

Concrete Solutions for Intersections and Roundabouts

2013 Northwest Pavement Management Association
October 17, 2013
Vancouver, WA



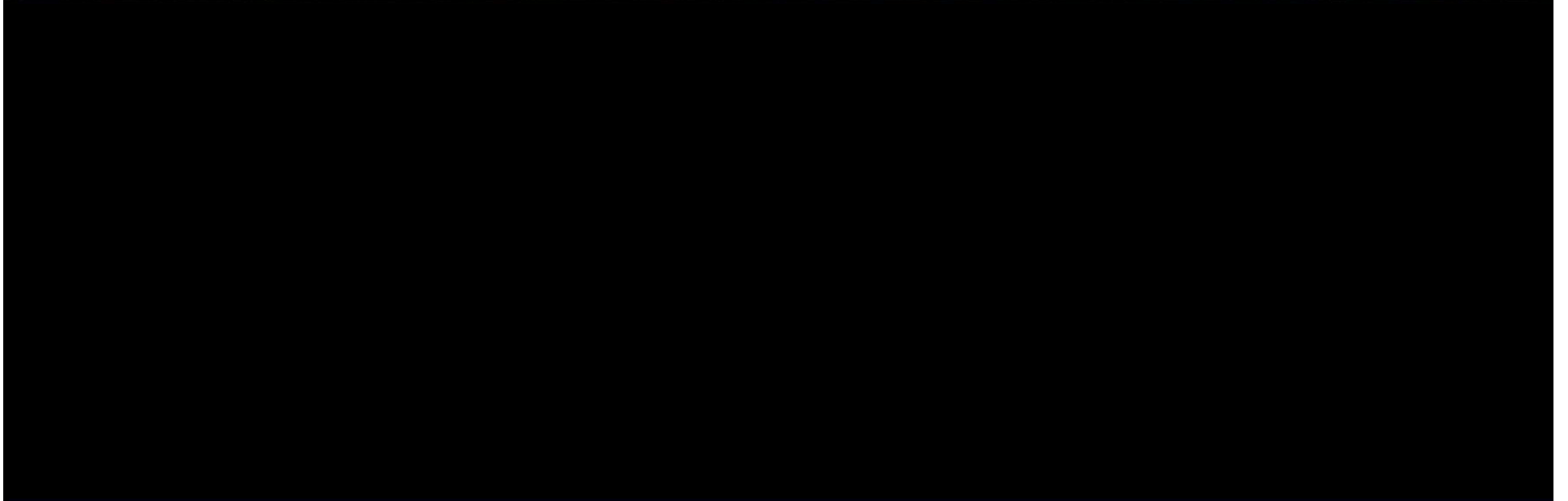












Concrete Solutions

- Provide long-life surface
- Can be constructed rapidly
- Can be full-depth or overlay

What Type of Design?

- Existing pavement condition and depth
- Vertical profile
- Construction staging
- Design life

Concrete Overlay

- Existing asphalt can be in poor condition, but fair is better
- Adequate depth
- Or ability to raise profile

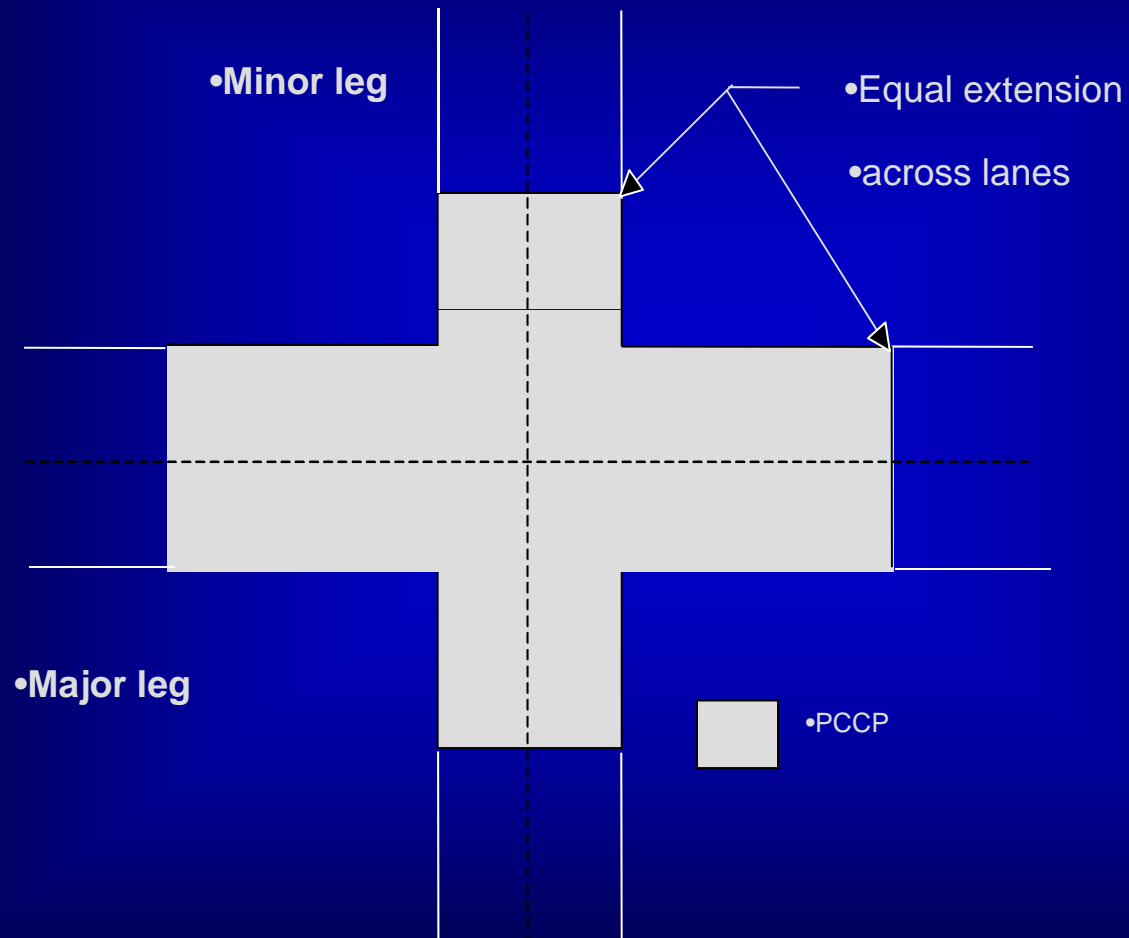
Concrete Overlay

- Typically 3"-6" thick
- Design life 20-30 years typical
- Need minimum of 3" of asphalt remaining

Full-Depth Concrete

- Existing asphalt in very poor condition
- Inadequate existing thickness
- Unable to raise profile
- Typical thickness 7"-10"
- 40-50 year design life

PCCP construction limits



Joint Sealants

History & Background

- Accepted definition:
Sealants minimize infiltration of surface water & incompressibles into the joint system.
- Erroneous definition:
Sealants prevent infiltration of surface water & incompressibles into the joint system.

Construction Considerations

- Staging
- Mix Design
- Opening to Traffic
- Public Relations

Phasing Concerns:

- Traffic Flow & Traffic Control
- Access to Adjacent Business
- Access for Construction & Material Delivery
- Construction Time
- Safe Construction Area for Employees & Equipment
- Mix Designs
- Curing & Opening to Traffic

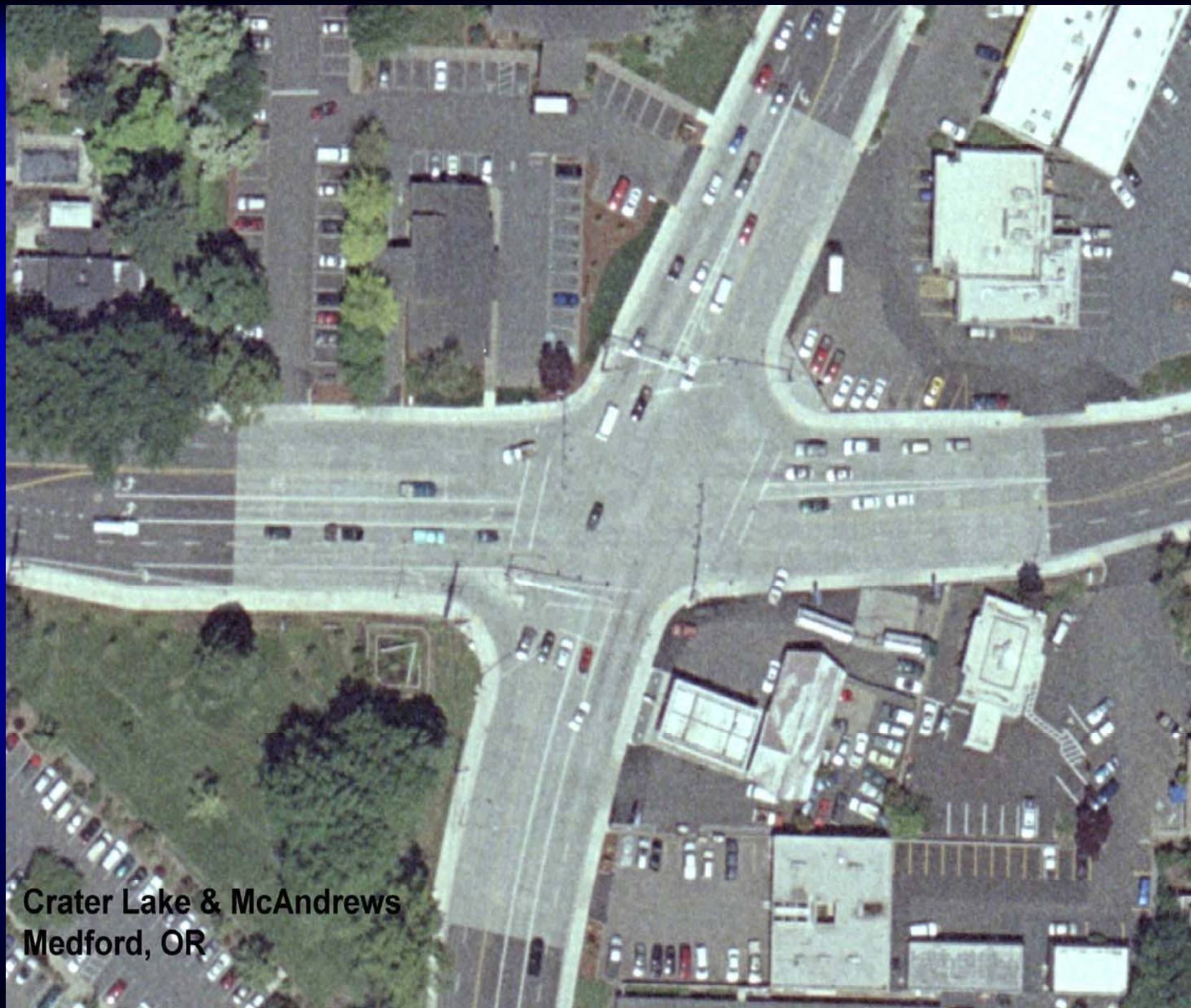
Traffic Flow & Traffic Control:

Four Options:

- Restricted Traffic Movement - Francis & Division
- Partial Closures - Pines & Broadway
- Complete Closures - Broadway and University
- Combination of the Above - SR 395 - Yelm, Clearwater, and Kennewick Avenue

Rapid Intersection Construction

- Crater Lake and McAndrews, Medford, Oregon
 - 60,000 ADT
 - Two 1 week half closures
- SR 395, Kennewick, Washington
 - 30,000 ADT
 - One weekend closure
- Union Hill, Redmond, Washington
 - 110,000 ADT
 - Two weekend half closures



**Crater Lake & McAndrews
Medford, OR**

Combination Closures:

SR-395 & Yelm, Clearwater, Kennewick Avenue:

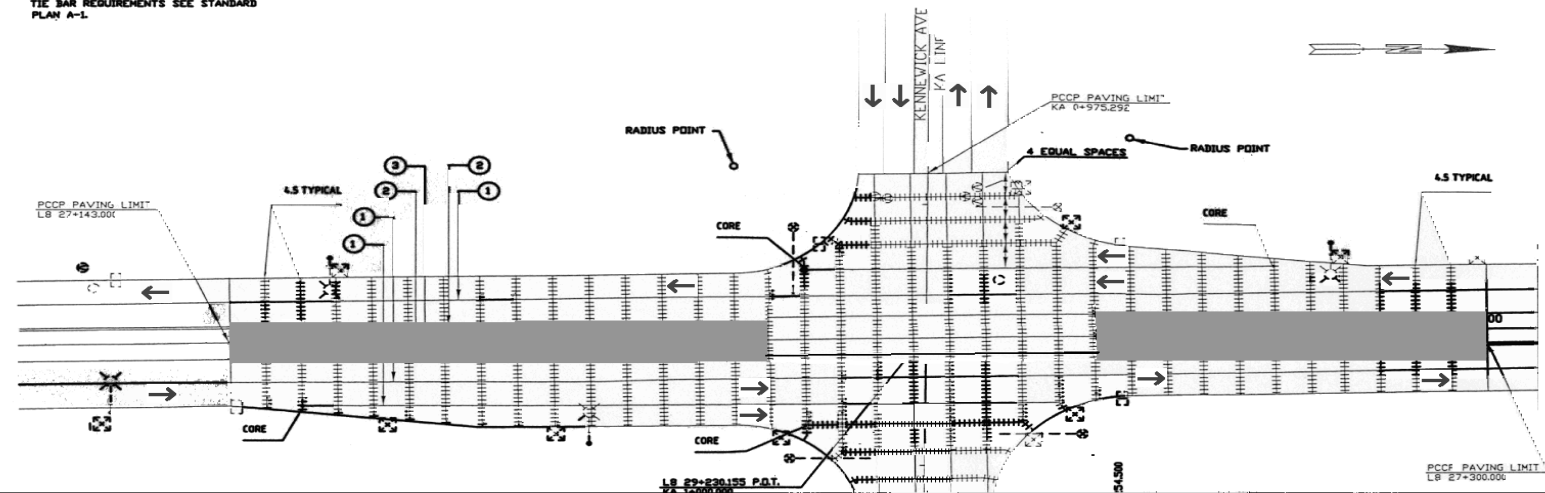
- Lane Closures Stages 1,2, 4
- Complete Closure Stage 3, Thursday at 7:00 PM to Monday 6:00 AM.
- Late opening penalty of up to \$2,400.00 per hour.

Time for Completion:

- Kennewick Avenue and Clearwater were built concurrently. This saved a considerable amount of time. Crews always had a place to work.
- In 15 days approximately 3384 cubic yards were placed in the two intersections.
- Construction staging was as follows:

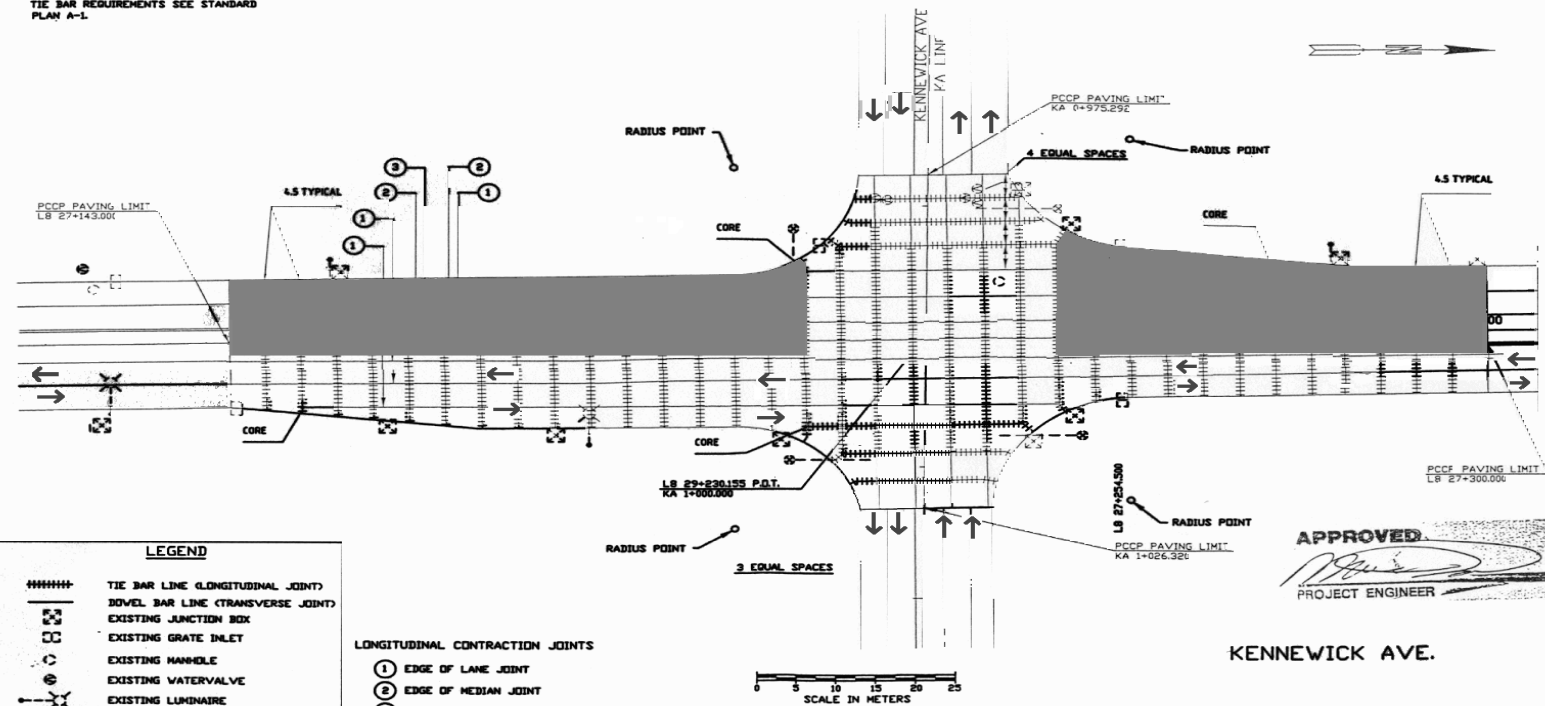
Kennewick Avenue Stage 1:

GENERAL NOTES:
1. FOR ADDITIONAL JOINT, DOVEL BAR AND TIE BAR REQUIREMENTS SEE STANDARD PLAN A-1.



Kennewick Avenue Stage 2:

GENERAL NOTES
 1. FOR ADDITIONAL JOINT, DOVEL BAR AND TIE BAR REQUIREMENTS SEE STANDARD PLAN A-1.



| LEGEND | |
|--------|-----------------------------------|
| ----- | TIE BAR LINE (LONGITUDINAL JOINT) |
| ----- | DOVEL BAR LINE (TRANSVERSE JOINT) |
| □ | EXISTING JUNCTION BOX |
| □ | EXISTING GRATE INLET |
| ○ | EXISTING MANHOLE |
| ⊕ | EXISTING WATERVALVE |
| ⊗ | EXISTING LUMINAIRE |
| ⊙ | EXISTING SIGNAL POLE TYPE 2 |

- LONGITUDINAL CONTRACTION JOINTS**
- ① EDGE OF LANE JOINT
 - ② EDGE OF MEDIAN JOINT
 - ③ CENTERLINE JOINT

APPROVED

 PROJECT ENGINEER

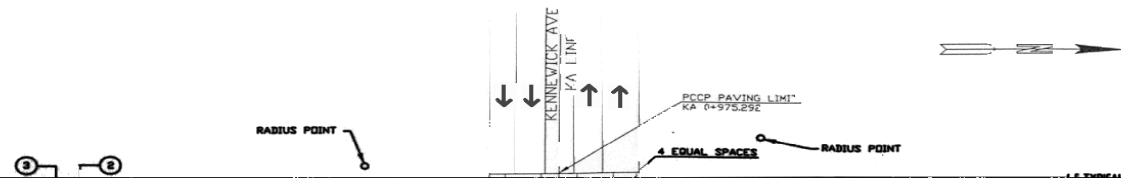
KENNEWICK AVE.

REVISED JOINTING
 SUBMITTED 7/7/2000 AWAITING APROVAL

Kennewick Avenue Stage 3:

GENERAL NOTES

1. FOR ADDITIONAL JOINT, DOVEL BAR AND TIE BAR REQUIREMENTS SEE STANDARD PLAN A-1.



Kennewick Avenue Stage 4:

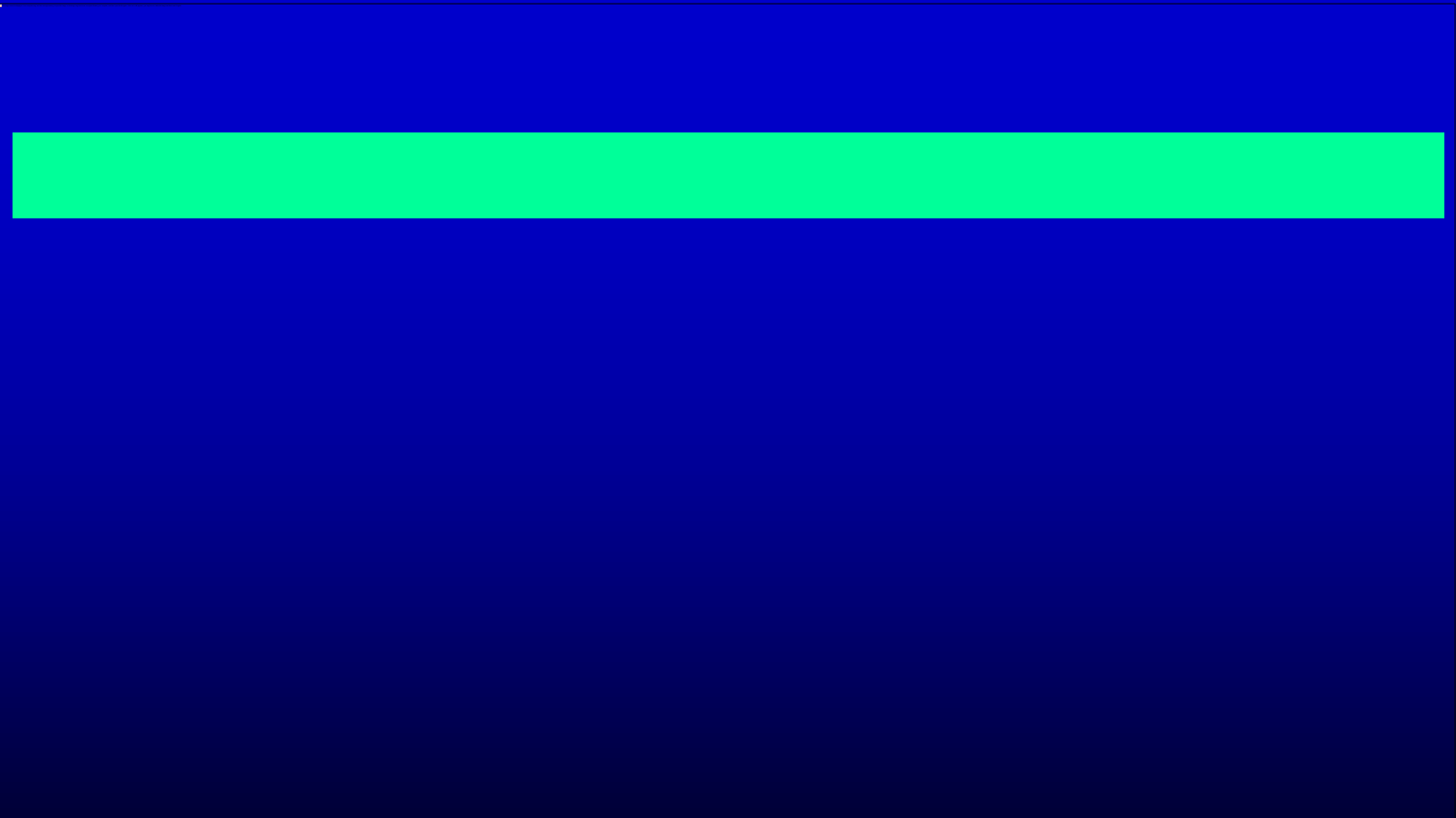


Photo Stage 4:



Partial Closure 2008 Success Stories

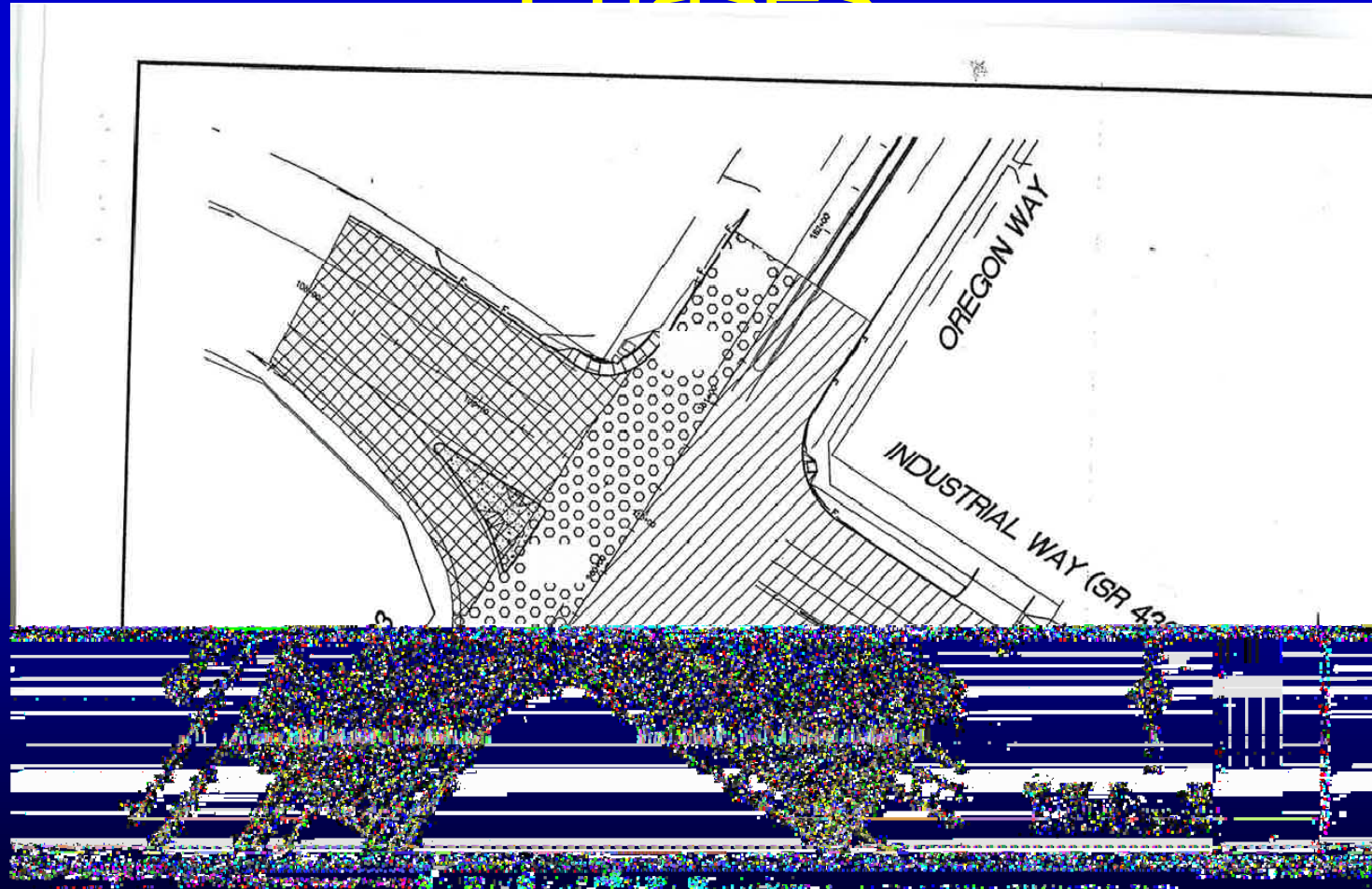
- City of Longview Washington
- City of Redmond Washington

SR 432 / SR 433
PCCP Rebuild
City of Longview

Finished Intersection



Intersection Rebuilt in 3 Phases



SR 520 Avondale Rd/Union Hill Rd

Redmond WA

100,000 ADT

- 100,000 ADT
- 2600 CY
- Construct in 2 Weekends
- Gary Merlino Construction
- Consultant Design
 - INCA Engineers Bellevue



Fast Track

- Standard technology for mix design
- Important to understand it is also sequencing methodology



What is Whitetopping?

- New concrete pavement over existing pavement
- Can be bonded or unbonded
- Most commonly used to refer to overlay of existing asphalt



Where Is It Feasible ?

- Existing AC is 6" or greater or grade is not an issue
- Minimum of 3" of AC must remain after milling
- Existing AC must have remaining structural value

Bond is Key Element

- Forms Composite Pavement
- Reduces edge stress on pavement
 - 3 1/2" overlay, unbonded 1480 psi
bonded 550 psi
 - 2" overlay, unbonded 2420 psi
bonded 420 psi

Thickness Design Procedures

- Based on the PCA Design Procedure
 - Fatigue in the concrete due to corner loading
 - Fatigue in the asphalt due to edge loading
- Information needed:
 - Flexural strength of concrete
 - Strength of subgrade support (k-value)
 - Asphalt pavement thickness after preparation
 - Asphalt pavement modulus
 - Weights, frequencies, and types of truck axles the pavement will carry

Mix Designs

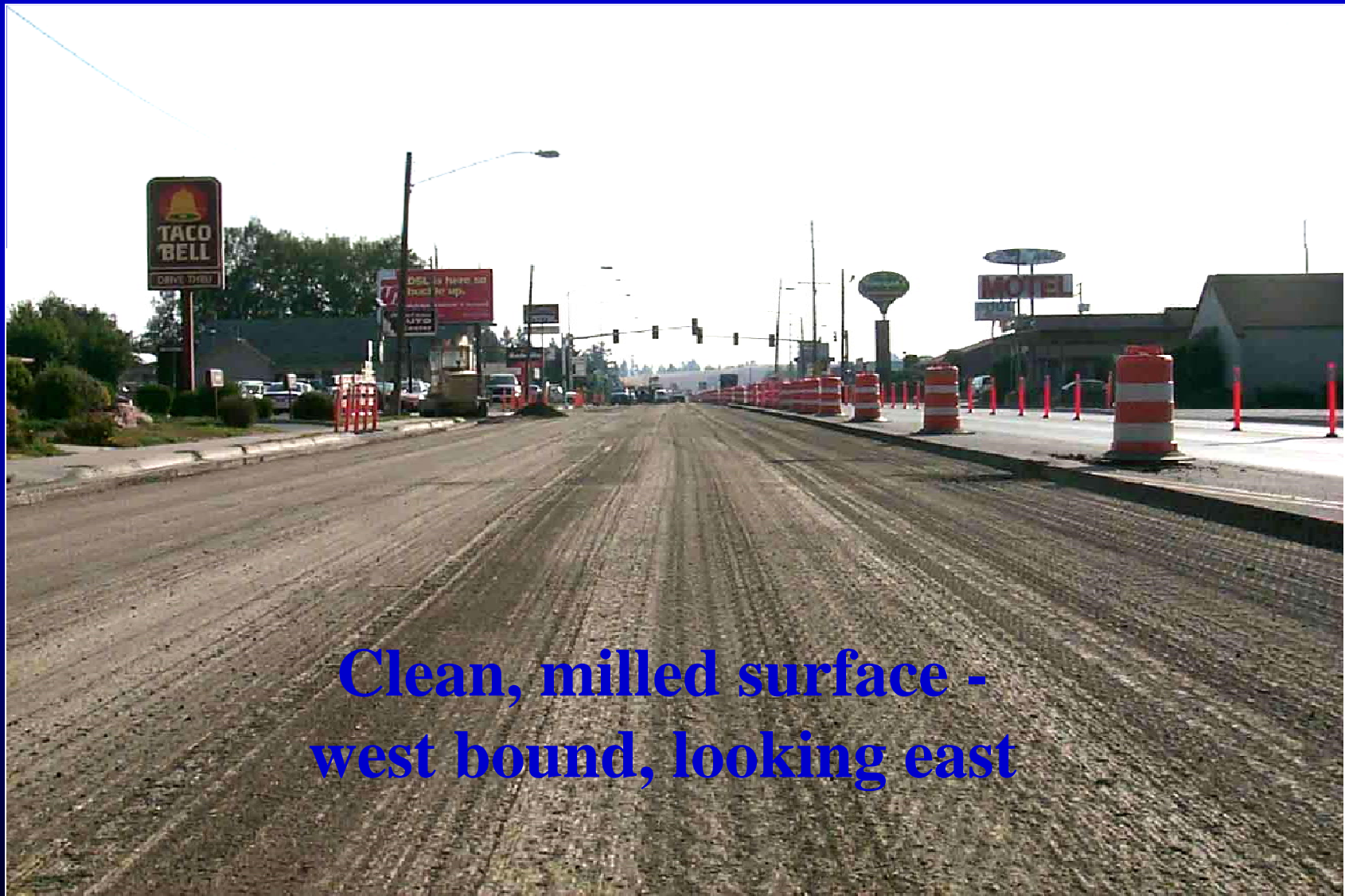
- Typical Higher Cement Content
- Low Water/Cement Ratio
- Synthetic Fibers

Construction Steps UTW

- Mill and clean the surface
- Place, finish, and cure
- Early saw
- Open to traffic



Kalispell



Clean, milled surface -
west bound, looking east

Spokane



**The importance
of vibrating**

Kalispell



Portland



Portland





**Application of
curing compound**

Curing is Critical

- Thin section loses moisture rapidly
- Double curing compound rate
- Apply immediately following texturing

Portland



Portland



Joint Layout

- 24 x T – granular base
- 21 x T – stabilized base
- Maximum of 15'
- $L:W \leq 1.5:1$
- Bond breaker on stabilized base



Keep it Short!



Keep it Uniform!



Keep it Perpendicular!



Keep it Simple!



Keep it Practical!

The Rules of Jointing

Things to Do

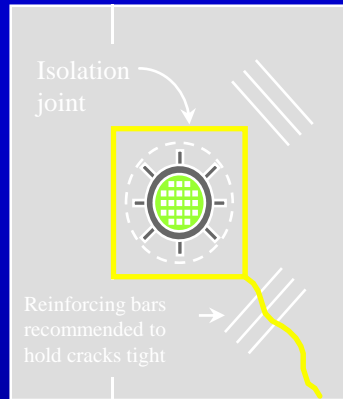
- Match existing joints or cracks
- Place joints to meet in-pavement structures
- Remember max. joint spacing
- Understand you can make field adjustments on joint locations!
- Be Practical

Things to Avoid

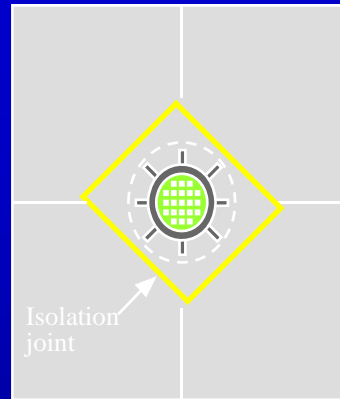
- Slabs < 1 ft (0.3 m) wide
- Slabs > 15 ft (5.0 m) wide
- Angles $< 60^\circ$ ($\sim 90^\circ$ is best)
 - Do this by dog-legging joints through curve radius points
- Creating interior corners
- Odd Shapes (keep slabs square or pie-shaped)

Boxing Out Fixtures

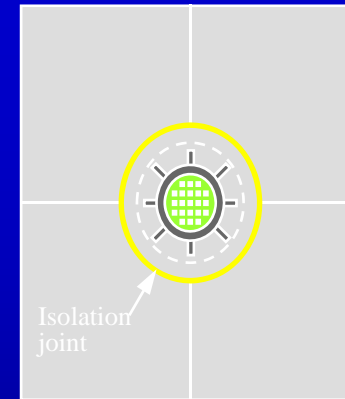
Square



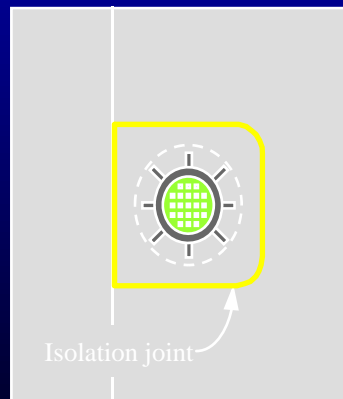
Diagonal



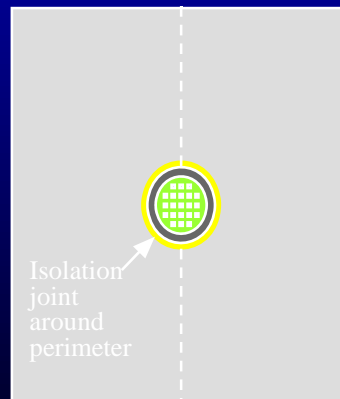
Circular



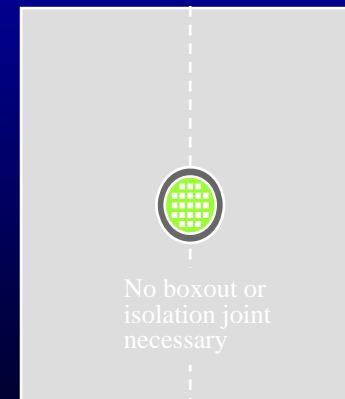
Square with Fillets



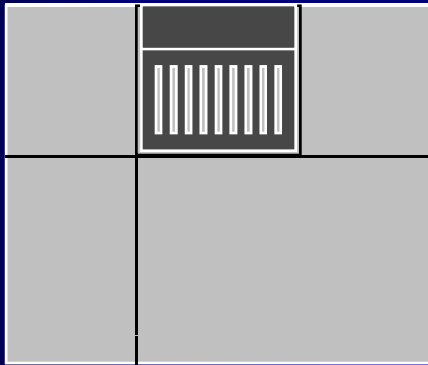
None



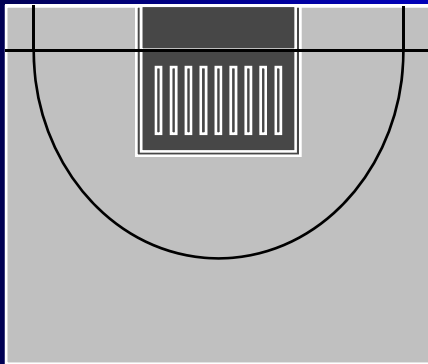
Telescoping Manhole



Square Inlet (no boxout)



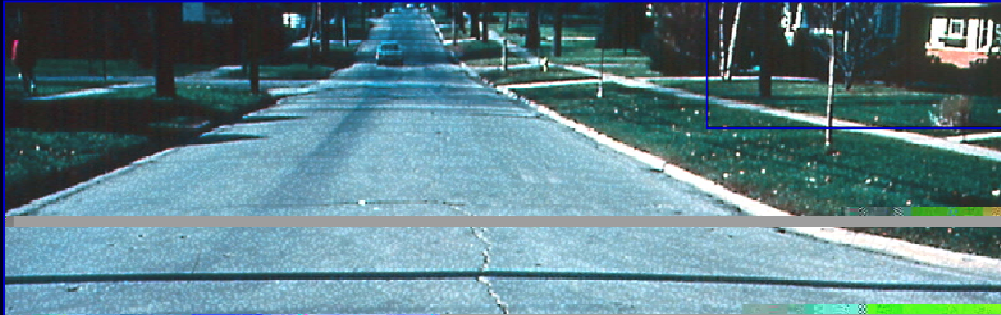
Round Inlet Boxout



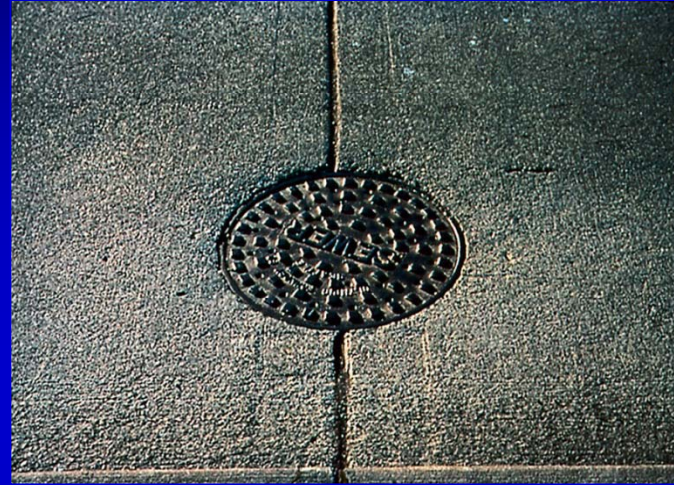


What were they thinking?

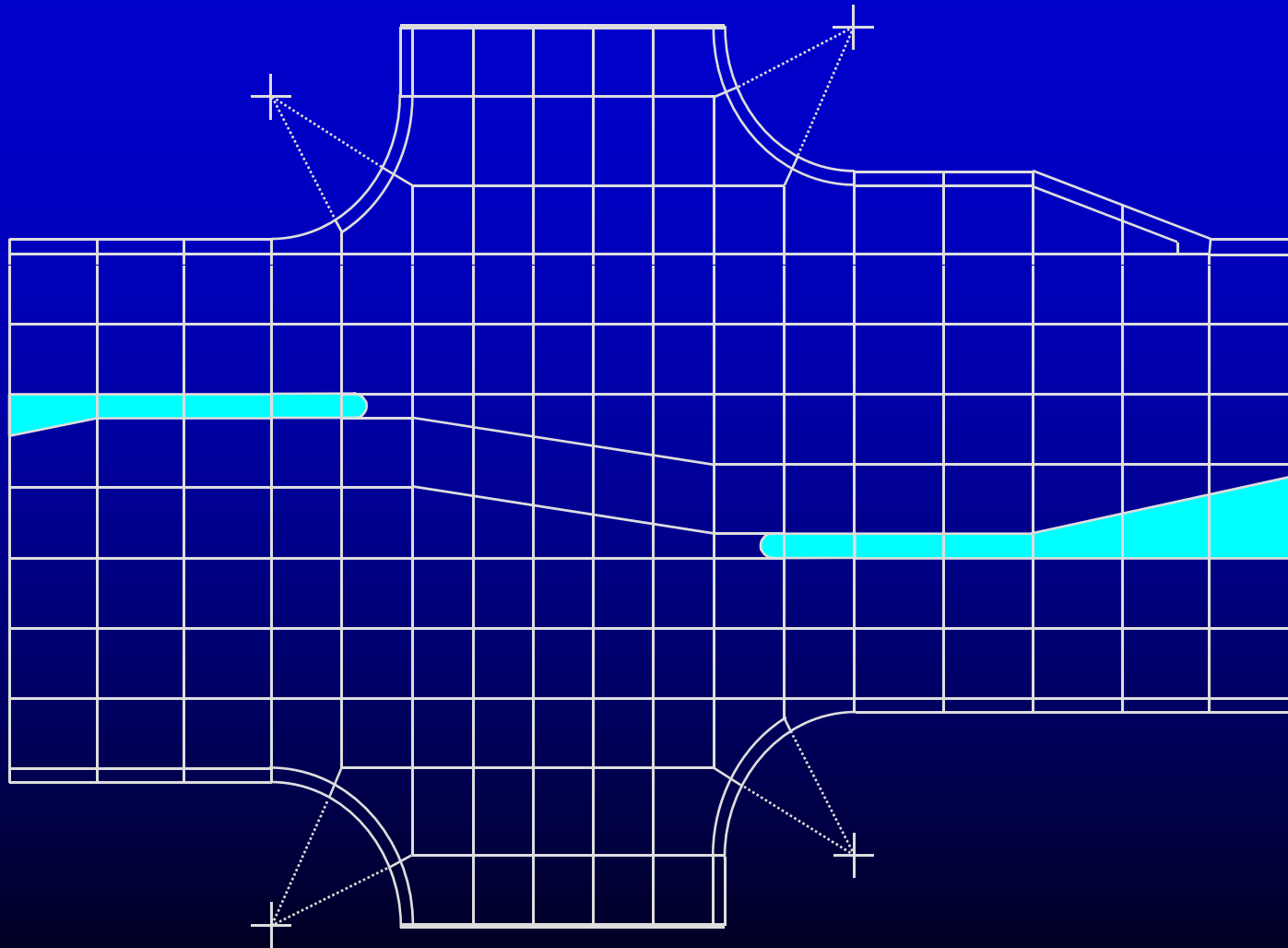
OOPS!!



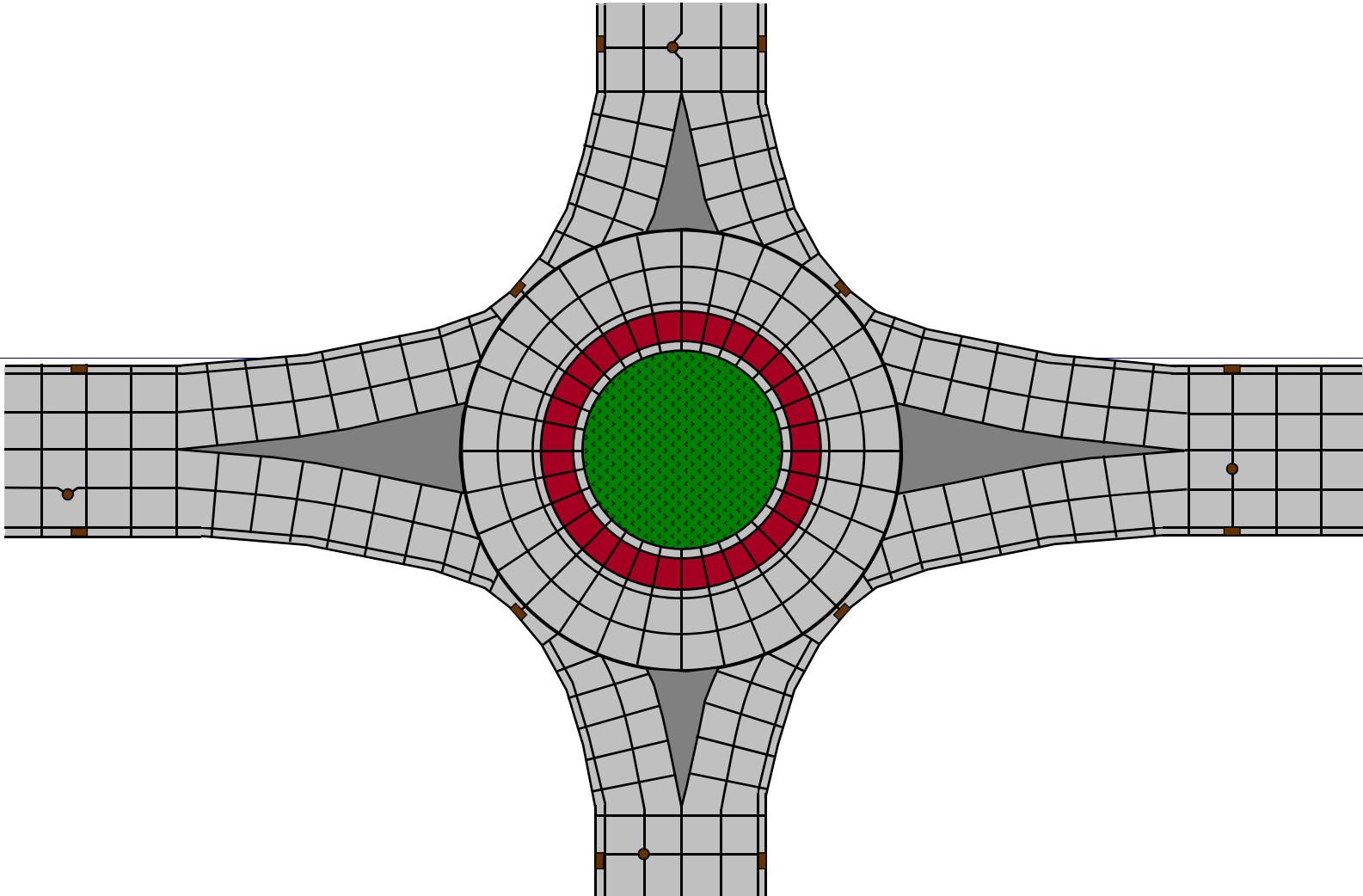
Good Practice!



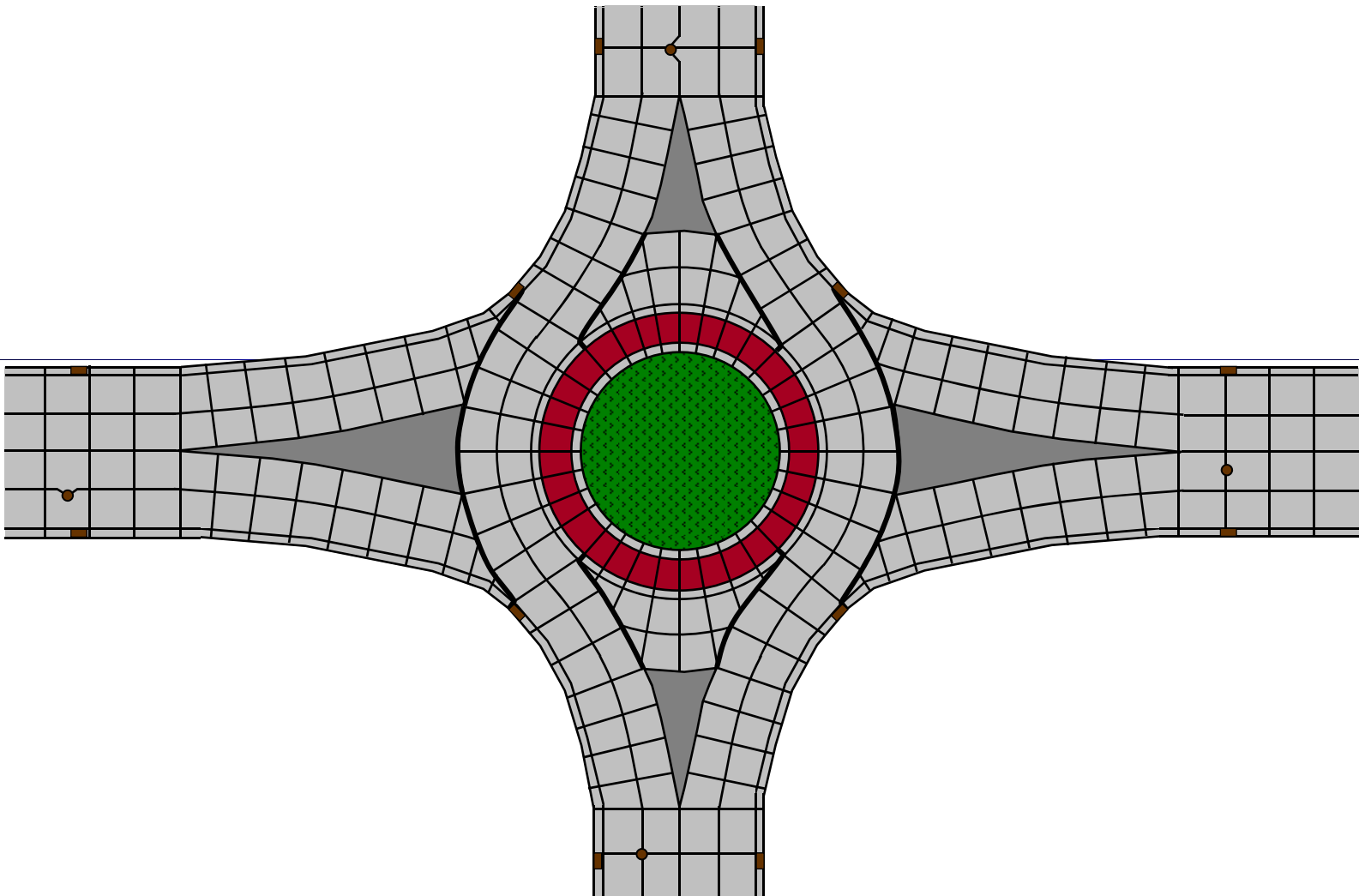
Joint Layout is Critical



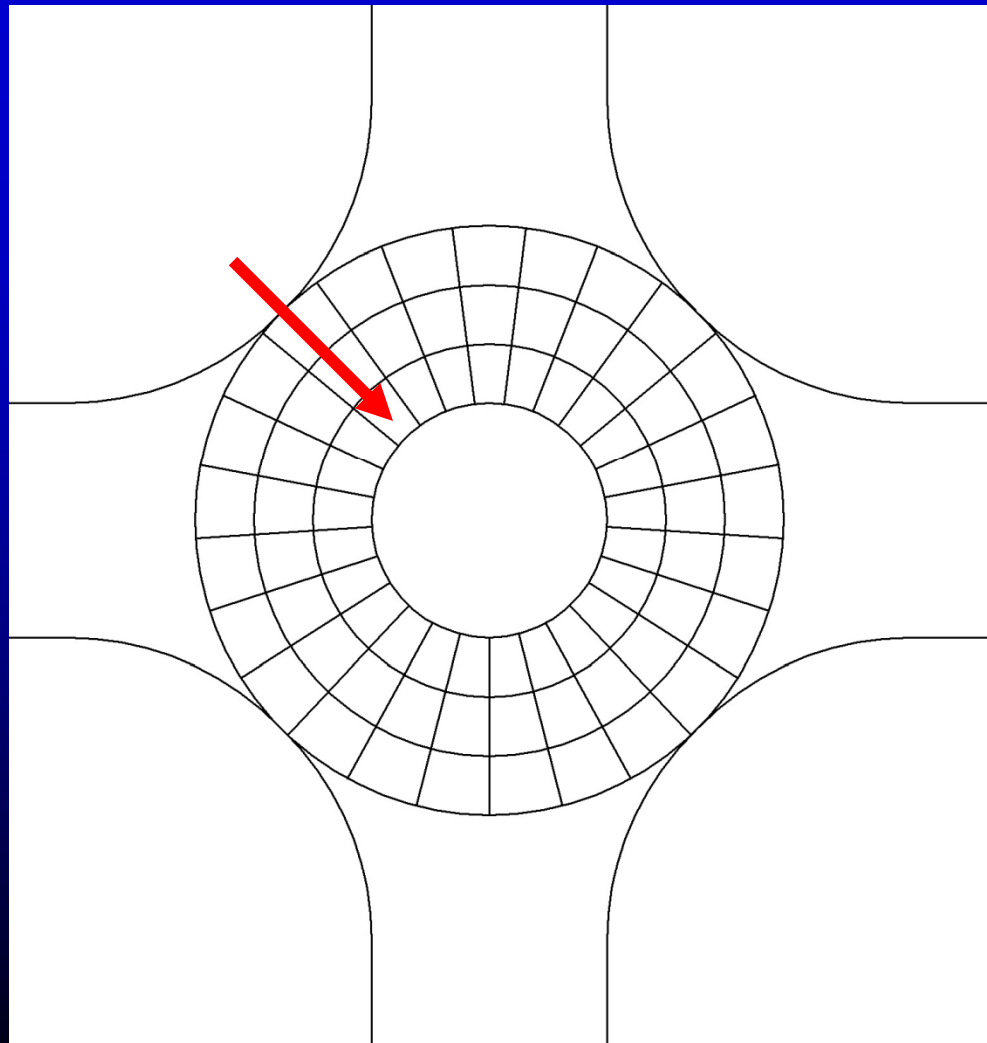
Isolate Circle



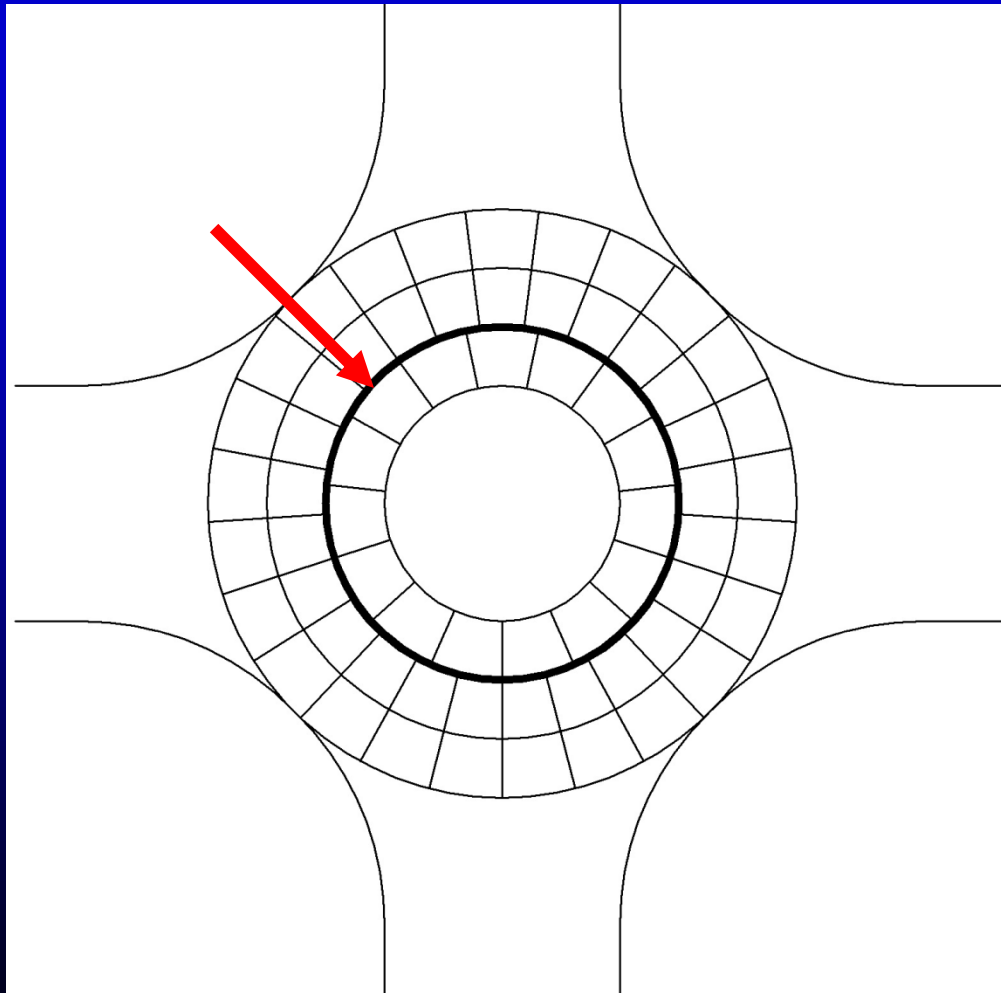
Pave Through



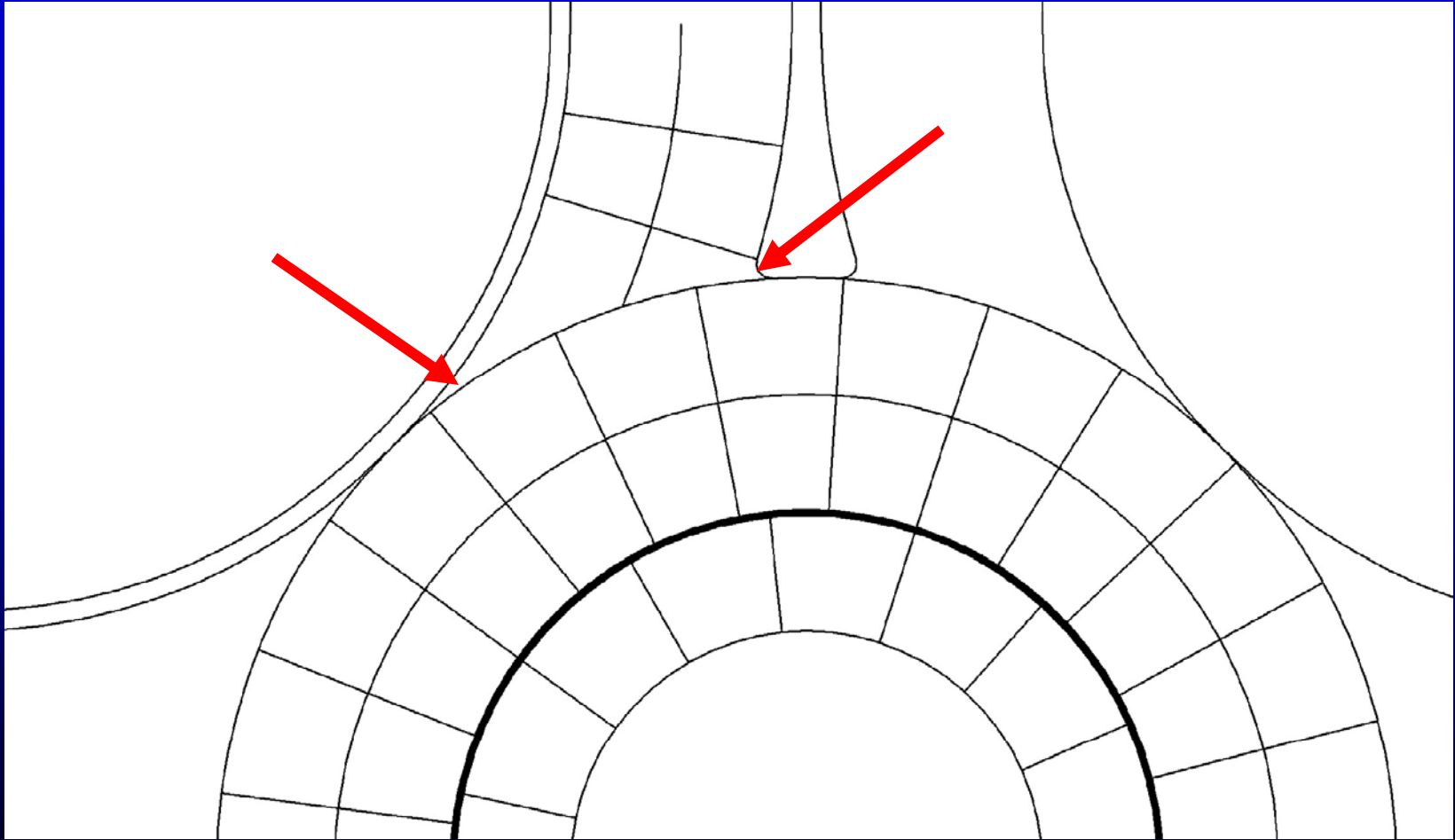
Narrow Radial Slabs/Truck Aprons



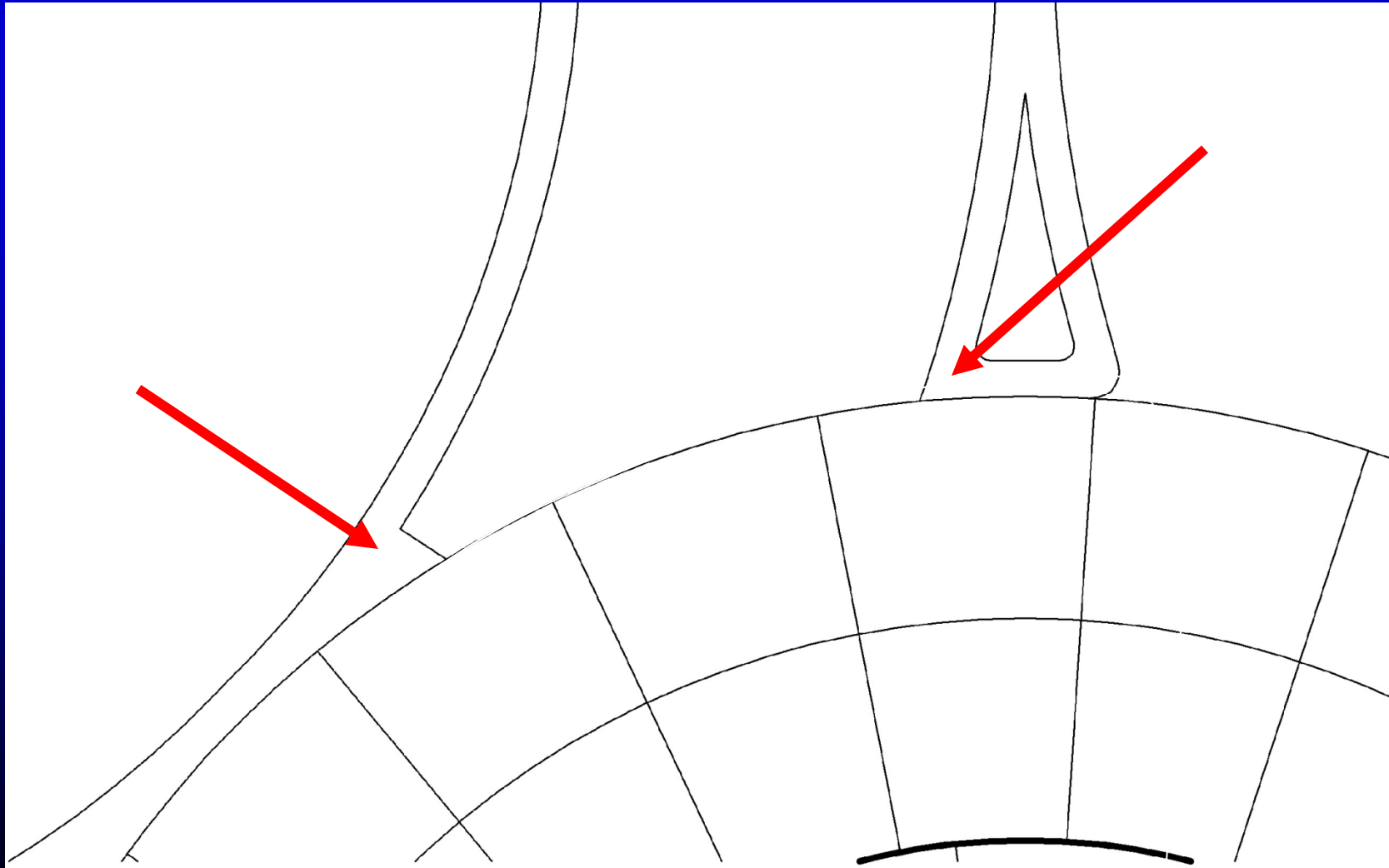
Narrow Radial Slabs/Truck Aprons Isolation Joint



Narrow Slivers



Narrow Slivers Widened Gutter



Curb Placement – Widened Gutter



Keys to Success

- Proper placement of isolation joints
- Remember rules of jointing
- Follow the steps
- Be practical and flexible!

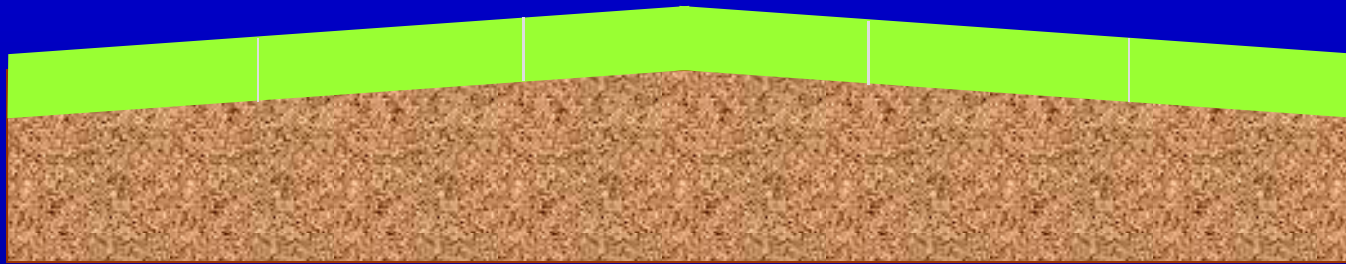
Conclusion

- Proper jointing requires only a few simple rules
- If you keep it simple and practical - jointing is easy!

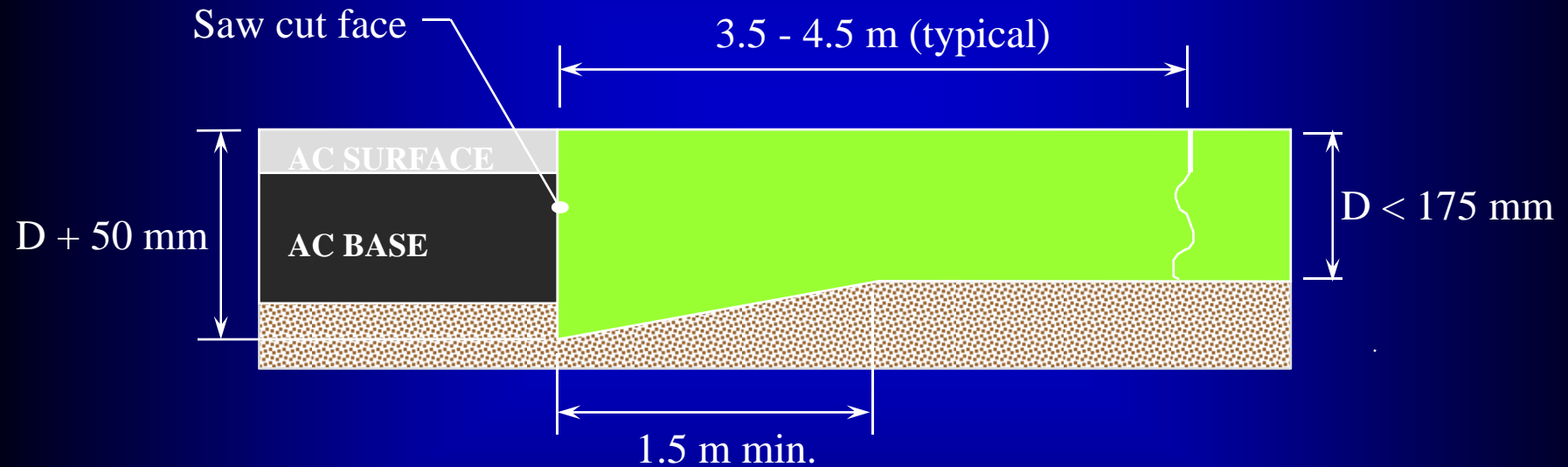
CROWN

1.5% min.
1% in intersection

?

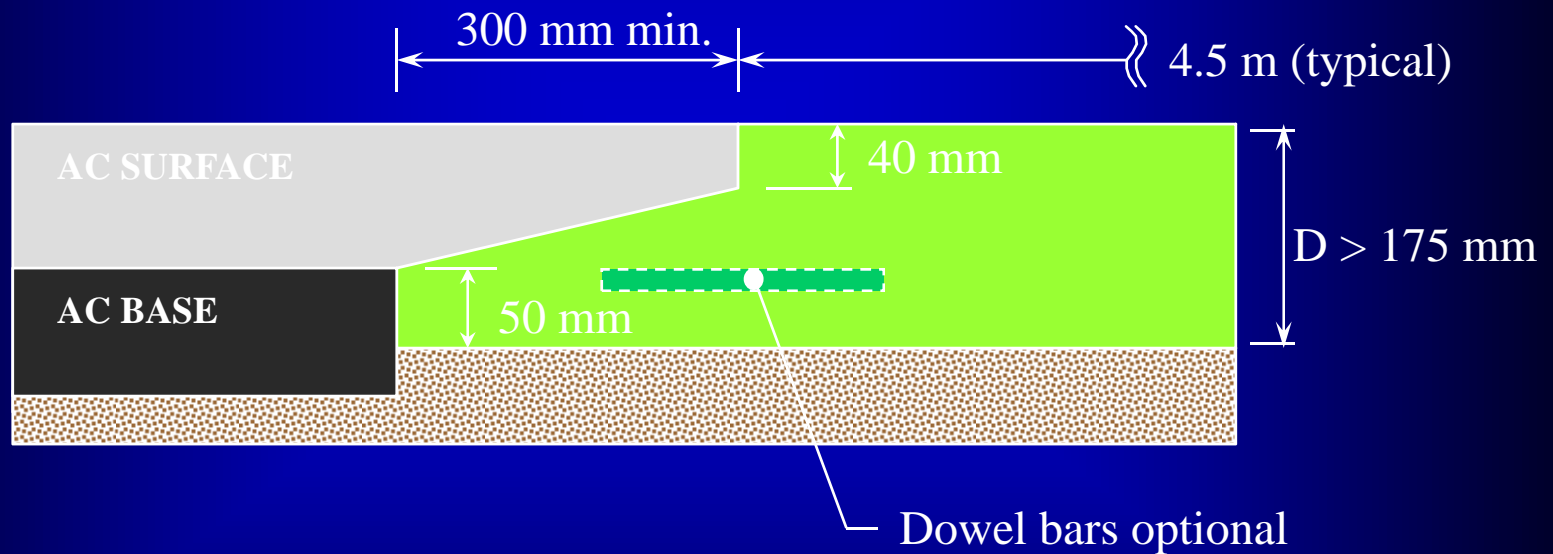


Concrete to Asphalt Transition $D < 175 \text{ mm}$



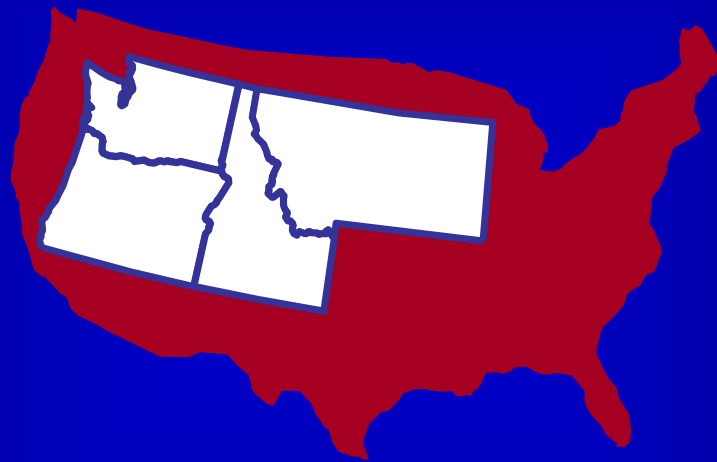
Thickened Edge

Concrete to Asphalt Transition $D > 175 \text{ mm}$



Impact Slab

NORTHWEST CHAPTER



ACPA

