VDOT's Pavement Management Program

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Outline

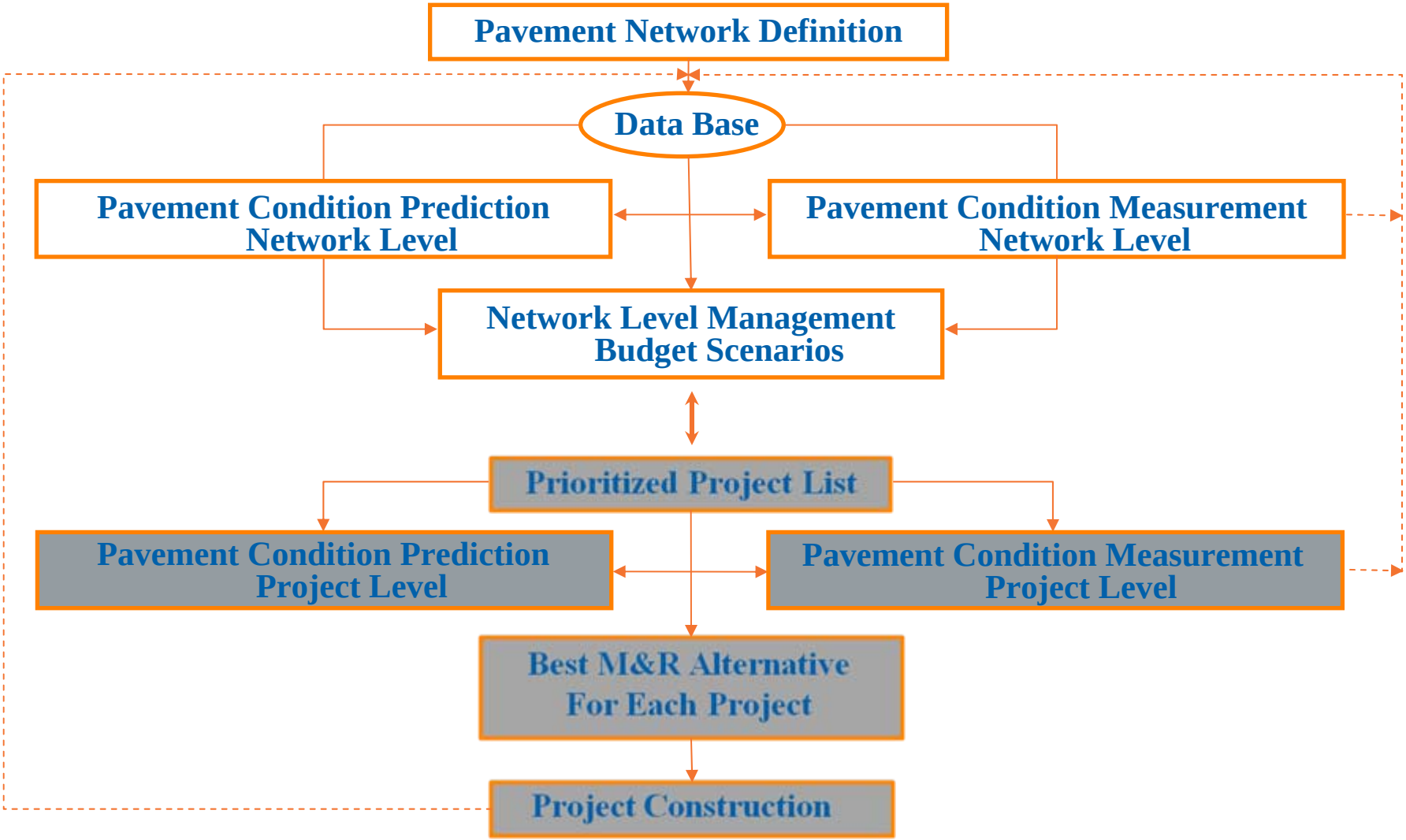
- **Pavement Management – network and project level**
- **Pavement Data Collection and QA/QC**
- **Data Analysis and Reporting – Concrete Pavements**
- **Performance-based Needs Analysis and Network Optimization**
- **Recent Successes and Lessons Learned**

Pavement Management System (PMS)

Pavement management system is a set of tools or methods that assist decision-makers in finding optimum strategies for providing, evaluating, and maintaining pavements in a serviceable condition over a period of time.

AASHTO *Guide for Design of Pavement Structures (1993)*

PMS Component – Network and Project Level



Lane Miles by District and System

District	Interstate	Primary	Secondary	Frontage	Total
Bristol	533	2,953	12,296	112	15,894
Salem	490	2,666	14,665	107	17,929
Lynchburg	0	2,798	12,362	35	15,195
Richmond	1,315	3,418	13,671	79	18,483
Hampton Roads	872	1,766	7,076	92	9,807
Fredericksburg	281	2,170	9,140	24	11,615
Culpeper	279	1,851	8,163	52	10,345
Staunton	942	2,472	10,481	76	13,971
Nova	684	1,548	10,207	81	12,520
Statewide	5,395	21,642	98,061	660	125,758

Approximately 18% of interstate and 3% of primary mileages are exposed concrete pavement

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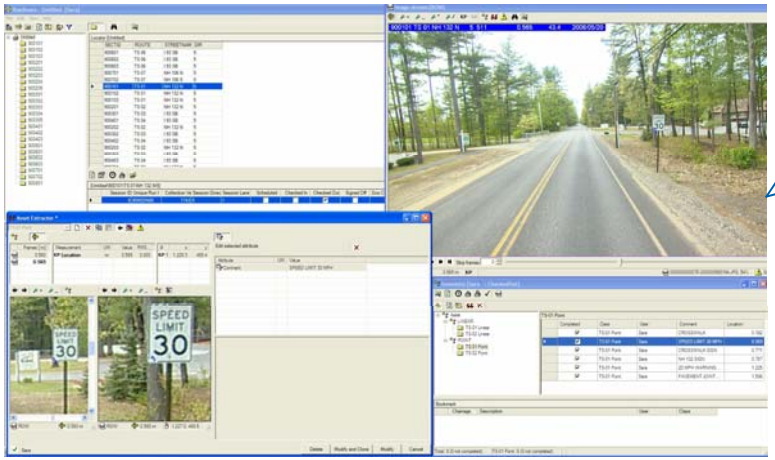
Pavement Distress Data

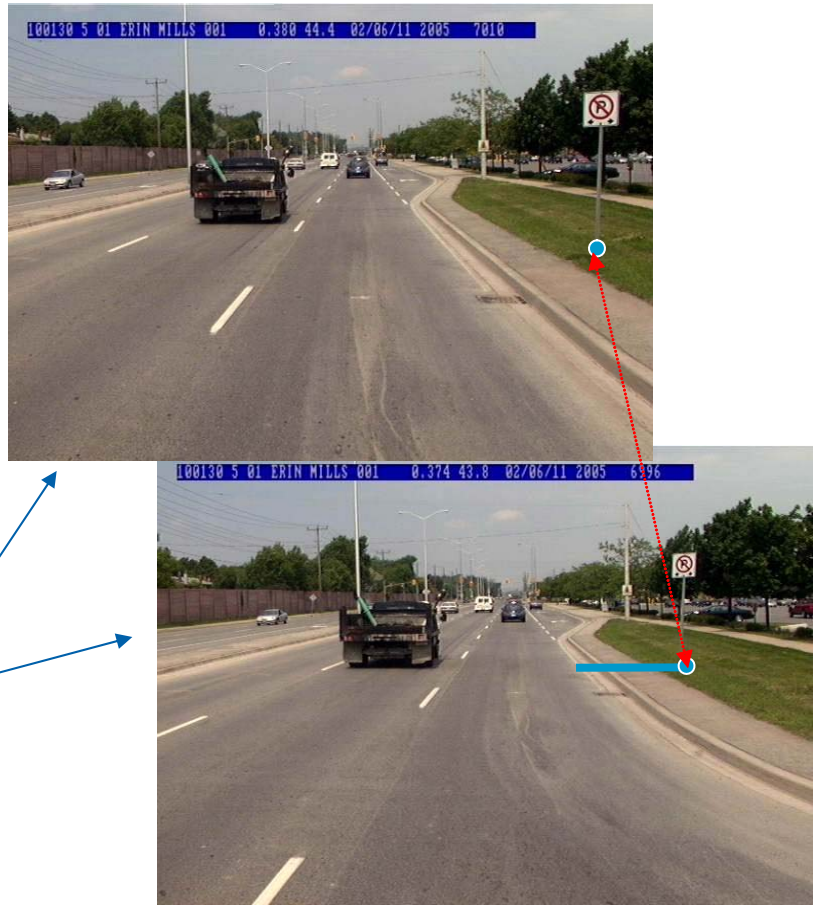
- **Pavement distress data collection in VDOT**
  - **Two unsuccessful contracts in the 90s**
  - **Windshield surveys from ‘01 to ‘06**
  - **Automated data collection since 2006**
- **Pavement distress data now being collected using digital images and analyzed using a automated crack detection methodology**

Automated Pavement Distress Analysis

Asset Inventory Methodology

- Calibrated camera
- Linear and geo-referenced images
- Software triangulates position





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Data Reporting Needs

- Yearly ‘State of the Pavement’ Report
- Legislative reports on Infrastructure Condition and Maintenance Needs (Biennial)
- Report to the Commonwealth Transportation Board
- Report to public Dashboard
- Report to FHWA (HPMS)
- Yearly paving schedule preparation

Distress Evaluation - Concrete Pavement

Type	Jointed	Continuously Reinforced
Distress	Corner Breaks	Transverse Cracking
	Joint Seal Condition	Cluster Cracking
	Spalling of Transverse Joints	Punchouts and Spalled "Y" Cracks
	Spalling of Longitudinal Joints	PCC Patch / Patch Deterioration
	Transverse Cracking	Asphalt Patch
	Longitudinal Cracking	Longitudinal Cracking
	Divided Slabs	Longitudinal Joint Spalling
	Blowups	Longitudinal Pavement / Shoulder Joint Seal Condition
	PCC Patch / Patch Deterioration	
	Asphalt Patch	
	Joint Faulting	

Pavement Condition Indices – Concrete Pavement

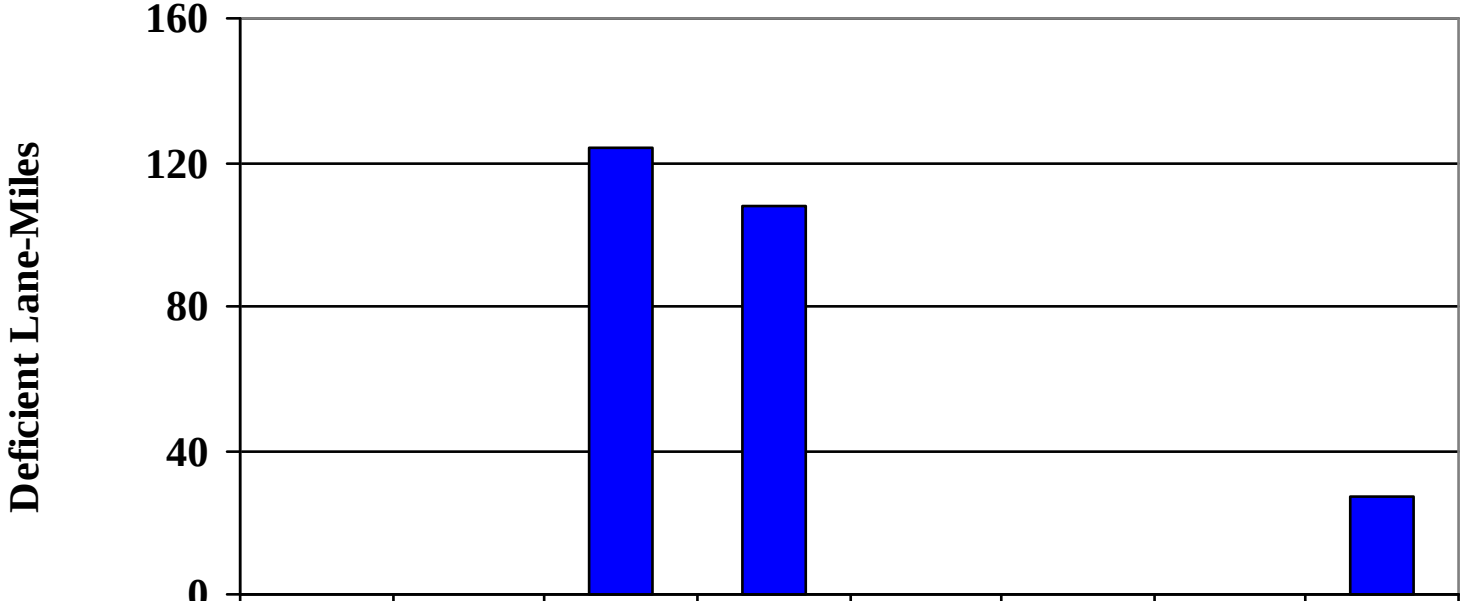
- **Jointed Concrete Pavement:**
  - **Slab distress rating (SDR)**
- **Continuously Reinforced Concrete Pavement**
  - **Concrete Distress Rating (CDR)**
  - **Concrete Punchout Rating (CPR)**
- **The lower of the two index values is the Critical Condition Index (CCI)**
- **All indices are on 0 to 100 scale**

Pavement Condition Category

Pavement Condition	Index Scale (CCI)
Excellent	90 and above
Good	70 - 89
Fair	60 - 69
Poor	50 - 59
Very Poor	49 and below

Pavements rated below 60 are termed as “deficient”

Deficient Lane Miles - Interstate Pavement



	1/BR	2/SA	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Total	-	-	124	108	-	-	-	27
Continuous	-	-	117	45	-	-	-	-
Jointed	-	-	7	63	-	-	-	27

Major Distress on Interstate Concrete Pavement

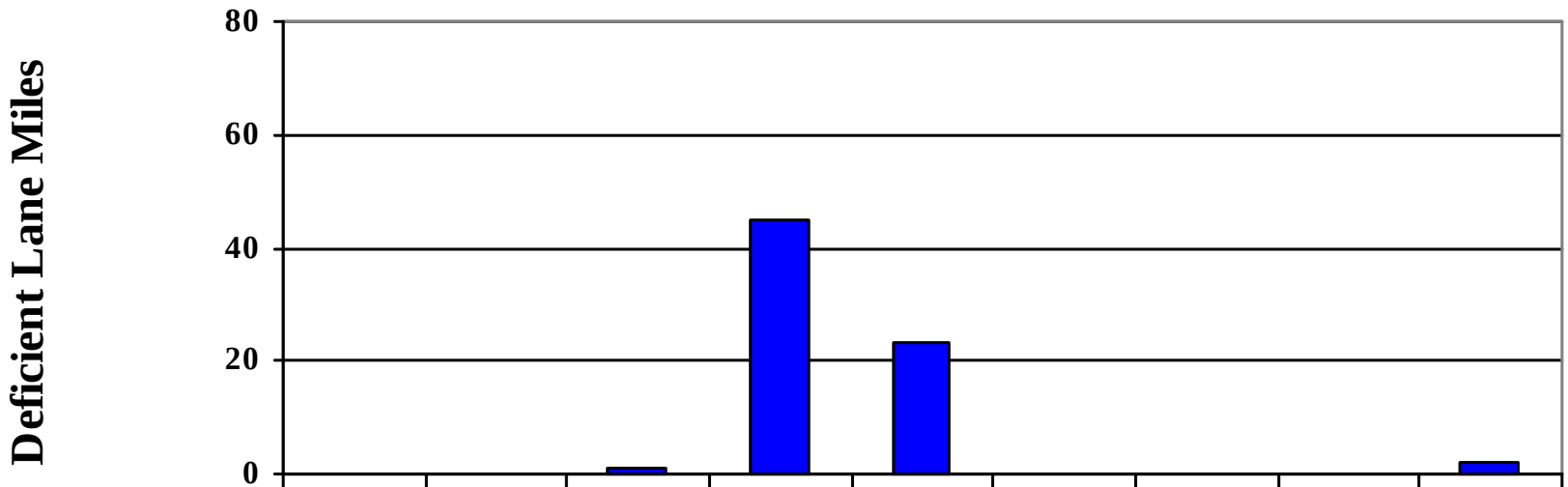
Jointed

Key Distresses	4/RI	5/HR	9/NO
Transverse Cracking (% slabs)	12.0%	9.4%	2.9%
Corner Breaks (% slabs)	2.5%	1.7%	2.4%
PCC Patching (% slabs)	10.4%	1.3%	8.6%
Asphalt Patching (% slabs)	29.0%	6.0%	8.4%

Continuously Reinforced

Key Distresses		4/RI	5/HR
Asphalt Patching (% total area)		2.0%	0.6%
Punchout (% total area)		0.2%	0.2%
PCC Patching (% total area)		2.8%	5.1%
Transverse Cracking	ft/lane mile	8,617	5,928
	Spacing (ft)	5.9	8.0

Deficient Lane Miles - Primary Pavement



	1/BR	2/SA	3/LY	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Total	-	-	1	45	23	-	-	-	2
Continuous	-	-	0	36	19	-	-	-	-
Jointed	-	-	1	9	4	-	-	-	2

Major Distress on Primary Concrete Pavement

Jointed

Key Distresses	D3 LY	D4 RI	D5 HR	D9 NO
Transverse Cracking (% slabs)	21.8%	9.2%	10.0%	6.1%
Corner Breaks (% slabs)	0.5%	3.0%	3.3%	10.6%
PCC Patching (% slabs)	0.1%	2.8%	6.5%	10.6%
Asphalt Patching (% slabs)	0.0%	4.2%	5.8%	41.7%

Continuously Reinforced

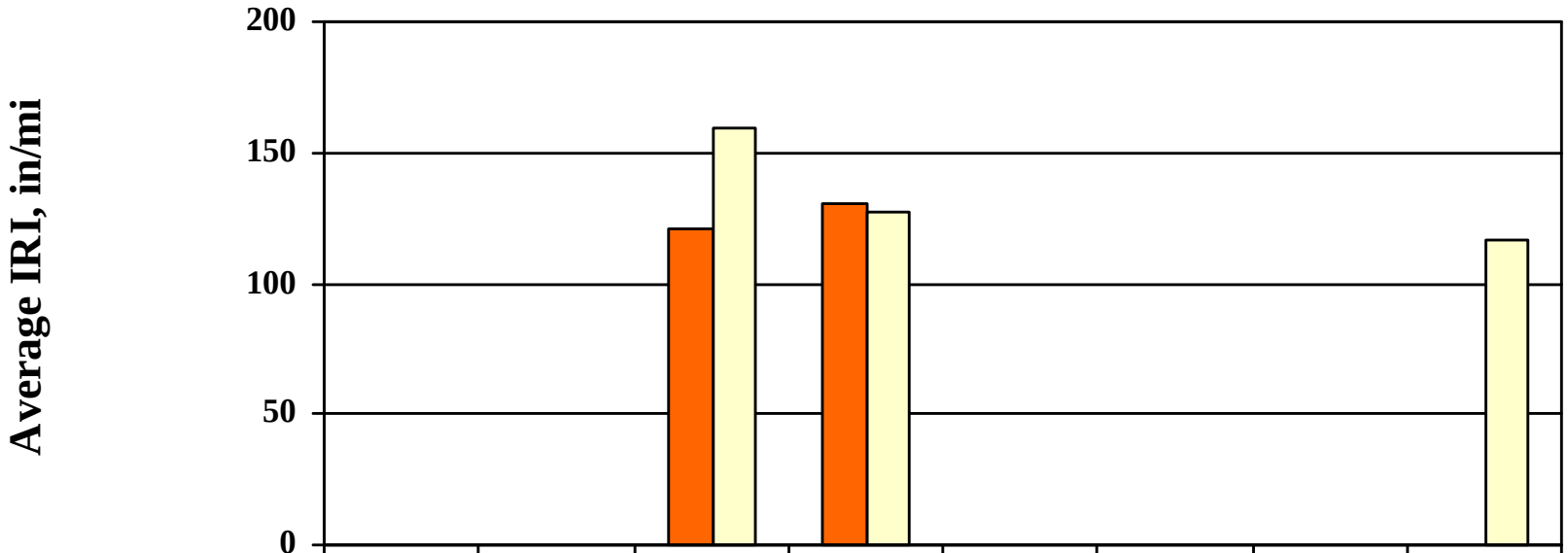
Key Distresses		D3 LY	D4 RI	D5 HR
Asphalt Patching (% total area)		0.0%	0.6%	0.1%
Punchout (% total area)		0.1%	0.4%	0.7%
PCC Patching (% total area)		0.5%	3.6%	12.0%
Transverse Cracking	ft/lane mile	9,530	6,960	7,228
	Spacing (ft)	6.2	7.8	7.9

Pavement Ride Quality Category

Ride Quality Category	IRI Rating (inch/mile) Interstate & Primary
Excellent	< 60
Good	60 to 99
Fair	100 to 139
Poor	140 to 200
Very Poor	≥ 200

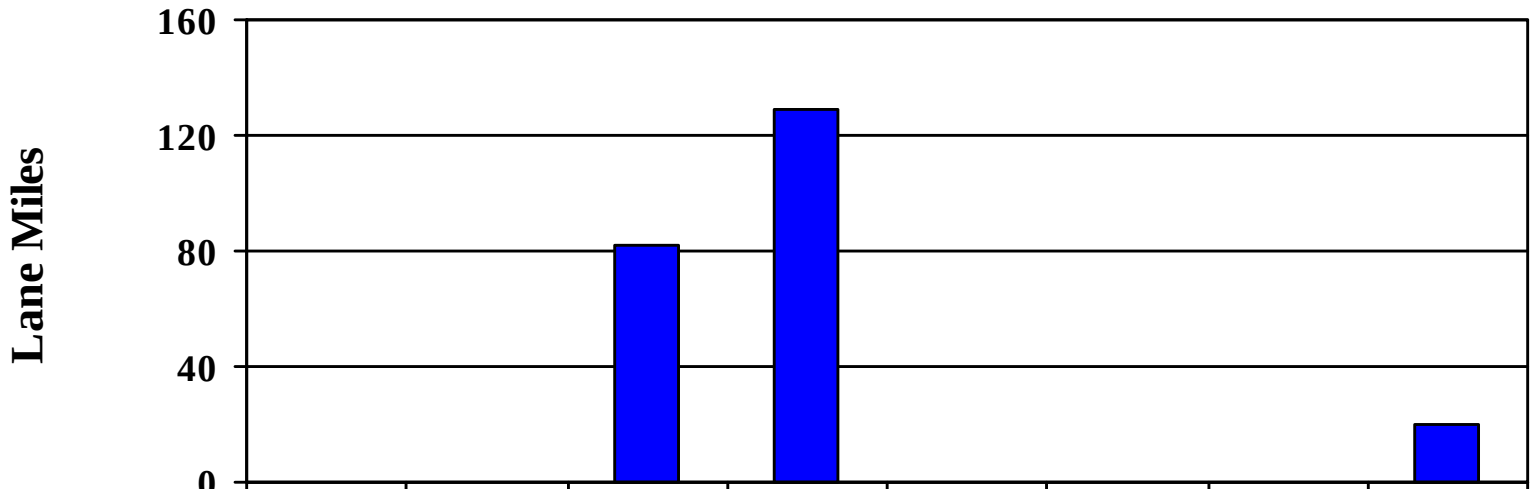
Pavements with poor and very poor ride quality are considered to have "deficient" ride quality.

Average IRI - Interstate Pavement



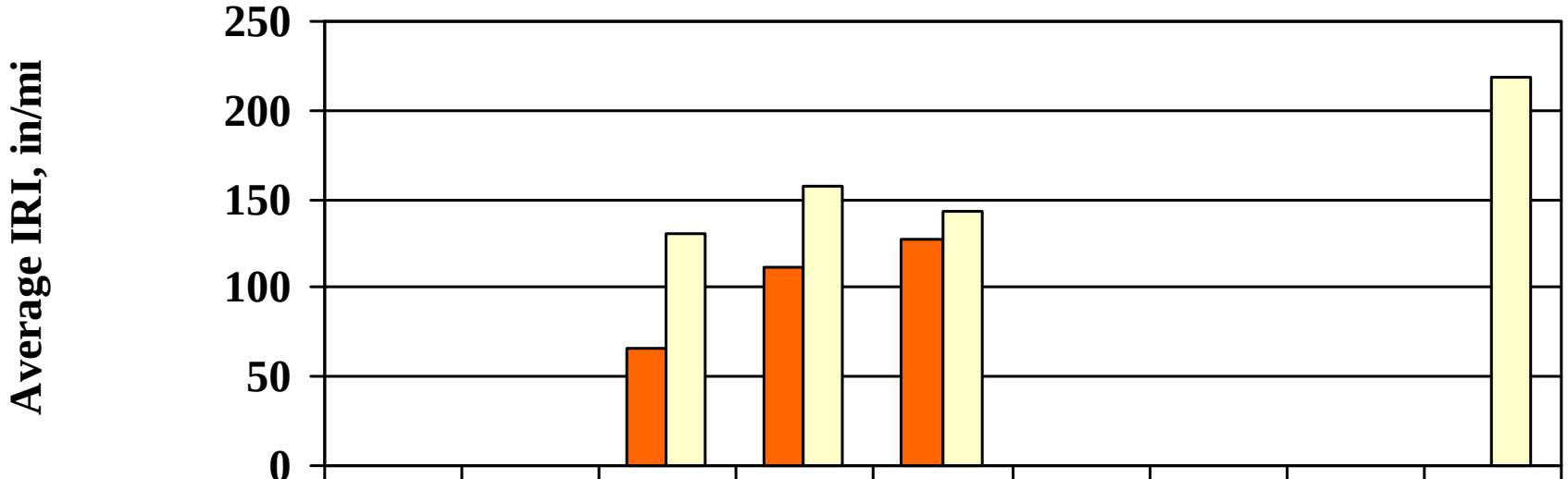
	1/BR	2/SA	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Continuous	-	-	121	130	-	-	-	-
Jointed	-	-	159	127	-	-	-	117

Deficient Lane Miles Due to Ride Quality – Interstate Pavement



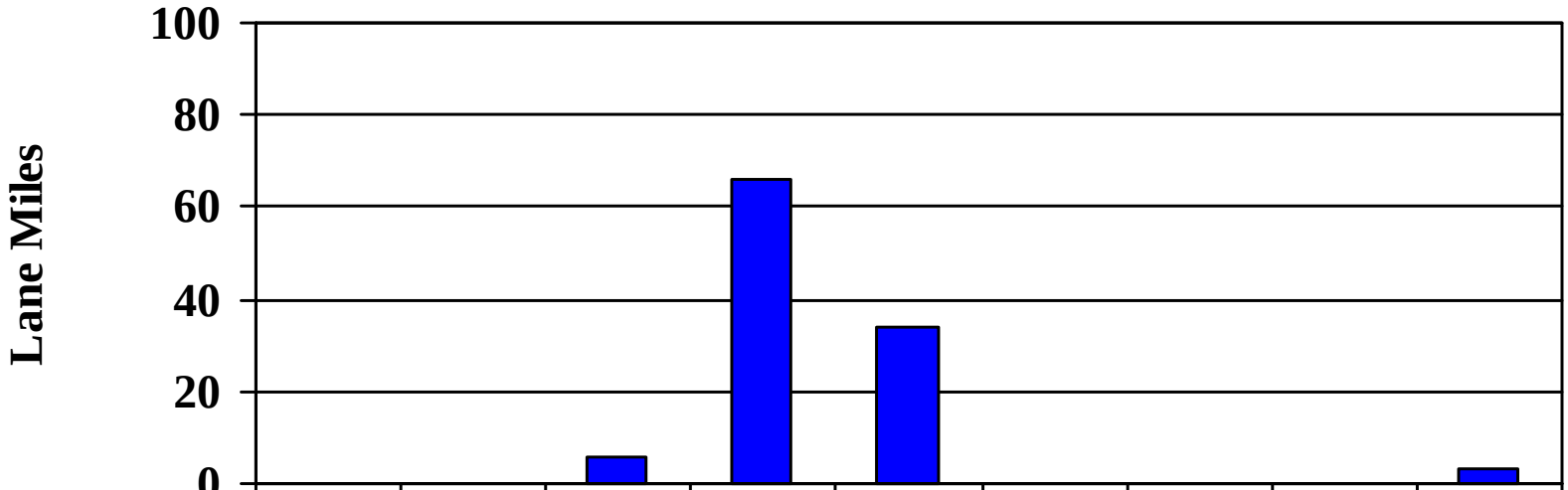
	1/BR	2/SA	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Deficient	-	-	82	129	-	-	-	20
Continuous	-	-	74	33	-	-	-	-
Jointed	-	-	8	96	-	-	-	20

Average IRI - Primary Pavement



	1/BR	2/SA	3/LY	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Continuous	-	-	66	111	128	-	-	-	-
Jointed	-	-	130	158	143	-	-	-	218

Deficient Lane Miles Due to Ride Quality – Primary Pavement



	1/BR	2/SA	3/LY	4/RI	5/HR	6/FR	7/CU	8/ST	9/NO
Deficient	-	-	6	66	34	-	-	-	3
Continuous	-	-	0	18	20	-	-	-	-
Jointed	-	-	6	48	14	-	-	-	3

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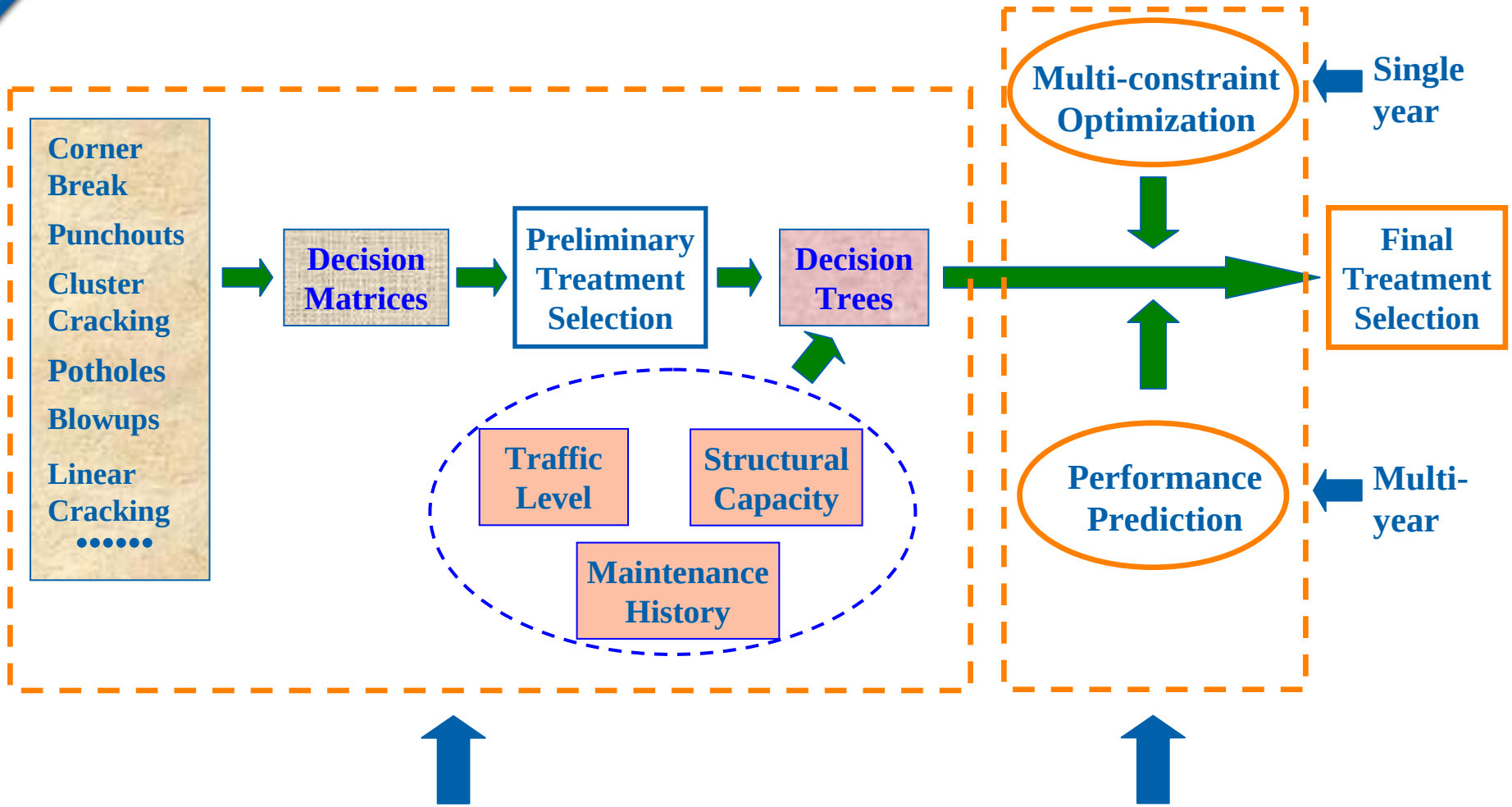
Maintenance Needs Analysis

- **Two Types of Needs Analysis**
  - **Unconstrained**
    - Provides a recommended treatment for entire network
    - Based on pavement condition, age, traffic and FWD Data
  - **Performance-based (Optimization)**
    - Uses performance targets, prediction models and constraints to optimize treatment selection and budgeting
- **Both use a common set of maintenance activities and costs**

Performance Based Needs – Optimization

- Collect and apply condition data to management sections
- Develop pavement deterioration prediction models
- Develop criteria for pavement maintenance activity selection
- Establish performance measures and targets
- Create planning scenarios and run optimizations
- Determine performance based needs

Decision Trees and Optimization



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Recent Successes in Implementing Pavement Management Program in Virginia

- **Reasonably “accurate” and “repeatable” automated pavement condition for the last four years**
- **Implementation of a web-based pavement management system that utilizes the data to make sound decisions**
- **Optimization results have been used for pavement maintenance budgeting and allocation**
- **Geospatial integration of the pavement condition data with traffic and other asset management systems**
- **Easy access of the pavement data and images by the users**
- **Both field level and executive (and legislative) level buy-in**

Recent Successes in Implementing Pavement Management Program in Virginia

- **Visible Outcomes**
  - **Allocation of dedicated pavement maintenance funds**
  - **Agency-wide use of pavement condition data (long – range transportation planning, PPTA, etc.)**
  - **High visibility of the data (Pavement condition data on the agency's public dashboard)**
- **Outcomes (I would like to see!)**
  - **Dedicated funding for preservation activities**
  - **Improvement of the pavement network condition**

Thank You