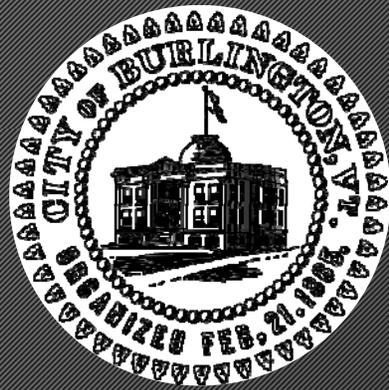




Introduction to Asset Management

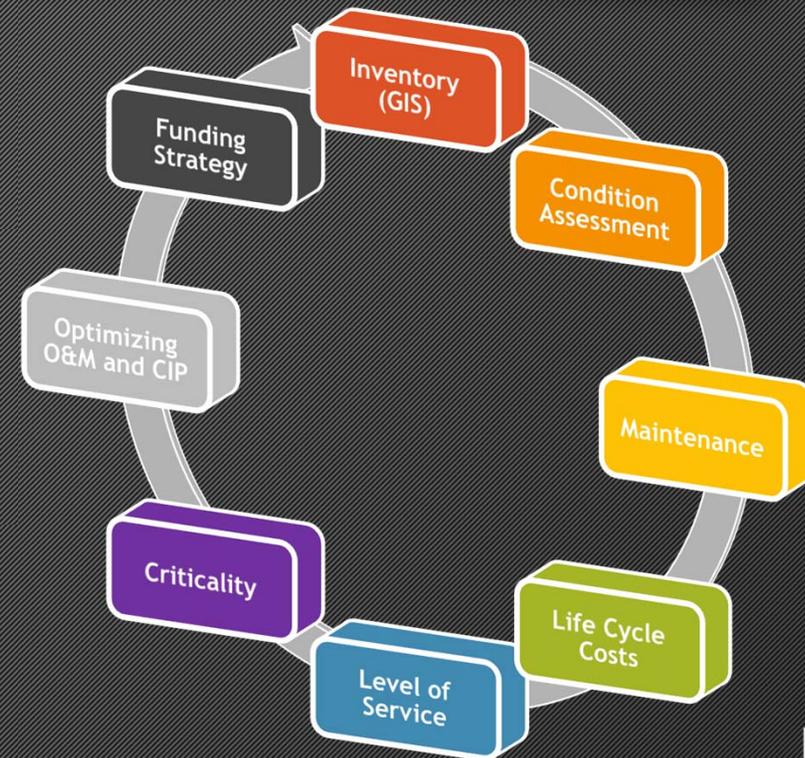
Hoyle, Tanner
& Associates, Inc.



October 15, 2015

Agenda

- Infrastructure Management
- Inventory
- Condition Assessment
- Maintenance
- Life Cycle Costs
- Level of Service
- Criticality
- Optimizing O&M and CIP
- Funding Strategy



Infrastructure Management

- Growing number of challenges...
 - Aging Infrastructure
 - Limited Staff Resources
 - Retiring Key Employees
 - Changing Boards and Councils
 - Increasing Demands on Budget
 - Increasing Customer Expectations (Higher Levels of Service)
 - Focusing on Accountability
 - Increasing Level of Technology
 - Changing Regulatory Environment



Infrastructure Management

- Many stakeholders
 - Board and Council
 - Management and Administration
 - Field Personnel
 - Technical Personnel
 - Operations Personnel
 - IT/CIS
 - Third Parties
 - ... and Don't Forget the Public!!!
- Implementation is a Major "Change" Initiative



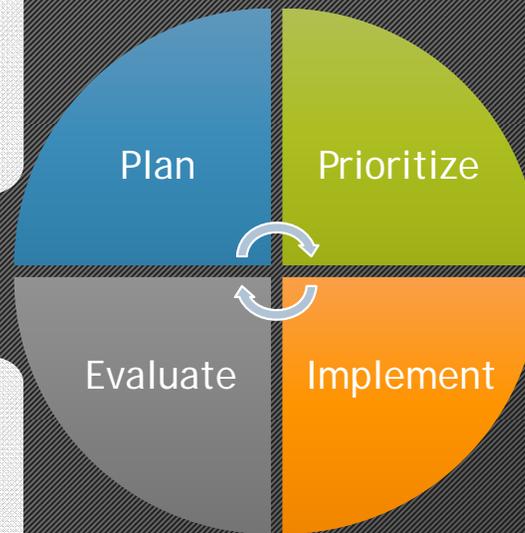
Infrastructure Management

Identify Where We're Going and What Needs to Get Done

- What Is Our Vision?
- Where Are We Now?
- Where Do We Want To Go?
- How Do We Get There?

Identify Where We Need to Focus Our Efforts

- Where Will We See the Biggest Returns?
- Where Are We Most Exposed?
- What Needs to Get Done Now, and What Can Wait?



Assess the Effectiveness of Measures Taken

- What Worked Well?
- Where Did We Go Wrong?
- What Can We be Doing Better?

Refine Asset Management Standards, Practices and Tools

- What Needs to be Changed?
- Who Will This Impact?
- How Do We Support Adoption?



Inventory

- What Do You Have? And What Does It Do?



Inventory

- What Types of Data Do We Need?



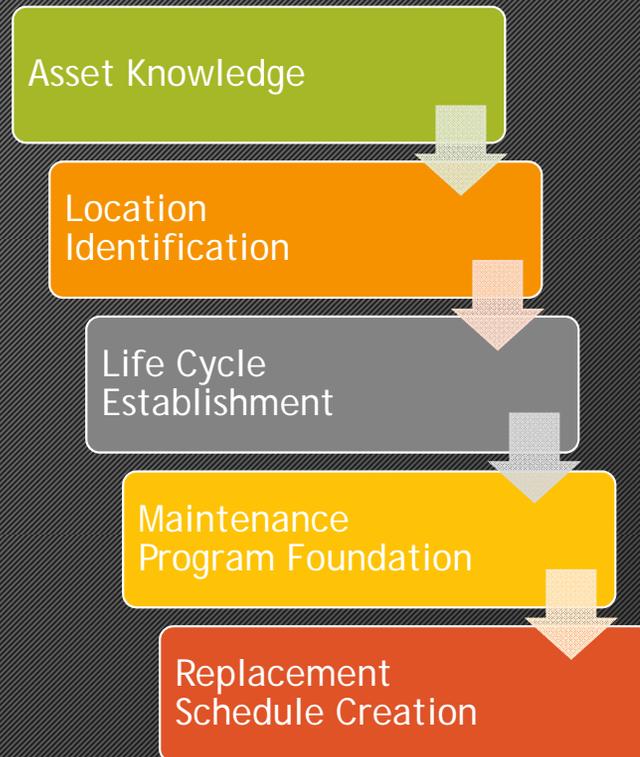
Inventory

- How Do We Manage This Data and Who Has Access?



Inventory

- Knowledge of the Assets
- Identification of Their Location
- Establish a Life Cycle
- Provide Maintenance Program
- Establish Replacement Schedules



Inventory

- Asset Containers Examples
 - Operations Building
 - Pump Stations
 - Preliminary Treatment
 - Rolling Stock
 - Building and Grounds
 - Panels - Alarm/Electrical
 - Tanks & Basins
 - Unit processes
 - Parking Facilities



Inventory

- Facilities Asset Hierarchy

Facilities

- Structure
- HVAC
- Plumbing
- Electrical
- Process Equipment

Rolling Stock

- Vehicles
- Heavy Equipment
- Load & Unloading Equipment

Parking Garages

- Decks
- Stairs
- Entrance Booth
- Security

Parks

- Playground Equipment
- Fencing
- Bathrooms
- Trees



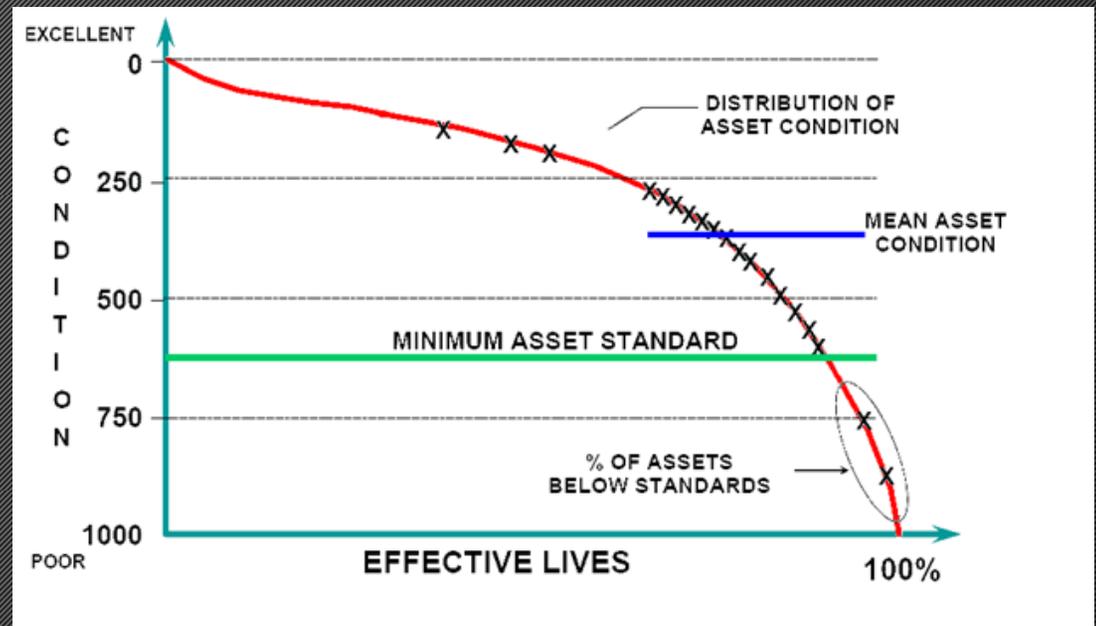
Inventory

- Organization - Horizontal Assets
 - Transportation: Roads, Railroad, Waterways, Bridges
 - Sewer, Water & Drainage Pipes & Structures
 - Recreation: Parks, Trails, Playgrounds
 - Airports: Runways, Parking lots, Taxiways



Condition Assessment

- Inspection vs. Condition
 - Inspection is the Minimum Acceptable Standard
 - Condition is a Numeric Rating on the Deterioration Curve



Condition

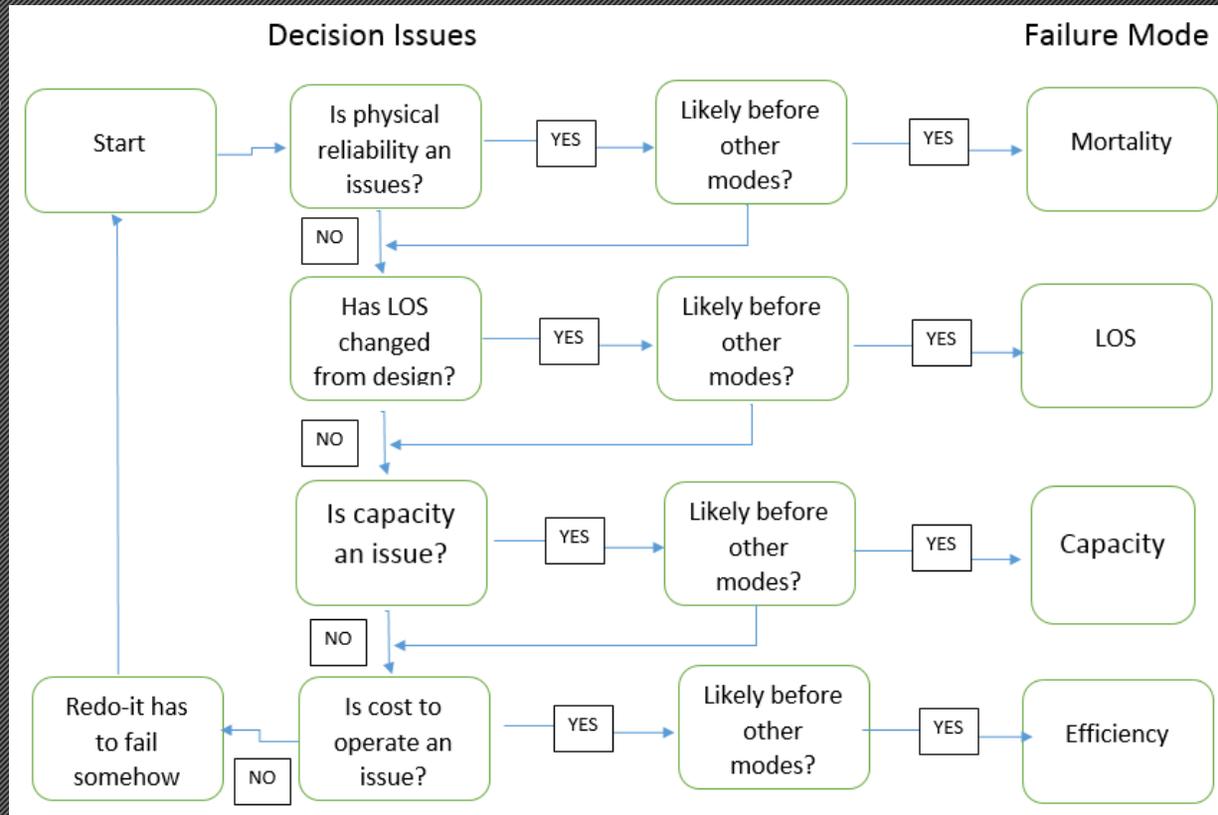
Inspection vs. Condition

FACILITIES	CONDITIONS	D	N	REMARKS	RESOLVED BY (Date/Initials)
Pavement Areas	Pavement lips over 3"				
	Hole - 5" diam. 3" deep				
	Cracks/spalling/heaves				
	FOD: gravel/debris/sand				
	Rubber deposits				
	Ponding/edge dams				



Condition Assessment

Failure Analysis



Condition Assessment

- Asset
 - Measuring Defects
 - Cost of Maintenance or Obsolete
- Level of Service
 - Maintaining to Manufacturers' Recommendations
 - Can it Meet Future Requirements Compliance
- Capacity
 - Meet Current and Future Needs
- Efficiency
 - New Technology Available, ROI



Condition Assessment

- Different Failure Modes

- Deterioration
 - Age, Corrosion, Excessive Use
- Regulatory Requirements
 - Environmental, Health & Safety, Code Requirements
- Capacity Limitation
 - New Growth, Change of Use, Climate Changes
- Inefficiency
 - New Technology, New Materials



Condition Assessment

Mechanical Physical Condition Assessment Scoring Guidelines						
Criteria	Condition	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Corrosion	Surface only	0%	< 10%	10% - 50%	> 50% - 75%	> 75%
	Structural	No	No	No	1 location	> 1 location
Leakage	Gaskets / Connections	No	Historic only	Drip only	Stream - 1 loc	Stream - > 1 loc
	Holes / Failures	No	No	No	1 location	> 1 location
Vibration	Apparent with Noise	No	No	Yes	Yes	Yes
	Non-Structural Damage	No	No	No	Yes	Yes
	Structural Damage	No	No	No	No	Yes
Concrete Pedestals	Surface Cracking / Loose Grout	No	< 10%	10% - 50%	> 50% - 75%	> 75%
	Through Cracks	No	No	No	< 25%	> = 25%
	Missing Pieces	No	No	No	No	1 or more



Condition Assessment



Condition Standards - PCI

- Two Ways to Measure the Road Network Condition
 - Only Address Reported Complaints
 - Preventative Maintenance Based on Condition Assessment
- Critical information for each roadway segment
 - Class - Local Residential, Collector, or Arterial
 - Length, Width, and Geometry
 - Traffic Type and Volume
 - Pavement Type - Flexible, Rigid, or Composite
 - Original Construction Date
 - Maintenance and Rehabilitation History
 - Current PCI Condition



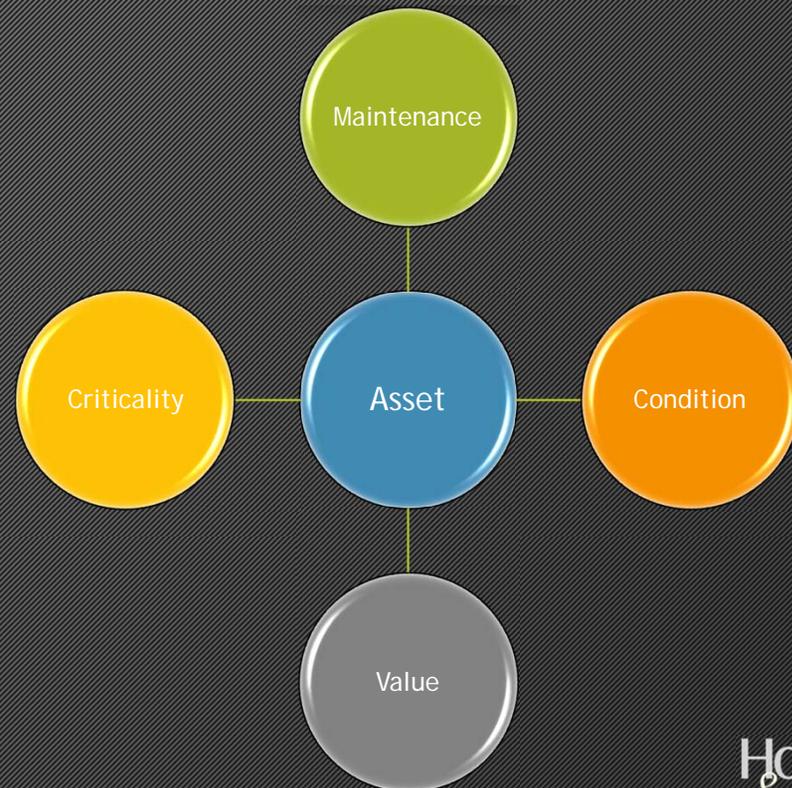
Maintenance

- Maintenance Program
 - Scheduled
 - Generated Through Routine Work Orders
 - Advanced Planning of Labor and Parts Needed
 - Updated Condition Assessment During Maintenance
 - Collect Associated Cost Data
 - Both Operations and Maintenance are Part of This System



Maintenance

- Asset "Centric"
 - Data Collection During Maintenance Forms the Foundation
 - Individual Asset Data Collected is Analyzed on System-wide Scale



Maintenance?

- Maintenance Goals
 - Maximize Asset Life and Reliability
 - Minimize Asset Failure
 - Increase Asset Efficiency
 - Increase Labor Efficiency



Maintenance

- Reactive Maintenance
 - Work Performed After a Breakdown
 - Emergency (High Risk)
 - Non-emergency (Low Risk)
 - Unplanned (Resources, Manpower, Loss of service)
 - Expensive (Unbudgeted, No Optimization of Purchasing, Overtime)



Maintenance

- Predictive Maintenance
 - Monitoring and Analyzing Asset Condition to Anticipate Failures
 - Delay or Prevent Failure
 - Reduces Operating Costs
 - Reduces Emergency Repairs
 - Provides Data on Effectiveness of Preventive Maintenance Program



Maintenance

- Preventive Maintenance
 - Schedule Maintenance Based on Manufacture Recommendation
 - Performance and Safety Inspections
 - Provides Data on Effectiveness of Preventive Maintenance Program
 - Testing Equipment
 - House Cleaning
 - Protect Surface From Corrosion



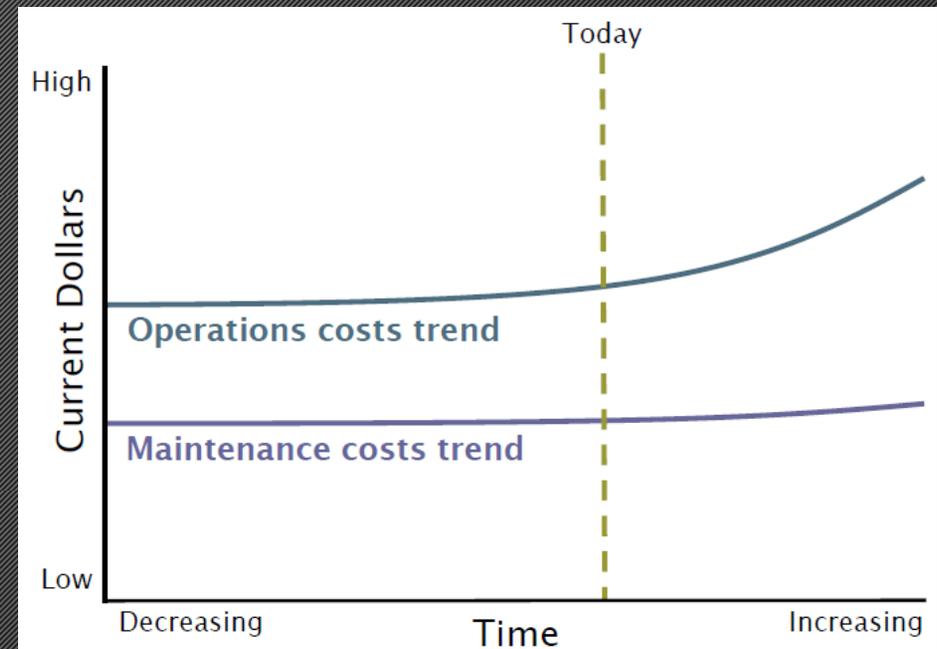
Life Cycle Costs

- Policies
 - Planning for Sustainable Asset Management
 - Focus on Total Cost of Ownership
 - Pro-active Approach to Monitor Long-term Thinking
- Goal
 - Making Capital Investments Based on Assets' Life Expectancy
 - Optimizing Service and Reliability
 - Operating Cost-effectively
 - Managing the Level of Service
 - Evaluating Investment Option (Repair, Rehabilitate, or Replace)



Direct Life Cycle Cost

- O&M Cost Continue to Increase Over Time
- When Do You Know When to Repair, Rehabilitate or Replace



Direct Life Cycle Cost

- Run to Failure
 - Maximizing the Life Cycle Cost by Maximizing the Life
 - Always?
 - When the Cost of Maintenance is Greater than Replacement
 - What Else Should You Consider?
 - When the Energy Cost Out Weighs the Replacement
 - How Do You Know This?
 - When it No Longer Provides Level of Service
 - Have You Set a Minimal Level of Service?



Financial Life Cycle Cost

- Direct Costs to the Local Government
 - Repair and Return to Service Costs
 - Service Outage Mitigation Costs
 - Utility Emergency Response Costs
 - Public Safety Costs
 - Administrative and Legal Costs of Damage Settlements
 - Lost Product Costs



Social Life Cycle Cost

Direct customer costs

- Property Damage Costs, Including Restoration of Business
- Service Outage Costs
- Service Outage Mitigation and Substitution Costs
- Access Impairment and Travel Delay Costs
- Health Damages



Life Cycle Costs

Renewal Schedule Main Pump	Interval	Cost
Replace Bearings and Seals	3 yrs	\$2,500
Replace Couplings	5 yrs	\$1,000
Replace Shaft Bearings	5 yrs	\$1,000
Recondition Check Valve	5 yrs	\$500
Replace Impeller & Wear Rings	7 yrs	\$5,000
Upgrade Controls	7 yrs	\$1,000
Reinsulate Motor	10 yrs	\$3,000
Replace Pump Unit	20 yrs	\$20,000
Recycle for Disposal		



Development Life Cycle Cost

- Determining Life Cycle Cost Requires Work Flow with Goal in Mind
- Cost Tracking
 - Integrating CMMS to Financial System
 - Setting Up Activity-Based Accounting
 - Exporting Data that has Value
- Cost Allocation
 - Direct Pay
 - Overhead or Administrative
 - Benefit Burden
 - Material Cost
 - Expense Cost



Level of Service

- Identifies of Points Maintenance is Required
 - Location, Risk, and Asset Type Influence the Established Level
- Defines Maintenance Timeframes
- Establishes the Funding Level (Effective Use of Available Funds)
- Preserves the Public and Private Investments



Level of Service

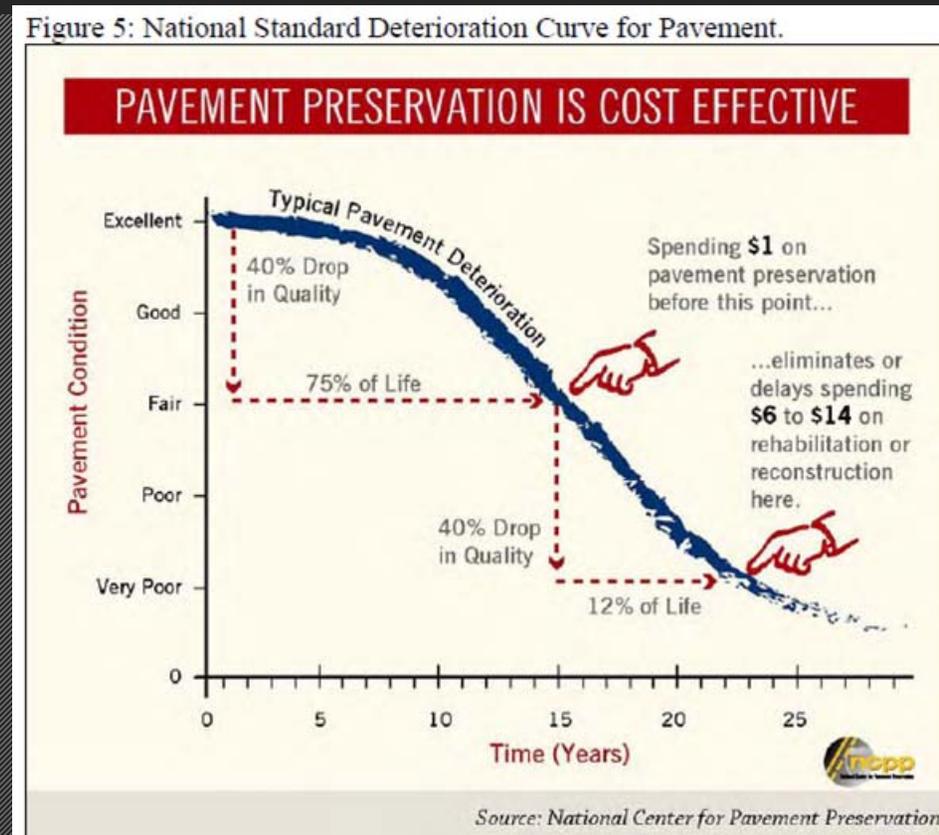
- Target Level of Service at Asset Level are Different Based on:
 - Locations
 - Customer Severed
 - Health and Safety
 - Number of Customers
 - Social Requirements



Level of Service

- Why is Pavement Preservation Important?
- Level of Service for Roads

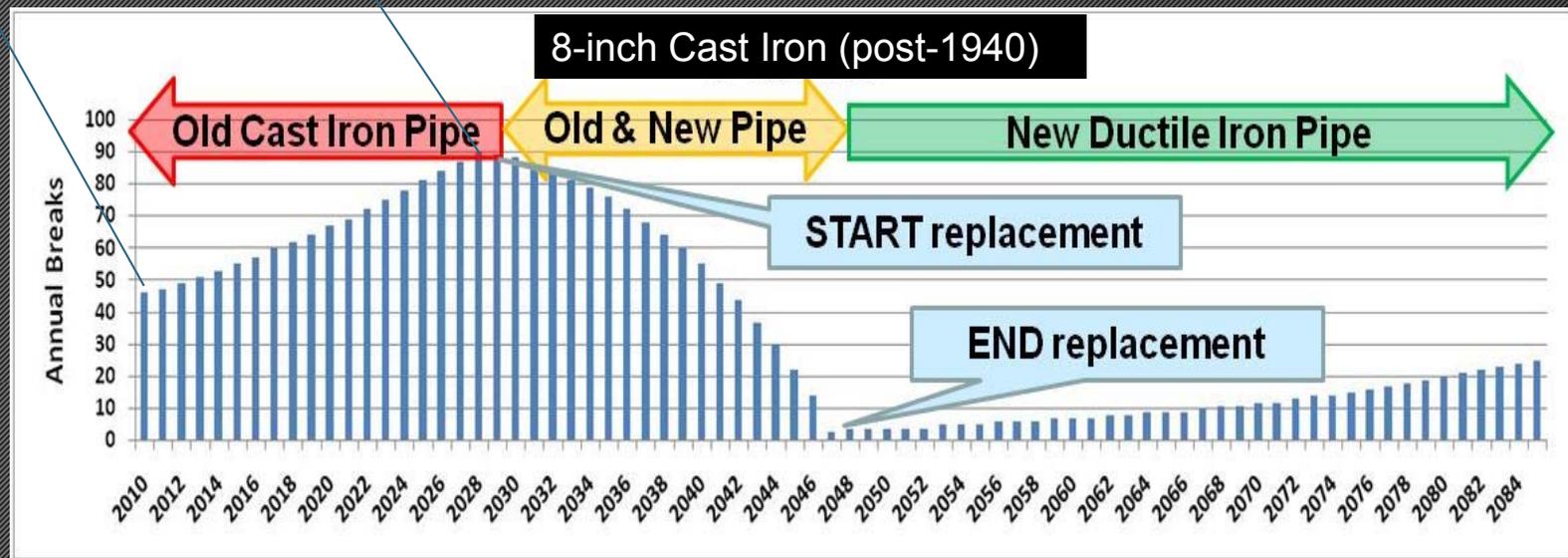
Figure 5: National Standard Deterioration Curve for Pavement.



Level of Service

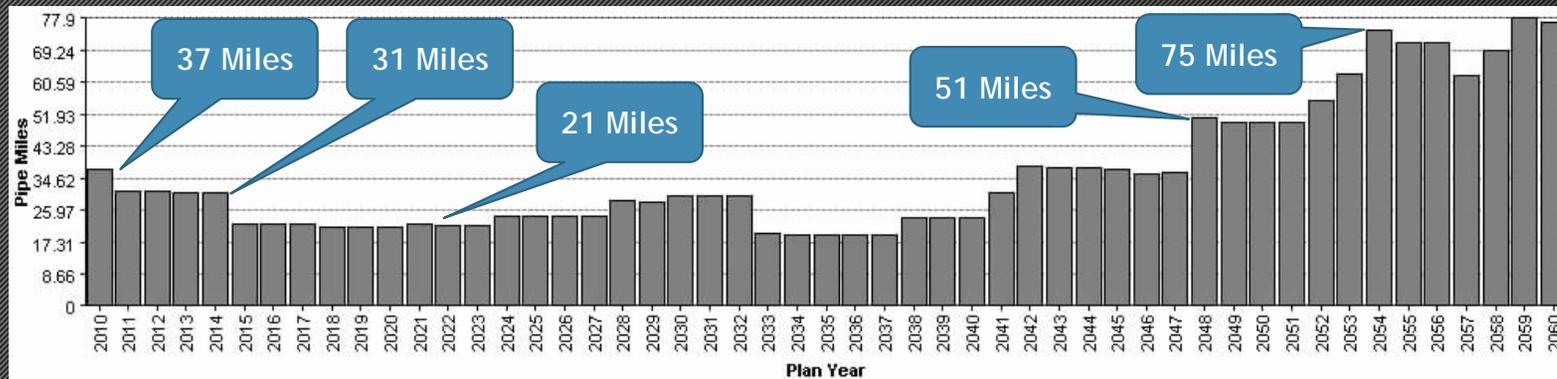
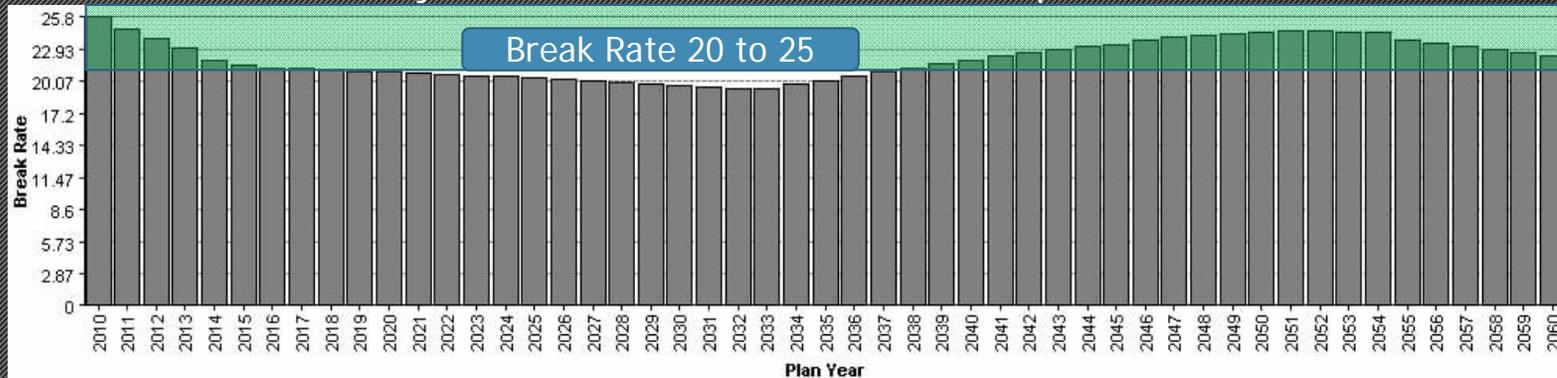
Break Rate =
45/100 mi/yr

Break Rate =
90/100 mi/yr



Level of Service

Preliminary Base Line Scenario for 50-Year Replacement Needs



Level of Service

- Does the Organization Have a Means of Communicating to the Customers?
- Does the Organization have Clearly Defined Goals and Are They Aligned with Expectations/Desires?
- Does the Organization Measure Progress?
- Does the Organization Analyze Current and Anticipated Customer Demands?



Level of Service

- Measure Your Level of Service
- Meet the Expectations of the Customers
- Protect Both Public and Private Assets
- Health & Safety is Always First



Criticality

- Risk (t) = Σ (Consequences x Probability)

Low Criticality

- Monitor and Forecast
- Repair or Replace Upon Failure
- Failure Can Be Addressed During Normal Operations
- Low Impact to the Public

Moderate Criticality

- Forecast and Address
- Repair or Replace Done During Failure or Maintenance
- Failure Can Be Accommodated but Strains Operations and Budget
- Interrupted Service to the Public

High Criticality

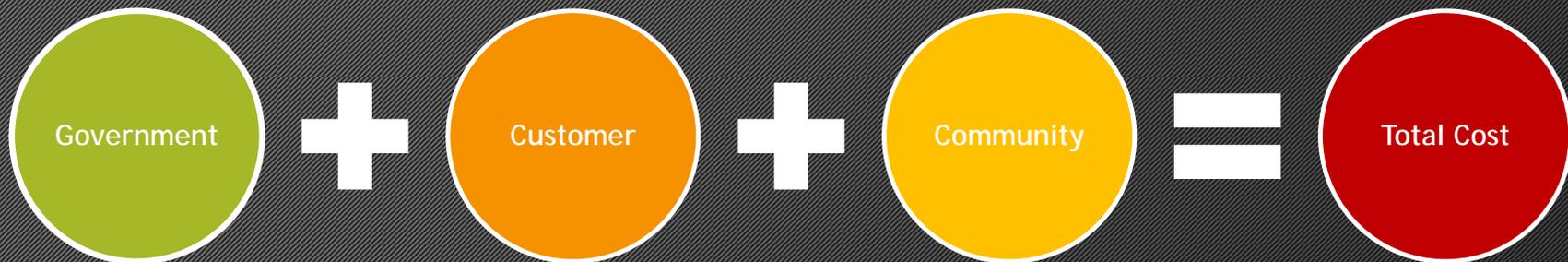
- Address
- Continuous Proactive Maintenance and Rehabilitation
- Failure Cannot Be Handled in an Effective Manner
- Maximum Negative Impact to the Public



Criticality

- Financial Criticality

- Direct Costs to the Local Government
 - This is What Hits Your Budget
- Direct Customer Costs
 - This is What Cost is for Loss of Service
- Community Costs
 - This Can Be the Cost to Growth, Opportunities and Image



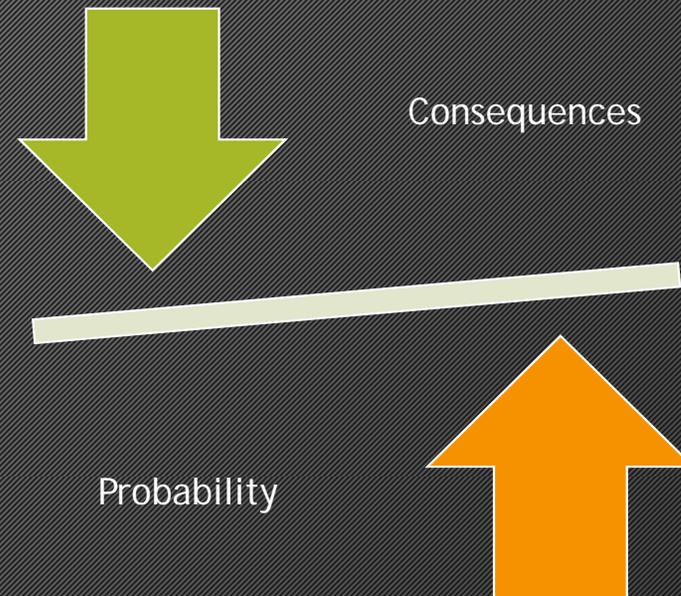
Criticality

- Impacts



Criticality

- The Owner Develops their Risk Level
- Risk Level Includes All Societal Cost



Optimizing the O&M and CIP



Future Investments

- Where is the Best Investment?
 - Budgeting (Review Maintenance History and Manage Risk)
 - Overlapping the Different Department Needs/Critical Assets
 - Data Driven Decision (Balance with Communities Goals)
 - Leveraging Funding Sources



Public Outreach

- What Does the Public Want to Know?
- What is Investment in the Community?
- What is Needed to Maintain Services?
- Have Alternatives Been Looked At?
- Are We Maintaining What We Own Properly?
- Are We Improving Operating and Maintenance Skills?



Budget Forecast

- Long-Term Budget Forecast: Software Selects Asset and Recommended Action
 - Multi-year Budget Estimate that Meets the Established Level of Service
 - Prioritized List of Assets Based on Criticality
 - Multi-year Budget Based on Criticality & Lifecycle Cost
- Short-Term Budget Forecast: Assets and Recommended Actions are Specified in Analyzed Projects
- Cost/Benefit Comparisons: Analyze Project Alternatives for Life-Cycle Cost to Calculate



Funding Strategy

- Rehabilitation/Replacement Program
 - Evaluate the Asset's Performance
 - Predict Long-term Capital Needs
 - Assist in Financial Planning Over a 10- to 20-Year Period
 - Dictate Required Management Activities



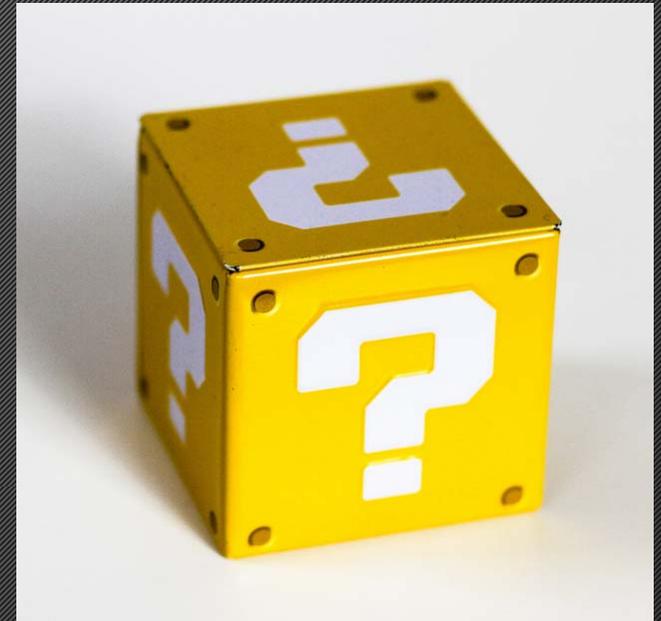
Funding Strategy

- Develop Rate Study based on Asset Management Practices
- Prioritize CIP Based on Risk
- Determine Financing Requirements Based Inventory and Condition
- Establish Lines of Communication Through All Departments



Funding Strategy

- Different Failure Methods Call for Different Funding Alternatives
 - FEMA
 - Bonds
 - SRF Loans / Principle Forgiveness
 - Economic Development
 - Private/Public Partnerships
 - Community Development Block Grants
 - Municipal Bridge Aid Program



Q & A

