REPORT CARD FOR ALASKA'S INFRASTRUCTURE

2021

Alaska Section of the American Society of Civil Engineers

INFRASTRUCTUREREPORTCARD.ORG/ALASKA

ASCE

AMERICAN SOCIETY OF CIVIL ENGINEERS

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Infrastructure for All Alaskans

Alaskans think about infrastructure a little bit differently than the rest of the United States. Alaska's infrastructure is truly unique, covering a vast area of over 663,000 square miles and supporting a population of just over 730,000 people. For transportation systems, there is no one mode of transport in Alaska, and sometimes the route is different depending on the time of year. Some homes do not have access to indoor plumbing, and while sometimes that is by choice, too often it is not. Many of Alaska's remote communities are still in need of water and wastewater systems that are safe, efficient, and sustainable, while even our most populated areas are still learning how to best handle every day solid waste in a subarctic environment.

Alaska's infrastructure investment is crucial for our way of life and success of the economy. Historic investment at the federal level through the Infrastructure Investment and Jobs Act creates a similarly historic opportunity for state and local levels to maximize the benefits of Alaska's infrastructure investment that would last for generations to come. As Alaska's legislators address budget challenges, the Alaska Report Card – developed for Alaska, by Alaskans – demonstrates the importance of continued infrastructure investment.

Four key solutions have been identified raise Alaska's infrastructure grades! With the information provided in this Report Card, it is American Society of Civil Engineers (ASCE) Alaska Section's hope that Alaska's Civil Engineers can work with state leaders to plan, design, build, operate and maintain safe, efficient, and sustainable infrastructure for all Alaskans.

Background on ASCE's Infrastructure Report Card Program

In 1998, the American Society of Civil Engineer's published the first Report Card for America's Infrastructure (Report Card). Using a simple A to F school report card format, the Report Card provides a comprehensive assessment of current infrastructure conditions and needs, both assigning grades and making recommendations for how to raise the grades. An Advisory Council of ASCE members assigns the grades according to the following eight criteria: capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation.

Raising the Grades

Key Solutions

1. Have a Plan and Fund for the Future:

All infrastructure owners and operators should create and fund capital replacement plans for both immediate and long-term needs.

2. Maintenance is Key for Alaska

Maintenance is the everyday work that must be done to keep things moving and Alaska's infrastructure needs it. Sometimes it is all about the basics, and maintenance is the first step to good infrastructure. Maintenance needs to be considered during design as it is often the largest ownership cost.

3. Keep Up Infrastructure Improvement Efforts:

Elected officials must lead the efforts to improve Alaska's infrastructure for today and in the future. However, fluctuating oil prices, impacts from climate change, and population flux cause challenges for the state. Deferred improvements only move the problem farther down the road, which costs Alaskans now and even more in the future.

4. Innovate as We Replace:

Alaska should support and encourage innovative solutions to infrastructure funding. The key to keeping up with rising needs is to keep replacing failing infrastructure with durable, resilient, and smarter solutions.

About ASCE Alaska Section

Civil engineers are entrusted by society to create a sustainable world and enhance the global quality of life. We are committed to maintaining and improving Alaska's infrastructure. Founded in 1951, the Alaska Section of ASCE represents about 850 civil engineers in Alaska. We understand that infrastructure is vital to our economy, health, and natural environment. With our commitment to serve and protect the public in mind, civil engineers throughout the state graded each infrastructure category according to the eight criteria of the Report Card program.

Report Card for Alaska's Infrastructure History

In 2017, the Alaska Section of ASCE released its first report card for Alaska's infrastructure. The report card release on February 7, 2017, was the culmination of thirteen months of dedicated efforts to assemble publicly available reports and data, as well as performing many interviews with infrastructure owners and administrators. The first report card covered nine areas of Alaska's

infrastructure: Aviation, Bridges, Dams, Energy, Marine Highway, Ports and Harbors, Highways, Solid Waste, and Water and Wastewater. From the release, the report card has been an important tool in our advocacy at the local, state, and national levels.

Work for this report card update started in 2020 and continued through the coronavirus pandemic (COVID-19). On February 23, 2022, ASCE Alaska Section released the 2021 Alaska report card with a presentation at the Capitol in Juneau. The same areas of infrastructure that were evaluated in the 2017 report card were reevaluated. Changes for the 2021 report card include the addition of Transit, Rail and School sections and the separation of the water and wastewater sections. Thanks to a group of dedicated engineers that have volunteered countless hours over the last year and a half, the 2021 Alaska report card is now complete. Now starts the work to use this resource in discussions and advocacy for our state's infrastructure.

Executive Summary

Aviation in Alaska is a huge economic engine, contributing approximately $3.5 billion annually to the state's economy. The Ted Stevens Anchorage International Airport (ANC), Alaska's largest airport, serves approximately 5.4 million passengers annually. ANC is also a cargo airport, and in the terms of tonnage, second only to Memphis in the U.S. and among the top five globally. With more than eight in ten of the state's communities accessible only by air or water, much of the state is dependent on aviation for access to fresh foods, mail, and healthcare. There are 200 airports in Alaska with infrastructure deficiencies estimated to require funding in excess of $1 billion to remedy.

Introduction

The Alaska aviation system is the largest in North America and consists of more than 760 registered private- and public-use airports. The State owns and operates 232 out of 394 public-use airports. It is the sixth largest economic sector in Alaska and contributes approximately $3.8 billion annually to the economy. Approximately 82% of Alaska's communities depend upon air travel as the only year-round means for transporting people, goods, equipment, and materials. These communities rely on the aviation system to have sufficient capacity to support air cargo operations, passenger travel, medevac operations, tourism adventures, and other economic activities. Hence, the quality of airport infrastructure affects the quality of life through the level of service provided to communities. Average airfield pavement condition for all categories of airports has improved since the 2013 comprehensive pavement condition report. However, operating costs for rural airports continue to outpace earned revenues yielding a $30.4 million annual deficit statewide. Overall, the state's capital improvements and maintenance requirements are growing as airports age and community needs change; these trends increase the need for more resources to preserve current assets and plan for the future.

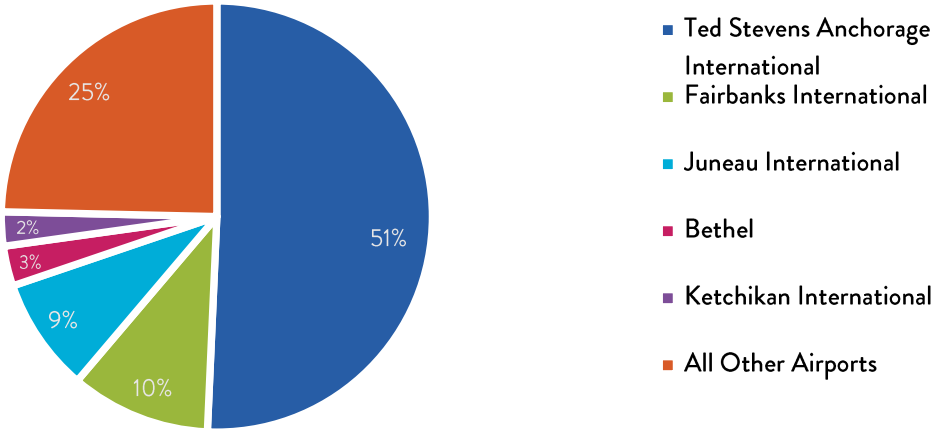
Capacity

The Alaska aviation system is unlike any other in the United States, being the largest in North America and consisting of more than 760 registered private- and public-use airports. Alaskans are eight times more likely to use aviation as transportation than those residing in the contiguous United States. Alaska has six times as many pilots and 16 times as many aircraft per capita than the rest of the country.

Most interstate passenger traffic is routed through the Alaska International Airport System (AIAS) consisting of the Ted Stevens Anchorage International Airport and Fairbanks International Airport. The Ted Stevens Anchorage International Airport is an important connection point for cargo between Asia and U.S. markets. The coronavirus pandemic (COVID-19) has led to an increase in cargo flights. According to the 2014 Airport Master Plan, the average annual delay for the existing airfield is two minutes per aircraft. This is well below the eight-to ten-minute delay threshold considered to be disruptive. The airport can accommodate a 30% increase in activity before reaching this threshold.

The figure below displays the percentage of passenger traffic experienced by the five busiest airports and all other Alaska airports in 2019.

Figure: 2019 Percentage of Passenger Traffic

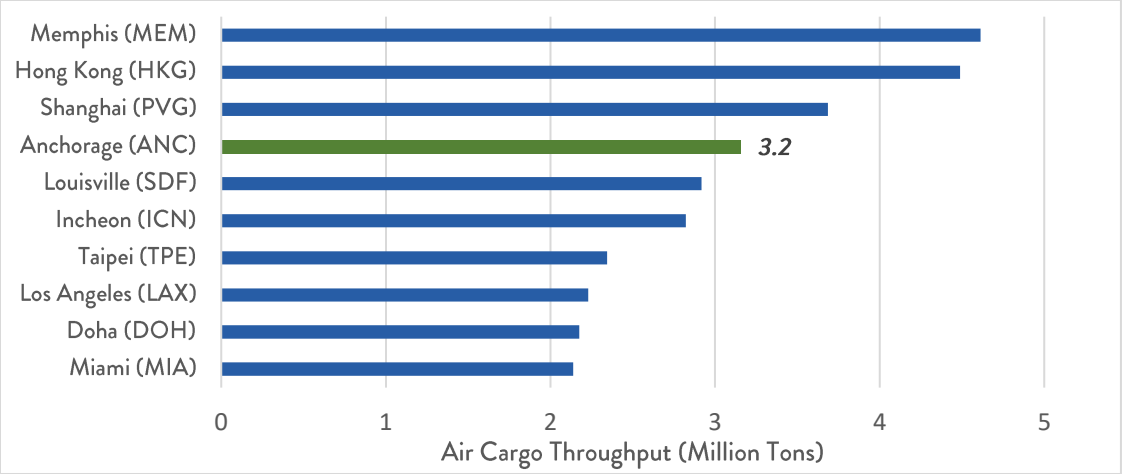


Credit: Federal Aviation Administration (FAA)

The Fairbanks International Airport provides an alternate landing location for Anchorage International Airport traffic. It has ample terminal area and airfield facilities to accommodate passengers and cargo aircraft when traffic needs to be diverted from Anchorage. Fairbanks is capable of handling 50% to 100% of the Anchorage air cargo traffic without airfield delays.

The AIAS has a relatively broad customer base consisting of domestic and international air cargo transfer operators and commercial passenger airlines. Anchorage International Airport is also a critical refueling stop for international cargo flights. It was ranked second in the United States and fourth in the world for air cargo throughput with over 3.2 million pounds of cargo weight landed in 2020, as shown by the figure on the next page.

Figure: Top 10 Air Cargo Airports in the World (2020)



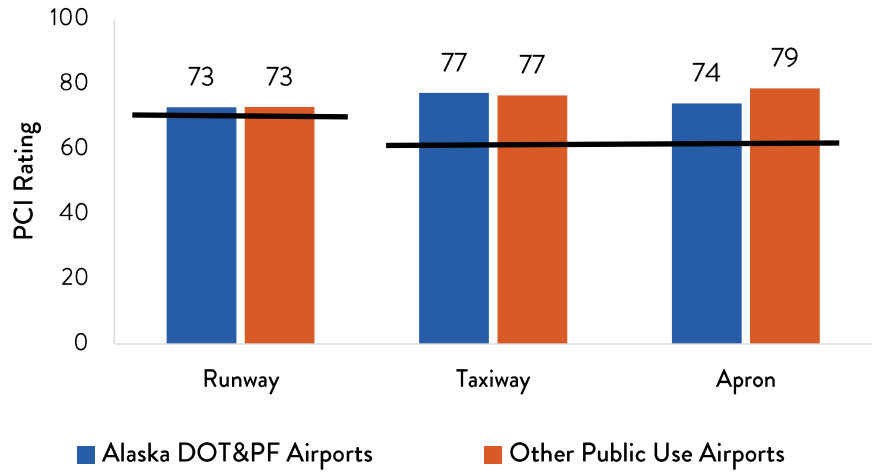
Credit: Airport Council International

The Alaska aviation system is constantly changing. Aircraft traffic and demand for cargo, passenger, and other commercial services periodically increases in some locations while decreasing in others. Alaska's airports have adequate capacity and delays are not an issue.

Condition

The Alaska Department of Transportation & Public Facilities (DOT&PF) has a robust system for inspecting airfield pavements. Every three years, the Alaska DOT&PF conducts visual assessments of state-owned and municipal paved airports to document pavement condition and wear. All pavement surfaces are rated on a Pavement Condition Index (PCI) scale of 1 to 100, with 100 being newly constructed pavement. The Alaska State Legislature established guidelines requiring Alaska DOT&PF to maintain minimum PCI condition ratings of 70 for runways and 60 for taxiways and aprons. The average PCI ratings for Alaskan airports are all above the minimum and are shown on the figure on next page, with black lines indicating the minimum PCI. This is a great improvement over the average PCIs of 73 for international and regional airports and average PCI of 64 for community and local airports reported in the 2013 comprehensive pavement condition report.

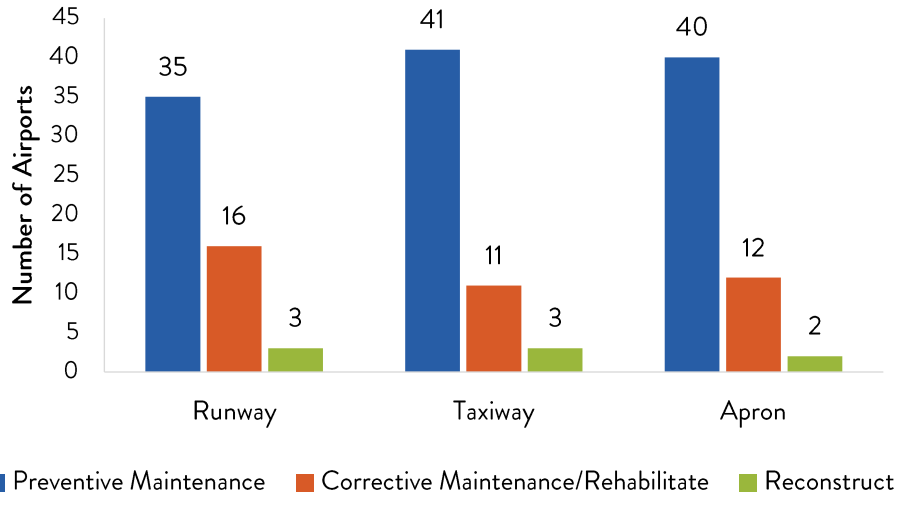
Figure: PCI Ratings for Public Use Airports



Credit: Alaska DOT&PF

The Alaska DOT&PF also keeps a database of airport maintenance and capital improvement needs. The needs generally fall into three categories: preventative maintenance, corrective maintenance/rehabilitation, and reconstruction. The database is updated annually with public requests, inspections, Alaska DOT&PF staff input, FAA letters of correction, and other issues. The database was upgraded in 2019 for display on portable tablets as part of the Alaska Aviation System Plan Phase II Updates. This step improved consistency and capture of airport conditions and needs. The identified needs for paved Alaska airports are summarized in the figure below.

Figure: Recommendations for Paved Public Airports



Credit: Alaska Aviation Database

Many community airports are unpaved and planes land on gravel, water, ice, grass, or dirt. The database also includes gravel airports that require resurfacing, addition of dust palliatives, and lighting replacement. The gravel surfaces of many community airports have eroded, thinned, and rutted over time due to environmental conditions and snow removal activities. Many of their lighting systems are damaged due to repeated exposure to freeze/thaw cycles.

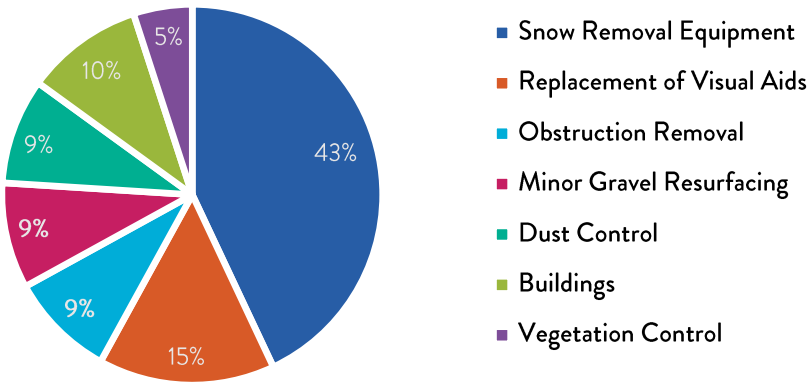
Operations & Maintenance

The harsh natural environment makes operation and maintenance of Alaskan airports difficult. Approximately 80% of Alaska's landmass is underlain by permafrost and the airports constructed over permafrost rely on it remaining frozen. The National Snow and Ice Data Center reports that permafrost has warmed 4 °F to 8 °F since the mid-1980's. Other challenging site conditions include lack of nearby sources of suitable construction material, excessive erosion, sensitive environments, extreme weather, earthquakes, floods, and dust from gravel surfaces.

AIAS airports are self-funded, earning revenue from leases and facility usage fees. In contrast, the operation and maintenance expenses of all rural airports exceed their revenues. In 2017 alone, operating costs for rural airports were estimated to be approximately $37 million (M) while revenues were approximately $6.6M, yielding a $30.4M deficit.

The top 2019 maintenance needs from the database are shown by percentage in the figure below. Snow removal equipment accounts for the greatest percentage of need and is essential for keeping airports safe and operational during the long winter months.

Figure: Top 7 Airport Maintenance Needs

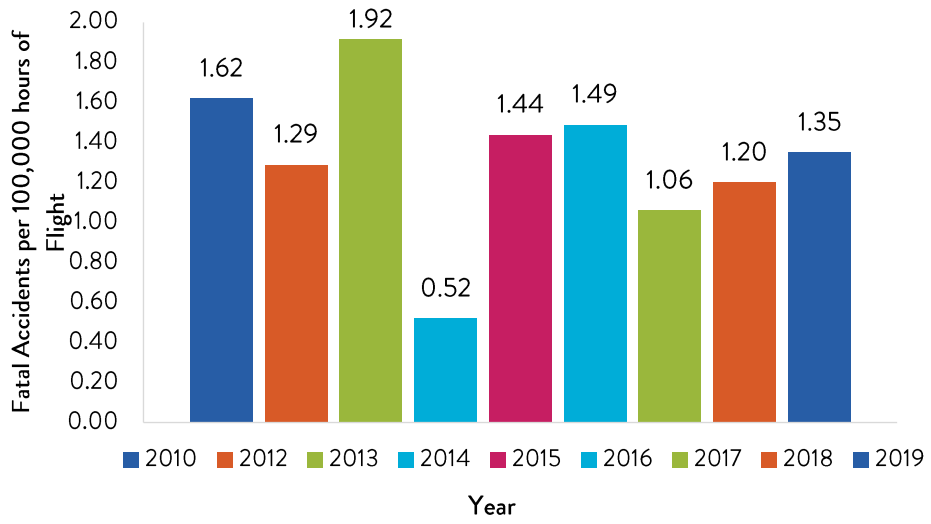


Credit: Alaska Aviation System Plan Phase II Final Report

Public Safety

Alaska's aviation crash and fatality accident rates have remained consistently high from 2010 to 2019, shown in the figure below. From 2008 to 2017 the total accident rate in Alaska was 2.35 times higher than for the rest of the United States. The fatal accident rate in the state was 1.34 times higher, according to NTSB statistics.

Figure: Fatal Accident Rates per 100,000 Hours of Flight (Alaska)



Credit: National Transportation Safety Board (NTSB)

The NTSB proposed various solutions for improving safety in its 2019-2020 Open Safety Recommendations

The NTSB's recommendations indicate that weather observations from approved sources are crucial for improving aviation safety in Alaska. Alaska's airport system contains 136 automated weather stations that broadcast weather information on a published radio frequency. At the FAA Aviation Safety Summit in October 2020, FAA announced that funding had been secured for 35 new weather stations to be installed over the next several years, with another 25 weather stations in progress. Approximately 140 more stations are needed to increase the density of weather reporting stations in Alaska to be comparable to the contiguous United States.

The FAA has established a large network of weather cameras at key locations throughout Alaska and plans to install more in the future. Although the cameras are of limited use under instrument flight rules, many pilots use them to obtain real-time advisory information about current enroute and destination weather conditions. However, Alaska lacks a sufficient number of certified weather stations.

Approximately 80% or more of airports in Alaska lack sufficient wind coverage. Constructing crosswind runways would increase the overall safety at airports and provide redundancy. However, such projects are not a priority for the state due to the substantially higher construction and maintenance costs associated with multiple runways. Other priorities such as deficient infrastructure including eroded, thinned, or rutted gravel surface runways and damaged airfield lights are considered to have a larger safety impact.

Funding & Future Need

There are many existing sources for funding airport infrastructure projects, maintenance, and operations. These include FAA Airport Improvement Program (AIP) funds, Alaska's general fund, local airport sponsor funds, airport lease rates and fees, and other sources.

AIP funds invested annually into Alaska's airports varied from $215M in 2016 to $243M in 2020. During that period, the State of Alaska spent an additional $37M annually on maintenance and operations for rural airports. However, revenues generated at the rural airports were approximately $6.6M, which resulted in a $30.4M deficit.

The Passenger Facility Charge (PFC) Program is an important source of capital funds for the Ted Stevens Anchorage International, Fairbanks International, Juneau International, Ketchikan International, and Sitka Rocky Gutierrez airports. The PFCs generate funds for airport improvement projects that enhance safety, security, and capacity; reduce noise; or increase air carrier competition.

Programs such as the Alaska Bypass Mail and Essential Air Service (EAS) are also important to the state, although they do not directly fund airport projects. The Alaska Bypass Mail Program subsidized cargo shipments to rural Alaska and the EAS program subsidizes airlines for scheduled air services to some communities. These programs generate aviation activity at several airports, making freight and travel to and from remote communities more efficient and affordable.

More than 25 local (non-Alaska DOT&PF) sponsors own and operate public use airports in Alaska. Although they must compete with Alaska DOT&PF owned airports for AIP funding, they often partner with and receive funding from Alaska DOT&PF.

Declines in oil prices between 2014 and 2016 reduced the State budget revenues generated by oil and gas production and shifted Alaska DOT&PF's focus from infrastructure expansion to maintenance and preservation despite an increase in AIP funding. In 2019, the database identified needs for over 200 airports with the total cost for addressing infrastructure deficiencies exceeding $1 billion. Individual airport needs range from brush-cutting and repair of small equipment to the construction of entire runways. The need for capital improvements and maintenance is growing as airports age and community needs change; however, there will be insufficient funds to address all identified needs for the foreseeable future if Alaska's budget remains as is.

Resilience

Most rural airports lack alternate means of year-round access such as roads. Construction, maintenance, or repair at these airports rely upon limited barge services to transport heavy equipment and supplies to the community. The logistical challenges and high costs associated with such work make it difficult to conduct maintenance and respond to natural disasters, which makes these airports less resilient.

Permafrost is warming and thawing at some airports, presenting new challenges. Issues such as slumping, ground subsidence, slope instability, thermal erosion and migration of riverbanks, catastrophic thaw collapse, and water quality degradation have occurred. Warming permafrost is also increasing the cost of construction and repair efforts needed to maintain airfield lighting, pavement, and navigational aids in satisfactory condition without compromising safety.

The Alaska DOT&PF and FAA have taken limited measures to minimize service disruptions by deploying certified temporary battery-powered portable lighting systems during airfield lighting outage emergencies. FAA has also installed emergency shelters for employees to use during inclement weather or during overnight trips at several airports. Such measures are not likely to significantly improve the resilience of all airports.

Innovation

The remote locations and challenging site conditions of Alaska airports necessitate innovative, practical, and sustainable solutions. Several research and technology transfer programs exist within the state to address these challenges. These programs are funded by transportation agencies, academic institutions, foundations, and private entities. Most of the work is geared toward finding cost-saving solutions, deploying new technologies, and leveraging sustainable economic opportunities. Examples of such programs include Alaska DOT&PF Research, Development, and Technology Transfer, Alaska State Transportation Innovation Council, and Alaska University Transportation Center.

A variety of unmanned aerial systems, hybrid airships, and Vertical Takeoff and Landing (VTOL) unmanned cargo aircraft are currently being developed. These types of aircrafts are being tested at a variety of communities in Alaska because they have the potential to operate in remote and inaccessible locations. These modes of air transportation require only a small fraction of the infrastructure compared to conventional modes of aviation. If these technologies are utilized more extensively, in the future it may be possible to reduce the scale, development costs, material needs, and maintenance costs for communities that adopt hybrid airships and VTOL aircraft alternatives.

Let's Raise the Grade

- Make funding deferred maintenance a priority.
- Increase research funding to find cost effective, practical, and sustainable alternatives for scarce aggregates.
- Construct more "on-route" certified weather stations and weather cameras.
- Make a comprehensive effort to improve aviation safety. This requires addressing infrastructure needs such as crosswind runways, airfield lighting systems, and gravel runway surface repairs.
- Improve the consistency and accuracy of inventory data.
- Repair deficient infrastructure such as eroded, thinned, or rutted gravel surface runways and damaged airfield lights to improve safety.

Find Out More

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Executive Summary

Alaska has 1,565 bridges, the majority of which are less than 50 years old, making them younger than bridges in most other states. While less than 7% of Alaska's state and local bridges are rated in poor condition, the critical and economical time to maintain this key infrastructure is before problems arise. Though there are a number of bridge improvement projects in planning or underway, a strategic funding approach is needed to maintain bridges before problems arise and replace bridges that are functionally or structurally inadequate.

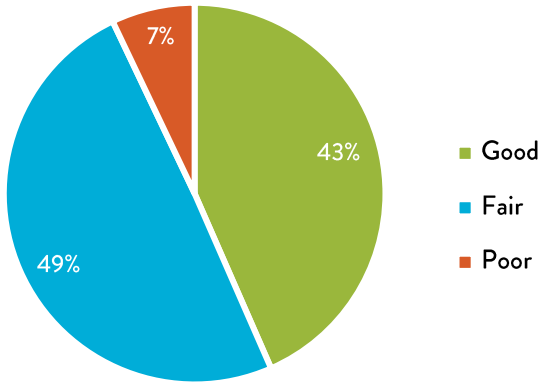
Introduction

Alaska is home to 1,565 bridges owned by tribal, local, state, and federal governments. Some of Alaska's bridges carry the lowest traffic levels in the country with more than 80% of the tribal and federally owned bridges seeing fewer than 10 vehicles per day. Progress has been made in addressing bridges in poor condition. The number of bridges in poor condition was 9.5% in 2015 compared to 7% of bridges in Alaska today, a value that is just below the national average. For Alaska Bridges on the National Highway System (NHS) these numbers went from 8.4% in 2015 to 4.7% in 2020. Otherwise, 49% of bridges are in fair condition, and 43% are in good condition. Alaska gas tax is among the lowest in the nation and is unchanged since 1970. Funding from the state gas tax is insufficient for maintenance of our state's bridges and the Alaska DOT&PF (Department of Transportation & Public Facilities) has long relied on general fund appropriations by our state legislature to fund part of the maintenance cost. Continuity in maintenance is necessary to keep our bridges in their current condition. Alaska's bridges have performed exceptionally well during recent major seismic events, and ongoing research is contributing to better understanding of cold design structures. Finally, to support improvements, Alaska needs to continue to develop an asset management program to support long-term decision making.

Capacity & Condition

When considering the condition of Alaska's bridges, it is important to note that federal funding prioritizes bridges on the NHS over those on non-NHS roads. The NHS includes the Alaska's major interstates, defense routes, and the Alaska Marine Highway System.

Figure: Alaska NHS and non-NHS Bridges Condition (2020)

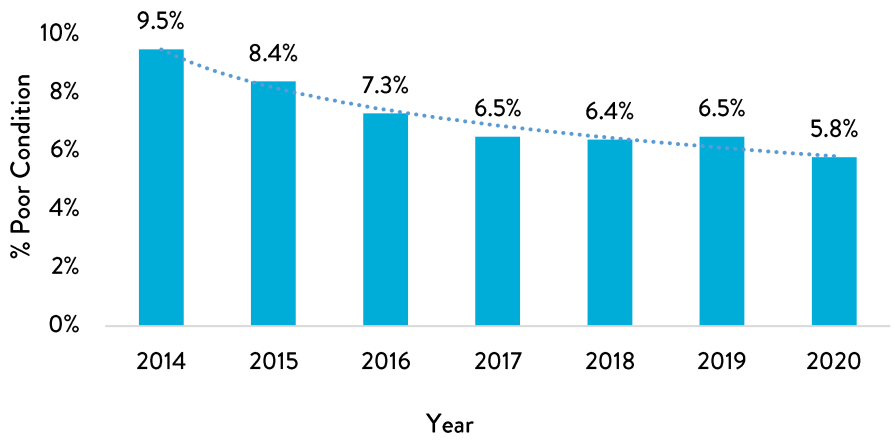


Credit: Alaska DOT&PF Bridge Section

The average Alaskan bridge is only 35 years old. This is younger than the national average age of 43 years. While not necessarily an indicator of condition, bridge age is still important relative to the structure's original design life. Older bridges were designed to have a 50-year lifespan, while newer bridges are designed to last for 75 years. Most of Alaska's bridges were designed for a 50-year lifespan. Typically, the older a bridge is, the more expensive maintenance will be, particularly if preventative maintenance has been deferred. As a result, Alaska's bridges are likely to have a longer remaining service life than the average bridge in other states.

The National Bridge Inventory rating system is used to evaluate the condition of bridges in the country. All states inspect public bridges every two years and assign a rating of good, fair, or poor to various bridge components. The percentage of Alaskan NHS bridges in poor condition has been declining, from 8.4% in 2015 to 4.7% in 2020. The figure on the next page shows a similar trend based on the deck area. In 2020, of the 74 total state and local bridges in poor condition, 73% were on non-NHS routes for which federal funding is not available.

Figure: Percentage of NHS Bridges (by Deck Area) in Poor Condition



Credit: Alaska DOT&PF Bridge Section

Bridges that are damaged or in poor condition may require restrictions, such as load posting, which limits the vehicle weight that may legally cross the bridge. Load postings can affect commerce and public safety because a load-posted bridge may prevent heavy emergency vehicles like ambulances and fire trucks from crossing to respond to an emergency. The number of load-posted bridges in Alaska has been reduced from 10% in 2016 to 7% in 2020, but none of them are on the NHS and federal funding is not available for repairs.

Operations & Maintenance

Routine maintenance of bridges includes reoccurring tasks like anti-icing, de-icing, snow plowing, and repairing collision damage. Preventative maintenance involves the tasks that extend the life of the bridge, such as sealing a bridge deck or repainting steel. Insufficient funding and time make it challenging to keep up with both of these maintenance activities in Alaska. Short summers restrict the time available to complete all the necessary maintenance activities. Federal funds cannot be used for routine maintenance, and support only some types of preventative maintenance.

Alaska DOT&PF's Northern and Central Regions have dedicated bridge maintenance crews, but the Southcoast Region does not. Without proper maintenance funding, work is deferred until more expensive repair or replacement work is needed. Furthermore, only addressing "worst first" problems is inefficient and increases overall lifecycle costs.

Public Safety and Resilience

All public bridges in the United States must be inspected at least once every two years. These inspections allow problems to be discovered and addressed before they affect serviceability or public safety. Bridges are also inspected more frequently to monitor known defects or to respond during emergencies like floods. Divers

inspect underwater portions of bridges at least once every five years. No major safety issues have been discovered in recent years.

Alaska's bridges must withstand harsh environmental conditions. Seismic activity can affect bridge structures directly and indirectly by resultant tsunamis in coastal areas. Warming temperatures increase glacial melt that increases river volumes flowing beneath bridges which can lead to increased scour of bridge foundations and potential failure. These factors make resilience to changing environmental conditions critical for bridge health.

In recent years, several large earthquakes have demonstrated the seismic resilience of Alaska's bridges and the short response time of engineering support. Within five days of the 2018 Anchorage earthquake, engineers had inspected 259 bridges for safety and damage. Only one pedestrian tunnel was damaged due to a waterline break, and no other major structural damage identified. Only 18 bridges needed minor repairs, with minimal temporary bridge closures required.

On July 21, 2020, Alaska experienced a 7.8 magnitude earthquake in the Pacific Ocean near the Aleutian Chain. Within a week, engineers were able to inspect all 15 bridges in the affected area and no significant damage was found. Seismic retrofitting or replacements should be considered for older bridges across the state to meet modern seismic engineering standards.

Funding & Future Need

Alaska receives about 90% of the costs for NHS bridge projects from the federal government and matches the remaining 10% with state funds. Federal funding through Fixing America's Surface Transportation (FAST) Act and its predecessor, the Moving Ahead for Progress in the 21st Century (MAP 21), required Alaska to develop and regularly update a Transportation Asset Management Plan (TAMP) to access federal funding for NHS bridges.

The TAMP presents several strategies to address bridges with poor ratings and maintain bridges in good condition. The TAMP predicts that Alaska needs to spend $175 million annually to improve poor bridges in the next 10 years. Additional planning and funding are needed for non-NHS bridges. The current annual optimized budget scenario provides $75 million for NHS bridges and $25 million for non-NHS bridges.

Currently, Alaskans pay a gas tax of $0.08 per gallon into the general fund and directed to non-NHS bridge projects as well as maintenance and operations projects, among other things. Alaska's motor fuels tax is the lowest in the nation and is unchanged since 1970. The revenue from the motor fuels tax cover only about one third of maintenance costs. Increasing the motor fuels tax and directing it to highway projects would help keep bridges in good and fair condition, while providing funds to improve the condition of the state's bridges in poor condition.

Innovation

In the last four years, Alaska spent $3 million on 10 bridge-based research projects. Bridge research in Alaska generally focuses on cold region design, tsunami and earthquake performance, and safety. These research projects help Alaska refine its approach to seismic design and supplement the American Association of State Highway and Transportation Officials bridge codes with design guidance specific to cold regions. Recently, Alaska's seismic research related to strain in columns spurred the National Cooperative Highway Research Project 12-106, which involved a multi-state effort and produced changes to AASHTO bridge design code.

Let's Raise the Grade

- Increase funding from all levels of government to reduce the number of bridges in poor condition and adequately maintain bridges in good and fair condition.
- Develop an asset management approach for bridge preservation, rehabilitation, and replacement decision-making. The approach should address bridges in all conditions and include both NHS and non-NHS bridges.
- Ensure that the state legislature plans and budgets adequately for long-term maintenance of transportation assets. This includes the state match for federally funded projects and costs not covered by federal dollars.
- Increase motor fuels tax and implement user fees for electric vehicles to provide a stable funding source for maintenance of transportation assets.

Find Out More

- The Federal Highway Administration's Long-Term Bridge Performance (LTBP) web portal for access to bridge data: https://infobridge.fhwa.dot.gov/Home
- Alaska DOT&PF Bridge Section: http://dot.alaska.gov/stwddes/desbridge/

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Executive Summary

There are 184 dams in Alaska, 28 of which with high hazard potential, meaning should failure occur, loss of life and significant economic harm are anticipated. Regulations require emergency action plans for high and significant hazard potential dams, and periodic safety inspections for all dams under federal or state jurisdiction. Currently, 25 of Alaska's 28 high hazard potential dams have emergency action plans, and 18 of the high hazard potential dams are in good or fair condition. A state program is needed to provide grants and low-interest financing to dam owners for maintenance, planning, and repairs.

Introduction

Alaska has fewer dams than other states, however 27% of Alaska's dams in the NID are rated as high hazard potential whereas the national average is only 17%. Historically, Alaskan dams have performed well, exhibiting minimal damage or failures during significant geohazard events including both earthquakes and record-level rainfall and flooding. This high level of performance demonstrates the overall resiliency of Alaska's dam infrastructure. However, there have been few recent efforts to maintain that resilience. Since 2017, relatively little has changed for dams in Alaska. Notably, one out of three regulated Alaskan dams has never had a condition assessment conducted since their construction. Aside from the lack of condition assessments, other changes have been modest or trending downwards. For example, there have also only been minor changes in operations and maintenance while funding for Alaskan dams has recently worsened. All dams regulated by the state of Alaska are required to have an operations & maintenance manual; however, 28% do not have one on file. Dams without operations & maintenance manuals are often poorly maintained and infrequently inspected particularly in rural communities. The funding need in Alaska has also increased over the last few years. Federal dam safety grant funding has decreased steadily from year to year. In addition, no state funding source exists specifically to assist dam owners with maintenance and repair costs which often places a large financial burden on small rural Alaskan communities. The federal high hazard potential dam grant is available but does not typically get used in Alaska as the amount of funding is limited and many of the dams in need of funding are not high hazard.

Capacity

The number of dams in service and the total available storage volume are important factors when considering the capacity of Alaska's freshwater reservoir dams. Most dams that serve urban and community hubs have

adequate storage volume, but many rural dams have inadequate capacity to serve their local communities. The lack of storage capacity may be related to either inadequate dam size or poor dam condition which limits the safe impoundment level. Rural dams are often used for water supply and capacity is critical because there is commonly not a backup source available. In these communities, there is a demand for new or rehabilitated small water supply dams.

Most of the dams in Alaska serve as freshwater reservoirs for communities; however, some are also used for industrial purposes such as hatcheries, mines, and hydroelectric plants. There are currently 184 dams listed in the State of Alaska dam database but only 108 are listed in the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID), due to differing definitions between the Alaska Statutes and the USACE of what constitutes a dam. Dams in Alaska are either regulated by the State or the Federal Energy Regulatory Commission (FERC), are owned and regulated by other federal agencies, or are considered non-jurisdictional. Alaska has 38 federal dams, 82 state dams, and 64 non-jurisdictional. Non-jurisdictional dams are typically small barriers and diversions to flow which do not meet either the State or the USACE definition of what constitutes a dam.

Condition

The USACE criteria used to assess and rate the condition of dams are shown in the table below and on the next page.

USACE Condition Assessment Definitions	
Rating	**Definition**
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Note: Rare or extreme event is defined by the regulatory agency based on their minimum applicable state or federal criteria.

USACE Condition Assessment Definitions Continued	
Rating	**Definition**
Poor	A dam safety deficiency is recognized for normal operating conditions which may realistically occur. Remedial action is necessary. Poor may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Investigations and studies are necessary.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

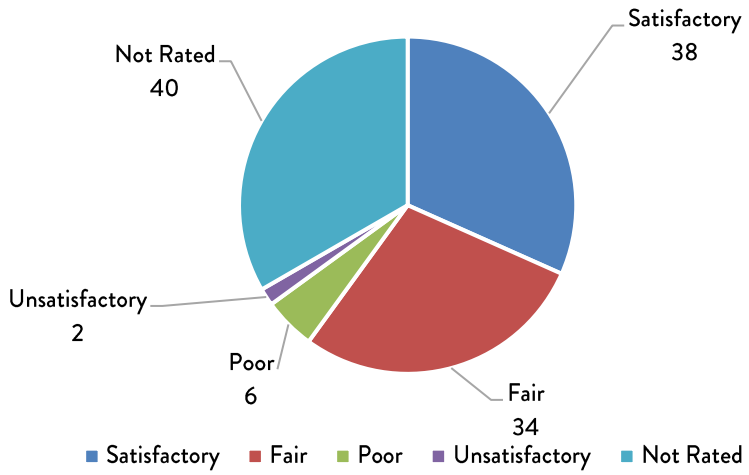
Most dams in Alaska are less than 50 years old and were designed and constructed with modern approaches and methods. Many are younger than the national average dam age in the NID of 57 years. Of the 29 NID high hazard potential dams, 22 are rated in satisfactory or fair condition, four are rated poor, and three have not yet had a formal condition assessment assigned. No high hazard potential dams in Alaska are currently assigned an unsatisfactory condition rating. A larger problem is that many dams in Alaska have not been rated since their original construction. Most of the unrated dams are small water supply reservoirs for remote rural communities which are difficult to access for routine inspections.

Per Alaska statues (AS 46.17) a dam meets jurisdictional criteria if it:

- is over 20 feet tall;
- is over 10 feet tall and impounds 50 acre-feet or more of volume or;
- poses a risk to life or property

Most unregulated dams in the state (not meeting the above criteria) have never had a condition assessment. These unregulated dams are not required by state or federal law to have condition assessments regularly conducted. However, the dam owner is still responsible to ensure the safe operation and maintenance of their structure. These dams aside, many of the dams which do meet the criteria have not had a condition assessment either as shown on the next page. This figure only presents the number of those dams which are either under state or federal jurisdiction. Those unregulated dams (meeting non-jurisdictional criteria) which are unlikely to receive a formal condition assessment have been excluded. The State of Alaska assigns condition assessments for state-regulated dams based on inspection reports, but does not receive regular data for federal dams, FERC-regulated dams, or non-jurisdictional dams. Only limited data from the USACE was available for the report card. The figure below summarizes the overall condition ratings of Alaska dams based on the combined data from both state and federal sources.

Figure: Federal and State Jurisdictional Dams Condition Assessments



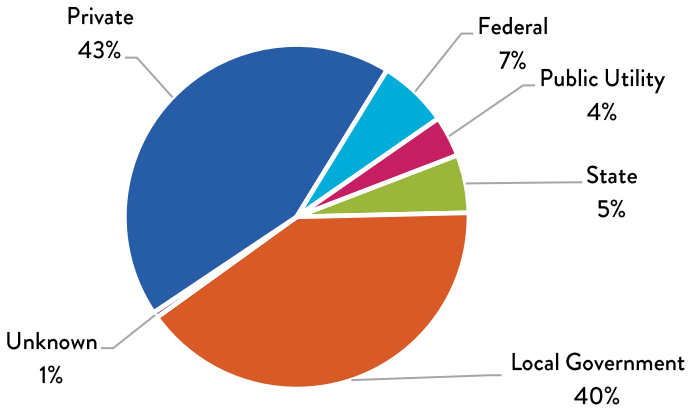
Credit: USACE NID 2021 & ADNR Dam Safety Program 2021

Many small rural dams were constructed between the 1960's and the 1980's by the Federal Public Health Service. Over the years, these facilities have not been well-maintained and are now in need of repair. The State is currently updating its Hazard Mitigation Plan and intends to include a more detailed review of the condition of dams.

Operations & Maintenance

The dam owner is ultimately responsible for operation and maintenance of dams. In some cases, the dam is operated by a third party that assumes responsibility for operations and maintenance. The figure below presents the ownership status of Alaskan dams.

Figure: Alaska Dam Ownership



Credit: ADNR Dam Safety Program 2021

No operating information is publicly available for federally owned or operated dams or FERC-regulated dams. State-regulated dams are required to have an operations and maintenance manual, but records indicate that 28% of these dams do not have this documentation. Additionally, many rural communities lack the manpower, equipment, and financial resources to adequately inspect and maintain their dams.

Public Safety

Dams are assigned a hazard potential classification based on detailed criteria in state regulations. Hazard potential classifications fall into the following three categories based on impacts should a dam fail:

- Low – Limited impacts
- Significant – Probable property damage or threat to public health or anadromous fish habitat
- High – Probable loss of life and property

The hazard potential classification only considers the consequences of a dam breach in the event of a failure and does not reflect the condition or inherent stability of the structure. The NID database indicates Alaska has 29 (27%) high hazard potential dams, 42 (39%) significant hazard potential dams, and 37 (34%) low hazard potential dams. Alaska has a larger proportion of high hazard potential dams compared to the national average (17%). The largest concentration of dams in Alaska is in the southeast which has topography characterized by high mountain watersheds draining into deep mountain valleys which are fed by heavy coastal precipitation patterns. This makes southeast ideal for hydroelectric generation and gravity-fed water supply dams.

There are a few dams that pose an increased risk to the public based on their current condition and significant or high hazard potential classification. These include Seward's Lowell Creek Diversion Dam, and water supply dams that serve the communities of Wrangell, Kotzebue and Hydaburg. Funding is needed to address known deficiencies at these dams.

Emergency action plans are used to help mitigate the risks from high and significant hazard potential dams. Those without a plan depend on community emergency response plans which may not recognize the risks associated with the dam, nor include all appropriate actions necessary during an emergency at the dam. There is only one high hazard potential dam in Alaska which does not have a current emergency action plan.

Routine care and maintenance are the most critical contributors to the safety and resilience of dams. Most water supply dams can be operated until they no longer serve their intended purpose, and then the dam can be decommissioned. In contrast, mine tailings dams must remain in service long after the mine has closed. As a result, the tailings dam owners must reclaim or abandon the dam in accordance with state regulations.

Figure: Fort Knox Mine Tailings Dam

Credit: ADNR Dam Safety, Ori Miller

Resilience

Alaskan dams have historically performed well given the harsh environmental conditions observed across the state. In 2012, several areas of Alaska experienced extreme rainfall that produced record breaking flood levels during August and September. Some areas experienced what the National Weather Service identified as their "500-year storm event." In December 2020, severe flooding occurred in many communities across southeast Alaska. No dams failed during either of these flood periods and only minor damage was reported to a few structures. During the 2018 Anchorage earthquake, dams in the area suffered minimal damage with no seismic failures reported. The high performance of dams during these notable geohazard events indicates Alaskan dams are relatively resilient.

Funding & Future Need

There is presently no designated state program or fund to assist dam owners in Alaska with rehabilitation, inspection, or maintenance costs. Establishing such a fund would decrease the long-term risk of dam failures in Alaska. Currently, the funding for the Alaska dam safety program does not reflect the deficit for deferred maintenance costs because these costs are typically borne by the dam owner and not the state. Estimating deferred maintenance or rehabilitation costs would be difficult because each dam is unique with varying needs.

Water supply dam owners may pursue low-interest loans through the Clean Water and Drinking Water State Revolving Funds administered by the Alaska Department of Environmental Conservation. Dam projects applying for funding through these programs must compete with a variety of other water-related projects, and special permission from EPA is required. Importantly, this funding is offered as a loan as opposed to a grant and therefore obligates the dam owner (typically a municipality or other government agency) to make the long-term repayments.

Federal funding may also be obtained through the High Hazard Potential Dam Rehabilitation Grant program. However, Alaska has not historically applied for or received this type of small funding because the amount available is much less than the need and the process to obtain a grant is complex. Additionally, low or significant hazard dams are not eligible.

Potential future improvements include increasing freshwater supply dams and developing small hydroelectric power facilities for rural communities. In addition, many small, rural dams in the Alaska Dam Inventory have not had a condition assessment since original construction. Existing dams require inspection and rehabilitation as they age. Some may need to be abandoned or replaced if they cannot be used as designed. Improved inspections and condition assessments are needed to better assess the needs of Alaskan dams, particularly for dams which have never been inspected.

Innovation

The Alaska Dam Safety Program provides guidelines, forms, and processes to help dam owners meet regulatory requirements. The Alaska Dam Safety Program is also leading a national discussion on the unique aspects of regulating tailings dams.

A number of dams in Alaska use geosynthetic membranes, geotextiles, geopipes, and other relatively novel materials in innovative applications for new construction and rehabilitation projects. Due to the unique challenges of constructing dams in arctic environments, dams in Alaska must be fundamentally innovative in their design approach to perform adequately in regions with frozen or partially frozen soil conditions. Alaskan dams have largely met the challenges of arctic design requirements, as demonstrated by their historic performance and more recent resilience to extreme weather.

Let's Raise the Grade

- Improve the percentage of dams in Alaska with current inspections and condition assessments.
- Decommission dams no longer in use.
- Develop and institute a state funding program to offer grants or low interest loan financing to assist dam owners with rehabilitation costs.
- Obtain funding for the rehabilitation of known deficient dams in Alaska.
- Develop operations & maintenance manuals for all dams and emergency action plans for all significant and high hazard potential dams.

Find Out More

- Alaska Dam Safety Program: http://dnr.alaska.gov/mlw/water/dams/

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DRINKING WATER

D

Executive Summary

Alaska's drinking water challenges are as diverse as its geography. Urban communities in Alaska have drinking water systems similar to those in cities across the U.S. Services for rural communities throughout Alaska vary from piped water to no service at all. Residents in 32 rural communities do not have in-home piped water or a community watering point and must haul water. There is an estimated need for funding in excess of $1 billion for drinking water infrastructure.

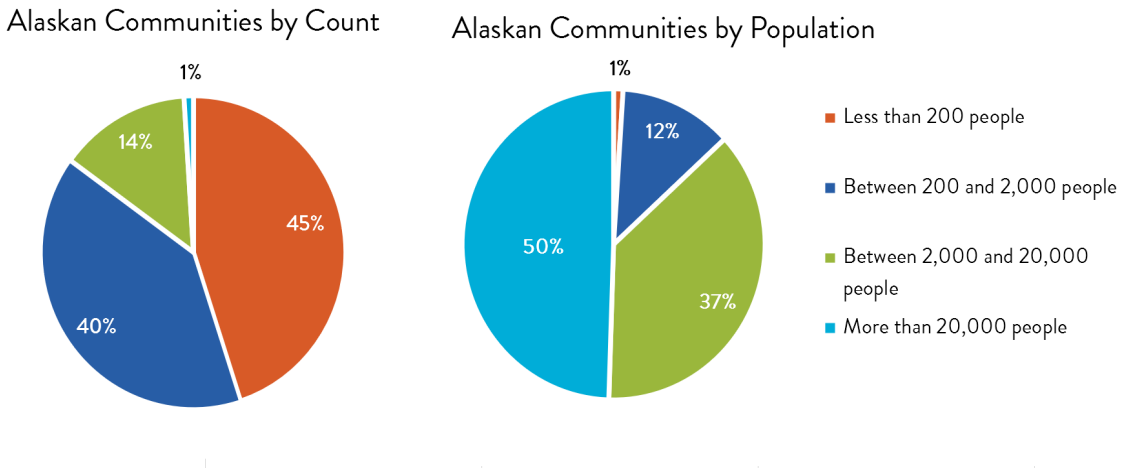
Introduction

Alaska's drinking water challenges are as diverse as its geography. Southeastern Alaska is a temperate rainforest with average annual precipitation of more than 150 inches and ample water supply. The North Slope is a polar desert with average annual precipitation of less than 5 inches and a precarious water supply.

Nearly half of Alaska's 730,000 residents live in the urban centers of Anchorage, Juneau, and Fairbanks where municipal water systems provide water treatment and piped water distribution. These systems are funded primarily by user fees and periodically benefit from state and federal funding. The rest of the state averages less than one resident per square mile. More than 75% of Alaskan communities (by count) accounting for 25% of the state's population. Many of these communities are inaccessible by road.

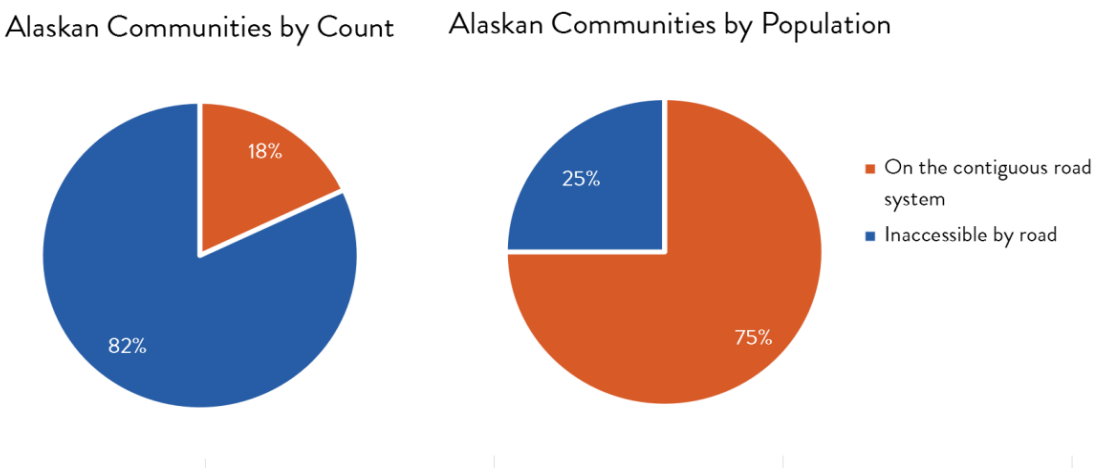
Alaska's mid-size cities, even those that are regional economic and administrative hubs such as Bethel, still struggle with providing drinking water and sanitation. Sixty-eight percent of Bethel's 6,000 residents lack piped water and sewer service, relying instead on truck-hauled service. Many of Alaska's smaller communities are severely challenged to provide water and sanitation. Alaska has 280 rural communities that are only accessible by air, and typically have less than 200 residents. Services for these rural communities vary from piped water and sewer to no service at all. Limited access, high cost of operation and maintenance, and limited population make the cost per user very high in remote communities.

Figure: Community count and total population compared to community



Credit: Alaska Department of Labor and Workforce Development

Figure: Community and population connection to the road system



Credit: Alaska Department of Transportation & Public Facilities

Capacity

Alaska's population generally tracks with the "boom and bust" cycles of the oil and gas industry, growing rapidly when the industry is booming and declining when production and prices drop. The Matanuska-Susitna (Mat-Su) Borough is the only region that experienced sustained growth since 2010. As a result, most of Alaska's urban water infrastructure is adequately sized to accommodate current and projected populations.

Service is limited in most rural communities and there are capacity challenges in many of those locations. For example, approximately 30% of Alaska has continuous permafrost, so communities in these areas experience

limitations in drinking water storage capacity, an issue exacerbated by a lack of groundwater and little rainfall. These communities must produce their year's supply of water from surface water during the three summer months and store it to have enough supply for the remainder of the year.

Condition, Operations, & Maintenance

Alaska's larger public utilities serving urban areas conduct condition assessments to help manage aging assets and the risk associated with their continued use. Much of Alaska's urban infrastructure is generally in fair to good condition. Its last major upgrade was during the oil boom of the 1980's through the early-1990's. Robust management, operations, maintenance, and capital improvements have helped maintain the condition of the urban infrastructure throughout the last few decades, but increased effort is necessary as facilities continue to age.

Most rural drinking water systems were built using grants but lack adequate funds from user fees to pay for on-going maintenance. Over time, limited maintenance and environmental factors, such as permafrost thaw and frost heave, have caused considerable damage. Therefore, these systems, operated and maintained by local governments or tribal agencies, often struggle in poor condition.

Another challenge for rural drinking water systems is for the operators to obtain and maintain the required certification. The positions generally do not provide a living wage and certified operators are typically not enticed to move to villages solely to take an operator's position. Since 1981, the Remote Maintenance Worker Program has supported rural communities in their efforts to grow operational capacity and avert catastrophic failure. The Rural Utility Business Advisor Program provides similar support to rural communities with a focus on building financial and managerial capacity that is critical to the long-term success of local utilities.

Public Safety

The difference in drinking water services among urban and rural communities reveals widely disparate quality of life and health outcomes. In addition, the quality of community water supply varies throughout the state. Often the quality of the source water changes depending on the time of year (open-to-the-air surface water versus frozen conditions). In 2019, Alaska ranked last among all 50 states for the percentage of its citizens receiving complete sanitation, which includes a flush toilet, shower or bath, and a kitchen sink.

Residents in 32 rural communities do not have in-home piped water or a community watering point and must haul water. These conditions contribute to poor public health, yet only five of these communities have received grant funding to raise their level of service. Low levels of water service have been associated with higher rates of hospitalizations for respiratory tract, skin, and gastrointestinal tract infections.

Resilience

Alaska experiences the effects of climate change at twice the rate of the rest of the U.S. Many rural Alaska communities are environmentally threatened due to increased erosion, flooding, and permafrost thaw. These threats adversely impact rural infrastructure. In 2019, more than 100 rural Alaska communities were identified as being highly vulnerable to environmental threats. These communities have begun to address these threats with engineering and policy solutions.

In the summer of 2019, drought in normally rainy areas of Alaska caused drinking water shortages. Communities of Homer, Seldovia, Metlakatla, and Wrangell rely on frequent rainfall and have relatively little water storage. These communities are beginning to plan to augment storage and change reservoir operations to reduce the likelihood of future water shortages.

The 2018 Anchorage earthquake caused damage to water and wastewater collection, storage, distribution, and treatment systems in southcentral Alaska. Luckily, the Anchorage Water and Wastewater Utility (AWWU) quickly responded to the damage due to their robust routine operations and maintenance program with a focus on emergency preparedness. They also effectively communicated public health concerns to the community, such as announcing a boil-water precaution.

Funding & Future Need

Drinking water systems are funded, in part, by revenue from local users; however, user fees alone are typically inadequate to fund capital improvements. Grant programs provide additional funding to allow communities to conduct improvements; these include programs covered by the Indian Health Service Sanitation Deficiency System and agencies such as the Alaska Department of Environmental Conservation (DEC), including Village Safe Water (VSW); U.S. Environmental Protection Agency; and U.S. Department of Agriculture and Rural Development. VSW and the Alaska Native Tribal Health Consortium (ANTHC) implement these improvement projects as partnerships with the communities.

Regardless of size or road connection, most Alaskan communities are functionally isolated from one another. This means much of the state's water service occurs at a community level, which centralizes control closer to the end users but also limits opportunities to economize based on sharing or scaling facilities. Therefore, providing water services at a more centralized scale is expensive statewide.

Across the state's water drinking water sector, the estimated need for funding is nearly $1 billion (B) over 20 years. This need is expected to increase in the future as systems continue to age and the environmental threats of climate change become ever more realized. At the same time, State funding has been decreasing. The State's Municipal Matching Grant program has not been funded since 2017, leaving community infrastructure grants accessible only by legislative appropriation.

ANTHC indicates rural communities' needs include $3.45B over the next 50 years to protect existing infrastructure. An additional $1B is needed to protect infrastructure in urban centers and mid-sized cities. An average of more than $80 million (M) per year is needed over the next decade and only about 10% of that total is available through existing programs.

Innovation

Alaska's challenges also offer opportunities for innovation. Challenges faced by rural Alaskans prompted VSW to sponsor a worldwide research competition to spark the development of innovative and cost-effective water and sewer systems for remote Alaskan villages. The competition started in 2014 and is aptly named the Alaska Water and Sewer Challenge (Challenge). It is a multi-phase research and development project that focuses on technologies for decentralized water and wastewater treatment, recycling, and water conservation for individual homes. The primary goal of the Challenge is to develop a system that supplies and drains water for a kitchen sink, bathroom sink, toilet, shower, and washing machine.

In 2018, a team led by the University of Alaska Anchorage developed an in-home water reuse system that met design targets for pathogen removal, capital and operational costs, and water/wastewater haul volume. Pilot testing to assess the system's feasibility and real-world application is in the planning stages.

Further innovation in rural communities is achieved through creative project delivery methods. Modular construction techniques allow most of the specialized labor to be performed in urban centers and reduces project costs. Furthermore, modular facilities can be relocated and repurposed as the needs of the community change. For example, Kivalina is in the early stages of planning to relocate but in dire need of a new water treatment plant. A plant is being designed to serve the immediate needs but will be relocated to serve the community in their new location in the future.

Let's Raise the Grade

- Secure funding for capital improvements from state and federal sources, including the U.S. EPA Clean Water State Revolving Fund.
- Reinstate the State Municipal Matching Grant program.
- Secure funding for long-term operations and maintenance from local and state sources, recognizing that preventative programs ultimately save money.
- Promote and fund a broad range of prevention, preparedness, mitigation, and response strategies through local, regional, and state cooperation.
- Further promote the capacity of Alaskans to operate local drinking water facilities.
- Promote and fund risk-based asset management covering capital improvements and operations and maintenance through local, regional, and state cooperation.

Find Out More

- Drinking Water Program: https://dec.alaska.gov/eh/dw.aspx

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Executive Summary

Alaska's power generation systems are generally in good/adequate condition in the larger, urbanized or highway-accessible areas of the state. Transmission systems, however, have not kept pace. In the remote areas that are not accessible on the main highway system, many energy facilities (including generation units and bulk fuel tank farms) are in fair to poor condition, with operations and maintenance being a key challenge. Policies and funding are needed to foster more cooperation, training programs, and Railbelt grid expansion.

Introduction

Alaska enjoys integrated and abundant power generation and transmission systems along the Railbelt corridor (from Fairbanks to the Kenai Peninsula) and in portions of southeast Alaska. The plants in these areas account for approximately 90% of Alaska's total power generation and most are in good condition. However, the lack of interconnected transmission lines limits distribution of the cheapest power sources.

The rural and off-road communities are typically served by "microgrid" systems and are not connected to other communities. These communities face more severe challenges that include basic operation and maintenance, administration, workforce training, and retention. There are a few successful rural cooperatives, but significant work is needed to provide consistent power in many communities.

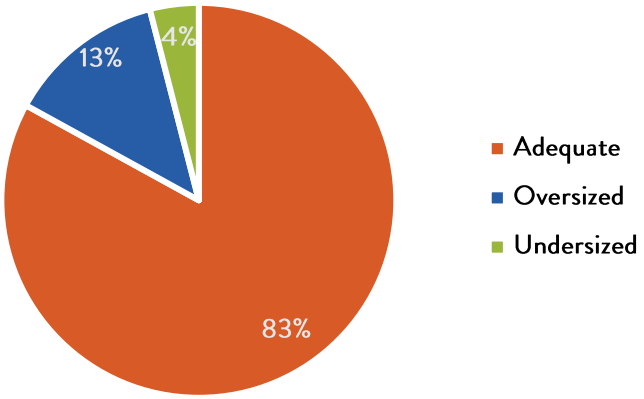
Capacity

Along the Railbelt, there is adequate power-generating capacity for current and future demands due to large investments in Anchorage-area power plants between 2010 and 2016. In addition, the generation capacity of Bradley Lake, the major hydroelectric dam serving the area, was boosted by about 10% in 2020 with completion of a diversion project.

Hydropower plants serve most Southeast Alaska communities and provide adequate power for the area through interties but have diesel generator backups in case of avalanches or other events. Outside of these areas – that is, in rural areas of the state – power generation is generally reliant on diesel-fuel powered electrical generation equipment servicing individual villages with no connectivity to a larger grid. The diesel generators, supplied in "powerhouse" modules, have enough capacity and redundancy to provide for the electrical needs if kept in good repair.

In its last survey (2012), Alaska Energy Authority (AEA) provided a breakdown of the percentage of oversize, undersized, and adequate rural powerhouses.

Figure: 2012 Rural Powerhouse Capacity



Credit: Alaska Energy Authority Rural Powerhouse Survey (2012)

The AEA has made progress in upgrading rural powerhouses and transmission lines but there are still many communities to address. A 2019 Alaska Energy Authority report indicated that 87 rural powerhouse and/or system upgrades (mostly to reduce fuel costs, but in some cases to improve capacity) had been completed since 2000, with 11 additional in design and three under construction.

Broadly, Alaska's transmission lines continue to be inadequate at providing consistent power through redundant mechanisms and experience challenges withstanding or accommodating impacts from the state's harsh weather conditions. State studies indicate over $900 million in funding is needed for transmission upgrades to achieve a fully redundant system that can provide power from multiple sources.

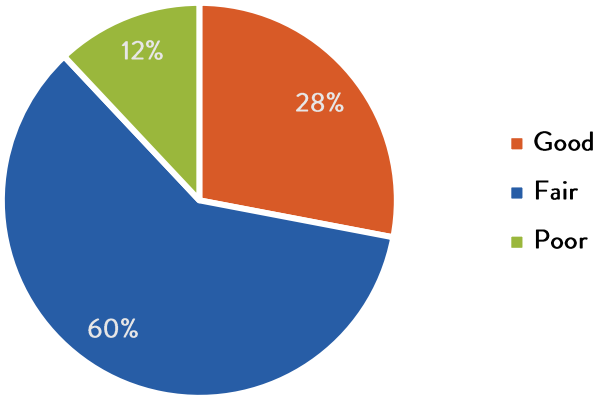
Condition

Along the Railbelt, most facilities are in adequate condition. Significant investment occurred between 2012 and 2017 to upgrade systems but has since slowed. Power transmission lines are observed to be in good physical condition along the Railbelt, but there are ongoing challenges with settlement and frost heaving of distribution poles in some areas, including along the Richardson and Alaska Highways.

Little information is available regarding the condition of most facilities in southeast Alaska, but Alaska Electric Light & Power considered its generation and transmission (G&T) facilities to be in good condition in 2017. Transmission lines have been subject to avalanche damage in this region due to its mountainous terrain, requiring reconstruction after lengthy outages.

In general, most rural systems are in worse condition than those along the Railbelt. The figure below shows the condition of Alaska's rural powerhouses.

Figure: 2012 Rural Powerhouse Condition



Credit: Alaska Energy Authority Rural Powerhouse Survey (2012)

Rural communities also struggle to maintain the bulk fuel tank farms that support the powerhouses, with 56 communities (out of 163 surveyed) having unmet needs. Challenges in rural communities include effective secondary containment, tank condition, piping and electrical deficiencies and code compliance problems, operations and maintenance, training, administration, abandonment, climate change, and erosion.

Operations & Maintenance

Most Railbelt and southeast Alaska utilities have adequate resources and personnel capacity to properly operate and maintain their facilities. Rural communities face severe operation and maintenance challenges. These challenges include the cost and time of getting parts, retaining qualified staff, and funding.

More highly developed areas of Alaska have sufficient population to support a professional organization with diverse administrative, technical and support skills positioned locally to service and maintain the system. In rural areas of the state, there is much less depth in both technician support and engineering/administrative support, which leads to challenges in ongoing operation and maintenance. The Alaska Village Electric Cooperative (AVEC) has been relatively successful in this regard by using pooled resources and central dispatching as a strategy for its 58 served communities.

Public Safety

Power outages longer than 48 hours put infrastructure and people at risk. The risk is particularly high during the winter months when continuous power is needed to prevent water lines from freezing and to keep people warm. Railbelt and most southeastern Alaska utilities indicated that outages that lasted longer than 48 hours typically occurred less than once a year. AVEC indicated in 2017 that outages occurred less frequently than once a year in their member communities. Beyond that, there is limited public safety data available for most rural communities.

Outage data is available from major community cooperatives and large utilities for developed areas. For these utilities, customers averaged 4.67 hours per year of power outages in 2019, approximately equaling the national average, according to data from the U.S. Energy Information Administration. This is not, however, typical of rural based microgrid systems.

Resilience

Alaska's energy infrastructure is generally resilient to the severe weather of a routine year; however, the transmission lines are vulnerable to natural disasters. In 2008, an avalanche cut Juneau off from the Snettisham power plant and resulted in months of expensive service from diesel backup generators. An earthquake separated Golden Valley Electric Association from the rest of the Railbelt in 2018. In 2019, wildfires isolated the community of Copper Center for 123 days, resulting in costs of $30,000 to $50,000 per day (roughly $20,000 per resident for the duration of the event).

As noted from these examples, operation can be threatened by weather and fire phenomena that may be affected by climate change, which may also destabilize foundations (e.g., for transmission towers). For that reason, continued maintenance of redundant plant assets and ongoing monitoring (settlement, slopes, snowpack) is indicated; however, monitoring and intervention are costly. A targeted and economical process for that monitoring must be developed and matured to assure resiliency in energy delivery.

Funding

The Railbelt and most southeast Alaska utilities have adequate funding for normal operation and maintenance of generation and distribution assets and utilities generally pay costs of capital upgrades such as the recent (2020) capacity upgrade to the Bradley Lake hydroelectric installation. Alaska's electrical cooperatives finance their generation projects using the U.S. Department of Agriculture's Rural Utilities Service (RUS) Electric Loan Program, servicing loans through consumer rates. However, there are no funding sources for the $900M needed for transmission line upgrades, largely due to the continuing absence of transmission cooperatives.

AVEC reports adequate funding for most operation and maintenance issues for the rural communities they serve. For most other rural communities, it is difficult to adequately fund routine maintenance since there are few funding sources for large capital projects. One of the notable exceptions is the U.S. Department of Energy (DOE) Office of Indian Energy grant program, which has applied about $22 million in grants as project cost sharing between 2010 and 2018 for Alaskan villages. (These grants were applied to about 50 projects and, in aggregate, represented close to a 40% cost sharing.)

The 2021 Infrastructure Investment and Jobs Act is projected to have a significant positive impact on funding for grid infrastructure modernization, including in Alaska. The bill includes a set-aside of 30% for small utilities to prevent outages and enhance resilience of the electric grid, with 50% of funding going to states or Indian tribes. It provides $1 billion for rural/remote areas to improve overall cost-effectiveness of energy generation, transmission or distribution systems, providing or modernizing electric generating facilities and developing microgrids. In addition, funding is provided to improve cybersecurity for large and small utility providers.

Future Need

The energy infrastructure in developed regions of Alaska has sufficient capacity to meet current and projected energy demands if all systems remain operational. In contrast, rural systems are at risk of not meeting future demands due to lack of funding for capital projects, a situation that may be partially addressed with forecast improvements under the Infrastructure Investment and Jobs Act.

Energy infrastructure supporting both rural and urban areas is vulnerable to damage induced by extreme weather events, which may be exacerbated by climate change. As noted in the Resilience section, it is essential to monitor infrastructure threats and to respond proactively; this may require additional maturation of methods and risk identification for targeting areas of concern.

Innovation

Renewable energy is a priority in Alaska. The Alaska Energy Authority (AEA) has a Renewable Energy Fund (REF) grant program that has been awarded in 13 rounds to date since its inception in 2008. A total of $275 million in renewable energy projects was awarded between 2008 and 2021, and 95 operating projects had been completed with REF contributions. A fourteenth round of grant applications was invited in November 2021 with a grant amount to be determined.

In addition, the Renewable Energy Alaska Project and the Alaska Native Tribal Health Consortium has ongoing work that is focused on developing viable and sustainable alternatives to high-cost liquid fuel. Depending on location, this could consist of solar power, wind energy, hydropower, geothermal energy or natural gas.

Let's Raise the Grade

- Create policies that will promote formation of energy consortiums and cooperatives. This will improve administration, operation, and maintenance of rural power systems, as demonstrated by the success of AVEC.
- Invest in workforce development programs to increase the number of local workers who operate and maintain rural facilities.
- Fund upgrades to Railbelt transmission lines to improve redundancy, reliability, and economy. This can be done under formation of transmission cooperatives, supplemented by public appropriation (e.g., under the 2021 bipartisan infrastructure bill).
- Expanding the Railbelt power grid to increase the service area and resiliency, thereby increasing generation and transmission redundancy.

Find Out More

- Alaska Energy Authority: www.akenergyauthority.org

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Executive Summary

The Alaska Marine Highway System (AMHS) supports commerce throughout the state, providing 1,700 jobs and an estimated $273 million in direct and indirect spending. Alaska has 6,640 miles of coastline, and 11 AMHS ferries serve 33 coastal communities. The average age of vessels operating on the system is 33 years. Though shore-side facilities are in relatively good condition, the state's marine highway system does not have adequate capacity of operational vessels. The AMHS operational budget is directly tied to the state's budget and was reduced by 30% in FY202, and remained at the reduced rate in FY2021, contributing to reduced maintenance. Adjustments are needed to the funding cycle and levels to achieve a stable and reliable marine highway system.

Introduction

The Alaska Marine Highway System (AMHS) is the State's publicly owned ferry system. Many coastal communities are located on islands or in remote areas where connected roads do not exist. These coastal communities rely heavily on AMHS for travel and transport of goods, where the only practicable alternative is more expensive aviation or private charter options. AMHS covers 3,500 miles of coastline and connects 35 communities that stretch from Bellingham, Washington to Dutch Harbor, Alaska. Alaska's ferries are diverse and range from mainline ships that sail thousands of miles and make multiple stops to day boats and shuttles that provide links between neighboring communities

Figure: Alaska Marine Highway System Route

Credit: AMHS

Scarce funding, the state funding process, and lack of a long-term capital improvement program are the key drivers to the infrastructure's status. Though the shoreside facilities are in relatively good condition, the state's marine highway system does not have adequate capacity of operational vessels. Furthermore, significant state budget cuts have led to reduced maintenance causing some of these vessels to be put in layup reducing the level of service AMHS can deliver. In recent years, the AMHS budget has fluctuated significantly in consequence of the state's fiscal ability. To provide more operational stability the state has moved to 18-month budget cycles for the AMHS and increased the operational budget over the 2019 level. The AMHS has one of the lowest passenger costs for a similar ferry system in the United States. Passenger fare increases have not kept pace with the Consumer Price Index or the Producer Price Index for marine transport services. Fare increases alone cannot close the budget shortfalls, but a new ticketing system has been implemented with dynamic pricing to help increase passenger revenue. In addition, funds from the new federal rural transit program will strengthen the buildup of the fare revenue.

Capacity

The current fleet consists of 10 vessels, ranging from larger mainline ships to smaller day boats and shuttle ferries. On average, mainline vessels can accommodate approximately 400 passengers and 80 vehicles up to 20 feet long. The table below provides passenger and vehicle capacities for each vessel as well as their current sailing status. The diverse fleet allows AMHS to provide a variety of services to the communities it serves; however, many ferry terminals were designed to accommodate only one type of vessel, which limits the flexibility to change service types or deploy different vessels.

Table: AMHS Vessels and Status

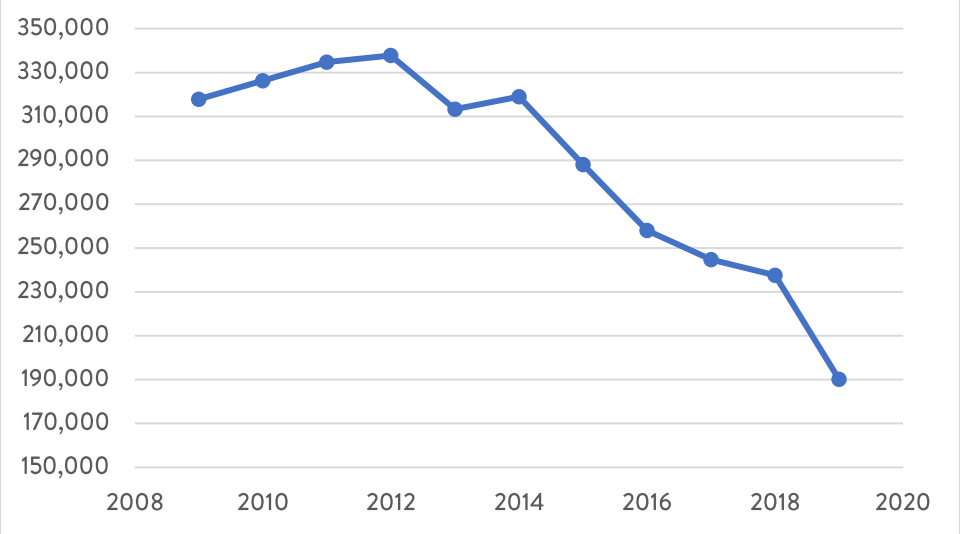
Vessel Name	Vessel Class	Year Built	Status as of June 2021	Passenger Capacity	Vehicle Capacity (20-foot)	Number of Staterooms
Columbia	Mainline	1974	Overhaul	499	133	104
Kennicott	Mainline	1998	In Service	450	78	109
Malaspina	Mainline	1963	Layup	450	83	72
Matansuka	Mainline	1963	In Service	450	83	106
Tustemena	Mainline	1964	Overhaul	160	34	24
Hubbard	Day Boat	2020	Layup	290	40	-
LeConte	Day Boat	1974	Layup	225	33	-
Lituya	Shuttle	2004	In Service	125	15	-
Tazlina	Day Boat	2019	Overhaul	290	40	-
Aurora	Day Boat	1977	In Service	250	33	-
Chenega	Shuttle	2005	Sold, March 2021	210	31	-
Fairweather	Shuttle	2004	Sold, March 2021	210	31	-

Notes: Layup = Indefinitely out of service; Source: Recreated from AMHS

AMHS experiences higher ridership in summer months (June, July, and August) due to tourism. Winter months (November through March) have the lowest ridership, with spring and fall acting as shoulder seasons. AMHS adjusts routes and levels of service seasonally based on ridership.

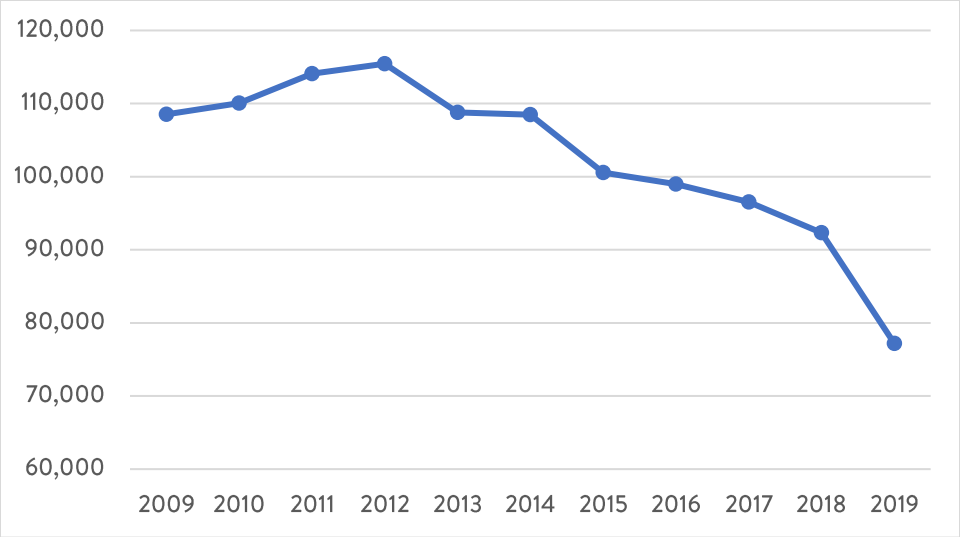
The AMHS reports capacity for passenger and vehicle traffic. Passenger booking capacity is based on functional limits rather than the maximum capacity authorized by the U.S. Coast Guard. Vehicle capacity is estimated from linear feet of car deck space sold versus total linear feet available. Passenger and vehicle traffic counts have steadily declined since 2014. In 2014 passenger and vehicle counts were 319,004 and 108,478, while in 2019 passenger and vehicle counts were 190,118 and 77,203, a 40% and 29% decline respectively. Vessel operating days have declined from a peaked of 2,698 in 2011 to a low of 2,005 in 2018. Changes to traffic volumes and vessel operating days are shown on the following figures. Much of the reduced ridership and reduced vessel operating days are attributed to system budget cuts which forced schedule service reductions, not from lack of demand. A union strike in 2019 reduced ridership even further that year.

Annual Passenger Traffic, 2009-2019



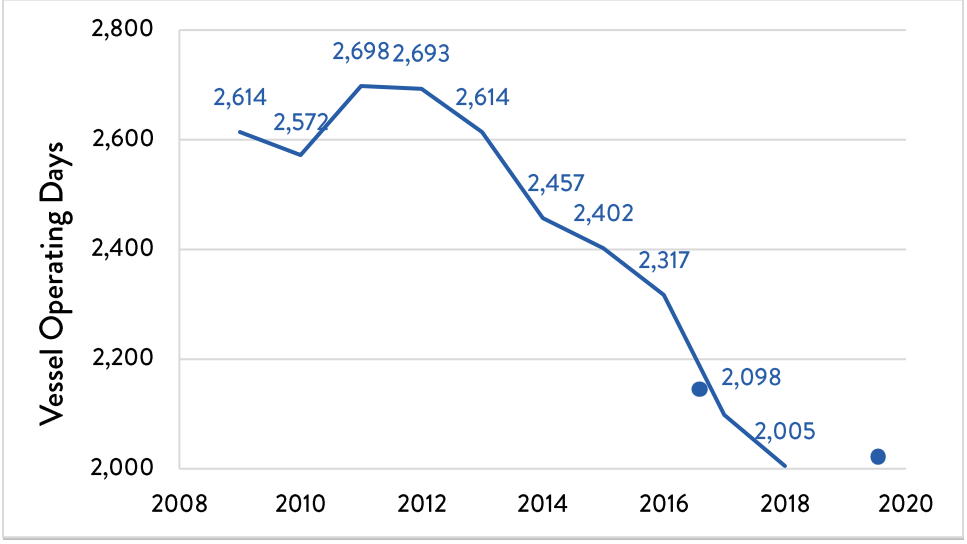
Credit: AMHS: *2019 Annual Traffic Volume Report*

Annual Vehicle Traffic, 2009-2019



Credit: AMHS: *2019 Annual Traffic Volume Report*

Figure: Number of Vessel Operating Days, 2009-2018



Credit: Northern Economics, Inc. *Draft: Reshaping the Alaska Marine Highway System*

AMHS has adequate capacity when all vessels are operational; however, in the past few years as vessels have been taken out of service and budget cuts have occurred, system capacity has been reduced.

Condition

Vessels

Many of the AMHS vessels are old and in poor condition. The AMHS fleet includes three vessels over 50 years old and three over 40 years old. As of the summer of 2021, six of the 10 vessels were in service: Kennicott, Matanuska, Lituya, LeConte, Tustemena, and Aurora. Other vessels were in layup or overhaul. Vessel life expectancy is 64 years according to AMHS; however, this is considered optimistic and dependent on operating conditions. As vessels age, maintenance costs increase, and with the budget shortfalls, maintenance is being deferred causing vessels to be out of service. Through retirement of old vessels and commissioning of two new vessels, the average vessel age is 33 years, as compared to 36 years old in 2017. The Alaska Department of Transportation & Public Facilities' (DOT&PF) 2016 Long-Range Transportation Plan noted the need for periodic infusions of capital to AMHS from the State's General Fund to maintain or replace older vessels. Alaska DOT&PF's project to replace the Tustumena now has secured funding, in addition the Hubbard vessel is being retrofitted with crew quarters that will increase the versatility of that vessel.

Terminals

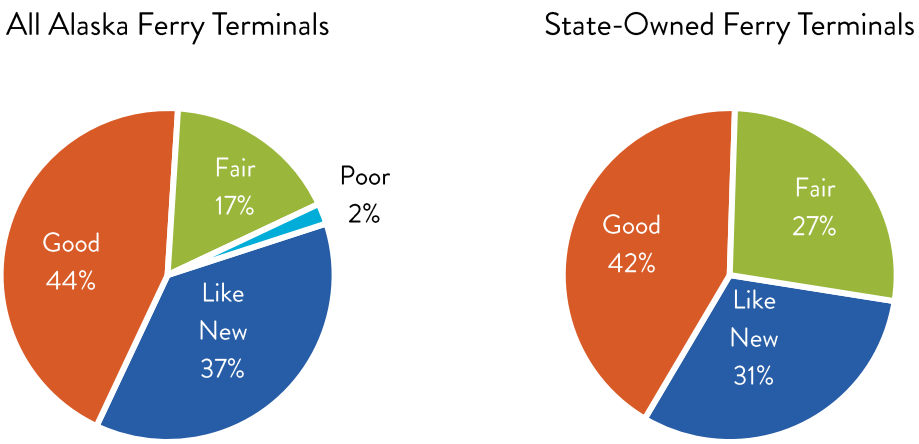
Terminal ownership varies by location. Many terminals in southeast Alaska are owned by the State while others are owned by the local communities. AMHS has little control over the condition of terminals that are not owned by the State.

Terminals are inspected biannually as a part of the National Bridge Inspection Program or the State's shoreside facility inspection program. The inspections examine the structural capacity and potential impacts the conditions may have on operations. Terminals can receive the following ratings:

- Like New - No problems
- Good - Some minor problems
- Fair - All primary structural elements are sound, but may have minor section loss, cracking, spalling, or corrosion
- Poor - Loss of section, advanced deterioration, or spalling that has affected primary structural components

The majority of the terminals are in adequate condition with 81% of all terminals and 73% of state-owned terminals in either like new or good condition. The State owns fewer like-new terminals, but the State's older structures are generally in better condition than terminals owned by other entities. The figure below shows the condition status of the ferry terminals.

Figure: Condition of Shoreside Facilities



Credit: Alaska DOT&PF, *2018 AMHS Shore Facilities Conditions Survey Report*

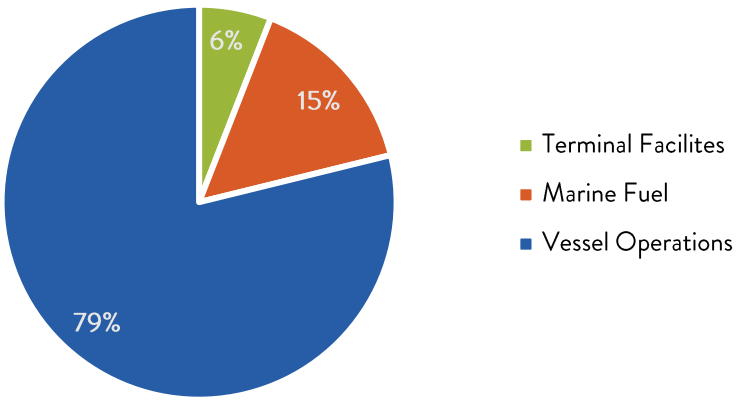
The newest vessels in the fleet, Hubbard and Tazlina, were designed to be roll-on/roll-off to facilitate rapid transfer of vehicles at the ports. However, no funding was allocated to build roll-on/roll-off terminals. Therefore, the vessels are being retrofitted with side doors to so that they can dock at the current, side-loading terminals.

Operations & Maintenance

The more than 30% budget reduction from FY2019 to FY 2020 significantly reduced the operational capacity of AMHS. Vessels were put out of service or laid up for service without funds to make the necessary repairs. Routes were cut and some communities that relied on AMHS no longer received service. These communities were forced to use more expensive aviation options, hire private watercraft, or cancel business. Costs for goods and services went up and reliable transportation was reduced as air travel is more subject to weather delays.

AMHS's largest costs include vessel operations, marine fuel, and operations of terminal facilities.

Figure: AMHS Operational Costs



Credit: Alaska DOT&PF

Maintenance costs have increased steadily as many vessels near the end of their service life. The Reshaping Working Group recommended reducing the fleet and putting the Fairweather and Chenega up for sale, which was recently accomplished. The state was paying over $500,000 per year to moor both vessels. In March of 2021, the State received bids of $2.1 million and $3.1 million for the Fairweather and Chenega, respectively, and sold the vessels to reduce mooring costs.

Public Safety & Resilience

AMHS provides critical connections and services to Alaskans and visitors to the state. The marine highway system is an important mode of transportation between smaller coastal communities and larger regional healthcare facilities, as it is not limited by the same weather restrictions as aviation. AMHS vessels have also been first responders to small ships and vessels in distress. It is vital to Alaskan communities that the service be predictable and reliable.

AMHS vessels follow the U.S. Coast Guard safety protocols that include detailed travel protocols for passengers, ensuring minimal to no danger to the public. Poor reliability and reduced service levels greatly affect the public, causing myriad socioeconomic issues for several communities.

Budget constraints, aging vessels in poor condition, lack of a long-term capital plan, and variations in ships and terminals all reduce the resiliency of AMHS. The Matanuska vessel breakdown in January 2020 was an example of how budget constraints and vessel conditions impact service. In the past, AMHS could have shifted passengers to another vessel; however, due to budget constraints only one mainline vessel was in operation. The breakdown of the aging vessel resulted in passengers being stranded for three weeks in Juneau.

The entire fleet cannot serve all communities due to incompatibility in the vessels and terminals. In response, the state of Alaska started contracting with private ferry operators to fill winter service gaps, the challenge is that these ferries only provide passenger service leaving the freight and vehicle needs unmet. Furthermore, the current lack of redundancy is problematic to communities' expectations of service reliability. Overall, AMHS is not as reliable as it should be to meet service needs.

Passengers have voiced that they would accept less frequent trips if the routes were more reliable with predictable service.

Funding & Future Need

AMHS is an extension of the National Highway System and individual ferry terminals often receive federal funding similar to roads and bridges. The federal government also contributes a small percentage of the funds needed for capital projects and repairs of vessels. Some of the operating budget for AMHS comes from fares, but a significant portion comes from the State's General Funds.

The AMHS has never been able to financially sustain itself and relies on State subsidies for 50% to 70% of its operating costs. In response to continued budget challenges, the State of Alaska commissioned a study to investigate privatization or a public/private partnership. A draft of this study was completed in January of 2020, and the Governor then established the Alaska Marine Highway Reshaping Work Group with the purpose of making recommendations on the future of the AMHS. The Reshaping Work Group Report was published in October 2020.

The 2019 fiscal year (FY) budget for AMHS was $140 million (M). Budget cuts in FY 2020 reduced funding by more than 30% to $99.6M, which included $48.1M from fares, $46M from the General Fund, and $5.5M from other sources. The FY 2021 budget increased to $108M. The proposed FY 2023 budget has been increased to $141.7M. The new federal rural transit program is also expected to allow for buildup of fare revenue in the AMHS stabilization account.

Since 2007, the Consumer Price Index in Alaska has increased by 12% and the Producer Price Index for marine transport services in the U.S. has increased by 19%. AMHS's operational costs increased by 33% between 2007 and 2015. Despite all these factors, fares remained constant. It is worth noting that AMHS has lower fares than similar systems elsewhere in the United States. Other ferry systems have increased fares by an average of 21% for passengers and 7% to 10% for vehicles since 2008. Rates for alternative freight and cargo options have increased by as much as 236% per nautical mile during that same time.

Historically, the legislative budget annual process makes it difficult for AMHS to plan services each year. AMHS received funding from the State on a year-to-year basis but had to determine schedules and service levels before overall funding was known. To provide more resilient funding, the state has moved to 18-month

budgets cycles for the AMHS. This provides more certainty in funding levels and enable planning for future schedules and services.

In addition, a long-term capital improvement plan is needed for vessel replacement and recapitalizing the system. Predictability and a long-term financial plan are critically needed to help stabilize the AMHS.

Innovation

AMHS has made innovative changes to ticket sales and pricing systems. Previously, passengers could buy a ticket the day of sailing, even on board with cash, but this made tracking ticket purchases unreliable and cumbersome. A new ticketing system was implemented that limits cash sales, requires a reservation, and allows dynamic pricing like that used by the airlines. This change has improved revenue and accountability.

Let's Raise the Grade

The biggest challenges of AMHS are the funding process, insufficient funding, and lack of a long-term capital improvement program. Significant changes are needed to keep this important transportation system for coastal communities of southern Alaska operational. The following are recommendations to improve AMHS:

- Provide AMHS with long-term funding commitments to enable annual planning and schedule development.
- Develop a long-term asset management plan and funding program to replace vessels and improve terminals.
- Raise user fees to offset inflation and rising operational costs.
- Develop a public outreach plan to inform the public and smooth the way for user fee increases.
- Plan and budget for adequate maintenance to minimize vessel downtime.
- Reduce operating costs by optimizing service on a seasonal basis using the most efficient vessels available.
- Reduce the number of sailings while maintaining regular and predictable service.
- Implement strategies to increase ridership.
- Modify terminals to accept a diverse range of vessels to increase flexibility and improve resiliency.

Find Out More

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PORTS & HARBORS

D+

Executive Summary

There are 125 small boat harbors in Alaska serving diverse maritime users. The conditions of the small boat harbors vary significantly based on the economic viability of the municipality that owns them, with numerous facility owners unable to maintain and repair aging infrastructure due to the lack of local funding. The Port of Alaska in Anchorage receives 85% of all consumer goods entering Alaska and needs additional funds to complete its modernization project. The lack of a deep-water Arctic port is a barrier to providing the infrastructure necessary to fully develop Alaska's resources and to carry out national strategic goals in the region.

Introduction

Alaska's ports and harbors enable essential economic activity through the transportation of cargo and passengers. These facilities serve a vital role in many communities by providing local employment opportunities, enabling access to goods and materials, promoting economic diversification, and supporting cultural and subsistence lifestyles. In 2019, 38 million tons of waterborne freight were transported through Alaska's ports. The vast majority of the export was through Valdez, where 24 million tons of North Slope product is delivered to the terminus via the Trans-Alaska Pipeline. Ports and harbors ensure a thriving commercial fishing industry with 5.6 billion pounds of fish harvested in 2019. Alaska produces approximately 60% of the total U.S. seafood harvests; and, in 2020 the top three U.S. fishing ports by tonnage was in Alaska (Dutch Harbor, Aleutian Islands and Kodiak). Additionally, the state boasts eleven of the largest 30 harbors nationally for commercial fishing. Ports and harbors also support tourism with over 1.5 million passengers anticipated to arrive via cruise ships in 2022. Harbors support independent summer travelers who use facilities for recreational boating or charter fishing.

Capacity

Alaska possesses 33,000 miles of coastline, which is more than the combined shoreline of the contiguous United States, yet there are only 125 ports and harbors within the state. The majority of these smaller ports and harbors are not connected to the North American highway system. These facilities are the portal for receiving durable and consumable goods for their community or region. Alaska's economy depends on resource extraction, including mining, fisheries, and oil, but lacks adequate infrastructure to support

vessel demand. As a result, there is an estimated $5 billion (B) in lost revenue opportunity as vessels transit from Alaska to Puget Sound and other West Coast destinations for ship repair and other shipwright services.

The largest ports by volume include Valdez (Trans-Alaskan Pipeline terminus), Nikiski (oil refinery), Anchorage (consumer products), and the Red Dog Port (mining). These large ports currently provide sufficient capacity to meet export demands. Juneau has recapitalized its public docks and new privately-owned cruise facilities have been constructed in Hoonah and Ketchikan to meet the growing demand for cruise ship destinations.

Condition

The condition of ports and harbors varies across the state due, in part to, irregular funding mechanisms. Generally, ports and harbors that are eligible for State grants or have access to cruise ship "head taxes" are better able to maintain, upgrade, and replace infrastructure. Ports and harbors that do not have access to grants or other regular revenue streams are commonly underfunded and cannot maintain the condition their facilitiesThe degenerating port infrastructure threatens Alaska's economy because the State does not have an alternative that can replace the Port of Alaska. The Municipality of Anchorage, after a decade of fiscal and legal challenges, has embarked on a $1B+ Port of Alaska Modernization Program (PAMP). The first phase of PAMP, the $208M replacement of the Petroleum-Concrete Terminal, was completed late in 2021. Additional phases are planned and moving forward. The Port of Alaska received a $25M BUILD (Better Utilizing Investments to Leverage Development) grant in 2019 and a $20M PIDP (Port Infrastructure Development Program (PIDP) in 2020.

In other parts of the state, the Seward Passenger Terminal has exceeded its useful life. The Alaska Railroad owns this facility and is moving toward developing a private-public partnership to fund its replacement and was successful in securing a $20M PIDP construction grant in 2020. The total estimated cost to replace is $79M.

Operations & Maintenance

The majority of Alaskan harbors were constructed circa 1959 and were maintained by the State until 2000 when it began divesting facilities to local municipalities. The ownership change has resulted in inconsistent operations and maintenance between the municipal harbors and the 17 state-managed harbors. The discrepancy is primarily due to the varying level of resources (both financial and human) that municipalities possess to maintain their infrastructure.

Several federal waterways are maintained by the U.S. Army Corps of Engineers (USACE) through dredging and breakwater projects. Annual dredging at ports such as Dillingham and Ninilchik are necessary to maintain economic vitality for their rural regions. Other USACE projects include dredging on a 10-year cycle for the

Cook Inlet Navigation Channel, Bethel, Ketchikan and Seward. Aside from these, there are numerous harbors that require maintenance dredging, and there is no reliable funding mechanism to complete the work.

Public Safety

Alaskan ports and harbors are experiencing challenges with abandoned and derelict vessels, many of which are WWII-era. Some derelicts pose the risk of environmental discharge while others may become navigational hazards. Alaskan ports and harbors also face financial risk associated with removal and disposal of vessels from irresponsible owners. Two significant Alaska statutes, enacted in 2015 and 2018, have begun to curb irresponsible vessel ownership. One enables local municipalities to manage derelicts on state-managed lands and the other requires vessels greater than 24 feet to be titled. Additionally, in 2020, the Department of Natural Resources created a position to oversee derelict vessels across the state.

The vast coastline of Alaska requires a system of reliable ports and harbors to provide access for emergency, freight, and logistical services throughout the state, especially in remote regions. For example, the Port of Nome was unable to secure barge deliveries of heating and transportation fuels in 2012 before the sea-ice made the harbor inaccessible. As a result, a historic operation that included a U.S. Coast Guard icebreaker and Russian ice-strengthened tanker was needed to deliver fuel in mid-winter. Alaska ports are critical to ensuring food security for many remote communities not served on the North American road system.

Resilience

The Port of Alaska receives 85% of the state's consumer goods and is in an active seismic zone. A seismic event could result in a supply interruption that would affect much of Alaska, including strategic military facilities. Its Upper Cook Inlet location makes Port of Alaska the only tsunami-proof, inbound cargo port in Southcentral Alaska.

Alaskan ports and harbors provide regional redundancy to other communities when natural disasters disrupt logistical supply chains. This is especially important for ports and harbors in areas not connected to the road system, as well as for communities dependent upon only one service road which could be obstructed for weeks due to avalanches.

The future construction of an Arctic deepwater port will be a step toward resiliency in a changing climate. This will also provide additional security in the Bering Strait region as increasing marine traffic transits the Arctic Ocean.

Funding

More than $500M is needed for improvements at Alaska's small boat harbors. Most harbors are maintained by the local municipalities with limited funding available from the State. Many of the small boat harbors

support subsistence lifestyles and thus are unable to collect sufficient fees to maintain or rebuild aging infrastructure. Small boat harbors only generate revenue during the short Alaskan boating season, which typically occurs from May through August. In 2006, the Alaska Department of Transportation & Public Facilities (DOT&PF) established an annual matching grant program for the reconstruction of small boat harbors; however, the program is oversubscribed and has only been fully funded twice. The ability for harbors to generate the grant matches and the State's ability to continue to fund the program severely jeopardizes the opportunity to reinvest in harbors. A survey of Alaska harbormasters indicated funding is the most significant challenge to maintaining and upgrading aging infrastructure.

Ports accommodating cruise ships have access to additional funding through the Commercial Passenger Vessel Excise Tax (CPV). The CPV is collected by the State and a portion is redistributed to the cities and boroughs where cruise ships dock.

The Juneau Harbor system has been successful in leveraging USACE's Operations & Maintenance funding program for Small, Remote, or Subsistence Harbors. With this program, the Juneau Harbor System has conducted over $9M in maintenance dredging at three harbors, most recently in 2021. If federal funding continues, this program could serve the dredging needs at most Alaskan communities' harbors.

In 2019, the federal Maritime Administration (MARAD) established the Port Infrastructure Development Grant which, along with 2021 U.S. DOT RAISE (Rebuilding America Infrastructure with Sustainability & Equity), has provided funding opportunities for several Alaskan ports. The small boat harbor in Cordova, AK and the municipal freight dock in Haines, AK each received $20M RAISE grants. It is notable that of the 90 recipients of the 2021 RAISE grants only three ports were selected with two from Alaska.

Future Need

Alaska lacks deep water Arctic ports; the closest deep-draft port is Unalaska/Dutch Harbor. Emerging potential for travel in the Arctic Ocean poses both opportunity and risk for trans-shipment, destinational shipment, and resource extraction along coastal Alaska. Construction of a deep-draft port to accommodate Arctic/Subarctic shipping would:

- Provide for local and regional economic development opportunities (resource extraction, tourism, and research).
- Decrease the cost of goods in the region.
- Provide protected dockage to support offshore oil and gas endeavors, fishing fleet, and resource extraction vessels.
- Provide vessel repair and maintenance support, as well as facilities for emergency response.

A deep-draft port would also improve international relationships, increase exports, optimize the benefits while preserving natural resources; raise awareness of the U.S. as an Arctic nation; and provide logistical support to

vessels operating in the region (fuel, water, electricity, food, medical, and storage, laydown/staging for resource extraction).

In March 2020, USACE released the *Port of Nome Modification Feasibility Study (Integrated Feasibility Report and Final Environmental Assessment*). The purpose of the study was to identify a solution that provides safe, reliable, and efficient navigation and mooring for vessels serving Nome. The study estimated the cost of improvements at $490M and was a critical step in establishing an Arctic deep-draft port. The State and the federal government must work in conjunction to develop the infrastructure and governance to meet the economic opportunity that a deep-draft Arctic port could provide. The Port of Nome Modification Feasibility Study provides a foundation to establish the necessary infrastructure to ensure the U.S. is a progressive Arctic Nation.

Innovation

The goal of innovation is to build facilities that last longer, are more environmentally friendly, are safe, and The goal of innovation is to build facilities that last longer, are more environmentally friendly, are safe, and meet user needs well into the future. One example of innovation is use of floating "pontoon system" docks at the newly-constructed cruise ship berths. The pontoon system docks easily rise and fall with Alaska's extreme tides and enhance the safety and efficiency of loading and unloading passenger vessels.

Alternative funding arrangements like joint ventures between cruise ship operators, Alaskan businesses, agencies, and Native Corporations are being used to develop cruise ship facilities. In addition, the Port of Juneau is studying the ability to provide electricity for two berths to reduce vessels' carbon footprint and improve air quality. The Port of Juneau was unsuccessful in a 2021 RAISE grant application for $25M to provide dock electrification at the two city owned facilities.

Let's Raise the Grade

- There are limited opportunities for federal funding for port and harbor improvements and it is imperative that the State prioritize legislative grant appropriations and matching harbor grant opportunities.
- Appropriate additional funds for the Port of Alaska. The Port of Alaska is progressing under the PAMP but remain $800M+ short of the funds needed.
- The U.S. Army Corps of Engineers Civil Works program needs to remain federally funded to ensure economic opportunities are available within Alaska's ports and harbors.
- The State and federal government must work in conjunction to develop the necessary infrastructure for a deep-draft Arctic port.
- The federal government must continue to offer grant programs allowing Alaskan ports and harbors to fairly compete with facilities throughout the U.S.

Find Out More

- Ports & Harbors Across Alaska: https://dot.alaska.gov/stwdmno/ports/hbr_orgs.shtml

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RAIL

C

Executive Summary

Alaska's railroads have some of the oldest infrastructure in the state. The Alaska Railroad Corporation provides cargo and passenger service from Seward and Whittier to Fairbanks. The ARRC operates as an independent government corporation and does not receive state funding. The White Pass & Yukon Railway serves over 500,000 passengers per year as a shore excursion for cruise ships. Alaskan rail infrastructure is aging, and facilities close to marine environments are in particularly great need of replacement.

Introduction

Alaska is served by the Alaska Railroad, operated by the Alaska Railroad Corporation (ARRC), and the White Pass & Yukon Route (WP&YR). These railroads provide passenger and freight services that power the State economy. Alaska operates and maintains rail infrastructure that is more than 100 years old. Repairs and refurbishments have kept this means of transportation operational, but investment is needed to meet current and future demands.

The Alaska Railroad is a Class II railroad that extends from Seward and Whittier to Fairbanks. This route is shown on the Alaska Railroad Route Map on the next page. Vessel and barge connections are provided to and from the Seattle, Washington marine terminal to the marine terminal in Whittier, Alaska, and also through the Port of Seward. Uniquely, the Alaska Railroad transports both cargo and passengers are transported through the ARRC marine terminals.

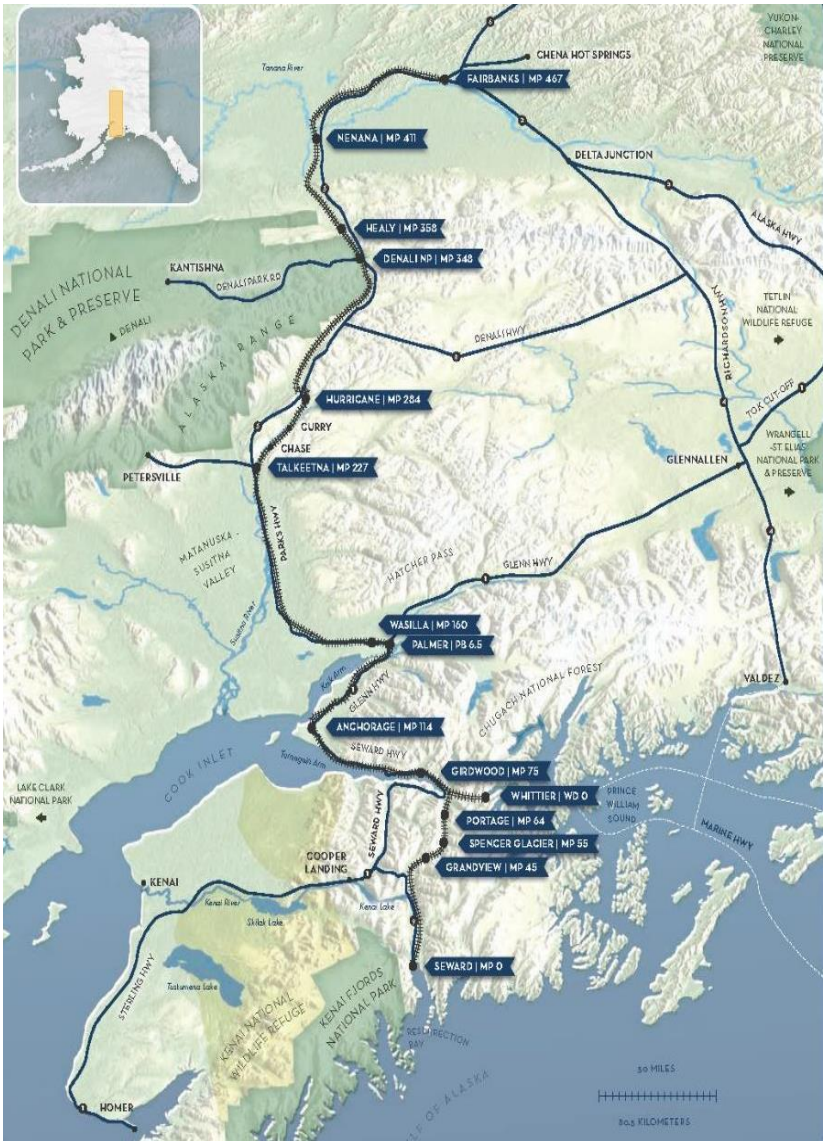
In 1985, Alaska Statute established ARRC as an independent government corporation capable of owning and operating the railroad after it was transferred from federal to state ownership. Now, ARRC operates financially separately from the State and does not receive state funding.

The White Pass & Yukon Route Railway (WP&YR) is a Canadian and U.S. Class II, narrow-gauge railroad. It was built in 1898 during the Klondike Gold Rush and links the port of Skagway, Alaska, to Whitehorse, Yukon. Its current route is shown on the WP&YR Route Map on the next page. WP&YR traverses steep grades of 3.9%, turns of 16 degrees, two tunnels, and numerous bridges and trestles. This railroad was designated as an International Historic Civil Engineering Landmark in 1994.

In the early 1900's, WP&YR was a fully integrated transportation company. In addition to trains, WP&YR operated docks, stagecoaches, sleighs, buses, paddle wheelers, trucks, ships, airplanes, hotels, and pipelines.

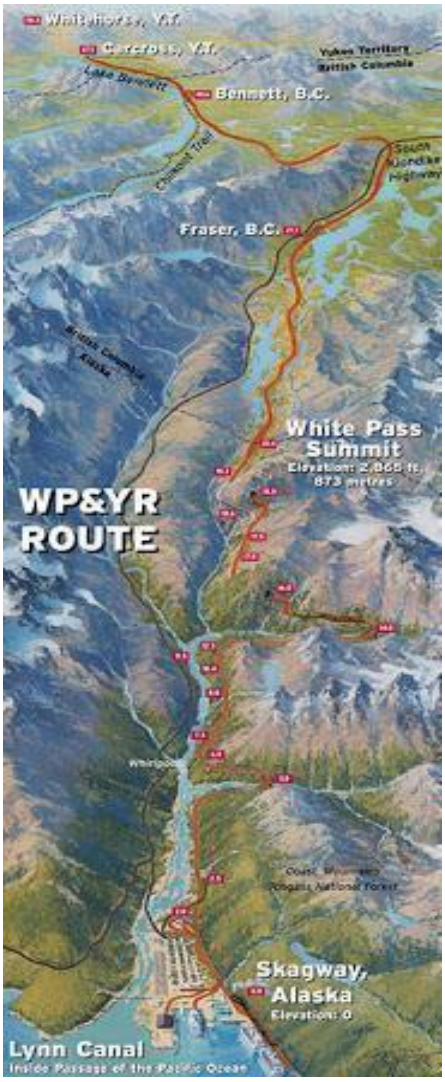
WP&YR suspended operations in 1982 when Yukon's mining industry collapsed. In 1988, the railroad reopened as a seasonal tourism operation and served 37,000 passengers. Ridership has steadily increased, and the WP&YR is now one of Alaska's most popular shore excursions, carrying over 500,000 passengers in 2019.

Figure: Alaska Railroad Route Map



Credit: Alaska Railroad

Figure: WP&YR Route Map



Credit: WP&YR

Capacity & Condition

ARRC provides year-round freight and passenger services over 611 miles of track, which include 470 miles of mainline. The Alaska Railroad does not currently have a direct, land-based connection with any other railroad lines on the North American network. Rail operations are predominately in undeveloped areas, and are affected by flooding, landslides, snow removal, avalanche controls and damage, fires, and wildlife strikes. These can delay or suspend train movements until repairs are made.

ARRC's total freight tonnage varies annually but is typically over four million tons. Capacity is limited by the rolling stock. The current ARRC engine fleet consists of 51 diesel-electric locomotives, two power cars, and one diesel multiple unit (DMU). About half of the locomotives in the fleet are SD70MACs, which are generally less than 20 years old. In 2020, ARRC purchased loading and rail equipment to support the replacement of the Trailer/Container-On-Flat-Car (TOFC/COFC) operations for continued growth and efficiency of the intermodal freight business.

Passenger trains operate year-round with as many as 12 trains per day in the summer and as few as two trains per day in the winter. The fleet ranges in age with the oldest passenger cars about 70 years old. Growth of the passenger service is limited by passenger rolling stock inventory and infrastructure improvements in some areas which require upgrades to comply with the federally mandated Positive Train Control (PTC). PTC systems need to be installed to fully utilize tracks in these areas. Some of the passenger depots have limited or no ADA facilities and require on-board lifts to transfer passengers. Similar to the Alaska Railroad, the WP&YR has no direct connection to any other railroad. Equipment, freight, and passengers generally arrive at the Port of Skagway and are transferred via road to the WP&YR. Currently, tracks are maintained along the first 67.5 miles between Skagway, AK and Carcoss, Y.T. The remaining 42.5 miles of track are idle and not operational. The current WP&YR fleet consists of 11 diesel-electric locomotives, 92 passenger cars, and a steam locomotive. In 2019, WP&YR operated up to 20 trains per day in the summer with capacity for additional passenger movements.

Operations, Maintenance, Funding, & Future Need

ARRC must act as a self-sufficient entity and does not receive funds from the State. Income is generated from a mixture of passenger services, freight services, and real estate leases, all with approximately equal contributions. While ARRC does not receive operating subsidies from the State, ARRC does receive Formula Funds from the Federal Transit Administration (FTA) to provide regularly scheduled, year-round passenger service. FTA funds have been used to maintain infrastructure and comply with federal mandates. These funds vary, but FTA and other Federal and State Grants have been approximately $30M annually. Additional investment is needed to recover from decades of deferred investment prior to the sale of the railroad to the State of Alaska, especially on some of the older bridges, facilities, and docks that have exceeded their life

expectancy. Three of the four operating marine docks are approximately 50 years old, and the oldest bridge is approaching 100 years old. In additional to maintaining the current system, ARRC also seeks to expand its line and services.

There are three significant plans to expand the existing ARRC system:

- Extension of the railroad 80-miles from Fairbanks to Delta Junction.
- 35-mile extension of the mainline at Houston to Port MacKenzie.
- Proposed Alberta to Alaska (A2A) Railroad project includes a privately-owned railroad that would connect to the Alaska Railroad to northern Alberta (1,600 miles).

ARRC showed profits between 2017 and 2019, with net income of $22 million in 2019. Extremely low demands for passenger rail service due to the coronavirus pandemic (COVID-19) resulted in a significant loss in revenue for 2020. Consequently, maintenance and infrastructure replacement are being reprioritized in accordance with limited funds and several projects are being deferred. ARRC is implementing asset management programs for infrastructure to assist with this task.

WP&YR has recently been replacing or eliminating old bridges to reduce maintenance costs. Their improvements include extending passing sidings, increasing yard capacity, reducing curves, changing lines, installing welded rail, and implementing automatic switch controls. Currently, there are no plans to restore service between Carcross and Whitehorse. In 2020, WP&YR cancelled all non-essential trips due to COVID-19.

Public Safety, Resilience, & Innovation

A total of 29 highway-rail incidents have occurred in the last 20 years on the Alaska Railroad, according to data from the U.S. Department of Transportation. Of the 249 at-grade highway crossings along the Alaska Railroad, 84 have flashing lights, 74 have automatic gates, and 112 have bells to provide advance notice of the approach of a train.

In 2020, ARRC completed a multi-phased program to implement the federally required PTC system that prevents potential accidents including trains exceeding their operating authority, trains entering the wrong tracks, trains over-speed, and unauthorized movement through work zones. The PTC system monitors and controls train movements and provides improved information for decision-making. If warranted, PTC will stop a train to avoid potentially dangerous situations.

ARRC has made significant investments in equipment, technology, research, and expertise to mitigate avalanche risk, particularly along slide-prone areas between Anchorage and Seward. The railroad has worked with the Alaska Department of Transportation & Public Facility (DOT&PF), U.S. Forest Service, and other public safety organizations to reduce uncertainty and hazardous conditions for vehicles. ARRC is developing

plans to mitigate or reduce flooding on the southern portion of the rail line caused by glacier dam releases (jökulhlaups). Funding for this effort is pending. PTC is not currently required on WP&YR but the company is pursuing a train control system that protects authority exceedances, speed limits, and track conditions.

Both railroads incorporate resiliency into planning and design including rerouting of track when feasible to avoid risks including those posed by avalanches, flooding, and seismic activity. Examples include an ARRC planning effort to raise bridges subject to flooding, and WP&YR replacing bridges with alternative structures, such as roller compacted concrete (RCC) to reduce maintenance and extend life spans.

Let's Raise the Grade

Priorities to raise the grade for ARRC include:

- Replace aging marine infrastructure, railroad terminals, and maintenance facilities.
- Replace or retrofit bridges for increased load capacity.
- Provide ADA-compliant boarding facilities for passengers.
- Implement clearance improvements along the corridor between Whittier and Anchorage.
- Replace aging rail cars and provide a funding plan for future replacement of other rolling stock.
- Perform yard improvements in terminals to efficiently handle trains.

Priorities to raise the grade for WP&YR include:

- Replace aging infrastructure with emphasis on marine facilities.
- Obtain long-term funding for train control systems, wayside systems, and protections against natural hazards.
- Increase capacity to address demand with primary focus on rolling stock.

Find Out More

- Public Transportation Providers Across Alaska: http://dot.alaska.gov/stwdplng/transit/rcs_providers.shtml

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ROADS & HIGHWAYS

C

Executive Summary

The State of Alaska maintains 5,609 centerline miles of roadways, 3,737 miles of which are paved. Along with state-maintained roads, there are roadways maintained by boroughs, cities, villages, and native corporations. Through capital improvements the number of National Highway System (NHS) lane miles in poor condition decreased from 15.6% to 8.1% between 2015 and 2018, which is lower than the national average of 20.1%. The state has experienced budget deficits over the last several years, which has led to cuts of maintenance funding for the highway program. Raising the gas tax and increasing funding will help maintain and improve Alaska roads.

Introduction

Alaska is bigger than California and Texas combined, yet it has the fifth-lowest road mileage in the nation. Alaska has 17,735 Certified Public Road Miles that are owned and maintained by a variety of agencies including the State of Alaska, Forestry Service, cities, and boroughs. Of these, 14,578 miles are rural, and 3,157 miles are urban. Only a total of 6,219 miles are paved. Boardwalks and ATV trails are also considered roadways in some villages. Alaska's metropolitan areas have experienced stagnating and decreasing population from 2013 to 2018, which has resulted in flat or decreased traffic volumes on many high-volume roads. From 2015 to 2018, the percentage of Alaska's roads in Poor condition decreased.

Alaska's roads connect vehicles and freight from the contiguous United States (through Canada), between major hubs (Anchorage and Fairbanks), and from the major hubs to some outlying communities. Connected communities are often served by one road that provides the only access for travel, food, and emergency service. Alaska Department of Transportation & Public Facilities (DOT&PF) is trying to maintain the same miles of road with $22 million (M) less per year than it was six years ago. Contributing to this budget limitation is that Alaska's gas tax is the lowest in the country, at just 8% per gallon and has not been raised since 1970. As the budget is limited and tax revenues to increase it are stagnant, roadway safety becomes a concern because maintenance constraints leave some roadways impassable in the wintertime. Unfortunately, funding constraints are not just limited to maintenance - the estimated deficit for the 2021-2022 budget was $1 billion before including the impacts from the coronavirus pandemic (COVID-19).

Capacity

Alaska experiences relatively low traffic congestion in comparison to other states due to its low population density, limited road network, and slow population growth. Alaska has only 0.2% of the national population and 0.2% of national vehicles miles traveled but has 16.2% of the national land area. The larger metropolitan areas of Anchorage and Fairbanks experience the most congestion, which results in average commute times of 18.4 and 12.9 minutes, respectively, well below the national average of 26.4 minutes.

The highest Average Annual Daily Traffic (AADT) counts are along the Glenn Highway between the Matanuska-Susitna (Mat-Su) Valley and Anchorage which sees over 60,000 vehicles per day. This can be attributed to population growth in the Mat-Su Valley and an increasing number of commuters to Anchorage. The Glenn Highway saw a 50% increase in travel time, from 18 to 27 minutes, from 2006 to 2013. The Glenn Highway has also seen an increase in AADT but is an outlier in the statistics in comparison to other higher-volume roads in Alaska. Most other high-volume roads have seen a decrease in AADT from 2013 to 2018.

Table: Anchorage Area Congested Roadway Segments AADT Comparison (2013 to 2018)

Roadway	Segment	2013 AADT	2018 AADT	% Change
Glenn Highway	Fort Rich to Hiland	54,866	60,767	10.76%
Lake Otis Parkway	Dowling to 68th	22,040	22,013	-0.12%
Tudor Road	Seward Hwy to Lake Otis	38,143	37,436	-1.85%
Boniface Parkway	Perry Dr. to DeBarr	24,159	23,930	-0.95%
Minnesota Drive	Raspberry to International	48,285	43,922	-9.04%
C Street	Tudor to International	29,170	25,122	-13.88%
Seward Highway	76th to Dowling	55,480	55,703	0.40%

The Fairbanks Area Surface Transportation (FAST) Planning agency conducted an analysis of AADT for area roads between 2012 to 2015 for the 2045 Metropolitan Transportation Plan. The study, which included roads with AADT changes of 15% or more, determined that although many roads experienced AADT increases of as much as 53%, the level of service did not change between 2012 and 2015.

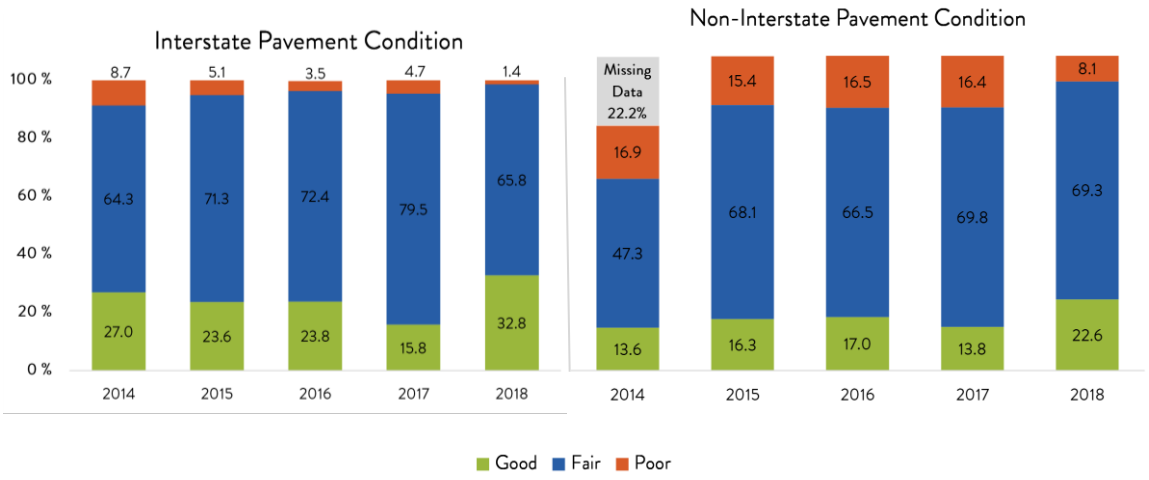
Condition

The Alaska DOT&PF prepared a statewide Transportation and Asset Management Plan (TAMP) for all their paved and non-paved roadway facilities in 2018. The plan includes the 2,347 miles of Interstate and National Highway System (NHS) paved and unpaved roads, which also includes 19.1 miles of roads owned and maintained by the Municipality of Anchorage. Condition data was not available for other federal or borough

roads. Condition data is used to rate the road pavement as good, fair, or poor based on roughness, cracking, and rutting. The TAMP's goals are to treat pavements in good and fair condition before they become poor to provide an overall saving through the life of the pavement. The data allows effective prioritization, selection, and design of future surface treatments, rehabilitation, and reconstruction projects.

The most recent data available was collected in 2018 and indicated both Interstate and NHS roads have seen a decrease in the percentage of roads in poor condition. The percentage of Interstate pavement in poor condition in 2018 was only 1.4%. The percentage of non-Interstate NHS roads with poor pavement decreased from 15.6% to 8.1% between 2015 and 2018, which is lower than the national average of 20.1%.

Figure: Alaska Pavement Condition



Credit: Alaska DOT&PF 2019 Transportation Asset Management Plan

Operations & Maintenance

Alaska's roads cover extreme and challenging environments with temperatures ranging from +100°F to -80°F, snowfalls as deep as 974 inches, ice-rich permafrost, and up to 225 inches of rain a year. Many of Alaska's communities are not connected to the larger road system, making it difficult to transport appropriate maintenance vehicles to the community. These and other factors combine to make Alaska's roadways more expensive to construct and maintain, per mile, than most other states with costs ranging from 6% higher in large urban areas to 270% higher in remote, rural areas.

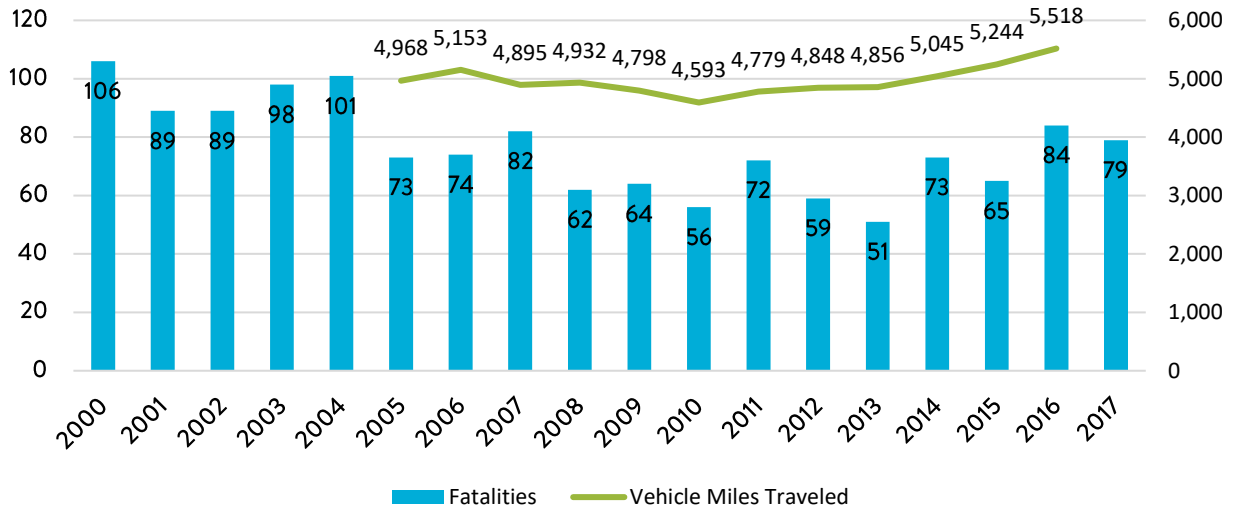
Alaska has been working to transition from a "reactive" program (plowing and sanding) to a "proactive" program (automated bridge de-icing systems); however, budget cuts have greatly reduced the impact and effectiveness of this program across the state. Alaska DOT&PF is trying to maintain the same miles of road

with $22 million (M) less per year than it was six years ago. Four maintenance stations have been closed due to budget constraints. Winter road maintenance has transitioned to a priority system with the highest volume roadways receiving the most attention and the lowest priority roadways potentially being impassable.

Public Safety

Alaska developed its first Strategic Highway Safety Plan (SHSP) in 2006 and updated it in 2013. The number of traffic-related fatalities has been relatively steady with 74 deaths in 2006, a low of 51 in 2013, and back up to 79 in 2017. Traffic-related serious injuries have gone from 437 in 2006 to a low of 333 in 2013 and back up to 392 in 2016. The highest percentage of all crashes are at intersections and lane departures and involve young drivers. Many factors, including distracted driving, can be attributed to these crashes.

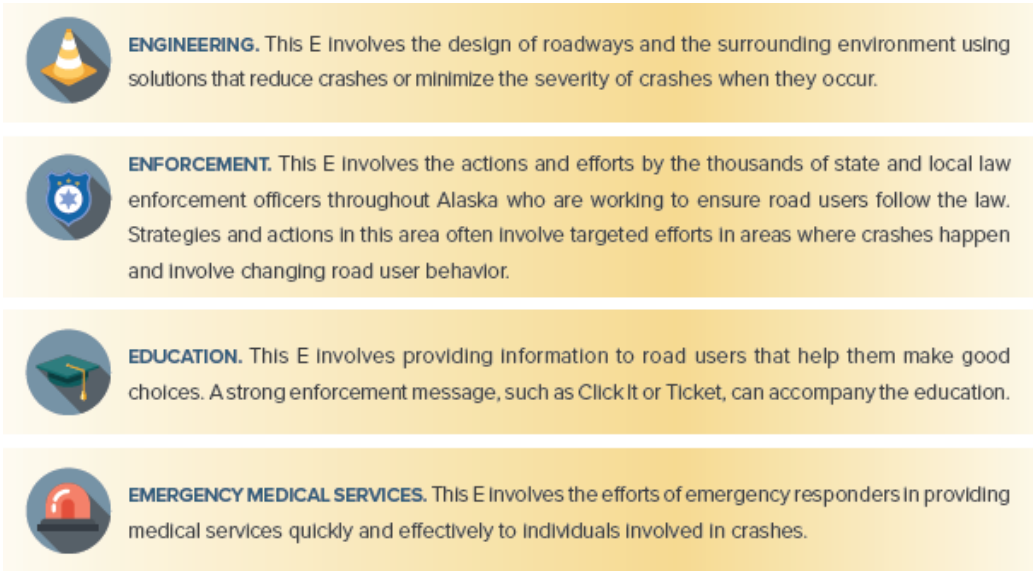
Figure: Number of Fatalities, 2000-2017



Credit: Alaska DOT&PF

Alaska DOT&PF started updating the SHSP in 2017 and has developed a goal to reduce fatality and serious injury crashes by 3.1% annually. The goal over five years is to reduce fatalities to 67 and serious injuries to 331 in 2022. The plan focuses on "The 4 E's of Safety" shown on the next page.

Figure: "The Four E's of Safety"



Credit: Alaska DOT&PF

Funding

Alaska's 2008 Long Range Transportation Plan states:

> *"[Alaska] DOT&PF does not currently have sufficient funding to exercise its full responsibility for preserving the transportation system while also developing the system. Without additional revenue this funding shortfall will become larger."*

The budget situation has worsened since Alaska DOT&PF's statement in 2008. The drop in oil prices since 2015 has resulted in a significant decline in state revenue and led to reductions in spending for maintenance, improvements, and new projects. Additionally, Alaska's gas tax is the lowest in the country, at just 8% per gallon and has not been raised since 1970. Alaska's total budget decreased by 27% from 2015 to 2018. The estimated deficit for the 2021-2022 budget was $1 billion before including the impacts and additional costs from COVID-19. The budget deficit has been exacerbated by the impacts of COVID-19.

The average real operation (maintenance) spending was $6,158 per capita from 1975 to 2020. In FY 2021, real agency operations spending is expected to be $4,971 per capita (the 6th lowest since 1975), translating into a nearly $1,200 per capita reduction.

The average real capital (improvement) spending was $1,152 per capita from 1975 to 2020. In FY 2021, real agency capital spending is expected to be $173 per capita, translating to a nearly $1,000 per capita reduction.

Like many states, Alaska is dependent on federal money to fund road maintenance and improvements. Alaska has been receiving funds through the Fixing America's Transportation Infrastructure (FAST) Act which allocated spending from 2015 through 2021. The FAST act was extended through 2021 and helps offset a portion of the significant cuts and budget deficits.

Resilience

Due to its size, climate, and geography, Alaska is subject to natural disasters that include wildfires, avalanches, volcanoes, earthquakes, tsunamis, ground failures, and glacial dam failures. Alaska has increased resilience planning and documentation since 2016. The Alaska Emergency Operations Plan (2018) outlines a clear and detailed plan with Transportation listed as Emergency Support Function #1. An example of this priority was the quick response after the 2018 Anchorage earthquake. The Alaska DOT&PF had damaged roads repaired within days.

Alaska is also looking for ways to reduce the impacts of natural disasters and adapt to climate changes through the following programs:

- Alaska DOT&PF has a Snow Avalanche Program aimed to improve the safety of highways by reducing avalanche hazards.
- The University of Alaska Fairbanks offers a Resilience and Adaptation Studies certificate program.

This proactive approach will help Alaska construct infrastructure, including roads, able to withstand natural disasters and changing climate.

Future Need

Approximately 1% of Interstate and 8% of non-Interstate roads are currently in poor condition and in need of immediate repair. The population is expected to grow by 31% in Alaska's largest metropolitan area (Anchorage and the adjacent Mat-Su Borough) from 2013 to 2040. This increase in population is expected to increase the vehicle miles travelled, increase congestion, and decrease the level of service. According to the Matanuska-Susitna Borough 2035 Long-Range Transportation, Alaska's fastest growing area in the state is expected to experience a 90% growth in population from 2015 to 2035. Anchorage, Mat-Su, and Fairbanks have regional planning agencies with long range transportation plans in place to tackle these issues.

Innovation

Innovative solutions are being implemented regularly along Alaska's roads. Alaska DOT&PF's "roundabouts first" policy has resulted in installation in 40 roundabouts to mitigate serious crashes and prioritize pedestrian safety. Alaska's first Diverging Diamond Interchange (DDI) was completed in 2018. The DDI is an innovative

interchange type that increases capacity for turning on and off ramps and reduces the number of conflicting movements at the intersections. A second is planned for the O'Malley Road-Seward Highway interchange.

Alaska DOT&PF created public information websites such as the Alaska Navigator website and interactive map depicting live roadway construction conditions. Alaska DOT&PF also provides weather conditions and live camera feeds via the Alaska 511 Traveler Info. Weather and pavement detectors that provide real-time information to support winter maintenance operations are also being installed across the state. In July of 2020, the Alaska DOT&PF and the University of Alaska Anchorage took the first step in preparing for Connected and Automated Vehicles (CAV) in Alaska by surveying department staff and professional practitioners to identify future infrastructure, maintenance investments, and research activities necessary for CAV implementation.

Let's Raise the Grade

- Raise the gas tax and increase state spending on roads. HB 104 (Motor Fuel Tax and Vehicle Registration Fee, 2021) would increase the tax to 16 cents per gallon. This would have been a good start, but unfortunately it did not pass in 2021.
- Continue the use of asset management programs to prioritize funding for system preservation.
- Continue implementing innovative designs and explore connected and automated vehicle technologies to improve system capacity and safety.

Find Out More

- Alaska Department of Transportation and Public Facilities: https://dot.alaska.gov/

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Federal

- FAST Act: fhwa.dot.gov/fastact
- FHWA Budget (2016 – 2020): highways.dot.gov/research/about/legislation-budget/budget
- FHWA Climate Resilience Pilot Programs: fhwa.dot.gov/environment/sustainability/resilience/pilots/index.cfm

Statewide/Alaska Department of Transportation & Public Facilities

- Long Range Transportation Plan: dot.state.ak.us/stwdplng/areaplans
- Statewide Transportation Improvement Program: dot.alaska.gov/stwdplng/cip/stip
- Certified public road mileage: dot.alaska.gov/stwdplng/transdata/cprm.shtml
- Emerging Practices in winter highway maintenance: dot.state.ak.us/stwdmno/Winter_Maintenance.pdf
- Maintenance & Operations: dot.alaska.gov/stwdmno/index.shtml

- State of Alaska Emergency Operations Plan: ready.alaska.gov/Plans/documents/2018-SOA-EOP.pdf
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- Alaska Budget: omb.alaska.gov
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- Anchorage Climate Action Plan (2019): muni.org/Departments/Mayor/AWARE/ResilientAnchorage/Documents/2019%20Anchorage%20Climate%20Action%20Plan_ADOPTED.pdf
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- Coordinated Transportation Plan 2015: fnsb.us/transportation/MACSDocuments/FNSB%20Coordinated%20Plan%202015.pdf
- FMATS to FAST: webcenter11.com/content/news/Fairbanks-Metropolitan-Area-Transportation-System-organization-replaced-with-non-profit-513120071.html
- UAF Resilience and Adaptation Studies: catalog.uaf.edu/graduate/graduate-degree-programs/resilience-adaptation-studies

Other communities

- Matanuska-Susitna Borough LRTP 2017: matsugov.us/plans/lrtp

News articles

- KTUU, "Department of Transportation to cut snow plow service on Seward Highway" (10-15-2019)
- "Closure of Silvertip Maintenance Station" (Commissioner Comments, 10-24-2019)
- USA Today: "Alaska repairs earthquake-damaged roads in just days?" (12-6 2018)

SCHOOLS

Executive Summary

Alaska has 447 public schools in 56 different school districts that serve over 125,000 kindergarten through 12th grade (K-12) students. Public schools are funded by the local school districts and the State Base Student Allocation. The Alaska Department of Education & Early Development (DEED) issues annual reports to the public for each school that highlights the educational condition and quality of our schools.

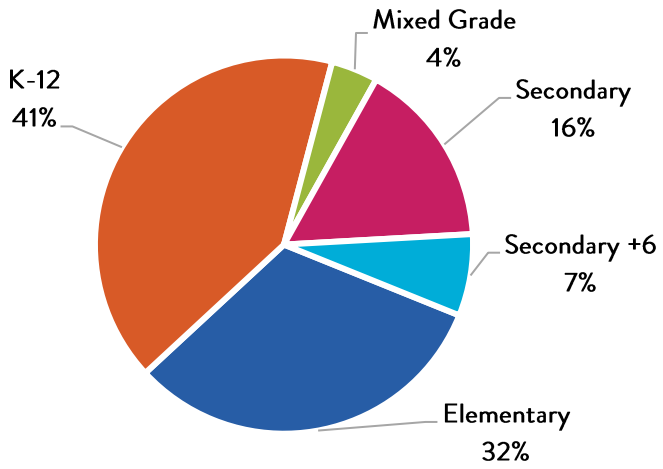
The purpose of ASCE's report card is to gather information about the infrastructure necessary to support our educational needs and how well it meets those needs.

Generally speaking, the public learns about the condition of our school infrastructure when new funding is needed for capital investments. ASCE recommends that the DEED also track data about the condition and needs of our school infrastructure so that long range planning for decision making is possible at the state level.

Introduction

Public schools serve a crucial role in the education and growth of the next generation of Alaskans. Alaska has 447 public schools in 56 different school districts that serve over 125,000 kindergarten through 12th grade (K-12) students. The Alaska public school system encompasses a total of 183 K-12 schools, 71 secondary schools, 144 elementary schools, 20 mixed-grade schools, 71 middle schools, and 29 combined secondary and sixth grade schools.

Figure: Alaskan Schools by Grade



Credit: Alaska Department of Education and Early Development

Many rural Alaskan communities, and therefore their schools, are only accessible by plane or boat. These communities' educators are commonly not year-round residents in the communities where they teach Additionally, the school facilities are multi-use, as they serve as community centers and primary emergency operation centers.

Alaska's Department of Education and Early Development (DEED) indicates $185 million (M) in funding is needed for capital improvements to sustain Alaska's schools. Many rural school facilities are reaching the end of their usable life and the cost to maintain them continues to rise. On the other hand, in urban areas, there is support from the community and allocated financial resources to modernize schools, expand access, and increase enrollment. Despite the student enrollment decline, 74 schools reported enrollment was over capacity. Urban schools are more likely to have capacity problems.

In addition to aging infrastructure, Alaskan schools are at greater risk of natural disasters including sever earthquakes and climate change. Several Alaskan schools were damaged in the 2018 Anchorage earthquake which caused over $150M in damage to schools and displaced students and staff. Several schools in rural communities are experiencing the impacts of degrading permafrost, coastal erosion, and increased storm activity due to climate change.

Alaskan schools receive state funding through Capital Improvements Projects. The State prioritizes the requests based on the need and the school's plan to address the need, with capacity problems generally prioritized over environmental risks.

The 2020-2022 Capital Improvements Projects plan includes projects to:

- Increase capacity
- Improve security
- Relocate infrastructure due to erosion
- Upgrade infrastructure to treat water
- Replace infrastructure damaged by earthquakes

Rural schools face several unique challenges, including the high costs for energy and routine maintenance due to the remote locations. In addition, the lack of funding creates a cycle of deferred maintenance and deterioration in rural schools.

Let's Raise the Grade

- Investment in sustainable school infrastructure should be the highest priority for Alaskan schools. Incorporating sustainable energy in each school renovation is one step toward sustainability.
- A coordinated approach is needed to partner with local and statewide agencies to acquire data on Alaskan school infrastructure.
- Support funding for the DEED Capital Improvement Projects Construction and increased funding for near term maintenance to avoid deferred maintenance and increased long-term maintenance cost.
- Work with the School Districts to develop metrics to better assess and prioritize infrastructure needs.

Find Out More

- School Districts Across Alaska: https://education.alaska.gov/DOE_Rolodex/SchoolCalendar/Home/Districts

References

- Banner Image: https://www.akbizmag.com

Executive Summary

Alaska's size, extreme weather, small population, and high costs make solid waste management a unique and challenging problem. There are nine Class I Landfills in Alaska's larger communities serving around 600,000 people – over 80% of Alaska's population. While Alaska's Class I landfills have sufficient capacity and safety standards to meet public health needs, an increase in funding would allow for increased recycling, innovation, and sustainable practices that would extend the life of these landfills. The Class II and III landfills that serve Alaska's remote communities need improved permitting, training, and maintenance.

Introduction

Solid waste is defined by the EPA as "any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material, resulting from industrial, commercial, mining, and agricultural operations from community activities." Alaska's diverse geography and logistical challenges contribute to unique landfill needs. Knowledge on the three landfill designations (Class I, Class II, and Class III) established by Alaska Department of Environmental Conservation (ADEC) is necessary to understand the status of Alaska's solid waste.

Landfill Classifications

Class III Landfills. Landfill classification is largely based on the tonnage and type of waste it receives and the level of precipitation the region receives. Class III landfills are unique to Alaska and comprise 95% of the waste collection and management facilities in the rural part of the state. These landfills serve communities with less than 1,500 people, receive less than five tons of waste per day, and have been granted primacy over federal regulations to accommodate various environmental challenges. Class III landfills vary from shallow trenches to pads installed above permafrost. Class III landfills face a host of challenges including:

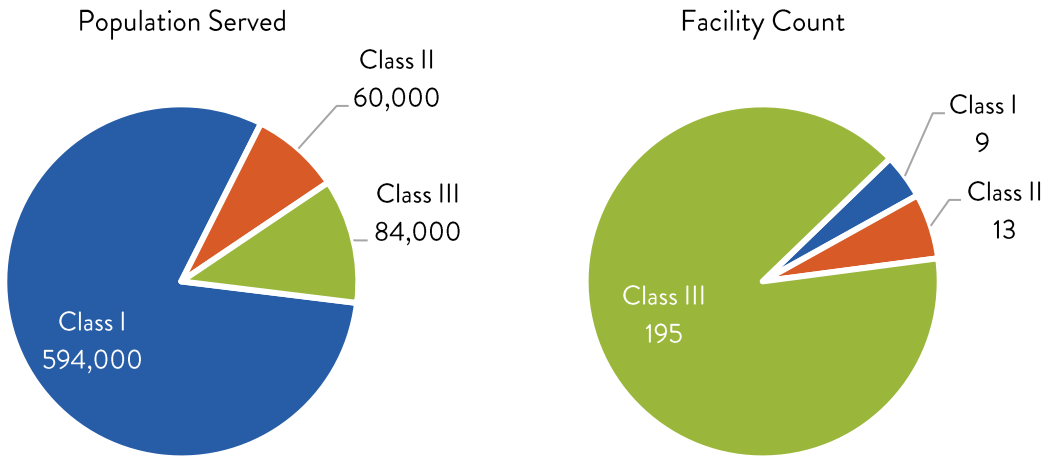
- Resilience in the face of climate change
- Separation between waste and drinking water sources
- High costs of design, construction, and maintenance
- Changing waste streams that now include increased quantities of pharmaceuticals, plastics, hazardous waste, and electronics

While these challenges are present for every class of landfill in Alaska, Class III landfills generally have less engineered controls to manage these issues.

Class II Landfills Class II landfills, also known as medium landfills, receive between five and 20 tons of waste per day. In 2021, there were 13 Class II landfills in Alaska. These landfills are not required to have lined cells, do not allow waste burning, and require surface and groundwater monitoring.

Class I Landfills Class I landfills serve over 75% of Alaska's population and are connected to the continuous road system. These landfills receive over 20 tons of waste per day and/or receive over 25 inches of precipitation and are required to have lined cells. The liners and associated leachate (wastewater produced by the landfill as a result of precipitation filtering through the waste) management systems prevent contamination from leaving the landfill. Class I landfills are also required to cap the waste, manage the gases produced as the waste decomposes, and monitor impacts to groundwater and air quality.

Figure: Population and Facilities by Landfill Class



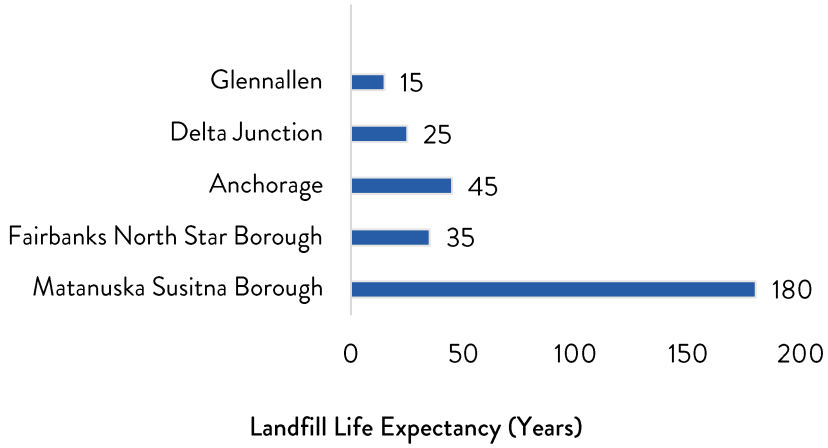
Credit: Alaska Department of Environmental Protection: Solid Waste (2020)

Capacity & Future Need

Landfills are expensive to design, permit, and construct. Therefore, maximizing the capacity of existing landfills is a universal goal for solid waste management. Several Class I, II, and III landfills have recently been constructed and, without a better approach to optimizing a landfill's capacity, they are expected to outlive their designed life expectancies. The figure on the next page shows various Class I and II landfill life expectancies. These were collected by sending surveys to landfill managers and operators across the state.

Based on this data, the average Class I and II landfill capacity is 60 years. Overall, Alaska currently has adequate landfill capacity.

Figure 1: Alaska Landfill Life Expectancy Beyond 2021



Credit: Class I and II Landfill Survey (2020)

One area of concern for future capacity is Anchorage, which has capacity for the next 44 years but no space for expansion. Efforts to extend the life of the Anchorage landfill include diversion of waste streams, recycling programs, composting projects, and reuse stores. In addition, public outreach tools, such as the Doomsday Clock, shown in the figure below, are used to raise awareness. The Doomsday Clock displays the amount of time before the current landfill is full. It is an interactive tool, based off of the Solid Waste Services Strategic Plan (2021), to show how recycling, composting, and other programs can extend the landfill's life.

Figure: Alaska Landfill Life Expectancy beyond 2021

Credit: Municipality of Anchorage, Department of Solid Waste Services

Condition

The overall condition of Alaska's Class I landfills is adequate, but reports indicate that upgrades to gas and leachate collection and management systems are needed.

ADEC reporting indicates that only 85% of Class II landfills and 95% of Class III landfills maintain approved permits, and improvement is needed through increased permitting and regulatory efforts. ADEC reports also indicate a trend of improving inspection scores for the permitted Class III landfills over the last five years. The average Class III score has been consistently increasing by 4 to 5% each year for the past five years. In addition, the total number of Class III permitted landfills has increased by 50% since 2016. All permitted landfills can be viewed via an online mapper through the ADEC Solid Waste website, which shows the landfill status and inspection score. Due to ADEC's inspection and permitting backlog, some landfills are missing facility information, authorizations, and inspection information.

Operations & Maintenance

Overall, most solid waste facilities operate in compliance with established standards. The EPA has granted Class III landfills certain exemptions for monitoring, such as groundwater, due to remote location and small capacity. Common challenges for providing routine operations and maintenance (O&M) include inadequate funding for upgrades and operations such as site control, collecting fees, monitoring dumping practices, and performing compaction and applying cover to the landfill. Most landfills want to improve infrastructure, adopt sustainable practices, such as increased organics composting and recycling, and improve management of leachate and landfill gas.

Most rural communities have low revenue and lack the equipment and resources to properly manage their solid waste. In urban Alaska, private partnerships can be used to introduce new initiatives while allowing operations and maintenance (O&M) staff to focus on routine operations. Urban hubs are primarily owned and operated by local municipalities and boroughs, whereas some communities like Juneau had solid waste services provided by large utilities like Waste Management.

A shortage of reliable O&M staff presents challenges to both urban and rural Alaskan solid waste management, a problem which is compounded by a high job turnover rate. Initiatives such as the Rural Alaska Landfill Operators and Manager of Landfill Operations training courses teach the duties of the landfill operator, regulatory and safety requirements, effective operating practices, and administrative practices. Such initiatives strive to provide a more reliable source of operators for Alaska's solid waste operations, but demand for operators remains unmet.

Public Safety

Over the last four years, Class I and II landfills in urban areas report an increase in their ability to provide for public safety, according to the responses to the survey that was sent to landfill managers and operators. On a scale of 1 to 5, survey respondents on average rated their landfills as a 4, stating they were confident in their landfill's ability to protect public safety. While existing concerns for management of leachate and landfill gas remain, the existing infrastructure provides adequate public safety in urban Alaska.

There is increasing concern for public safety in rural Alaska. Concerns include:

- Inadequate or expensive collection and processing for hazardous materials
- Impacts of environmental conditions on landfill infrastructure
- Inadequate processing for human waste, including honey bucket disposal at rural landfill facilities

In addition, recent research indicates an increase of heavy metals, pharmaceuticals, and antibiotic/antiviral/antifungal microbials in groundwater due to failing landfills in rural Alaska. An additional concern for landfill operations in Alaska is the emergency of polyfluoroalkyl substances, PFAS, in waste streams and leachate production, however, it is not currently tracked at both the urban and rural levels.

Funding

Class I and Class II landfills generally received adequate revenue through rate payers and grants to fund maintenance and capital improvements, as stated in the landfill operator and manager surveys. Rate increases are often incorporated into long-term planning to account for current and future needs; however, decreases in state and federal funding can result in unsustainable increases in user fees.

On average, large urban hubs experience an average tipping fee of $110.93 per ton. Juneau, Fairbanks, and the Anchorage Regional Landfill, and the Anchorage Central Transfer Station have the following fees, respectively: $180 per ton, $145 per ton, $63.73 per ton, and $74.38 per ton.

Many Class III landfills in rural Alaska rely heavily on the Indian Environmental General Assistance Program (IGAP) and lack adequate funding for infrastructure upgrades and routine O&M. Additionally, the cost of construction is high in rural communities because they are not connected to the road system.

Overall, urban communities have more reliable funding sources to provide for routine needs and prepare for unforeseen emergencies. Rural Alaskan communities typically lack a reliable funding stream.

Resilience & Innovation

Significant innovative solutions have overcome many of Alaska's solid waste management challenges. Unfortunately, in 2021 Alaska ranks 48th amongst the United States with a recycling rate of 6%. Sustainable

practices such as recycling and organic collections are gaining traction in urban hubs. For example, private partnerships in the Matanuska-Susitna (Mat-Su) Valley have developed a for-profit recycling service where volunteers help bundle and sort recycled materials for export. Anchorage has developed a curbside collection project, implemented both at the commercial and municipal level, to compost organics rather than ship them to the landfill. These programs divert waste from landfills and extend the life of the existing infrastructure.

Urban landfills have also found opportunities to streamline their operations through infrastructure upgrades. Anchorage initiated a waste-to-energy project that transforms landfill methane gas into energy that feeds the electrical grid. This waste-to-energy project could further the landfill's resilience by providing additional potential sources of energy and income, as well as provide for redundancy for their electrical needs. Anchorage is also welcoming a fleet of electric garbage and recycling trucks coming in 2021. The Kenai Peninsula has the State's first evaporator to minimize its leachate volume.

Innovation is also present in Class II and III landfills, where adaption to constrained budgets and environmental barriers produces unique waste management opportunities. Arctic Village, located in northern Interior Alaska, was innovative in the face of funding adversity. Arctic Village was denied significant grant opportunities for its landfill construction and streamlined their design and construction process to self-finance and construct its landfill at a fraction of the project's initial estimated cost.

Waste backhaul is a practice that utilizes returning aircraft and barges to transport recyclables and hazardous waste from small communities to a hub that can manage the waste properly. This is a common practice in Alaska when compared to the rest of the U.S. and leverages the return transportation that would otherwise have little to no cargo. Waste backhaul is used to avoid the construction of expensive leachate management systems that would be needed in several southeast Alaska communities due to high rainfall. Alaska lacks a hazardous waste landfill and backhaul provides a mechanism for transporting materials to their final disposal.

Let's Raise the Grade

The keys to improving solid waste in Alaska are managing waste streams, investing in infrastructure, engaging and educating the public, maintaining regulatory permits and inspections, and cultivating the operators who will keep Alaska's solid waste management safe and reliable.

- Prioritize state funding to sustain capital improvements and maintain permitted landfills.
- Obtain 100% permitting rates for Class II and III landfills.
- Develop clear metrics to measure the impacts of sustainable practices such as composting and recycling.
- Improve condition assessments and reporting.
- Increase public education, outreach, and engagement.
- Extend the life of existing landfills.
- Support operator training programs.

Find Out More

- Alaska Department of Environmental Conservation – Solid Waste Program and online mapper: https://dec.alaska.gov/eh/solid-waste/
- Municipality of Anchorage, Solid Waste Services: http://www.muni.org/departments/sws/Pages/default.aspx
- Waste 360: Alaska's Unique Solid Waste Management Tactics (waste360.com)

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CREDIT: CAPITAL TRANSIT

TRANSIT

B-

Executive Summary

Mass transit serves 72% of the state's population in four of Alaska's most populated cities and boroughs: Anchorage, Juneau, Fairbanks, and Matanuska-Susitna (Mat-Su). Service is provided using multiple modes of transit including fixed-route bus service, paratransit, vanpools, and elderly/disabled transportation that are generally reliable. Recent innovations include electric fleets and "fat tire" bicycle racks that have been modified for the Alaskan environment. Identified needs include improvements to bus stops to encourage year-round ridership, increased safety of bus stops, and additional focus on long-range planning.

Introduction

Mass transit is available in four of Alaska's most populated cities and boroughs: Anchorage, Juneau, Fairbanks, and Matanuska-Susitna (Mat-Su), providing service for 72% of the state's population. Each community system is generally reliable as it serves a diverse array of riders using multiple modes of transit including fixed route bus service, paratransit, vanpools, and elderly/disabled transportation. These systems generally have enough capacity to serve their riders, use vehicles that are within their useful life (defined as 12-15 years for buses by the Federal Transit Administration), and are actively working on facility improvements. Some safety, winter accessibility, and connectivity concerns have arisen that each organization is assessing. Each year, the systems depend on annual funding to provide maintenance, keep operations going, and adapt to the community's needs.

The transit system in Anchorage serves 289,600 people over an area of 1,955 square miles. Anchorage Public Transportation Department (PTD) operates three services: People Mover fixed route bus, AnchorRides paratransit and senior transportation, and RideShare vanpool. The transit system in Fairbanks serves a smaller urban area with a population of 97,500 (including surrounding communities) with a large percentage of university students. The transit system in Juneau serves a population of 32,200 that includes many commuters traveling to and from residences in "the (Juneau) Valley" to work locations downtown (approximately 15 miles one-way). It also serves an influx of seasonal tourists and summer workers. The transit system in the Mat-Su Borough serves 108,800 residents and is commonly utilized for its commuter fixed route bus service to and from "the (Mat-Su) Valley" and Anchorage for work (approximately 45 miles one-way).

Other transit systems service smaller communities, "off-grid" users, and rural areas that are not encompassed by the larger systems. Transportation providers for smaller Alaskan communities that were not included in the analysis due to limited data include:

- Bethel Public Transit System serving Bethel
- Glacier Valley Transit serving Girdwood
- Soaring Eagle Transit serving Gulkana
- Inter-Island Ferry Authority serving Hollis
- The Bus serving Ketchikan
- Kodiak Area Transit System serving Kodiak
- The Ride serving Sitka
- Central Area Rural Transit (CARTS) serving Soldotna
- Sunshine Transit serving Talkeetna
- Interior Alaska Bus Line serving Tok

Capacity

From 2008 through 2018, ridership declined on Anchorage's fixed route bus system called People Mover, from approximately 16,000 to 11,000 weekday riders. From late 2017 to early 2020, the system was modified and aimed to provide more frequent service by changing routes without increasing costs. In 2019, the average weekday ridership increased 5.4%, which equates to an additional 600 trips per day. That year, People Mover served 3.4 million riders and provided 2.1 million miles of transportation. During the coronavirus pandemic (COVID-19), People Mover served 1.7 million riders in 2020 and 1.9 million riders in 2021. The 2040 Metropolitan Transportation Plan estimates that the existing transit system has capacity to accommodate additional riders in the future.

The fixed route bus system in Fairbanks is called the Metropolitan Area Commuter System, or MACS and serves Fairbanks, North Pole, Farmers Loop, and Fairbanks International Airport with its eight fixed routes. Ridership and number of transportation vehicles was high between 2014 and 2017, with a maximum of 571,600 rider trips and 17 vehicles (buses and on-demand vehicles) in 2015. However, after 2017 through 2019, ridership dropped 19.7%, to 438,800 rider trips using 14 vehicles. During COVID-19 in 2020, ridership was at 311,400 using 14 vehicles.

On Juneau's fixed route bus system, Capital Transit, annual ridership is among the highest in the country for a "rural" community (less than 50,000 residents) with over 1.23 million passenger trips annually. Ridership varies seasonally. Being the state capital, the Alaska State Legislature generates annual demand from January through April. From May through September, an influx of cruise ship passengers, other tourists, and seasonal workers increases demand during the summer. Throughout the year, overloading (crowding) occurs during

peak commuting periods (7 am - 8 am, 6:30 pm - 7:30 pm) between the Juneau Valley and downtown. It should be noted that overloading only occurs in the primary commuter direction during peak hours.

The fixed route bus system in the Mat-Su is called Valley Transit and provides commuter service from the Mat-Su Valley to Anchorage and demand response service within the Mat-Su Borough from Monday through Saturday. Demand response is a curb-to-curb service that is open to everyone and based on reservation. The transit system was renamed to Valley Transit after a 2017 merger of Valley Mover and Mat-Su Community Transit (MASCOT). Peak usage occurs on the primary commuter routes and overcrowding can occur in the mornings from the Mat-Su Valley to Anchorage.

Condition

The Anchorage People Mover fleet consists of Americans with Disabilities Act (ADA) compliant buses. Based on People Mover's 2020 Federal Transit Administration (FTA) system report card, they had 45 buses in operation, with an average vehicle age of 9.6 years. For reference, FTA defines the useful life of a bus at 12-15 years. Two of the main transit stations: in downtown Anchorage and at the Dimond Center Mall, were renovated around 2015. Additional condition data for the Anchorage PTD paratransit, vanpool fleet, and other transit stations were not assessed in this report.

As of 2020, Juneau's Capital Transit fleet consisted of 18, 35-foot buses, made mostly in 2010, 2016, and 2018. Their fleet of shorter buses with wheelchair lifts consists of 10 vehicles, manufactured in 2010 and 2018. In April 2021, Juneau received its first electric bus: a 40-foot battery-electric Proterra bus. After almost a year of use, the bus's range averaged 170 miles or eight hours in the summer and 150 miles or six hours in the winter. In colder months, it was unable to complete its full route and in general had several mechanical issues that periodically removed it from service.

As of 2020, Fairbank's MACS fleet consisted of nine buses and six on-demand vehicles in operation with an average vehicle age of 10.8 and 9.1 years, respectively.

In the 2018 Mat-Su Coordinated Human Service Transportation Plan, Valley Transit was anticipating the need to replace their existing bus fleet in the next few years because every vehicle they own has approximately 700,000 miles on it. As of 2020, Mat-Su's Valley Transit had five buses and five on-demand vehicles in operation.

Operations & Maintenance

Anchorage's People Mover operates every day with 15 weekday routes and eight weekend routes. Times vary based on location and day of the week but start as early as 6 am and go as late as 11:59 pm. In 2019, People Mover served 3.4 million passengers, was on-time 85% of the time, and missed less than 1% of all trips. That

year, the $23.5 million (M) annual operating costs equated to an average cost of $10.17 per passenger per year. Maintenance of bus stops and surrounding pedestrian facilities are the responsibility of the Municipality's Street Maintenance department and the Alaska Department of Transportation & Public Facilities (DOT&PF) maintenance and operations (M&O) department, depending on the maintenance responsibility of the road. In 2020, 1.7 million riders were served with 89% of buses on time and less than 1% of trips missed.

Fairbank's MACS operates eight weekday routes and five routes on Saturday, varying from 6 am to 9:45 pm. MACS accrues approximately 500,000 miles annually providing service to Fairbanks and its surrounding communities.

Juneau's Capital Transit operates every day with 16 weekday routes and five weekend routes, varying from 6:15 am to 11:45 pm. Capital Transit also provides a "Ride Free Zone," where users can ride for free on any route between four downtown bus stops. Per month, it's fleet drives almost 55,000 miles.

Mat-Su's Valley Transit operates 13 round trips per weekday and four roundtrips on Saturday between the Mat-Su Valley and Anchorage, varying from 4:40 am to 8:00 pm.

Figure: Valley Transit Buses

Credit: Mat-Su Valley Transit

Public Safety

Statewide safety recommendations include improving seasonal accessibility of bus stops, improving sidewalks and connectivity across major roads, safe locations for crossing to other bus stops, pullouts for buses to leave the travel lane while loading passengers, and bus stop lighting. Riders throughout the state have expressed safety concerns about walking to bus stops and riding on buses. Loitering and personal safety are key concerns at Anchorage's transit centers and major bus stops. As a result of public comments, People Mover added a Road Supervisor in 2019 who patrols problem locations daily. The Municipality of Anchorage (MOA) tasked People Mover and the Anchorage Police Department to work collaboratively to identify and implement solutions to address safety issues at bus stops.

The pandemic drastically changed transit operations across the state. All major transit providers followed federal, state, and local laws and mandates. Some changes included entering from the rear of the bus, reduced routes, reduced passenger amount, allowing essential travel only, requiring masks, additional cleaning, and in some cases pausing a route.

Funding

Across the state, transit is reliant upon annual funding from federal, state, and local governments, as the collection of passenger fares, profit from advertisements, and private donations only cover part of the costs. For paratransit, elderly, and disabled individual transportation services, nationwide budgets provide funding alongside local and state government funds. Funds can be more easily planned and directed for communities with a short- or long-range transportation plan. Smaller communities more heavily rely on user input to identify needs and local government or community efforts to raise funds.

Anchorage's People Mover experienced increased operating costs in 2019 due to a shift from contractor to municipal operations. People Mover is reliant on government funding to close the gap between costs and revenue. In response, the 2020 Anchorage Municipality budget increased PTD's budget to match a federal grant and added a top-priority route, identified in Anchorage's Transit on the Move (TOTM) 2020 Short-Range Transportation Plan. Anchorage's 2040 Long-Range Transportation Plan concluded that the increased level of service and expanded service coverage areas identified in the 2020 Short-Range Transportation Plan could be achieved by considerable investment in their transit system.

Funding comes from a mixture of sales tax, federal transportation grants, and city funds. During the pandemic, FTA authorized $29M in grants to Alaska's transit agencies (including the Alaska Marine Highway System) to help offset the costs of low/no service.

Future Need

Communities often have short-range and long-range planning tools to direct funding for their specific future needs. Across the state, replacing and updating aging infrastructure, facilities, and fleets were identified.

Anchorage's 2020 Short-Range Transportation Plan identified transit needs based on the public's needs, values, and desires. Projects were prioritized to meet the goals of increasing accessibility, convenience, reliability, and safety. The future needs included increasing seasonal accessibility of bus stops, expanding service, decreasing wait time, increasing amenities at bus stops, and improving security at bus stops and on buses.

Prior to 2019, the Fairbanks Metropolitan Area Transportation System (FMATS) worked with local transportation organizations to help plan for future transportation needs. In 2015, FMATS long term goals

included providing service on Sundays, improving headways on popular bus routes, and improving bus stop shelters and amenities. In 2019, an independent, nonprofit organization called Fairbanks Area Surface Transportation Planning (FAST Planning) replaced FMATS, increasing the opportunity to apply for federal transportation grants.

Juneau Coordinated Transportation Coalition (JCTC) is a group of community partners that work to improve the effectiveness and efficiency of transportation in Juneau. Their 2020 Coordinated Human Service Transportation Plan identified education, awareness, vehicle upgrades, expansion of service, winter facility maintenance, and improving schedules as future needs.

The Mat-Su Borough's 2035 Long-Range Transportation Plan assessed growth over the next 20 years and identified roadway connectivity and improving the collector roadway network as future needs. The 2020 U.S. Census designated the Mat-Su as an urbanized area, requiring it to form a Metropolitan Planning Organization for planning, measuring performance targets, and monitoring implemented projects for the borough. Once Alaska DOT&PF and State of Alaska funds are appropriated, the boundary for this organization will be established and formalized planning will commence.

Resilience & Innovation

Creative and unique ideas innovate transit in the harsh, Alaskan environment. In the winter of 2018, People Mover leased an electric/battery powered bus for a four-month trial period to investigate winter performance and the feasibility of an electric bus fleet. The results indicated the electric bus did not have sufficient range to replace a diesel engine bus on cold days, as it could not complete the route without mid-day charging.

Figure: Alaska's First Electric Bus in Anchorage, AK

Credit: Alaska Public Media

With the results of the Anchorage trial, electric buses were considered more feasible in Juneau's warmer climate. In 2020, Juneau received a $5M federal grant to purchase new electric buses and associated charging infrastructure. The first bus went into service April 2021 and performed well during the summer but had issues during the colder winter months. Even with these results, Juneau is not deterred and has pending

funding to replace seven more diesel buses with electric buses. They are looking into other electric bus manufacturers and seeing what other cities in cold climates are using, in order to work towards their goal of 80% renewable energy by 2045.

Anchorage, Juneau, and Fairbanks have promoted bicycle-bus modal options through bicycle lockers and bicycle bus racks. Throughout the summer season, People Mover, Capital Transit, and Valley Transit buses are equipped with front bumper bicycle racks that hold up to three bicycles. As of January 2020, People Mover buses now accommodate winter-friendly "fat tire" bicycles with extra-large, front bumper racks that hold up to two fat tire bicycles and one child/regular tire bicycle. No matter the season, bicycles are another mode of transportation in Alaska and these racks increase convenience and accessibility for users.

Anchorage's downtown transit center has a planned façade upgrade, scheduled to start construction in October 2022. The revamped front will add a hotel, restaurant, retail spaces, and housing while leaving the parking garage and bus terminal. Juneau's Capital Transit started construction in September 2021 on their new Valley Transfer (bus) Station. The station will be a rider transfer site with other amenities that include public restrooms, bus shelters, a parking lot for transit users, several electric vehicle chargers, and bicycle lockers. Construction is expected to take place through June 2022.

Figure: People Mover's Bike. Rack. & Roll. Promotional Photo

Credit: Anchorage People Mover

A proposal to add another transit service, called Microtransit, to Anchorage's PTD is being considered. Microtransit is like other ride-share services where users can use a smartphone app (or phone call) to request a ride that will pick up and drop off passengers wherever they wish to travel within the service area boundary. This service could make public transit more competitive to private ride-share services.

Let's Raise the Grade

- Improve and maintain facilities, sidewalks, and crossings around bus stops year-round to encourage ridership, comfort, and safety.
- Assess frequency and bus capacity based on route and demand to maximize efficiency.
- Explore ways to educate the public about transit options to increase ridership.
- Create publicly available, long-range transit plans that prioritize new routes in fast growing areas with increasing traffic congestion.
- Identify issues and implement strategies that prioritize rider confidence and feeling of safety at bus stops and transit centers.

Find Out More

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WASTEWATER

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Executive Summary

Urban communities in Alaska have wastewater systems similar to those in cities across the US. They provide wastewater collection and treatment and are funded primarily by user fees and/or local taxes and periodically benefit from state and federal funding. Services for rural communities throughout Alaska vary from centralized sewer to no service at all. Limited access, high cost of operation and maintenance, and limited population make the cost per user very high in remote communities. Residents in 32 rural communities do not have in-home piped water or a community watering point and must haul water. In these communities, wastewater is collected in honey buckets and discarded nearby. Most rural wastewater systems were built using grants but lack adequate funds from user fees to pay for on-going maintenance including asset management programs. While user fees for wastewater systems in Alaska ($629 annually) are higher than the national average ($504 annually), they do not provide enough resources for capital needs. Over time, limited maintenance, a lack of capital investment, and harsh environmental conditions have caused considerable damage which makes managing these systems, many in poor condition, challenging. Accordingly, some grant programs provide additional funding to allow communities to implement improvements, but those programs are insufficient. For example, the Alaska Native Tribal Health Consortium estimates that over the next decade, the rural communities it serves will need more than $80 million per year on average to sustain and improve wastewater systems with only about 10% of that total currently available through existing programs.

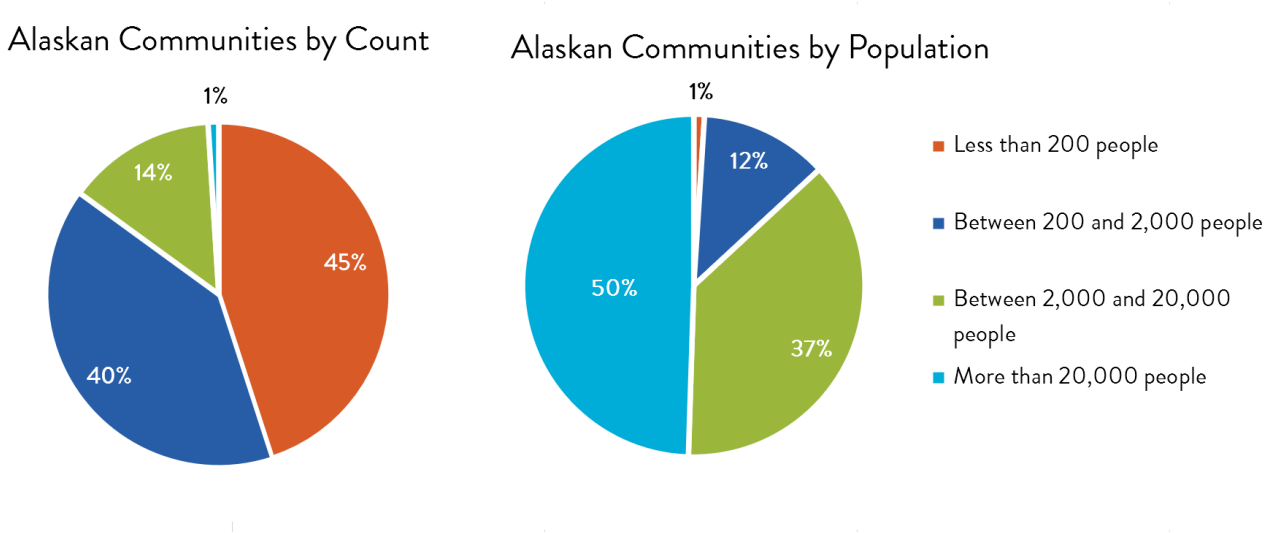
Introduction

Nearly half of Alaska's 730,000 residents live in the urban centers of Anchorage, Juneau, and Fairbanks. These communities have wastewater systems similar to cities across the US. They provide wastewater collection and treatment. These municipal systems are funded primarily by user fees and/or local taxes and periodically benefit from state and federal funding. The rest of the state averages less than one resident per square mile. More than 75% of Alaskan communities (by count) are inaccessible by road, and are home to 25% of the state's population.

Alaska's mid-size cities, even those that are regional economic and administrative hubs such as Bethel, still struggle with providing drinking water and sanitation. Sixty-eight percent of Bethel's 6,000 residents lack piped water and sewer service, relying instead on truck-hauled service. Dry toilets, like 5-gallon buckets, are still used in some households.

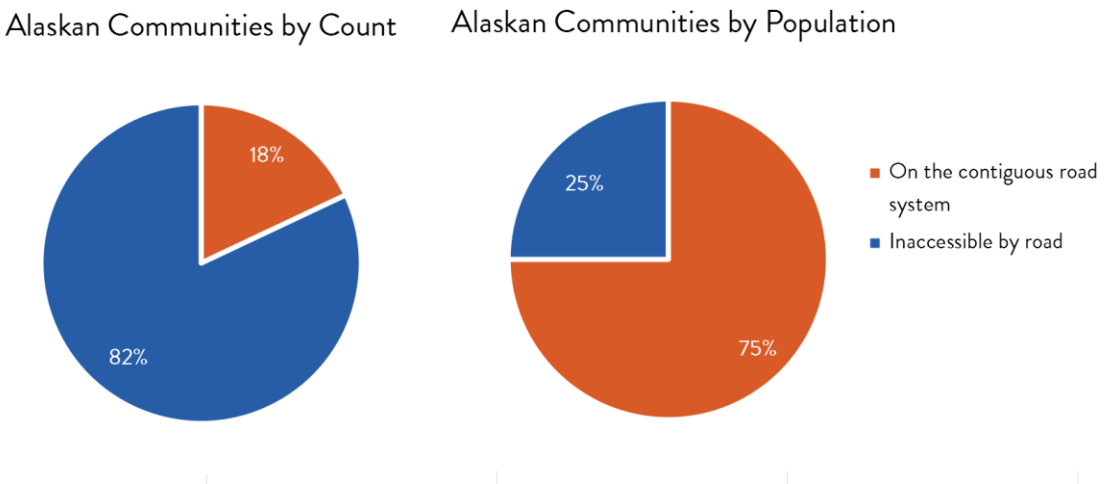
Similarly, many of Alaska's smaller communities struggle to provide water and sanitation. Alaska has 280 rural communities that are only accessible by air, and typically have less than 200 residents. Services for these rural communities vary from piped water and sewer to no service at all. Limited access, high cost of operation and maintenance, and limited population make the cost per user very high in remote communities.

Figure: Community count and total population compared to community size.



Credit: Alaska Department of Labor and Workforce Development

Figure: Community and population connection to the road system



Credit: Alaska DOT&PF

Capacity

Alaska's population generally tracks with the "boom and bust" cycles of the oil and gas industry, growing rapidly when the industry is booming and declining when production and prices drop. The Matanuska-Susitna (Mat-Su) Borough is the only region that experienced sustained growth since 2010. As a result, most of Alaska's urban wastewater infrastructure is adequately sized to accommodate current and projected populations. Service is limited in most rural communities and there are capacity challenges in many of those locations. For example, approximately 30% of Alaska has continuous permafrost, so communities in these areas experience limitations in their storage capacity.

Condition, Operations & Maintenance

Alaska's larger public utilities serving urban areas conduct condition assessments to help manage aging assets and the risk associated with their continued use. Much of Alaska's urban infrastructure is generally in fair to good condition. Its last major upgrade was during the oil boom of the 1980's through the early-1990's. Robust management, operations, maintenance, and capital improvements have helped maintain the condition of the urban infrastructure throughout the last few decades, but increased effort will be needed as facilities continue to age and some near the end of their useful life. Some of the urban wastewater collection systems in Southeast Alaska already need replacement, creating periodic surges of necessary repairs for operations and maintenance crews. In addition, some urban wastewater treatment systems throughout Alaska are considering significant upgrades in response to evolving regulations.

Most rural wastewater systems were built using grants but lack adequate funds from user fees to pay for on-going maintenance including systematic asset management programs. Over time, limited maintenance and environmental factors, such as permafrost thaw and frost heave, have caused considerable damage. These systems, typically operated and maintained by local governments or tribal agencies, often struggle in poor condition.

Another challenge for rural wastewater systems is for the operators to obtain and maintain the required certification. The positions generally do not provide a living wage and certified operators are typically not enticed to move to villages solely to take an operator's position. Since 1981, the Remote Maintenance Worker Program has supported rural communities in their efforts to grow operational capacity and avert systemic failure. The Rural Utility Business Advisor Program provides similar support to rural communities with a focus on building financial and managerial capacity that is critical to the long-term success of local utilities.

Public Safety

The difference in wastewater services between urban and rural communities results in widely disparate quality of life and health outcomes. In 2019, Alaska ranked last among all 50 states for the percentage of its citizens receiving complete sanitation, which includes a flush toilet, shower or bath, and a kitchen sink.

Residents in 32 rural communities do not have in-home piped water or a community watering point and must haul water. In these communities, wastewater is collected in honey buckets and discarded nearby. These conditions contribute to poor public health, yet only five of these communities have received grant funding to raise their level of service. Federal grants in Alaska are typically applied to both drinking water and wastewater infrastructure, so both systems are typically required to access federal grants.

Resilience

Alaska experiences the effects of climate change at twice the rate of the rest of the US. Many rural Alaska communities are environmentally threatened due to increased erosion, flooding, and permafrost thaw. These threats adversely impact rural infrastructure. In 2019, more than 100 rural Alaska communities were identified as being highly vulnerable to environmental threats. These communities have begun to address these threats with engineering and policy solutions.

The 2018 Anchorage earthquake caused damage to wastewater collection, storage, and treatment systems in southcentral Alaska. Luckily, the Anchorage Water and Wastewater Utility (AWWU) quickly responded to the damage due to their robust routine operations and maintenance program with a focus on emergency preparedness. They also effectively communicated public health concerns to the community, such announcing a boil-water precaution.

Funding & Future Need

Wastewater systems are funded, in part, by revenue from user fees; however, revenues alone are typically inadequate to fund capital improvements. User fees for wastewater systems in Alaska ($629 annually) are higher than the national average reported fees ($504 annually). Grant programs provide additional funding to allow communities to conduct improvements; these include programs covered by the Indian Health Service Sanitation Deficiency System and agencies such as the Alaska Department of Environmental Conservation (DEC), including Village Safe Water (VSW); U.S. Environmental Protection Agency; and U.S. Department of Agriculture and Rural Development. VSW and the Alaska Native Tribal Health Consortium (ANTHC) implement these improvement projects as partnerships with the communities. Alaska's wastewater systems do receive funding from the EPA's Clean Water State Revolving Fund program, however, it is not adequate for Alaska's needs.

Regardless of size or road connection, most Alaskan communities are functionally isolated from one another. This means much of the state's wastewater service occurs at a community level, which limits opportunities to economize based on sharing or scaling facilities. Therefore, providing wastewater services is expensive statewide. Across the state's water sector, drinking water and wastewater, the estimated need for funding is extremely high. This need is expected to increase in the future as systems continue to age and the environmental threats of climate change are realized. At the same time, State funding has been decreasing. The State's Municipal Matching Grant program has not been funded since 2017, leaving community infrastructure grants accessible only by legislative appropriation

Eight communities within Alaska, including Anchorage, have wastewater treatment plants that do not meet Environmental Protection Agency (EPA) discharge standards and must operate on waivers. These waivers are at risk of not being renewed and would result in unforeseen and significant modifications to facilities. In the case of Anchorage, the modifications to meet EPA discharge standards would cost $1B.

ANTHC indicates rural communities' needs include $3.45B over the next 50 years to protect existing infrastructure from environmental threats. An additional $1B is needed to protect infrastructure in regional hubs. An average of more than $80 million (M) per year is needed over the next decade and only about 10% of that total is available through existing programs.

Innovation

Alaska's challenges also offer opportunities for innovation. Challenges faced by rural Alaskans prompted VSW to sponsor a worldwide research competition to spark the development of innovative and cost-effective sewer systems for remote Alaskan villages. The competition started in 2014 and is aptly named the Alaska Water and Sewer Challenge (Challenge). It is a multi-phase research and development project that focuses on technologies for decentralized wastewater treatment, recycling, and water conservation for individual homes. The primary goal of the Challenge is to develop a system that supplies and drains water for a kitchen sink, bathroom sink, toilet, shower, and washing machine hookup.

The Challenge led to several real-world applications to improve sanitation services in rural communities. Examples include a pilot test of waterless urine diverting toilets and a water usage study to more precisely quantify residential water demands. Findings from both projects will inform future development of sanitation projects in rural communities.

ANTHC has designed and implemented a low-cost sanitation alternative for remote communities. The Portable Alternative Sanitation System (PASS) addresses basic sanitation needs including handwashing, clean drinking water, and safe disposal of human waste. The system improves the quality of life, can be configured according to the available space and personal preferences, and can be relocated if needed. Approximately 70

PASS units are operational in Kivalina, Oscarville, Chalkyitsik, Allakaket, Alatna, and Mertarvik with additional units planned for Kotlik and Alatna in 2021. Another project will install over 100 mini PASS units in homes across the State in response to the coronavirus pandemic. The PASS units do not provide the same level of sanitation as piped water and wastewater, but they are a major improvement over communal wash basins and honey buckets.

Let's Raise the Grade

- Secure increased funding for capital improvements from state and federal sources, including the U.S. EPA Clean Water State Revolving Fund.
- Reinstate the State Municipal Matching Grant program.
- Secure funding for long-term operations and maintenance from local and state sources, recognizing that preventative programs ultimately save money.
- Promote and fund a broad range of prevention, preparedness, mitigation, and response strategies through local, regional, and state cooperation.
- Further promote the capacity of Alaskans to operate local wastewater facilities.
- Promote and fund risk-based asset management covering capital improvements and operations and maintenance through local, regional, and state cooperation.

Find Out More

- Alaska Wastewater Discharge Authorization and APDES Program: https://dec.alaska.gov/water/wastewater/

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Closing Remarks from the Report Card Committee

The 2021 Alaska Infrastructure Report Card is a collaborative effort undertaken by the American Society of Civil Engineers (ASCE) Alaska Section. This effort was made possible through the hard work of many of our members and non-members.

Our infrastructure is too often taken for granted in our daily lives. Many fail to consider what it takes to ensure our infrastructure is designed, constructed, and maintained to meet our needs today and for generations to come.

During 2021, ASCE Alaska Section reviewed nine of our state's infrastructure systems. An objective look at publicly available information, the expertise of professionals in the field, and our own knowledge of the infrastructure we work with every day culminates within this report card. We hope that this report card will provide a better understanding and valuable insight on Alaska's infrastructure.

Our vast and beautiful state offers many unique challenges to those providing the infrastructure necessary for our everyday lives. Our state would not be the great place it is to live, work, and play without our infrastructure. Thank you to all that make that possible.

Through the whole process, we had valuable help, guidance, and support from ASCE staff members including Christy Prouty, Anna Denecke, and Kevin Longley; and the ASCE Committee on America's Infrastructure.

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For the report card committee,

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