Our mission is to *Keep Alaska Moving* through service and infrastructure.
1964 Good Friday Earthquake Mw 9.2
Inspection Response

• 3 Inspection teams flew up from Juneau immediately following the event, another team arrived a few days later

• 25% of state bridge inventory inspected in 5 days

• Bridges marked after inspection in case of second event and to prevent overlap
Inspection Boundaries

GLENN HIGHWAY - 62
PARKS HIGHWAY, SOUTH - 69
SEWARD HIGHWAY, NORTH - 50
SEWARD HIGHWAY, SOUTH - 51
MATSU BOROUGH - 61
ANCHORAGE - 81

BRIDGES TO INSPECT - 243

20% PGA
Numerous reports of damage came from Eagle River in the hours after the earthquake.
Eagle River Bridges

- Glenn Hwy Southbound
- Glenn Hwy Northbound
- ER Loop, PED Tunnel
- ER Loop, Briggs Bridge
Glenn Hwy-Eagle River NB #2303

- Approach roadway “cracking”
Glenn Hwy-Eagle River River NB #2303

- Settlement adjacent to wingwalls
Glenn Hwy-Eagle River NB #2303

- Settlement adjacent to wingwalls

16 Inches
Glenn Hwy-Eagle River River NB #2303

- Slope movement in front of abutment
Glenn Hwy-Eagle River NB #2303

- Shear key cracking (expected damage)
• South Abutment
Glenn Hwy-Eagle River SB #1341

- South Abutment Bearings
Glenn Hwy-Eagle River SB #1341

- South Abutment Movement
Eagle River Loop-Briggs Bridge #1739

• South Abutment Movement

~4% Grade
Eagle River Loop-Briggs Bridge #1739

- South Abutment Joint
Eagle River Loop-Briggs Bridge #1739

- South Abutment Joint
Eagle River Loop-ER Ped Tunnel #7020

- June 2018
Eagle River Loop-ER Ped Tunnel #7020

- November 2018
Eagle River Loop-ER Ped Tunnel #7020
Muldoon Road-Muldoon OC #2308

- Cracks and spalling at shear keys
West Dowling-Dowling OC #2273

- Cracks and spalls at shear keys
De Armoun Rd-De Armoun OC #1391

- Spalled shear keys and cracked abutment cap beams
Why didn’t we see this kind of damage?

Northridge 1994 $M_w$ 6.7

Loma Prieta 1989 $M_w$ 6.9
Average Displacement Spectra for Anchorage EQ

Majority of AKDOT’s multi-span bridges have periods between 1.5-3.5 seconds.
Other Contributing Factors

- Most structures behaved essentially elastically
  - Actual stiffness > design stiffness
  - Actual structure period < design period
    - Smaller periods associated with smaller displacements

- Many newer bridges in the Anchorage area driven by population growth -> fewer seismically vulnerable bridges
Past Seismic Research Sponsored by DOT&PF

- Seismic Performance of Reinforced Concrete Filled Steel Tubes in Soil
  
  2016-North Carolina State University

- Strain Limits for Concrete Filled Steel Tubes in AASHTO Seismic Provisions
  
  2013-North Carolina State University

- Frozen Soil Lateral Resistance for the Seismic Design of Highway Bridge Foundations
  
  2012-University of Alaska Anchorage

- Seismic Performance and Design of Bridge Foundations in Liquefiable Ground with a Frozen Crust
  
  2012-University of Alaska Anchorage

- Ductility of Welded Steel Column to Steel Cap Beam Connections
  
  2010-North Carolina State University

- Full-Scale Test of the Alaska Cast-In-Place Steel Shell Three Column Bridge Bent
  
  1999-University of California San Diego
Conclusions

• Earthquake was fairly deep and didn’t produce large displacements for most bridge periods

• Damage observed was largely related to soil failures. (roadway approaches closed bridges, not structural issues)

• ~20 bridges require some sort of structural repair, work scheduled for 2020

• This was not the design level earthquake

• Just because this earthquake didn’t cause significant structural damage, doesn’t mean the next one won’t!
Seismic Performance of Reinforced Concrete Filled Steel Tubes Lab Testing

Questions?

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