Concrete Pavements for City Streets

Virginia Concrete Conference
March 7, 2008

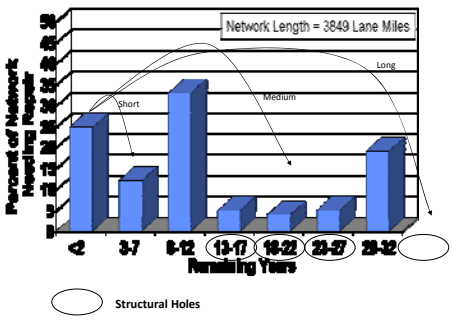
Scott Haislip
Director of Streets & Roads

Count on Concrete

S&R Pavement Markets

- New/Reconstruction of Concrete Pavements
- Concrete Pavement Restoration - Utility Cuts
- Concrete Overlays
  - Bonded (UTW)
  - Unbonded (Whitetopping)
- Concrete Inlays
  - Intersections
  - Roundabouts
  - Bus Pads
  - Alleys

Remaining Service Life Model



New Design Tools for SLR

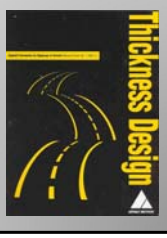
- StreetPave Software
  - Concrete Thickness
  - Asphalt Institute Design Thickness
  - Life Cycle Cost Analysis
- Information Sheet IS184
- Equivalent Pavement Design Charts

Equivalent Pavement Design

StreetPave Software

- Concrete pavement thickness design based on revised criteria
- Asphalt equivalent section based on converted total carrying capacity
- Life-Cycle cost analysis based on initial costs of equivalent pavements and predicted maintenance

What's Equivalent



Concrete Pavement Types

- Jointed Plain
  - Undoweled
  - Doweled
- Jointed Reinforced
- Continuously Reinforced
- Prestressed

ACPA Count on Concrete

Municipal Pavement Design

- Street classification and traffic
- Geometric design
- Subgrades and subbases
- Concrete quality
- Thickness design
- Jointing
- Construction specifications

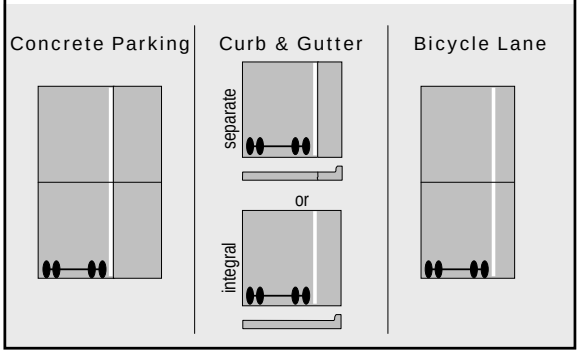
ACPA Count on Concrete

Street Class	Description	Two-way Average Daily Traffic (ADT)	Two-way Average Daily Truck Traffic (ADTT)	Typical Range of Slab Thickness
Light Residential	Short streets in subdivisions and similar residential areas – often not through-streets.	Less than 200	2-4	4.0 - 5.0 in. (100-125 mm)
Residential	Through-streets in subdivisions and similar residential areas that occasionally carry a heavy vehicle (truck or bus).	200-1,000	10-50	5.0 - 7.0 in. (125-175 mm)
Collector	Streets that collect traffic from several residential subdivisions, and that may serve buses and trucks.	1,000-8,000	50-500	5.5 - 9.0 in. (135-225 mm)
Business	Streets that provide access to shopping and urban central business districts.	11,000-17,000	400-700	6.0 - 9.0 in. (150-225 mm)
Industrial	Streets that provide access to industrial areas or parks, and typically carry heavier trucks than the business class.	2,000-4,000	300-800	7.0 - 10.5 in. (175-260 mm)
Arterial	Streets that serve traffic from major expressways and carry traffic through metropolitan areas. Truck and bus routes are primarily on these roads.	4,000-15,000 (minor) 4,000-30,000 (major)	300-600 700-1,500	6.0 - 9.0 in. (150-225 mm) 7.0 - 11.0 in. (175-275 mm)

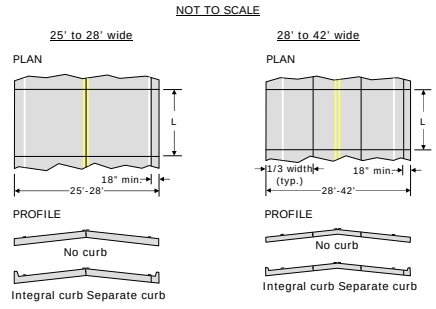
Geometric Design

- Increase Edge Support
  - Integral Curb
  - Tied Curb & Gutter
  - Widened Lanes (2 feet no parking)
  - Parking Lanes
  - Rural Areas – Tied Concrete Shoulders
- Street Widths
  - Minimum width of 25 ft.
  - Maximum Cross Slope of 2 percent (¼" per ft.)
  - Traffic Lanes 10-12 feet
  - Parking Lanes 7-8 feet

Edge Support



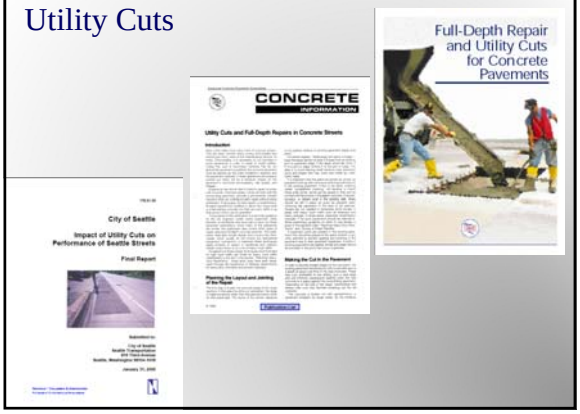
Basic Two-Lane Section



Concrete Pavement Restoration

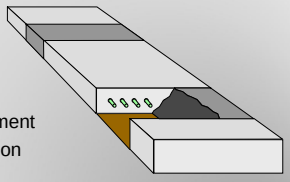
- CPR Focused:
  - Full Depth Pavement Patching
  - Partial Depth Pavement Patching
  - Surface Grinding
- Utility Cuts

Utility Cuts



Full-Depth Utility Cut Patches

- Purpose
  - Restore structure
  - Restore ride
- Used for
  - Utility repair, replacement
  - Joint/crack deterioration
  - Broken panels



Planning Utility Cut Repairs

- If patch near joint (within 3-4 ft), extend to joint
- For small patches in interior of slab, simply tie into surrounding pavement with tiebars
- For long, trench patches, re-form joints in same locations as before
- Avoid odd-shaped patches
- Max. aspect ratio (length/width) = 1.5 to 2.0

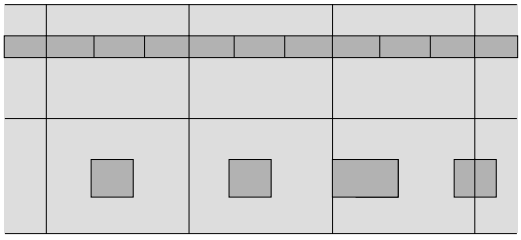
ACPA Count on Concrete

Joint Types

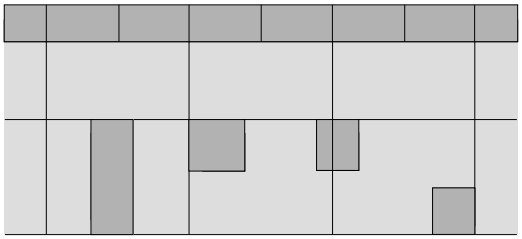
- Replace existing joints with same
- Tie (i.e. deformed bars) to existing slab for interior patches, longitudinal joints, and transverse joints that are not full lane width
- Dowel (i.e. smooth bars) at all existing transverse joints, and new transverse joints that are full lane width

ACPA Count on Concrete

Planning Utility Cut Repairs



Planning Utility Cut Repairs



Steps in Utility Cut Repairs

7 steps:

- Isolate area to be removed with full-depth saw cuts
- Remove old concrete
- Place utility, compact backfill (or use CLSM), drain rainwater (if necessary)
- Provide load transfer at joint faces
- Place & finish new concrete
- Cure & insulate concrete
- Saw & seal perimeters

ACPA

Count on Concrete

Defining Repair Limits

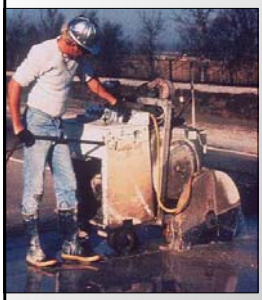
- If edge of patch within 3-4 feet of any joint, extend to joint (after utility work completed)
- Combine patches if close together

ACPA

Count on Concrete

Combine Patches!

Sawing Boundaries Full-Depth



Perform Utility Work

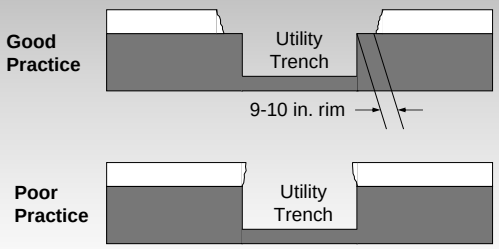
Trench Compaction

Flowable Fill

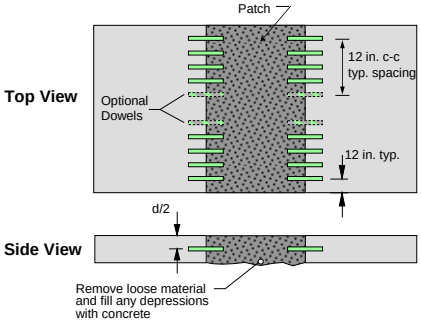
- Controlled Low-Strength Material (CLSM)
- ½ to 1 sack of cement per cu.yd.
- No compaction needed
- Retains ability to be excavated
- Offers better support than granular fill
  - For utilities and for pavement

ACPA Count on Concrete

Load Transfer



Load Transfer



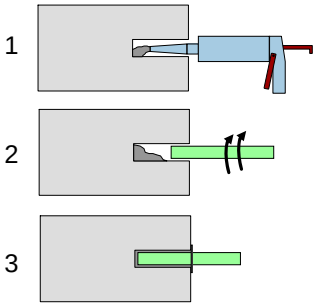
Drilling Dowel Holes

Dowel Sizes

Pavement Thickness, in.	Dowel Diameter, in.	Drilled Hole Diameter, in. *	
		Cement-Based Grout	Epoxy-Based Grout
6	0.75	0.95	0.83
7	1.0	1.2	1.08
8	1.0	1.2	1.08
9	1.25	1.45	1.33
10	1.25	1.45	1.33

* Cement-based, Dowel diam. + 0.2" Epoxy-based, Dowel diam. + 0.08"

Installing Dowels



Injecting Grout

ACPA

Count on Concrete

What **NOT** To Do

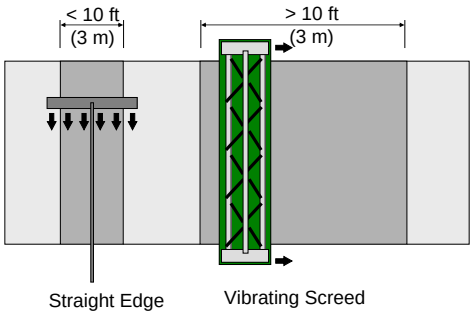
What **NOT** To Do

Dry out the grade!!

Placement of Bond-Breaking Board

Concrete Placement

Finishing



Finishing

Texturing

Curing

Curing

Keys to Success

- Full-depth perimeter sawcuts
- Proper trench compaction is key in utility cuts; flowable fill (controlled low-strength material) can help
- Establish proper load transfer to existing pavement
- Finish smooth & level with surrounding pavement; and with a similar texture

ACPA

Count on Concrete

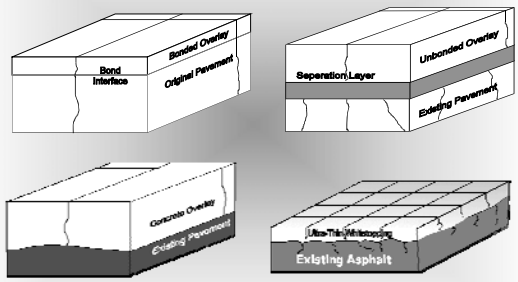
Summary

- A few key details for repairs will help improve their performance
- Maintenance crews can be easily trained to do concrete repair work
- Tools, equipment, and materials required are readily available
- Proper maintenance & repair will extend concrete's inherent long-life even further

ACPA

Count on Concrete

Concrete Overlays - *General Types*



Concrete Overlay History

- Bonded Overlays (1913 Warsaw St. Toledo, OH)
- Unbonded Overlays (1916 Grand River Ave. Wayne County, MI)
- Whitetopping (1918 S. 7th St. Terre Haute, IN)
- Ultra-Thin Whitetopping (1991 Landfill Access Road near Louisville, KY)

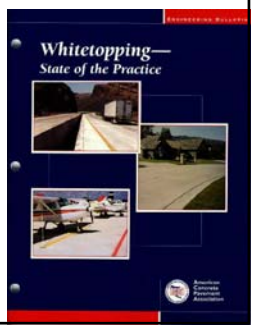
Bellefontaine, Ohio, 1891

Whitetopping – State of the Practice

ACPA
Engineering Bulletin Published (1998)

Std. Whitetopping
- Design
- Construction
- Performance

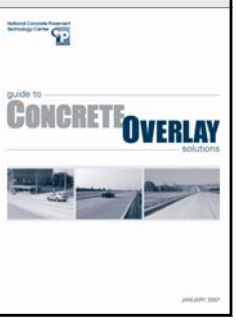
Ultra-Thin Whitetopping
- Design
- Construction
- Performance



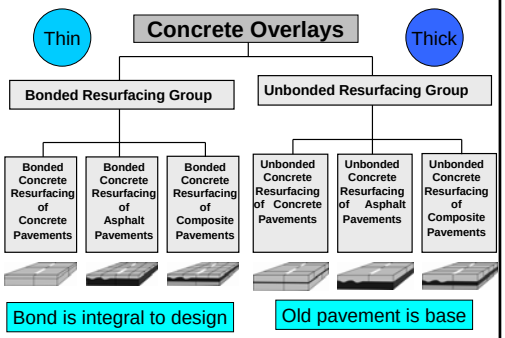
Guide Contents

- Introduction
- Overview of the two overlay classes
- Six overlay types described in detail
- Design of concrete overlays
- Standard design details
- Materials
- Key points

Available through
www.pavement.com
publication # TB021P



Classes of Concrete Overlays



Bonded (UTW)

Before

After

Unbonded (Whitetopping)

Before

After

Unbonded

Before

After

Unbonded

Before

After

Bonded Composite

Before

After

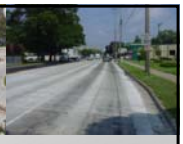
Bonded Summary

- Bonded overlays are rapidly gaining in popularity, particularly in urban environments
- They have been used at intersections, bus pads , highway ramps, parking areas, subdivision streets
- Performance has generally been excellent
- Where problems occurred, improper placement reducing bond

Unbonded Summary

- Conventional whitetopping is probably over designed by not accounting for bond
- The new StreetPave Mechanistic Pavement Design software will produce a more optimized design than previous design methods
- Projects can be constructed and opened to traffic in a relatively short time (fast-track techniques)
- Performance has been excellent

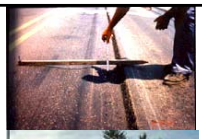
Concrete Inlays



- Intersections
- Bus Stops
  (Chicago 1000 full and partial depth pads)
- Alleys
- Turn Lanes

Concrete Inlays (cont.)

- Turn Lanes
- Any Stopping Area



Main Street USA Award

New Castle, Pennsylvania

Questions

- Thank you
- For additional information, please contact Scott Haislip at shaislip@pavement.com or visit the American Concrete Pavement Association website at www.pavement.com

ACPA

Count on Concrete