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. 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's by choice, too often it's 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 best to handle every day solid waste in a subarctic environment.

Alaska's infrastructure investment is crucial to our way of life and the success of the economy. With declining oil prices and uncertain federal funding unable to keep up with the demand for projects or the operations and maintenance needs of current systems, the American Society of Civil Engineers (ASCE) Alaska Section wants to ensure Alaska's leaders have the best information available about the current conditions of Alaska's infrastructure. As Alaska legislators address budget challenges, the ASCE Alaska Section's Report Card – developed for Alaska, by Alaskans – demonstrates the importance of infrastructure investment.

There are solutions to Alaska's infrastructure poor grades! Together with the information provided in the Report Card for Alaska's Infrastructure, it is ASCE Alaska Section's goal that Alaska's Civil Engineers work together with state leaders to plan, design, build, operate and maintain a safe, efficient and sustainable infrastructure for all Alaskans.

RAISING THE GRADES

4 KEY SOLUTIONS

1. Have a Plan and Fund for the Future: All infrastructure owners and operators 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 has to be done to keep things moving, and Alaska's infrastructure needs it. Sometimes it's all about the basics, and maintenance is the basic first step to good infrastructure. Maintenance need to be a consideration in design, as maintenance cost often is 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. Alaska has some challenging times ahead, but kicking the can down the road will only cost Alaskans 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 longer lasting, more resilient and smarter solutions.

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.

ABOUT ASCE - ALASKA

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 the American Society of Civil Engineers (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 following eight criteria: capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation.

Report Card for Alaska's Infrastructure History

Members of the Alaska Section of ASCE have tried to prepare a report card for Alaska's infrastructure for over five years. Unfortunately, we never achieved full momentum, and it stalled several times. We finally had a group of dedicated engineers who were driven to complete the report card in 2016. Alaska's report card is complete, and we will have a formal launch on February 7th, in Juneau. At that time, the grades for nine categories of infrastructure will be released.

ROADS

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What You Should Know about Alaska's Roads

State Highways and Roadways

Alaska's roadways, although very limited in total miles compared to most states, are vital to the economic growth and development of the state. The Alaska Department of Transportation and Public Facilities maintains 5,609 centerline miles of highways, 3,737 of which are paved. The highway system provides connectivity for freight and travel from the lower 48 states through Canada into Alaska, and from Alaska's economic hub, Anchorage, to communities across the state. Alaska, having some of the richest and most productive oil fields in the country, requires transport of equipment and infrastructure to the oil fields on the North Slope of Alaska. The 414 mile Dalton Highway (Alaska Route 11) is the only highway that connects Alaska's North Slope oil fields to the rest of the state, and shutdown of this highway for maintenance or due to catastrophic events has major effects on Alaska's economy, and affects the production and price of oil. Other major highways include the Alaska Highway, Seward Highway, Glenn Highway, Parks Highway, and Richardson Highway, which are corridors that provide connectivity throughout the central and northern part of the state.

Municipal and Borough Roadways

Municipal and Borough Roadways are typically a mixture of paved and unpaved roads in Alaska's hub towns and cities. Many of these areas are a mixture of state and municipal or borough owned roads, and are maintained by state and local governments. These towns and cities are the main population centers spread across the state where goods are typically shipped to in order to reach villages by road and air. Many of these areas contain populations over 1,000 people.

Village and Rural Roadways

Village and Rural Roadways consist mainly of unpaved roads, walkways, trails, and boardwalks in areas outside of Alaska's hub towns. These areas contain populations of less than 500 people and the local roadway facilities are typically maintained by local village governments and regional native corporations. The roads, walkways, trails, and boardwalks in these areas are of importance to locals because they serve as routes to local hub towns, medical facilities, schools, and routes to subsistence hunting and fishing locations. Villages located north of the Arctic Circle and Western Alaska are built on permafrost which experience thawing and melting in the summer months. These conditions make it unsustainable and cost prohibitive to build conventional roadways due to rapid deterioration. Many of these villages are connected by a series of boardwalks that are accessible by pedestrians, four-wheelers (all-terrain vehicles), and snow machines (snow mobiles).

Capacity

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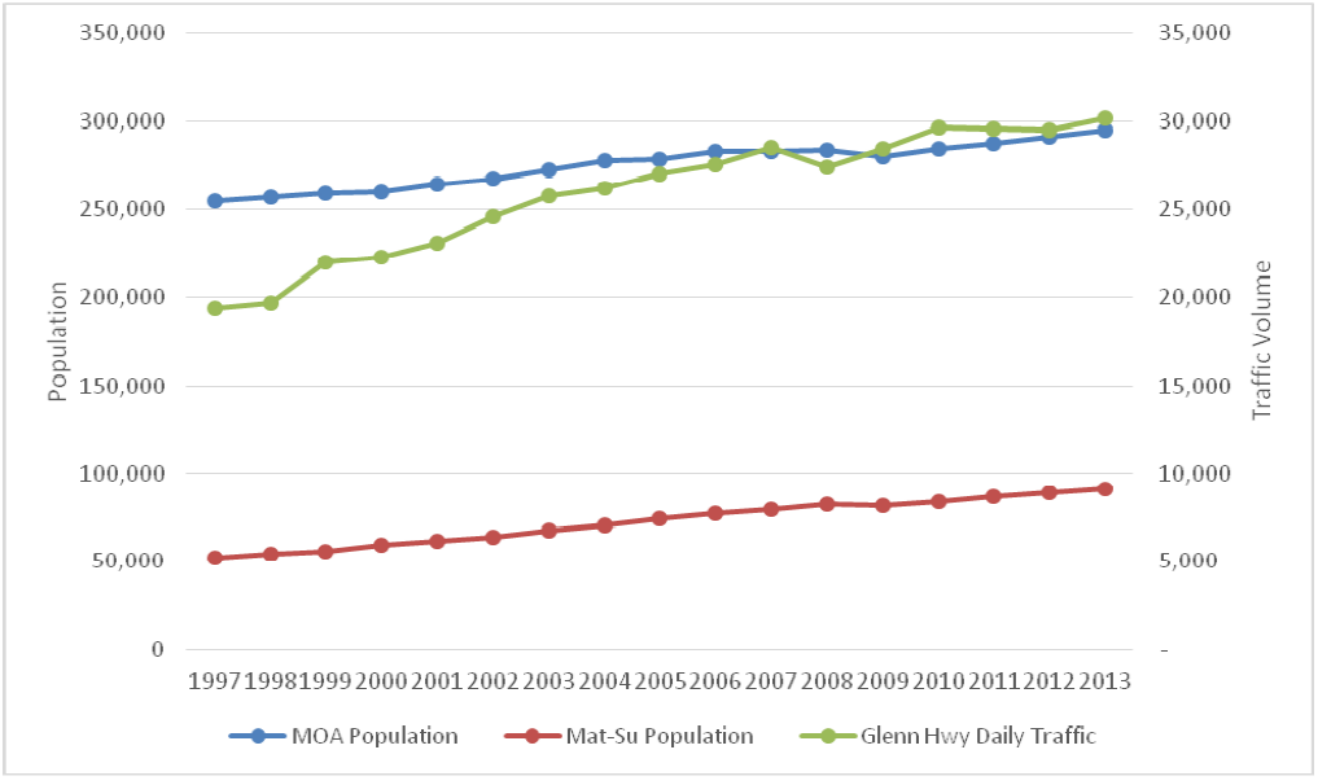
Alaska has the lowest population density in the country, 1.3 people per square mile, and because of this there is low traffic congestion outside of its population centers. However, Anchorage contains nearly 40% of the state's population, causing the Municipality of Anchorage (MOA) and the nearby Matanuska-Susitna Borough (MSB) to experience the heaviest traffic in the state. These areas have the highest population densities across the state. The MOA and MSB have experienced steady population growth over the last decade, which have contributed to capacity issues in the area. The figure below shows increasing traffic volume (vehicles per day) along the Glenn Highway which connects the borough and the municipality, in conjunction with population growth in Anchorage from 1997 to 2013. Several intersections in Anchorage experience Level of Service E and F, which are the highest congestion designations, during peak AM and PM traffic.



Source: US Census American Community Survey 5-year Estimates, Status of the System Report 2010, Volumes from DOT & PF Annual Traffic Volume Reports

The Anchorage Metropolitan Area Transportation Solutions (AMATS) have identified several projects which will make improvements to the Road System, Public Transportation, Pedestrian and Bicycle Systems, and Freight

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Distribution and Regional Connection Elements. Many of the projects highlighted in the AMATS plan are currently underway, however, in order to keep up with a rate of 1-3% increase in population growth per year, the AK DOT&PF, Municipality of Anchorage, and Matanuska Susitna Borough will continue to require investing in the projects highlighted by the study.

Condition

In 2013 the Alaska Department of Transportation & Public Facilities released Alaska's Pavement report. The report is an evaluation of approximately 4,100 lane-miles of Alaska's highways in order to come up with a comprehensive score of the condition of the state's pavement. The evaluation includes several data points that are entered into the Performance and Economic Rating System (PERS) software. These data points include:

- General sectional information, such as numerical identification, number of lanes, road classification, pavement type, functional class, etc.
- Traffic data (vehicles per day) and equivalent axle loadings.
- Structural data showing materials and thicknesses forming the support system of the roadway.
- Surface data with rutting and with IRI (International Roughness Index) indicators used to calculate remaining life.
- Modeling information allowing the engineer to account for varying conditions by modifying the formulas.
- Past construction and maintenance data.

PSR Ratings Guide

>4.0		Very Good
<4.0	> 3.5	Good
<3.5	> 3.1	Fair
3.4		2017 Statewide Goal
<3.0	> 2.6	Marginal
<2.6		Poor

Using these data points the PERS software calculates a Pavement Serviceability Rating (PSR) for each roadway segment evaluated and a comprehensive PSR for all roadways evaluated. The rating system assigns a score between 0 (very poor) and 5 (excellent). The evaluation resulted in a cumulative PSR of 3.1, which is Fair, however just above a Marginal rating. This result was mainly affected by irregularities in the pavement including cracks, potholes, and frost heaves.

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The department is currently developing the 2016 Alaska Pavement Report, at the time of this publication the report was not yet available.

Operations and Maintenance

Maintaining roadways in Alaska is very challenging due to many factors that are not commonly experienced in many other states. Extreme weather conditions, with temperature that range from -60° in winter to 100°F in summer, areas where snow can average over 200" per year that are prone to avalanches, and temperate rainforest locations that average over 150" of rain per year, create conditions that are ripe for pavement ware. From October through April it is legal for drivers to use tires with studs for traction in snowy and icy conditions. The use of studs causes rutting, which are a longitudinal grooves along the wheel path, over a period of time, which significantly decreases the life of the pavement and the ride quality. Many roadways in middle and northern Alaska are built on permafrost, which is a thin layer of soil over several feet of ice. With the average temperatures across Alaska on the increase, this is causing the melting of permafrost, which causes roadbeds in these areas to fail. The melting and freezing of permafrost and subsurface water cause and effect called "Frost-Heaving" which is characteristic of large vertical deviations, bumps and dips, which can be very dangerous for drivers and cause very poor ride quality. Many of Alaska's highways are in remote locations that are hundreds of miles from the nearest cities which make them difficult to access by maintenance and construction crews. These factors combined make each road mile in Alaska significantly more expensive to construct and maintain in comparison to a road mile in most other states. With significant budget cuts planned at the state level it will become increasingly difficult to maintain rural roads.

Public Safety

The AK DOT&PF has adopted the Alaska Strategic Highway Safety Plan (SHSP) which involves a multi-disciplinary approach to improving public safety on state roadways: Engineering, Education, Enforcement, and Emergency Medical Services. The goal of the plan titled *move Toward Zero Deaths*, is to significantly reduce roadway fatalities by half by 2030 and eventually eliminate roadway fatalities.

In an analysis performed in 2013 of the SHSP it has been noted that Alaska has achieved improvements in public safety on highways, but there still remains room for improvement. The three-year average of fatalities on highways were consistently on the decline until 2013. Since 2013 there has been a 40% increase in fatalities. The three-year average of serious injuries has risen which does not meet the 3.1% reduction per year desired in the plan.

In order to achieve reductions in fatalities and improve on reductions in serious injuries the department is focusing on three areas of emphasis with strategic initiatives to ensure targets are met.

Driver Behavior

1. Strengthen enforcement programs related to driving violations.
2. Improve the prosecution and adjudication of all driver violations.
3. Educate drivers to be responsible.

Roadways

1. Implement education/awareness programs to enhance roadway safety.
2. Implement engineering programs to enhance roadway safety.
3. Implement improvements to EMS to enhance roadway safety.
4. Utilize data and electronic information programs to enhance roadway safety.
5. Implement HSIP-qualified strategies.

Special Users

1. Implement education/awareness practices to enhance bicycle, pedestrian, motorcyclist, and OHV safety.
2. Implement engineering programs to enhance bicycle, pedestrian, motorcyclist, and OHV safety.
3. Implement evaluation programs to enhance bicycle, pedestrian, motorcyclist, and OHV safety.

Funding

According the Statewide Long-Range Transportation plan, the DOT&PF does not currently have sufficient funding in order to preserve the existing transportation and for future development. Without an increase in state revenue, funding in not expected to increase in the near term due to sustained low oil prices. The State of Alaska experienced a $3 billion budget deficit in 2016, which has been referred to as Alaska's worst economic recession since the 1980's. The budget deficit has triggered law makers to make significant cuts to state programs, including reducing budgets maintenance and operations for the DOT&PF. In June 2016 Governor Walker vetoed $250 million in highway construction spending, which put a pause on 8 highway projects around the state. In December, 2015 the Fixing America's Transportation Infrastructure (F.A.S.T.) Act was signed into law, which allocated $2.6 billion to Alaska for highway preservation and improvement projects. The F.A.S.T. act is expected add nearly $555.3 million per year in highway spending through 2020 which will offset a portion of the significant cuts that are being planned at the state level.

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Innovation

In 2009 the AK DOT&PF released its *iways* architecture, which is an innovative plan to improve efficiency, safety, and reliability of the state's transportation system by implementing Intelligent Transportation System (ITS) technologies. The department has been implementing projects throughout the state which include advanced communication, information processing, and computer hardware and software. These projects include 511 Traveler Information, Automated Vehicle Identification (AVI), Roadway Weather Information System (RWIS), and Traffic Signal Electronics Modernization. The current draft of the Statewide Long Range Transportation Plan includes policies that will continue support of the iways architecture in order to continue to use and implement new technologies that will improve efficiency and effectiveness.

Resilience

A limited study was conducted by FHWA in 2016 regarding Alaska's resilience to climate change, which highlighted case studies of three events that resulted in infrastructure damage which was linked to a changing climate. The study concluded that in many areas, due to sparse population, cost cannot be considered into the traditional benefit-cost analyses and broader factors of concern need to be taken into account to reflect appropriate response measures.

The current draft of the AK DOT&PF's Long Range Transportation Plan (LRTP) includes a risk-based analysis of trends affecting transportation system performance, which highlight climate change, earthquakes, natural disasters, and extreme weather events as having a high likelihood of affecting transportation infrastructure and increasing cost in the future. The plan includes policies that take these events into consideration in the project development phase in order to improve system resiliency.

Let's Raise the Grade

- Replace substandard roadways with pavement sections and materials that are more resilient to the extreme conditions.
- Construct new roadways with service life of the road as a priority, utilizing non-frost susceptible soils and strong pavements that can withstand the ware from the use of studded tires, frost heave, and melting tundra.
- **Focus a portion of funding toward projects that will ease congestion issues in the areas of the state that experience poor Level of Service.**
- **Continue to support efforts to improve public safety by minimizing roadway fatalities and injuries.**
- **Continue funding and implementation of innovative transportation infrastructure.**

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Find Out More

- http://dot.alaska.gov/stwddes/desmaterials/assets/pdf/pavement_report_2013.pdf
- http://dot.alaska.gov/iways/documents/iways-SummRpt.pdf
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Closing comments from the Report Card Committee

The Report Card for Alaska's Infrastructure 2017, is a collaborative effort undertaken by the Alaska Section of the American Society of Civil Engineers (ASCE). This effort was made possible through the hard work of several of our members and also non-members.

Our Infrastructure is all too often taken for granted in our daily lives and we often fail to consider what it takes to ensure the infrastructure is constructed and maintained to meet the needs of our society and future generations.

During 2016 we have reviewed publicly available information on nine of our state's infrastructure systems, often had questions for the infrastructure owner's or our peers. All the time wanting to give an objective overview or our infrastructure we have relied heavily on public knowledge and the professional expertise of our peers and our own knowledge of the infrastructure we work with every day. This report card is the result of that effort.

We hope that this report card will give valuable insight in, and a better understanding of Alaska's Infrastructure.

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

Through the whole process we have had valuable help, guidance and support from ASCE staff members including Brittney Kohler, Becky Moylan, and Carolyn Sofman; and the ASCE Committee on America's Infrastructure.

We also want to recognize the authors and many that offered their help in the writing of the report card. We sincerely apologize if we have failed to include anyone that helped in this effort. Any such omissions are completely unintentional. The following were the authors of the respective report card sections

Airports. Lead author Tor Anderzen, P.E., M., ASCE, Senior Aviation Engineer at HDL Engineering Consultants. Tor had much help from Rebecca Rauf, C.M. Aviation System Planner and Alexa Greene Western Area Planner at Alaska Department of Transportation and Public Facilities. Ori Miller EIT and engineering student at University of Alaska Fairbanks also provided much needed help with interviews of airport managers, and data gathering.

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Ports and Harbors. Lead Authors Carl Uchityl, P.E. Port Director, City and Borough of Juneau and Elizabeth Greer P.E. Senior Engineer, AECOM. Carl also had the assistance of many fellow port directors and harbor masters.

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For the report card committee

Greg Kinney, P.E.

Tor Anderzen, P.E.

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[i] A dam under state jurisdiction is defined in AS 46.17 as an artificial barrier that:
1. Has or will have an impounding capacity at maximum water storage elevation of 50 acre-feet and is at least 10 feet in height measured from the lowest point of the toe to the crest of the dam; or
2. Is at least 20 feet in height measured from the lowest point of the toe to the crest; or
3. Poses a threat to lives and property as determined by the department after an inspection. Artificial barriers with a Class I (high) and Class II (significant) hazard potential classification as defined in 11 AAC 93.157 are considered dams. This definition of a dam is inconsistent with the definition used by the USACE for the NID, which contributes to inconsistencies between the state and federal databases.

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