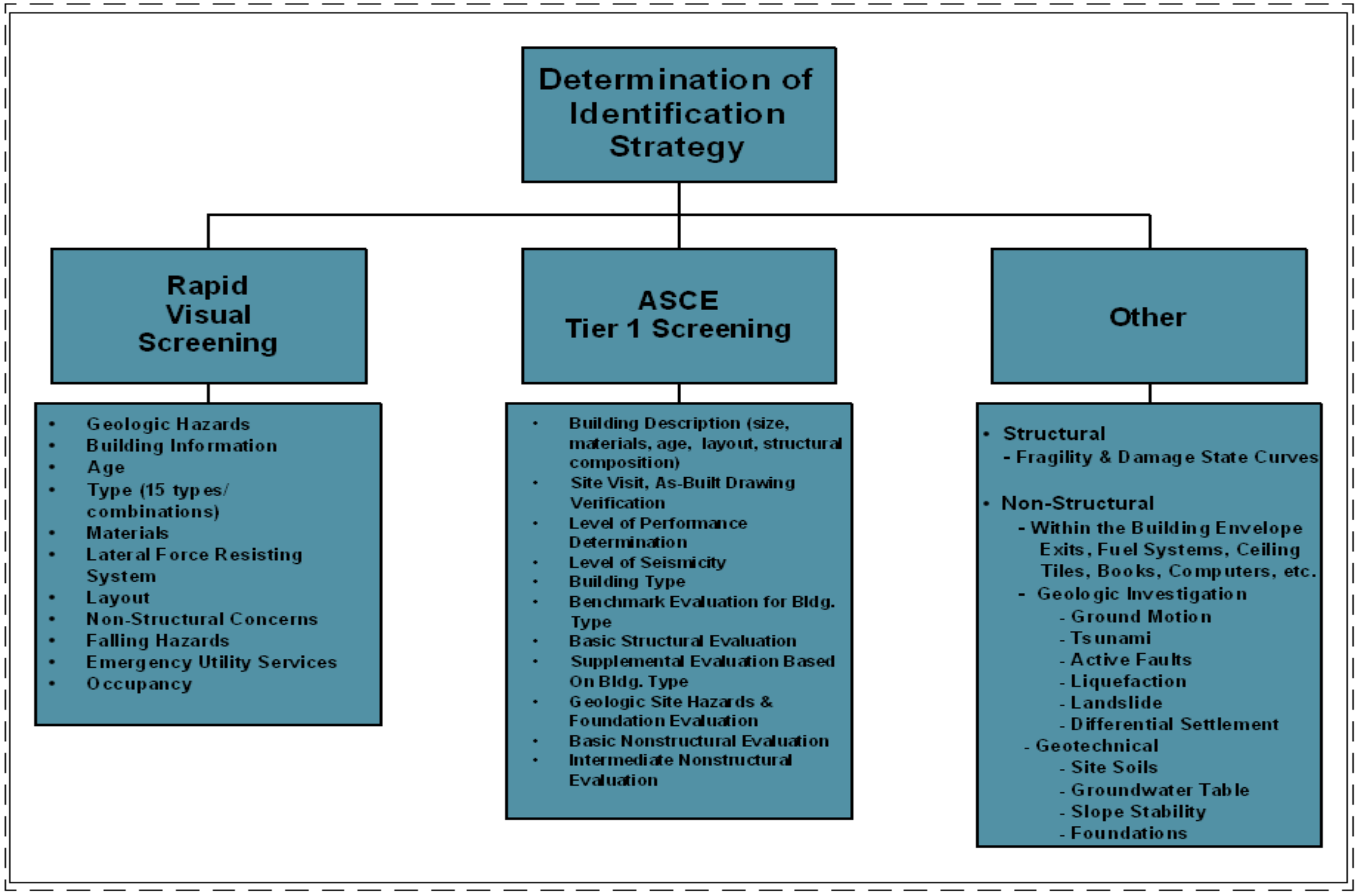


ASHSC Alaska Seismic Hazards Safety Commission

Identification, Funding, Staffing & Project Implementation

IDENTIFICATION

- Recognition of Problem
- Identification of Structures at Risk
- Prioritization of Mitigation
- Final Determination of Remediation Project



ASHSC Alaska Seismic Hazards Safety Commission

Identification, Funding, Staffing & Project Implementation

FUNDING

- Federal
  - FEMA Hazard Mitigation Grant Program (HMGP) – Post Disaster

    Federal HMGP funds made available following a disaster can provide a federal share of up to 75% of the costs of an approved project. The remaining 25% must be met through non-federal funds such as local government funds, community development block grants, etc.
  - FEMA Pre-Disaster Mitigation Program (PDM)
    - » Mitigation planning: $1M cap on Federal share, not to exceed 3 years
    - » Mitigation projects: $3M cap on Federal share, not to exceed 3 years
    - » Information dissemination activities not to exceed 10%, must directly relate to planning or project sub-application
    - » Applicant management costs not to exceed 10%
    - » Sub-applicant management costs not to exceed 5%
  - US Senators
  - US Representatives
- State
  - School Facilities Capital Improvement Project Grant (Dept. of Education)
  - State Capital Projects
    - » State Senators
    - » State Representatives
  - Governor
- Local
  - Bonds
  - Maintenance
  - Special Capital Projects/Special Funds (Sale of Shuyak Island)
  - General Fund (Mill Rate/Property Taxes/Severance Taxes/Intergovernmental Sources)
  - Local Government Representatives
  - Local Government Employees
- Private (In-Kind Donations)
  - Services
  - Materials/Supplies
  - Benefactors

Identification, Funding, Staffing & Project Implementation

STAFFING

- **Local Government**
  - Credentials
  - Time Commitment
  - Specialized Hire Considerations
  - Points of Contact
    - Finance
    - Record drawings (digital?)
    - Building Access
    - Public Meetings & Outreach
    - Project Management (Identification, Mitigation Grants, Construction)
- **Municipal/School Building Managers**
  - Engineers (Large Districts)
  - Architects (Large Districts)
  - Finance
  - Maintenance
- **Private Contract**
  - Evaluation
    - Geologic
    - Geotechnical
    - Structural
  - Grant Application
  - Design
  - Construction
  - Inspection

ASHSC Alaska Seismic Hazards Safety Commission

Identification, Funding, Staffing & Project Implementation

PROJECT IMPLEMENTATION

- **Seismic Only**
- **Combined**
  - Maintenance Upgrade (Roof, Mechanical, Electrical)
  - Energy Efficiency
  - Expansion
- **Phased/Unphased**
- **Unanticipated Issues**
  - Existing Conditions
    - » Lead (paint, plumbing, etc.)
    - » Asbestos (flooring, insulation, roofing, etc.)
    - » Non-Code Compliant Electric, Plumbing, Fire, Fuel/Heat
    - » Unknown Existing Conditions (Structural/Non-Structural)
  - Funding Difficulties
    - » Long Stretches of Time between Identification & Construction
    - » Multiple Agencies
    - » Rising Construction Costs
    - » Unaccounted Local Cost Factors

Item No. 3.B

Kodiak Island Borough

AGENDA STATEMENT

Special Meeting of June 26, 2007 **Contract No. FY2007-50**

Authorizing the Manager to Execute Contract No. FY2008-01 for Phase I of the Seismic Upgrades to the Kodiak Middle School.

Kodiak Island 3.16.020 "Limitation on Manager's Authority" states that a contract exceeding $25,000 requires Assembly approval.

This Contract is for work at the Kodiak Middle School shown on the construction documents prepared by Jensen Yorba Lott, Inc. titled "Kodiak Middle School Seismic Upgrade", dated April 27, 2007, and includes structural, mechanical, electrical, and architectural work. The construction documents, bid documents and associated addendum are available for review on the KIB website. The work will be phased over two (2) years.

The Project is funded in part by monies from a FEMA PDM-c Grant; Bond Projects for Floor Covering Replacement and KHS/KMS Roof Upgrade; and Legislative funds. Additional funding sources are to be identified.

Bids received in response to KIB's Invitation to Bid dated April 2007 are:

	Base Bid Phase 1	Alt Bid 1 Phase 2	Total	
Brechan Enterprises	$2,340,000	$3,175,000	$5,515,000	
F & W Construction	$2,469,667	$3,011,917	$5,481,584	
Engineers Estimate			$3,465,000	
% Difference			58%	Over

The E/F Department has reviewed the bids and, as both bids received are substantially higher than the engineers estimate, recommends that a Contract for Seismic Upgrades at the Kodiak Middle School be awarded to Brechan Enterprises, Inc. in an amount not to exceed $2,340,000 for Phase 1 work only. Phase 2 is to be re-bid at a later date.

Fiscal Notes:	☐ n/a	Acct No.	420 515 452 150 05014 6 410 523 452 150 05022 5 410 531 452 150 07015 6
Expenditure Required: $	☐ n/a	Amount Budgeted:	☐ n/a

APPROVAL FOR AGENDA:

Recommended motion: ***Move to authorize the manager to execute Contract No. FY2007-50 with Brechan Enterprises, Inc of Kodiak in an amount not to exceed $2,340,000.***

Thank You!

Artwork by

Eustace Ziegler (1881-1969), Alaskan Frontier Artist

(My great grandfather's brother.)

Note: Numerous pieces of his artwork were lost in the 1964 Valdez tsunami. Some of his surviving works can be seen at the Anchorage Museum and the State Capitol Building and State Museum in Juneau.

Questions? E-mail: **Laura.W.Kelly@uscg.mil**