Incorporating Geotechnical Assets into Transportation Asset Management

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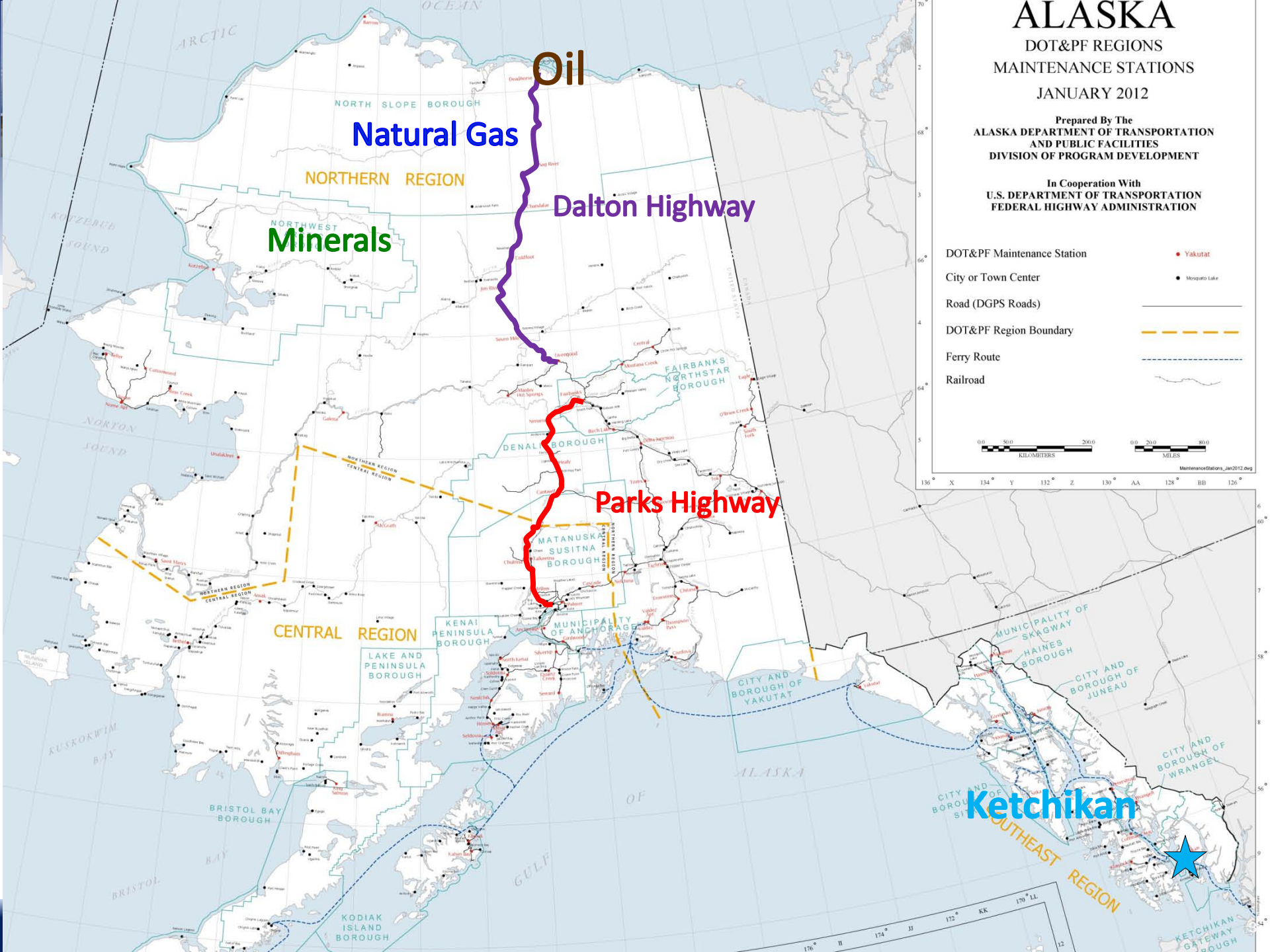
Overview

- **TAM and GAM for AKDOT&PF**
  - Implementation of TAM
  - Current GAM programs
  - Current Research projects
- **Corridor Management for AKDOT&PF**
  - Concept Development – supporting role of geotechnical assets
    - Parks Hwy – Anchorage to Fairbanks at Phase II
    - Tongass Corridor – Ketchikan at Phase 0
    - Dalton Highway – Northern Alaska Roads to Resources at Phase 0
- **Whither TAM, GAM and Corridor Management?**
  - Projects highlight knowledge gaps and lead to research opportunities
  - Focus research on moving beyond inventory and condition surveys
  - Action Items/Objectives


Oil
Natural Gas
Minerals
Dalton Highway
Parks Highway
Ketchikan
NORTH SLOPE BOROUGH
NORTHERN REGION
NORTHWEST
FAIRBANKS NORTHSTAR BOROUGH
DENALI BOROUGH
MATANUSKA SUSITNA BOROUGH
CENTRAL REGION
KENAI PENINSULA BOROUGH
MUNICIPALITY OF ANCHORAGE
LAKE AND PENINSULA BOROUGH
CITY AND BOROUGH OF YAKUTAT
MUNICIPALITY OF SKAGWAY
HAINES BOROUGH
CITY AND BOROUGH OF JUNEAU
CITY AND BOROUGH OF WRANGELL
SOUTHEAST REGION
BRISTOL BAY BOROUGH
KODIAK ISLAND BOROUGH
KETCHIKAN GATEWAY BOROUGH
ALASKA
DOT&PF REGIONS
MAINTENANCE STATIONS
JANUARY 2012
Prepared By The
ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES
DIVISION OF PROGRAM DEVELOPMENT
In Cooperation With
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
DOT&PF Maintenance Station
Yakutat
City or Town Center
Mosquito Lake
Road (DGPS Roads)
DOT&PF Region Boundary
Ferry Route
Railroad
KILOMETERS
MILES
MaintenanceStations_Jan2012.dwg

AKDOT&PF Commissioner:

"The STIP is really an investment guide more than a spending plan. The improvements that we construct today and plan for tomorrow must be managed as assets and preserved for future generations. We must become as skilled at optimizing the lifecycle costs and overall performance of our transportation assets as we have traditionally been at engineering and building them."

- Commissioner Marc Luiken

STIP Introduction Letter

February 9, 2012

PROCESS IMPROVEMENT

RANDOM MOTION

- Lots of Energy – Not Much Progress
- Individual Effort
- Frequent Conflict
- You Don't Know Where You'll End Up

DIRECTED MOTION

- Every Step Brings Us Closer to the Goal
- Coordinated Efforts
- Cooperation
- Predictable Results

Asset Management

The Alaska Department of Transportation and Public Facilities is implementing a comprehensive Transportation Asset Management (TAM) program. TAM is a business model, a decision support system, and a management approach which can be used across an agency to deliver corporate goals and objects. TAM is not just a tool or an end in itself.

Implementing TAM is a process of continuous improvement. TAM is an agency-wide process not an independent specialist activity undertaken only by transportation engineers or practitioners. Its strategic direction and the strategic goals it seeks to deliver are elements or core corporate strategic policy, so the approach to TAM should be policy driven. (AASHTO TAM Guide, A Focus on Implementation, January 2011.)

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Highlights

NEW **Parks Highway Corridor Management Project**

February 27, 2012 - The Department has kicked off a corridor management project for the Parks Highway as part of our Transportation Asset Management program. The first project phase is collection of existing essential data that supports our engineering work and our asset management program. The project will include the launch of a one-stop web page for access to existing databases of essential data about the corridor including, among many other things, pavement condition, location and condition of material sites, access to geotechnical reports, culvert and sign inventories, location and condition rating of unstable slopes etc. Over time, the Department plans to create an integrated database available to all that will act as a repository for new data as it is collected and will provide continued access to existing data.

Stay tuned to this location for additional news and details as the project progresses.

If you have any questions about corridor management, please call Project Manager Dave Stanley at 269-6236 or send him an email at dave.stanley@alaska.gov.

Reports

- DOT&PF TAM Assessment
- Final Bridge Report

Resources

- Transportation Asset Management Guide, (NCHRP, 2002)
- AASHTO Transportation Asset Management Resource Page
- AASHTO TAM Guide(January, 2011)
- FHWA Transportation Asset Management
- FHWA: Elevating TAM
- FHWA TAM Overview
- Article: Geotechnical Asset Management

Training

- AASHTO Subcommittee on Asset Management Webinar

Department of Transportation & Public Facilities
PO Box 112500
3132 Channel Drive
Juneau, Alaska 99811-2500
Phone: 907-465-3900 || 907-586-8365 (FAX)

Asset Management Programs Under Way at AKDOT&PF

- Bridge Management
- Pavement Management
- Geotechnical Asset Management
- Culvert Inventory
- Sign Inventory

Asset Management Process

Data Collection

- Inventory and Condition Survey
- GIS, Databases, eDocs, etc.

Develop Asset Knowledge & Understanding

- Service life
- Levels of Service
- Risk/Hazard Analysis
- Performance Measures

Conduct Analysis

- Benefit/ Cost Lifecycle Cost Analysis
- Decision Support Analysis & Software

Asset Management

- Create Alternatives for Investment

Executive Management

- Project Scope & Selection Decisions

What is Geotechnical Asset Management?

- Application of TAM principles to *Geotechnical Assets*
- *Asset Management in a World of Dirt*
- Geotechnical Assets include: slopes, embankments, material sites, retaining walls, rock bolts, tie-back anchors, rockfall mesh, etc.
- Some are visible, some are buried – creating management difficulties.

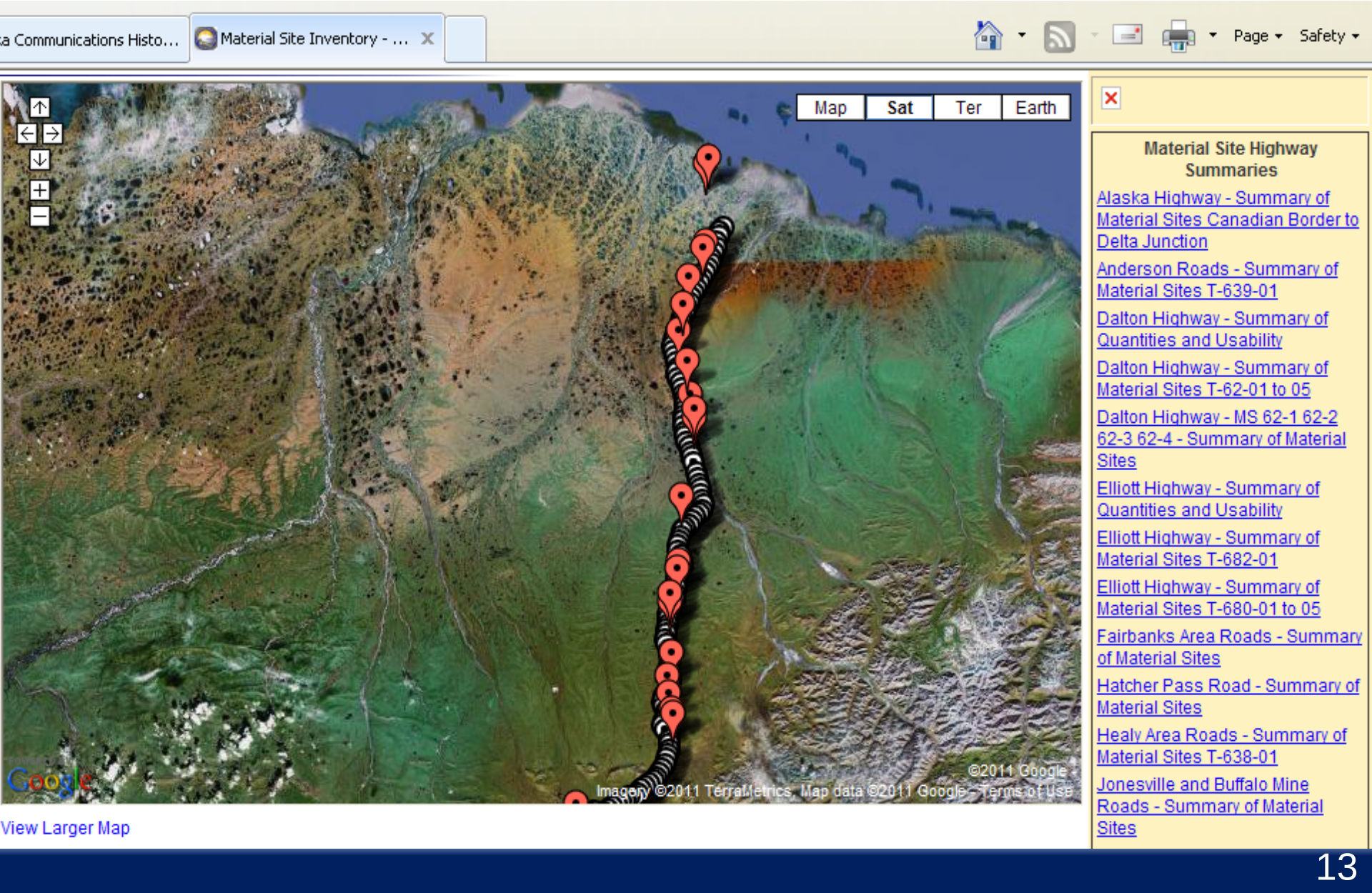
Why Should We Manage Geotechnical Assets?

Virtually every structure is supported by soil or rock. Those that aren't either fly, float or fall over!

AKDOT&PF GAM Programs

- Materials Site Inventory
  - Under way
- Unstable Slope Management Program
  - Under way
- Retaining Wall Management Program
  - Just beginning
- Unstable Embankment Management Program
  - Pretty iffy

Material Site Inventory



Unstable Slope Management Program

MP-75.4

Alaska DOT and PF
Unstable Slope Management Program

GLENN HIGHWAY @ Milepost 75.4

Total Score: 576
Rank: 20

Region: CR
District: Matanuska Susitna
Station: Cascade
Community: Sutton
Comments: Major adverse structure dipping towards highway.
Preliminary Score: 250
Basic Geometry:

Slope Length: 700 ft
Slope Height: 73 ft
Roadway Width: 24 ft
AADT: 1393 veh/day
Speed Limit: 55 mph
Sight Distance: 550 ft

Unstable Slope HAZARD Rating: 442 (95th Percentile)

Rockfall Hazard

	Category Score
Case 1 (C1) or Case 2 (C2) Type Rockfall: C1	
C1 Structural Condition: 90	
C1 Rock Friction: 40	
C2 Erosional Features: 0	
C2 Erosion Rate: 0	
Ditch Effectiveness: 40	
Maintenance Frequency: 20	
Rockfall History: 60	
Block Size (12 ft) or volume (cy): 100	

Common Hazards

Slope Height: 25	
Site Hydrology (Rainfall:9 and Drainage:3): 6	

Unstable Slope RISK Rating: 134 (75th Percentile)

Category Score	*Category Score*
Daily Traffic: 6	Right of Way: 3
Average Vehicle Risk: 2	Environmental Impact: 0
Roadway Width: 47	Impact on Traffic/Detour Length: 25
Sight Distance: 4	Frequency of Maintenance: 20
	Event Cost: 27

Photographs:

Imagery Date: 4/15/2011
61°47'33.76" N 148°44'24.42" W elev 3664 ft

Retaining Wall Management

Trying Not To Reinvent The Wheel

RETAINING WALL INVENTORY AND CONDITION ASSESSMENT PROGRAM (WIP)
National Park Service Procedures Manual

Publication No. FHWA-CFL/TD-10-003 August 2010

U.S. Department of Transportation
Federal Highway Administration

Federal Lands Highway
Commitment to Excellence

NATIONAL PARK SERVICE

Central Federal Lands Highway Division
12300 West Dakota Avenue
Lakewood, CO 80228

Incorporating GAM into TAM

In the Context of *Corridor Management* Start to Develop an Understanding of Present and Future Condition of Corridor Assets

- Use Condition Indices to Describe Condition
- Estimate Asset Future Condition
- From Future Condition ⇒ Level of Service
- From Level of Service ⇒ Performance Measures
- From Analysis ⇒ Development of Alternatives
- From Alternatives ⇒ Decision-Making

M&O Winter Levels of Service

Level of Service (LOS)	LOS Description	Illustration
A (Good Winter Driving Conditions)	Bare pavement is the primary goal. Good winter driving conditions exist when snow and ice have been removed from the driving lanes and excessive loose snow has been removed from the shoulders and centerline of the highway. Short sections of ice and packed snow are acceptable and can be expected within the driving lanes between the wheel paths, as well as on centerline. Bare pavement may not be possible in the Northern and Central Region's during periods of extreme cold weather. Generally loose snow has been cleared and traction is good for most vehicles properly equipped for winter driving. If required for traction, 100% of roadway has sand present.	
B (Fair to Good Winter Driving Conditions)	Roads are passable with varying conditions. Drivers may encounter some standing water, packed snow and icy patches covering the surface. Generally loose snow has been cleared from the travelway and traction is adequate for most vehicles properly equipped for winter driving. If required for traction, sand applied to hills, curves, intersections, and bridge decks. LOS B represents a fair to good level of service, which ranges from targets of bare pavement as much as possible on higher-standard or highly traveled highways to snow-pack or icy conditions on northern region roads as well as on lower-standard or low-volume roads. Traffic moves at reduced speed, with isolated slowdowns or delays.	
C Fair to Poor Winter Driving Conditions)	Roads are generally passable with varying conditions. Drivers may encounter some standing water, loose snow, some snow drifts, packed snow and icy patches covering the surface. Patches of snow or ice exist even on the highest-standard roads, and these conditions may degenerate to predominately snow-packed or icy conditions throughout, with accompanying slowdowns or delays. On lower-standard or low-volume roads the surface is snow-covered (up to 2") with substantial traffic delays.	



Unstable Slopes Levels of Service

USMP - LEVELS OF SERVICE

Service 1. Roadway safety from earth movements whether from rockfalls or landslides will be addressed within the limited resources available to the agency in a proactive manner, statewide. Performance based on a running total of projects advanced by each region to address slope or embankment stability issues with the overall goal of addressing all unstable slopes within 50 years;

Service 2. Maintenance forces will monitor and patrol historically unstable areas in order to keep roadways clear of debris. Performance based on the number of hours each maintenance section spends on slope stability road patrols divided by the number of USMP sites within their section times the number of road miles within their section

Service 3. If additional equipment is required, debris will be removed and the roadway passage reestablished within 8 hours of any event if it is deemed safe to enter the affected area and the amount affecting the roadway is less than 3,000 cubic yards of material. Evaluated based on the number of road closure days related to slope failures each year per Region or Maintenance District.

Service 4. Regional (based on organizational boundaries) geotechnical personnel will be notified the same day of all road closing events lasting more than one hour or for any event that results in damage to a vehicle or personal injury. Evaluated based on the number of notifications made versus the number of measureable events that occur.

Service 5. If notified and there was no vehicle involvement or personal injury, the region geotechnical person will review the area in person as soon as possible and always within one week of the event. Evaluated based on the percentage of qualified events that are inspected by region geotechnical staff within the assigned time.

Service 6. If working conditions are deemed unsafe by maintenance, if an extended road closure in excess of one day is anticipated, or if an accident has resulted, the region geotechnical person will visit the site within 24 hours to provide technical guidance and direction. Performance based on the percentage of qualified events that are inspected by region geotechnical staff within the assigned time.

Service 7. Whenever a site is visited, the region geotechnical person will reevaluate the site using the USMP to determine if the assigned section rating and site priority should be adjusted. Performance based on the number of updated ratings compared to the number of sites visited.

Service 8. Public satisfaction with the GAM efforts and results related to unstable slopes will improve. Evaluated based on level of improved public perception, as verified by opinion polls/surveys or by a measureable reduction in the annual complaints received.

Service 9. The AKDOT&PF maintenance expenditures related to unstable slopes in each region will decrease 5% per biennium allowing more of the operations budgets to be expended on other agency needs. Performance based on downward trend of operating costs related to proper investments in unstable slopes.

Condition Indices

- A means to consider together many different asset types and condition rating systems and methods
- Can transform all condition indices (numeric or descriptive) to a single scale. (Metzger 2008)

Condition Index Scale

Zone	Condition Index	Condition Description	Recommended Action
1	85 to 100	**Excellent:** No noticeable defects. Some aging or wear may be visible	No immediate action required.
	70 to 84	**Good:** Only minor deterioration or defects are evident.	
2	55 to 69	**Fair:** Some deterioration or defects are evident, but function is not significantly affected	Economic analysis of repair alternatives is recommended to determine appropriate action
	40 to 54	**Marginal:** Moderate deterioration. Function is still adequate.	
3	25 to 39	**Poor**: Serious deterioration in at least some portions of the structure. Function is inadequate.	Detailed evaluation is required to determine the need for repair, rehabilitation, or reconstruction. Safety evaluation is recommended
	10 to 24	**Very Poor**: Extensive deterioration. Barely functional.	
	0 to 9	**Failed**: No longer functions. General failure or complete failure of a major structural component.	

After: Repair Evaluation Maintenance Rehabilitation (REMR) Technical Note OM-CI-1.2 (1996)

Condition Index Scale Comparisons

Descriptive State	FHWA Nat Bridge Insp Condition Rating	Corps of Engineers REMR	Navy BASEREP Conformance with Mission Demands	Pavement Condition Index
New	7-9	70-100	C1 - Fully Met	100 - 70
Minor Deterioration	4-6	40-69	C2 - Substantially Met	69 - 40
Major Deterioration	3	25-39	C3 - Marginally Met	39 - 0
Failure	0-2	0-24	C4 - Not Met	

Pavement Example

Very Good

Good

70

Fair

Poor

40

Very Poor

Seal $20,000

Seal $20,000

Overlay $200,000

Seal $20,000

Seal $20,000

Overlay $200,000

Seal $20,000

Seal $20,000

Tillamook

Initial Building Cost $750,000

Rebuild $500,000

Rebuild $500,000

Preserved Total = $520,000

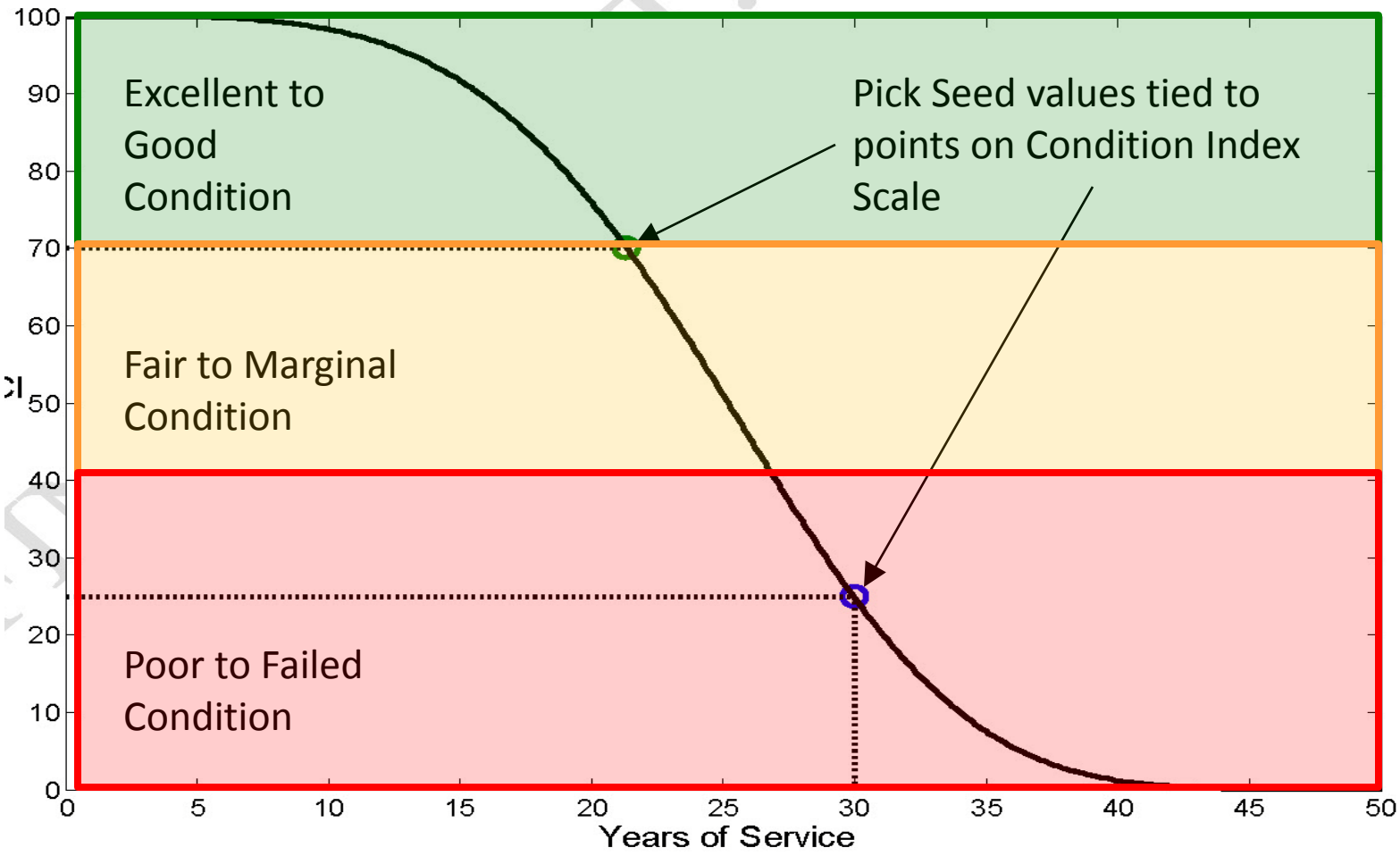
Non-Preserved Total = $1.0 Million

Minimum Service Level

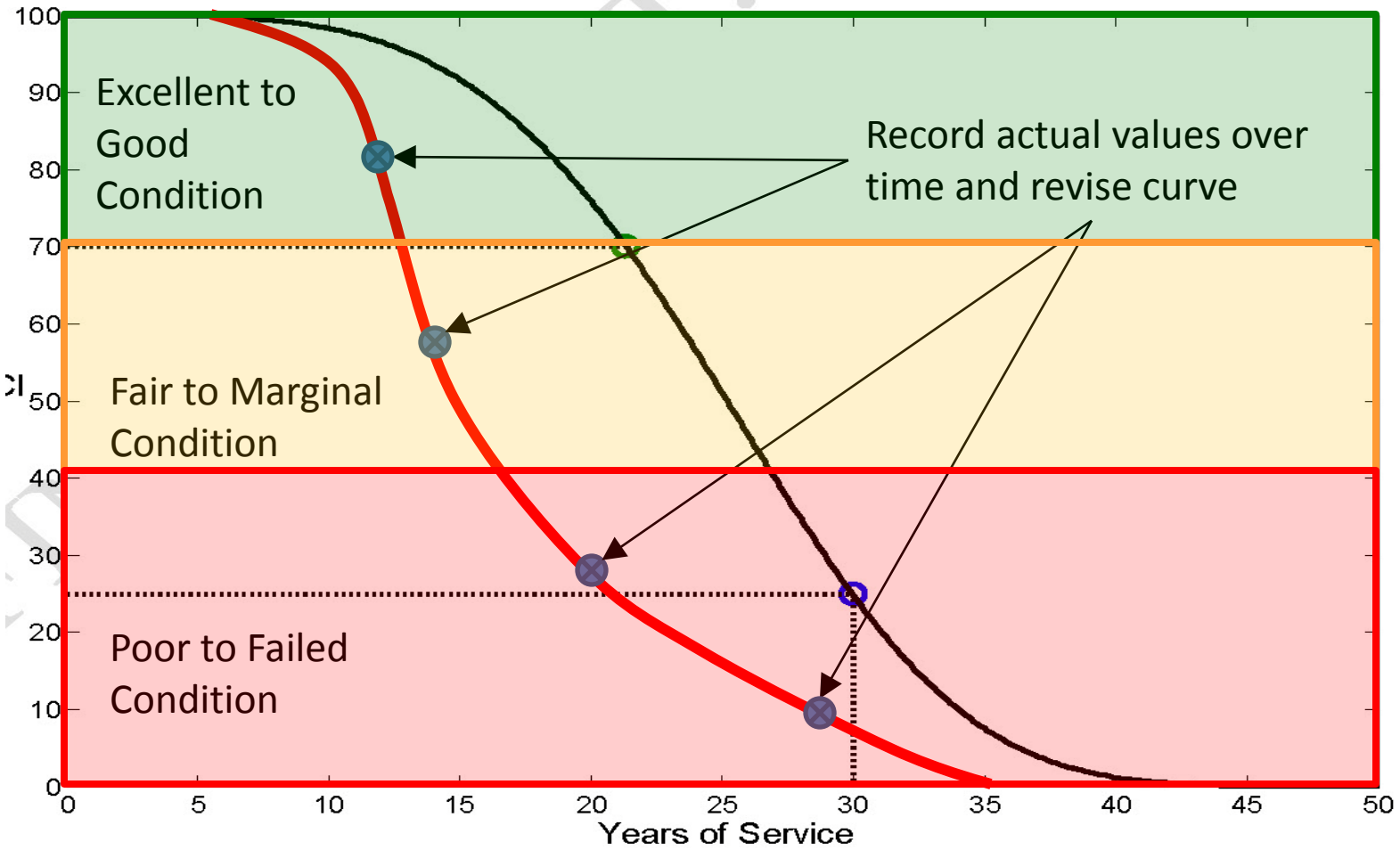
0 5 20 25 30 35 40 45 50 55

Pavement Age (Years)

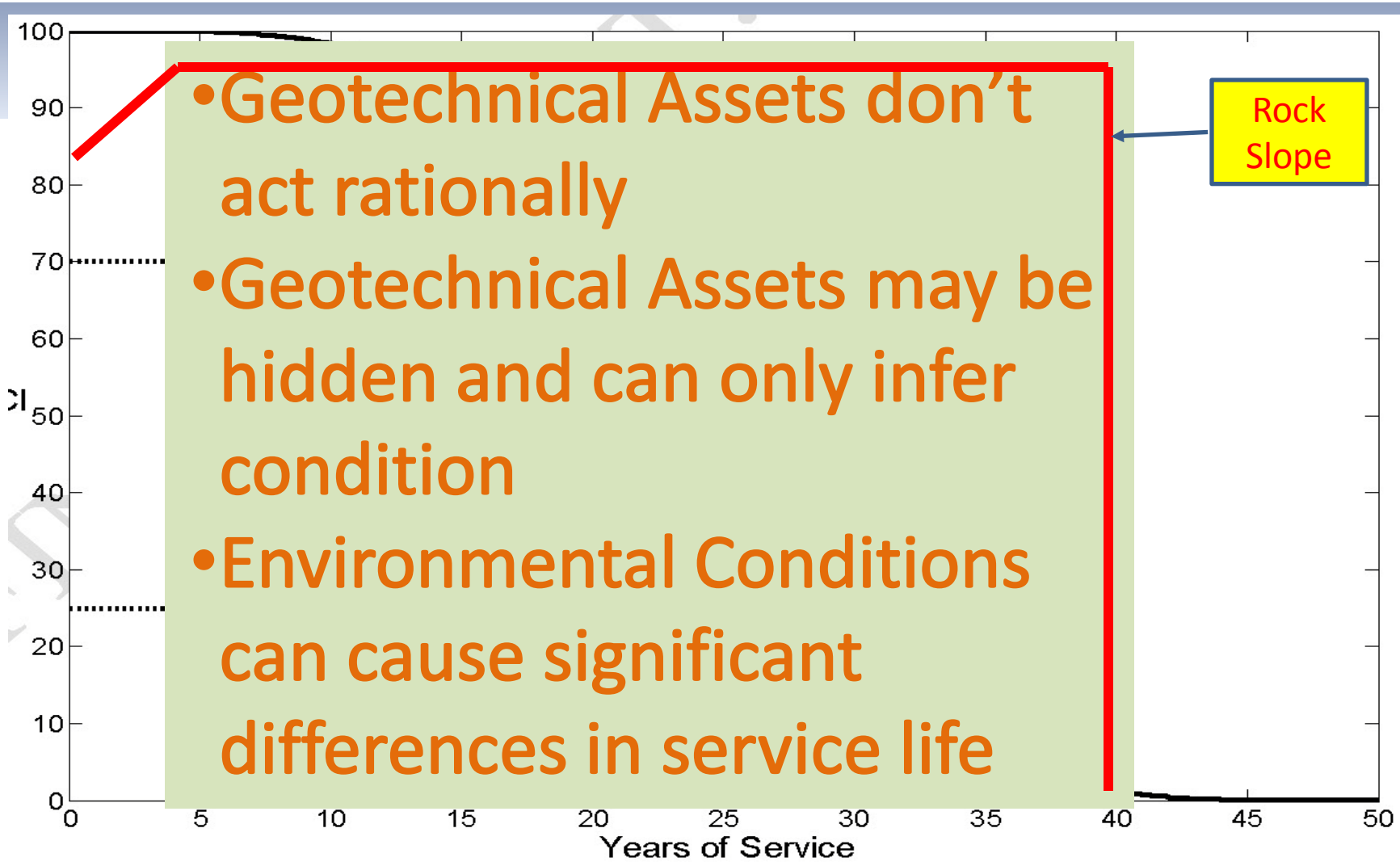
Estimating Future Condition



Confirming Future Condition

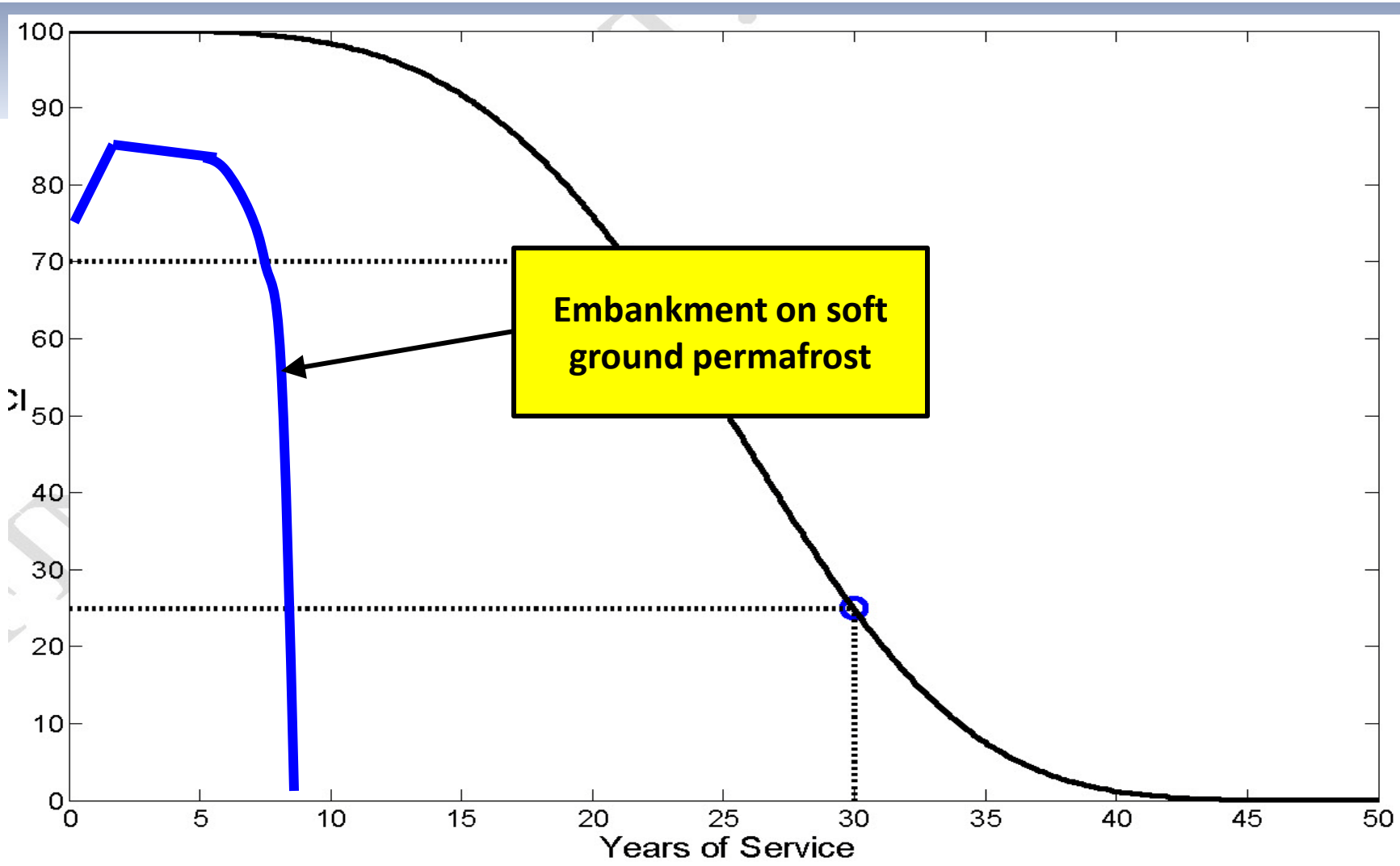


Estimating the Inestimable: Future of Geotechnical Assets

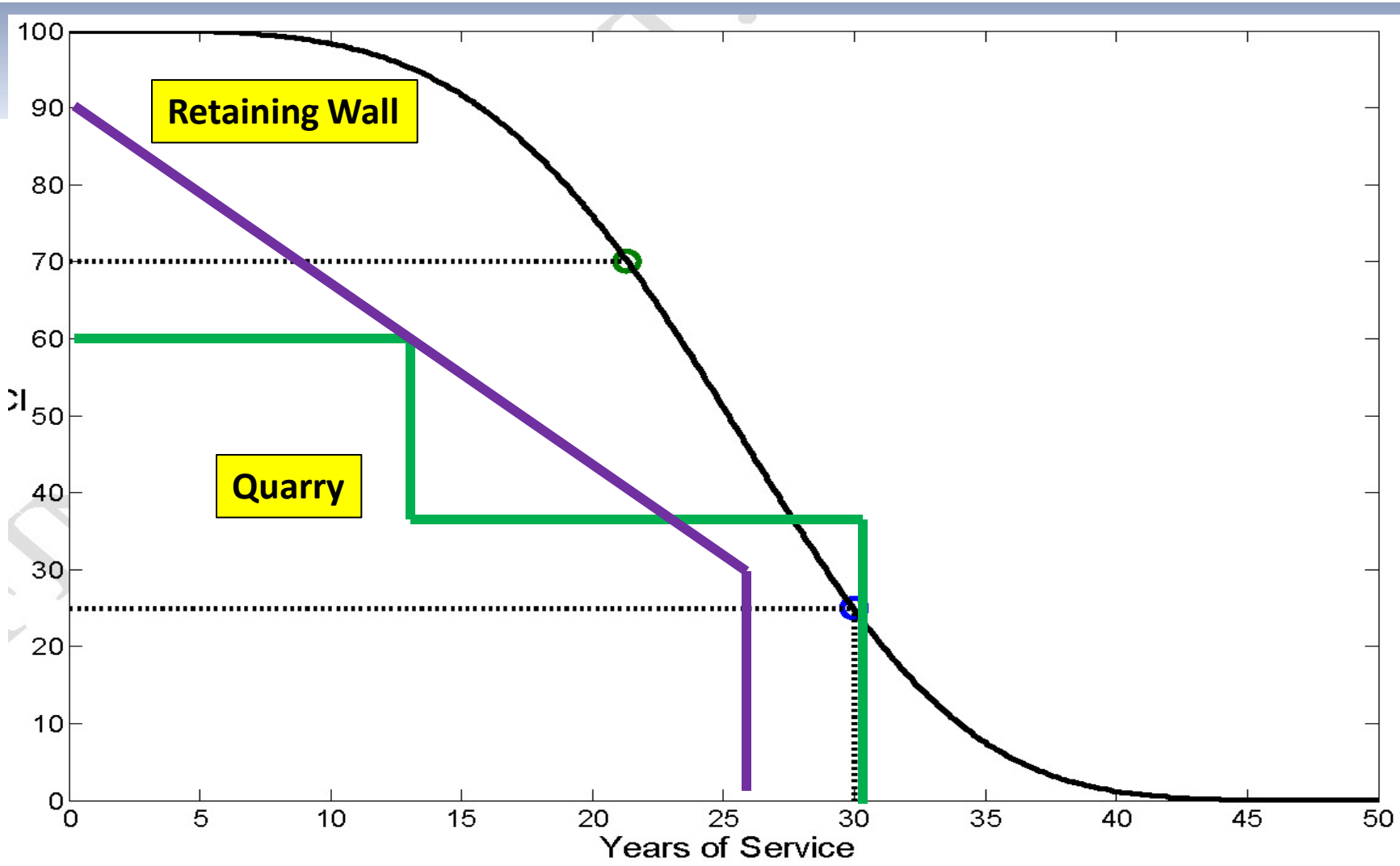


- Geotechnical Assets don't act rationally
- Geotechnical Assets may be hidden and can only infer condition
- Environmental Conditions can cause significant differences in service life

Estimating the Inestimable: Future of Geotechnical Assets



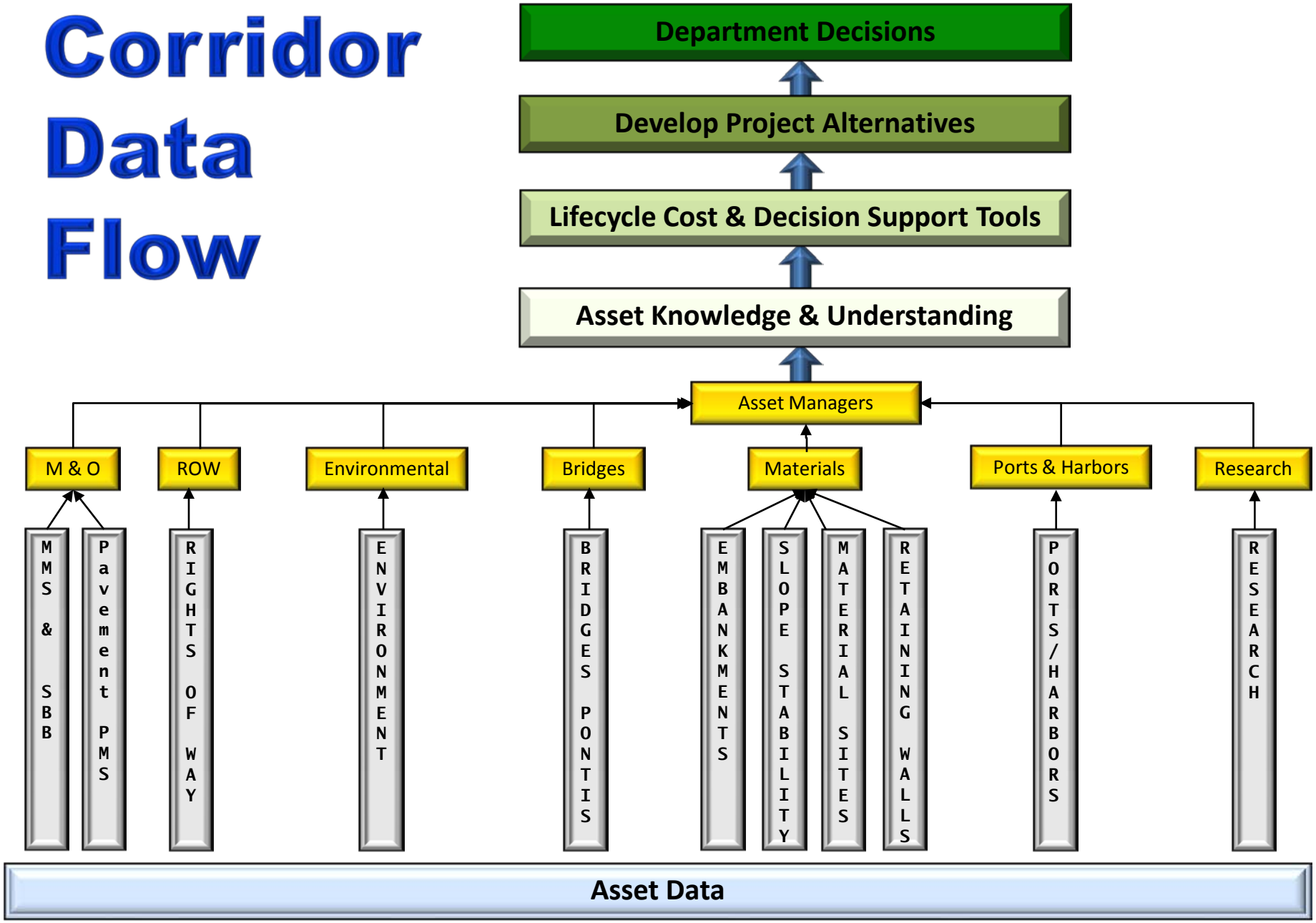
Estimating the Inestimable: Future of Geotechnical Assets

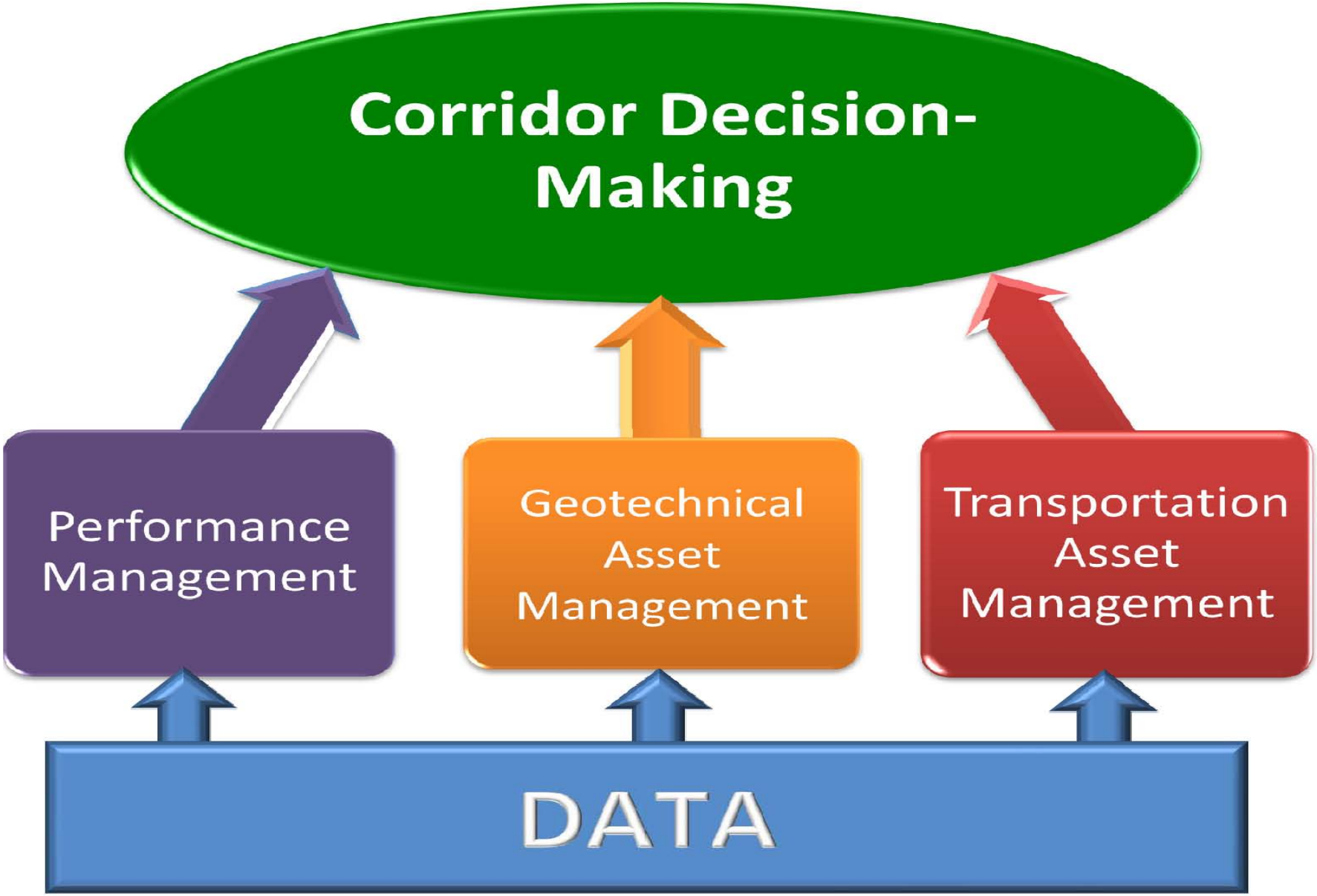


Take Away

- We will never understand and be able to communicate the lifecycle of geotechnical assets if we do not start collecting condition data and reporting it.
- Geotecnical Asset Mangers should create a communication plan that includes sharing this information.

Corridor Data Flow




Corridor Decision-Making
Performance Management
Geotechnical Asset Management
Transportation Asset Management
DATA

CORRIDOR MANAGEMENT

- The purpose of transportation infrastructure is to create mobility - the **functionality** of moving people and goods along our transportation corridors. The assets in the transportation corridor must be managed to support that functionality.
- Corridor Management allows viewing an entire corridor and all the essential assets that must be managed to support functionality and make appropriate decisions about project selection, scope and timing or construction, maintenance, and replacement.
- The **importance of data** in every aspect of TAM, GAM and Corridor Management is clear, along with the need to take steps to manage, preserve and make available the data.

SUMMARY

- Alaska DOT&PF is moving forward deliberately to implement TAM.
- GAM is further along than TAM thanks to some fortuitous funding and is being used to support Corridor Management projects.
- Development of Corridor Management is one means of bringing asset management principles to AKDOT&PF

SUMMARY

- TAM, GAM, PM and Corridor Management are all elements of management structure that can be employed by transportation agencies to improve their business processes and meet strategic agency goals policies, and objectives.
- The ability to forecast performance of Geotechnical Assets will be critical for the future of GAM.
- Use of condition indices can provide the ability to look at all critical assets in a corridor together to support the decision-making process.

Realistic Expectations

- Geotechnical Assets are not any agency's top priority. The work we are doing now is important for the long haul – no overnight success story.
- Mature Pavement and Bridge management programs are already in existing PM and TAM systems - these will remain a top priority for the immediate future.
- Other assets will have regulatory imperatives that give them priority (signs, culverts, etc.)
- Help your organization to recognize the importance of Geotechnical Assets, their role in the general health of transportation systems and their role in decision-making support for managing our transportation corridors.

Action Items for AM/PM Development for Geotechnical Assets

- Get started tracking asset condition. Use inventory and condition surveys to establish a baseline and develop a picture of asset condition over time - use estimating methods to start and fill in the blanks later.
- Assess results and modify data collection programs to focus on assets and attributes that are most important – collect only useful data.
- Continue developing Levels of Service and Performance Measures.
- Learn about Asset Management analysis tools and find out how to adapt them to Geotechnical Assets and Corridor Management.
- Look for research funding to support TAM and GAM development. Look for partnering opportunities with other agencies and public/private. Make deals unabashedly – just ask and you may receive support.