INFLUENCE OF THE 1964 GREAT ALASKA EARTHQUAKE ON CIVIL ENGINEERING AND BUILDING CODES IN ALASKA (AND THE USA)

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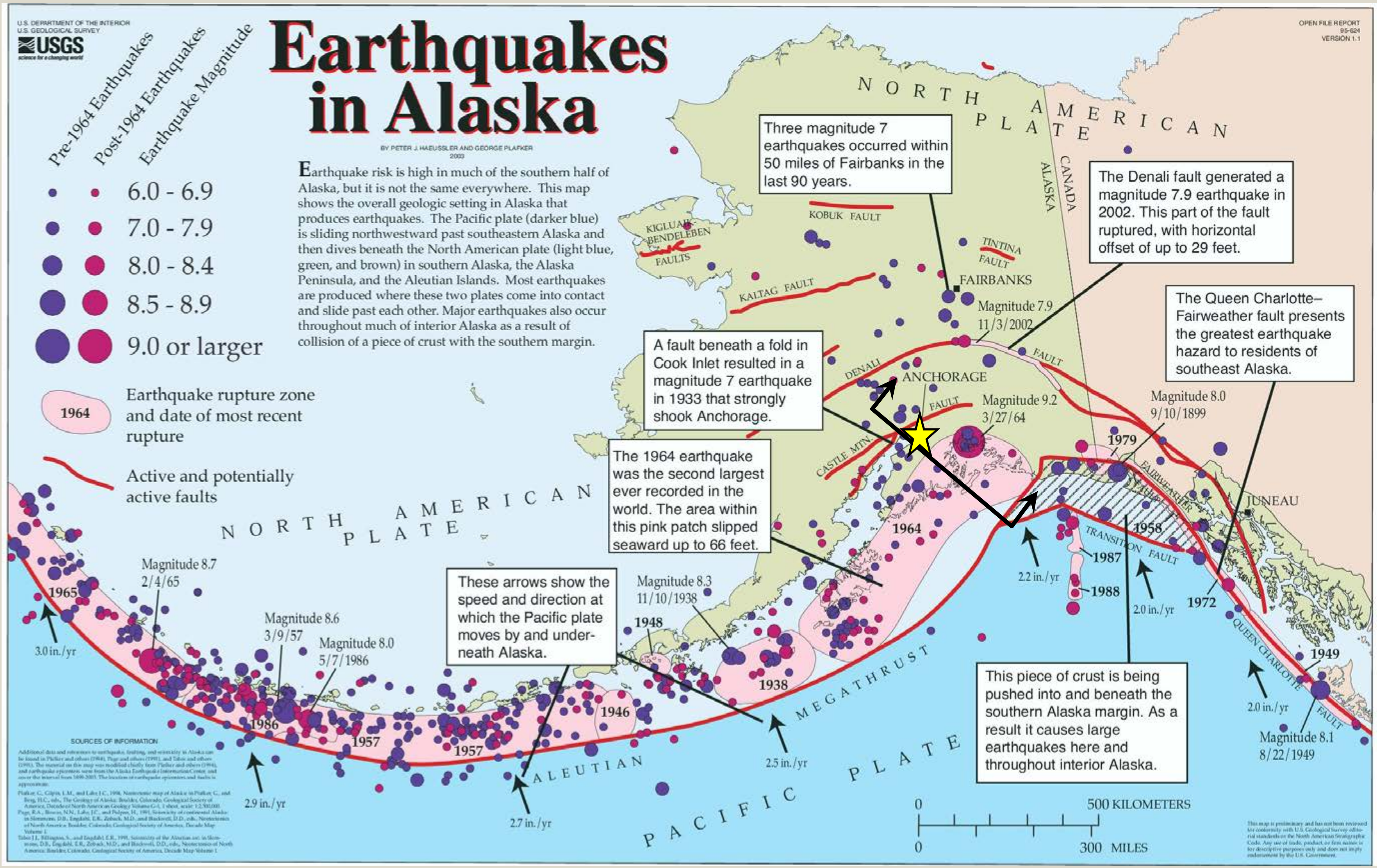
Anchorage Geotechnical Advisory Commission

ASHSC Alaska Seismic Hazards Safety Commission

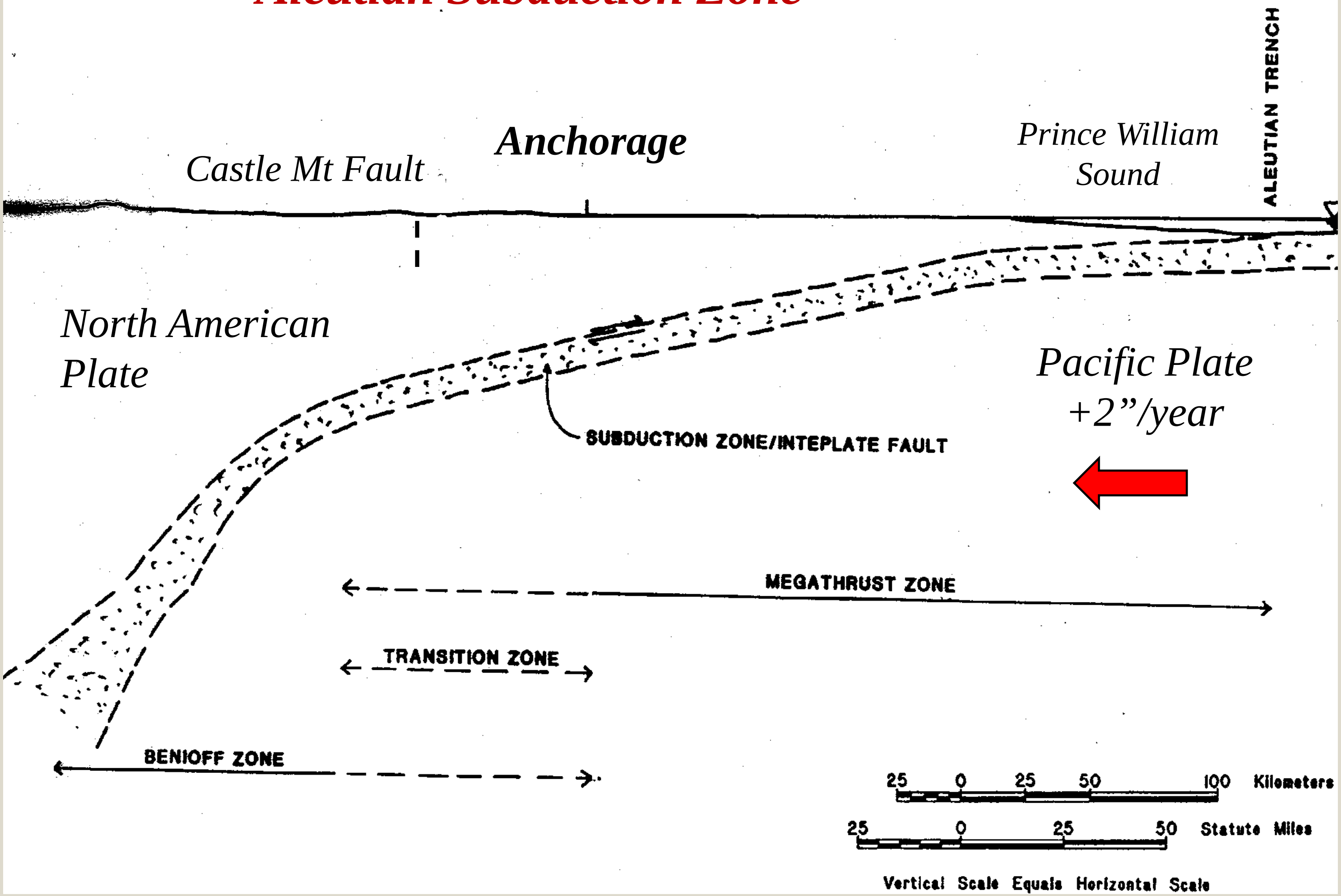
Alaska Seismicity

- Most seismically active State
- Since early 1900s:
  - 11% of instrumented earthquakes in world; 3 of 12 largest in world; and 9 of 10 largest in N.A.
  - 50 to 100 earthquakes daily; ≈ 24,000 annually, including at least one M6-7; M8+ every 13 years
- One of the most prominent sources of tsunamis in the world



(USGS OFR 95-624)

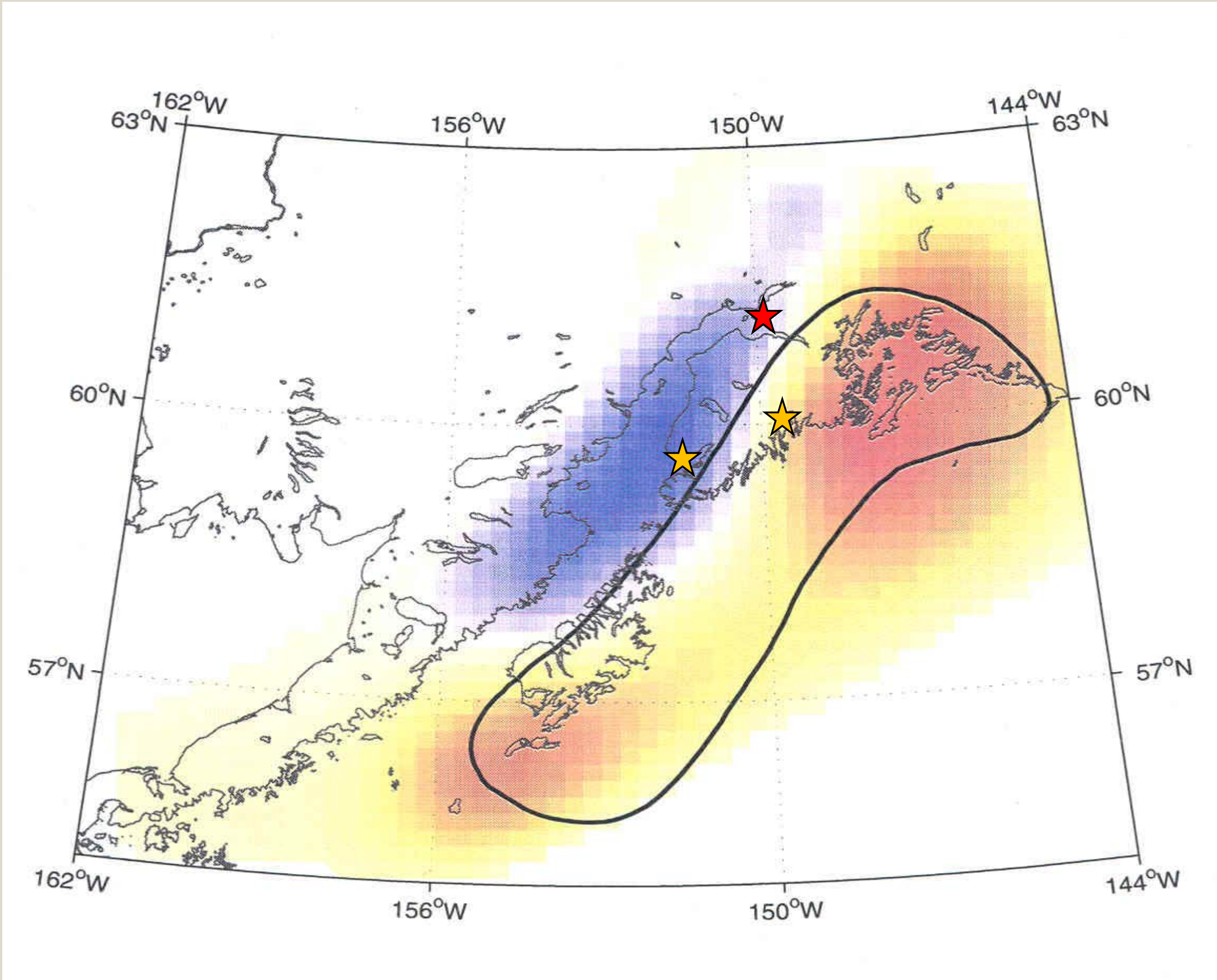
Aleutian Subduction Zone



27 March 1964 Great Alaska (Good Friday) Earthquake

- M9.2 (*largest recorded earthquake US History*)
- Strong Shaking (*almost 5 minutes in Anchorage*)
- $311 million damage (*$2.3 billion in 2013 dollars*); 131 deaths (*122 in tsunamis*)
- Extensive Ground Failure (*accounted for most of damage in Anchorage, versus ground shaking*)

Post 1964 Earthquake Plate Movements (1992-2001)

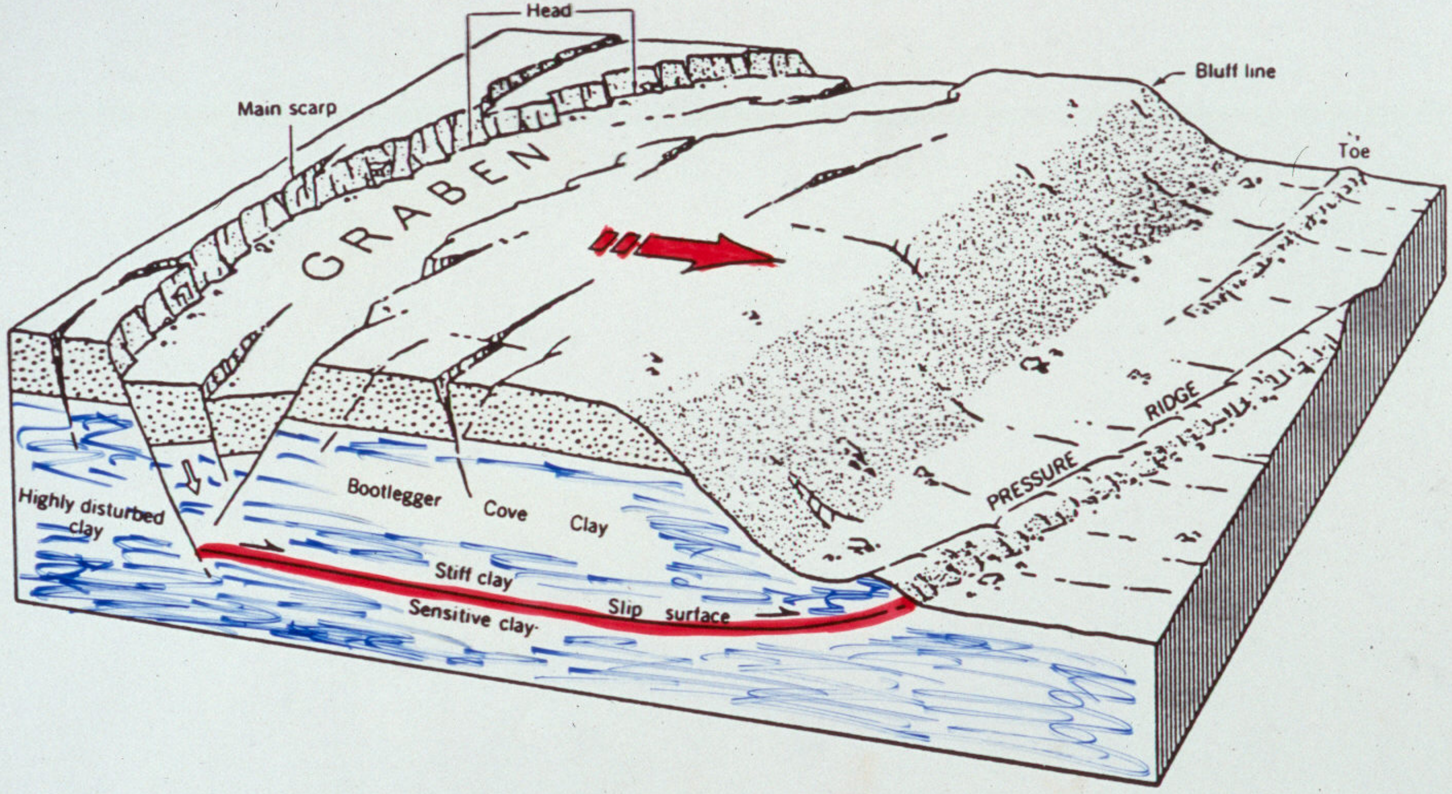


(*Zweck & Freymueller 2002*)

Damage at Anchorage due to Ground Shaking

JC Penny Building

Damage at Anchorage due to Ground Failure



Low-Angle Landslides

After Hansen (1965)

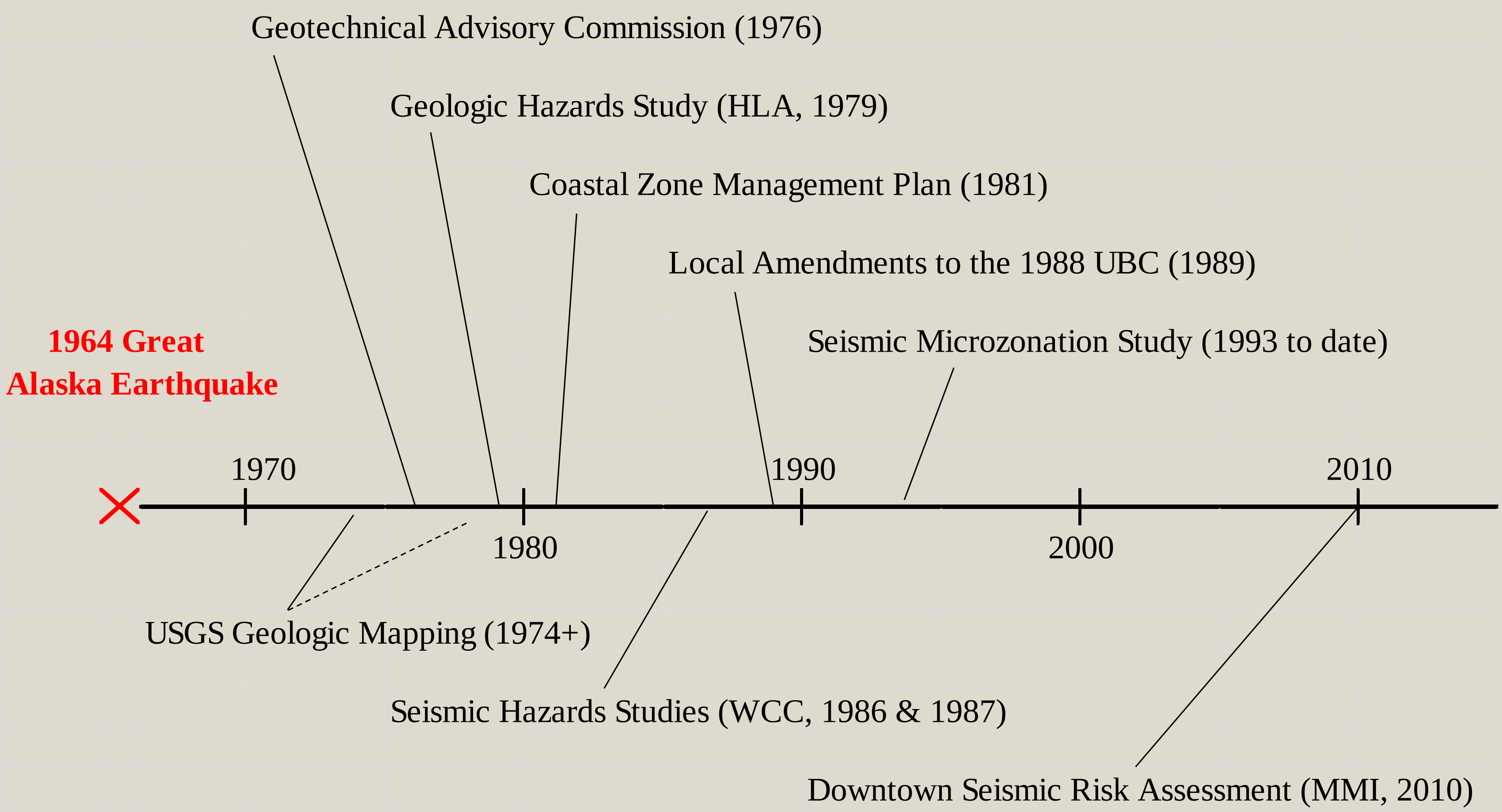
4th Avenue Slide

Government Hill Slide

L Street Slide Pressure Ridge

Turnagain Heights Slide

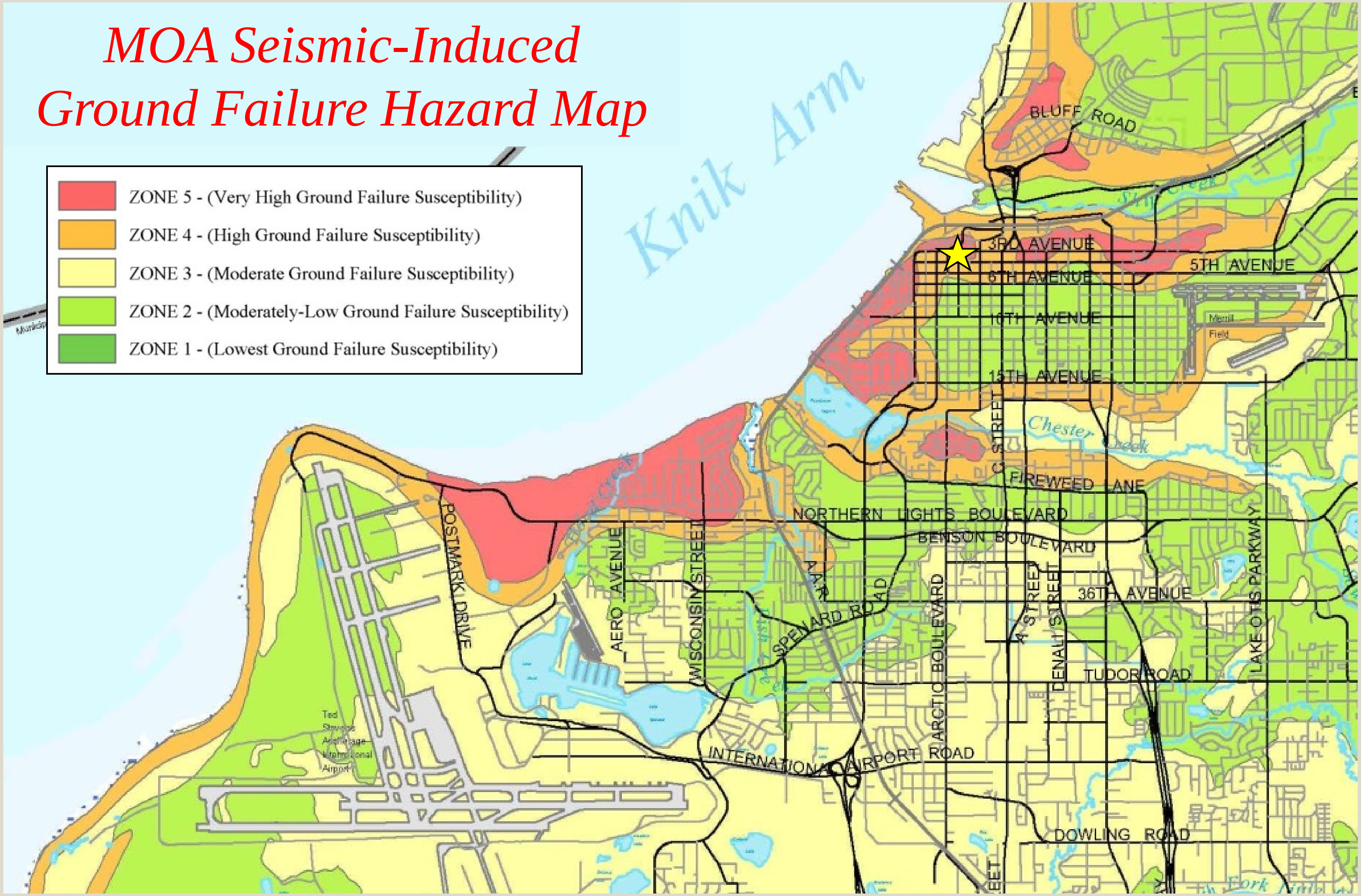
Post 1964 Earthquake Engineering Milestones in Anchorage

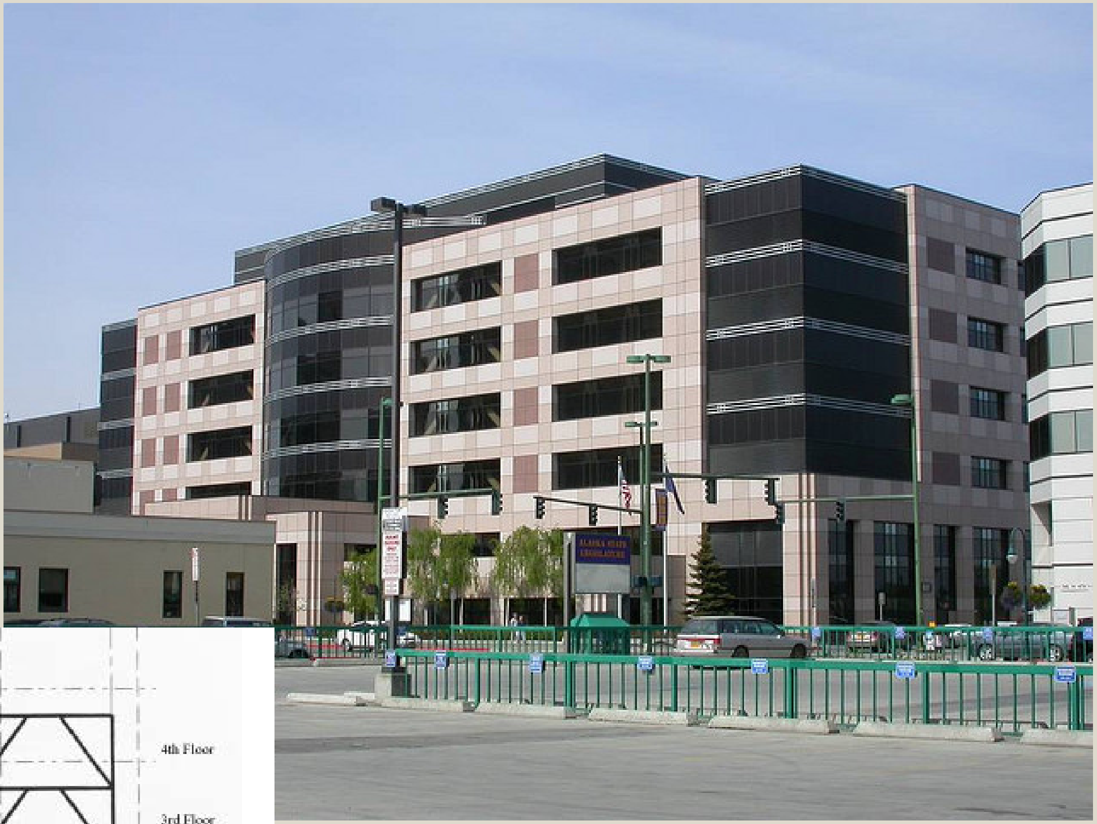


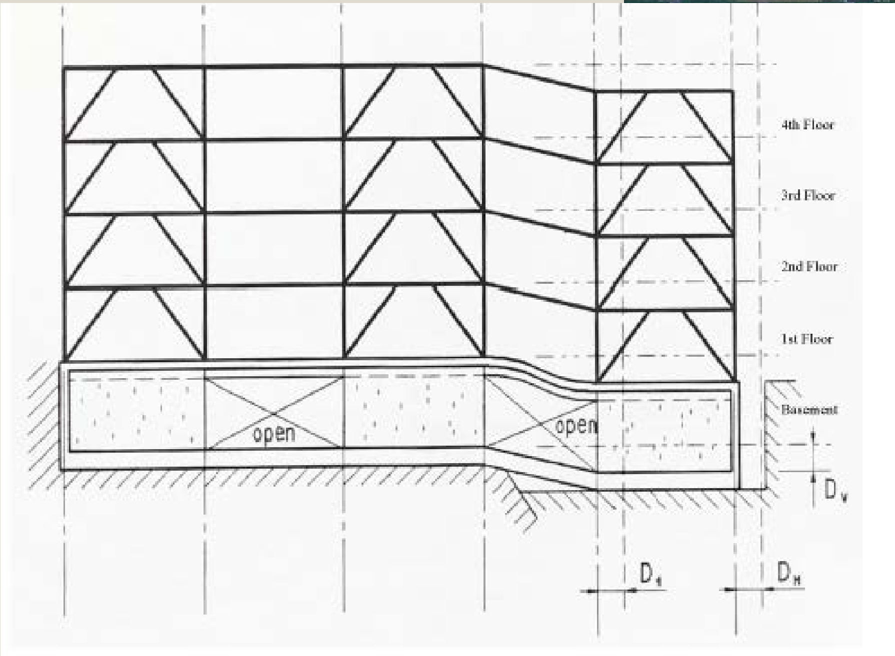
ANCHORAGE GEOTECHNICAL ADVISORY COMMISSION

- Established in 1976; 9 members (*civil engineers & geologists*)
- Technical advisory resource to the Mayor, Assembly & City Departments
- Key Accomplishments:
  - Inventory of geologic hazards (HLA, 1979)
  - Local amendments to the building code
  - Review major projects in high earthquake hazard zones
  - Downtown Seismic Risk Assessment (MMI, 2010)

MOA Seismic-Induced Ground Failure Hazard Map

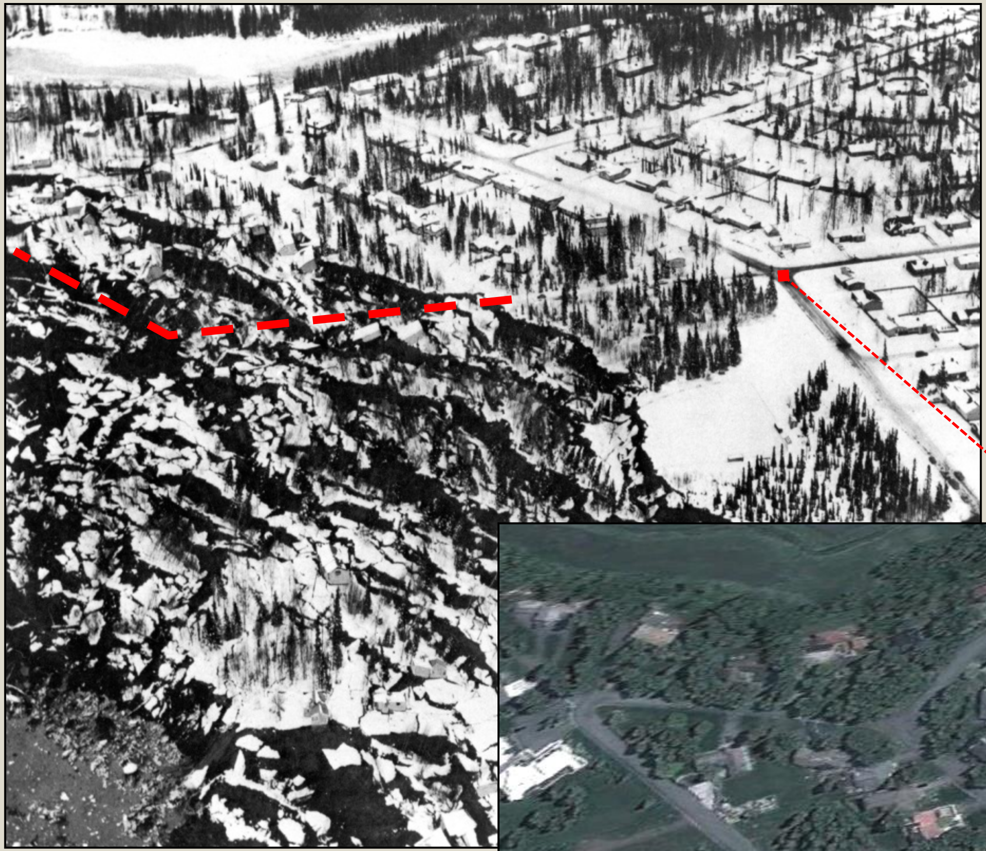


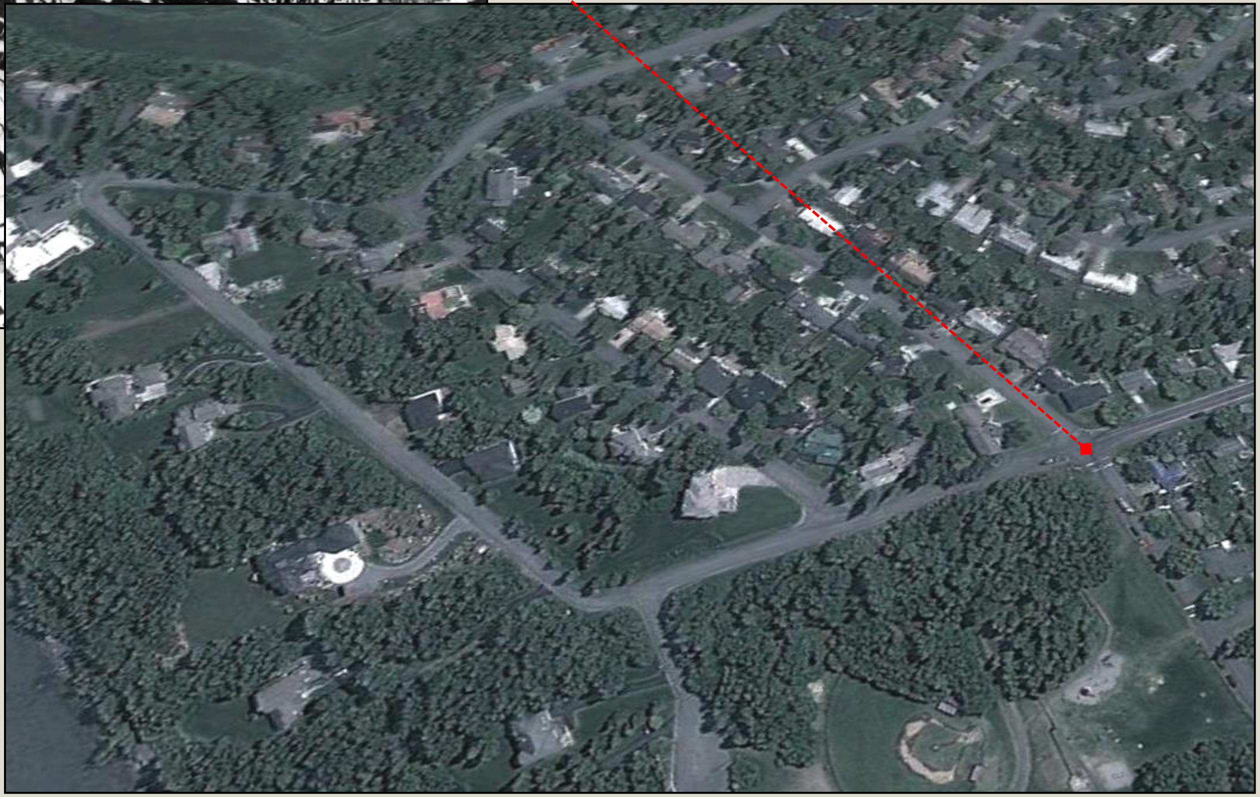




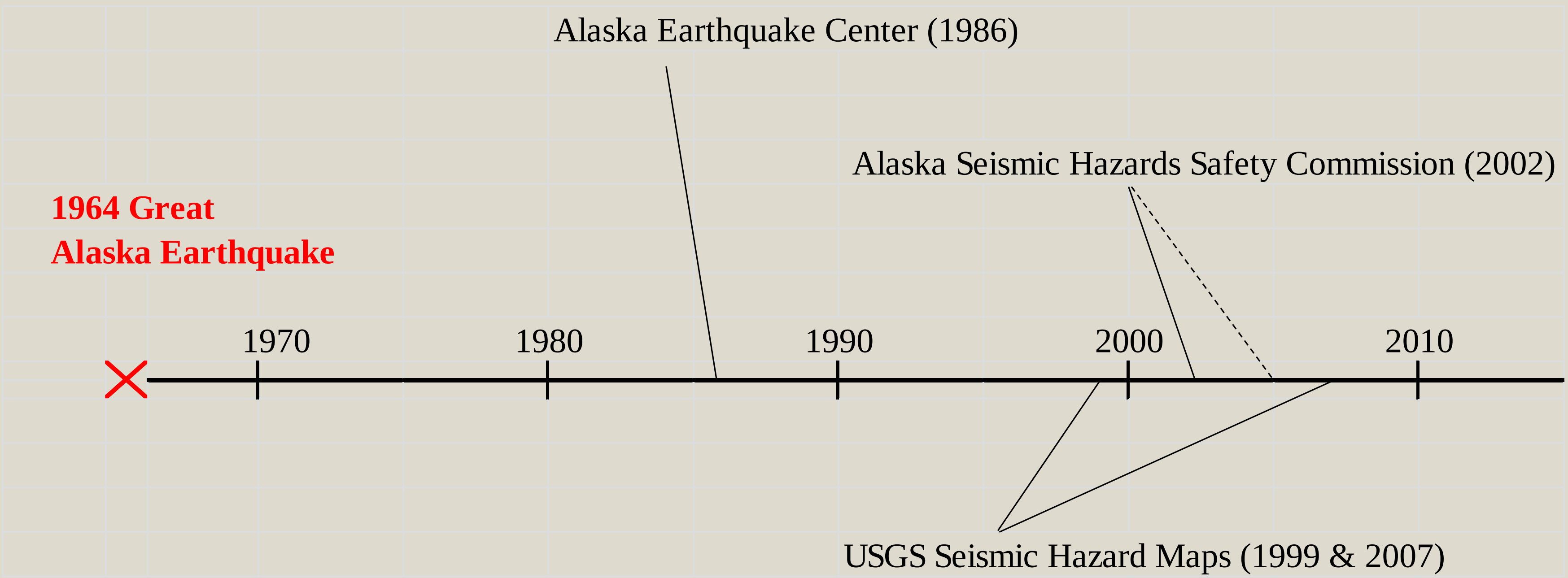
Alaska State (Nesbitt) Court House

Turnagian Heights then and now





Post 1964 Earthquake Engineering Milestones in Alaska



Alaska Seismic Hazards Safety Commission

- Established in 2002, first members appointed in 2005; 11 members (*civil engineering*, *geology*, *seismology*, *emergency management*, *local government*, *insurance*)
- Advisory body empowered to recommend to the governor, legislature, state departments and local governments goals, priorities, programs, research, recovery practices, etc. to mitigate seismic hazards in Alaska.
- Key Objectives & Projects:
  - Identify and prioritize schools at risk from earthquakes
  - Independent review of designs and construction of public facilities
  - Kodiak scenario earthquake study
  - Advocate for Alaska earthquake research
  - Regulations for seismic knowledge of civil engineers licensed in Alaska

On a national scale, the 1964 Great Alaska Earthquake strongly affected:

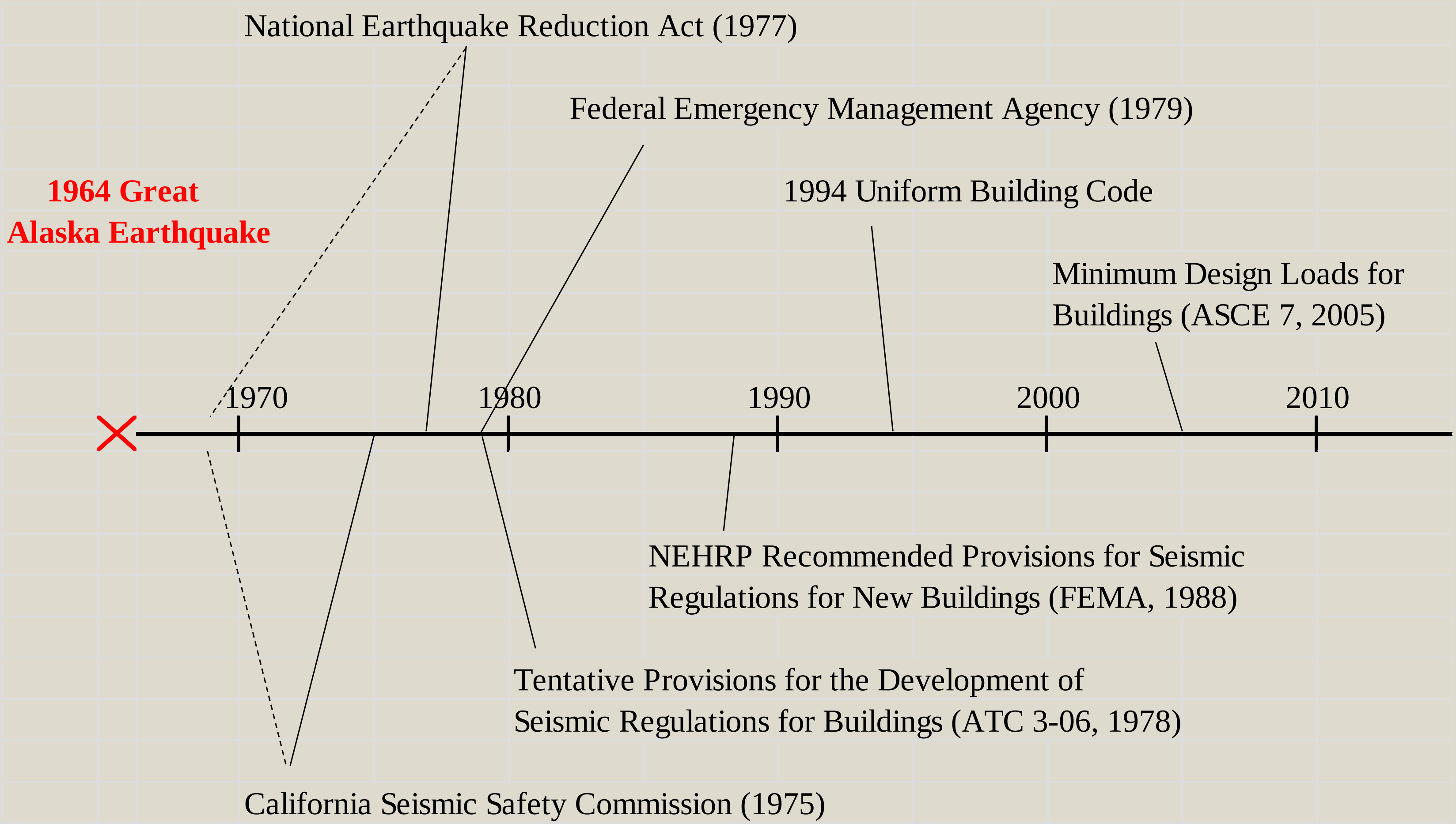
- Geology - *Theory of plate tectonics*
- Seismology – *Subduction zone earthquakes*
- Seismic Engineering – *Geotechnical hazards*

R.E. WALLACE, PhD, USGS GEOLOGIST:

"The great Alaskan earthquake on Good Friday 1964 was a major turning point and a trigger for new [*national*] programs. To my thinking, and most people's thinking, I believe, the Alaskan earthquake was the beginning of, and stimulus for, our whole modern earthquake program. That earthquake showed what great seismic events could do very close to home."

(*in USGS 1996; OFR 96-260*)

Post 1964 Earthquake Engineering Milestones in the USA



NATIONAL BUILDING CODES

- The design codes are intended to protect the safety of a building's occupants during and immediately after an earthquake – not to eliminate structural damage or loss of property.
- Design codes are based on a premise that the ground is and remains stable.
- Provisions to design for earthquake loads have been included in national building codes since the late 1920s; however, specific requirements to consider the potential for earthquake-induced ground failure were not included until the 1994 UBC *(despite recommendations in ATC 3-06 {1978} and NEHRP {1988}, etc.)*

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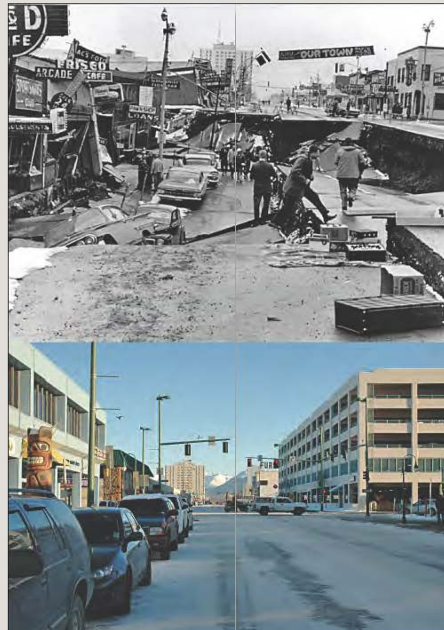
1964 Great Alaska Earthquake—A Photographic Tour of Anchorage, Alaska



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