

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



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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
- Afeis 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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