# Examples of Decision Support Using Pavement Management Data

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Oregon Department of Transportation

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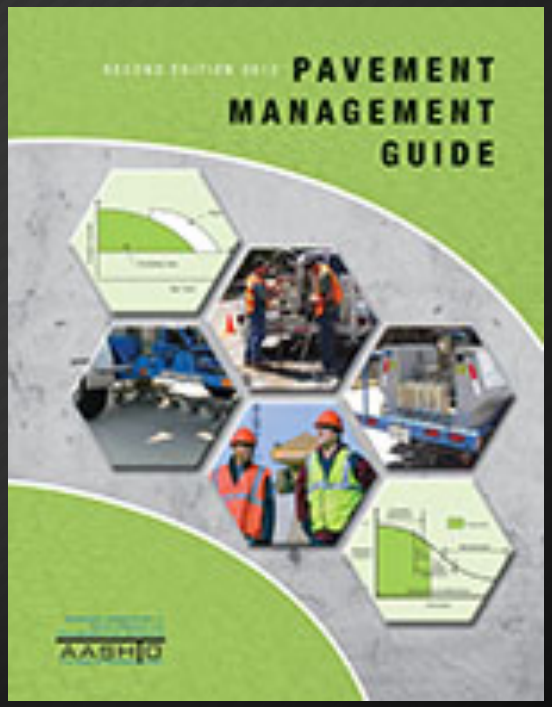
Oregon Department of Transportation

2016 NWPMA Conference

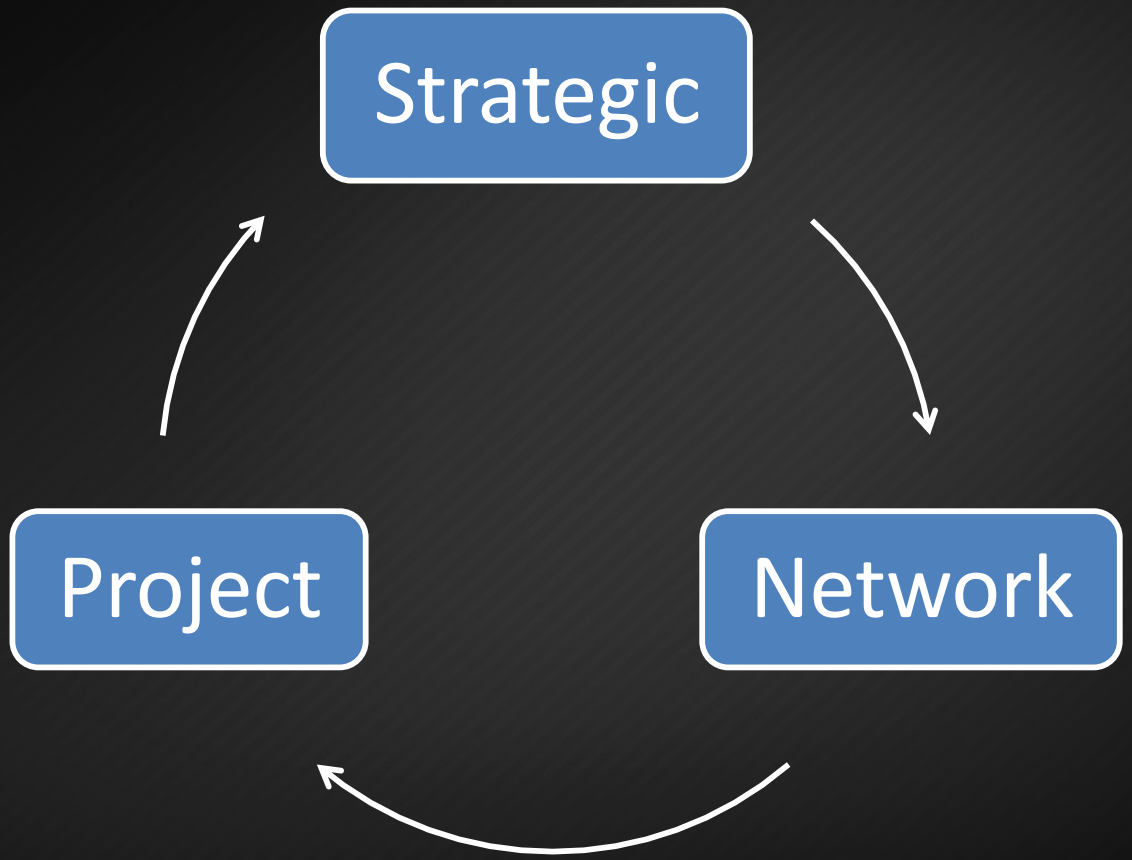
# Decision Levels*

- Strategic
- Network (Tactical)
- Project (Operational)




*Pavement Management Guide, 2nd Ed.
AASHTO, 2012

| Level | Audience | Types of Decisions | Apply to | Detail |
|---|---|---|---|---|
| Strategic | Politicians<br>Commission<br>Agency Heads | Perf. Meas./Targets<br>Funding Impacts<br>Pavement Strategy | Entire Network | Low |
| Network | Engr. Mgrs.<br>District Mgrs.<br>Planning<br>Asset Mgrs. | Funding Allocations<br>Pavement Workplan<br>Project Selection<br>Initial Scoping | Entire Network or Subset | Mod. |
| Project | Project and Maintenance staff | Scope refinement<br>Thickness design<br>Materials selection | Project or corridor | High |


Strategic
Network
Project

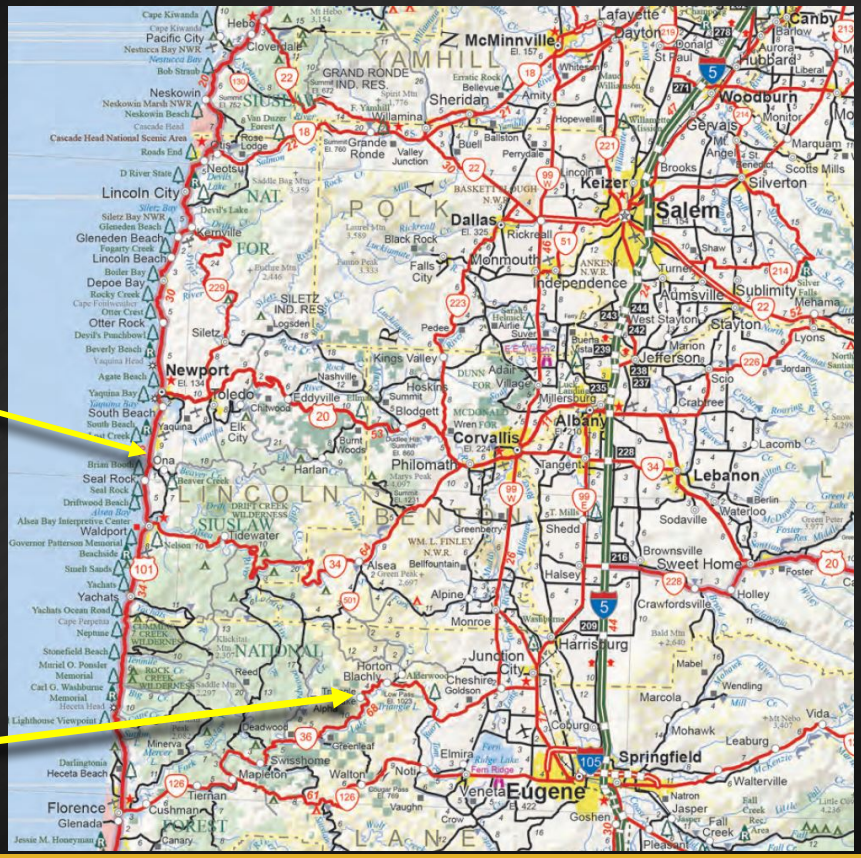
# STRATEGIC LEVEL

- What is the condition of our roads?

# Measuring Pavement Conditions

AUTOMATED

WINDSHIELD


McMinnville
Newport
Lincoln City
Neskowin
Sheridan
Dallas
Salem
Keizer
Woodburn
Albany
Corvallis
Lebanon
Philomath
Toledo
Siletz
Depoe Bay
Otter Rock
Gleneden Beach
Lincoln Beach
Waldport
Yachats
Florence
Junction City
Harrisburg
Springfield
Eugene
Veneta
Coburg
Sweet Home
Lyons
Stayton
Sublimity
Aumsville
Independence
Monmouth
Falls City
Rickreall
Black Rock
Grande Ronde
Valley Junction
Willamina
Amity
Dayton
Lafayette
Canby
Hubbard
Gervais
Scotts Mills
Silverton
Marquam
Brooks
Scio
Jefferson
Crabtree
Lacomb
Tangent
Shedd
Halsey
Brownsville
Sodaville
Waterloo
Berlin
Foster
Holley
Crawfordsville
Marcola
Mohawk
Leaburg
Walterville
Wendling
Mabel
Vida
Natron
Jasper
Fall Creek
Goshen
Pleasant Hill
Cottage Grove
Dorena Reservoir
Cottage Grove Reservoir
Row River
Coast Fork Willamette
Middle Fork Willamette
Long Tom
Calapooia
Marys Peak
Mary's Peak
Alsea
Bellfountain
Greenberry
Kings Valley
Hoskins
Blodgett
Summit
Eddyville
Chitwood
Elk City
Burnt Woods
Harlan
Tidewater
Nelson
Reed
Blachly
Horton
Cheshire
Goldson
Alderwood
Deadwood
Greenleaf
Swisshome
Mapleton
Walton
Noti
Elmira
Ona
Seal Rock
Driftwood Beach
Waldport
Yachats
Florence
Glenada
Tierman
Cushman
Canary
Vaughn
Crow
Monroe
Alpine
Peoria
Pedee
Siletz
Logsden
Kernville
Devil's Lake
Rose Lodge
Neotsu
Cloverdale
Hebo
Pacific City
Neskowin
Cape Kiwanda
Cascade Head
Roads End
Gleneden Beach
Depoe Bay
Otter Rock
Beverly Beach
Agate Beach
South Beach
Yaquina
Yaquina Bay
Yaquina Head
Seal Rock
Waldport
Yachats
Florence
Glenada
Darlingtonia
Heceta Beach
Stonefield Beach
Muriel O. Ponsler Memorial
Carl G. Washburne Memorial
Governor Patterson Memorial
Alsea Bay Interpretive Center
Beachside
Smelt Sands
Neptune
Cape Perpetua
Yachats Ocean Road
Lighthouse Viewpoint
Jessie M. Honeyman
Siuslaw River
Alsea River
Yaquina River
Mary's River
Willamette River
Santiam River
Calapooia River
Long Tom River
Coast Fork Willamette River
Middle Fork Willamette River
Row River
Dorena Reservoir
Cottage Grove Reservoir
Siuslaw National Forest
Oregon Coast Range
Cascade Range
Willamette Valley
Central Oregon Coast
Oregon Coast
Pacific Ocean
Cascade Head National Scenic Area
Cascade Head
Neskowin Beach
Neskowin March NWR
Siletz Bay NWR
Gleneden Beach
Fogarty Creek
Lincoln Beach
Boiler Bay
Rocky Creek
Cape Foulweather
Otter Crest
Devil's Punchbowl
Yaquina Head
Agate Beach
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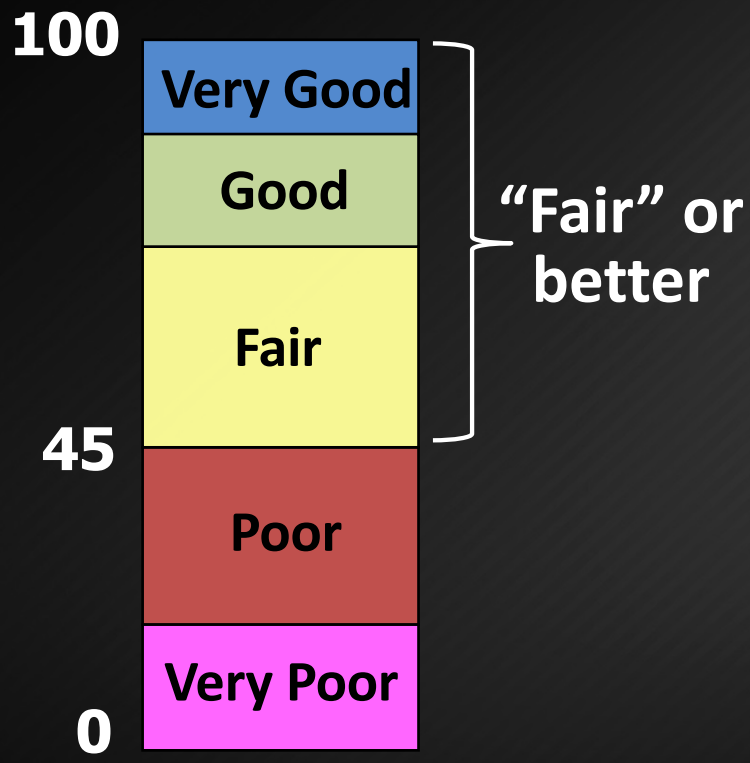
# Pavement Rating

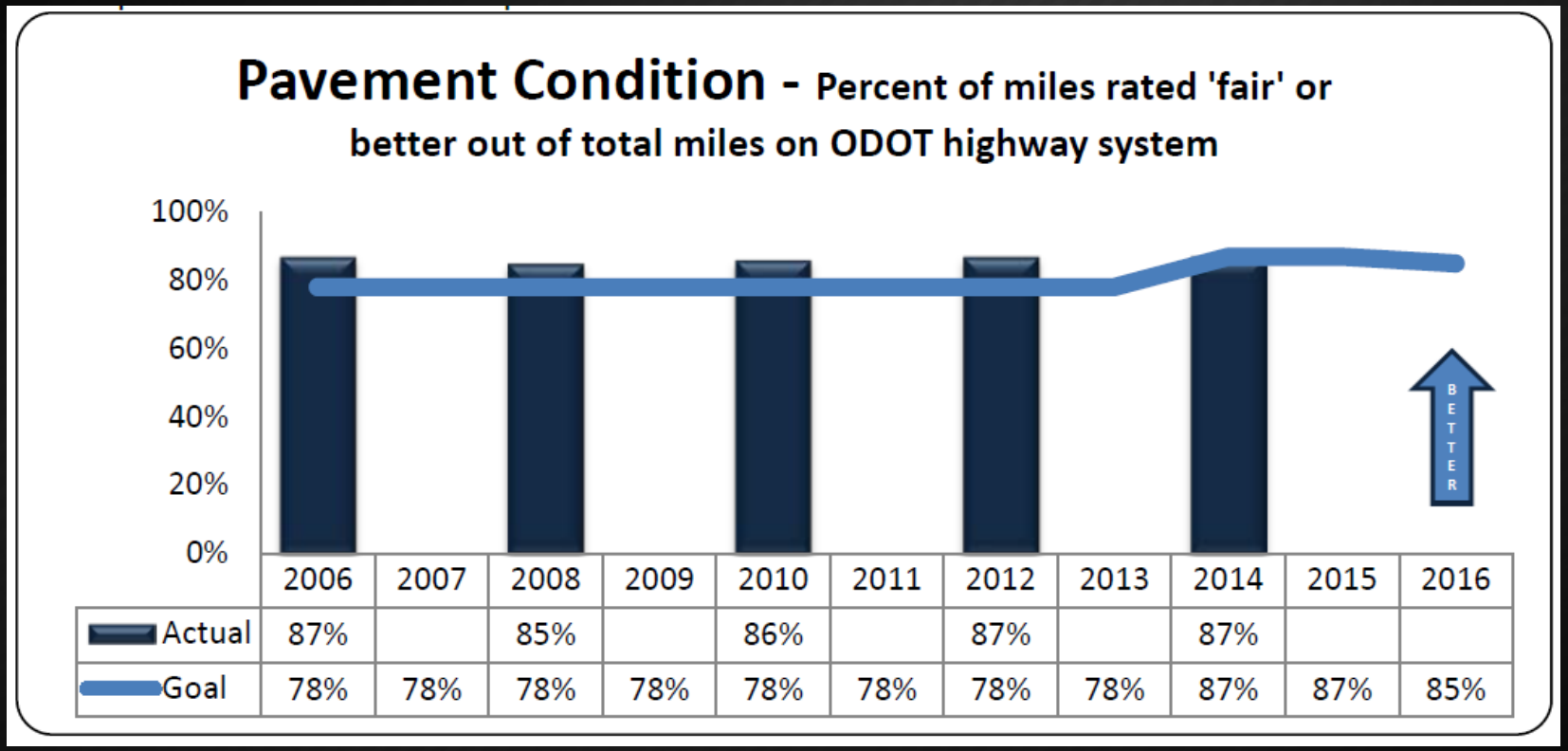



- 100% Survey
- Score each PMS section
- Sum miles in each category
- Calculate % Fair-or-better mileage

# STRATEGIC LEVEL

- What is the condition of our roads?
- Are they getting better or worse?

# Performance Measures and Targets

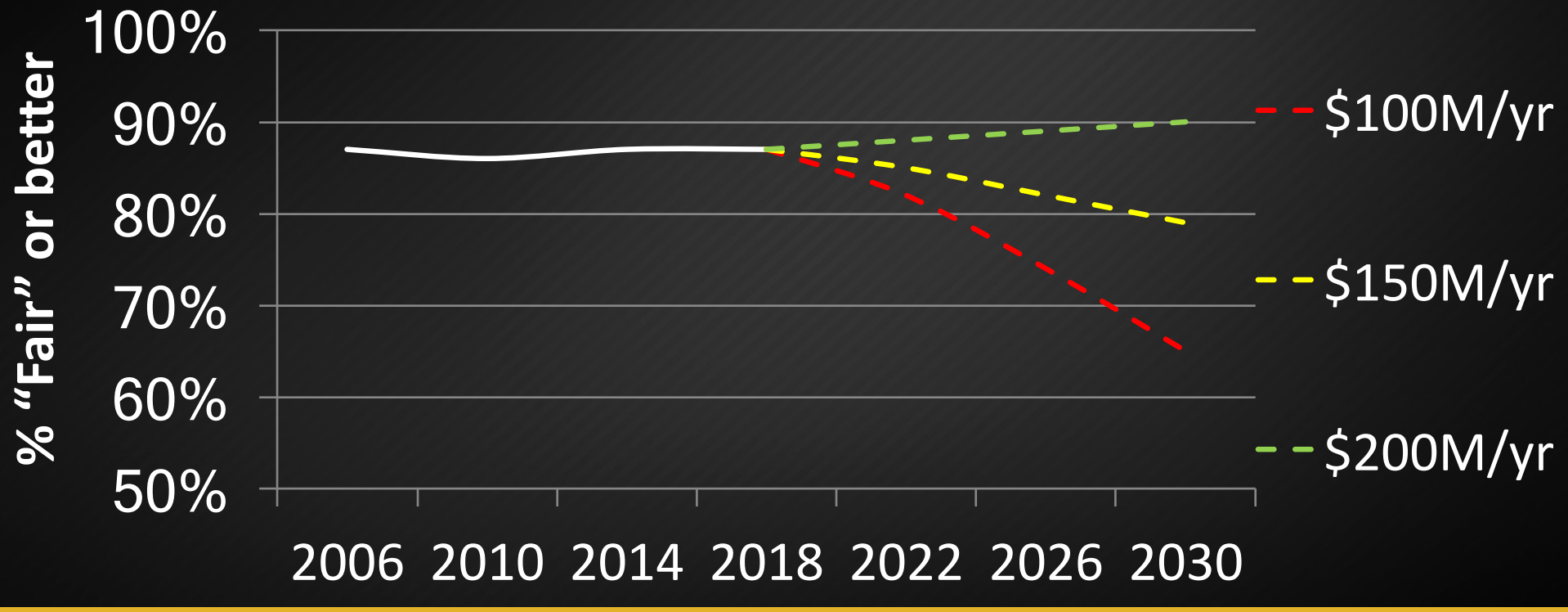



| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual | 87% | | 85% | | 86% | | 87% | | 87% | | |
| Goal | 78% | 78% | 78% | 78% | 78% | 78% | 78% | 78% | 87% | 87% | 85% |

# STRATEGIC LEVEL

- What is the condition of our roads?
- Are they getting better or worse?
- How much money should we allocate to our pavement programs?

# Funding Impacts

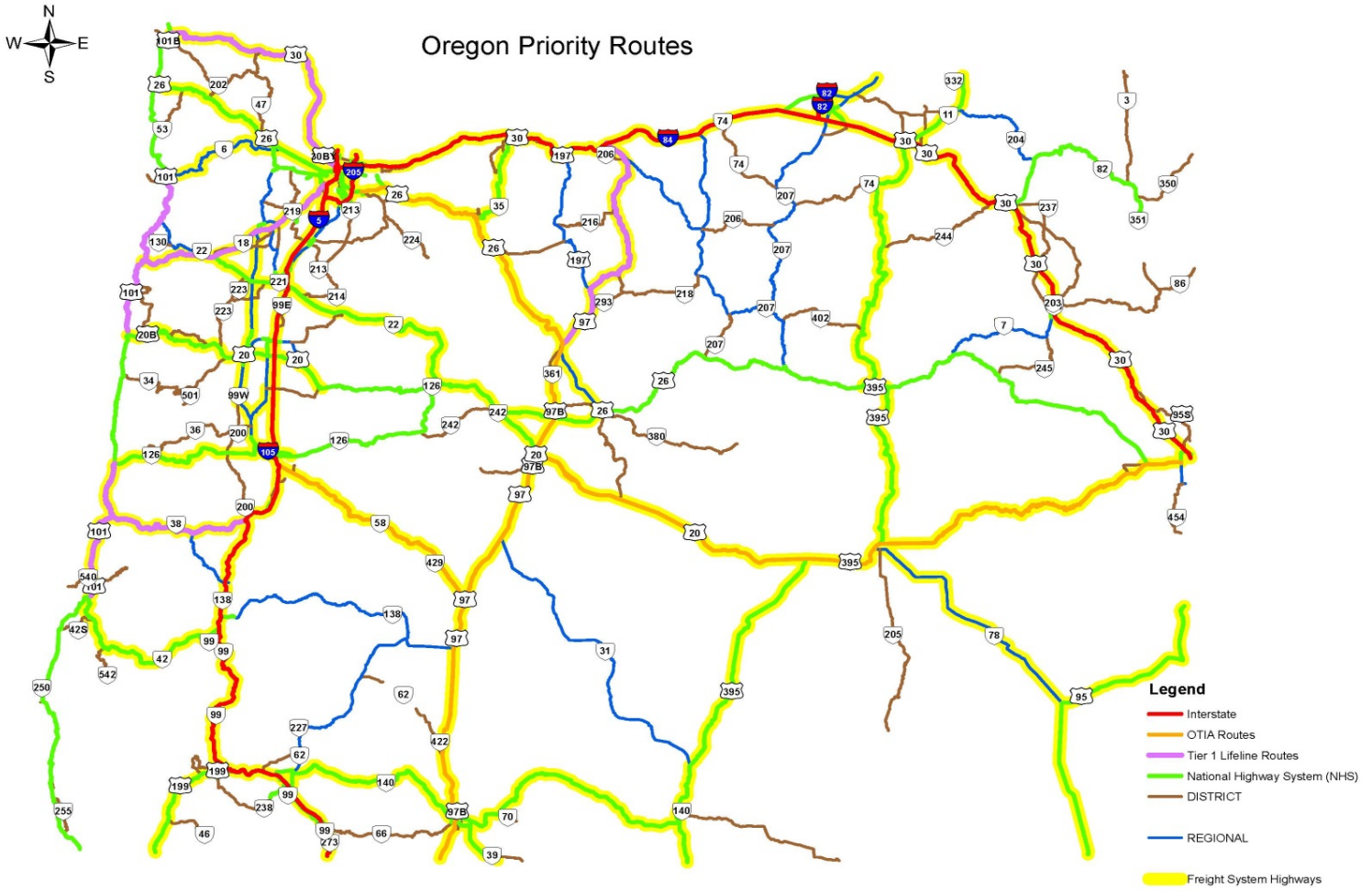


# STRATEGIC LEVEL

- What is the condition of our roads?
- Are they getting better or worse?
- How much money should we allocate to our pavement programs?
- How should we prioritize our pavement investments?

# Investment Priorities

| Route Strategy | Treatment Priorities |
|---|---|
| Level of Importance<br>1. Interstate<br>2. State Level (NHS) Routes<br>3. Region / District Level Routes | Cost / Benefit<br>1. Chip Seals / 1” Lift<br>2. 2”-3” Paving<br>3. Multi-lift 3R Paving<br>4. Reconstruction |

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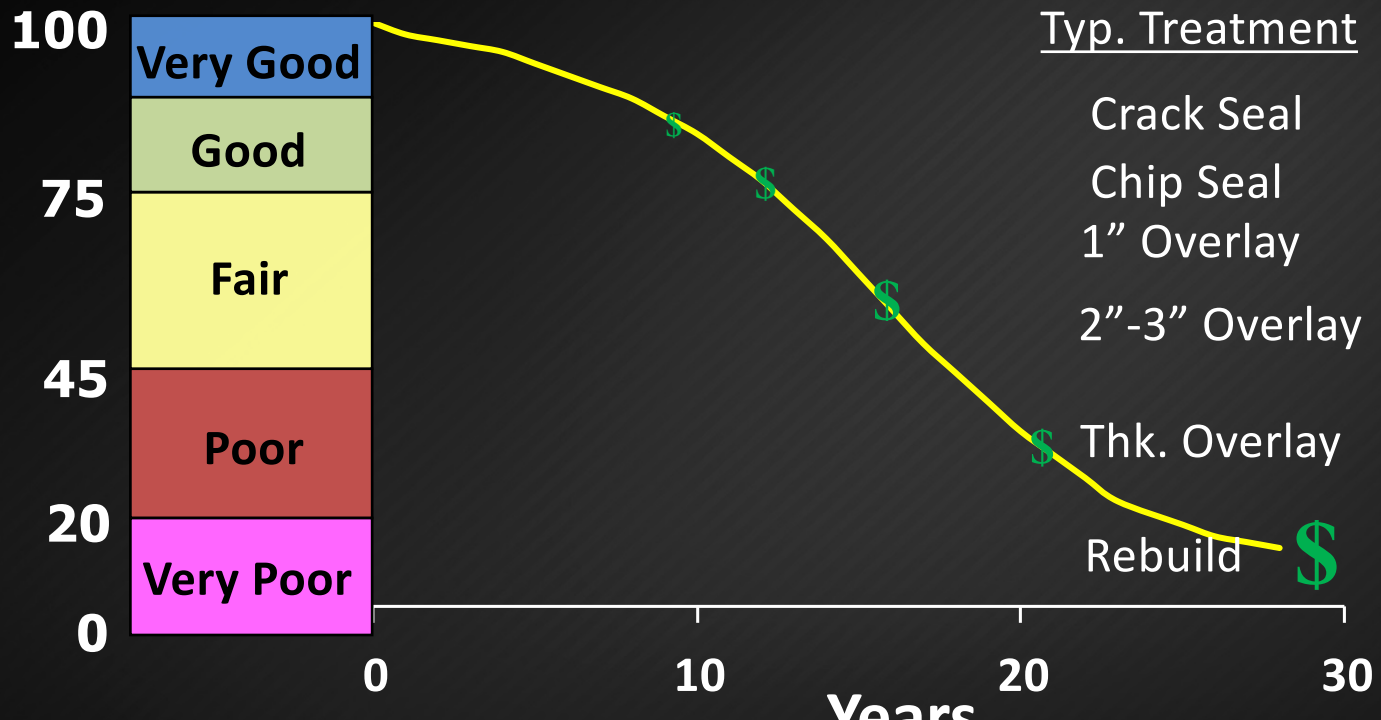
# Treatment Priorities




(varies by road section)

| Typ. Treatment | Life | $/LM/Year |
|---|---|---|
| Crack Seal | 2 yrs | $1,500 |
| Chip Seal | 5 yrs | $5,000 |
| 1” Overlay | 9 yrs | $8,000 |
| 2”-3” Overlay | 14 yrs | $12,000 |
| Thk. Overlay | 17 yrs | $16,000 |
| Rebuild | 40 yrs | $50,000 |

# NETWORK LEVEL

- How do we divide the money up?

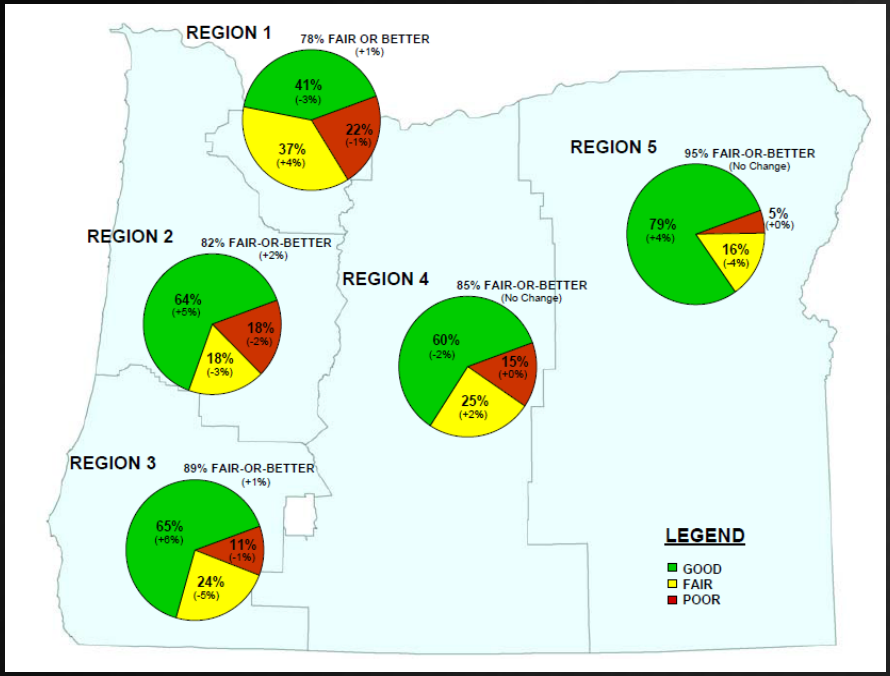
# Money Allocations

- Fix-It STIP (Federal Funds)
  - Interstate Paving
  - Region Paving
  - Chip Seals
- Maintenance Program (State Funds)
  - MIM (Interstate quick hit)
  - Low Volume (Chip Seals and Thin Paving)
  - Patching

# Interstate Allocation

- Target - minimum 95% fair or better
- Revolving 8 Year Workplan – Update every 2 yrs.
  - Current 4-Year STIP
  - Draft STIP (Years 5 and 6)
  - Future STIP (Years 7 and 8)
  - Shelf Projects

# Region Paving – Initial Allocation




1. Forecast conditions one STIP cycle ahead (8 yrs. from data year)
2. Compute % fair or better by Region
3. Compare to target (by Hwy. class)
4. Determine $ needs in each Region to reach target
5. Apply resulting percentages to funds available

# Chip Seal Allocations

- STIP – Primary Routes
  - Target Cycle Time – 6-10 years

- Maintenance – Low Volume Secondary
  - District Discretion – up to 80% of their budget
  - Target Cycle Time – 8-14 years

# NETWORK LEVEL

- How do we divide the money up?
- What projects should we do, and what year?

# Fix-It STIP Paving Program

- Timeline – Data to Construction – 6 years!
- Use PMS to develop initial priority list
  - Project conditions 6 years ahead
  - Look to paving where chip seals, crack sealing, or patching is not viable option or will no longer work
  - Priority to higher classes / traffic highways
  - Priority to projects with higher cost effectiveness

# Fix-It STIP Paving Program

- Regional preservation team (led by DM's)
  - Do road tour
  - Factor in regional and local issues, other work, etc.
  - Prioritize list for scoping

# 150% List

1. Start with Road Tour Priority List
2. Field Scope ≈200% of Initial Allocation
3. Refine Cost Estimates
   – Investigate differences - planning $ vs. scope $
4. Cut to 150% list

# New Trial Process 150% → 100%

***Applies to Pavement and Bridge Program***

| Score 1-5 for Each of these Factors | Weighting |
|---|---|
| Route Classification, ADT, Truck ADT | 25% |
| Cost Effectiveness, Delay Risk | 25% |
| Program Priority | 25% |
| Region Priority | 25% |

# Classification Points

| Classification | Score |
|---|---|
| Interstate | 5 |
| OTIA or Seismic Lifeline | 4 |
| State Class Route or NHS | 3 |
| Regional Class Route | 2 |
| District Class or Other | 1 |

# ADT Points

| Traffic Level (ADT) | Score |
|---|---|
| > 10,000 | 5 |
| >4,000 to <=10,000 | 4 |
| >1,500 to <= 4,000 | 3 |
| >500 to <=1,500 | 2 |
| <=500 | 1 |

# Truck ADT Points

| Truck ADT | Score |
|---|---|
| > 1,200 | 5 |
| >600 to <= 1,200 | 4 |
| >300 to <= 600 | 3 |
| >100 to <=300 | 2 |
| <=100 | 1 |

# Cost Effectiveness

| $ / Lane Mile / Year | Score |
|---|---|
| <= $10,000 | 5 |
| >$10,000 to <=$15,000 | 4 |
| >$15,000 to <=$20,000 | 3 |
| >$20,000 to <= $40,000 | 2 |
| >$40,000 | 1 |

# Delay Risk

- Score 1 to 5
- Looks at Consequence of Delay beyond STIP
  - Maintenance Cost / Risk
  - Pavement Repair Cost Risk (missing the window)

# Program Priority (1 to 5)

- Pavement Program Manager (yours truly) allotted 3 points per project
- Favor Projects which….

- Help performance measure achieve target
- Maximize benefit to the pavement and/or reduce maintenance requirements and costs
- Maximize long term pavement service life
- Provide safety benefits (i.e. rutting or pothole / failed pavement hazards / friction issues)
- Improve poor smoothness on routes with higher traffic speeds and freight movements

- Address severe raveling / degradation of driving surface too widespread for patching
- Minimize repetitive, reactive “throw away” maintenance costs
- Treat the disease rather than doing “short term fixes” that temporarily treat symptoms
- Have negative impacts if treatment is deferred beyond the STIP period

# Region Priority (1 to 5)

- Regions Allotted 3 points per project
- Suggested criteria include, but not limited to:
  - Maintenance Impact
  - Community Impacts (economics, travel time, freight & modal impacts, etc.)
  - Safety Impact
  - Detour or alternative route availability
  - Project Delivery Staffing implications

# 100% List

1. Combine Bridge and Pavement project in one list
2. Rank by total weighted scores
3. Send to Highway Management Team
   - use results to set final Bridge/Pavement funding levels
   - use results for regional paving splits
   - use results for initial 100% project list

# NETWORK LEVEL

- How do we divide the money up?
- What projects should we do, and what year?
- Are there bundling opportunities?
- Are there leveraging opportunities?

# 100% List → Final

- Start with 100% list
- Option to swap projects (leverage enhance)
  - Swap must be from the 150% list
  - Program Manager and District Manager must approve
- Shelf Program – develop from unselected projects

# PROJECT LEVEL

- What is this road section made of?
  - Last resurfacing  When?  What?  How thick?

# Pavement History

**SECTION:** US 30 : LEG TO BEAVER FALLS RD - SWEDETOWN RD
**HWY NO:** 092
**SEAL:**
**AGE:**
**BEGIN MP:** 54.50
**PVMT TYPE:** DGAC THIN OVLY A
**ENDING MP:** 60.94
**WC:** B-MIX
**AGE:** 19
**LENGTH:** 6.44
**REGION:** 2

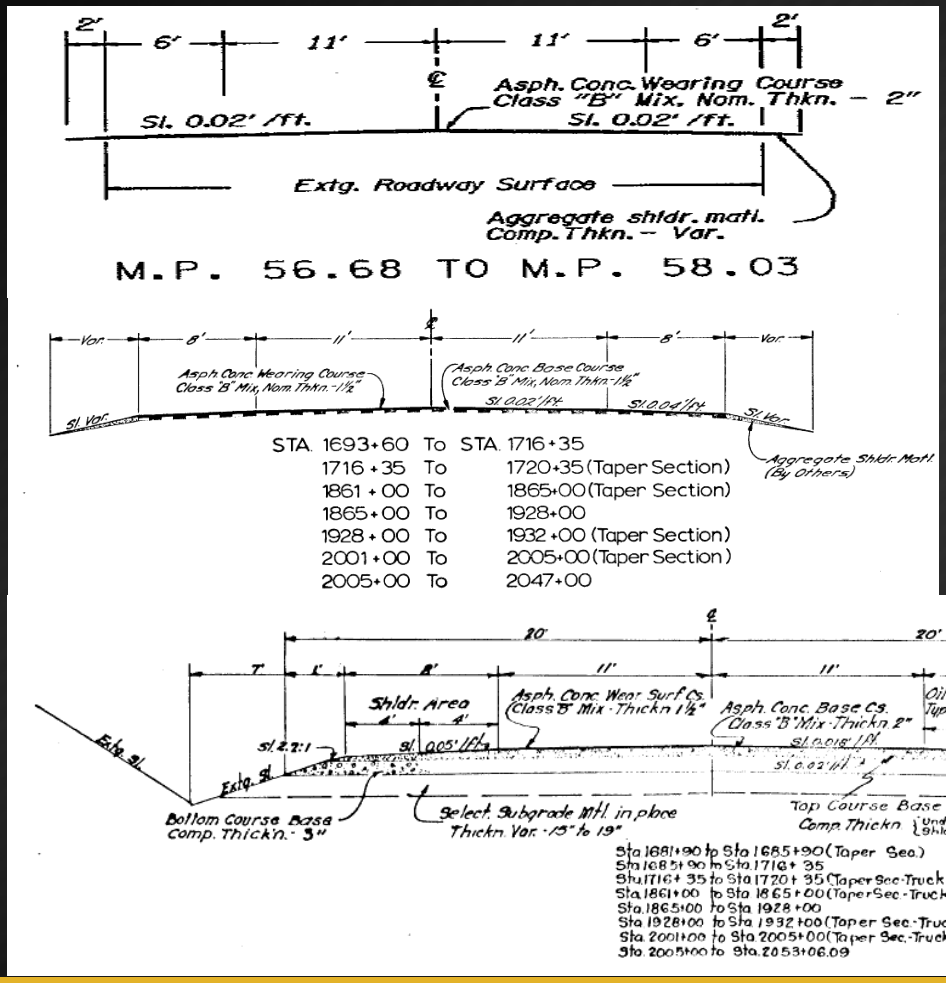
**CONSTRUCTION HISTORY**

| DATE | THKN | MTRL | THKN | MTRL | THKN | MTRL | CPPR | THKN | BASE | THKN | SUB | V-FILE | CON # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 2 | B | | | | | | | | | | 00V-226 | C11477 |
| COMMENTS: Pres list, 58.0-60.7 (1992) 2" inly in climbing lane | | | | | | | | | | | | | |
| 1972 | 1.5 | B | 1.5 | B | | | | | | | | 10V-289 | C07716 |
| COMMENTS: | | | | | | | | | | | | | |
| 1954 | 1.5 | B | 2 | B | | | | 2 | AG | 16 | AG | 5V-026 | C04172 |
| COMMENTS: | | | | | | | | | | | | | |

1995 00V-226

1972 10V-289

1954 5V-026




Total via Plans:

8.5" DGAC

4" Agg. Base

15"-19" Subbase

# Mix Design Database

2007 US30: COLUMBIA COUNTY LINE - MP 61.70 (BOAT BMP 61.70 EMP 69.95 ☑ Wearing ☑ Base C13350

**Asphalt Mix Properties:**

Mix Type: 1/2" Dense Mix

Mix Level: 3

Number of Gyrations: 100

☐ Lime Added to Mix

Asphalt Grade: PG 64-22

%Rap: 30.00

Tensile Strength Ratio: 93

**Volumetric Properties as Built:**

Effective binder content (%): 11.0013

Air voids (%): 7

Total unit weight (pcf): 147.98

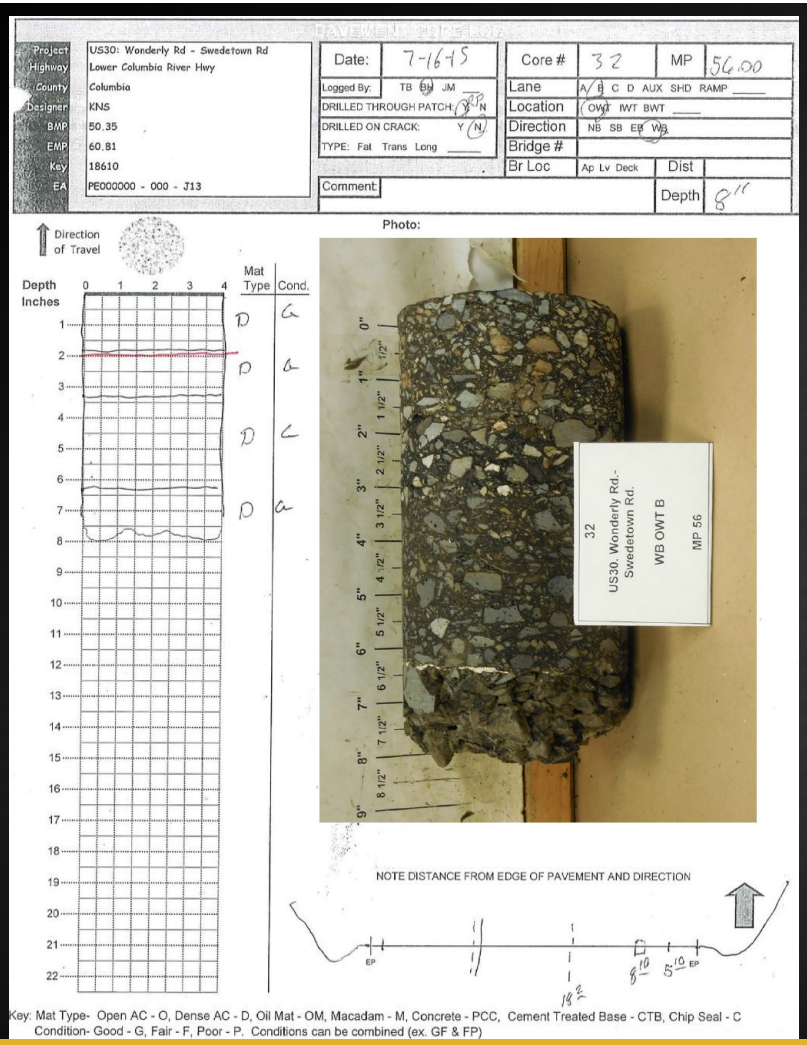
**Asphalt Mix Gradation:**

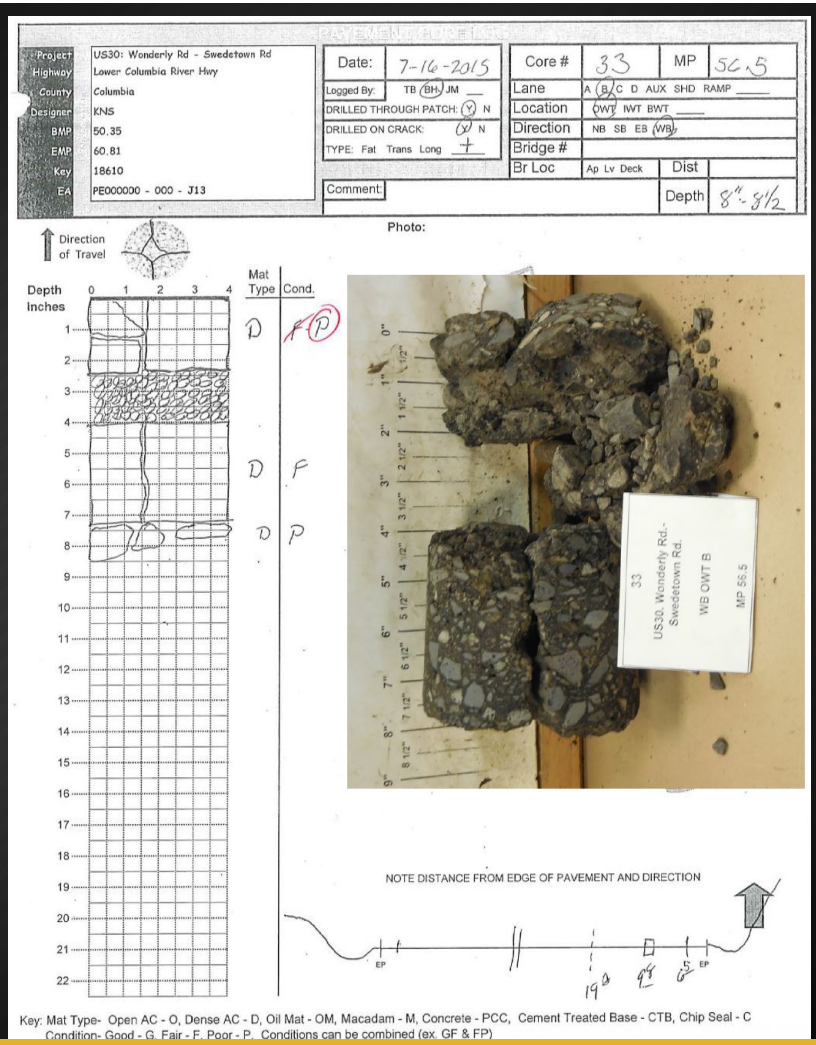
% Retained 3/4": 0

% Retained 3/8": 20

% Retained #4: 49

% Passing #200: 7.2


Project: US30: Wonderly Rd - Swedetown Rd
Highway: Lower Columbia River Hwy
County: Columbia
Designer: KNS
BMP: 50.35
EMP: 60.81
Key: 18610
EA: PE000000 - 000 - J13
Date: 7-16-15
Logged By: TB BH JM
DRILLED THROUGH PATCH: Y N
DRILLED ON CRACK: Y N
TYPE: Fat Trans Long
Core # 32
MP 56.00
Lane A B C D AUX SHD RAMP
Location OWT IWT BWT
Direction NB SB EB WB
Bridge #
Br Loc Ap Lv Deck
Dist
Depth 8"
Comment:
Direction of Travel
Depth Inches
Mat Type
Cond.
D G
D G
D C
D G
Photo:
32
US30. Wonderly Rd.-
Swedetown Rd.
WB OWT B
MP 56
NOTE DISTANCE FROM EDGE OF PAVEMENT AND DIRECTION
EP
8-10
5-10
EP
18-2
Key: Mat Type- Open AC - O, Dense AC - D, Oil Mat - OM, Macadam - M, Concrete - PCC, Cement Treated Base - CTB, Chip Seal - C
Condition- Good - G, Fair - F, Poor - P. Conditions can be combined (ex. GF & FP)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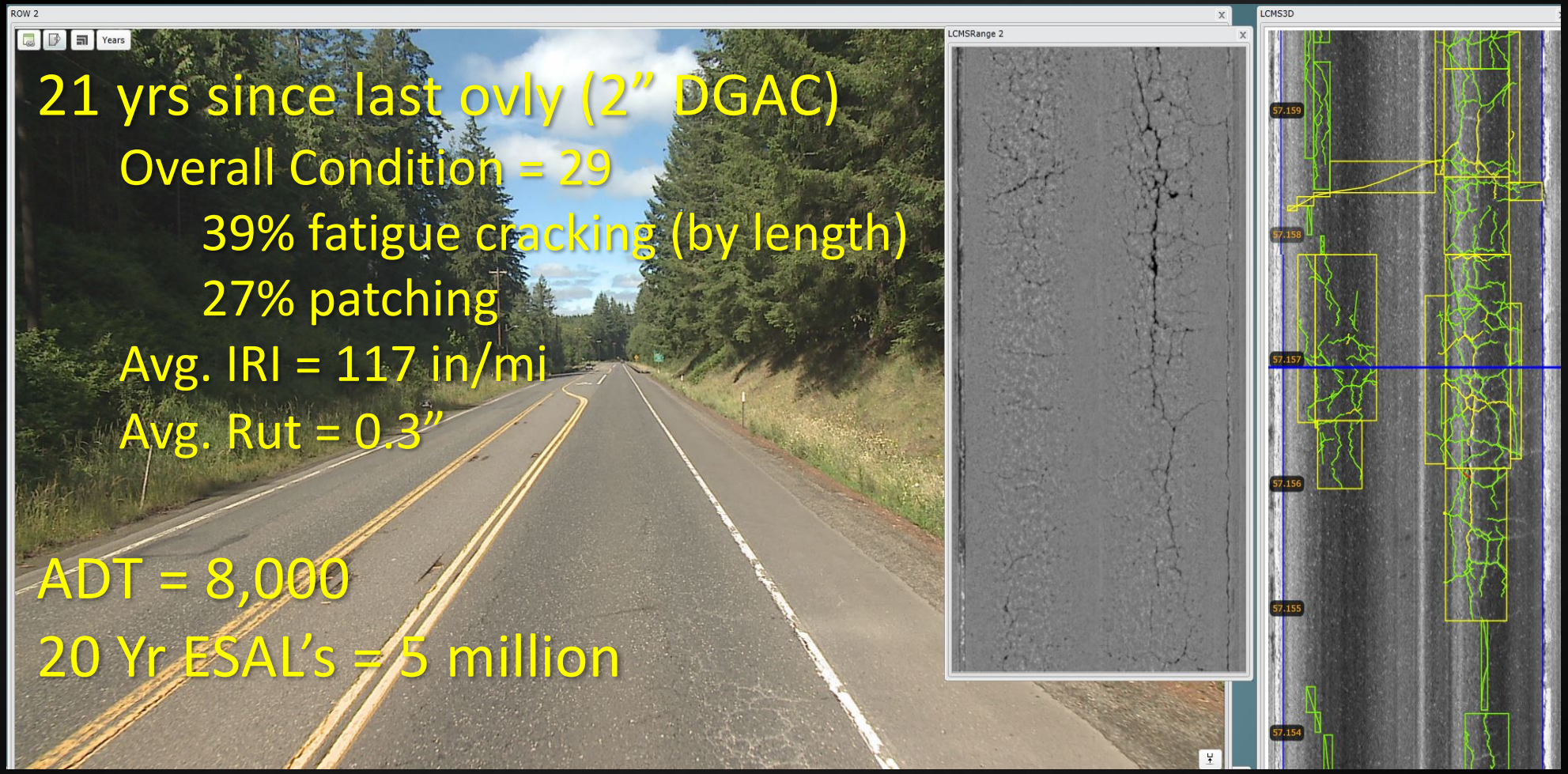
TYPE: Fat Trans Long +
Core # 33
MP 56.5
Lane A B C D AUX SHD RAMP
Location OWT IWT BWT
Direction NB SB EB WB
Bridge #
Br Loc Ap Lv Deck
Dist
Depth 8"-8 1/2
Comment:
Direction of Travel
Depth Inches
Mat Type
Cond.
D F P
D F
D P
Photo:
33
US30. Wonderly Rd.-
Swedetown Rd.
WB OWT B
MP 56.5
NOTE DISTANCE FROM EDGE OF PAVEMENT AND DIRECTION
EP
19
9-5
6-5
EP
Key: Mat Type- Open AC - O, Dense AC - D, Oil Mat - OM, Macadam - M, Concrete - PCC, Cement Treated Base - CTB, Chip Seal - C
Condition- Good - G, Fair - F, Poor - P. Conditions can be combined (ex. GF & FP)

# PROJECT LEVEL

- What is this road section made of?
  - Last resurfacing When? What? How thick?
- Performance?
  - How well has this section performed?




21 yrs since last ovly (2” DGAC)

Overall Condition = 29

39% fatigue cracking (by length)

27% patching

Avg. IRI = 117 in/mi

Avg. Rut = 0.3”

ADT = 8,000

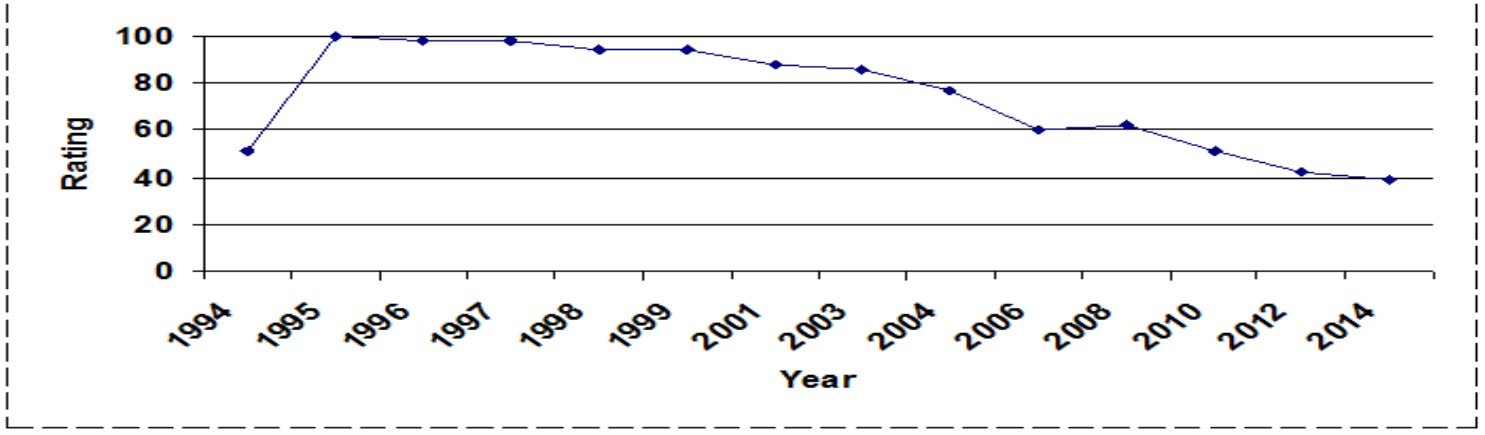
20 Yr ESAL’s = 5 million

# Performance Over Time

CONDITION HISTORY

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2001 | 2003 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RATING: | 51 | 100 | 98 | 98 | 94 | 94 | 88 | 86 | 77 | 60 | 62 | 51 | 42 | 39 |
| RUT: | 0.43 | | 0.23 | | 0.22 | | | 0.22 | 0.21 | 0.22 | 0.27 | 0.29 | 0.31 | 0.27 |
| IRI: | 127 | | 101 | | 100 | | | 87 | 87 | 89 | 96 | 110 | 124 | 119 |
| SKID: | 55 | | 49 | | 49 | | | | 47 | 49 | 45 | 50 | 53 | |

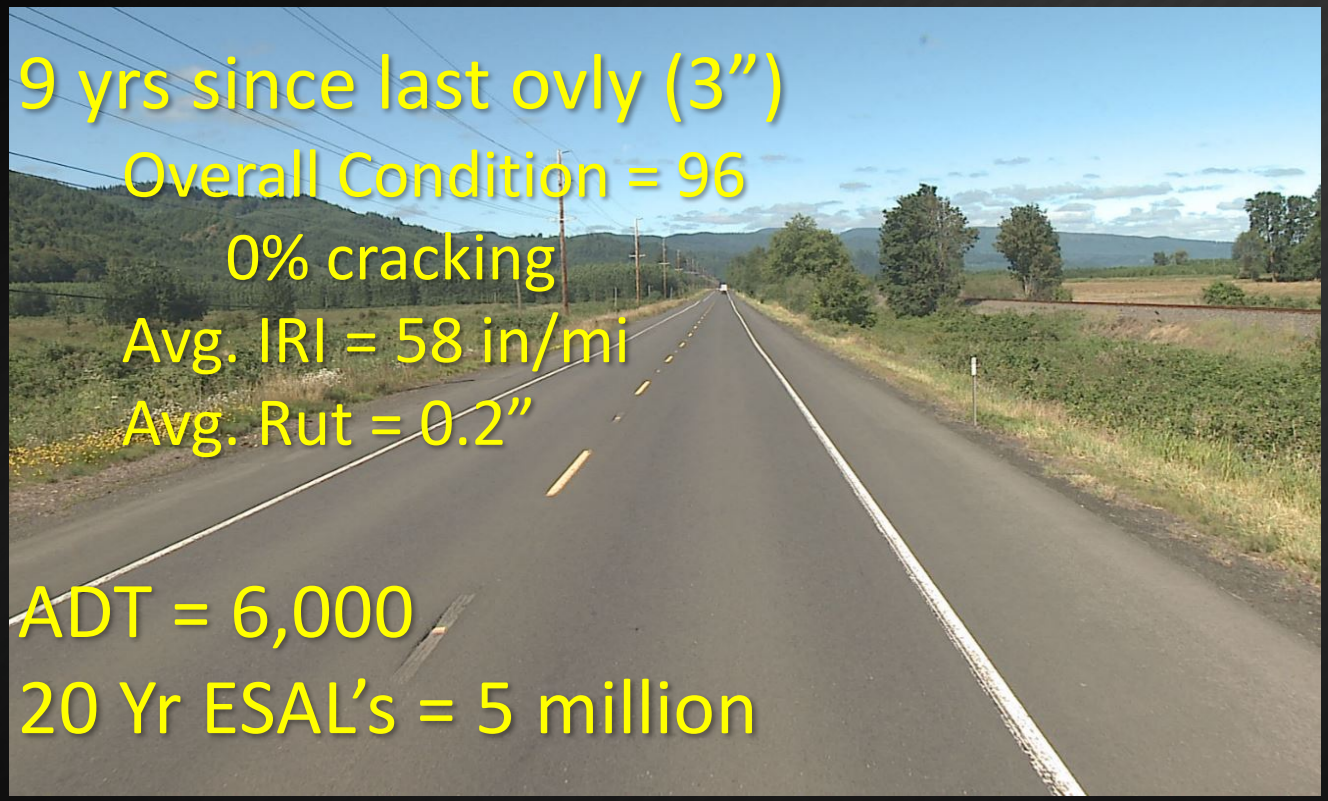
CONDITION GRAPH



# PROJECT LEVEL

- What is this road section made of?
  - Last resurfacing  When?  What?  How thick?
- Performance?
  - How well has this section performed?
  - How have other projects like the one we are planning to do been performing?

# Nearby Project - Context




Total via Plans:

8.5” DGAC

10” Agg. Base

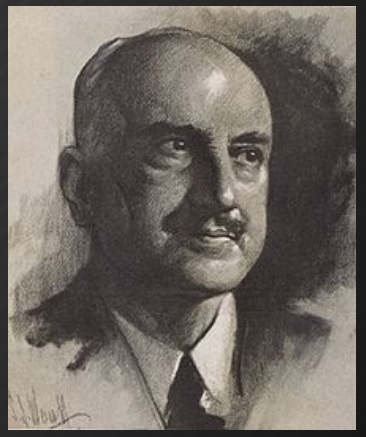
18” Subbase

# PMS Data has Lessons

- PMS data is the feedback tool for evaluating previous decisions that have been made

- PMS data can be an important knowledge transfer tool for future road managers

George Santayana



*"Those who fail to learn from history are doomed to repeat it"*

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