

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)



DOT&PF AIRPORTS IN ALASKA

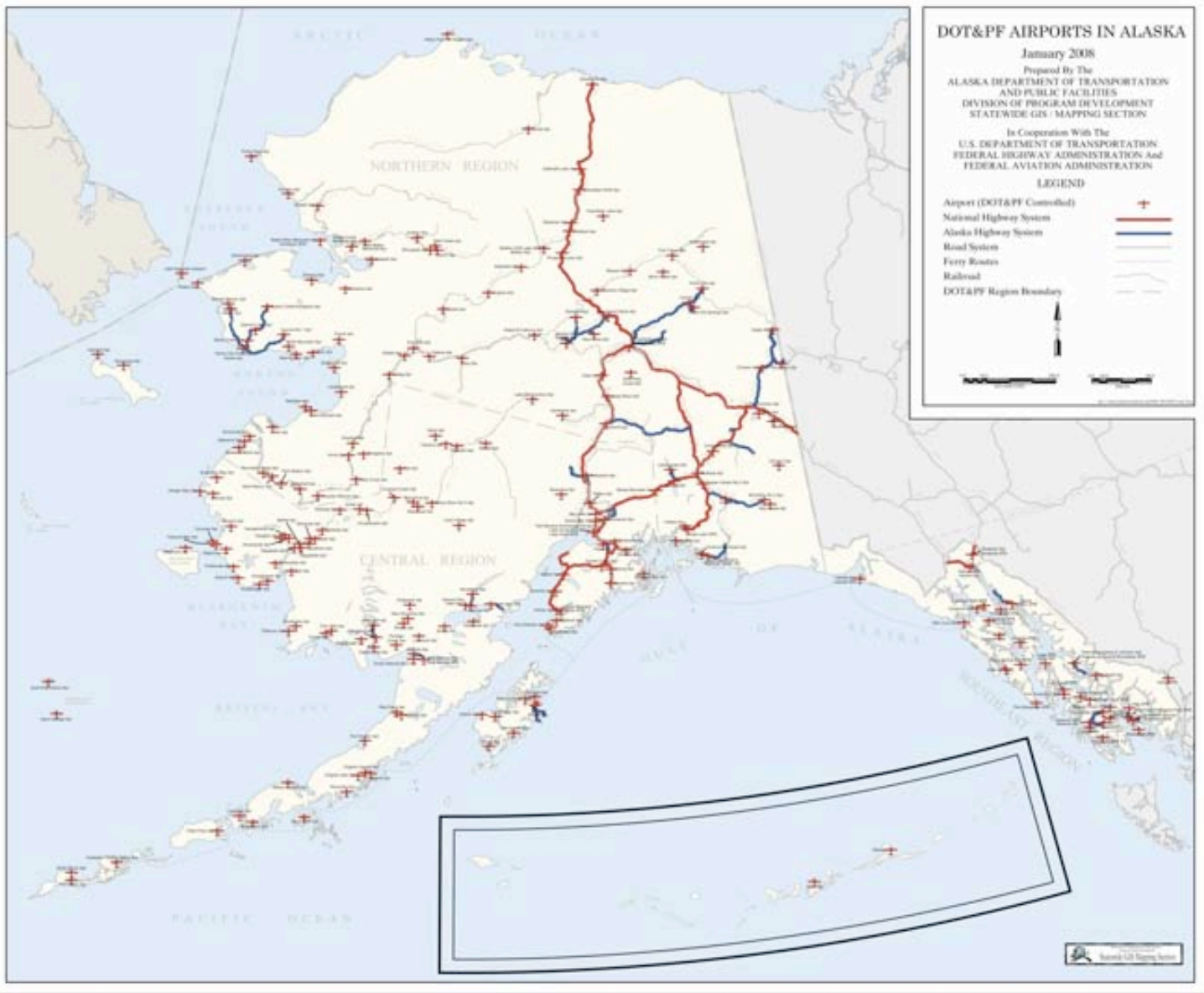
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Prepared By The
ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES
DIVISION OF PROGRAM DEVELOPMENT
STATEWIDE GIS / MAPPING SECTION

In Cooperation With The
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION AND
FEDERAL AVIATION ADMINISTRATION

LEGEND

- Airport (DOT&PF Controlled) 
- National Highway System 
- Alaska Highway System 
- Road System 
- Ferry Routes 
- Railroad 
- DOT&PF Region Boundary 



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



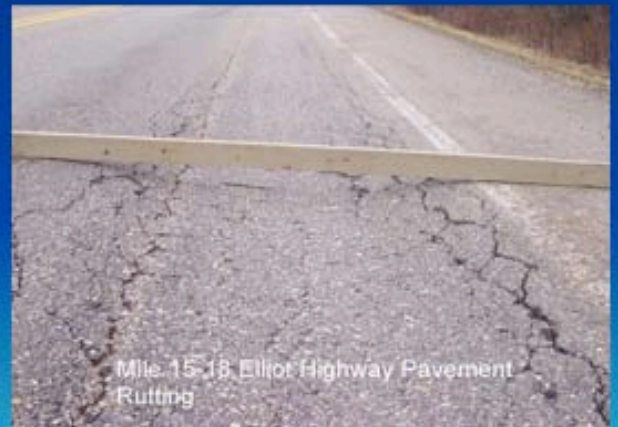
Richardson Highway

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



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

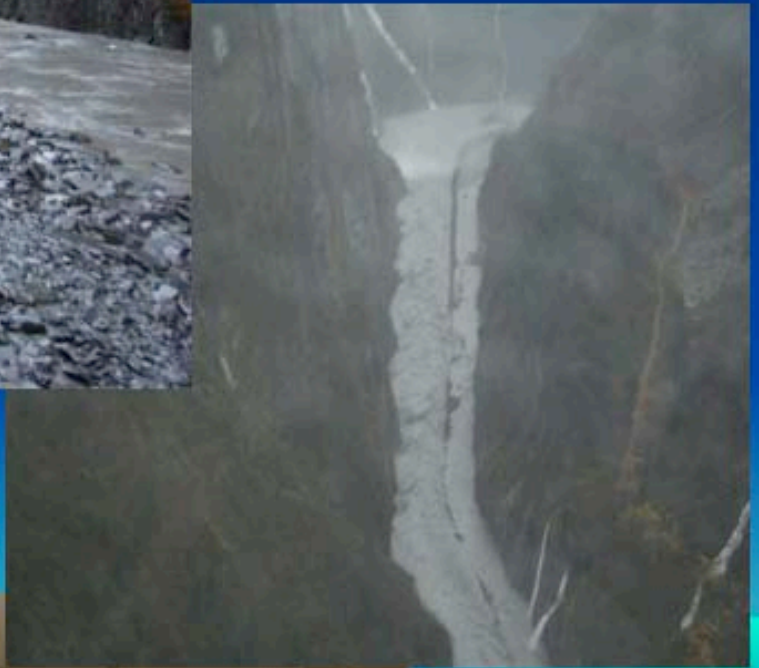
- Coastal communities and their infrastructure are vulnerable to accelerated coastal erosion due to storm activity and wave action eroding shorelines once protected by shore-fast sea ice
- As the climate warms, coastal erosion will increase as sea ice retreats and coastal storms become more frequent
- 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
- Aulse 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**



What is DOT & PF Doing Now Shoreline 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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