

Concrete Overlays for City Streets



**NORTH DAKOTA
AWWA/WPCC**

PRESENTATION BY
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Goal of this Presentation



- **Contribute to understanding of concrete overlays**
- **Help identify logical candidate projects**
- **Discuss tools to attain optimal success**
- **Concentrate on concrete overlays on existing asphalt**

Advantages of Concrete Overlays

- ❑ Do not always require extensive repairs of existing pavement
- ❑ Quick to construct
- ❑ Long performance lives
- ❑ Low maintenance requirements
- ❑ Easy to repair
- ❑ Withstands truck traffic
- ❑ Effective life-cycle costs
- ❑ Recyclable



Technical Help



Goals:

- ❑ Understanding of concrete overlays
- ❑ Develop confidence in design
- ❑ Available through www.pavement.com publication TB021P, or see Dave Sethre

National Concrete Pavement
Technology Center



guide to _____

CONCRETE OVERLAY

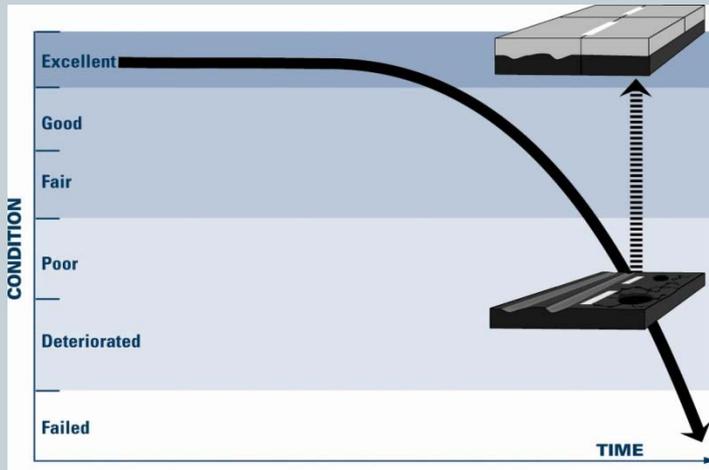
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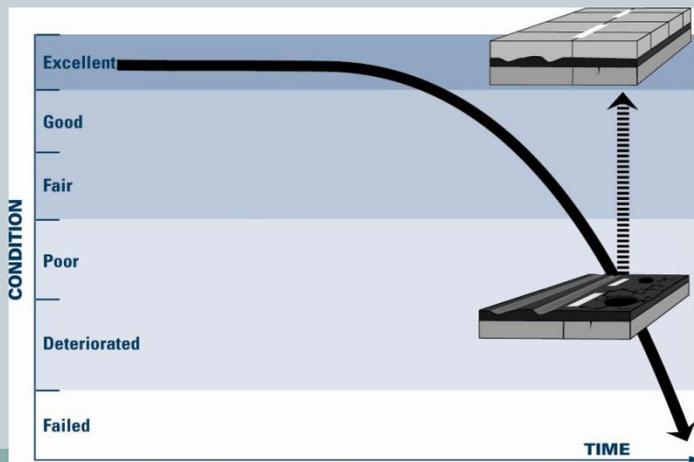
JANUARY 2007



Uses and Advantages



- Increase pavement life
 - Often equivalent to full-depth pavement
- Good alternative even when pavements are cracked or rutted



4"–7" thickness

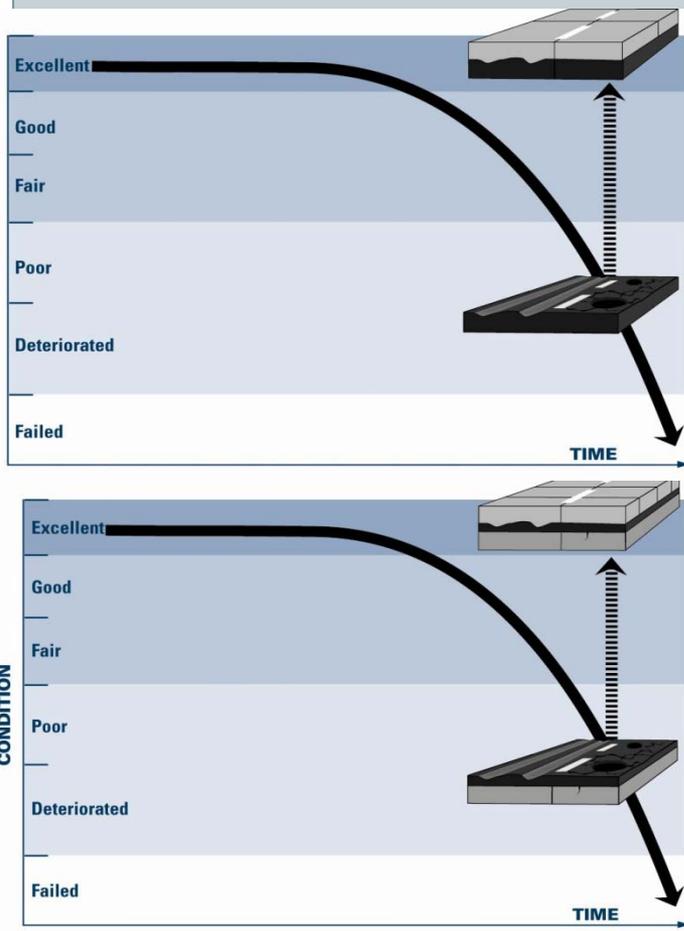
For Extremely Deteriorated Asphalt



- With some repairs, can use when existing pavement is significantly deteriorated

- Severe rutting
- Potholes
- Alligator cracking
- Shoving and pumping
- Stripped asphalt

Essentially, the pavement is ready for reconstruction



Primary Thinking in Thickness



- **4" Thick Overlay**
 - When asphalt is in better condition
 - When truck loads are moderate
- **5" Thick Overlay**
 - When asphalt is in fair to poor condition
 - When truck loads are moderate
- **6" Thick Overlay**
 - When asphalt is in fair to poor condition
 - When truck loads are heavier

So how can thin concrete work with heavy loads?



- **The key is small concrete panels**
 - 6 ft. by 6 ft. panels in general
 - 5 ft. by 6 ft. is good
 - 5 ft. by 5 ft. is good
- **Camp Grafton Main Access Road**
 - 4" thick overlay on 4" to 6" asphalt
 - 6 ft. by 6 ft. panels for 24' total width
- **No joint sealants – 1/8" saw cut**

City Street Projects Criteria



- Will mill into existing asphalt to inlay concrete pavement
- Can Mill between curbs, or mill into curbs
- Can increase final slope of pavement to increase pavement thickness at center
- Need thicker asphalt pavement to start in order to leave 3” minimum of asphalt
 - Otherwise, will mill all asphalt out for a full depth section adjacent to the overlay
 - Disturb sub-base as little as possible for full depth milling

Overlay Cross-section



Dealing with Existing Features



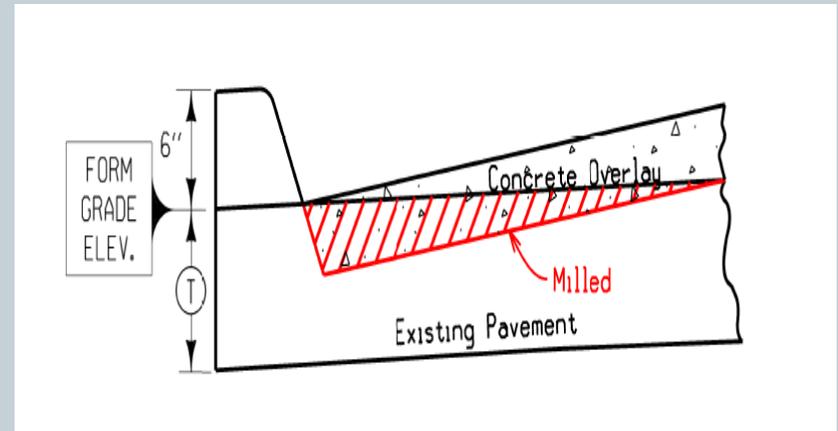
- Curb and gutter
- Sidewalks and driveways
- Storm sewer inlets
- Manholes
- ADA sidewalk
- Utilities
- Maintenance of traffic



Treatment of Existing Curb



- Leave the existing curb in place
- Remove the curb
- Remove the curb and gutter
- Overlay the curb



Removing Curb and Gutter

- Full depth section of  curb and gutter could be milled, or
- When there are obstructions behind the curb, a full-depth saw cut and traditional excavation methods may be preferred

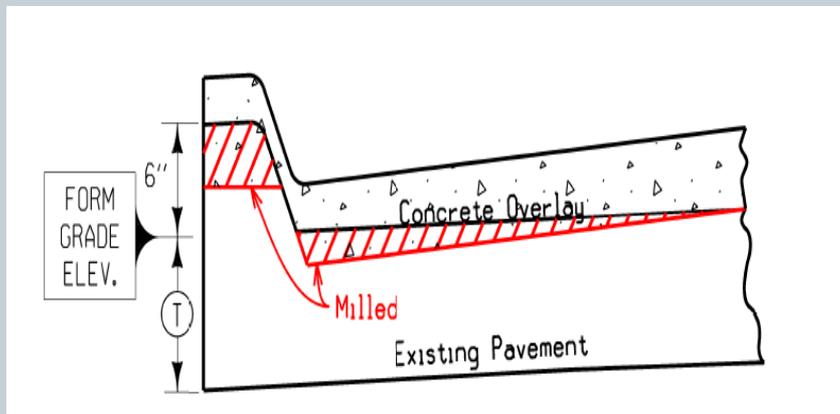


Removing Existing
Curb by Milling

Overlaid Curb



- Possible to place a concrete overlay which encases the existing curb
- May require adjustment of adjoining and adjacent roadway features



Recommendations for Planning Activities



- **Brainstorming Meeting:**
 - Milling requirements and appropriate specifications
 - Best practices for dealing with existing structures
 - Zero-clearance and minimum-clearance paving
 - Retrofitting under-drains and improving drainage

Recommendations for Planning Activities



- **Brainstorming Meeting (continued):**
 - Thickness design procedures
 - Mixture constituents (especially SCM, chemical admixtures, fibers)
 - Mixture proportions
 - Load transfer systems and reinforcement
 - Plan and specification details for thin overlays in urban environments
 - Site investigation techniques for determining the level of deterioration

Colorado US-287



**Colorado 6x6 - 6"
Asphalt - 4" Remaining after Milling
Concrete - 6" Thick - Joint Spacing 6' X 6'
Tie Steel at Lane Lines Only – No Dowels
Joints 1/8" Not Sealed
Traffic now at 10 Million ESAL's**

Review of Colorado US 287 Design



- **Illinois DOT Design Model Predicts**
 - 6 x 6 Panel – 6” thick on 4” asphalt
 - First Crack at 7.8 million ESAL’s
 - Predicted traffic will be 20 Million ESAL’s

Denver Urban Section



Rural Sections - Denver



MnROAD 3.5" w/ 5' x 6' Panels



MnROAD Joint Experiments



Hot pour Fill



Unfilled

2005 Photos

Asphalt Roadway Preparation



REVIEW OF NORMAL PRACTICES

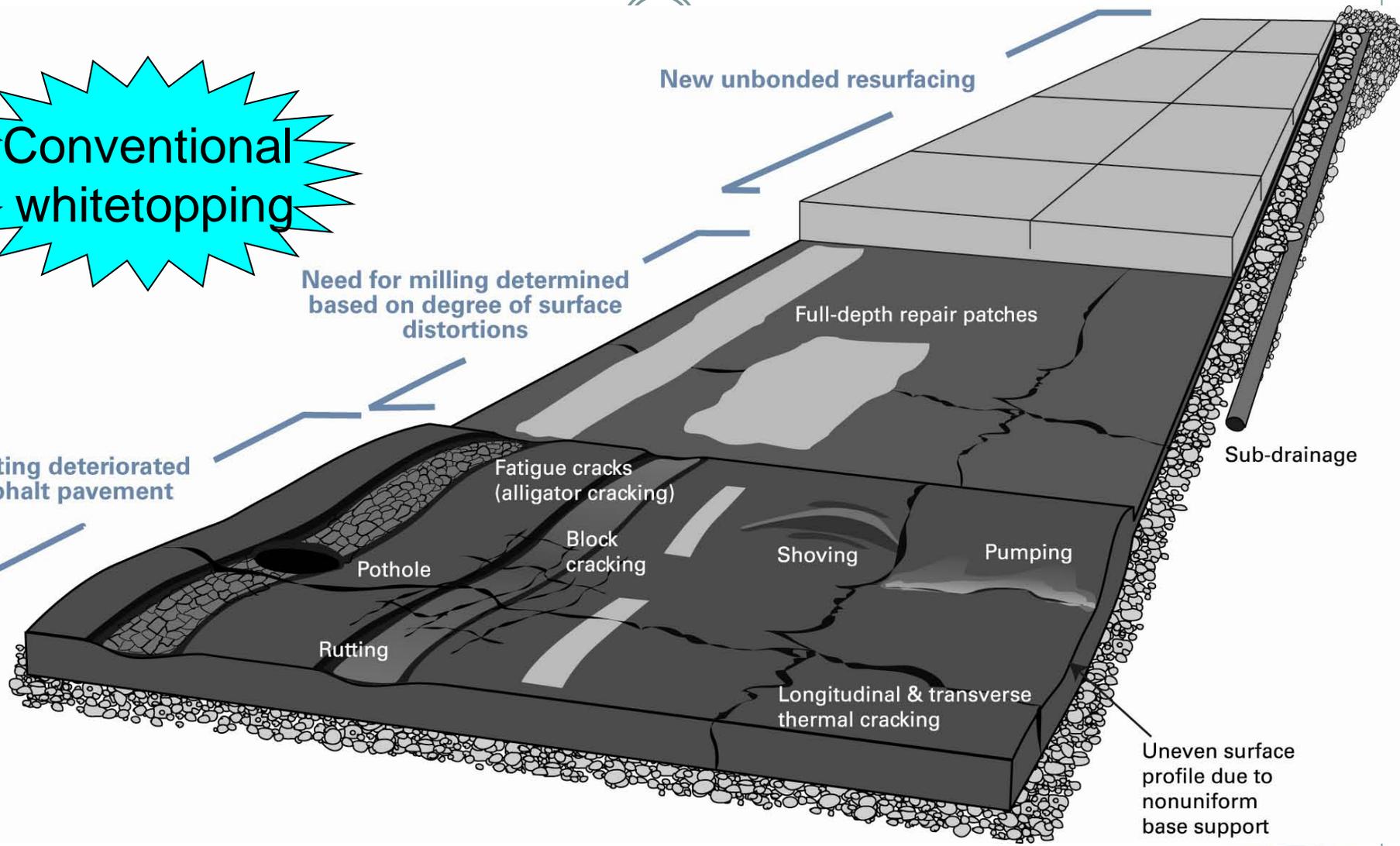
Unbonded | Asphalt Base

Conventional whitetopping

Need for milling determined based on degree of surface distortions

New unbonded resurfacing

Existing deteriorated asphalt pavement



Scheduling Needs



- If no traffic, progress is rapid
- Little of site is disturbed
- Old pavement is working platform
- 30 to 40 days schedule not unusual
- Fast-track technology
 - Cross-Roads
 - Driveways

Fast-track Mixes



- Gives concrete ability to handle traffic similar to asphalt
 - Concrete gains strength for trucks within 24 hours
 - Single lift required for concrete
- For short-term projects like overlays, fast-track is a meaningful tool

Uses for fast-track



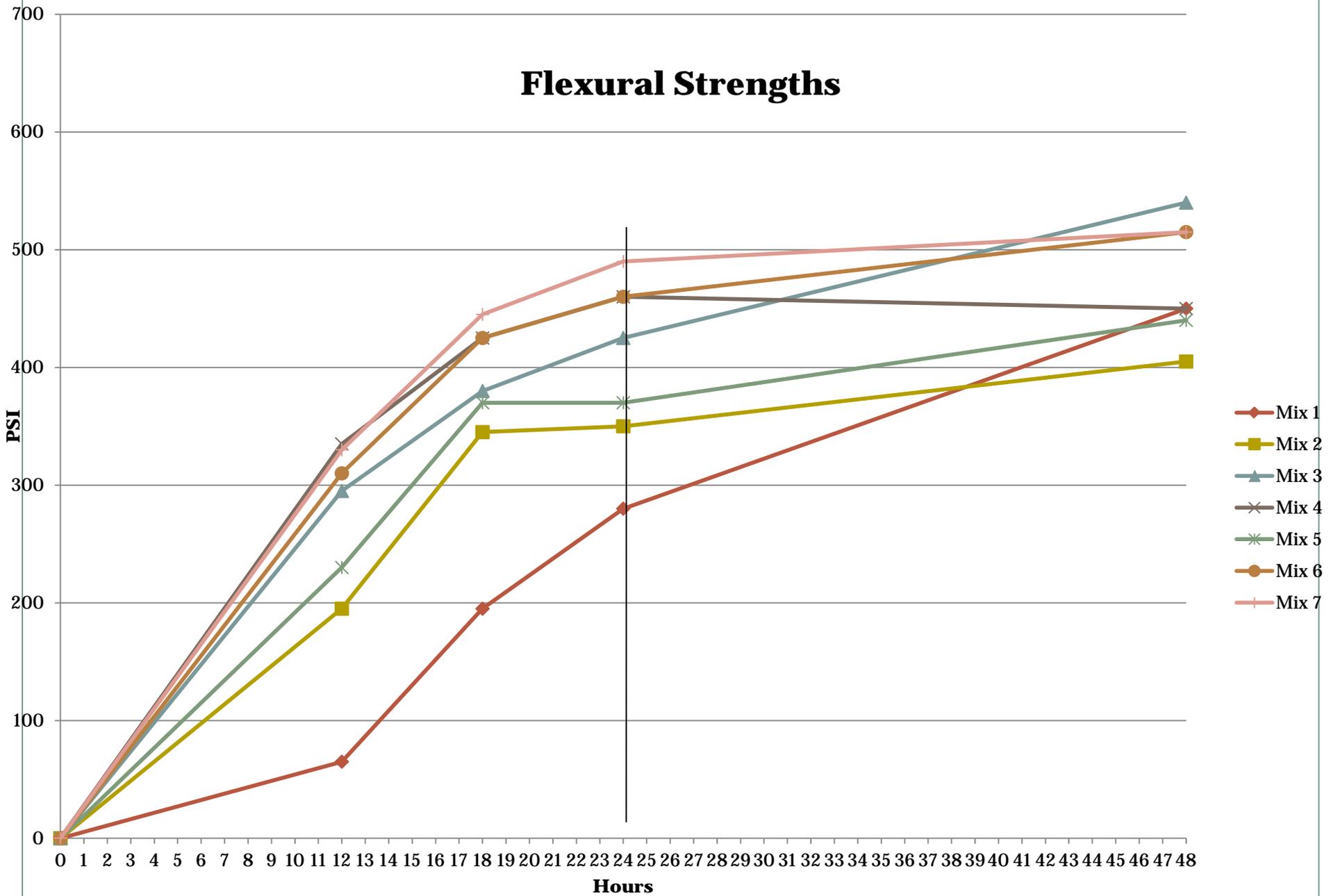
- **Highway Leave-outs**
 - Allows paving through these
 - With gravel bubble, truck traffic allowed next day
- **Municipal**
 - Driveways
 - Intersections
- **Other**

Please! New technology for fast-track



- **Don't make brittle concrete with high cement content; i.e. High Early Mixes**
 - Low Durability – 60 to 80 percent of normal life
 - High Crack potential
- **Use admixture technology to replace cement**
 - Water reducers
 - Non-chloride Accelerators
 - Leave some fly ash in mixes; i.e. 20% or so
 - Other

Flexural Strengths



- Mix 1
- Mix 2
- Mix 3
- Mix 4
- Mix 5
- Mix 6
- Mix 7

Sampling of Projects



CONCRETE OVERLAYS IN OUR REGION

Valley City Airport Access Road - 1997

5" Overlay



Glendive, MT County 16 - 1996

Photo: 2010



4" Overlay



4" Concrete Overlay
Camp Grafton Main Access Road



Clay County 52 – 6" Concrete Overlay



ND 200 N. of Hillsboro
5" & 6" Concrete Overlay
2011



Full Depth Pavement Abutting a 5" Concrete Overlay



US Hwy. 2 – WB at Rugby



7" Overlay

Summary



- ❑ Unbonded overlays of asphalt pavements (whitetopping) have shown excellent performance and cost effectiveness
- ❑ Projects can be constructed and opened to traffic in a relatively short time (fast-track techniques)
- ❑ Concrete pavements **stop** the perpetual cycle of chip seals and overlays at future high oil prices

Questions or Comments?



**THANK YOU!
FOR ADDITIONAL INFORMATION, PLEASE
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