

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

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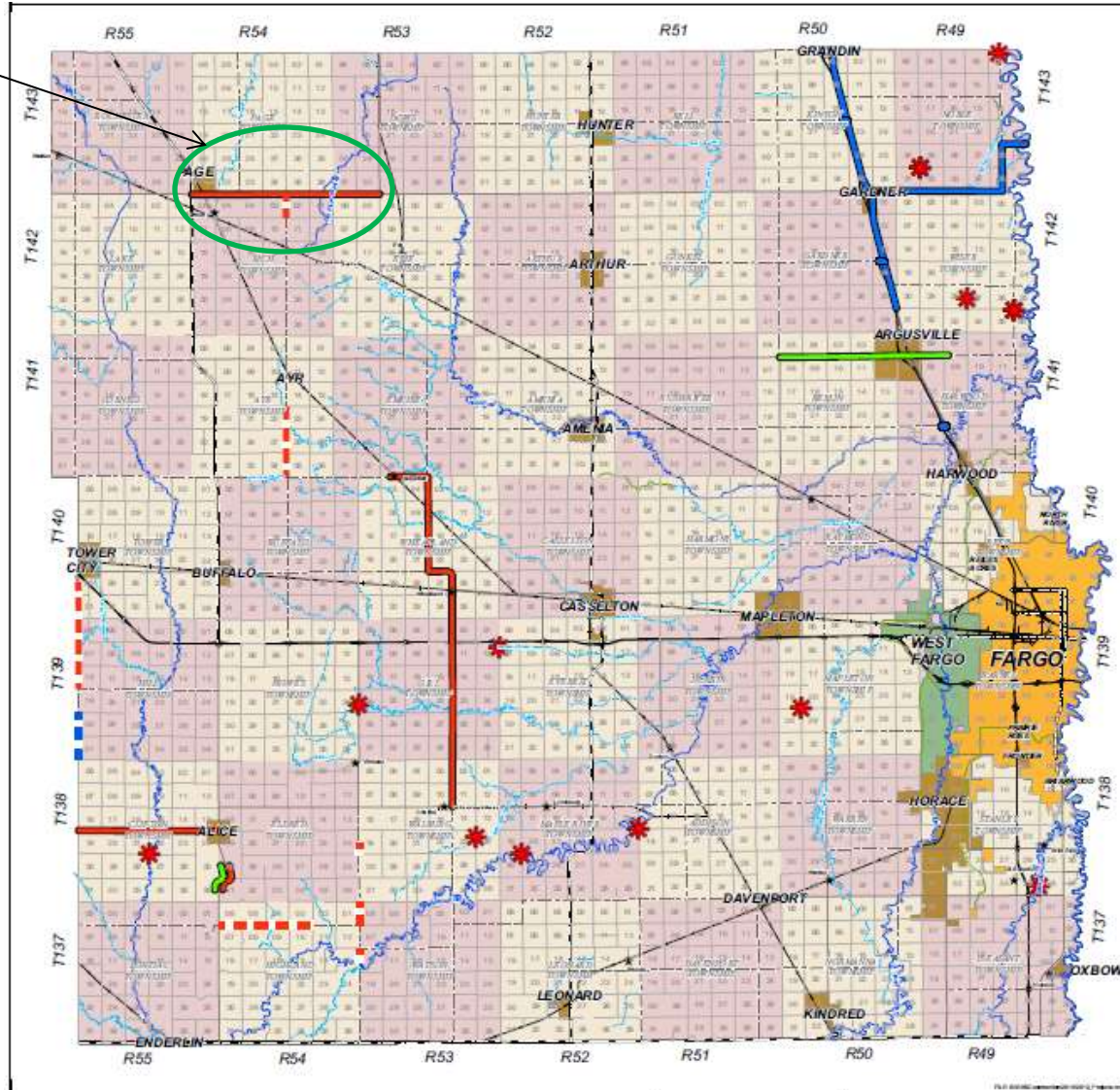
Project SC-0910(062)

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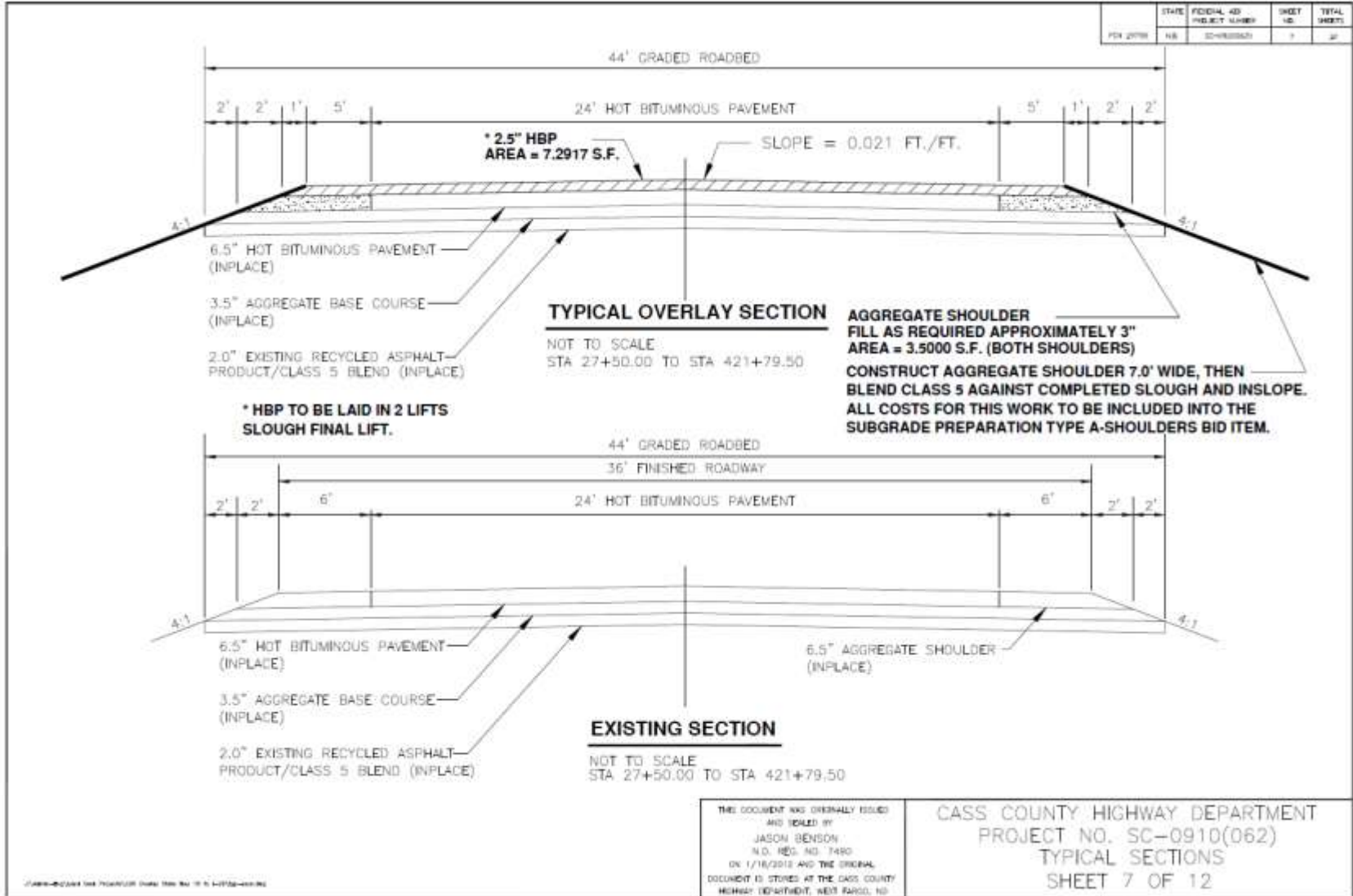
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- Original road section: 2-12' lanes, 6' gravel shoulder
- Overlay to include 6' shoulders to create 36' asphalt road top
- Designed as a standard Hot Mix Asphalt (HMA) project
 - All PG 58-28 Asphalt
- NDDOT Specification 410

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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

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

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

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 8-2-10

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

Test No.	TIME		(1) Aggr. Tons Rdg.	(2) Salv. Bit. Tons Rdg.	% VIR. AGGR. = (1) / (1) + (2)	(3) BITUMEN	(4) Wt. Per Gal.	(5) AC TONS	(6) AC Percent Added
	Random Number	Test Time	(Dry Tons)	(Dry Tons)	(Dry Tons)	Flow Meter Reading (Gal)		Tons Used = (3)x(4) /2000	= (5) / (1)+(2)+(5)
1		9:45	1027.81	243.95				56.98	4.29
			1027.81	243.95				56.98	
2		12:10	1771.44	420.42				97.82	4.25
			743.63	176.47				40.84	
3		2:30	2488.52	590.70				137.71	4.30
			717.08	170.28				39.89	
4		4:00	2840.55	674.29				157.27	4.29
			352.03	83.59				19.52	
CUTOFF REPORT COMPARISON		Totalizer Cutoff	3137.63	744.44				173.72	4.28
		Totals from the Cutoff Report	Total Mix Produced = <u>4277.26</u>			Total Bitumen Used = <u>183.67</u>			4.28

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

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

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

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

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

FUTURE USE OF WMA/RAP

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% \pm 5% RAP mixture for bituminous surfacing
 - Project bid opening on Feb 21, 2013.
 - Central Specialties low bid
 - \$3,390,000 (46,000 ton project)



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

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

Questions?

