Port of Alaska is a Muni-owned and -operated facility that serves Anchorage, the state of Alaska and the nation.

Port of Anchorage opened in 1961 to support regional economic development.

Anchorage Assembly renamed “Port of Alaska” in October 2017 to reflect its regional, state and national significance.

Let me start this presentation by giving you some context about Port of Alaska, its roles in Alaska and its seismic vulnerability.
Alaska is a big state with a small and expensive-to-reach market because of its relatively small, widely dispersed population and remote location.

State is a virtual island:
• Just over 90 percent of all Alaska inbound freight is marine cargo (either ship or barge).
• Air and truck carriers each account for a bit less than five percent of statewide, inbound freight.
Port of Alaska is the state’s primary inbound cargo-handling facility -- handled some 3.9 million tons of fuel and cargo in 2018

- Handles goods consumed by 90% of Alaska’s population
- Accounts for more than 80% of the vans and containers shipped to Southcentral Alaska ports ... eventually distributed to every region of state
- Accounts for 75% of all non-petroleum marine cargo shipped into Alaska, exclusive of Southeast Alaska (which is primarily served by barges directly from Puget Sound)
- Accounts for 50% of all freight shipped into Alaska . . . by all modes
- Supports more than $14 billion in commercial activity in Alaska . . . is state’s main inbound, containerized freight and fuel distribution center

NOTE: Port of Alaska is fourth biggest Alaska port by tonnage, behind export facilities in Valdez, Nikiski and Red Dog Mine’s facility on the Chukchi Sea.
Port of Alaska was not always Alaska’s main, inbound port.

Seward was original gateway to Interior Alaska starting in late 1800s . . . Iditarod trail, Alaska Railroad and Alaska highway system all start in Seward (opened first deep-water dock in 1906).

Everything changed after the Good Friday Earthquake (9.4 megathrust earthquake on March 27, 1964) triggered tsunamis that destroyed every deep-water port in Southcentral Alaska except Anchorage.

Inadvertently discovered that Upper Cook Inlet geography is tsunami-proof . . . rendered 26-ft wave that rolled past mouth of Kachemak Bay in 1964 into ripple by time it reached Nikiski.

Anchorage instantly became Alaska’s main inbound cargo port and supported regional reconstruction, Cook Inlet oil boom and Alaska economic growth and development.
Successful ports have three things:

1) Proximity to final cargo destinations (54% of state population lives within 60-minute drive of dock)

2) Intermodal transportation connections needed to move freight from port to final destinations . . . Port of Alaska links state’s primary marine, road, rail, pipeline and air cargo systems

3) Appropriate cargo-handling infrastructure . . . Port of Alaska docks leverage/are leveraged by hundreds of millions of dollars of freight-related, private-sector infrastructure:
   - 125 acres of cargo-handling infrastructure, including intermodal cargo transport connections
   - 3.4 million barrels liquid fuel storage
   - 60,000 tons cement storage
   - . . . dock cranes, RO/RO ramps, docksider cement-handling system, pipelines, etc.
Port of Alaska today serves three core functions:

1. Commerce – i.e., statewide fuel and cargo services and economic development

2. National defense . . . projects U.S. force across Alaska, Pacific Rim and the Arctic

3. Earthquake resiliency/ disaster response and recovery . . . functional port of Alaska is key to successful implementation of virtually every state and federal disaster response plan

**NOTE:** If port fails, Alaska has six-to-ten days worth of food in state . . . other Southcentral ports, roads, etc. will almost certainly be compromised . . . airlift to replace Port of Alaska sealift capability would require some 700 wide-body cargo flights per week. To give that number perspective: Ted Stevens International Airport is the fifth busiest cargo airport in the world and now handles about 500 wide-body flights per week (mostly 747s).
Port’s aging docks have long exceeded 35-year design life

Half-century-old docks are suffering slow-motion disaster of corrosion and obsolescence

- **Docks supported by 1,423 hollow-steel wharf piles** that average 24-inches in diameter and originally averaged 7/16-inch thick.
- Aging piles have **lost up to three-quarters of their original thickness at mud line**
- **Wharf-pile repair started in 2004** . . . jacketed 659 piles through end of 2018 . . . also installed safety chains on 113 sets of fender piles to protect ships and ensure continued operations if fender piles fail. **Spend about $3 million annually to maintain corroding piles, etc.**

Pile jackets are **one-time fix that lasts 10-15 years** – docks losing load ratings and will start closing within 10 years, regardless of repair efforts . . . possibly sooner if there is another big earthquake

- There were no seismic standards when docks were originally constructed . . . they would not be permitted today.
- Existing terminal-side piles only driven 60 ft.-to 80 ft. into silt. 2016 test pile program drove piles between 133 ft. and 188 ft. to point of refusal.
Port of Alaska Modernization Program

- Replace aging docks and related infrastructure
- Improve operational safety and efficiency
- Accommodate modern shipping operations
- Improve resiliency – to survive extreme seismic events and Cook Inlet’s harsh marine environment

Port of Alaska Modernization Program is a series of projects that will replace aging terminals and related infrastructure and repair problems caused by failed Port Intermodal Expansion Project (PIEP).
Nov. 30, 2018

0829:29 Alaska Time

**M 7.1 earthquake**
47 km/29 miles deep
12.5 km/7.75 miles from dock

---------------------------

0835:37 Alaska Time

**M 5.7 aftershock**
41 km/25 miles deep
1.6 km/1 mile from dock

Earth moved and tested:

1. Port of Alaska dock and facility condition . . . including ongoing maintenance
2. Engineers’ conclusions about existing facility condition
3. South backlands design and construction
Remained open

Single tanker at dock suspended operations but remained at dock when earthquake and aftershocks occurred.

Port of Alaska had no known/reported fuel spills connected to the Nov. 30 earthquake.

Tanker Pacific Beryl was off-loading jet fuel and still had about 2,800 bbl of product on-board when earthquake struck.

It immediately suspended operations when the earthquake struck . . . remained at POL1 throughout earthquake and fuel-system inspections . . . finished offloading operation the next day after dock and shore fuel systems were approved for use.

Half-century-old dock survived . . . due to combination of extensive, ongoing dock maintenance and a lot of luck.

Crews inspected all critical structures immediately after the earthquake and implemented non-structural repairs so that port never closed after the earthquake.

Note: three 38-gauge, rail-mounted dock cranes were “tied-down” when earthquake struck.
On the docks . . .

Initial inspections revealed no significant damage to dock structure . . . but inspections were limited because they were performed during a relatively high tide cycle, when low tides occurred before sunrise / after sunset and snow and ice-up started less than two days after initial earthquake.

Terminal 1-2 expansion seam that had minor deck damage from earthquake hammering.
Discovered that several dock lights and cameras were damaged, and numerous cathodic protection system wires and connections failed.

Damage caused no significant impact on Port operations.
Port administrative office that is on-dock adjacent to terminal 1 was shaken . . . but no significant structural damage.
Shore failure adjacent to Terminal 1

Slope failures occurred along full length of container docks
Yard slope failures

Scariest damage involved yard-slope failures and soil liquefaction that moved shore toward aging, badly corroded wharf piles.
Shore/slope failures adjacent to all container docks

Minor shore/slope failure cracks ran the length of docks
North extension slope failures adjacent to dry barge berth

Engineers and construction crews also passed the test.

No pictures to show it because of snow and ice, but there were no failures in the south backlands in the hardened soils in the vicinity of ABI’s 40,000-ton cement dome and the future Petroleum-Cement Terminal. There were, however, minors slope/shore failures on either side of last summer’s soil-hardening project.

On the north end of the port . . . There were minor slope/shore failures in the vicinity of the dry barge berth . . .
Note that tug and barge stayed on their blocks despite nearby slope failures.
... none of Home Depot’s stacks of dimensional lumber and building supplies were impacted.
Initial south backland stabilization for new petroleum-cement terminal constructed was complete in October 2018 . . . and cement storage dome was full of about 40,000 tons of cement.

Stabilized shore sustained no significant damage during the earthquake

Shore on either side of stabilized area had slope failures and sand boils from early stages of soil liquefaction.
Spring/Summer 2019 inspections

Spring/summer 2019 inspections . . . performed after ice melted, at lower tides and more daylight . . . substantial dock and shore infrastructure failures

Docks supported by some more than 1,400 connected piles . . . a few isolated pile failures raise minor concerns because loads are spread over multiple piles . . . BUT clusters of pile failures create risk of progressive pile failure (think falling dominos) . . ..
Low-tide, visual inspections revealed three types of weld failures . . . often in clusters:

1) Spiral seams (esp. under POL2 . . . 20 percent of deck piles are compromised)
2) Butt welds (esp. under Terminal 1 and POL 1)
3) Vertical seams (relatively few . . . Mostly under Terminal 2)

Weld techniques used in 1960s and 1970s use different grades of steel than are used today . . . are cathodic to wharf pile steel . . . corrode and fail faster than main pile steel.
Terminal 2
Fender pile failures . . . and dock repairs

Other damage includes:
• Fender pile failures
• Storm drain failures
• Etc.

Dock repairs . . . including pile jackets, new pin piles, etc. are underway.
We used multibeam sonar for first time to inspect POL1 AND POL2 wharf piles.

Technique enables “visual” inspection in silty water

Concern before multibeam sonar inspections was that the lower the tide, the more damage we discovered . . . so we didn’t know how much damage was underwater and out of sight

Multibeam sonar inspection showed that worst corrosion (and damage) is concentrated in low-tide zone AND our visual inspections had already identified the most significant problems
We used multibeam sonar for first time to inspect POL1 AND POL2 wharf piles.

Technique enables “visual” inspection in silty water

Concern before multibeam sonar inspections was that the lower the tide, the more damage we discovered . . . so we didn’t know how much damage was underwater and out of sight

Multibeam sonar inspection showed that worst corrosion (and damage) is concentrated in low-tide zone AND our visual inspections had already identified the most significant problems
• Initial construction is underway . . . shoreline stabilization and transitional dredging for new petroleum-cement terminal (PCT) completed in Sept. 2019

• In-water PCT construction starts in 2020 . . .

• Total program expected to exceed $1 billion . . . driven by:
  1) Market/User needs
  2) DoD needs . . .
  3) Earthquake resiliency, response and disaster recovery needs
  4) Funding!!!
Thank you

Questions?