

An aerial photograph of a river valley during sunset. The sky is filled with soft, colorful clouds in shades of pink, orange, and purple. The river flows through a lush green valley, with a road and a bridge visible. The surrounding hills are covered in dense forest, and the overall scene is peaceful and scenic.

Culverts: A Framework for Managing Your Critical Stormwater Assets

ESRI UC 2017

Project Background

Why?

•Organizational

- Executive management changes—asset management
- Staff and resources

•Technical

- Complete and accurate culvert inventory high priority
- Cartegraph OMS

•Catalyst

- Learning from our neighbors



Project Background

Where?



Bonneville Dam to Forest Park



Asset Management Framework

Collect

- What infrastructure do we have?
- Where is each asset located?

Inspect

- What condition is the culvert in?
- What does inspection tell us?
- How often does it need to be inspected?

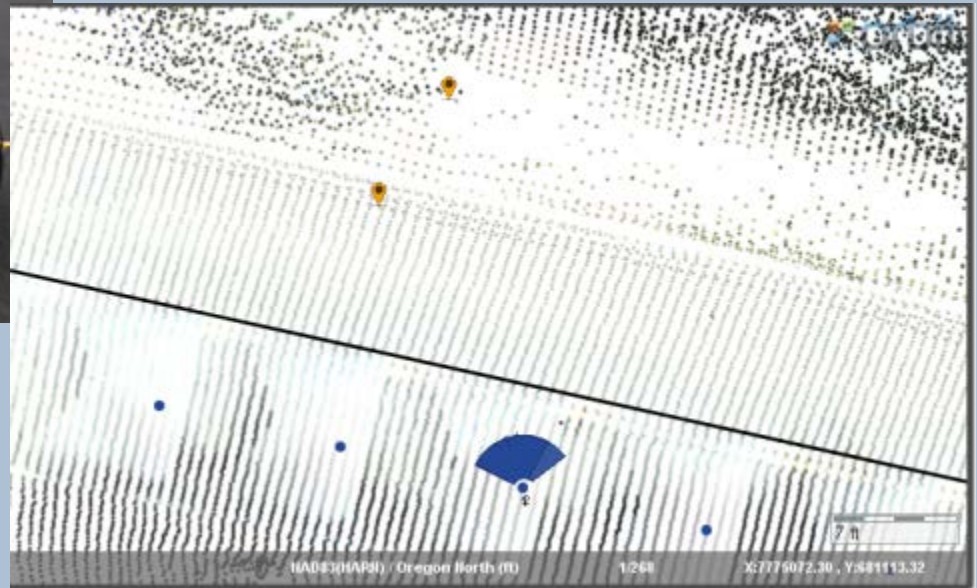
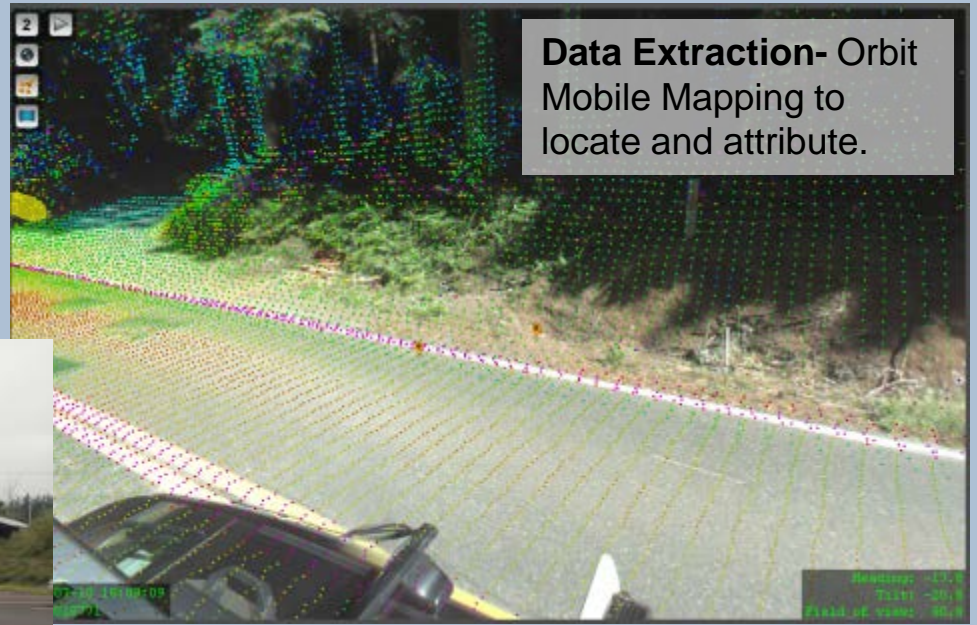
Maintain

- Schedule tasks and work orders to maintain hydraulic performance
- Reduce overall maintenance costs and effort
- Proactively plan – preserve culverts to usable limit



Culvert Inventory

Mobile Scan- Top Con IP-S2



Culvert Inspection Types



Maintenance Check:

- Annual visual inspection from the roadway to determine immediate prevention
- Fall and Winter Prep

Condition Rating:

- Assess and rate culvert condition using metrics¹ in order to prioritize repair, rehab, or replacement.
- Rate Structural, Hydraulic, and Geotechnical conditions



Ratings Criteria



Guardrail settlement



Settlement



Out of round



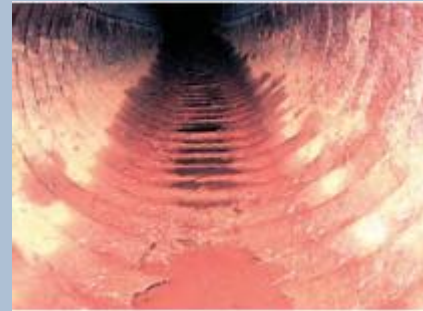
Cracking



Embankment pop outs



Embankment protection



Invert condition



Sediment blockage



Pavement cracks



Scour



Open joints



General barrel condition



Condition Rating Inspections

Verizon LTE 1:14 PM 55%

Inspecting Asset Add Task

Inspection Detail

Basic Information

* Inspection Date 9/27/2016

Inspected By 23

Full Name Rick Arriola

Urgent Attention

Follow Up Task

Maintenance Notes

Condition Categories

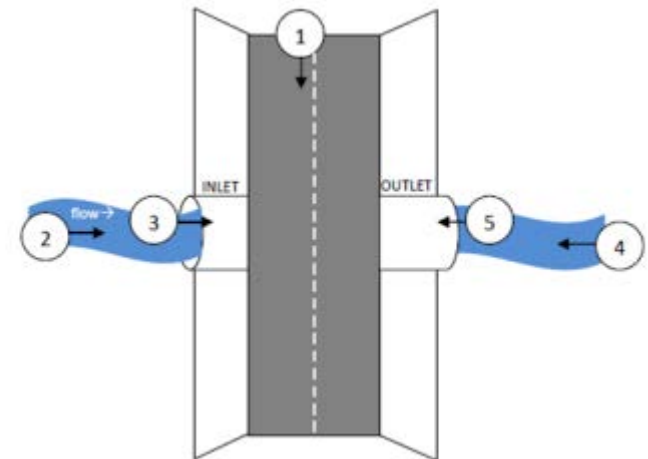
Pavement Crack/Patc...	Good	4
Sag Roadway/Guardrail	Good	4
Embankment Popouts/...	Good	4
Embankment Inlet	Good	4
Scour Inlet	Good	4
Invert Condition (Metal)	Option	⚠
Settlement (Concrete/...	Good	4

+

Edit



1	Road surface
2	Inlet end
3	Inlet inside
4	Outlet end
5	Outlet inside



Condition Rating Scoring

- Weighted score of all condition categories.
- Matrix is unique to each material type: concrete, plastic, and metal
- Overall culvert condition based on the total score

Multnomah Storm Culvert Inspections ODOT Scoring Matrix

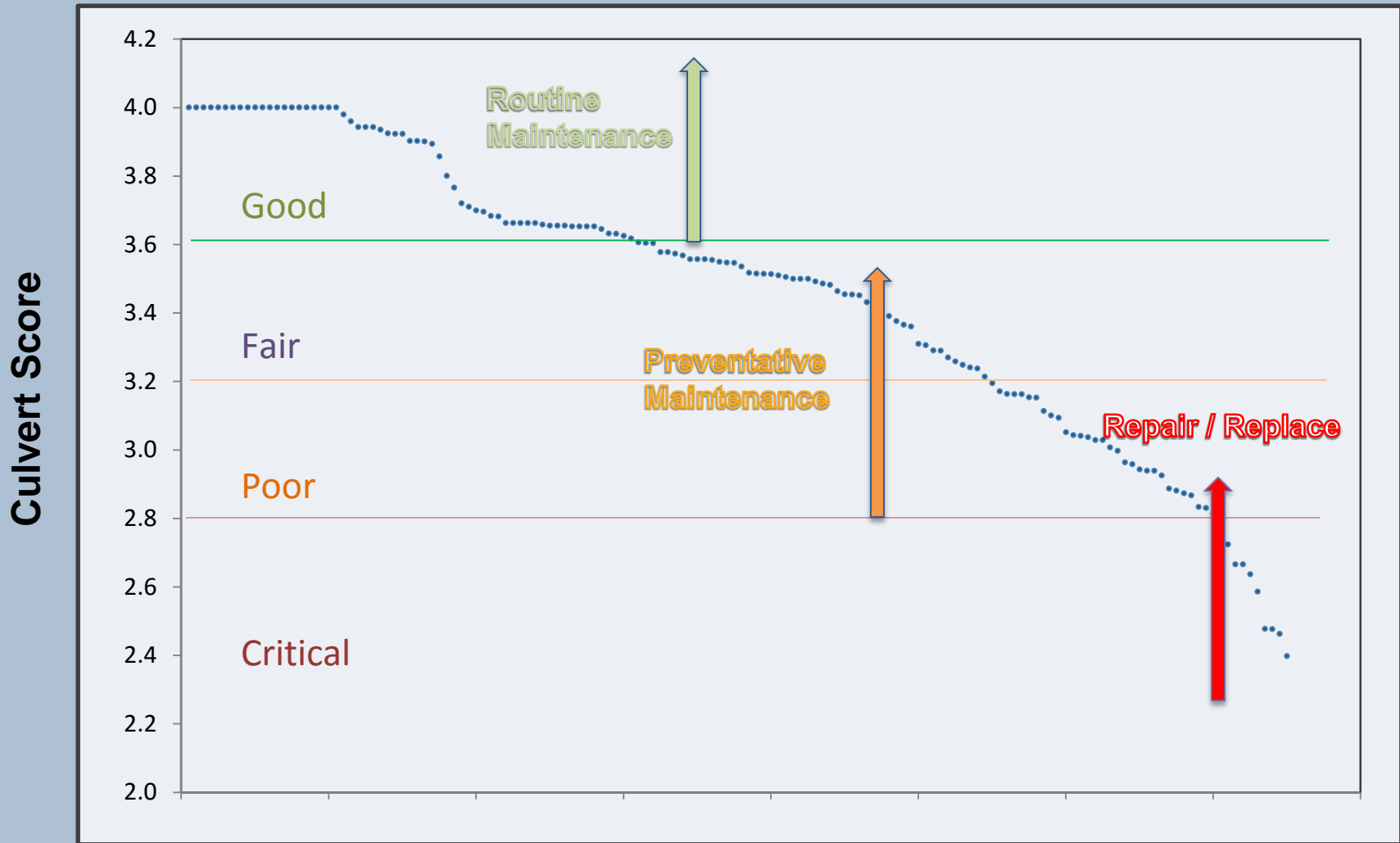
CULVERT SCORING example

Rating group	Rating field	Rating	Weight	Score
Structure	General barrel condition		0.412	0
	Settlement		0.056	0
	Open Joints		0.184	0
	Out of Round		0.103	0
	Blockage		0.17	0
	Cracking		0.061	0
	Sub total			
Group Total			0.68	0
Hydraulic	Embankment protection - Inlet		0.17	0
	Embankment protection - Outlet		0.17	0
	Scour - Inlet		0.121	0
	Scour - Outlet		0.54	0
	Sub total			
Group Total			0.12	0
Geotechnical	Embankment pop outs/voids		0.429	0
	Pavement cracks/patches		0.286	0
	Sag Roadway/guardrails		0.286	0
	Sub total			
Group Total			0.2	0
Grand Total				0

Culvert Score	Condition
3.61 – 4.00	Good
3.21 – 3.60	Fair
2.80-3.20	Poor
0.00 – 2.79	Critical



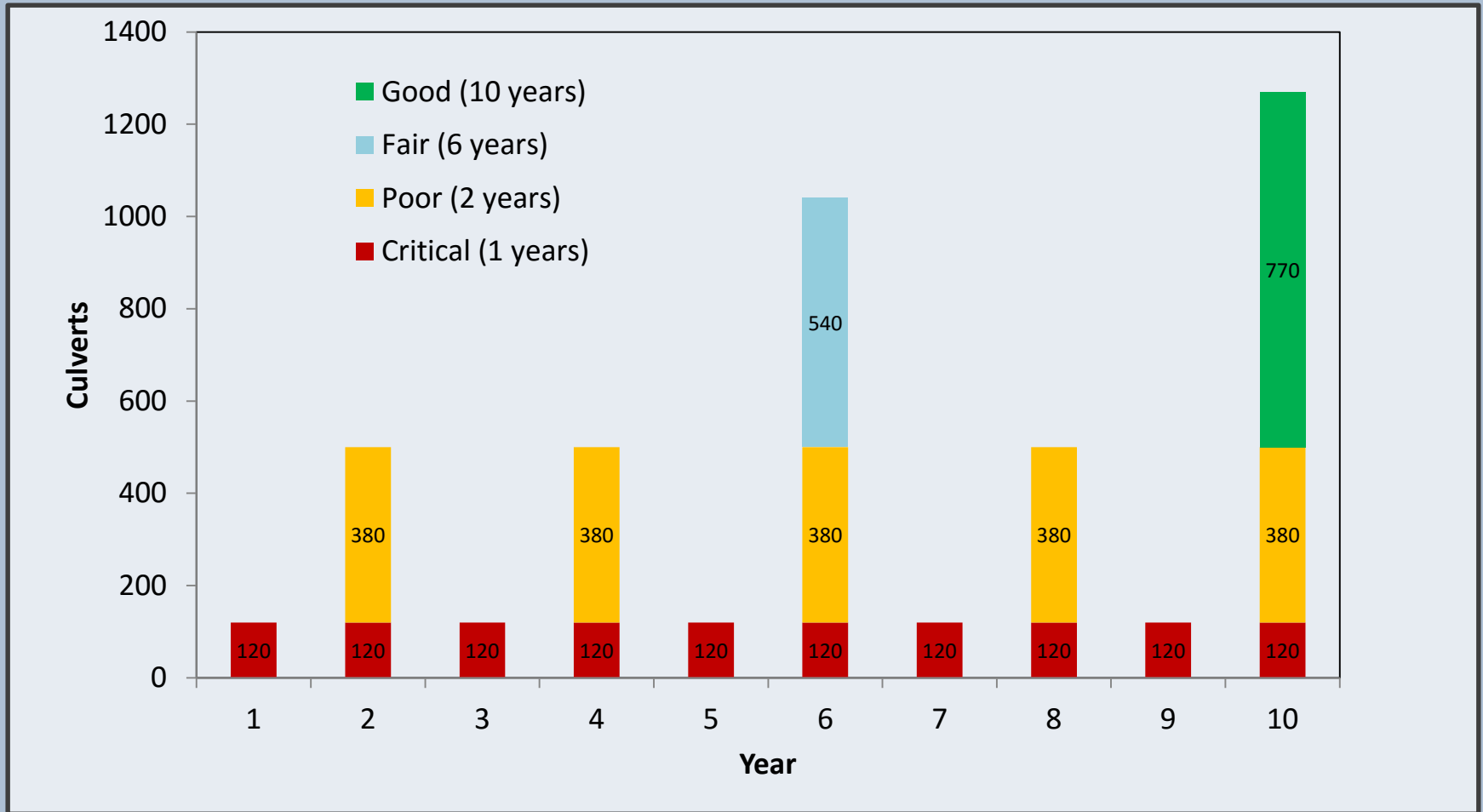
Culvert Maintenance and Repair Strategies



2016 In Stream Inspections



Culvert Inspection Schedule



Conclusions

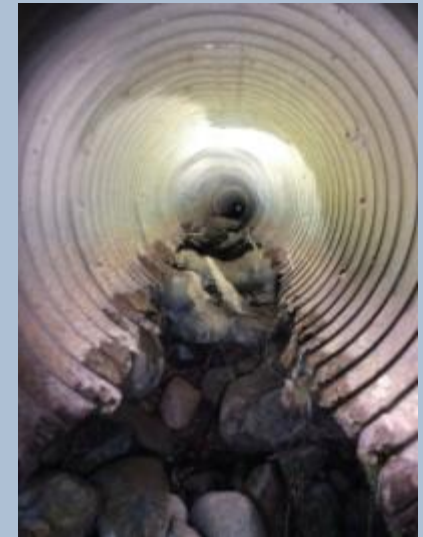
What Works

- Road maintenance inspectors
 - Photos, notes, follow up tasks
- Check-in meetings
- Quality data/ accurate locations



Challenges / Improvements

- Access
- Condition category / material uncertainty
- New automated procedures



Questions?

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References:

- ¹ Oregon Department of Transportation, 2013. Culvert Inspection & Inventory Field Handbook.
http://www.oregon.gov/ODOT/HWY/TECHSERV/AMI%20docs/Form_734-2728_web_03-28-13.pdf

