

Climate Change in Alaska

Transportation Infrastructure and Climate Change



Michael J. Coffey

Chief, Statewide Maintenance and Operations

Alaska Department of Transportation and Public Facilities

Public Infrastructure and Climate Change – ADOT/PF

- 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 regions are 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
- 845 Bridges
- 257 Rural Airports
- 28 Harbors
- 720 Buildings (DOT owned or managed)



Alaska Compared to the Continental U.S.A.



Barrow = Duluth, Minnesota

Ketchikan = Jacksonville, Florida

Nome = Omaha, Nebraska

Akutan = El Paso, Texas

DOT&PF AIRPORTS IN ALASKA

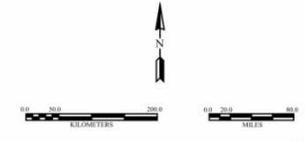
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STATEWIDE GIS / MAPPING SECTION

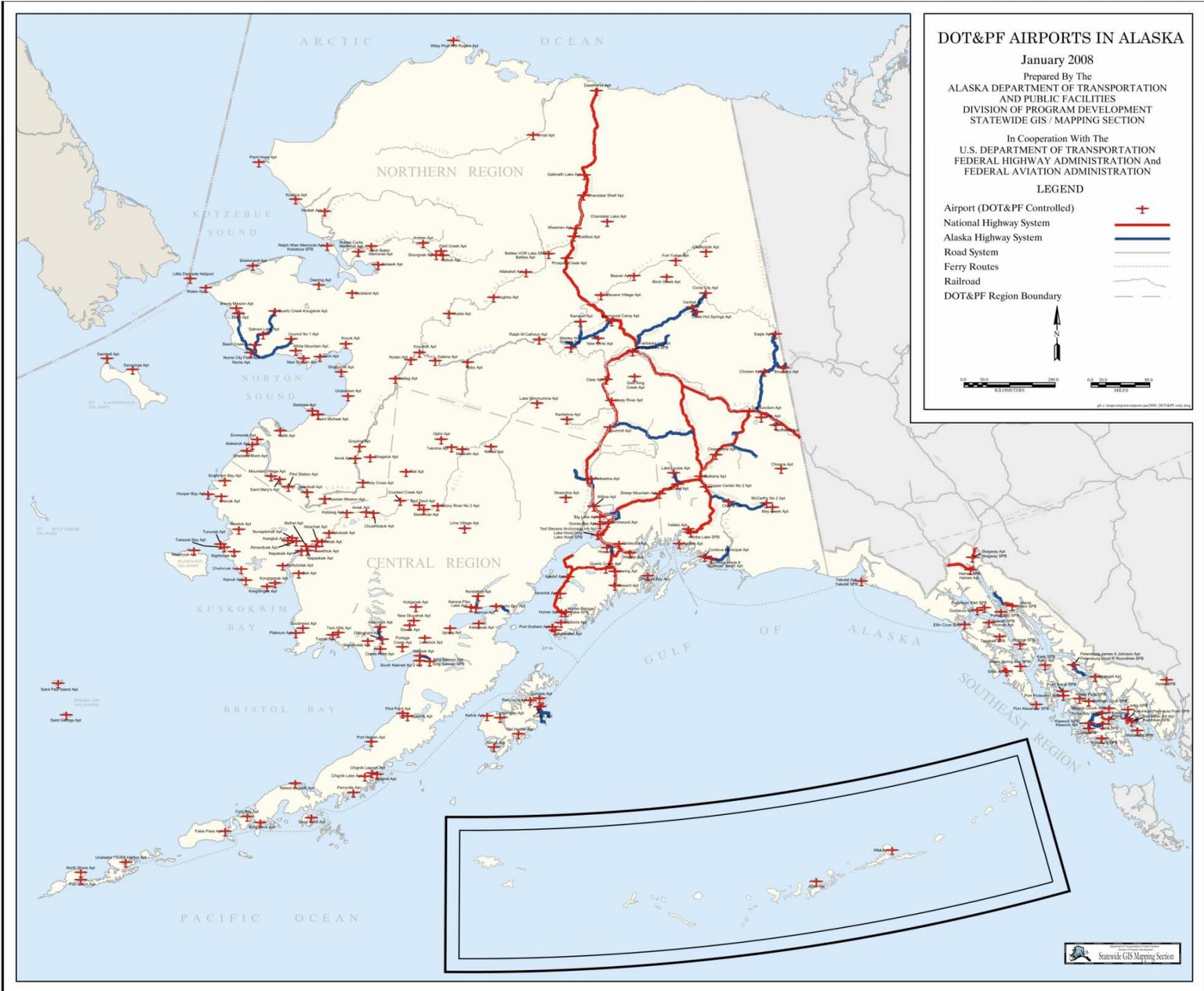
In Cooperation With The
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION And
FEDERAL AVIATION ADMINISTRATION

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 Coastal erosion due to lack of sea-ice
- Increased river and shore erosion
- Sea-level rise
- Increasing temperatures



Nome-
Council
Road



Copper
River
Highway

Potential Impacts to Infrastructure

Melting/Warming Permafrost

- Current estimate is the Northern Region M&O spends approximately \$10+ million annually due to melting permafrost
- This represents a fraction of the need
- Costs will increase if warming trend continues



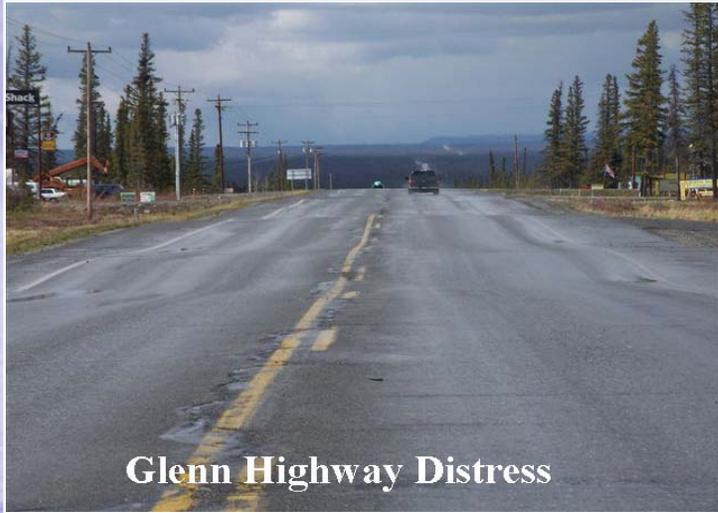
Tok Cutoff Highway

Potential Impacts to Infrastructure

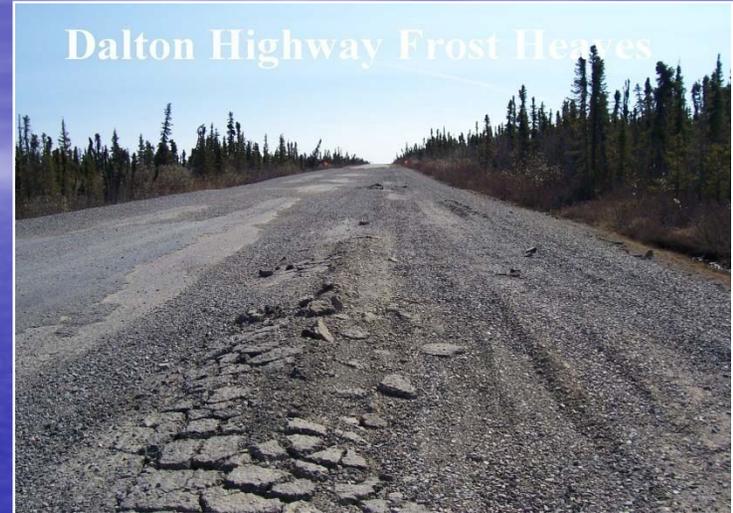
Melting/Warming Permafrost

- 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



Glenn Highway Distress



Dalton Highway Frost Heaves



Alaska Highway Damage and rutting



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 M&O 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



Potential Impacts to Infrastructure

Loss of Shore-fast Sea Ice

- Erosion rate: These two photos were taken 2 hours apart, note the ATV tracks in the road (note the 55 gallon barrel). This road no longer exists.
- In 1997, Shishmaref lost 125 feet of beach in a single storm



Flooding



Flooding



Western Alaska Storm Damage



Affected

- Highways
- Buildings
- Airports
- Waysides



Nome

Western Alaska Storm Damage



Nome-Council Highway

Kotzebue



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 and insects to prosper in Alaska

What is DOT & PF Doing Now

- Shoreline Protection
- Relocation
- Evacuation Routes/Shelters
- Flood Mitigation
- Drainage Improvements
- Permafrost Protection

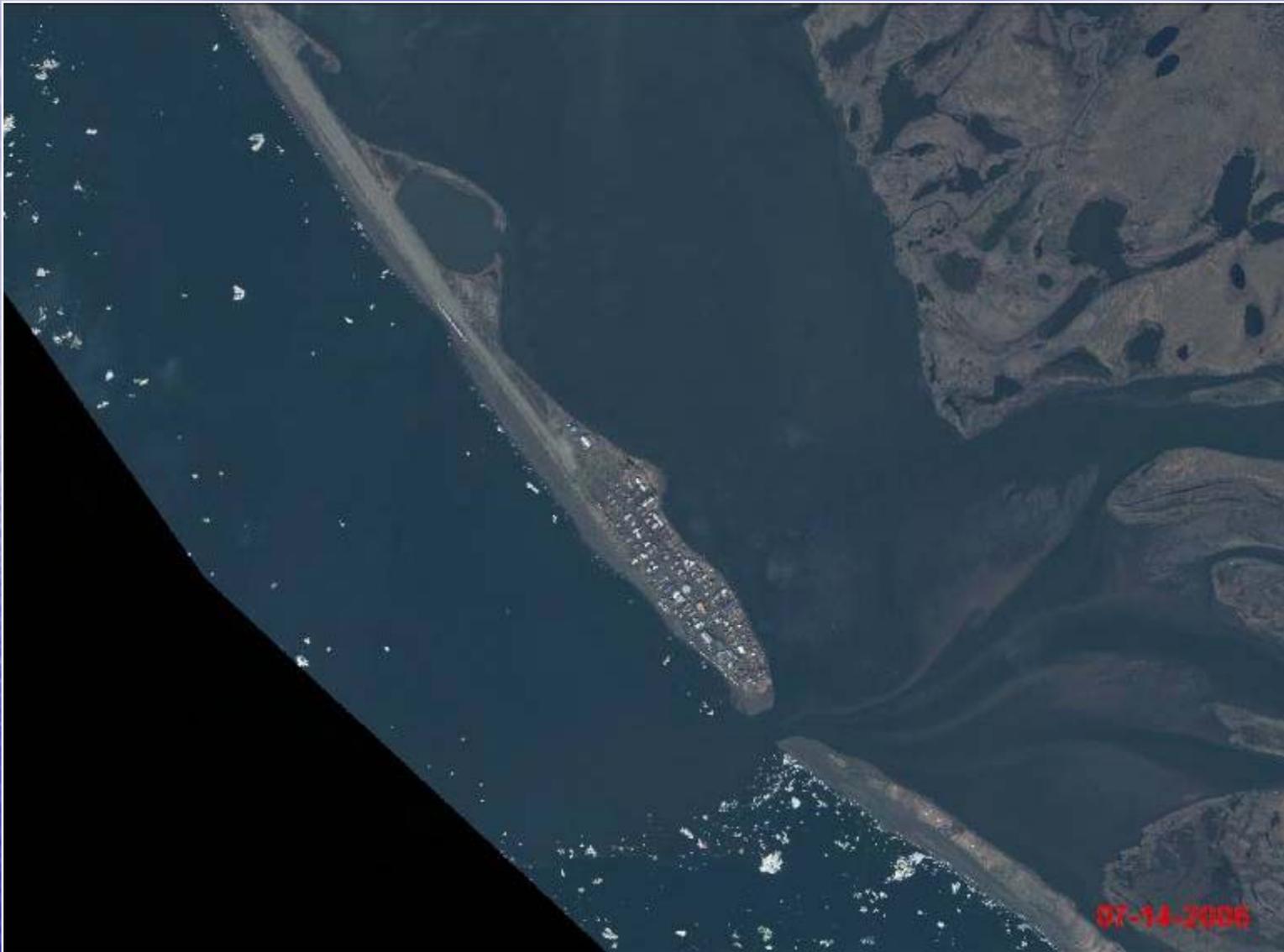


What is DOT & PF Doing Now Shoreline Protection Kivalina Airport (FEMA)

- Placed supersacks on the coastal side of airport property to protect the taxiway after sea storm
- Used local labor and materials
- Developing a more permanent
 - \$5.3M Const est.
 - Scheduled 2009 if FEMA approves



Kivalina



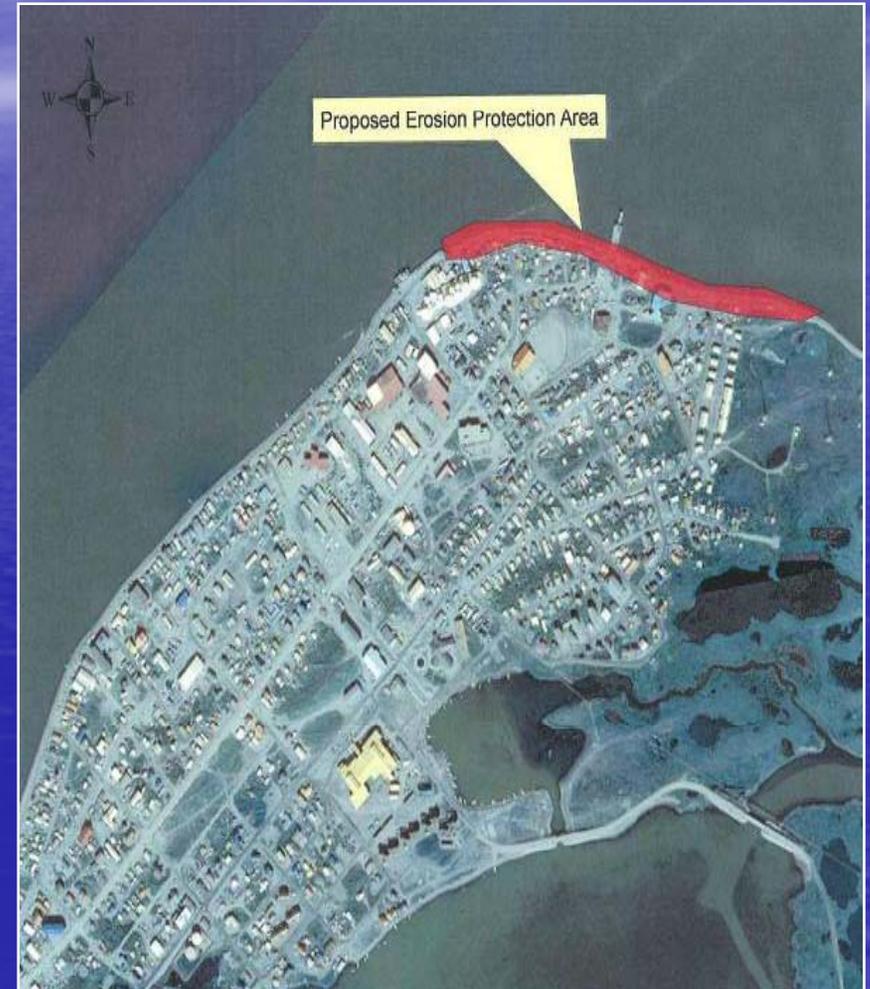
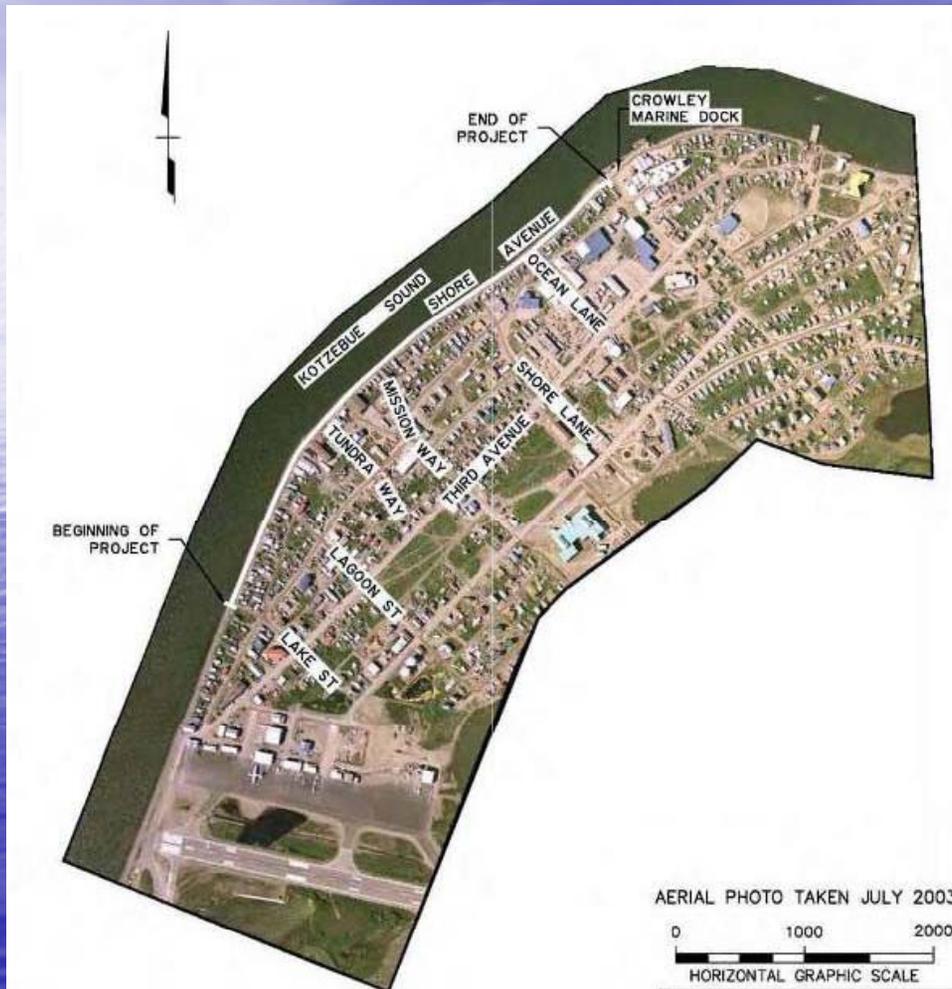
What is DOT & PF Doing Now Shoreline Protection

Kotzebue Shore Avenue (FHWA)

- FHWA funded project to construct approximately 4400 lineal feet of sheet pile erosion protection
- Design complete

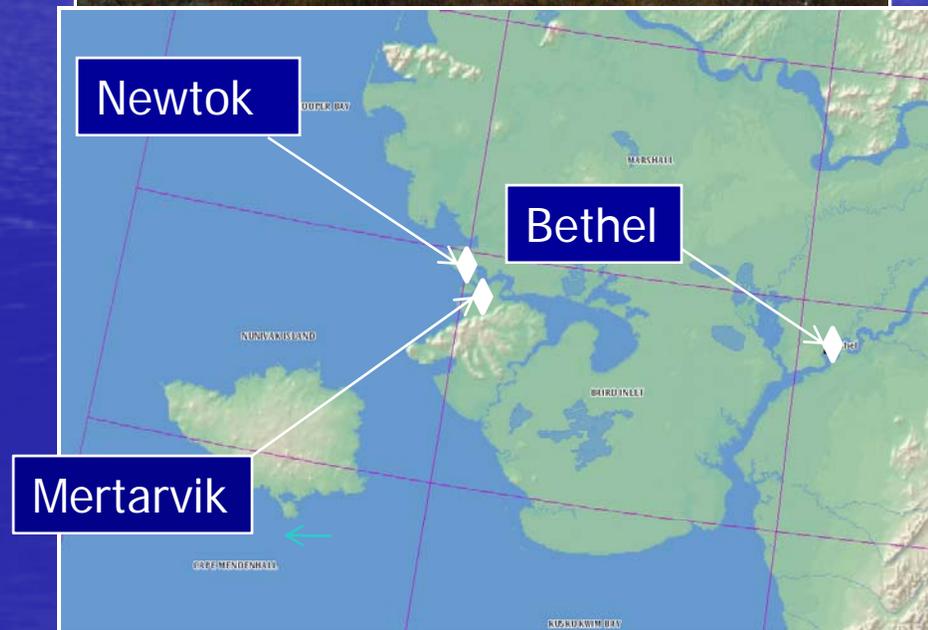


Kotzebue Roads - Shore Avenue



Mertarvik Barge Facility

- Scope of Project: Construct 30,000 foot staging area with 16 foot wide boat ramp at Mertarvik
- Design: Nearing completion \$250K
- Construction: estimated \$1.8 million
- Total Project Cost: \$2.8 million (includes \$800K from Economic Development Administration - remainder General Funds)
- Schedule
 - Advertise February 25, 2009
 - Bid Opening March 27, 2009
 - Substantial Completion: July 15, 2009



Shishmaref Relocation Road

Reconnaissance Study

- Field work started in 2007
- Reconnaissance studies are broad in scope – provide overview of challenges and issues
- Major issue at Shishmaref is materials costs
- Scope: Evaluate the possibilities of a road from Ear Mountain to a barge site on the coast.
- Working in cooperation with the National Park Service
- Potential road alignments currently being evaluated

What is DOT & PF Doing Now

Evacuation Routes

Gambell Evacuation Road

- FHWA funded
- Construct an evacuation road to safe ground during storm events
- Currently the Environmental Document is under review
- The project is underfunded

What is DOT & PF Doing Now

Evacuation Routes - Point Hope

- Point Hope Evacuation Road Rehabilitation
 - FHWA funded project to raise the elevation of the road above flood levels
 - Construction in 2009
- Point Hope Evacuation Road Extension
 - FHWA project in Design (NSB) to extend the evacuation road as funding allows.
 - Construction in 2010



Hopper Bay Airport Relocation

- Coastal erosion has plagued the airport in recent years, likely exacerbated by climate change and marginal sea ice conditions
- Various erosion protection measures have been attempted
- Currently an airport **relocation** project is scheduled for FFY11 or FFY12 (under design)



What is DOT & PF Doing Now

Flood Mitigation

Koyukuk Airport Improvements

- Airport project completed in 2006
- Lengthened and widened runway.
- Raised grade above the 100 year flood levels
- Total Cost: \$9.2 M
- Requested funding for evacuation road



What is DOT & PF Doing Now

Drainage Improvements

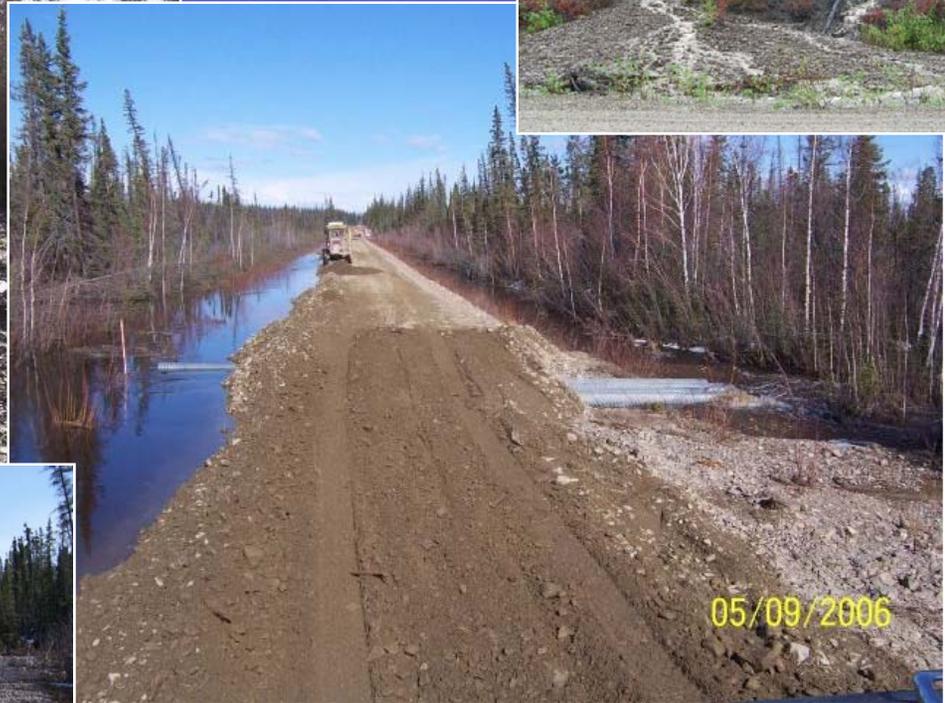
Steese and Taylor Highways

- 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



05/09/2006



05/11/2006

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



*Presented by Michael J. Coffey
State of Alaska DOT & PF
State Maintenance and Operations Chief
mike.coffey@alaska.gov*