Public Infrastructure and Climate Change – ADOT/PF
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• The Department of Transportation and Public Facilities (DOT&PF) manages the State’s transportation infrastructure in a very challenging environment
• Many facilities in the Alaska’s interior, northern, and southwest region’s underlain by ice-rich permafrost
Alaska Department of Transportation and Public Facilities

- Over 14,000 Miles of Public Roadway
- Over 5,600 Miles of State owned road
- 916 Bridges
- 257 Rural Airports
- 28 Harbors
- 720 Buildings (DOT owned or managed)
Potential Climate Change Impacts

- Melting/Warming permafrost
- Increased storm frequencies and intensity
- Increased river and shore erosion
- Sea-level rise
- Increased scour of bridge foundations
- Increasing temperatures

Nome-Council Road
Copper River Highway
Potential Impacts to Infrastructure
Melting/Warming Permafrost

- Current estimate is the Northern Region spends approximately $10+ million annually due to melting permafrost
- This represents a fraction of the need
- Costs will increase if warming trend continues
Potential Impacts to Infrastructure
Melting/Warming Permafrost

- Increased highway and airport surface distress
- Increased Active Layer Detachments (slope sloughing and failures)
- Embankments built over permafrost will need to be thicker to prevent the underlying ground from thawing
- Public buildings may require relocation/reconstruction if their foundations thaw
Permafrost Problems

- Glenn Highway Distress
- Alaska Highway Damage and rutting
- Dalton Highway Frost Heaves
- Mile 15.18 Elliot Highway Pavement Rutting
Longitudinal Shoulder Cracking
Thaw Settlement
Ice-Rich Permafrost Thawing
Potential Impacts to Infrastructure
Increased Storm Frequencies and Intensities

- Changes in timing, frequency, form and/or intensity of precipitation may cause related and increasing natural processes, including:
  - Debris flows
  - Avalanches
  - Floods

- Significantly increases costs
Potential Impacts to Infrastructure

Increased Storm Frequencies and Intensities

- Coastal communities and their infrastructure are vulnerable to accelerated coastal erosion due to storm activity and wave action eroding shorelines once protected by shore-fast sea ice.
- As the climate warms, coastal erosion will increase as sea ice retreats and coastal storms become more frequent.
- Glacial-fed rivers and streams will likely experience increased flows with the potential for flooding and the cutting of new, unanticipated stream channels.
Flooding
Flooding
Flooding
Western Alaska Storm Damage

Affected
- Highways
- Buildings
- Airports
- Waysides

Nome
Western Alaska Storm Damage

Nome-Council Highway
Potential Impacts to Infrastructure

General Warming Trend

A longer seasonal transition period from fall to winter and winter to spring may require a different and potentially more costly approach to snow and ice control.
Potential Impacts to Infrastructure

General Warming Trend

• The continued warming trend will likely result in the increase in erosion of shorelines and riverbanks which will impact any facility constructed adjacent to the waterbody.

• Aufeis problems will likely increase as melt water flows out of warming zones of permafrost, requiring additional maintenance.
Potential Impacts to Infrastructure

General Warming Trend

• An increase in the frequency and severity of hot days could result in more highway and airport problems related to asphalt softening and traffic-related pavement damage and rutting.

• Milder winters, with more freeze-thaw cycles, would accelerate road deterioration and increase maintenance costs.
Potential Impacts to Infrastructure

General Warming Trend

- Warming temperatures are altering the blend of vegetative growth on the North Slope of Alaska
- Increasing temperatures will allow a variety of invasive plants to prosper in Alaska
What is DOT & PF Doing Now

- Shoreline Protection
- Relocation
- Drainage Improvements
- Permafrost Protection
Kivalina Airport Shoreline Protection (FEMA)

• Placed supersacks on the coastal side of airport property to protect the taxiway after sea storm
• Developing a more permanent fix
What is DOT & PF Doing Now
Shoreline Protection

Kotzebue Shore Avenue (FHWA)

• Final design underway includes sheet pile and rip rap to protect the shoreline and road
What is DOT & PF Doing Now
Shoreline Protection

Unalakleet Beach Road Permanent Repairs
(FEMA and ER)

- Final design underway: considering construction of a dynamically stable beach
What is DOT & PF Doing Now
Shoreline Protection

Nome-Council Highway Permanent Repairs (FHWA)

• Includes restoration of the highway and rip rap protection (limited to what was there before the storm)
What is DOT & PF Doing Now
Relocation

Shishmaref Relocation Road Reconnaissance Study (Earmark)

• Perform a study to determine a road alignment to access gravel for the relocation of the community
What is DOT & PF Doing Now
Relocation

Shishmaref Airport Master Plan Update (FAA)

- Developing a geographically referenced database of information at the existing and potential relocation site
What is DOT & PF Doing Now

Relocation

Noatak Airport Relocation (FAA)

- Relocate the airport due to the erosion from the Noatak River
- Other airport relocations include Allakaket (complete) and Alakanuk (in progress)
What is DOT & PF Doing Now
Drainage Improvements

Steese Highway

• Fires denuded slopes along the highway
• Impacts include:
  - Falling trees
  - Mudslides
  - Increased water flow necessitating additional drainage
What is DOT & PF Doing Now

Drainage Improvements

Steese Highway
What is DOT & PF Doing Now
Permafrost Protection

- Deeper embankments
- Foam board insulation
- Air Convection Embankments (ACE)
- Post foundations
- Passive and mechanical refrigeration
What Needs to be Done

• Increase the collection and density of data ranging from
  – stream flow records
  – precipitation and other weather related data records
  – geotechnical and foundation information
  – other hydrologic data

• Investigate alternative design, construction, and maintenance techniques to address the changing environment
What Needs to be Done

• Continue partnering with the University of Alaska and other State and Federal agencies to address the most immediate needs of communities already being impacted

• Identify the critical information we need to gather to be able to address future impacts of climate change
Thank You

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