Public Infrastructure Technical Working Group

Revised PI-2 for AAG Consideration – May 15, 2009

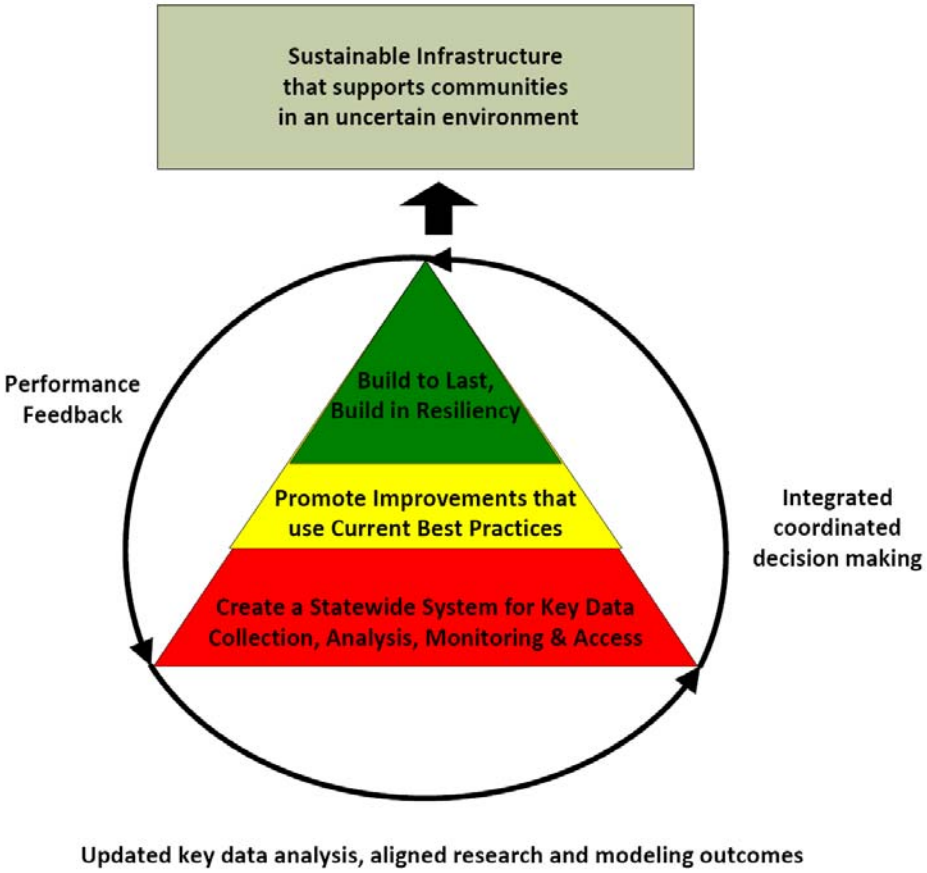
CONTEXT for MAY 15 AAG Review
Adapting Public Infrastructure to an Uncertain Climate: A Systems Approach

Infrastructure is the platform upon which our society functions. Public Infrastructure are the essential facilities and utilities under public, cooperative or private ownership that deliver goods and services to communities. Common examples in Alaska include, but are not limited to:

- Highways and bridges, railways
- Airports, landing strips
- Harbors, docks and ports
- Public buildings
- Seawalls and river shoreline protection
- Water, sewer, stormwater and solid waste systems including sewage lagoons, dumps/landfills, and related pipes and utilidors
- Publicly owned or essential utilities and distribution systems
- National defense infrastructure, military installations

Climate change in Alaska is creating the following potential impacts for public infrastructure (with significant regional variation):

- Increased flooding and erosion
- Decreased duration (cold season) and extent (warm season) of shore fast sea ice
- Increasing freeze/thaw cycles
- Changing wind and precipitation
- Increased storm frequencies and duration
- Warming and thawing permafrost
- Increased fire risk



PI-1 Create a Statewide System for Key Data Collection, Analysis, Monitoring and Access. Baseline data on the condition of current infrastructure and on regional and local environmental conditions needs to be collected. We need to know where and what the problems are. We need to know what is working and what is not working. Based on the best science and collected empirical data we need to predict our future. The resulting information needs to be available to all interested parties.

PI-2 Promote Improvements that use Current Best Practices. Managing the risks and/or reducing the uncertainties associated with climate change will take time. Promoting sustainability, reducing operating costs, and protecting/extending the service life of existing infrastructure is always worthwhile. Simultaneous with PI-1, improvements to existing infrastructure that are worth doing regardless of climate change effects should be enacted.

PI-3 Build to Last; Build Resiliency into Alaska's Public Infrastructure. As PI-1 and PI-2 are enacted and we learn more as a result, new and upgraded infrastructure need to be planned, designed, and built to be resilient and sustainable in an uncertain environment. Systematic feedback with a performance review and analysis needs to be integrated into the public infrastructure funding, development, construction, and operations, so that planners and builders use "what works" and codes and standards are assessed and improved as needed to achieve the best results.

PI-2. Promote Improvements that Use Current Best Practices

Component Description

While the time for action is now, there are currently many uncertainties about the impacts of climate change on the public infrastructure in Alaska. How we deal with these uncertainties will ultimately determine how we adapt to a changing climate. For sure, as our predictions on future climate change become more accurate with the execution of PI-1 (Statewide, Systematic Collection, Analysis, Monitoring and Access of Key Data) the uncertainties will be reduced. By accurately forecasting future climate change and its effects, we can better protect our existing infrastructure and better plan and design new infrastructure.

Managing the risks and/or reducing the uncertainties associated with climate change will take time. Meanwhile, as data is being collected and analyzed, the focus should be on implementing public infrastructure improvement solutions that are worth doing regardless of climate change effects. This is the goal of PI-2, Promote Improvements using the Current Best Practices, of the PI TWG Sustainable Infrastructure System. This approach provides cost-effective and cost-saving benefits regardless of future climate changes. It creates balanced awareness by promoting agility and resiliency that does not overly depend on the potential consequences of future climatic events on infrastructure in Alaska.

Component Design

Structure/Design

Sustainable Infrastructure System Policy PI-1 will establish a data baseline, continue data collection over time, and improve trend analysis and forecasting tools as necessary to achieve the best value in our future infrastructure development. The ability to accurately forecast the effects of climate change are critical to success. However, our understanding today of climate change processes and the associated impacts in Alaska are incomplete, which makes it extremely difficult to adapt existing and new infrastructure to future changes in the environment. Due to these uncertainties, the overall infrastructure strategy will have to balance the short term need for agility with the long term need for resiliency of facilities to survive in an uncertain environment.

Projects that integrate Current Best Practices provide the near term agility and long term resiliency vital to an effective response. Utilizing the most current information and technology, these projects focus on protecting Alaska's infrastructure investment regardless of climate change impacts by:

1. Protecting and extending the design service life of infrastructure,
2. Reducing infrastructure operating costs and complexity, and
3. Promoting sustainability in the development, design and construction of new infrastructure.

Implementing sustainable improvement projects will provide cost-effective benefits to communities even if the underlying climate change assumptions are incorrect. Implementation of a policy to repair and improve existing infrastructure will continue to build resilience that starts with Policy PI-1 (Systematic Key Data Collection, Analysis, Monitoring and Access) and ends with Policy PI-3 (Build to Last), which also requires regular reporting of environmental data and infrastructure performance to create a systematic feedback loop and thereby continually better measures and options.

Current Best Practices include actions to adapt infrastructure so that it can better withstand impacts due to the changing climate and use of measures designed to address the vulnerabilities of existing infrastructure. The goals of all actions are to promote sustainability, reduce operating costs, and protect/extend the service life of existing infrastructure.

Examples of adaptation actions include:

- The use of existing technology such as adjustable and/or mobile building foundation systems,
- Building foundations that use thermosiphons or thermopiling,
- Protecting facilities from flood or erosion damage, or
- Providing energy conservation upgrades.
- Long-term planning and preparedness,
- Building local capacity for operations and maintenance,
- Promoting energy–efficient technologies,
- Using alternative energy sources, or
- Building with better materials.

An example of using Current Best Practices are the efforts of the Alaska Immediate Action Work Group (IAWG), part of the Governors Climate Change initiative.

Over the past year the IAWG methodically labored to prevent loss of life and infrastructure and protect what is already in place in six imminently threatened rural Alaska communities. The IAWG functions as a central coordination entity. Membership is comprised of an array of senior agency staffers that coordinate the various agency authorities and ensure that each agency acts in alignment with the others. These experienced members know who to coordinate with and how to make things happen within the state and federal governments.

Each of the six immediately imperiled communities had an overall vulnerability assessment completed and recommended infrastructure improvements have been integrated into a series of near term plans to protect an/or extend the service life of each town site. Individual analysis of each location has enabled them to tailor best practice recommendations to each site. The examples below show applicant of Current Best Practices. PI-2 recommends routinely using adaptation actions like this.

- An emergency evacuation road has been proposed for Shaktoolik potentially enabling the current town site to be occupied for many more years. The availability of a safe evacuation route during winter storms will greatly reduce the risk of injury or death for residents an enable the continued utilization of town infrastructure for many years to come.
- Strengthening the existing revetment in Unalakleet was judged to be the appropriate approach to protect and extend the operating life of existing core town site infrastructure while a migration plan to the hillside was being developed.
- The concept of incremental relocation has been introduced at Newtok. The design and incremental construction of new community infrastructure has started at a new townsite in close proximity to the existing Newtok town site. This will enable the State to maximize the remaining service life of existing infrastructure and then incrementally build replacement stock in the new location. New homes are being designed to be relocateable, relying on the concept of resilience rather than strengthening foundations and armoring current locations.
- Kivalina and Shishmaref are relying on extensive new revetments to slow erosion and extend the service life of existing infrastructure.
- No infrastructure improvements have been approved for Koyukuk yet. A feasibility study and community planning grant have been established to help the community create a plan that will have the unified support of residents and help protect the community from seasonal flooding.

Each community has been assessed and an individual Current Best Practice plan has been put in place or is under development that will enable residents to better cope with their changing environment. The Current Best Practice approach enables the State to incrementally respond to communities across Alaska within available resources. The efforts and successes of the IAWG provide an excellent model on which to effectively and efficiently protect our current infrastructure investment, while data is being collected and a longer term climate change strategy is being developed.

Targets/Goals/Timing

Implementation of PI-2 can begin immediately. During the initial phase (years 1-5) of deployment of the Sustainable Infrastructure System, PI-2 will proceed concurrently with Policy PI-1. As both efforts progress, Policy PI-3 (Build to Last) will be introduced. This third policy will overtake and replace PI-2 once the ability to accurately forecast the effects of climate change is firmly in place and adaptation strategies for future infrastructure are created.

Participants/Parties involved

Use of Current Best Practices can be readily integrated in current funding agency infrastructure investment prioritization methodologies. This will enable federal and state agencies that already fund infrastructure development, construction and/or operation the opportunity for an orderly transition to developing "Build to Last (PI-3)" methods.

Infrastructure development, construction and operation are key responsibilities for all levels of government. Participation by federal and state agencies, municipal and tribal governments, design professionals and others will be necessary for the successful deployment of this policy.

Evaluation

Evaluation of the effectiveness of this policy will depend on establishing a regular schedule and process for sharing the results of implemented improvements. Opportunities for sharing current best practices and project administration/outcome feedback loops will need to be integrated into infrastructure funding awards, reporting and follow-up processes. The Information Center/Clearinghouse (recommended in PI-1) should receive and index infrastructure retrofit, repair, replacement techniques that are working, that didn't work, materials development and testing results, developing designs, contact information, and more.

Research and Data Needs

While research and data are critical to the other policies of the Sustainable Infrastructure System, the ability to proceed based on the best available information provides the opportunity for agility and resiliency that makes this policy so valuable.

Implementation Mechanisms

PI-2 can be best implemented through close coordination among federal, state and local government agencies, academia and design professionals that fund and build infrastructure. This will allow alignment of process and purpose. This will be achieved most efficiently if an IAWG-like coordination entity is established to align implementation and communication horizontally among partner agencies and vertically between the various layers of government and other stakeholders.

Implementation can begin immediately by:

1. Routinely gather and make available information on measures and practices that are, and are not, working to adapt infrastructure. A program partner should be identified with the capability to organize and host an Information Center or Clearinghouse for tracking sustainable and resilient best practices. This Center/Clearinghouse could index readily available and cost effective infrastructure development and protection techniques that are working, that didn't work, materials development and testing results, developing designs, contact information, and more.

2. Integrate factors into agency funding and prioritization formulas (such as Alaska DOT&PF STIP evaluation or Village Safe Water Capital Improvement Project) to reward consideration of climate change and use of current best practices. For example, funding agencies could give higher scores to projects that include items such as:
   - Includes an engineering peer review process incorporating current best practices (as catalogued by the to-be-established Information Clearinghouse/Center),
   - Includes a value engineering review process that demonstrates improved performance, reliability, quality and life cycle costs.
   - Presents a project site or community vulnerability assessment to document its location compared to expected hazards.
   - Commits to a schedule of reporting environmental data and infrastructure performance (to the to-be-established Information Clearinghouse/Center) following project construction.

By systematically rewarding behaviors that promote more resilient and sustainable infrastructure, the State will be better prepared to meet the future. More efficient information exchange will reduce the time typically needed to accomplish cycles of learning and performance improvement, further enhancing the effect.

As more climate change data becomes available it can readily be introduced into the information feedback loops established by this process and allow for a smoother transition into PI-3.

Related Policies/Programs and Resources

The other components of the Sustainable Infrastructure System are integrally related to the long term success of this component. All three policies must be initiated as a system to achieve the vision and to ensure the maximum return on investment.

Existing resources of the agencies that currently fund the development, construction and operation of infrastructure can be used to implement this policy.

Benefits and Costs

The public relies on infrastructure to provide a safe and healthy environment. Maintaining transportation and sanitation infrastructure are key to ensuring public health, safety and welfare are protected. Existing public infrastructure that is required to protect public health, safety and welfare must be repaired and upgraded so it is safe and operable. Implementing modifications and repairs using Current Best Practices will maintain the functionality of existing infrastructure, extend its service life, potentially reduce or contain operating costs and sustain capital investment. The benefits to protecting public health, safety and welfare will outweigh the costs associated with the implementation of this methodology.

Feasibility and Constraints

The United States has the required technology and needed capacity to be successful in this endeavor. Public Infrastructure Policy PI-2 can be initiated with minimal additional resources; to optimize its effectiveness. An IAWG-like central coordinating entity should be established to ensure existing infrastructure funding, development, construction and operations agencies are better aligned.

Adequate funding is not available. However, this policy will help align funding opportunities and priorities.

Sufficient Alaska specific scientific research capacity does not yet exist to assure the long-term success of the overall Sustainable Infrastructure System

A coordinated statewide database with key information displayed and readily available to decision-makers in an understandable and actionable format does not currently exist.

The ability does not yet exist for state and federal agencies, and municipal and tribal governments to regularly communicate and share data or establish connected and aligned policies, procedures, and information to empower decision-makers.

TWG Approval and Deliberations

The PI TWG unanimously recommends approval of, “PI-2, Promote Improvements that Use Current Best Practices.” All agree that implementing this component is critical for adapting Alaska’s public infrastructure to a changing climate.