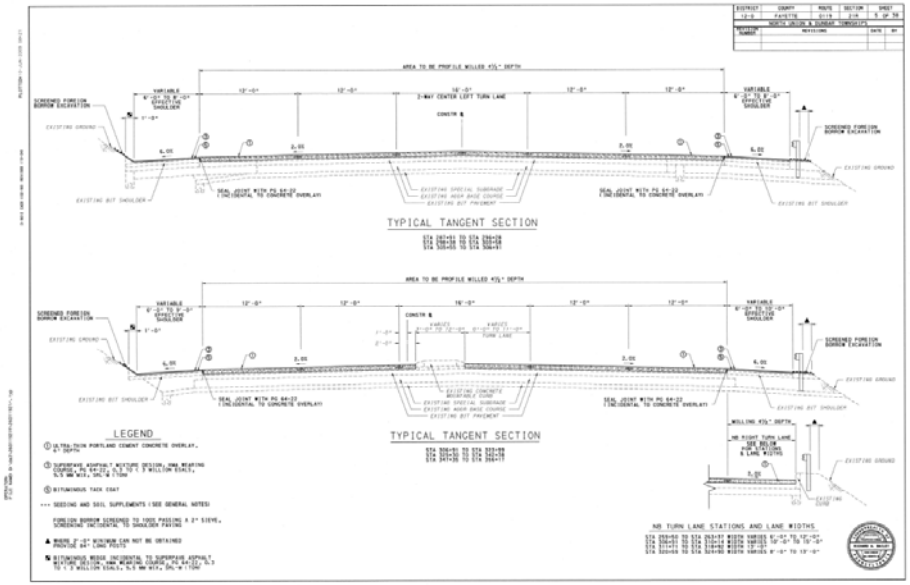
National Concrete Pavement Technology Center

Tech Center

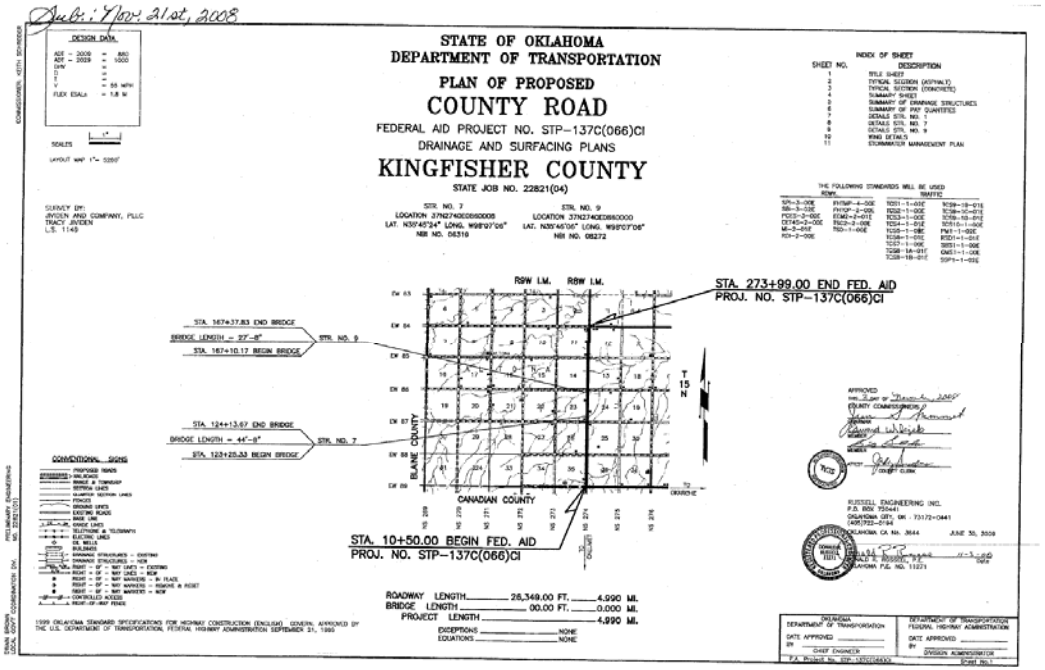
Concrete Overlay
Plans, MOT and Construction

Plan Development



- For agencies that are inexperienced with the design of concrete overlays, the approach should be similar to that of designing an asphalt overlay
- The location, geometrics and maintenance of traffic requirements should dictate the level of design detail that is required in the plans

Plan Development



- Oklahoma example
- 5 mile county road – 5” concrete overlay
- 12 plan sheets (4 are structure details)

Identify and Quantify Constraints

- Vertical and horizontal constraints need to be identified during the pavement evaluation
  - Existing structures
  - Overhead clearances – overpasses, signs and utilities
  - Barrier rails
  - Existing cross-slope variability and new cross-slope requirements
  - Drainage structures
  - Existing foreslopes
  - Intersections, driveways and field entrances

Traffic Management- Concrete Overlays

Traffic management for concrete overlay projects is no more challenging than for any other paving project, particularly under traffic, as long as straightforward practices are followed:

Traffic Management- Concrete Overlays
Top 20 Elements

1. Traffic Congestion-Capacity analyses-lanes required, length of queues anticipated, large trucks, construction speed, etc
2. Time restrictions—peak hours, seasonal peaks
3. Limits to work areas & local access
4. Detour routes and their capacity
5. Work vehicle access and worker parking
6. Bicycle and pedestrian traffic (urban)
7. Warning sign locations—detours, long queues, intersecting roads
8. Nighttime restrictions, delineation and illumination
9. Signals, turning lanes, bus stops
10. Traffic service—residential/business

Traffic Management- Concrete Overlays

11. Opening to traffic—maturity, strength requirements, cure time
12. Off-peak traffic hours for increased production
13. Phasing of work—length of work zone, project limits
14. Special conditions such as dropoffs, bridge installation
15. Pre-paving and paving restrictions
16. Short duration closures anticipated
17. Emergency Planning
18. Public information—public meetings with landowners, media,
19. Local officials—police, fire, hospitals, schools, railroads, airports
20. Special events

Work Zone
Cost Effectiveness

- Traffic strategies can significantly affect project costs
- Traffic control costs and construction costs should be balanced against the impact on the public
- Many urban intersections have been overlaid with concrete utilizing only weekend work hours
- Agency sets the criteria regarding staging, contractor proposes staging that meets criteria

2 Lane Roadways: Open or Closed for Overlay Construction?

- Always analyze the option of closing road where feasible.
  - Partly or completely closing a work zone to traffic can help minimize traffic management costs.
  - Projects closed to traffic can save time and cost of 25% to 35%.
- Concrete overlays can be successfully and cost-effectively constructed without closing the roadway to traffic
- Contractor is responsible for maintaining local access for residents and businesses.
- Putting the onus on the contractor allows flexibility in their methods for providing local access is a preferred strategy

Paving

- Maintenance of traffic
  - Depends on concrete overlay thickness
    - If edge drop-off criteria is exceeded, then MOT is just like full depth PCC reconstruction
    - Otherwise, similar to MOT for asphalt projects
  - Options include:
    - Construction adjacent to traffic (lane at a time)
    - Positive separation or cones
    - Pilot car operation for two lane roadways
    - Crossovers and construct full width
    - Staged intersections or full closure with accelerated opening (48 to 72 hr)
  - All concrete overlays are accelerated construction!

Inside Safety Material

Inside Safety Edge Placement

Inside Safety Edge Placement Removal

Permanent Safety Edge

Permanent Safety Edge

Contingency Bid Items

- Token quantities established for
  - Undercut and backfill to repair subgrade failures
  - Full depth patching (bituminous and/or PCC)
  - Temporary surfacing (granular and/or bituminous) to provide access to property owners

Pre-Paving

- Milling
  - Remove distortions of 2” or more
  - Reduce high spots to insure minimum overlay thickness
  - Match adjacent lanes
  - Enhance bond
  - Minimize vertical grade changes
  - Restore profile
- Bonded on asphalt or composite must maintain a minimum of 3” sound asphalt after milling

Pre-Paving

- Cautions for milling
  - Milling should be minimized to retain structural support of pavement
  - Grade corrections should be made in the thickness of the concrete overlay

Excessive milling of existing asphalt

Pre-Paving

- Surface cleaning
  - Power sweeping
  - Air blasting

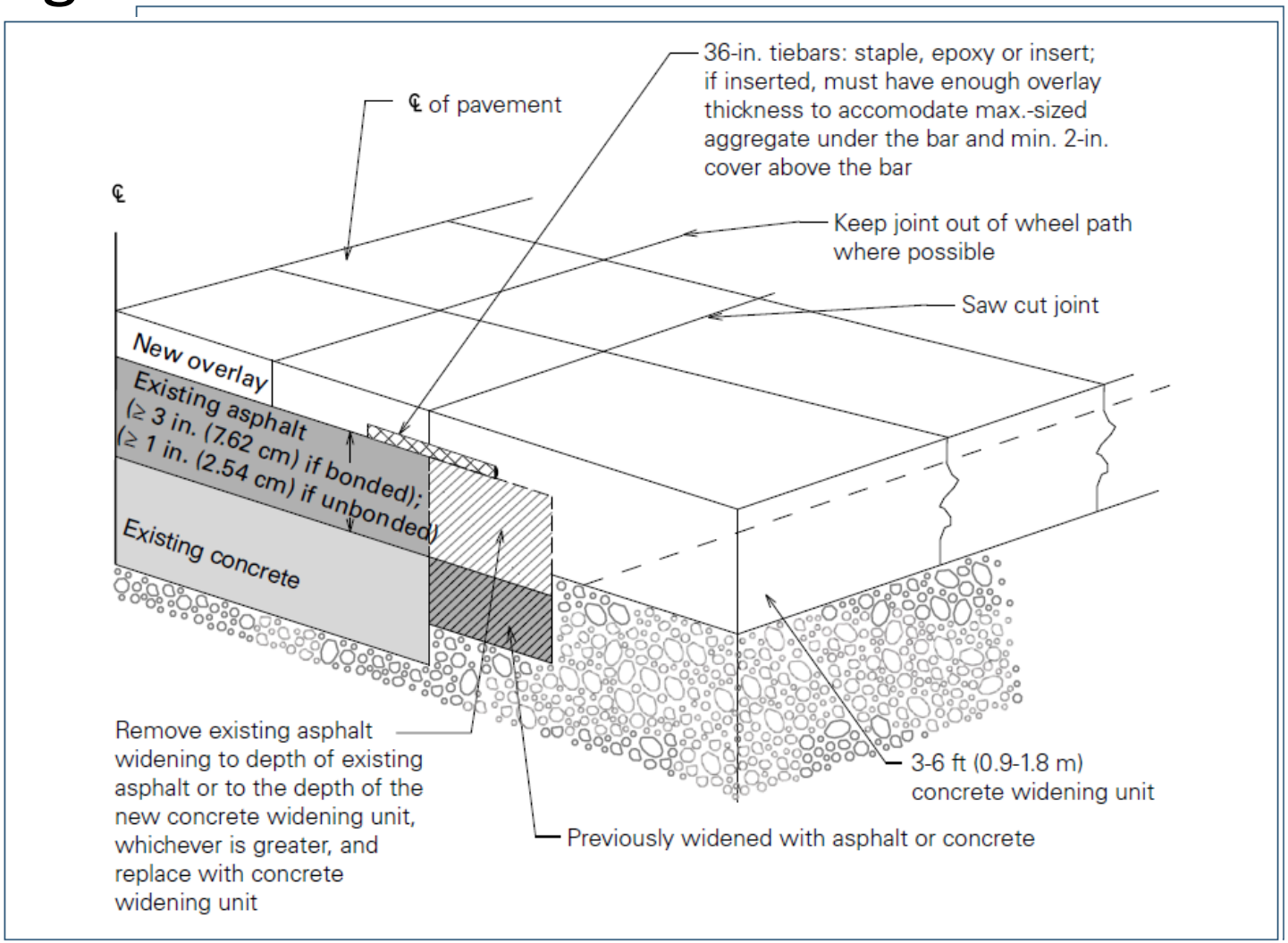
Separation Layer for Unbonded on Concrete

- Required for good performance
  - Isolate overlay from existing distress
    - Prevent reflective cracking
    - Provide cushioning
    - Allow for drainage
  - Provide construction platform for overlay construction

- Recommended separation layer material:
  - 1 in HMA
  - Geotextile fabric

Pre-Paving

- Widening units

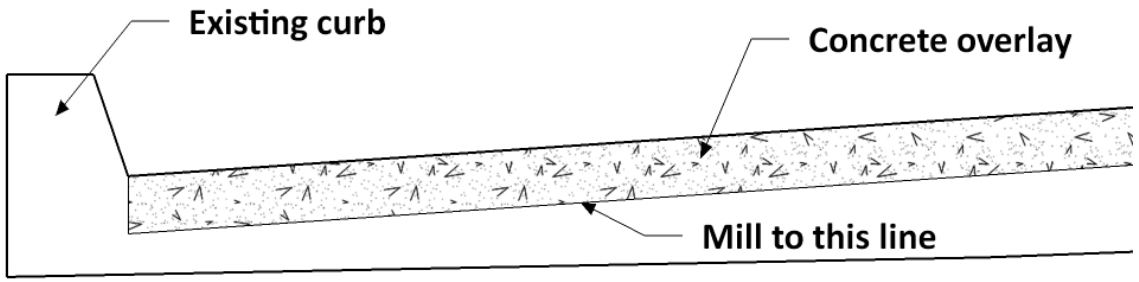


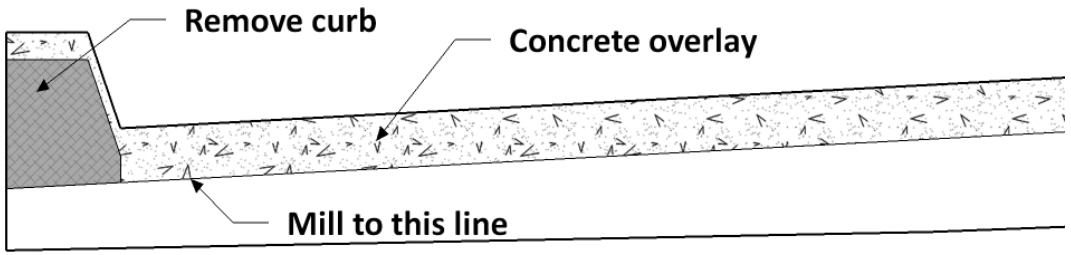
Pre-Paving

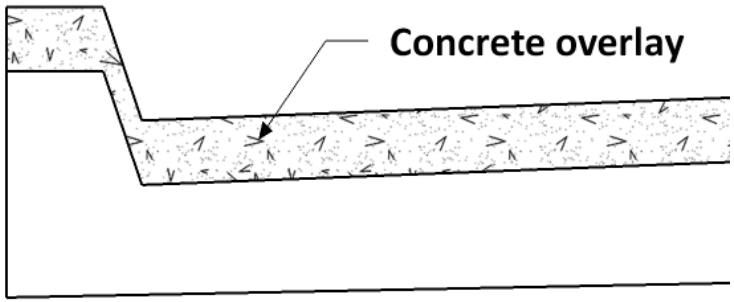
- Dowel basket placement
  - t ≥ 7″
  - Securely anchored
  - Variable thickness HMA interlayer must be accounted for (anchor length and shot force)

Paving

- Curb treatments

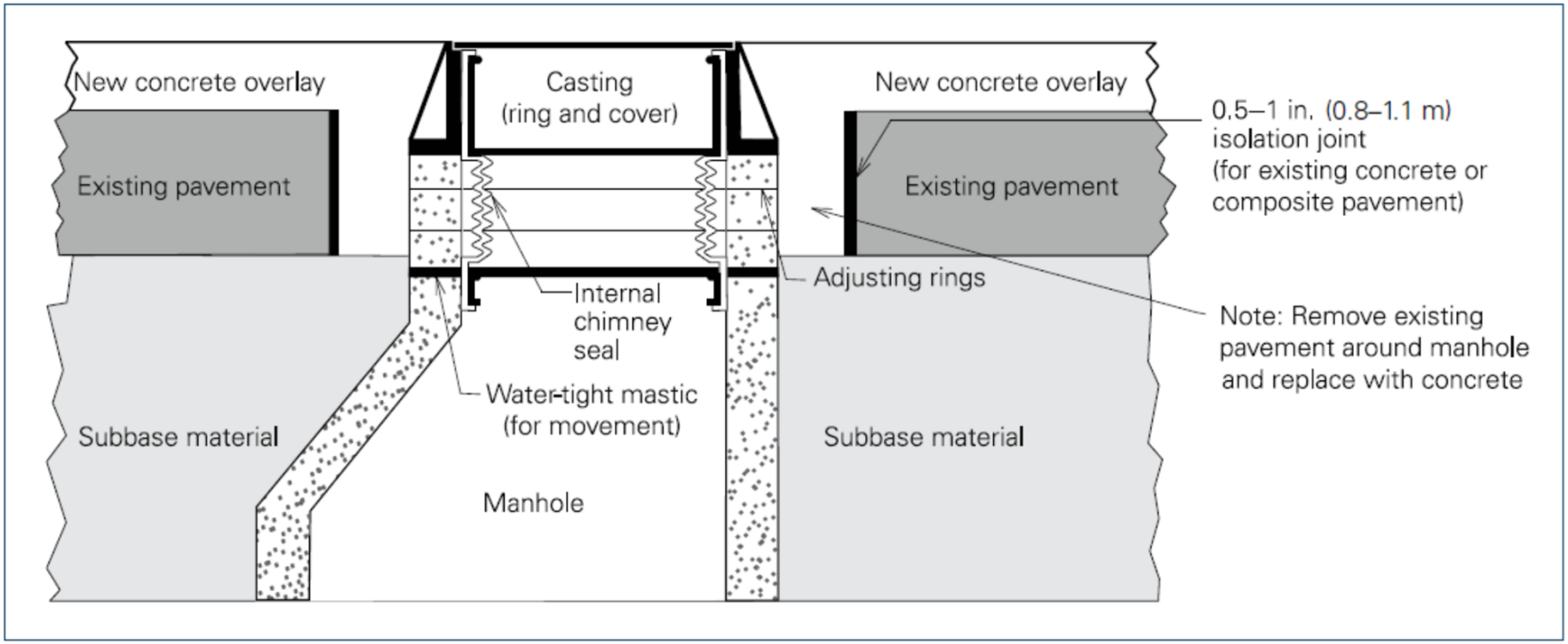






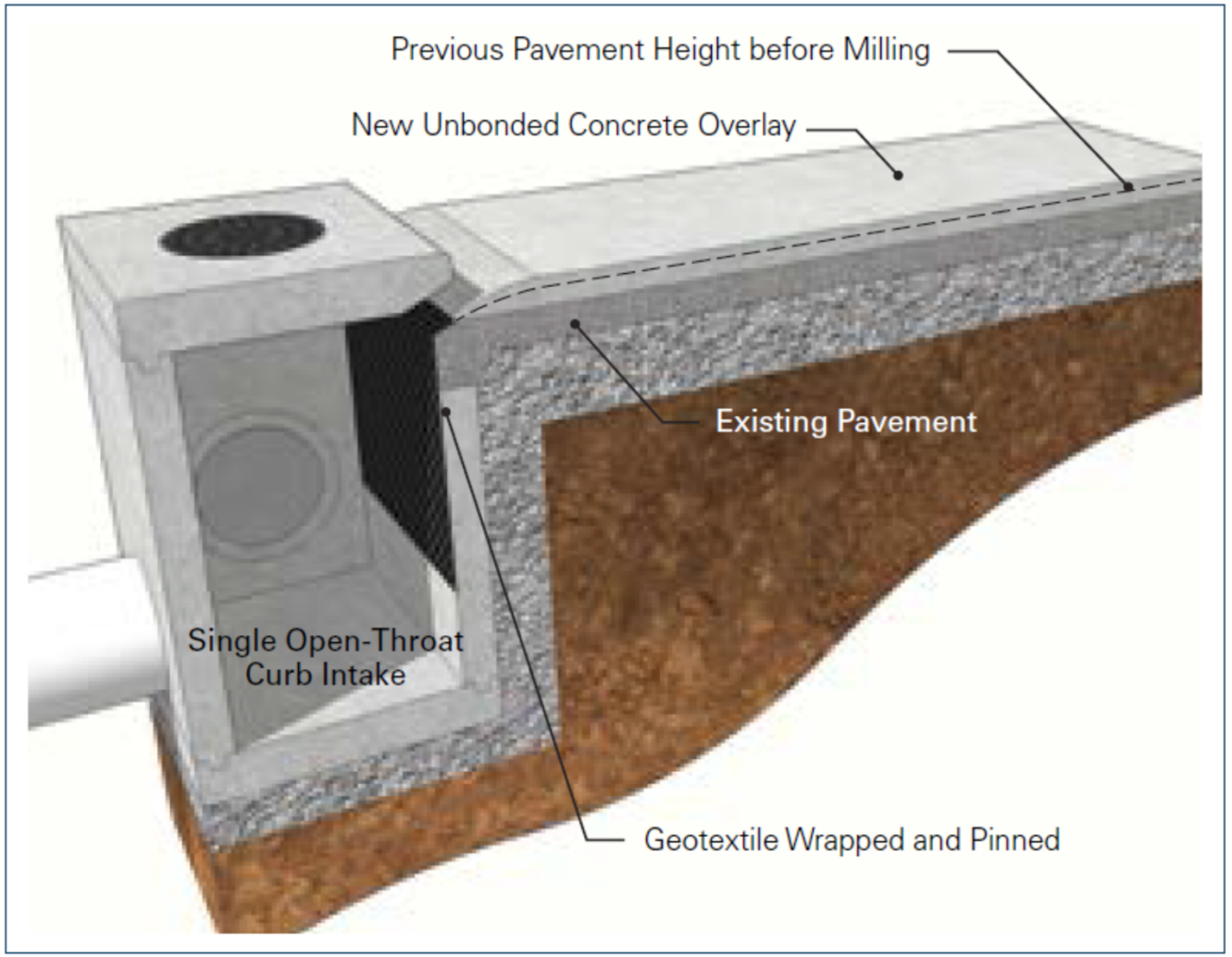
Paving

- Manhole and utility structures



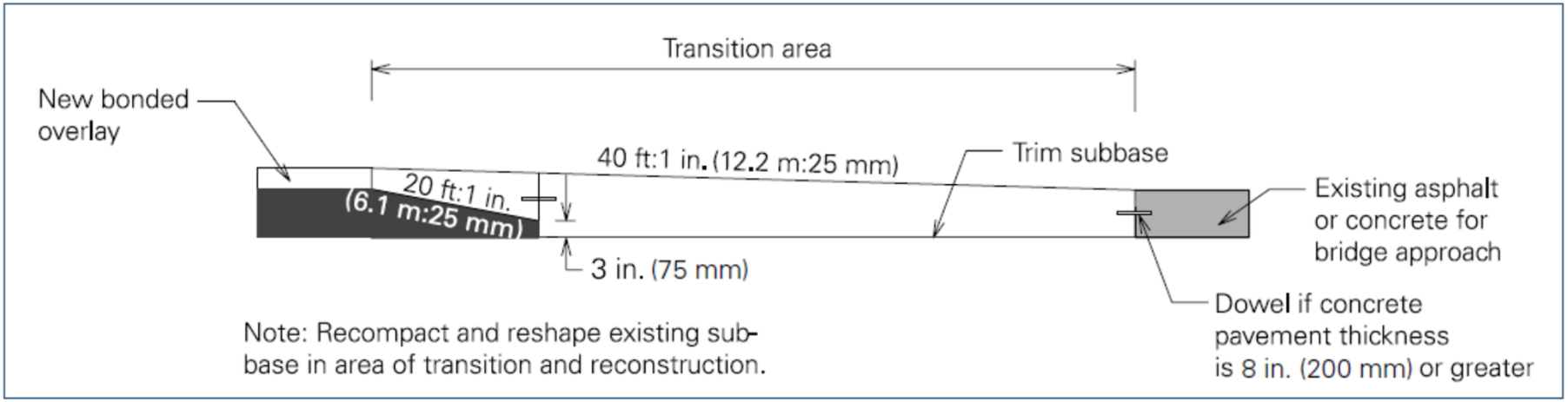
Paving

- Draining geotextile interlayer in urban sections



Paving

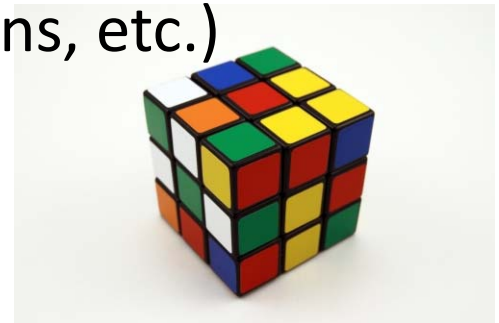
- Transitions to existing pavement and structures



Clearance Challenges

The primary challenges to maintaining reduced clearances are:

- Equipment Clearances:
  - Physical tracks and frame of the slip-form paving machine
  - Traditional paving controls such as use of a string line
- Adequate working area for workers
- Traffic controls for traffic in adjacent lanes
- Traffic Users (vehicles, bicycles, pedestrians, etc.)

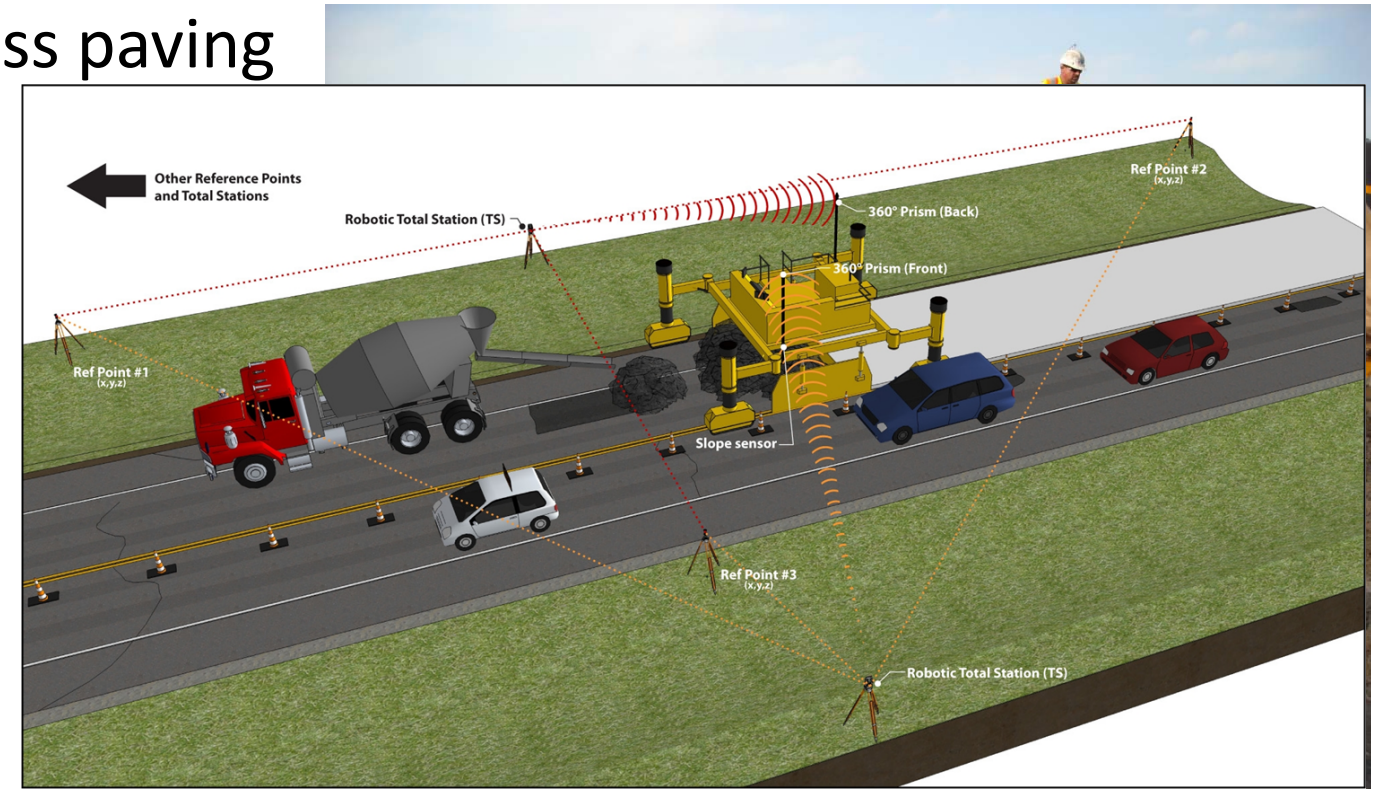


Reducing Clearances

- Do not specify a particular piece of equipment or method …
  - Define the maximum allowable clearance zone
  - Allow the contractor to innovate with their equipment and processes

Clearance Challenges

- Adaptation
  - Moving string (ski)
- Innovation
  - Stringless paving



Pre-Paving

- Stringline
- Stringless – 3D models for existing/milled surface and concrete overlay
- Profiles optimized to balance
  - Thickness
  - Volume
  - Smoothness

Concrete Overlays
Accelerated Construction

- Eliminates exposing subgrade to the weather
- Production is typically (or should be) limited by the capacity to saw joints in a timely manner
- Lane rental and A+B bidding with incentives can be used to motivate accelerated opening
- Normal concrete mixtures can and should be used

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Concrete Overlay Construction and Inspection

WETTING THE MILLED SURFACE

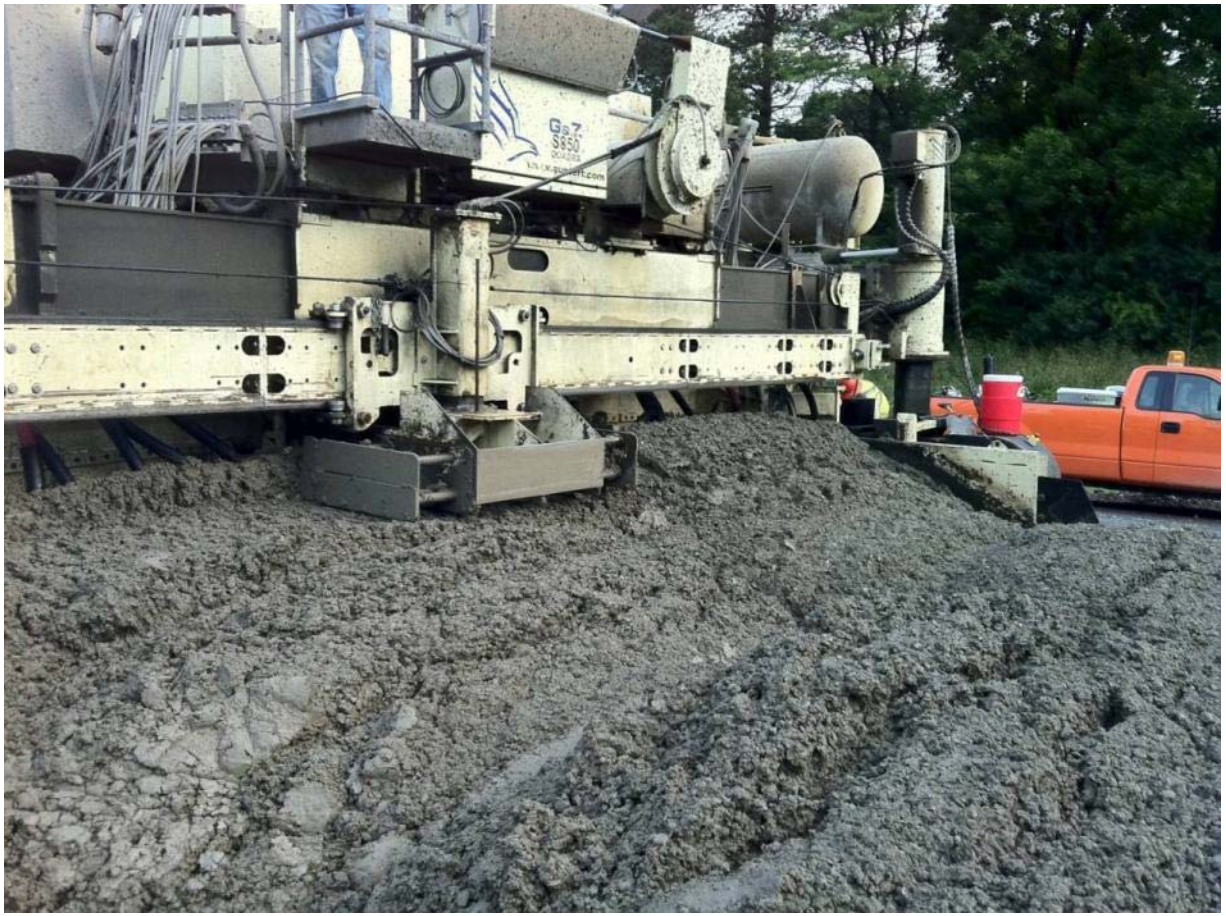
- NO STANDING WATER

SPREADING CONCRETE

- Continuous supply of concrete to the paver
- Consistent head => smoothness

Recommended Practices

- Maintain a consistent head – too much?



Recommended Practices

- Maintain a consistent head – too little?

Key Inspection Items

- Look for segregation and/or improperly mixed concrete
- Note times/locations when concrete head is at the extremes

Appropriate Actions

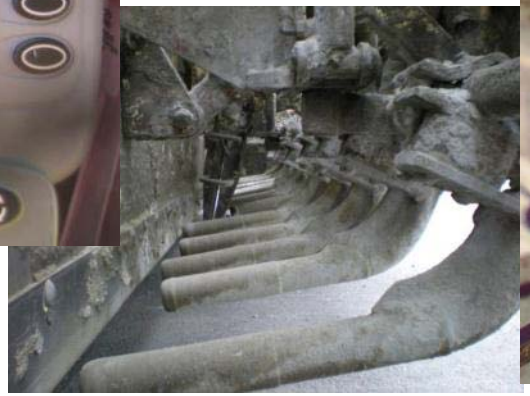
- Adjust spreading process
- Reject pavement if the grout box empties

Slipform Paver Functions

- Consolidation
- Shaping
- Surface finish
- Pavement smoothness

Consolidation

- Match vibrator frequency to workability and paver speed
- Electronic vibrator monitor



Over-Vibration

- Vibrator Trails
- Segregation

Key Inspection Items

- Visually inspect the pavement edge and surface for proper consolidation
- Some voids are preferable to slurry

Appropriate Actions

- Adjust vibrator frequency
- Adjust speed
- Refine mixture proportions
- Stop paving if the edge keeps falling

WIDENING TIEBAR PLACEMENT

WIDENING TIEBAR PLACEMENT

- Mark the transverse joints first
- Mark bar locations second with 30 inch centers on two bars/panel & equal space from bar to transverse joint location
- Do not place a bar closer than 4 inches to a transverse joint
- Place two clips behind the bar and one in front to prevent turning
- Bars should be reasonably perpendicular to the slab

Key Inspection Items

- Periodically verify steel location behind the paver
  - Cover meter (pachometer)
  - GPR after hardened
  - MIT Scan T2

Recommended Practices

- Fill surface voids
- Avoid over-finishing

Recommended Practices

- Identify bumps and dips – overlap straightedge by 1/2
- Correct bumps and dips

Appropriate Actions

- Adjust mixture workability
- Adjust vibrator frequency

Texturing

- Micro texture
  - Drag texture with adequate contact area
  - Dry pavement friction

Key Inspection Items

- Cure as soon as practical
- Even and complete coverage
- Consistent operating speed

Key Inspection Items

- Edge covered also
- Even and complete coverage

Recommended Practice

- Apply cure before surface drying occurs

Appropriate Actions

- Adjust curing operations for dry and/or windy weather conditions
- Clean/adjust nozzles for uniform coverage

Sawing

- Why do we saw joints?

Differential Movement

- Considerations for Spring and Autumn construction
  - Existing pavement structure is expanding and contracting more with larger temperature swings
  - Increased risk for cracking if the concrete mixture has a slow rate of strength gain

Sawing

- Specify the depth
- Require adequate number of saws and blades
- Production rates should consider sawing requirements?
  - Example 2,500 CY per day
    - 6” thick x 24’ wide with 6’x6’ slabs = 39,378 lf of sawcut
    - 10” thick x 24’ wide with 12’x15’ slabs = 8,746 lf of sawcut

Recommended Practices

- Adequate number of saws on the project

Recommended Practices

- Joints marked accurately

Recommended Practices

- Saw in the window
- Timing is critical
- Monitor depth of cut (T/3)

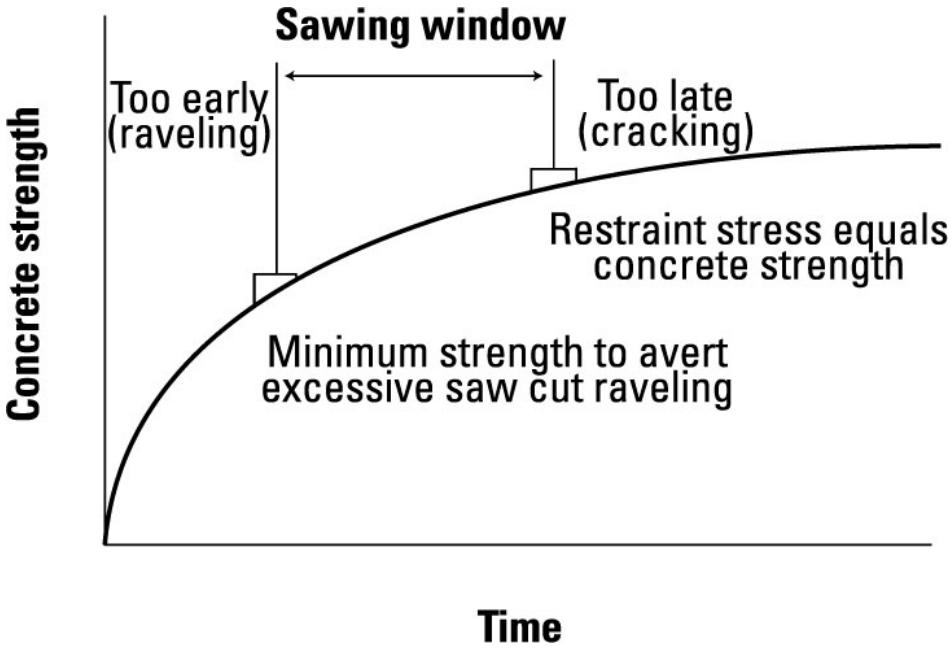


Figure 8-23. Close-up of different degrees of raveling caused by joint sawing (ACPA)

Key Inspection Items

- Specified sawing depth and width
- Appropriate saw blades
- Ample saw blades on-hand

Appropriate Actions

- Adjust mix to control set time
- Change saw timing to match weather conditions

Questions and Discussion