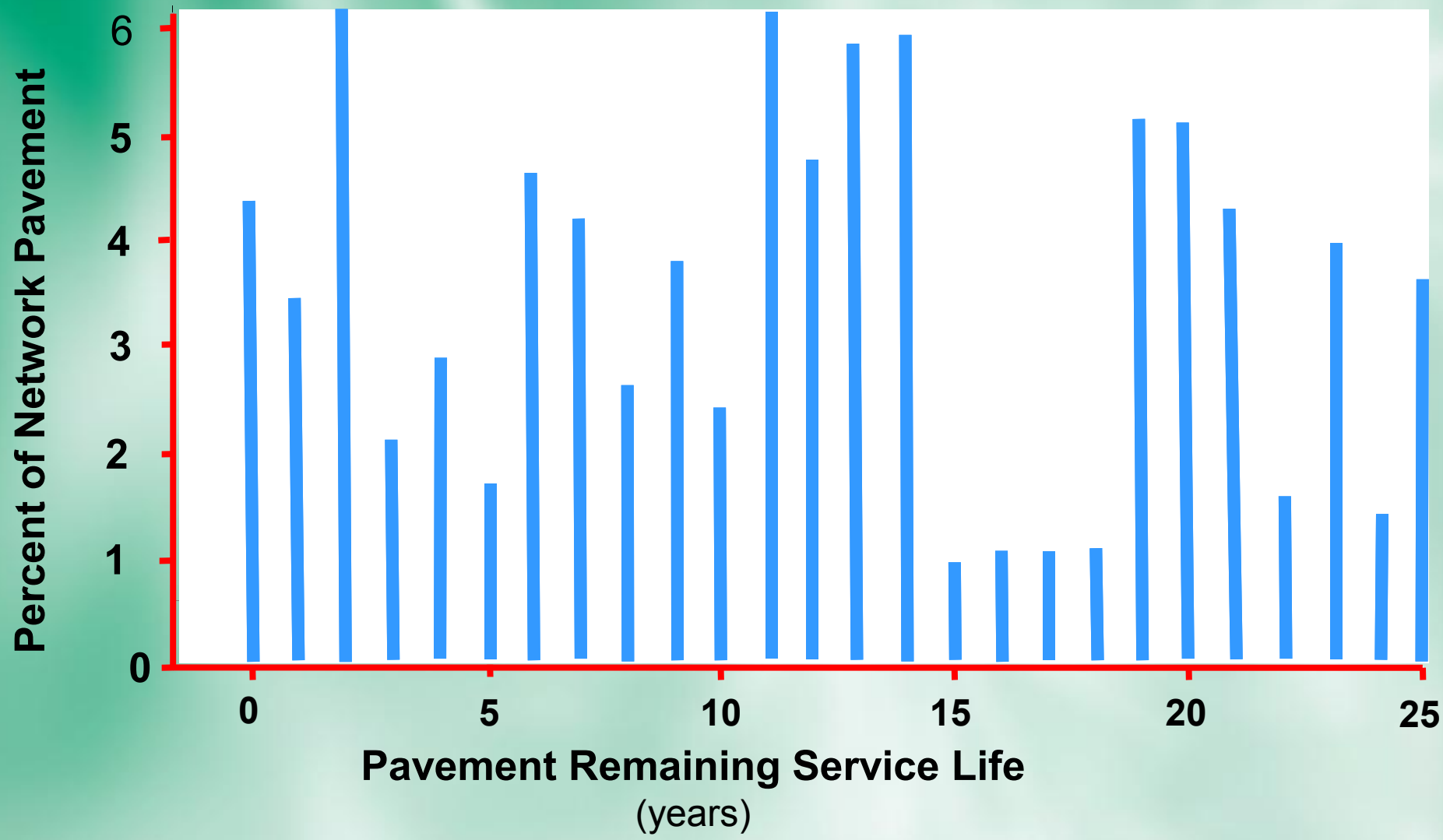
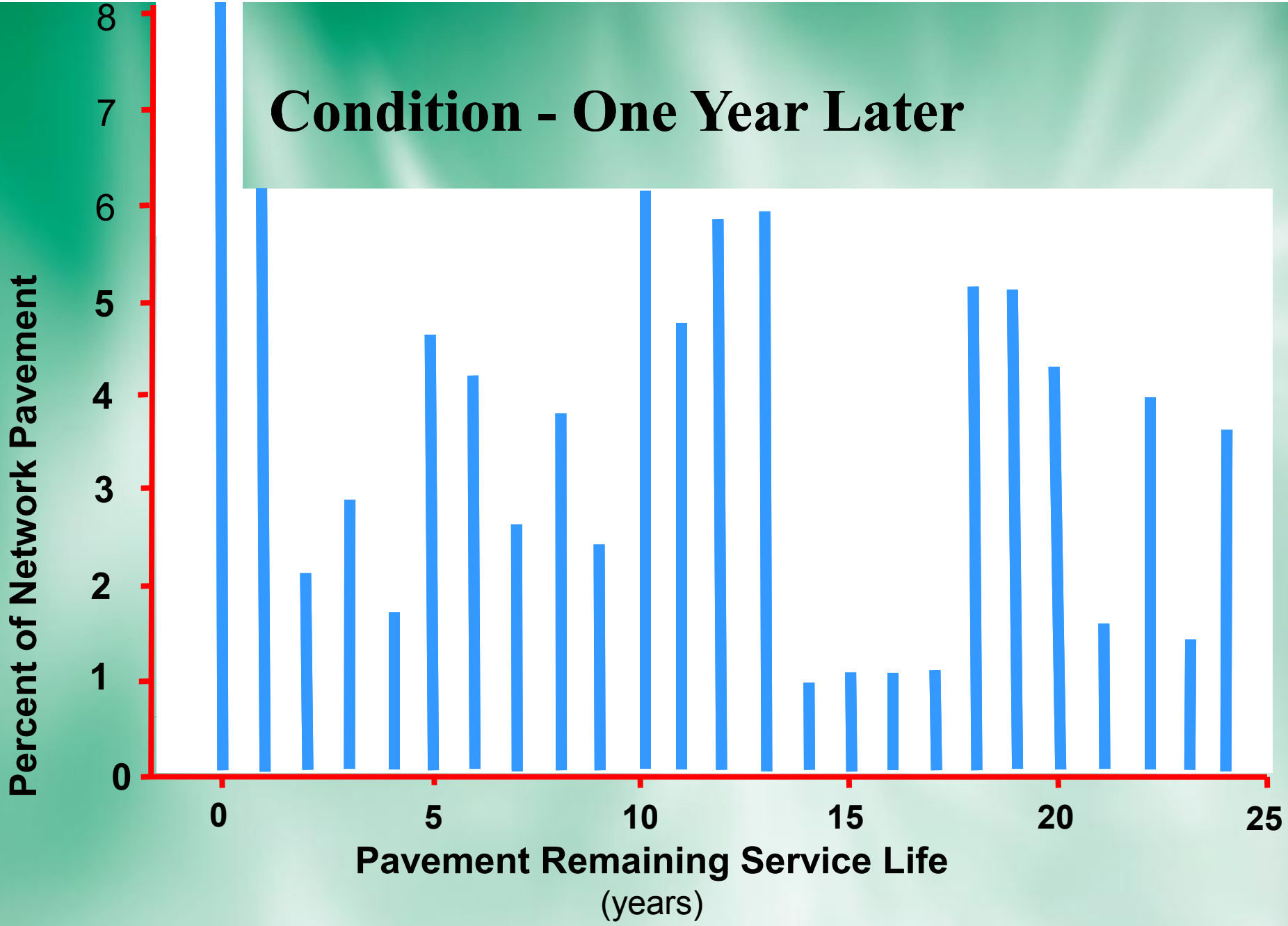
Project Selection

A Key to Success

Current Condition



Condition - One Year Later

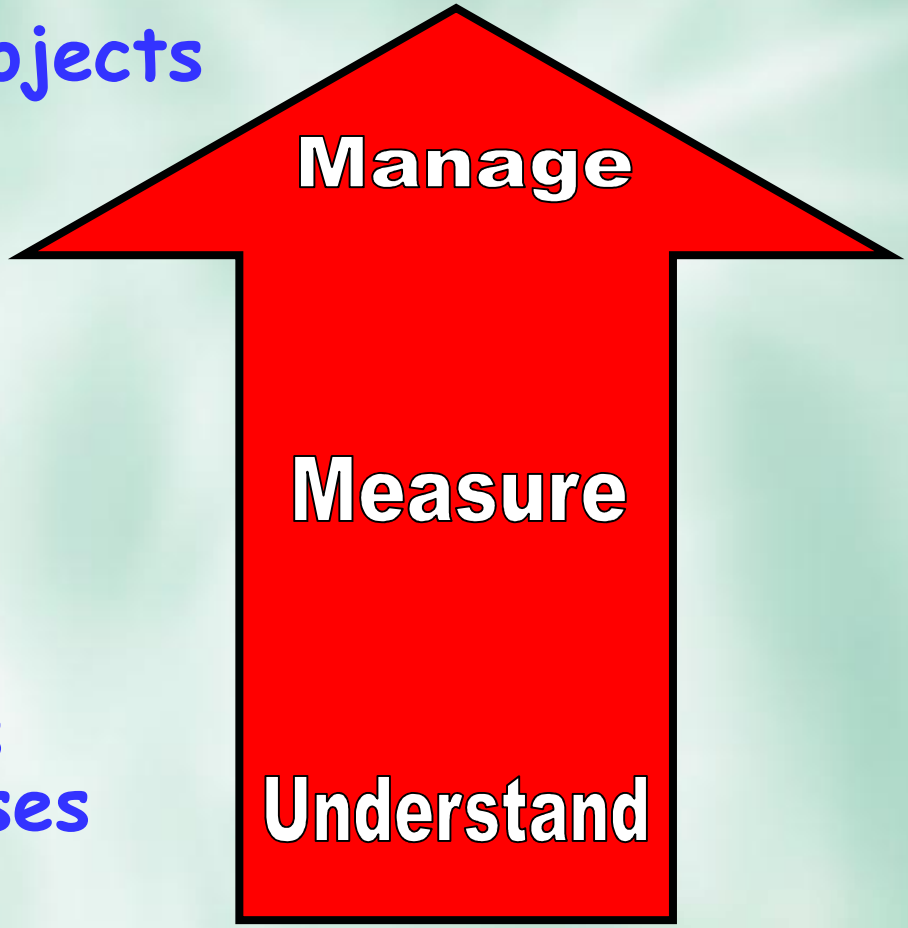


How to Select Projects

You cannot properly select projects unless you manage pavements

You cannot manage pavements unless you measure conditions

You cannot measure conditions unless you understand distresses



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Characteristics of Pavement Work Activities

Activity Type	Activity Subcategory	Increases Capacity	Increases Strength	Reduces Aging	Restores Serviceability
Capital Improvement	New Construction	X	X	X	X
	Reconstruction	X	X	X	X
	(Structural) Major Rehabilitation		X	X	X
	(Structural) Resurfacing		X	X	X
Pavement Preservation	(Non-Structural) Minor Rehabilitation			X	X
	Preventive Maintenance			X	X
	Routine Maintenance				X
Maintenance	Corrective Maintenance				X
	Reactive Maintenance				X
	Catastrophic Maintenance				X

Source: FHWA Office of Asset Management

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How to Manage Pavements

- Establish pavement network goals
- Measure pavement conditions
- Utilize a treatment toolbox
- Quantify performance
- Create strategic plan

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Establish Network Pavement Goals

Goals Should Be Measureable

Potential Examples

- Provide Good Pavement Condition
- Increase Ride Quality
- Extend Pavement Life
- Ensure Cost-Effectiveness
- Reduce User Delays

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Measure Pavement Conditions

- Identify Distress Types
- Determine Severity Levels
- Separate Structural & Functional Distresses
- Understand the Cause of Each Distress

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Flexible Pavement Distresses

1. Alligator (fatigue) Cracking
2. Bleeding
3. Block Cracking
4. Corrugation
5. Depression
6. Joint Reflective Cracking
7. Lane/Shoulder Drop Off or Heave
8. Lane/Shoulder Separation
9. Longitudinal & Transverse Cracking
10. Patch Deterioration
11. Polished Aggregate
12. Potholes
13. Pumping & Water Bleeding
14. Raveling, Weathering, Stripping
15. Rutting
16. Slippage Cracking
17. Swelling

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ALLIGATOR (fatigue) CRACK
(LOW SEVERITY)

ALLIGATOR (fatigue) CRACK

(MEDIUM SEVERITY)

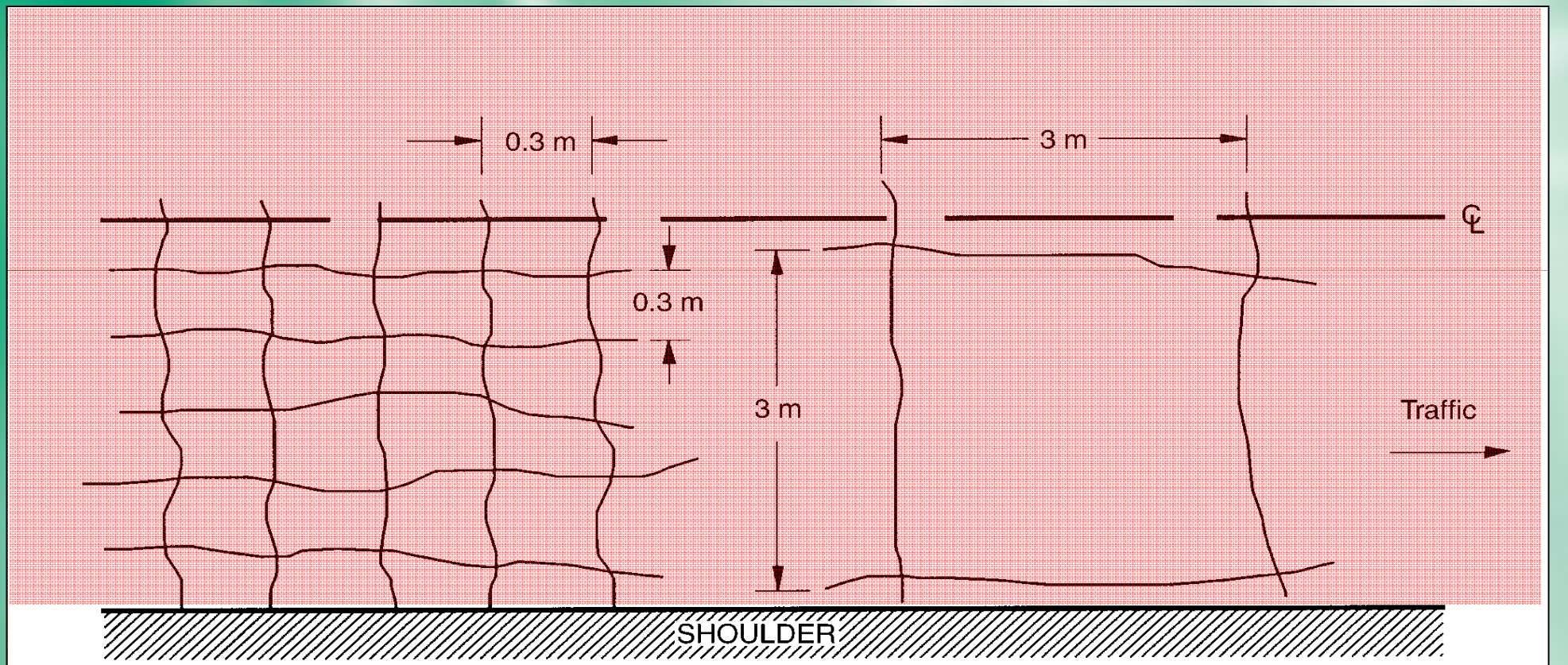
ALLIGATOR (fatigue) CRACK

(HIGH SEVERITY)

BLEEDING

BLEEDING

INITIATION OF BLOCK CRACKING



BLOCK CRACKING
(LOW SEVERITY)

BLOCK CRACKING
(MEDIUM SEVERITY)

BLOCK CRACKING
(HIGH SEVERITY)

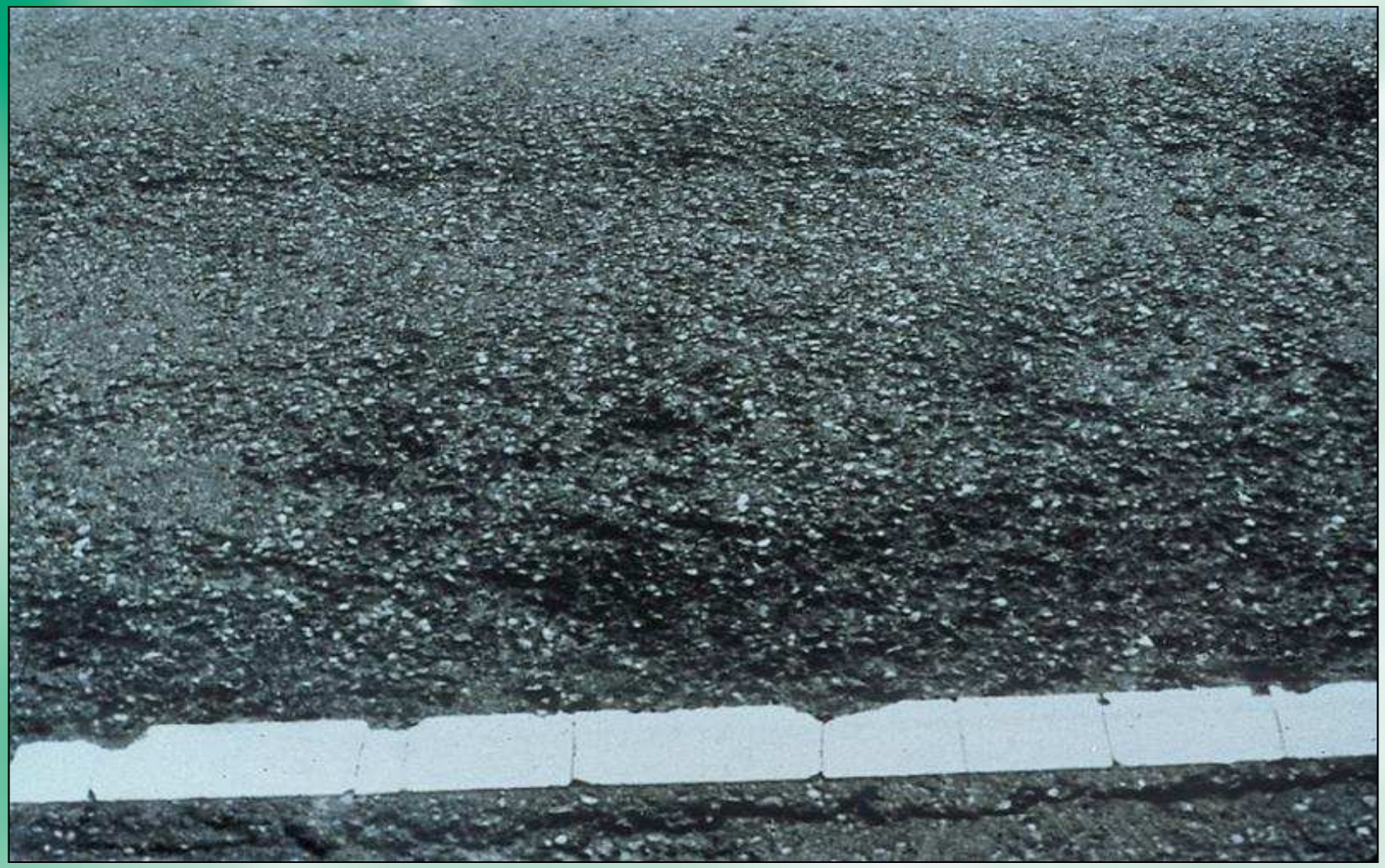
POLISHED AGGREGATE

POLISHED AGGREGATE

POTHOLE *(MEDIUM SEVERITY)*

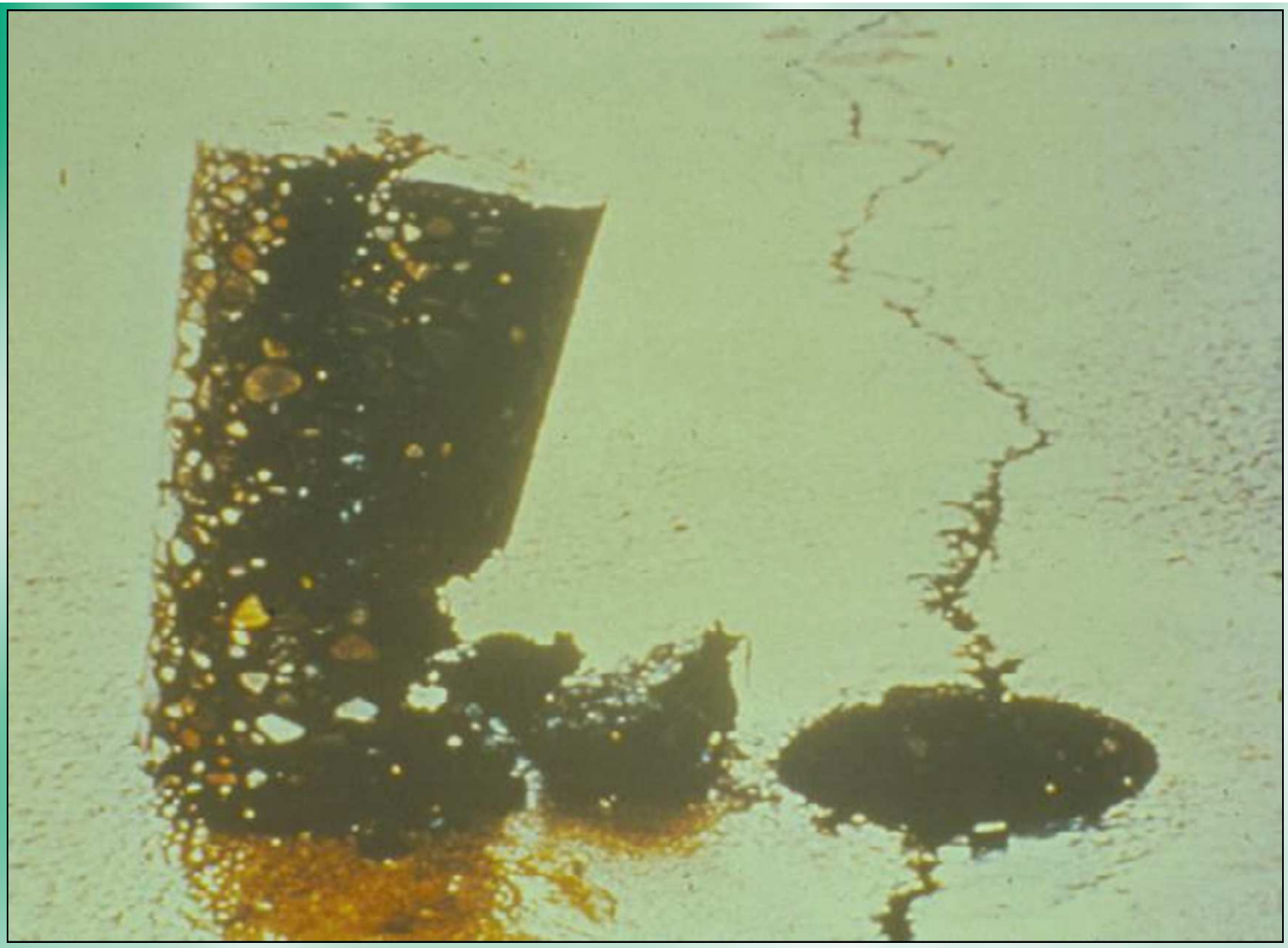
POTHOLE *(HIGH SEVERITY)*

RAVELING
(LOSS OF FINE AGGREGATE)

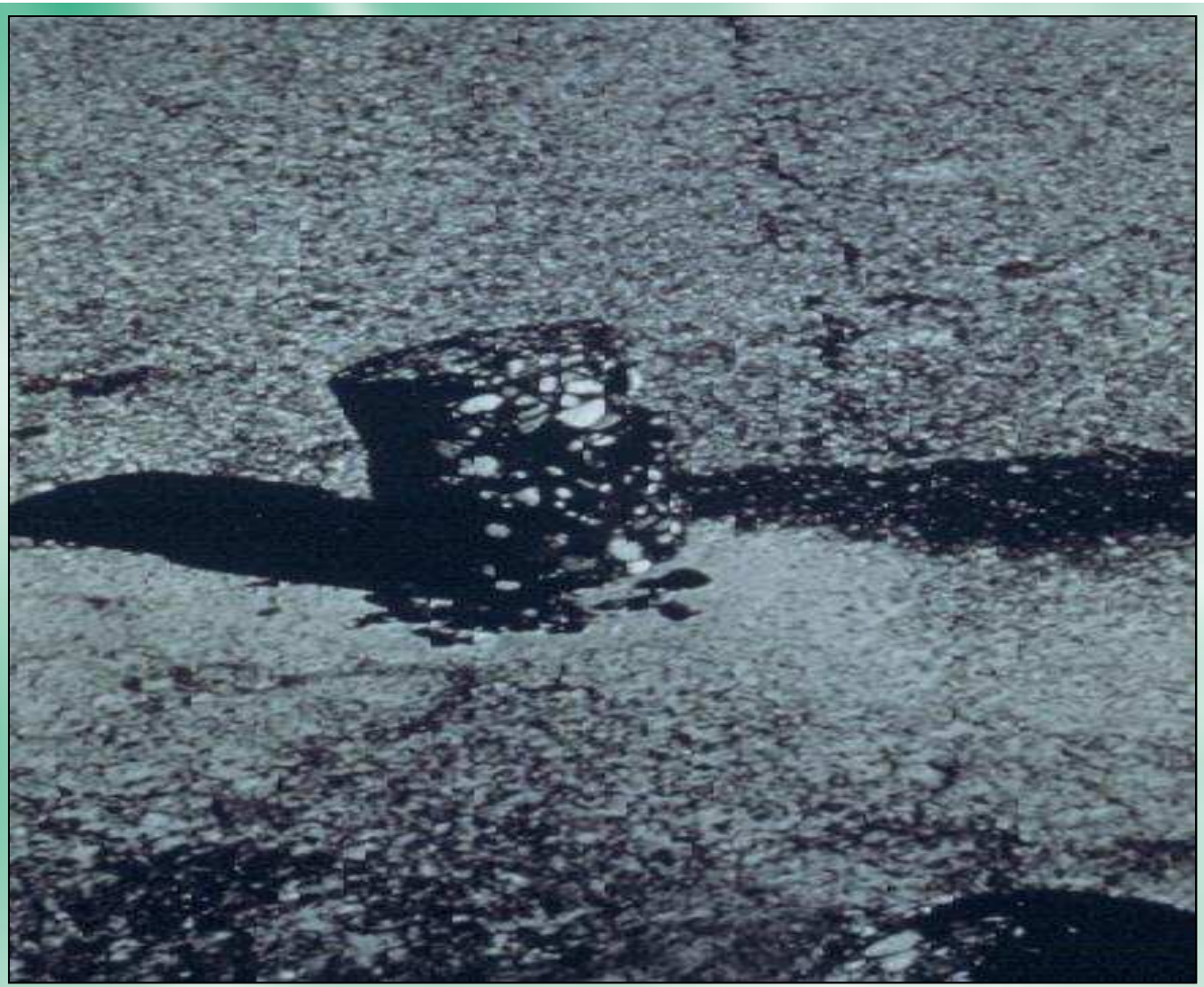


RAVELING
(LOSS OF COURSE AGGREGATE)

STRIPPING



STRIPPING



RUTTING

RUTTING
(HYDROPLANING, SAFETY)

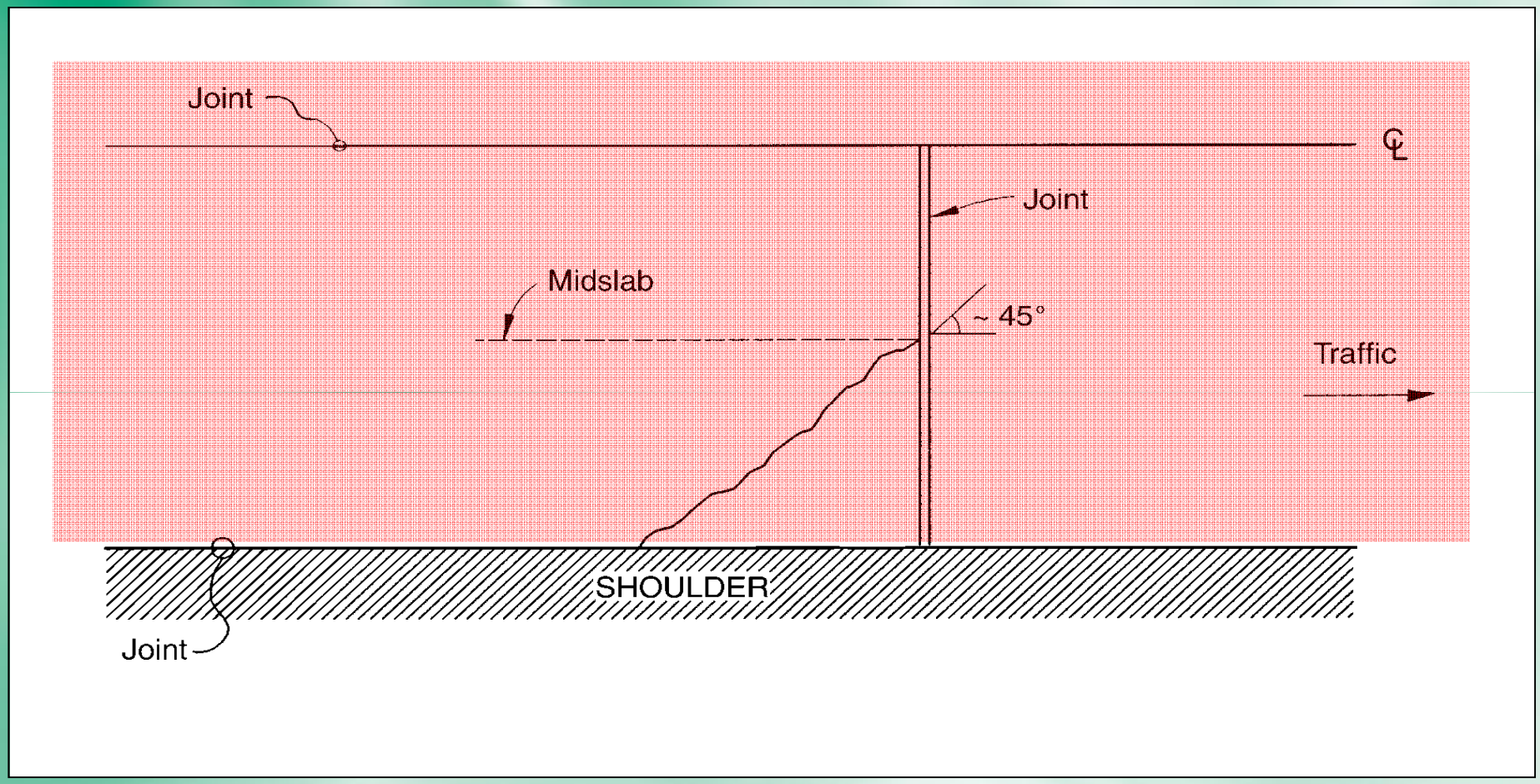
Rigid Pavement Distresses

1. Blowup
2. Corner Break
3. Depression
4. Durability (“D”) Cracking
5. Faulting of Transverse Joints & Cracks
6. Load Transfer Associated Deterioration
7. Joint Seal Damage
8. Lane/Shoulder Drop Off or Heave
9. Lane/Shoulder Joint Separation
10. Longitudinal Cracks

19

11. Longitudinal Joint Faulting
12. Patch Deterioration
13. Popout
14. Pumping & Water Bleeding
15. Reactive Aggregate
16. Scaling, Map Cracking
17. Spalling
18. Swell
19. Transverse and Diagonal Cracks

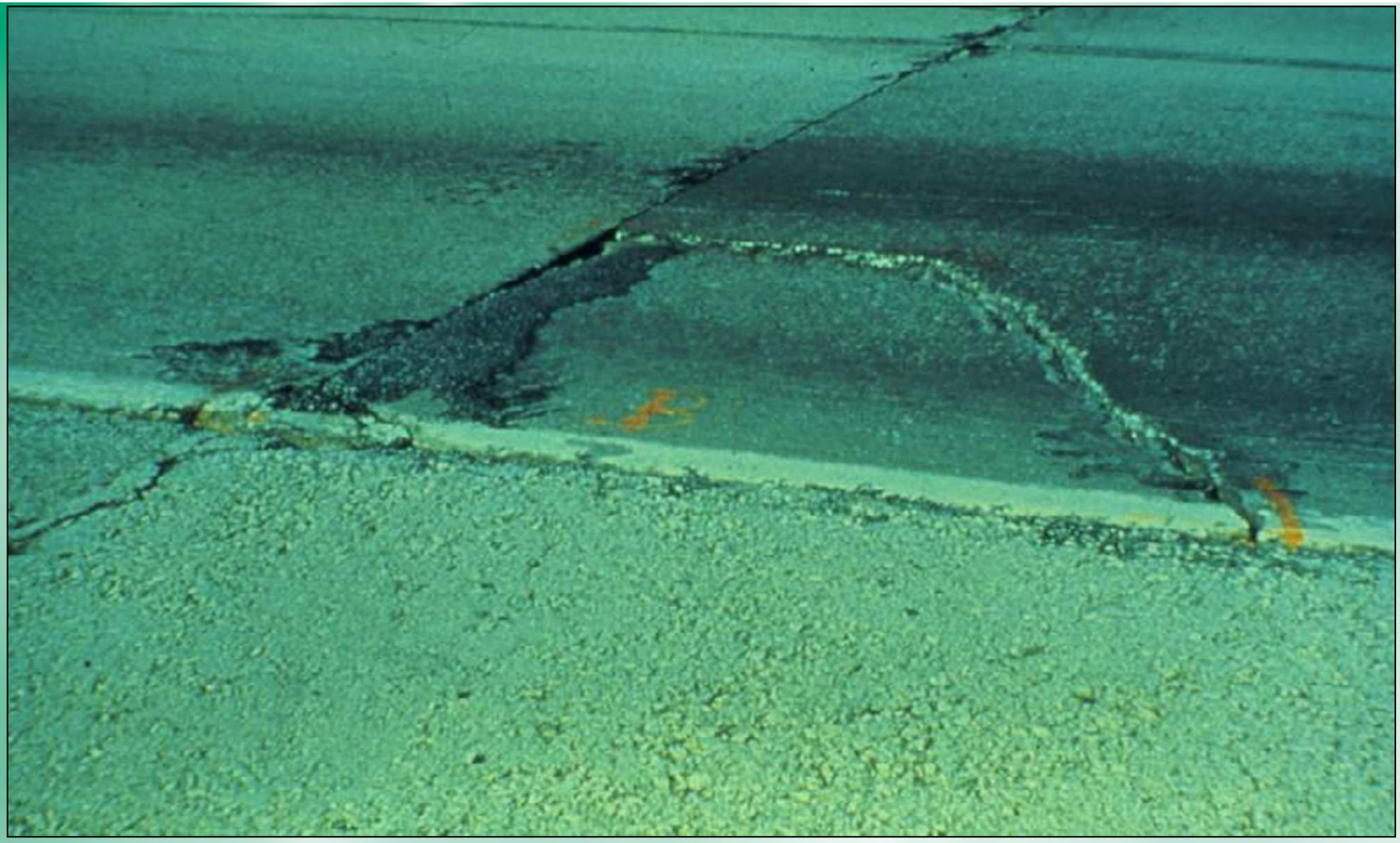
CORNER BREAKS



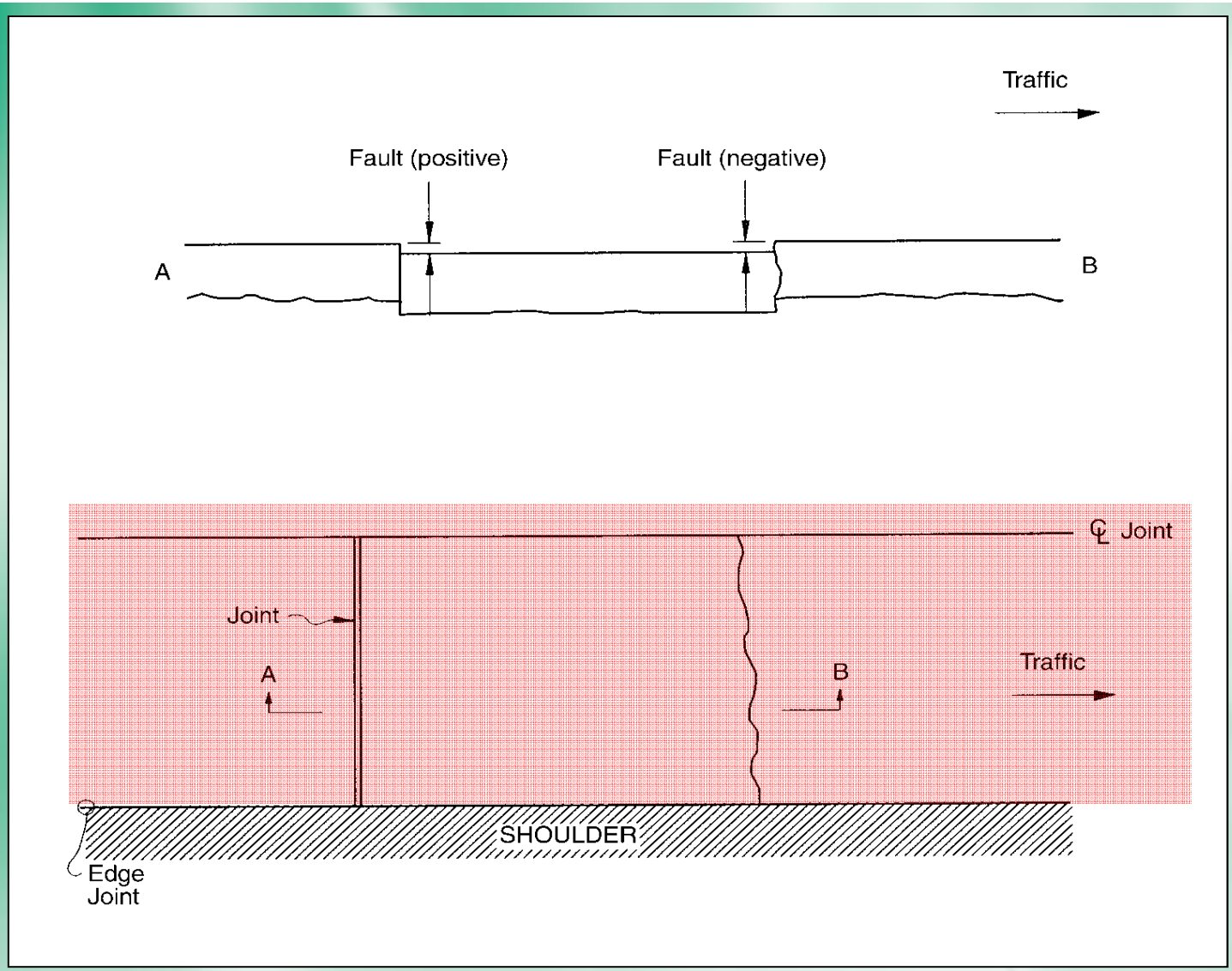
CORNER BREAKS
(LOW SEVERITY)

CORNER BREAKS
(MEDIUM SEVERITY)

CORNER BREAKS
(HIGH SEVERITY)



FAULTING OF TRANSVERSE CRACKS & JOINTS

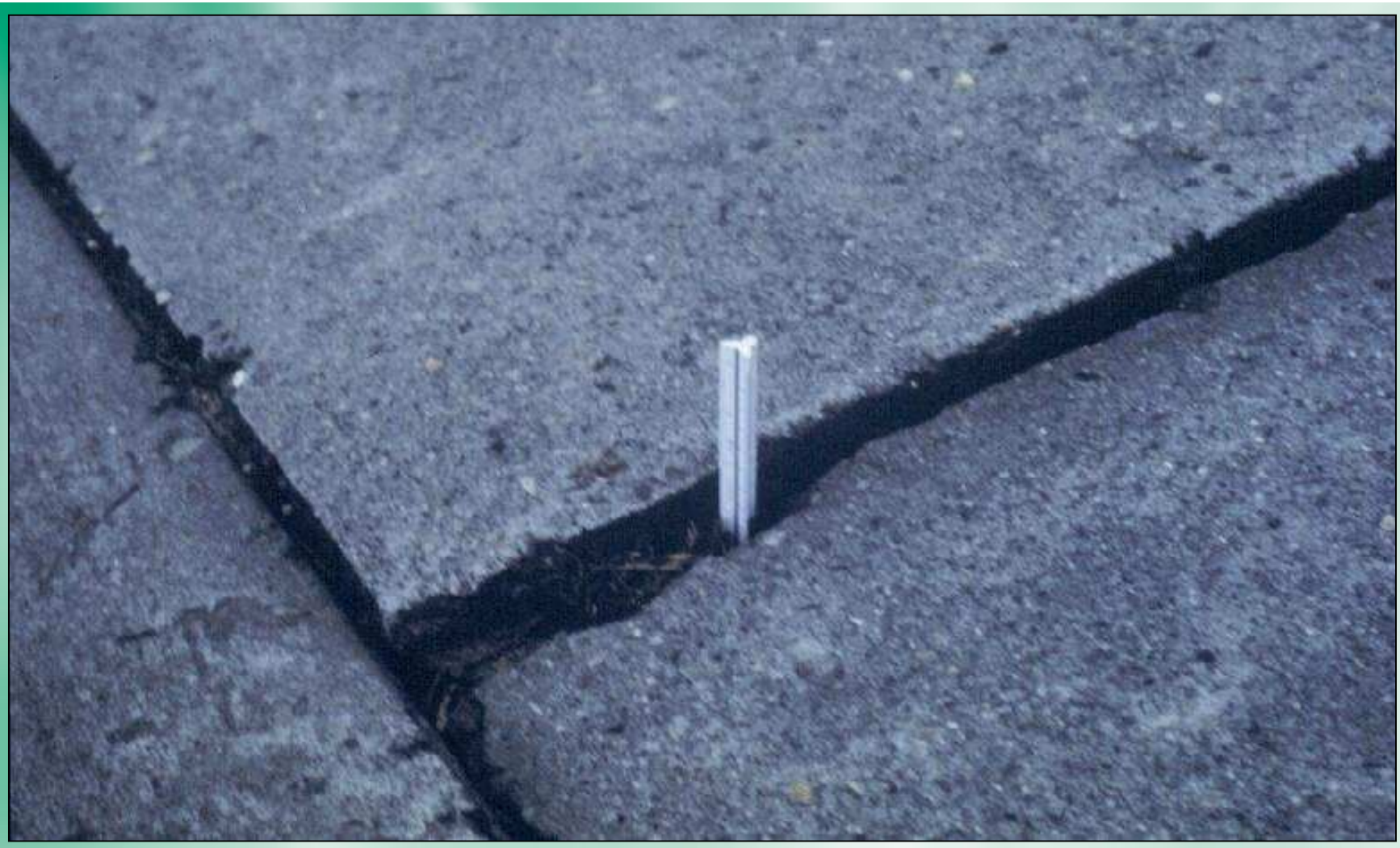


FAULTING OF A TRANSVERSE CRACK
(MEDIUM SEVERITY)

FAULTING OF A TRANSVERSE CRACK
(HIGH SEVERITY)

FAULTING OF A TRANSVERSE JOINT

FAULTING OF A TRANSVERSE JOINT *(HIGH SEVERITY)*



LOAD TRANSFER ASSOCIATED DISTRESS

LOAD TRANSFER ASSOCIATED DISTRESS

LANE to SHOULDER DROP-OFF

LANE to SHOULDER DROP-OFF
(SHOULDER SETTLEMENT)

LANE-SHOULDER SEPARATION
(POORLY SEALED)

LONGITUDINAL CRACK
(LOW SEVERITY)

LONGITUDINAL CRACK

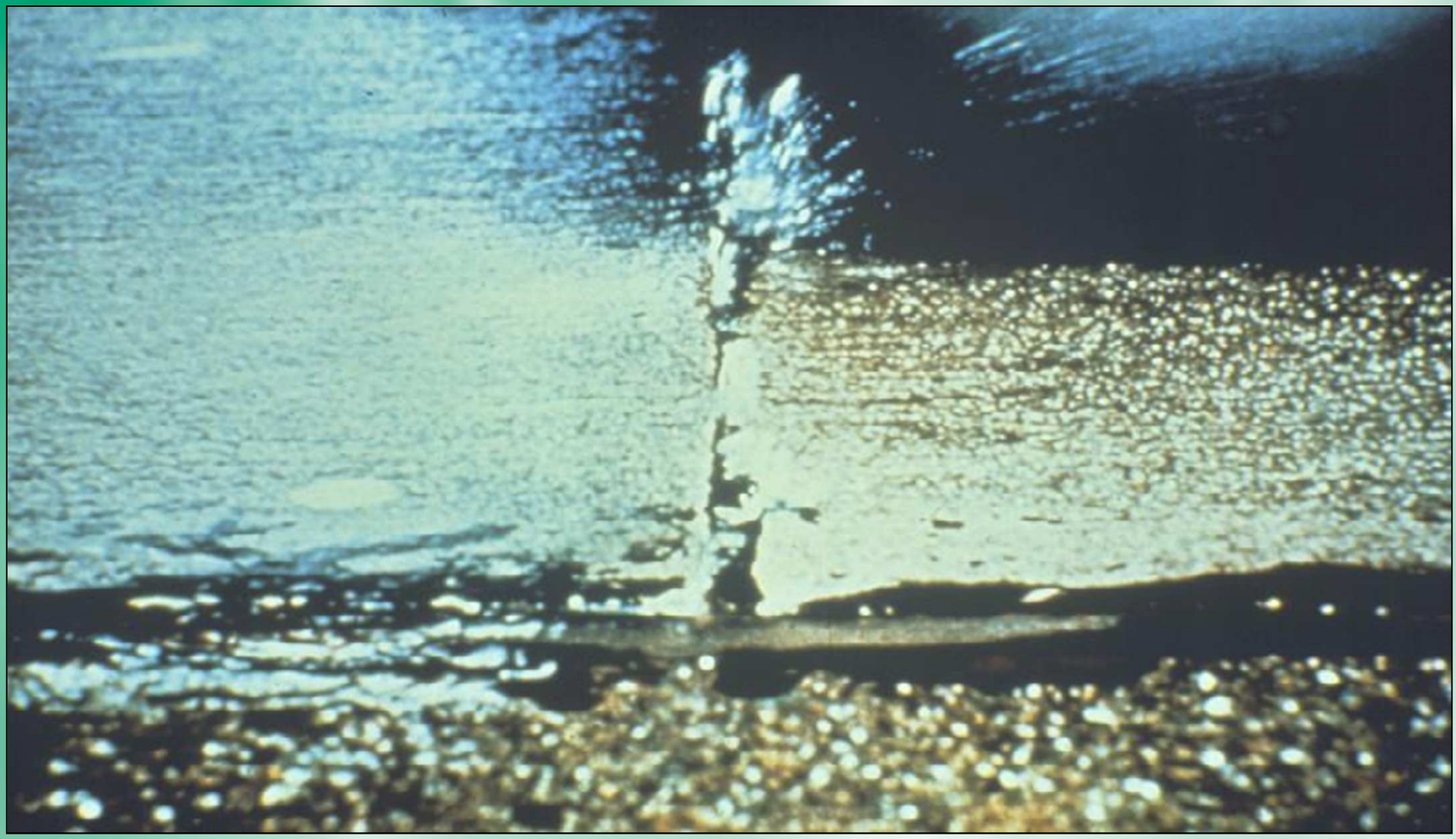
(MEDIUM SEVERITY)

LONGITUDINAL CRACK
(HIGH SEVERITY)

POPOUTS

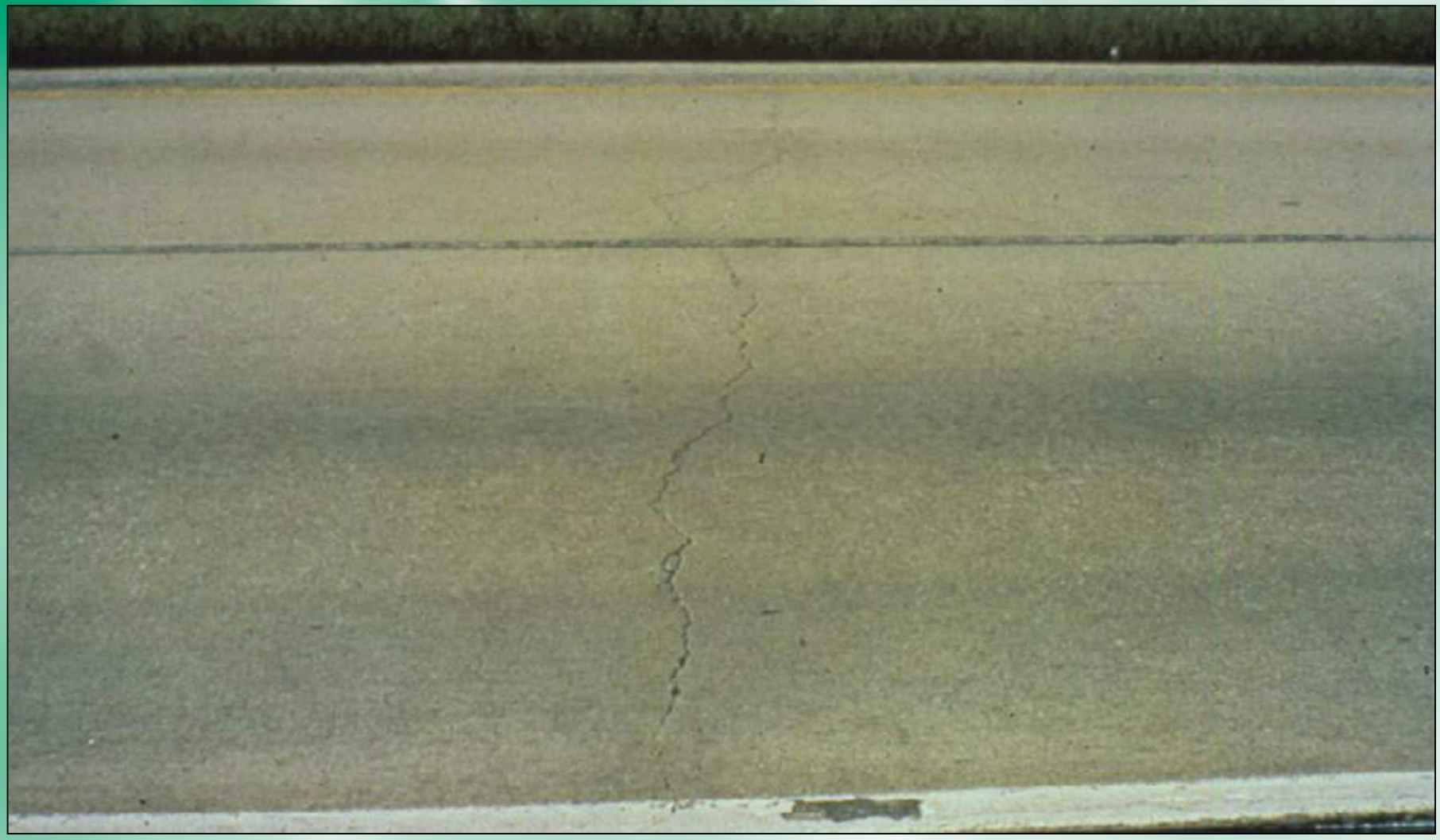
POPOUTS

PUMPING

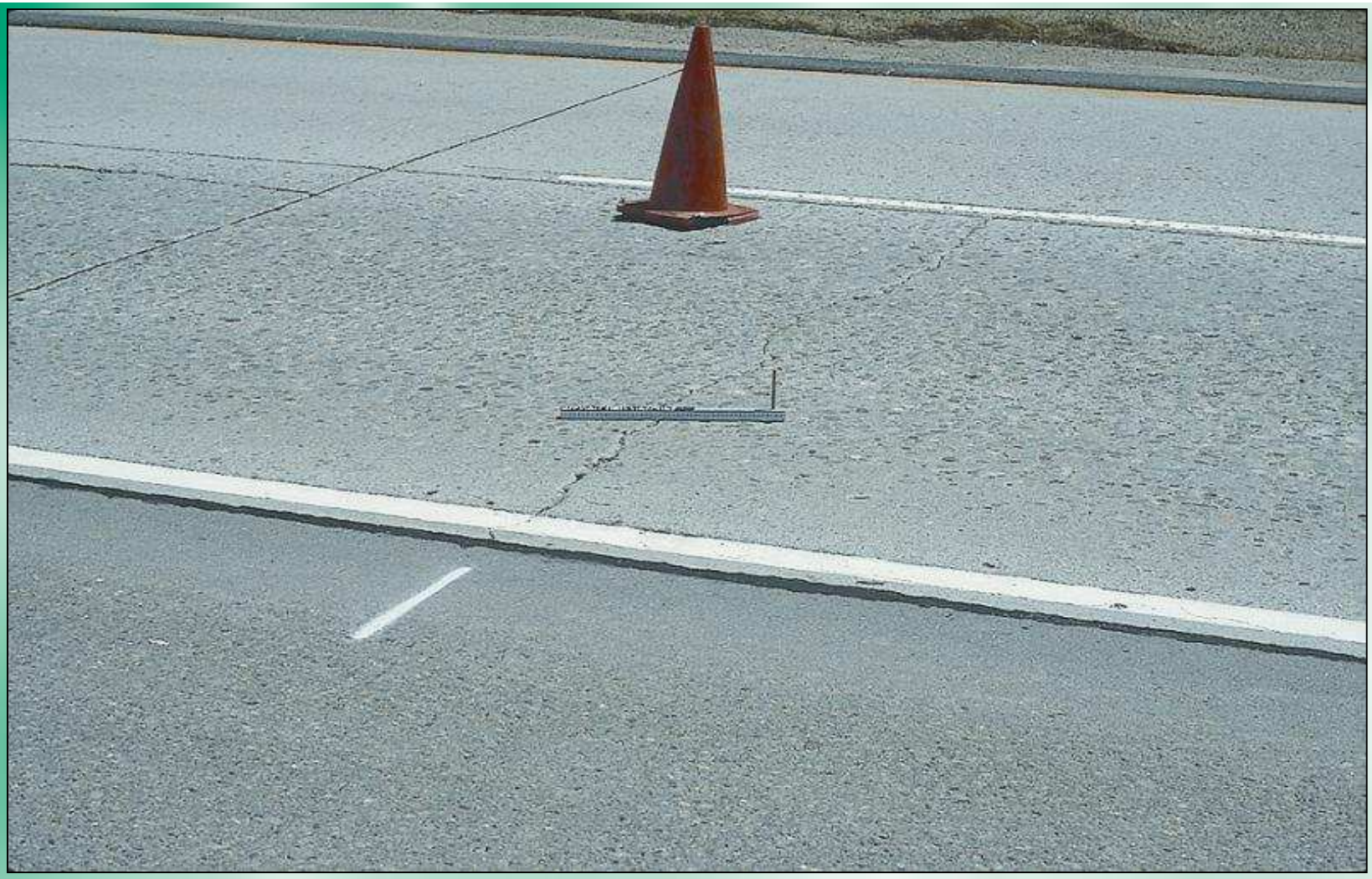


PUMPING

TRANSVERSE CRACK
(LOW SEVERITY)



TRANSVERSE CRACK
(MEDIUM SEVERITY)



TRANSVERSE CRACK
(HIGH SEVERITY)

TRANSVERSE CRACK
(EXTRA HIGH SEVERITY)

Utilize a Treatment Toolbox

Apply Treatments

- While pavement is in good condition
- Before structural damage occurs

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Flexible Pavement Treatments

- Asphalt Rejuvenators
- Crack Sealing
- Chip Seals
- Slurry Seals
- Micro-surfacing
- Ultra-thin Overlays
- Profile Milling
- Hot In-place Recycling
- Cold In-place Recycling
- Asphalt Sealers
- Crack Filling
- Cape Seals
- Sand Seals
- Scrub Seals
- Bonded Wearing Course
- Ultra-Thin Overlays
- Thin Overlays
- Mill & Resurface

….and many others!

Rigid Pavement Treatments

- Crack Sealing
- Undersealing
- Spall Repair
- Partial Depth Repair
- Full Depth Repair
- Diamond Grooving
- Joint Resealing
- Dowel Bar Retrofit
- Cross Stitching - longitudinal cracks & joints
- Diamond Grinding
- CPR

….and many others!

Typical Life Extensions

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Crack Fill	1 - 3	0 - 2	0
Crack Seal	1 - 5	0 - 3	0
Fog Seal	1 - 3	0 - 1	0
Chip Seal	4 - 10	3 - 5	0 - 3
Micro-Surfacing	4 – 8	3 - 5	1 - 4
Thin HMA	4 - 10	3 - 7	2 - 4

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Treatment Selection

- Distress Type
- Parameter Levels, e.g. Cracking
- Location
- Available Funding
- Other Constraints, e.g. Political

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Utilize a Treatment Toolbox

Benefits of Pavement Preservation

- Defer Costly Reconstruction/Rehabilitation
- Reduced Traffic Delays
- Improved Mobility
- Reduced Congestion
- Longer-Lasting Capital Investments

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Treatment Selection Tools

- **Decision Trees Specialized by:**
  - ✓ Pavement type, e.g. Asphalt
  - ✓ Road type
  - ✓ Traffic
  - ✓ Functional characteristics
- **Decision Matrices**
  - ✓ Used for complex decisions
  - ✓ Framework for making tradeoffs
  - ✓ Evaluates alternative treatments for given resources
  - ✓ Evaluates treatment combinations for least cost
  - ✓ Limited optimization

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Establish Strategic Plan

- Concentrate on Network or Major Components
- Barriers or Constraints
  - ✓ Funding Restrictions
  - ✓ Analytical Convenience
  - ✓ Political Factors

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QUESTIONS ?

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Network Level Strategy

Worst First Approach

Versus

Mix of Fixes Approach

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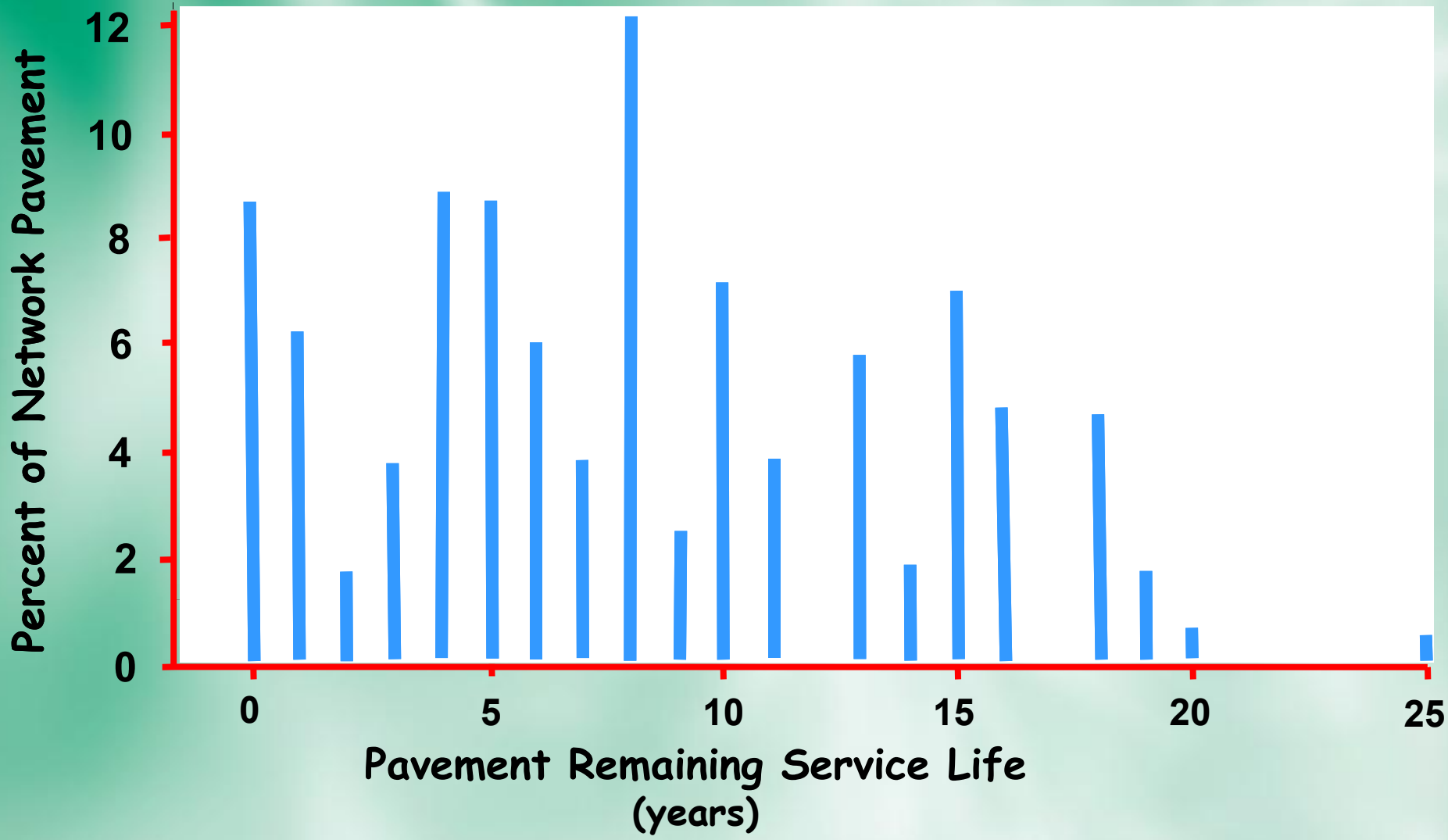
Parameters

- Annual Budget = $21.5 Million
- Network = 1,232 lane miles
- Constraints
  - *Interstate (I-23) must be reconstructed*
  - *County Road (CR-55) must be rehabilitated*
  - *Funding advances not permitted*
  - *Carry-overs and overruns not permitted*

Beginning Condition



“Worst First” Approach

Worst First

1st Year Strategy

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#111	Reconstruction (I-23), Urban - RSL = 0 Flexible Design Life = 25 years				$17,020,000
#112	Rehabilitation (US-235), Urban - RSL = 1 Composite Design Life = 15 years				$ 4,290,000
	Total	=	65.5		$21,310,000

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Worst First

2nd Year Strategy

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#111	Reconstruction (I-23), Urban - RSL = 0 Rigid Design Life = 25 years				$17,020,000
#114	Rehabilitation (CR-55), Rural - RSL = 1 Flexible Design Life = 15 years				$ 1,885,000
#116	Rehabilitation (Riggs), Urban - RSL = 0 Composite Design Life = 15 years				$ 660,000
#118	Rehabilitation (US-484), Rural - RSL = 0 Flexible Design Life = 15 years				$ 580,000
#119	Rehabilitation (SR-272), Urban - RSL = 0 Composite Design Life = 15 years				$ 1,320,000
	Total	=	69		$21,465,000

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Worst First

3rd Year Strategy

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#115	Rehabilitation (SR-20), Rural - RSL = 0 Flexible Design Life = 15 years				$ 1,305,000
#117	Reconstruction (SR-38), Urban = 0 Rigid Design Life = 30 years				$ 3,487,500
#222	Reconstruction (I-7), Rural = 1 Flexible Design Life = 20 years				$ 7,950,000
#230	Rehabilitation (I-36), Rural = 2 Composite Design Life = 15 years				$ 8,120,000
	Total	=	102.5		$20,862,500

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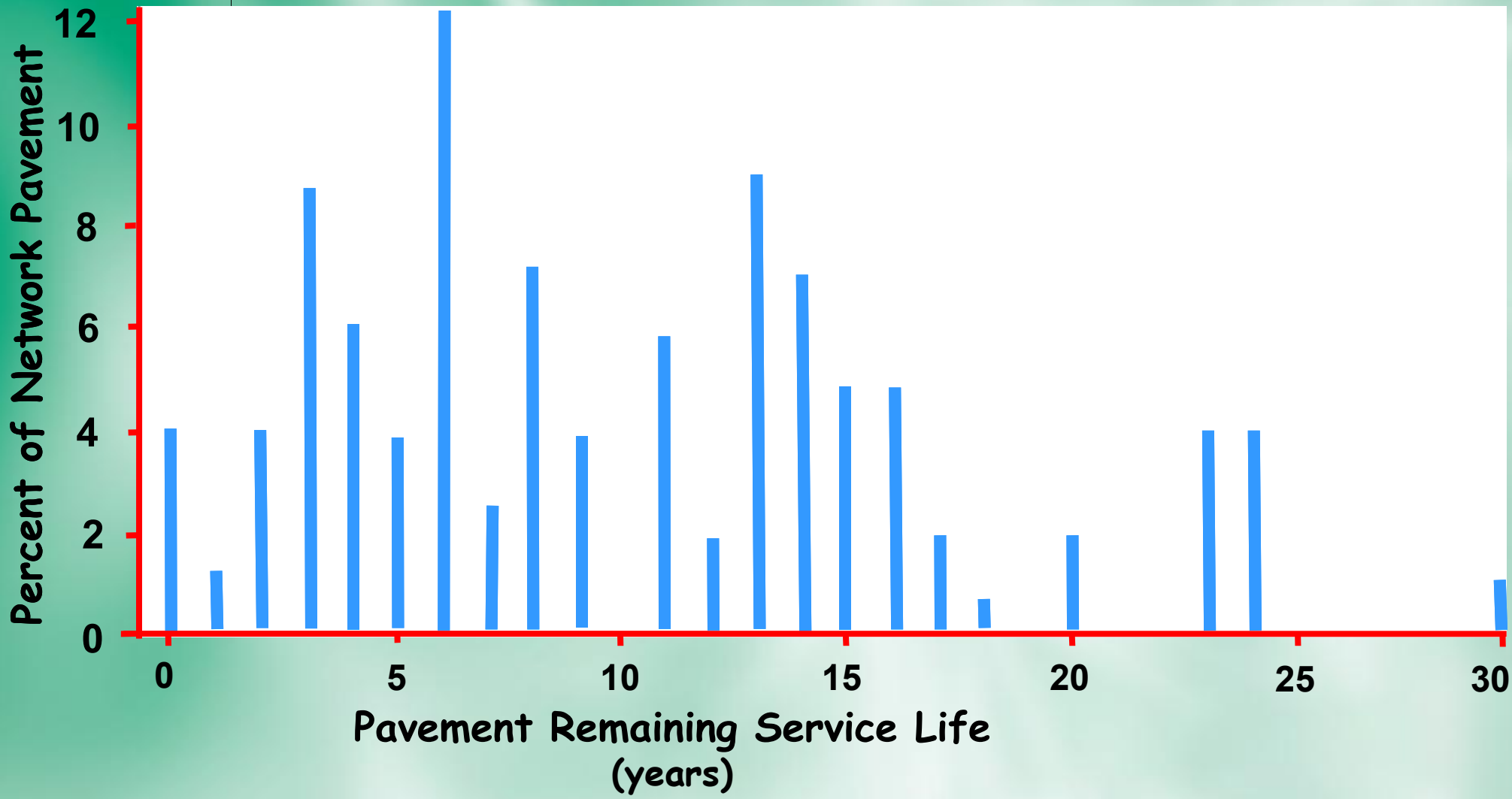
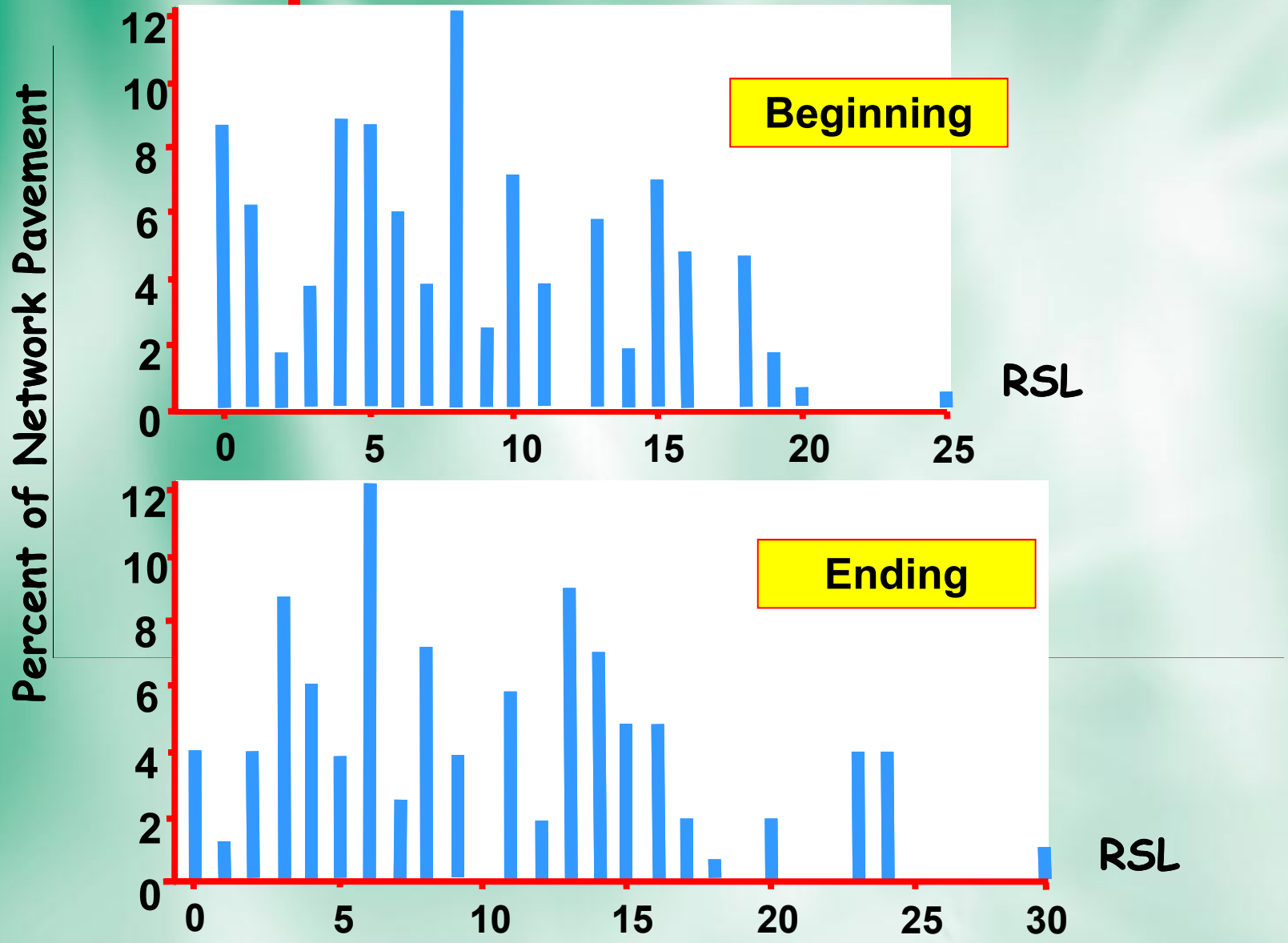
Worst First Summary

Year	Projects	Lane Miles	Costs
1	2	65.5	$21,310,000
2	5	69.0	$21,465,000
3	4	102.5	$20,862,500
Totals	11	237.0	$63,637,500

Condition After 3 Years



Comparison of Conditions



Impact on Network Condition

Network Health = Average R.S.L.

After 3 Years…

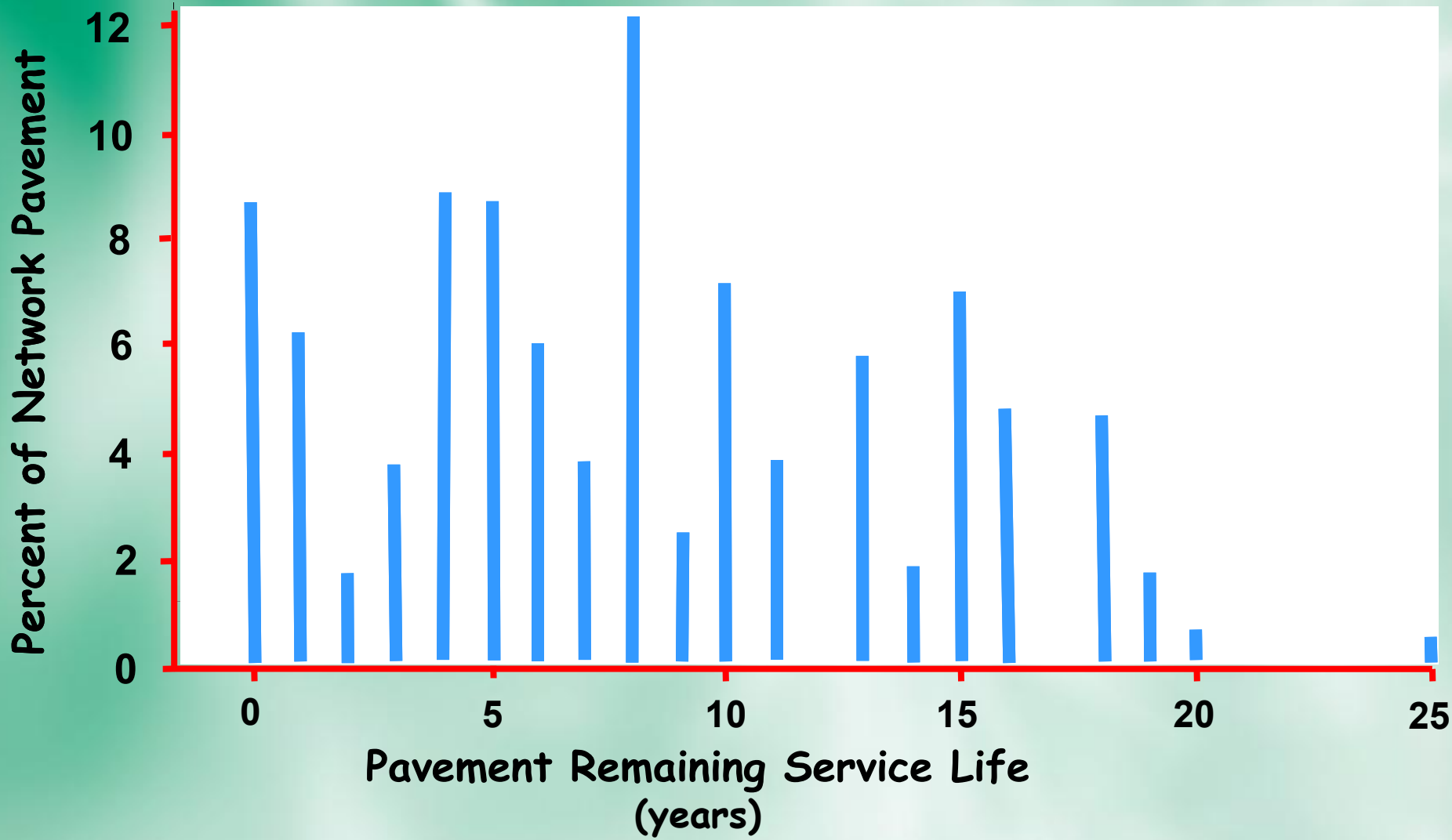
Do Nothing = 6.4 Average R.S.L.

Worst First = 10.1 Average R.S.L.

Network Improvement = 3.7 Years

“Mix of Fixes” Approach

Beginning Condition



Mix of Fixes

1st Year Strategy

Page 1 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#112	Minor Rehab (US-235), Urban - RSL = 1 Life Extension = 12 years				$ 2,340,000
#113	Minor Rehab (SR-77), Rural - RSL = 1 Life Extension = 12 years				$ 5,880,000
#117	Minor Rehab (SR-38), Urban - RSL = 1 Life Extension = 12 years				$ 975,000
#228	PM (US-103), Rural - RSL = 4 Life Extension = 10 years				$ 2,090,000
#230	PM (I-36), Rural - RSL = 4 Life Extension = 10 years				$ 3,080,000

Subtotal (Page 1) = $ 14,365,000

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Mix of Fixes

1st Year Strategy

Page 2 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#224	PM (Meridian), Urban - RSL = 5 Life Extension = 10 years				$ 55,000
#227	PM (I-18), Urban - RSL = 5 Life Extension = 10 years				$ 4,200,000
#233	PM (Del Webb), Urban - RSL = 4 Life Extension = 10 years				$ 110,000
#235	PM (CR-44), Rural - RSL = 4 Life Extension = 10 years				$ 220,000
#345	PM (I-92), Rural - RSL = 8 Life Extension = 5 years				$ 1,232,000

Subtotal (Page 2) = $ 5,817,000

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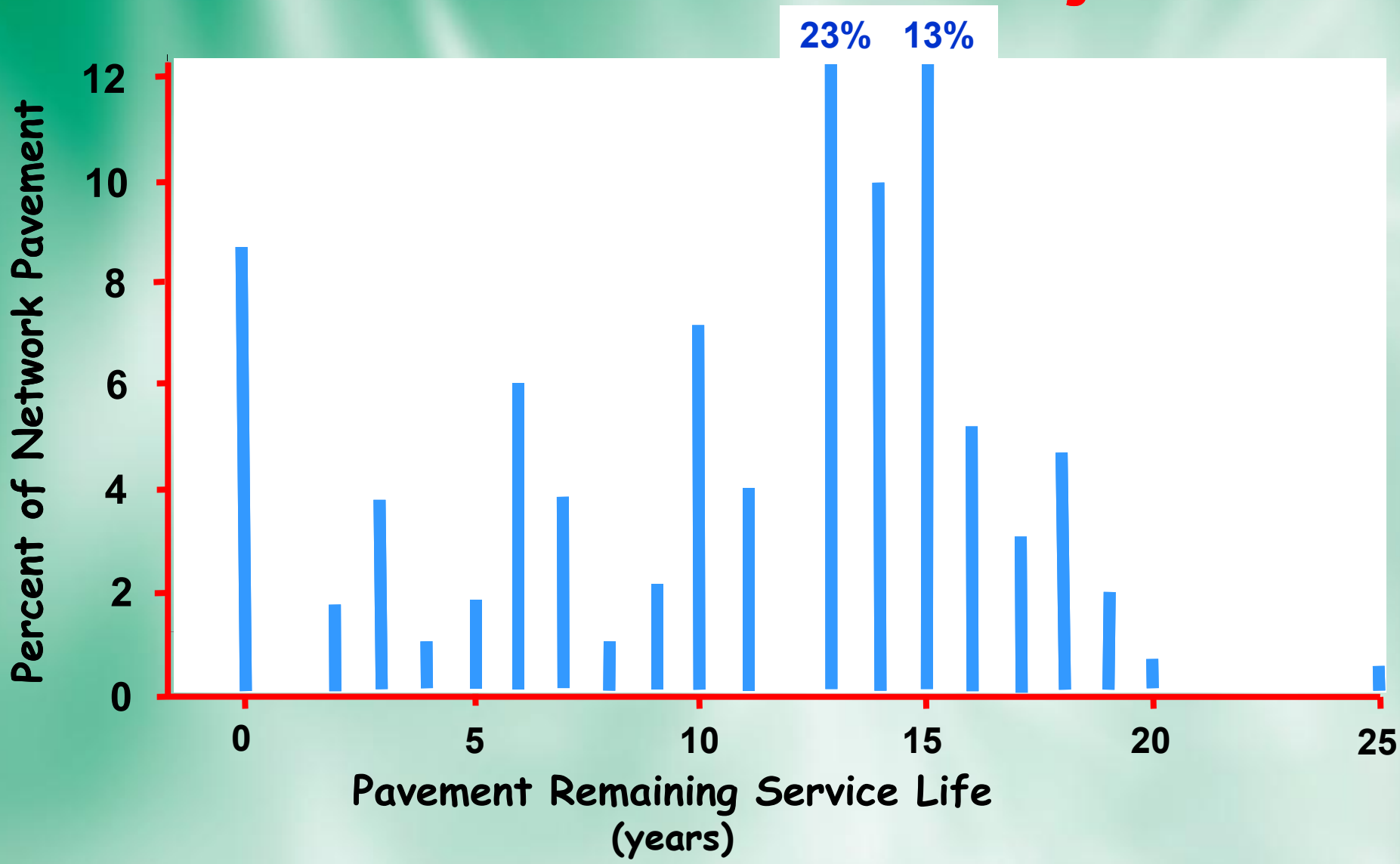
Mix of Fixes

1st Year Strategy

Page 3 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#346	PM (US-47), Rural - RSL = 8 Life Extension = 5 years				$ 630,000
#349	PM (I-53), Urban - RSL = 10 Life Extension = 5 years				$ 480,000
#455	PM (SR-101), Rural - RSL = 15 Life Extension = 2 years				$ 180,000
	Subtotal Page 1		170		$14,365,000
	Subtotal Page 2		99		$ 5,817,000
Total =			374		$21,472,000

Condition After 1st Year Projects



Mix of Fixes

2nd Year Strategy

Page 1 of 2

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#111	Reconstruction (I-23), Urban - RSL = 0 Flexible Design Life = 25 years				$17,020,000
#115	Minor Rehab (SR-20), Rural - RSL = 1 Life Extension = 12 years				$ 1,080,000
#222	PM (I-7), Rural - RSL = 2 Life Extension = 10 years				$ 1,650,000
#450	PM (I-46), Rural - RSL = 12 Life Extension = 5 years				$ 1,008,000

Subtotal (Page 1) = $ 20,758,000

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Mix of Fixes

2nd Year Strategy

Page 2 of 2

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#453	PM (SR-6), Rural - RSL = 14 Life Extension = 5 years				$ 294,000
#454	PM (CR-25), Rural - RSL = 14 Life Extension = 5 years				$ 406,000
	Subtotal Page 1		157		$21,758,000
	Total	=	207		$21,458,000

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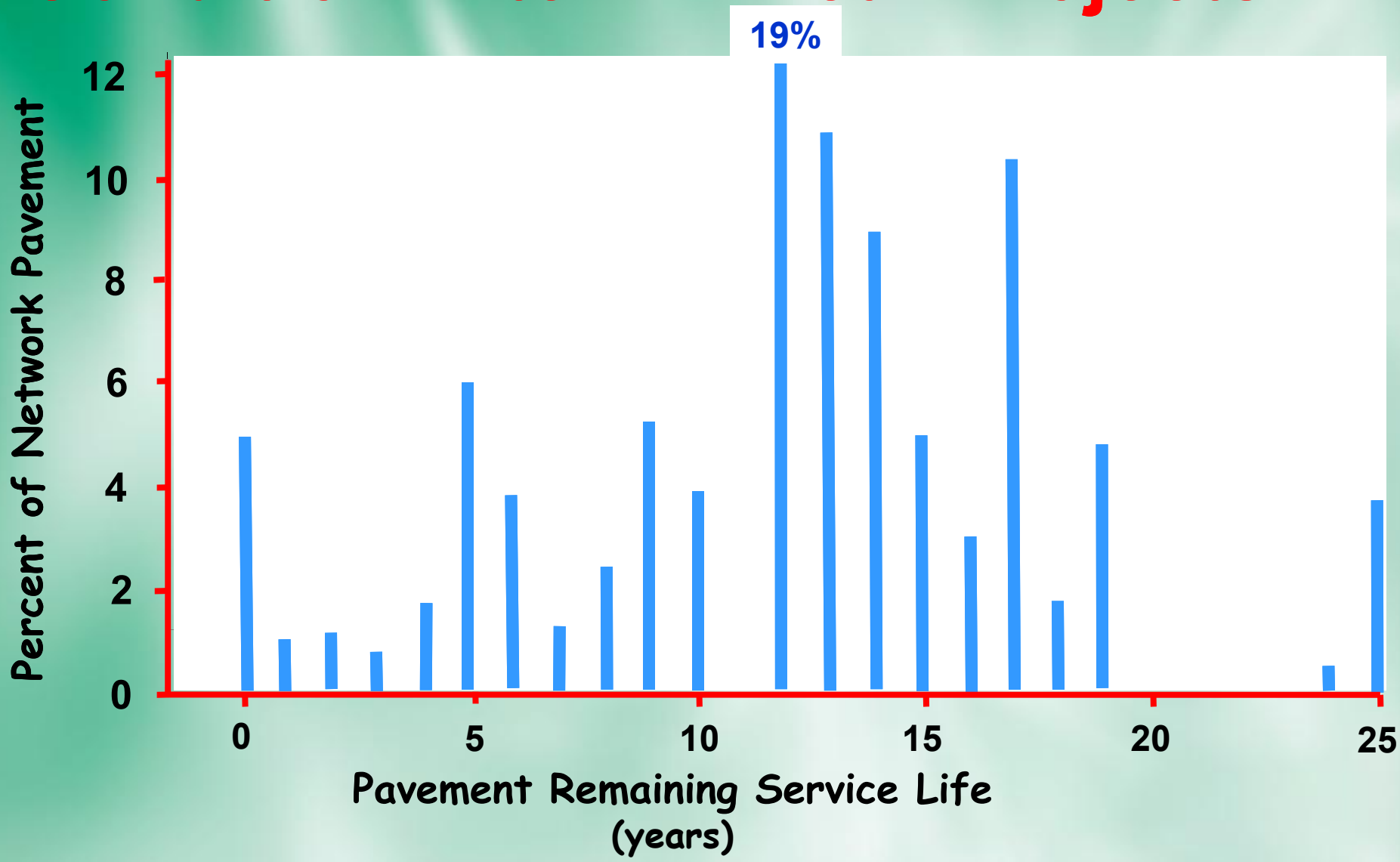
Condition After 2nd Year Projects



Mix of Fixes

3rd Year Strategy

Page 1 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#111	Reconstruction (I-23), Urban - RSL = 0 Flexible Design Life = 25 years				$17,020,000
#114	Rehabilitation (CR-55), Rural - RSL = 0 Flexible Design Life = 15 years				$ 1,885,000
#118	Rehabilitation (US-484), Rural - RSL = 0 Flexible Design Life = 15 years				$ 580,000
#229	PM (SR-170), Rural - RSL = 4 Life Extension = 5 years				$ 392,000

Subtotal (Page 1) = $ 19,877,000

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Mix of Fixes

3rd Year Strategy

Page 2 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#340	PM (CR-3), Rural - RSL = 7 Life Extension = 7 years				$ 252,000
#342	PM (I-67), Rural - RSL = 9 Life Extension = 5 years				$ 672,000
#347	PM (CR-24), Rural - RSL = 8 Life Extension = 2 years				$ 75,000
#451	PM (US-88), Rural - RSL = 14 Life Extension = 2 years				$ 180,000

Subtotal (Page 2) = $ 1,179,000

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Mix of Fixes

3rd Year Strategy

Page 3 of 3

Project	Route	Pavement Type	Lane Miles	Lane Mile Costs	Total Cost
#452	PM (CR-16), Rural - RSL = 12 Life Extension = 5 years				$ 336,000
#456	PM (SR-207), Urban - RSL = 14 Life Extension = 2 years				$ 88,000
	Subtotal Page 1		91		$19,877,000
	Subtotal Page 2		108		$ 1,179,000
	Total	=	245		$21,480,000

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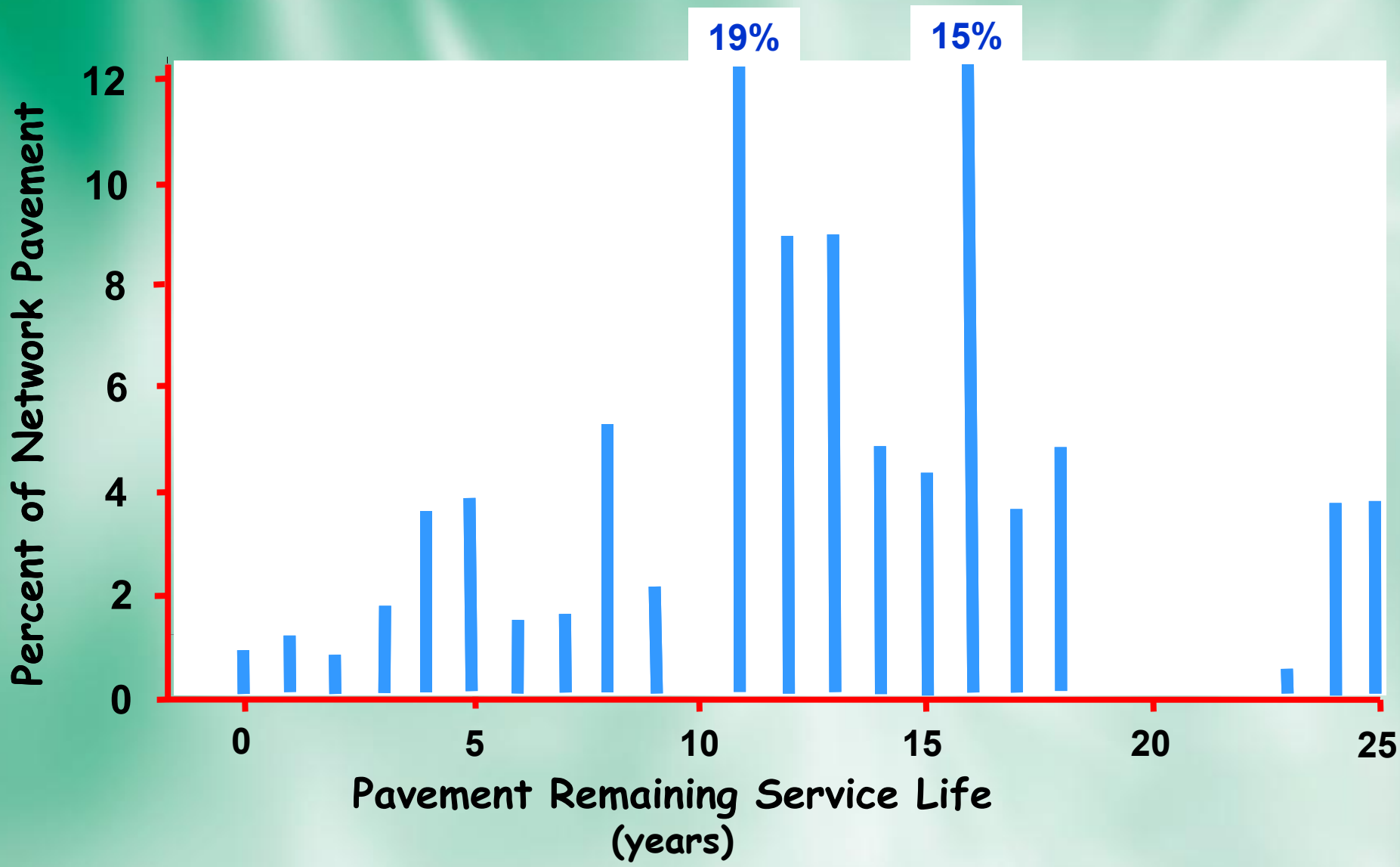
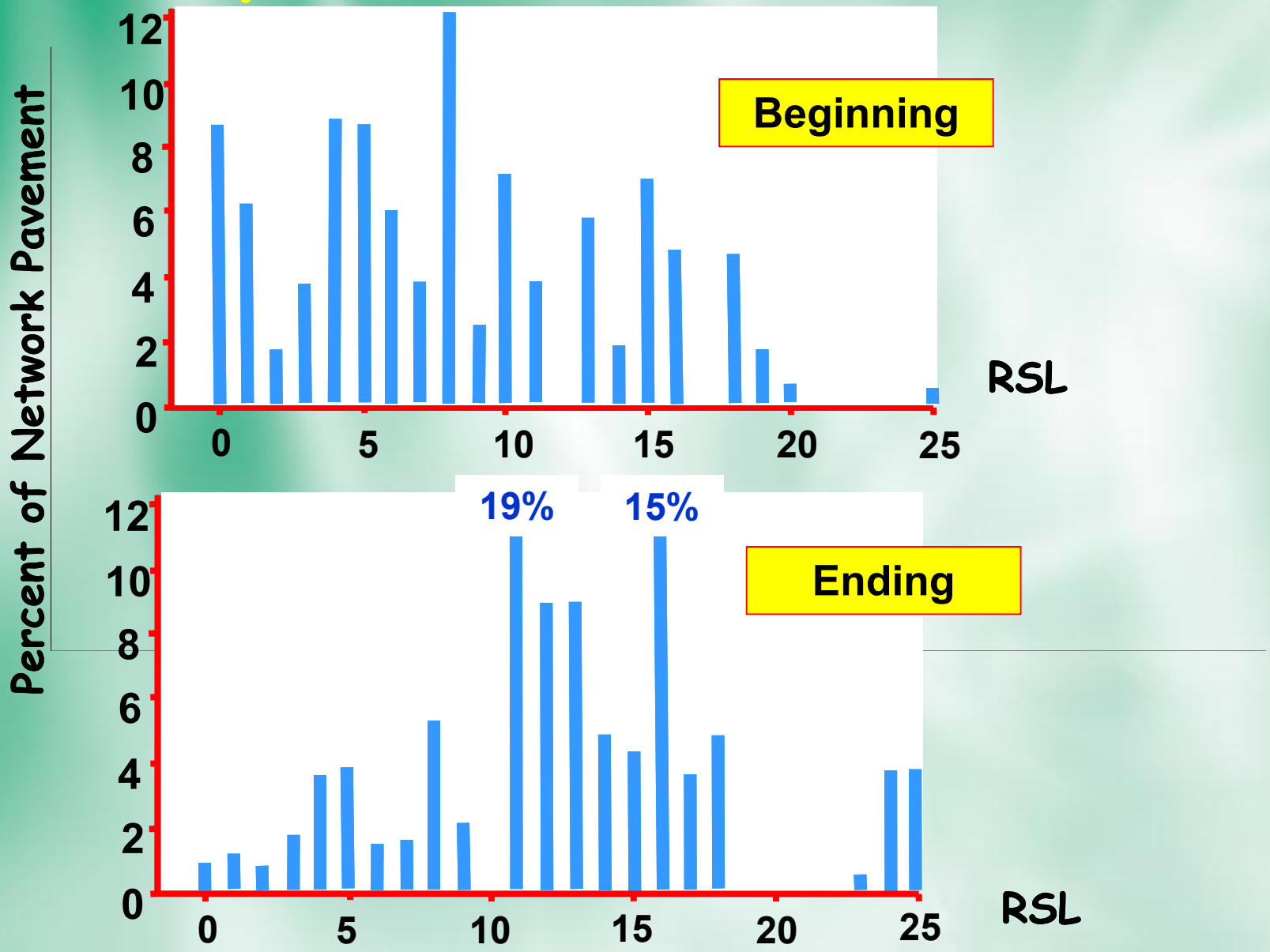
Condition After 3 Years



Mix of Fixes Summary

Year	Projects	Lane Miles	Costs
1	13	374	$21,472,000
2	6	207	$21,458,000
3	10	245	$21,480,000
Totals	29	826.0	$64,410,000

Comparison of Conditions



Impact on Network Condition

Network Health = Average R.S.L.

After 3 Years…

Do Nothing = 6.4 Average R.S.L.

Mix of Fixes = 11.9 Average R.S.L.

Network Improvement = 5.5 Years

Summary of Network Condition

After 3 Years…

Mix of Fixes = 11.9 Average R.S.L.

Worst First = 10.1 Average R.S.L.

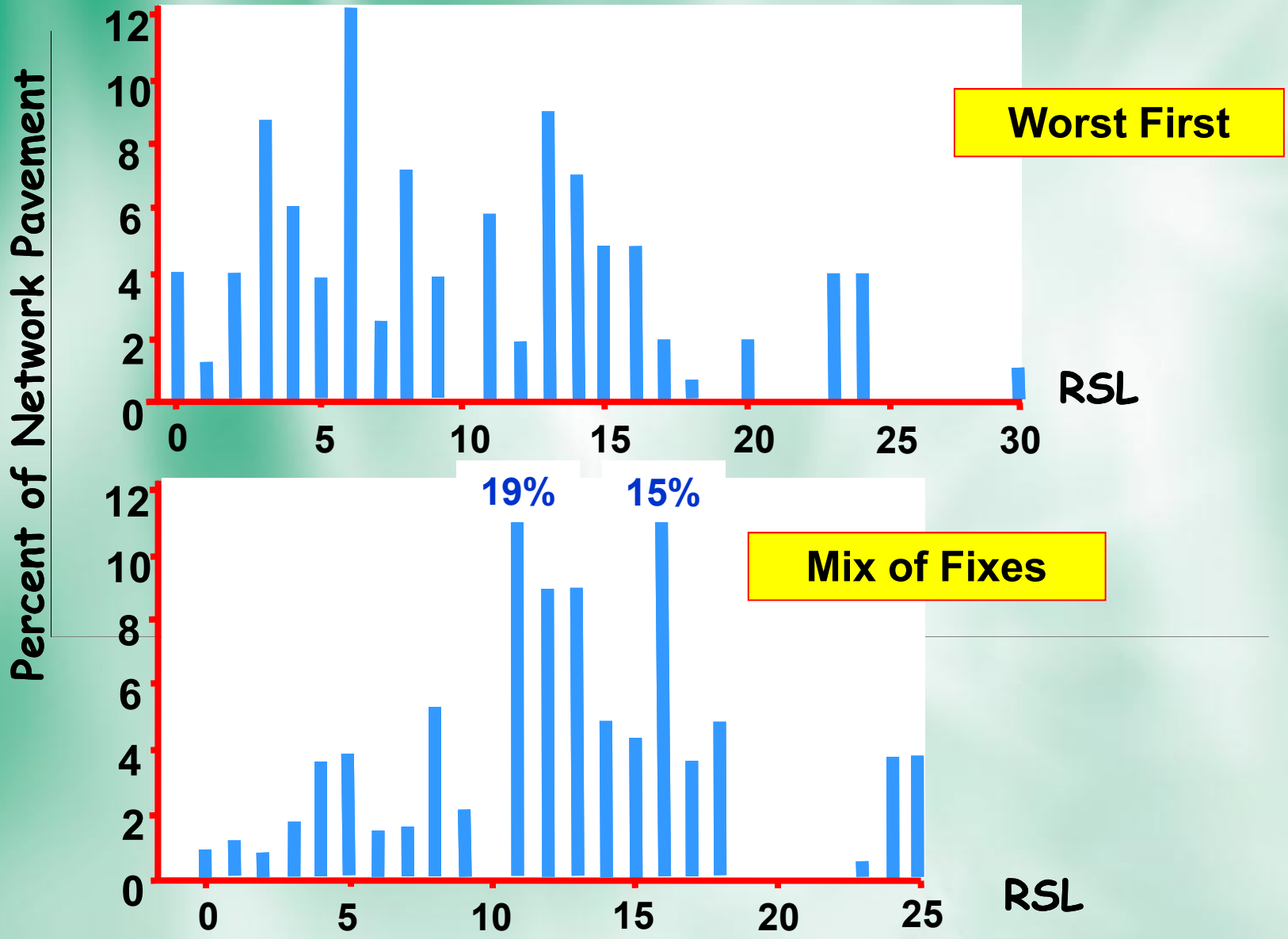
Improvement = 1.8 Years

After 3 Years…

Mix of Fixes = 826 Miles Improved

Worst First = 237 Miles Improved

Comparison of Distributions



QUESTIONS ?

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