



Full Depth Reclamation

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Full Depth Reclamation

Roadway Reconstruction

- Primary Corridors End of Service Life
- Incorporate Existing Asphalt into New Base
- Cement Stabilization
- High Cost / High Performance

Roadway Reclamation

- Low Volume Asphalt Corridors
- Utilize Existing Asphalt in Gravel Surfacing
- Chemical Stabilization / Dust Control
- Reduced Maintenance Effort and Cost

Long Term Solutions

Roadway Reconstruction

Evolution of Reconstruction Sections

1990's



2020's

Roadway Reconstruction

- 1990's
 - 7" HBP & 3" Aggregate
 - SN 3.1
 - No work done to subgrade besides working and compacting
 - Full Depth Mill (millings given to contractor)
 - Tons of imported material per Mile (7,500)
 - Cost per Mile (today's dollars)
 - \$570k
 - \$183k per SN



Roadway Reconstruction

- 2000's
 - 7" HBP & 12" Aggregate
 - SN 4.0
 - No work done to subgrade besides working and compacting
 - R1 Fabric added on top of subgrade
 - Full Depth Mill (millings given to contractor/Included into RAP)
 - Tons of imported material per Mile (15,500)
 - Cost per Mile (today's dollars)
 - \$760k
 - \$190k per SN

Roadway Reconstruction

- 2010's
 - 6" HBP, 8" Salvaged Base, & 12" Cement Treated Subgrade
 - Salvaged Base Removed & Replaced
 - Evolving into perpetual pavement section by improving base section
 - Able to lessen HBP section with stronger base
 - SN 5.4
 - Full Depth Mill (included into Rap & used at Salvaged Base)
 - Tons of imported material per Mile (6,500)
 - Cost per Mile (today's dollars)
 - \$605k
 - \$112k per SN

Roadway Reconstruction

- 2020's
 - 6" HBP, 12" Cement Stabilized Full Depth Reclamation
 - Salvaged Base material kept on the roadway
 - Evolving into perpetual pavement section by improving base section
 - Able to lessen HBP section with stronger base
- SN 5.4
- FDR completed before SFDR
- Tons of imported material per Mile (5,000)
- Cost per Mile (today's dollars)
 - \$525k
 - \$97k per SN



Roadway Reconstruction

Years	Section	Cost per Mile	Cost per SN
1990's	7" HBP, 3" Aggregate	\$570k	\$183k
2000's	7" HBP, 12" Aggregate	\$760k	\$190k
2010's	6" HBP, 8" Salvaged Base, 12" Cement Treated Subgrade	\$605k	\$112k
2020's	6" HBP, 12" Cement Stabilized Full Depth Reclamation	\$525k	\$97k

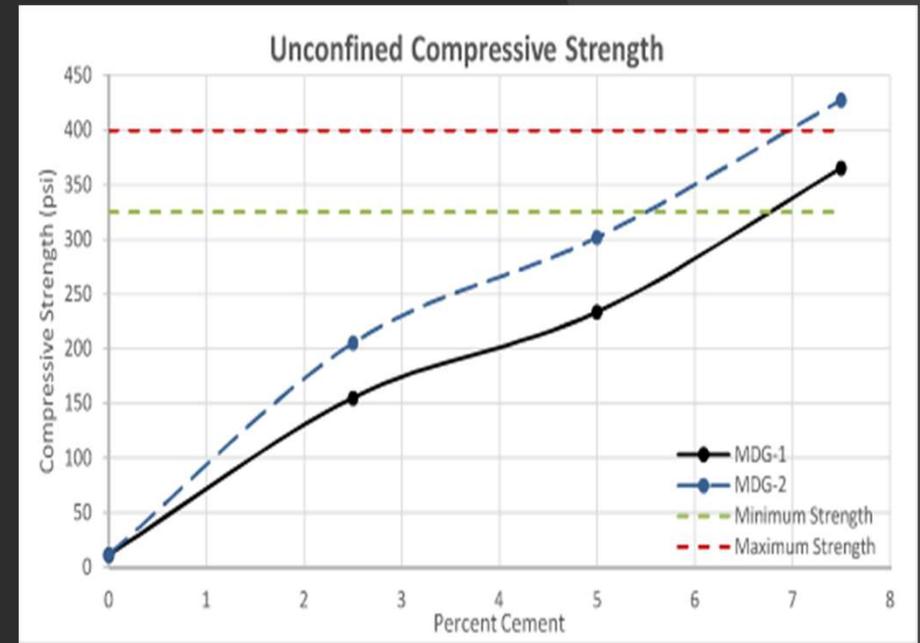
Cement Stabilized Full Depth Reclamation

- Plan Basis of Estimate
 - Dry Density for SFDR – 125LBS/CF
 - Portland Cement % for SFDR – 6%
- Plan Notes
 - Contractor equipment
 - 2 Pad foot rollers
 - 1 steel drum
 - 1 Motor Grader with GPS capabilities
 - Require third party material testing/mix design
 - Mix Design
 - Compressive Strengths – 325 (min) – 400 (max) psi at 7 days
 - Parameters to meet requirements
 - Cement percentage
 - Moisture content
 - Testing
 - Density and moisture content per 1/10 roadway mile
 - One additional proctor to be taken every mile
 - Perform DCP test every mile
 - One at 24 hours
 - One at 7 days



Cement Stabilized Full Depth Reclamation

- Mix Design Findings
 - 100% Milling Mixture
 - Too many voids in mixture
 - High cement percentage needed to achieve required strengths
 - 6.75% provided 325psi
 - 70% Milling/30% gravel Mixture
 - Some voids but better than 100% millings
 - 7-10% improvement in strength vs 100% milling mixture
 - 6% cement provided 350psi
 - Would require to haul in additional gravel
 - 60% Milling/40% Clay
 - Little to no voids
 - 6% cement provided 350psi
 - No required additional gravel

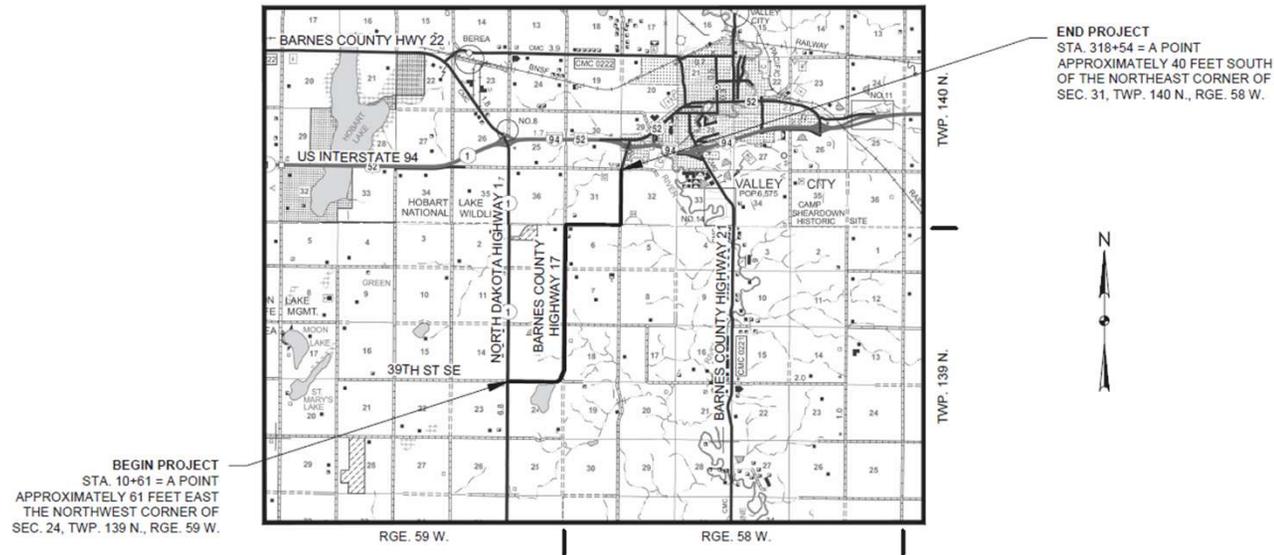


Cement Stabilized Full Depth Reclamation



- Additional Benefits
 - Road can stay open to local traffic during construction
 - Asphalt can remain until all grading/culverts are completed
 - Roadway widening
 - Shoulders can be benched and FDR spread evenly over new grading width
 - SFDR then can be incorporated into FDR material as well as underlining clay
 - If not currently raining or freezing temps' production can continue
- Disadvantages
 - If elevation sensitive roadways, can be difficult to get to exact elevation
 - If profile design changes are required, will need to remove and replace FDR section thus cutting into savings

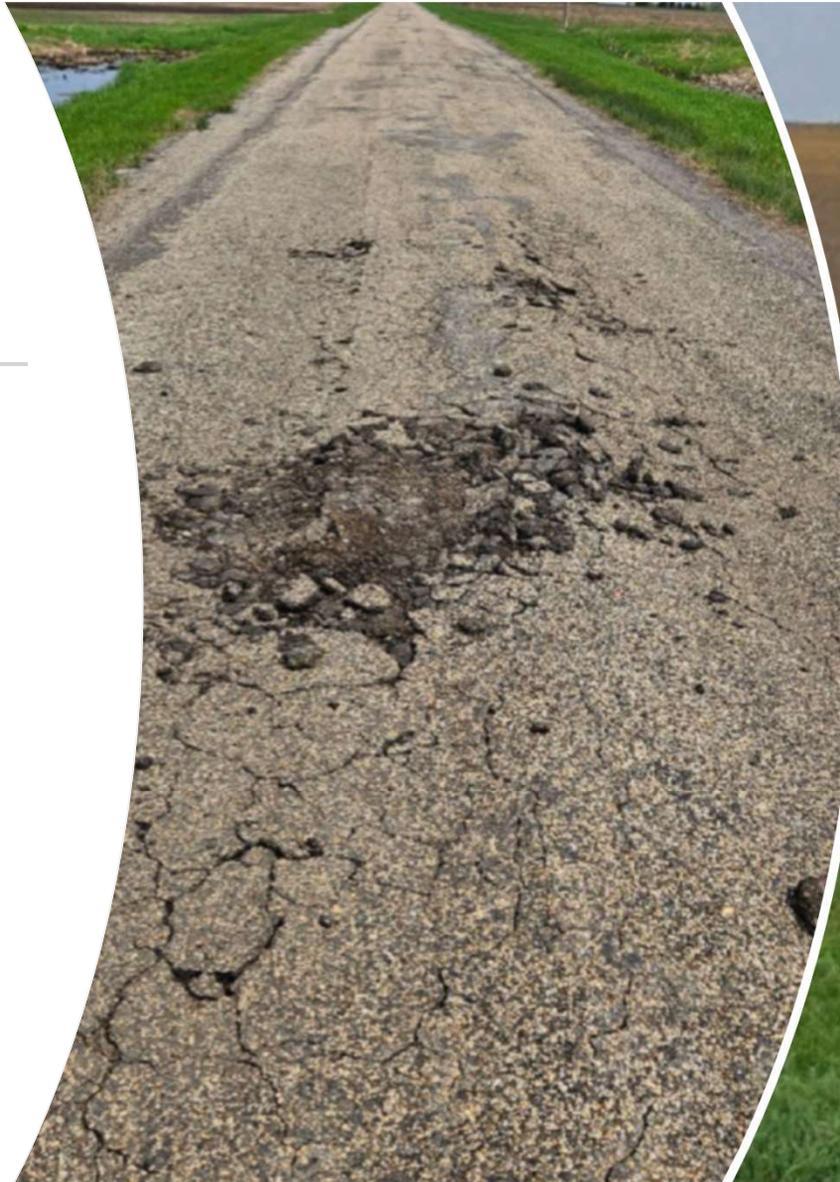
Case Study Barnes County Highway 17



- History - Old North Dakota Highway 1 – Granted to Barnes County in 1930's
- 4.8 Miles of Existing Asphalt, 1 Mile Existing Gravel.
- Existing Asphalt Range from 2"-7" Average of 4"
- Little to no Aggregate Base Present – Average 1"

Corridor Issues

- Narrow Width & Steep Inslopes
- Inadequate Roadway Structure
 - Year-Round Load Posting
 - No Trucks During Spring Restrictions
- Safety Concerns
 - Speed Reductions
- Funding Constraints
 - Non-CMC Route





Project Preparation Local Forces

- Culvert Replacements
- Snow Trap Removals
- Grade Raise, Riprap & Widening
- Herbicide Treatment

Alternatives

- Sliver Widening & Asphalt Overlay
 - Width Constraints, Culvert replacements/Extensions
 - Compromised Existing Roadway
- Full Reconstruct
 - Traffic Volumes
 - Cost/Benefit
- Current Method
 - Yearly Patching
 - Crack and Chip Seal
- Reclamation
 - Gravel Surfacing
 - Maintenance



Inflation Vs Funding

Cost of a Structural (3" Overlay) & Federal Aid Distributions		
Year	Cost Per Mile	Federal Aid Distribution
1990's	\$70,000	\$250,000
2000's	\$115,000	\$400,000
2010's	\$280,000	\$425,000
Today	\$325,000	\$450,000

460% Increase in structural overlay cost in the last 35 years

180% Increase in Federal aid distributions in last 35 years.

Public Involvement

- Pushback from Residents
 - “I’d Rather Live on the Worst Paved Road than the Best Gravel Road”
- Support from Producers
 - Eliminate load postings
 - Wider Roadway

Project Timeline



Awarded Flex Funding for
the project in Spring 2024



Bid March of 2025



Construction Began 6/2/25
– Completed 6/18/25

TABULATION OF BIDS
 FXS-0002(056), PCN 24339
 GRAVEL SURFACING, LIQUID STABILIZED RECLAMATION, DUST PALLIATIVE & INCIDENTALS
 BARNES COUNTY, NORTH DAKOTA



Bid Letting: 1:30 PM March 13th, 2025
 Comp. No. Nate Bagby
 Checked by: Bryan Tykwinski

ITEM	SPEC	CODE	UNIT DESCRIPTION	QTY	UNIT	Engineers Estimate		Williams Excavation Elbow Lake, MN		Central Specialties, Inc. Alexandria, MN		Border States Paving, Inc. Fargo, ND		Knife River Materials Bemidji, MN	
						UNIT PRICE	TOTAL SUM	UNIT PRICE	TOTAL SUM	UNIT PRICE	TOTAL SUM	UNIT PRICE	TOTAL SUM	UNIT PRICE	TOTAL SUM
1	103	0100	CONTRACT BOND	1	L SUM	\$ 5,000.00	\$ 5,000.00	\$ 10,000.00	\$ 10,000.00	\$ 1,000.00	\$ 1,000.00	\$ 2,203.00	\$ 2,203.00	\$ 1,950.00	\$ 1,950.00
2	216	0100	WATER	315	M GAL	25.00	7,875.00	40.00	12,600.00	50.00	15,750.00	60.00	18,900.00	15.00	4,725.00
3	302	0356	AGGREGATE SURFACE COURSE CL 13	12,813	TOH	23.00	294,699.00	22.90	293,417.70	19.00	243,447.00	20.60	263,947.80	22.00	281,886.00
4	306	0510	FULL DEPTH RECLAMATION	53,517	SY	1.50	80,275.50	0.60	32,110.20	1.05	56,192.85	0.93	49,770.81	1.00	53,517.00
5	350	0900	CHEMICALLY STABILIZED GRAVEL SURFACING	308	STA	425.00	130,900.00	320.00	98,560.00	450.00	138,600.00	390.00	120,120.00	425.00	130,900.00
6	702	0100	MOBILIZATION	1.00	L SUM	50,000.00	50,000.00	34,800.00	34,800.00	44,945.00	44,945.00	42,340.00	42,340.00	33,000.00	33,000.00
7	704	0100	FLAGGING	400.00	MHR	60.00	24,000.00	50.00	20,000.00	56.00	22,400.00	40.00	16,000.00	50.00	20,000.00
8	704	1000	TRAFFIC CONTROL SIGNS	965.00	UNIT	3.00	2,895.00	1.00	965.00	1.50	1,447.50	1.60	1,544.00	1.50	1,447.50
9	704	1185	PILOT CAR	200	HR	75.00	15,000.00	80.00	16,000.00	50.00	10,000.00	70.00	14,000.00	60.00	12,000.00
10	754	0110	FLAT SHEET FOR SIGNS-TYPE XI REFL SHEETING	59	SF	30.00	1,776.00	20.00	1,184.00	20.00	1,184.00	22.00	1,302.40	20.00	1,184.00
11	754	0206	STEEL GALV POSTS-TELESCOPING PERFORATED TUBE	142	LF	30.00	4,248.00	13.00	1,840.80	9.25	1,309.80	10.00	1,416.00	9.25	1,309.80
12	920	1500	DUST PALLIATIVE MATERIAL	24,634	GAL	3.00	73,902.00	2.00	49,268.00	1.78	43,848.52	2.00	49,268.00	1.83	45,080.22
TOTAL ESTIMATED PROJECT COST						\$ 690,570.50	\$ 570,745.70	\$ 580,124.67	\$ 580,812.01	\$ 586,999.52					

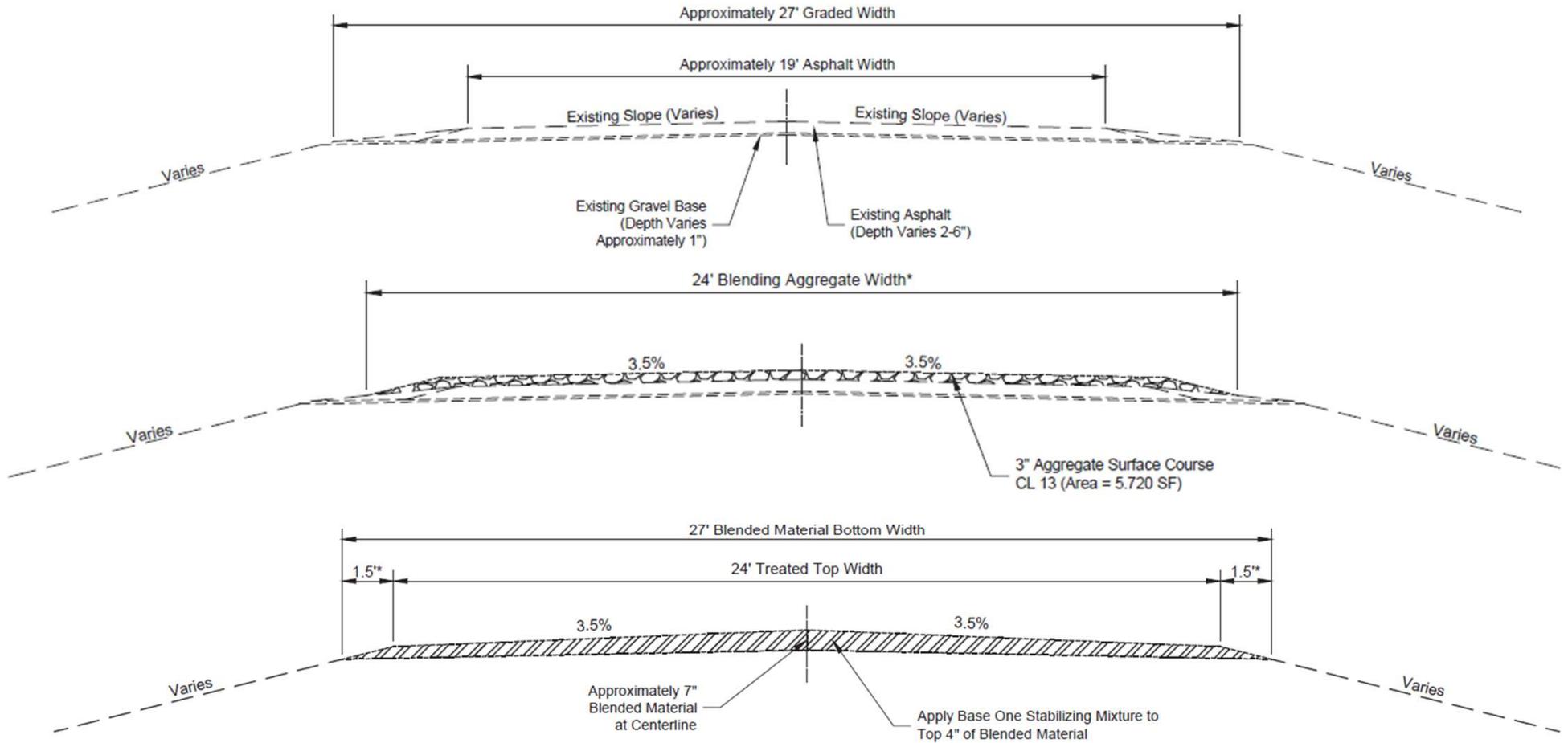
TRUE TABULATION OF BIDS
 KLJ Engineering LLC

Process

- Blending Aggregate Placed
- 1st Pass Reclaim – Blend Existing Asphalt With Aggregate
- 2nd Pass Reclaim - Base One Stabilization
- Finish Blading and Compaction
- Calcium Chloride Surface Treatment



Typical Sections







Existing Conditions



Finished Product

Lessons Learned

- Moisture is Key
- Setup Time After Base One Application
- Final Blading / Cross Slope Considerations
- Calcium Chloride Application Timing



Project Wrap-up

- Public Perception
- Continued Maintenance
- Expectations Vs Reality



Questions
