Warm Mix Asphalt (WMA) and Recycled Asphalt Pavement (RAP)

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Project SC-0910(062)

- Cass Highway 26 from State Highway 38 to Cass Highway 5 North
- Graded in 1993
- Originally surfaced in 1994 (planned first overlay)
- Planned 2.5” asphalt overlay (≈26,000 tons)
- Length: 8 Miles
- March 23, 2012 NDDOT bid opening
- Engineer’s estimate: $2,055,944.15
- Original low bid: $2,170,430.85
- First Superpave project in Cass County

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Project SC-0910(062)

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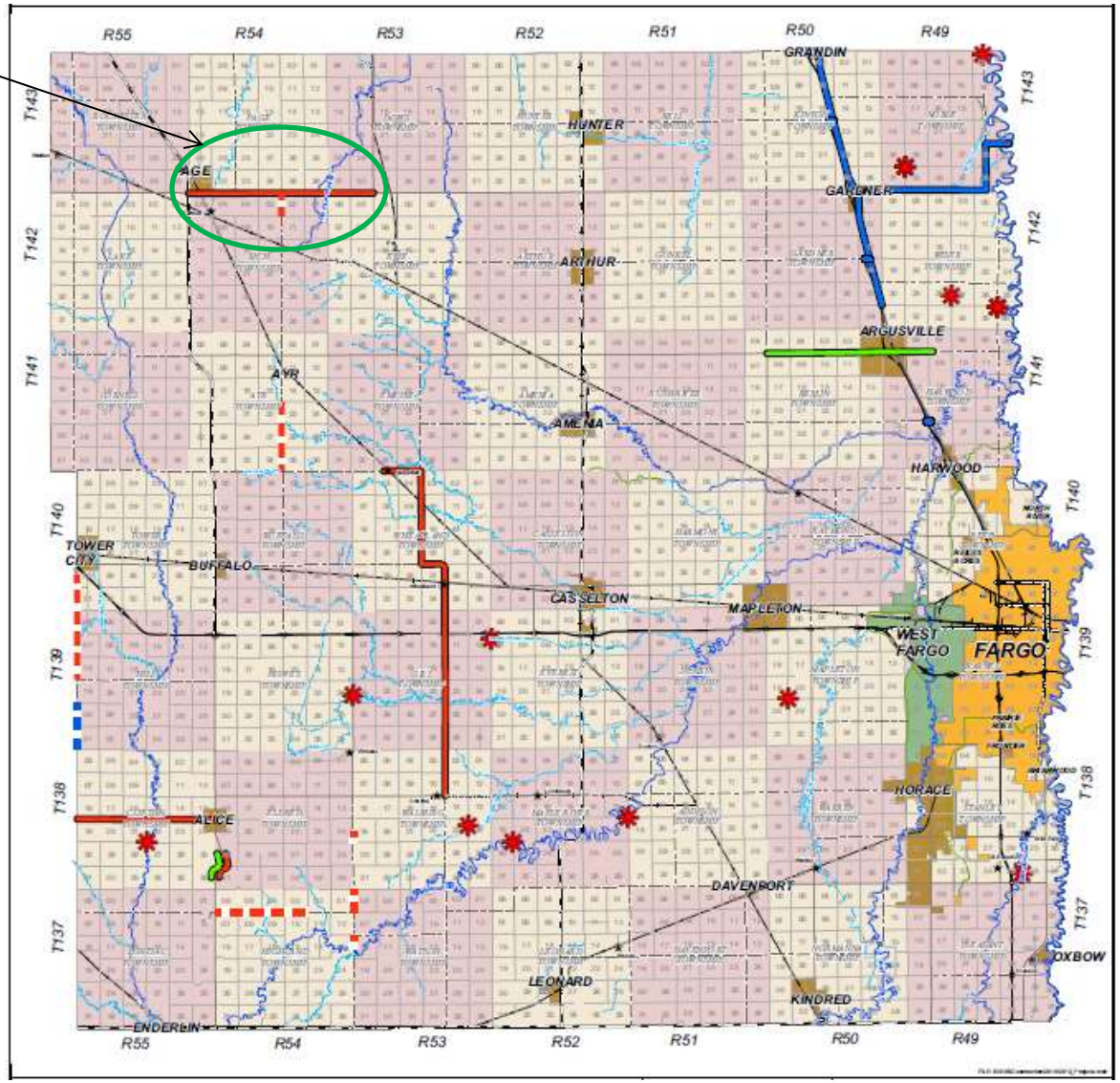

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- Original road section: 2-12’ lanes, 6’ gravel shoulder
- Overlay to include 6’ shoulders to create 36’ asphalt road top
- Designed as a standard Hot Mix Asphalt (HMA) project
  - All PG 58-28 Asphalt
- NDDOT Specification 410

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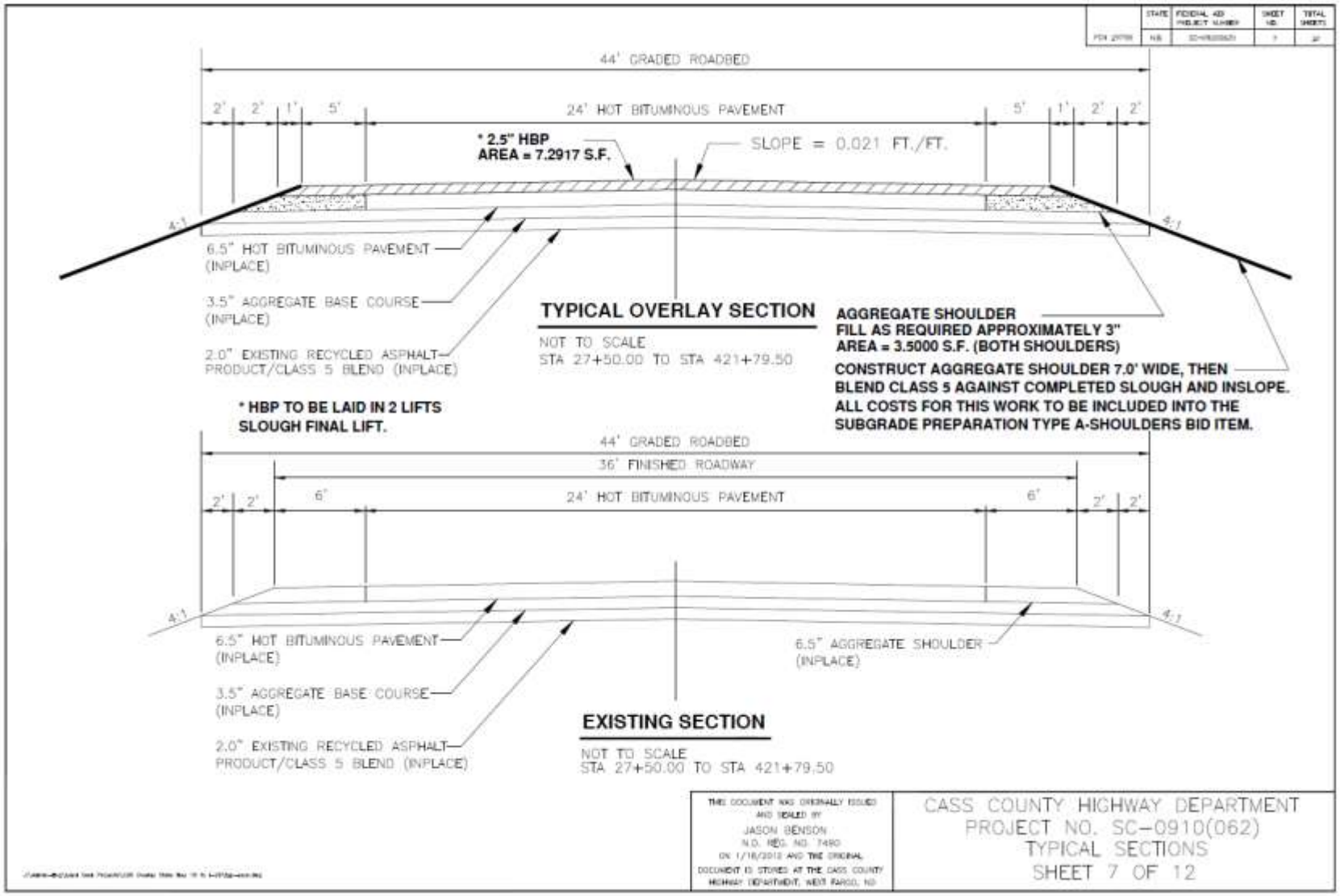

Project SC-0910(062)

HOW WE GOT TO WMA/RAP

How we got to WMA/RAP

- Traditional bid process through NDDOT
  - Low bidder: Knife River Materials; Bemidji, MN
- First project with Knife River Materials
  - Had done several RAP/WMA projects in MN
  - Last HMA project was several years previous
- Had viewed KR project in Norman County, MN in 2010
  - Demonstration WMA/RAP project

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How we got to WMA/RAP

- Pre-Construction Conference
  - May 30, 2012
  - Section 104.08 “Value Engineering”
    - Contractor allowed for use of WMA at bid price
    - Contractor suggested use of RAP (initial suggestion of 20% ± 5%) in mix
    - RAP source to be 1” milling of existing road
    - Re-quoted milling cost from subcontractor
    - Lowered gravel shoulders 1”
    - Estimated cost savings: $200,000
  - Completed NDDOT Change Order mid-July, 2012

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How we got to WMA/RAP

- Minnesota specifications differ greatly from ND
  - Allows from oil from any source (RAP, RAS)
    - Allows for RAP to be from any source, not just existing road
  - Required to have 70% new oil in mix
    - Allows for 25-35% RAP in mix depending on RAP AC
    - Required on highly polymerized asphalts to lower RAP content (i.e. 20% max RAP on PG 58-34)
  - Do not pay for oil separate of mix
  - Mix tested off the road for AC content and gradation
    - Allows for on the fly adjustments to final product

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CONSTRUCTION

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- Project started July 30, 2012
  - Initially widening gravel shoulders with class 5 aggregate
  - Existing road milled simultaneously
  - RAP stockpiled at asphalt plant/pit location in Sibley, ND

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- Paving started August 1, 2012
  - 1” Leveling course 26’ wide
  - 1.5” wear course with 2.5” shouldering 36’ wide
    - Started wear course August 2, 2012

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- Single extraction of RAP mix taken before project started by contractor for mix design
  - Cores taken from several locations to gather extraction and mix design samples
- Only additional test was single sieve analysis of RAP millings to verify nominal size
- Normal NDDOT Superpave specification testing followed

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- QA/QC Asphalt testing
  - Virgin aggregate testing conducted every day by both QA/QC
  - Additional worksheet filled out assure correct amount of RAP added to mixture
  - Asphalt samples removed behind paver for Rice and Gyratory testing

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ASPHAL, CONTENT & VIRGIN AGGREGATE DETERMINATION
North Dakota Department of Transportation, Construction
SFN 18674 (Rev. 04-2000)

Date: 8-2-12

Project: SC-0910(062)
Contractor: Knife River
Scheduled Hours:
Target Ac Content: 4.3 %
Target Virgin Aggr. %:

Test No.	TIME: Random Number	TIME: Test Time	(1) Aggr. Tons Rdg. (Dry Tons)	(2) Salv. Bit. Tons Rdg. (Dry Tons)	% VIR. AGGR. = (1) / (1) + (2) (Dry Tons)	(3) BITUMEN Flow Meter Reading (Gal)	(4) Wt. Per Gal.	(5) AC TONS Tons Used = (3)x(4) /2000	(6) AC Percent Added = (5) / (1)+(2)+(5)
1		9:45	1027.81	243.95				56.98	
			1027.81	243.95				56.98	4.29
2		12:10	1771.44	420.42				97.82	
			743.63	176.47				40.84	4.25
3		2:30	2488.52	590.70				137.71	
			717.08	170.28				39.89	4.30
4		4:00	2840.55	674.29				157.27	
			352.03	83.59				19.52	4.29
CUTOFF REPORT COMPARISON	Totalizer Cutoff		3137.63	744.44				173.72	4.28
	Totals from the Cutoff Report		Total Mix Produced = 43779.2			Total Bitumen Used = 183.07			-1.28

AVERAGE VIRGIN AGGR. %
SUM %
NUMBER =

REMARKS

DISTRIBUTION: Project Records

11/13/12 D.D.

Inspector's Signature

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- Lowered add AC% from 5.6 to 4.3
  - RAP had AC% of 6.3%
  - Target AC% of Mix Design at 5.6%
  - Resulted in 30% decrease in added AC%

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- Asphalt plant modifications
  - Asphalt foamer by Maxam
    - AQUABlack foamer installed on existing drum plants
    - Water only added to mix, no additional chemicals
  - RAP insertion point
    - RAP collar added to plant by manufacturer

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- Paving operations completed August 9, 2012
- Project completed August 10, 2012
- Final Project cost: $1,872,680.43
- **Savings from initial bid: $297,750.42**
  - Total of 13.7% Savings
  - Biggest savings in PG 58-28 and Class 5
  - 66% and 72% original quantity

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PROJECT REVIEW

Project Review

- WMA technology
  - Cores hit compaction requirements
    - NDDOT cores between 91-96%
  - Paving Ambient temperature 80F-90F
  - Lower WMA temperature allowed for better cooling
    - HMA project earlier in season had shoving and cooling issues in hot weather
    - WMA started at lower temperatures, less time required to reach workable temperatures

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Project Review

- Foamer technology used for WMA
  - Water added to asphalt at plant to create asphalt emulsion
    - Water required to be potable and free of debris
  - Lower energy costs since less heating required to coat aggregate
  - Allows for lower temperatures of mixing and hauling
  - Lower temperatures results in better mixture with RAP with less reheating of aged bitumen

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Project Review

- Excited by Possibilities of RAP
  - Costs savings of over 10% by using RAP
  - 1” milling removed damaged layer of asphalt from roadway
    - With 1” depth removal, structure of roadway not compromised
    - Removed rutting layer, equalized rate of application
  - Milling removed crack seal from roadway
    - Had problems with the crack seal activating in heat and causing cracks to reflect through on previous projects

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Project Review

- RAP future savings
  - Average oil cost (2012 ND): $642/ton
  - AC savings from RAP: 30%
  - Savings of $8.35/ton of bituminous material

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Project Review

- Road up for chip seal in 2013 or 2014, pending funds
  - County regularly chip seals 2 years after overlay to increase life of pavement
  - Chip seal after 2 years to add oil to RAP mixture and keep mix flexible

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FUTURE USE OF WMA/RAP

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Future Use of WMA/RAP

- New project bid by CCHD using RAP
  - Cass County Highway 4 bituminous surfacing
  - 40,000+ Tons of RAP in stockpile from removing existing road
  - Requiring use of stockpile to create 20% ± 5% RAP mixture for bituminous surfacing
  - Project bid opening on Feb 21, 2013.
    - Central Specialties low bid
    - $3,390,000 (46,000 ton project)

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Future use of WMA/RAP

Future Use of WMA/RAP

- NDDOT Specification includes section on Recycled Pavements
  - NDDOT Specification Section 407
  - Built internal plan note referencing specification for use on future projects

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Future Use of WMA/RAP

- Allowing use of WMA on future bituminous surfacing/overlay projects
  - Created note for county paving projects allowing use of WMA at Contractor's discretion
  - Some contractors in area not retrofitted for WMA yet

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Questions?

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