

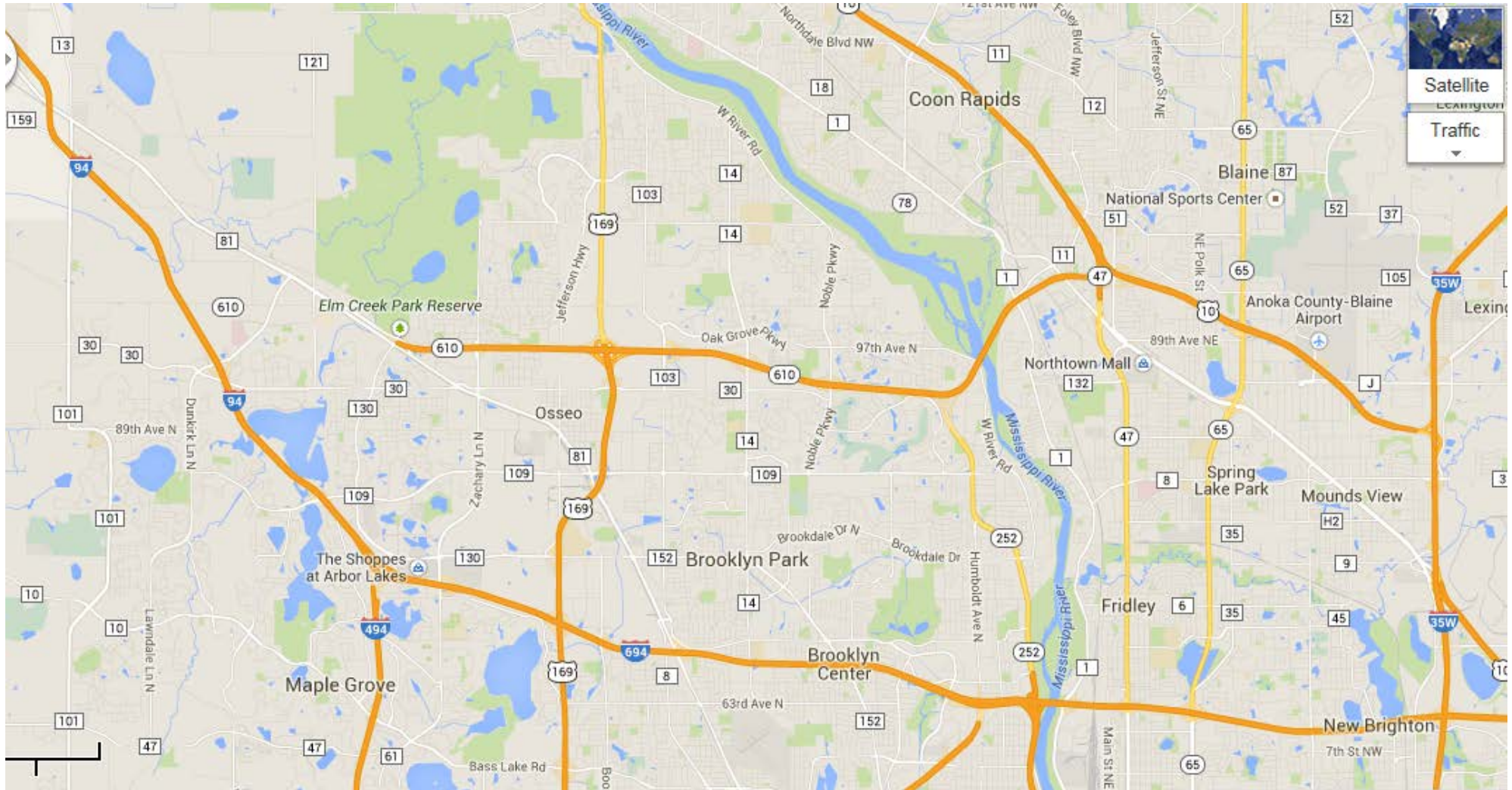
Innovative Pavement Design on TH 610

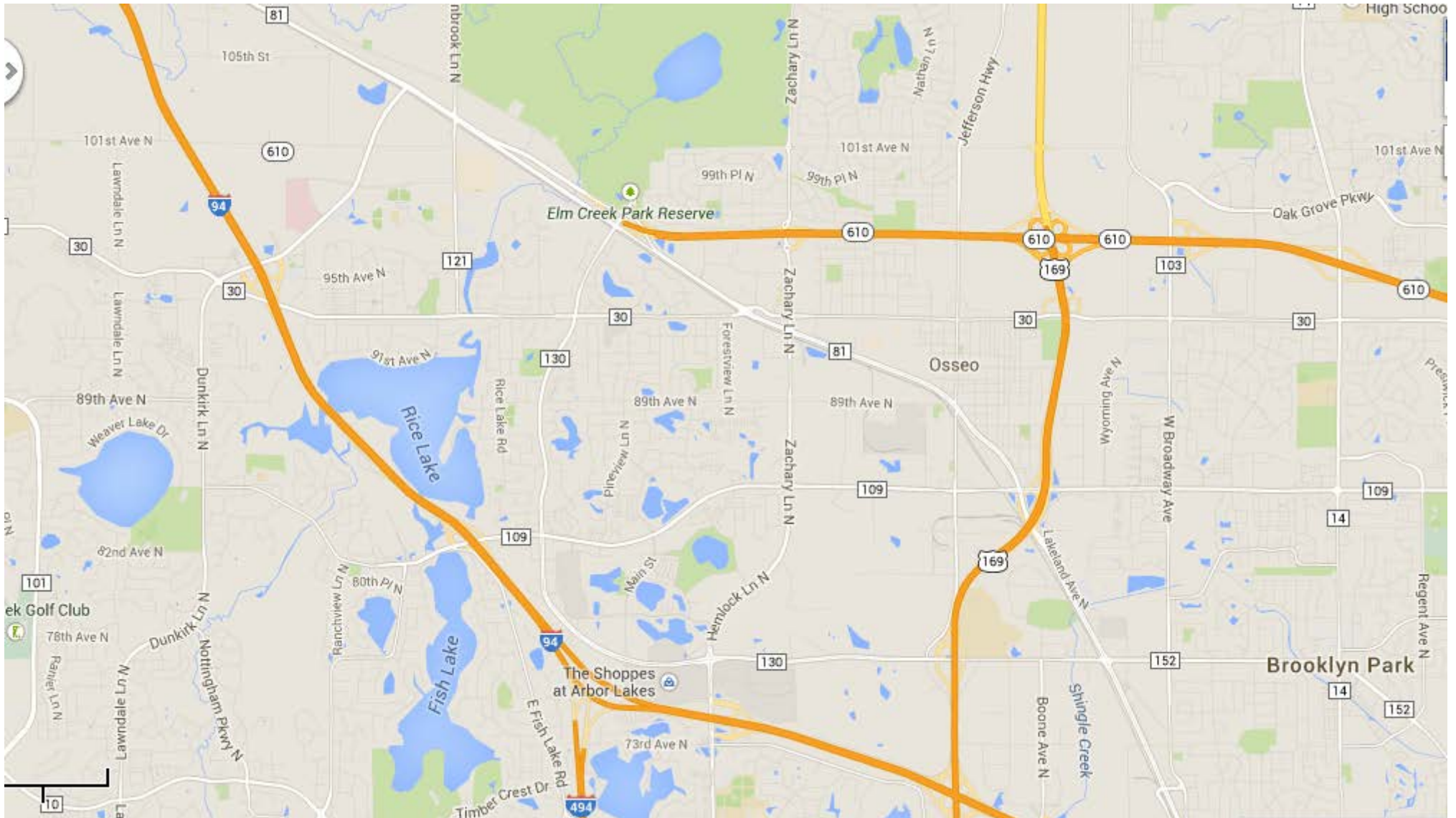
Chris Kufner, MnDOT

*19th Annual TERRA Pavement Conference
February 12, 2015*



Layout





TH 610

- 30+ years of construction
- Final Connection I-94 to I-35w
- Funded in November 2013
- August 2014 letting
- 3 miles of new freeway
- On new alignment
- \$80 ~ \$100 million estimate
- Be Innovative



Layout

PROJECT 1: SP 2771-37 DESIGN BUILD



Innovative Pavement Design

Oxymoron

Or

It's about time!



Project Delivery “old”

- Design Bid Build
- Formal Pavement Type Selection
- MnDOT Pavement Design



Design-Build Overview

Design-Bid-Build



Design-Build



Design Build Specifications

- Design-Bid-Build Specs are prescriptive.
 - “Build a 4-lane freeway exactly along the plan alignment”
 - “Construct four ponds at the plan locations”
 - “Use soil mixing to stabilize the slope”
- Design-Build Specs are ideally performance-based.
 - “Build a road from A to B”
 - “Treat runoff according to Drainage standards”
 - “Stabilize the slope to a global stability factor of 1.25”
- MnDOT had always prescribed pavement designs, even in Design Build projects



Pavement Type Selection

■ Formal Pavement Selection

- Extensive LCCA – very dependent on first cost using “old” data
- Pavement Selection guidance expired – 2011 Alternate Bid policy

■ Alternate Bid in lieu of Formal Pavement Selection

- Provide both Concrete and Bituminous designs to bid on
- Perform LCCA to develop a Maintenance Factor
- Allows for optimum timing of pavement type decision – time of bid
- MnDOT had done the pavement design for all Alt Bid projects
- Tech Memo to consider Design Build on all Alternate Bid projects



2014 Management Challenge

Allow more pavement design innovation in Design-Build without decreasing quality.



Innovative Pavement Design

Conservative Engineer

+

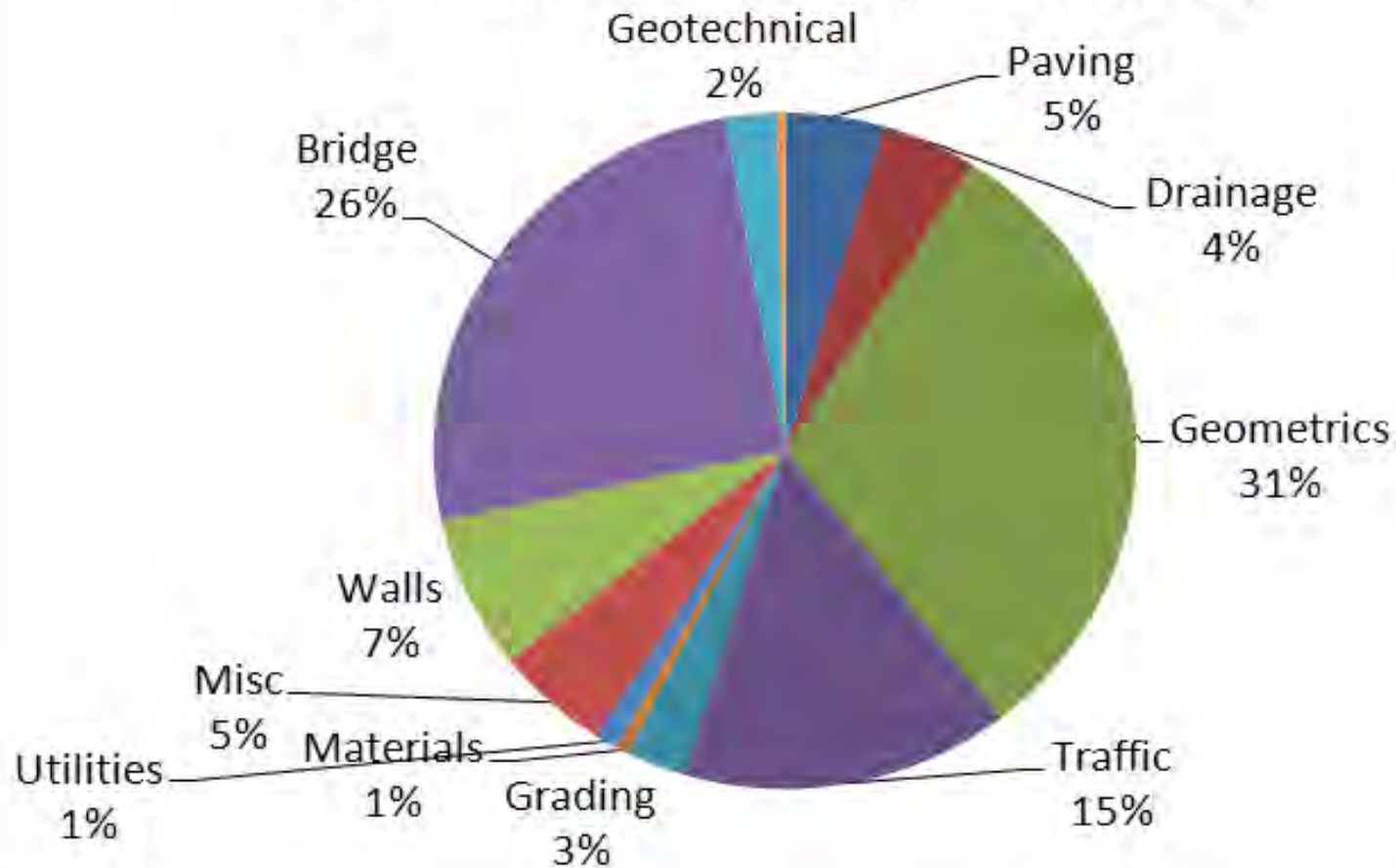
Uncertainty (a.k.a. Innovation)

=

Certain Heart Attack



ATC Submittals by Category



Option 2: PAEs

- “Pre-Accepted Element”
- Mechanism to approve/accept a design concept prior to bid
 - “Acceptance” versus “Equal or Better”
 - Two-way discussion at 1 on 1 meetings
- Previously used for risky bridge elements
- What about Pavement Design??
 - Contractor Pavement Design



Project Delivery “old”

- Design Bid Build
- Formal Pavement Type Selection
- MnDOT Pavement Design



Project Delivery – “new”

- Design Build
- Alternate Bid
- Contractor Pavement Design
- Conservative Engineer:



Pavement PAE

■ Contractor Pavement Design

- Submit up to 2 pavement PAEs for acceptance
- Decide on the one PAE when submitting Technical Proposal

■ Design the following roadways

- TH 610 Mainline
- TH 610 Shoulders
- TH 610 Ramps at I-94
- TH 610 Ramps/Loops at Maple Grove Parkway
- TH 610 Ramps at CSAH 81



PAE Particulars

- Must use MnDOT Pavement Design programs
 - FlexPave and RigidPave, or
 - MnPAVE-Flexible and MnPAVE-Rigid
 - Some inputs fixed: M_R , weather, traffic loading, etc.
 - However, Pavement Design Manual had not been released yet



Pavement Design Programs

MnDOT M-E Design for Rigid Pavements

Main | Design Values | User Guide | About | Defaults

Project name: Load from *.txt file

*.txt file path: S:\Materials\Pavement design Edit

Project notes:

Design life, years: Climate (by district):

Initial traffic, HCADT: Linear yearly growth, %:

Axle load spectra: MnDOT WIM Average


Widened outer lane? Joint spacing, feet:

Shoulder type:


Thickness: Exit Run

MnPAVE - MnPAVE1

File Edit View Window Help



MnPAVE
MnDOT Flexible Pavement Design
Mechanistic-Empirical Method
Version 6.3



Project SPECIAL VERSION TH 610 DESIGN

Climate **Traffic** **Structure** **Output**

For Help, press F1 NUM

Bituminous & Concrete Requirements

- SMA wearing course for top 2"
- PG xx-34 binder, air voids
- Mainline & shoulder minimum thickness
- 30" or 36" frost free
- Drainable base layer under concrete



Subgrade Soils

Challenges

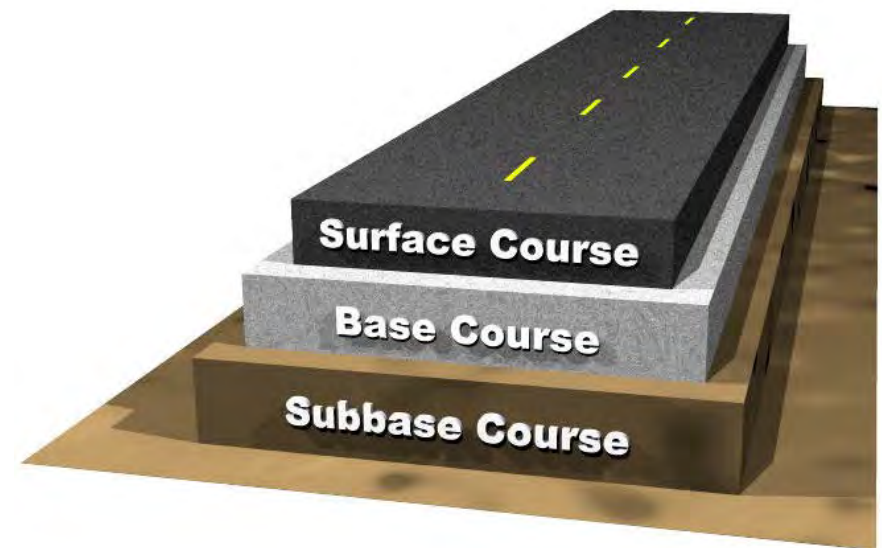
- Non-Uniform Soils
 - Highly plastic material
- Shallow Water Table
- Organics
- R-Value?
- Frost Depth

Solutions/Requirements

- Final grade 4.5 ft above water table
- Excavate 4 ft minimum
 - “Provide uniform soils”
- Deeper for silty soils, which were numerous
- Minimum 12” Select Granular
- Subcut drains
- Submit material samples

PAE Results

- 3 DB teams with 2 Accepted pavement designs per team:
 - 5 Concrete, 1 Bituminous
- Similar to MnDOT designs, except:
 - FDR vs Class 6 (ATC)
 - Geocomposite vs OGAB (ATC)
 - Select Grading Material vs 4' Sand



ATC'S

ATC-03 Aggregate Base Materials

***Description:** A detailed description and schematic drawings of the configuration of the ATC or other appropriate descriptive information (including, if appropriate, product details [i.e., specifications, construction tolerances, special provisions] and a traffic operational analysis).*

This ATC proposes to allow the use of full depth reclamation containing up to 100% asphalt millings in lieu of the specified Class 6 Aggregate Base on the project. The full depth reclamation (FDR) we are proposing would have a maximum top size of 3 inches.

- Approved as equal or better
- Estimated \$200k savings

ATC's

- Geocomposite Drainage Layer vs. OGAB
 - Estimated **\$500k - \$700k** reduction in costs
 - Idea came from MnROAD!



PAEs Submitted

PAE #	Pavement Type	Pavement Thickness	Shoulder Type	Shoulder Thickness	Agg Base Type	Agg Base Thickness	Select Granular
A-1	Bituminous	7.0"	Bituminous	4"	FDR/RAP	8"	24"
A-2	Concrete	8.5"	Concrete	6"	Geocomposite, FDR/RAP	4"	12"
B-1	Concrete	8.5"	Concrete	6"	OGAB	4"	12"
B-2	Concrete	8.5"	Bituminous	6"	OGAB	4"	12"
C-1	Concrete	8.5"	Concrete	6"	OGAB	4"	12"
C-2	Concrete	8.5"	Bituminous	6"	OGAB	4"	12"



ALTERNATE BID RESULTS

Contractor	Technical Proposal Score	Bid	Maintenance Factor	Proposal Price	Adjusted Score (Price / Technical Score)
A	93.77	\$79,362,000	\$1,461,239	\$80,823,239	861,930.67
B	94.55	\$84,947,000	\$0	\$84,947,000	898,434.69
C	93.93	\$80,725,000	\$0	\$80,725,000	859,416.59

Apparent Best-Value = Lowest Adjusted Score



Summary

- Pre-Accepted Element process encouraged innovation
- Added up-front effort is not unreasonable
- Cost savings were realized with the same or enhanced quality

This process (or something similar) will likely be used on other Design Build projects moving forward.



Questions?



Chris Kufner

651-366-5507

chris.kufner@state.mn.us

