FINAL REPORT

RECYCLED ASPHALT PAVEMENT

Kossuth County
Iowa

by

Richard P. Henely

and

Richard Schiek
Kossuth County Engineer

Sponsored By

Iowa Highway Research Board

Project HR-176

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TABLE OF CONTENTS

ACKNOWLEDGEMENT

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INTRODUCTION

In 1975, Kossuth County had 492 miles of asphalt pavements, sixty percent of which were between 15 and 20 years old. Many of these roadways were in need of rehabilitation. Normally, asphaltic resurfacing would be the procedure for correcting the pavement deterioration.

There are areas within the state of Iowa which do not have Class I aggregate readily available for asphalt cement concrete paving. Kossuth County is one of those areas. The problem is typified by this project. Limestone aggregate to be incorporated into the asphalt resurfacing had to be hauled 53 miles from the quarry to the plant site. The cost of hauling good quality aggregate coupled with the increasing cost of asphalt cement encouraged Kossuth County to investigate the possibility of asphaltic pavement recycling.

Another problem, possibly unique to Kossuth County, was the way the original roadways had been constructed. A good clay soil was present under 3 to 4 feet of poorer soil. In order to obtain this good clay soil for subbase construction, the roadway ditches were excavated 1 to 3 feet into the clay soil layer. The resultant roadway tops were several feet above the surrounding farm land and generally less than 26 feet wide.

To bring the existing roadway up to current minimum design width, there were two choices: One was to widen the roadway by truck hauling soil and constructing new 4 to 6 foot shoulders.

The cost of widening by this method averaged $36,000 per mile in 1975. The other choice was to remove the old pavement and widen the roadway by lowering the grade line. The desire to provide wider paved roadways gave Kossuth County the additional incentive needed to proceed with a pavement recycling project.

OBJECTIVE

The objective of the demonstration project was to determine if a satisfactory asphalt pavement could be constructed using salvaged asphalt pavement and conventional asphalt mixing and paving equipment.

PROJECT DESCRIPTION

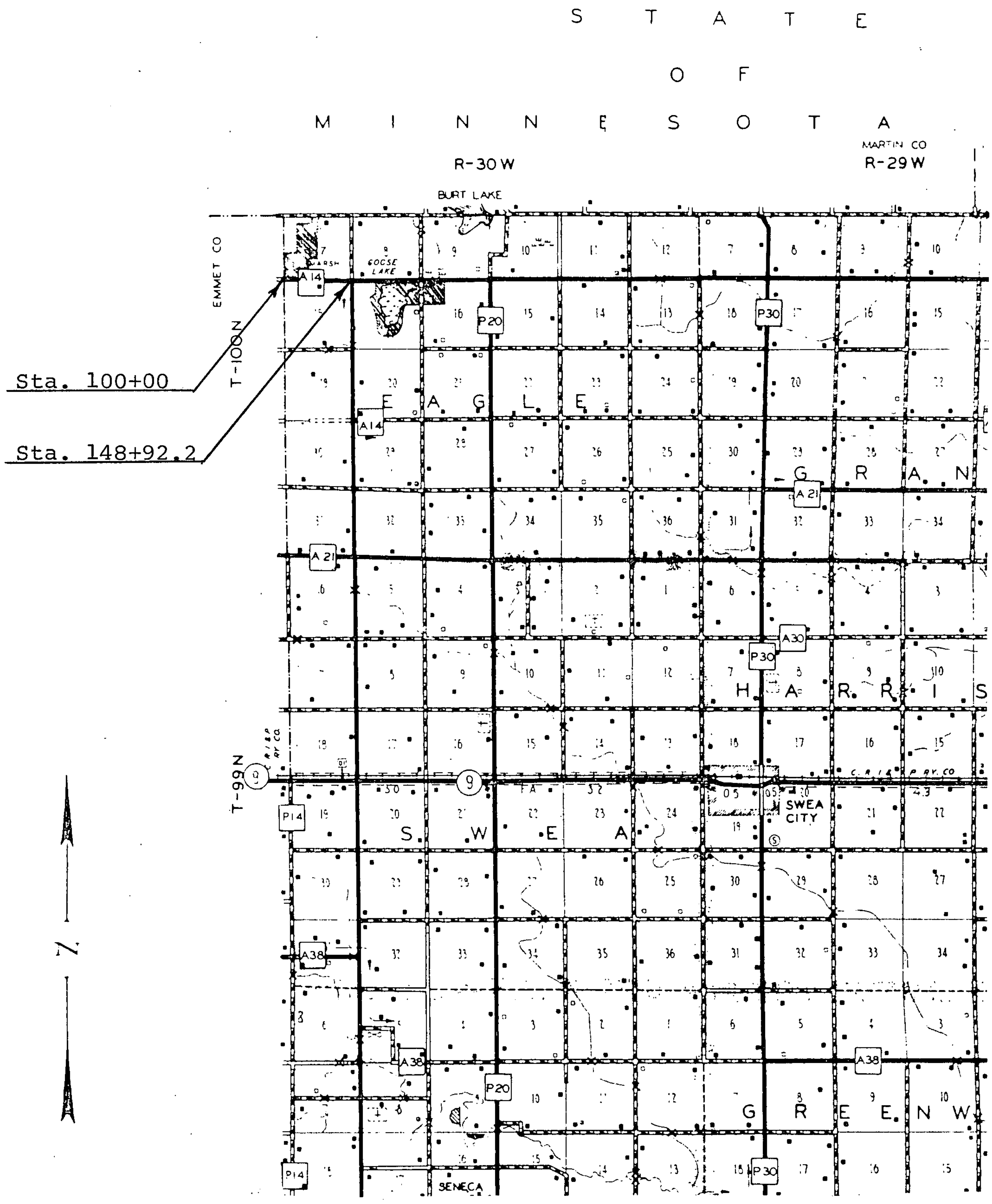
The project is a 0.93 mile segment of Kossuth County Road A-14 (Figure 1). The average daily traffic was 142 in 1971 and 398 in 1980.

The project concept was to remove and salvage the existing pavement and subbase, lower the gradeline, and widen the roadway. Core samples were taken from the road to determine the condition of the pavement and subbase. Appendix A contains a typical cross section showing the pavement and subbase details. The average asphalt content of the old asphaltic pavement was 3.6 percent. Subbase samples indicated that the soil agggregate was satisfactory for re-use.

The construction of the new roadway top included the salvaged soil aggregate material for the subbase and the

Figure 1 - Project Location

KOSSUTH COUNTY
IOWA



salvaged asphalt pavement with additional asphalt cement for the base. An additional 3 inch lift of asphaltic concrete was needed to meet the structural requirements to withstand traffic. This additional lift of asphalt, however made evaluation of the recycled lift difficult. The typical cross section for the reconstructed roadway is in Appendix A.

The test section placements for the recycled mixes are:

Section	Sta. to Sta.		Aggregates	Added Asphalt
1	100+00	116+50	100% recycled	2.5
2	116+50	140+00	100% recycled	3.5
3	140+00	144+00	100% recycled	4.5
4	144+00	148+92	70% recycled 30% limestone	4.5

CONSTRUCTION

The construction was in May and June, 1975. Everds Brothers, Incorporated of Algona, Iowa was the contractor. The special provisions and tabulation of bids for the project are in Appendices A and B.

The order of the construction was as follows:

1. Salvaging recyclable bituminous material
2. Salvaging subbase and widening roadbed
3. Constructing subbase
4. Crushing recyclable bituminous material
5. Processing recyclable bituminous material
6. Surfacing - final course

SALVAGING RECYCLABLE BITUMINOUS MATERIAL

A Caterpillar 14 motor grader with a rear mounted ripper scarified the old pavement to a depth of 4 1/2 inches. Minor problems were encountered in areas of 2 inch hot mix surface patches and areas of full depth asphalt patches. For scarifying the patched areas one of the three teeth of the ripper was removed and a loader was used with the grader for additional power. The old roadway generally scarified easily with the pavement either being pulverized or broken into square sections.

The scarified pavement material was then further broken up by using a Caterpillar DW20 tractor with Hyster compactor wheels. About 95 percent of the time this operation broke the old pavement into sections no larger than four inches. The difficult areas were still those with the pavement patches. In one area where an emulsified cold mix patch had been placed, the material began to recompact rather than break up and pulverize.

With completion of the road pulverization operation, the next step was to load and haul the material to the plant site and prepare it for crushing. Loading the salvageable material on a narrow grade presented a minor problem. This was solved by using a Caterpillar D8 tractor and 80 scraper to haul the material to entrances or farm driveways where the haul trucks had room to maneuver and be loaded by a rubber tired loader. In some areas the roadway was wide enough to permit windrowing of the salvaged material and loading into trucks with the end loader. A self-propelled windrow loader would probably solve this problem.

SALVAGING SUBBASE AND WIDENING ROADBED

The subbase salvaging and roadbed widening were accomplished by working one-half the roadway at a time. First, a half section of roadway, containing only the gravel-clay subbase, was scarified to a depth of 4 inches. The scarified material was then windrowed, moved and stockpiled on top of the unscarified half of roadway.

With the salvaged subbase material windrowed on the other half of roadway, a motor grader cut the grade down uniformly one foot and pushed excavated soil onto the foreslope. The material was compacted with a sheep-foot roller. The remaining half of the roadway was worked in the same manner.

It was felt that during the widening operation granular material should be available in the event of wet weather. However, on this project the subgrade remained firm as far down as excavated and presented no problems.

CONSTRUCTING SUBBASE

The resulting windrow of salvaged gravel-clay subbase amounted to approximately 1500 cubic yards, which was greater than previously anticipated. At that point, it was decided that additional granular material for reconstruction of the subbase was not needed and was eliminated from the contract.

The construction of the 26 foot wide subbase was done according to typical soil-aggregate subbase construction specifications. Field densities ranged from 95 to 100 percent of modified proctor with specific gravities that ranged from 1.99 to 2.02.

CRUSHING RECYCLABLE BITUMINOUS MATERIAL

A roll type crusher was used to crush the salvaged asphalt material to the specified 2 inch maximum size. Samples of the crushed material were obtained to determine the average asphalt content and a suitable mix design. The gradation of the recovered aggregate and the data for the trial mixes are in Appendix C. The asphalt content recommended for the mix was 6.1 percent, of which 3.7 percent was present in the salvaged material.

PROCESSING RECYCLABLE BITUMINOUS MATERIAL

The recycled mix was made using a Barber Green 10 x 30 drum mixer with low efficiency wet wash. All other plant equipment was the conventional type used for standard asphalt paving operations. The plant had been tested by the Iowa Department of Environmental Quality and found to be in compliance in May 1975.

No major problem was encountered introducing the recycled aggregates into the drum mixer. A minor problem was the occasional sticking and plugging of the cold feed bins and inlet chute to the drum mixer.

It was determined in a short time that it was possible to recycle old asphaltic concrete. It was also apparent that smoke from the stack had to be reduced to an acceptable level. The smoke was caused by the ignition of asphalt on the recycled particles when subjected to the hot flame upon entering the drum mixer.

Mixing began at a production rate of 275 to 300 tons per hour with a mix temperature of 300° F. No water was added to the aggregates and the wet wash was inoperative. Smoke was dense, near 100 percent Ringelmann* and very unacceptable. Something had to be done to control the smoke.

Several alternatives were available. They were: (a) changing the rate of production, (b) changing the mix temperature, (c) adding water to the aggregates, and (d) adding new aggregates to the recyclable aggregates. The order of changes that were made and the emission results observed are shown in Appendix D. With three percent moisture added to the aggregates, production maintained at 275 to 300 tons per hour, mix temperature at 225° F, and 30 percent limestone added to the mix, the smoke was brought near an acceptable level.

The mixing process produced a mix that could be laid and compacted with conventional asphalt equipment. Even at the lower mixing temperatures (225° F) there were few, if any, lumps. The recycled base was laid 4½ inches thick using a Barber Green full-width paver. A normal rolling sequence was used for compaction. When the recycled material was mixed and laid at the higher temperatures, the rollers had to be held up several minutes due to heat retention in

*A subjective estimate of the solid matter emitted from smoke stacks by comparing the grayness of the smoke with a series of shade diagrams.

the thick mat.

At the beginning of the paving operation, the mix appeared to be low on asphalt. The mix tended to shove during rolling and was difficult to handle. After laying 1650 feet of base, it was decided to increase the percent of asphalt added to 3.5 percent. When 3.5 percent asphalt was added, the mix looked very much like a conventional asphalt mix.

All of the mixes were laid without problems. The densities for the first 1900 feet of the project were low. Ironically, the first 1900 feet of asphalt was mixed at the higher temperatures. The lab densities are given in Appendix C.

With 30 percent limestone added to the recycled material and 4.5 percent asphalt added to the mix, the extracted asphalt content was 6.9 percent, the field specific gravity was 2.25, the field voids were 6.4 percent, and the smoke during the mixing process was reduced to near acceptable limits.

SURFACING - FINAL COURSE

The final surfacing placed on the recycled base was standard 3 Inch, Type B, Class I, Asphaltic Concrete according to Iowa State Highway Commission Specifications. From the standpoint of monitoring the results of the project, it is probably regretable that this phase was necessary to provide adequate pavement thickness.

SUMMARY

The principle question "Can Old Asphalt Pavements Be Recycled?" has been answered by the results of this project. However, economic and social factors should be considered. Factors to be considered are: (1) Pavement performance, (2) Economy of process, and (3) Environment versus conservation.

PAVEMENT PERFORMANCE

From the results shown and analyzed in Appendix C, it is possible to assume that the only characteristic widely different in new and recycled pavements was the residual or recovered asphalt penetration. On normal projects when new aggregates and virgin asphalt cement are used exclusively, the recovered asphalt cement penetration usually is 80 to 90 when 85 to 100 penetration is employed in the product. On this project, the recovered asphalt penetrations were 37 to 49 which indicated a brittle pavement. However, after six years, this does not appear to be a problem.

The pavement is performing very well. There is some transverse cracking, but this would be considered normal for full-depth asphaltic cement concrete paving. All other tests indicate that the recycled material is performing as well as all new material.

The potential problem of low penetration of residual asphalt was corrected on later Kossuth County recycling projects by adding 200 to 300 penetration asphalt cement.

ECONOMY OF PROCESS

In areas where aggregate sources are plentiful, where haul distances are relatively short, and where roadway widths are adequate, it is possible that recycling of pavements may not be economical. However, if just one of the above factors is present, recycling should be considered. In Kossuth County Iowa, all three factors existed.

The economics of recycling cannot be judged by the cost of this experimental project. The project was too short and there were too many unknown areas of the costs involved in the process. Bidding contractors had to protect themselves and their financial investment. However, there is now sufficient data available to the Engineer to assist in the preparation of a detailed cost analysis.

ENVIRONMENTAL CONCERNS

The only serious problem relative to this project was the pollution created by the mixing operation.

The pollution problem which occurred in the recycling process has been addressed by the equipment manufacturers and contractors and is no longer a problem.

FUTURE OF RECYCLING

The future of recycling speaks for itself. Who would have thought at the time this research project was started that the recycling process would almost be conventional practice just five years later.

The interest shown by the equipment manufacturers, the contractors, and the contracting authorities nationwide has shown the potential for recycling. The continued spiraling cost of asphalt cement has shown the economics of recycling.

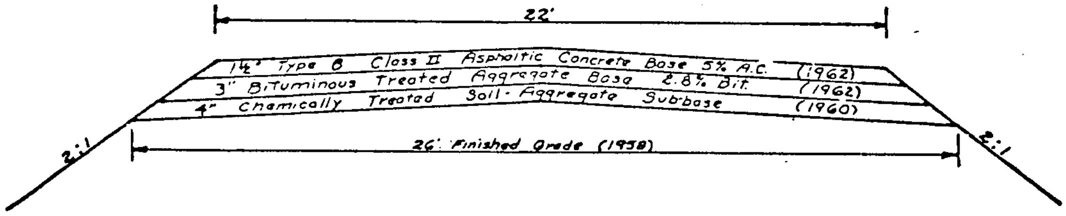
Kossuth County is proud to have played a part in the establishment of recycling as a viable construction alternative to help stretch the shrinking construction funds, and, at the same time, help to conserve our rapidly depleting construction materials.

Appendix A

Typical Cross Sections &

Special Provisions

TYPICAL CROSS SECTION
Sta. 100+00 to Sta. 148+92.2
(Existing Roadway)

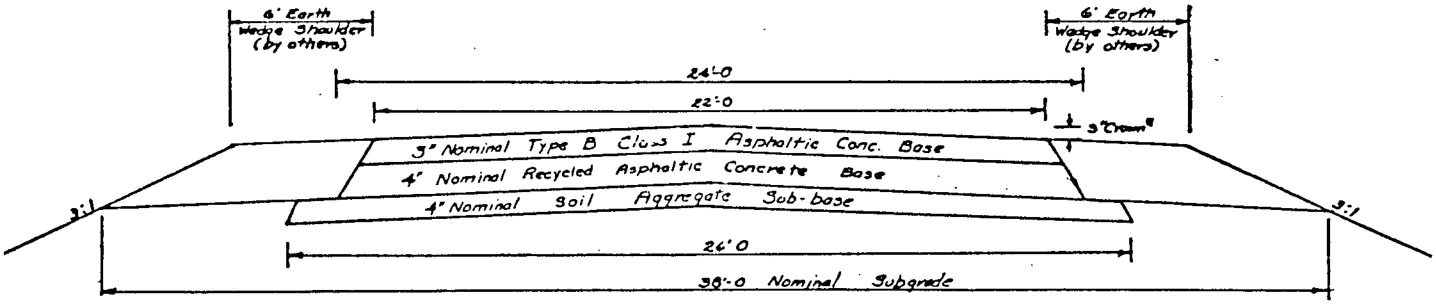


Contractor will scarify existing 4½" nominal bituminous material in such a manner as to salvage the maximum amount of the bituminous material. Contractor will load the bituminous material and haul to the plant site where the material will be crushed to a 2" maximum size. No other gradation requirements will be specified. Price bid will be on a sq. yd. basis and will include all costs for scarifying, salvaging, loading, hauling and crushing.

Contractor to salvage existing 4" Chemically Treated Soil-Aggregate Sub-base and stockpile the material at a location secured by the contractor in accordance with Section 2126 of 1972 Standard Specifications.

After the bituminous material and the sub-base material has been removed the contractor will lower the remaining roadbed uniformly, an average depth of 12" and to a nominal width of 38' with 3:1 foreslopes. The sod on the foreslopes, after thorough disking, shall be removed from the area and placed on the area to be occupied by the outer portion of the embankment in layers not over 8" in loose thickness. The existing slopes shall be notched as required by the Engineer in steps as the grade is lowered and widened. The material will be placed on the slopes in layers not over 6" in loose thickness. After the layer has been smoothed and before the next layer is deposited upon it, the layer shall be compacted with a minimum of one rolling per inch of depth of each lift, and it is further required that the roller continue operation until it is supported on its tamping feet or the equivalent.

TYPICAL CROSS SECTION
Sta. 100+00 to Sta. 148+92.2
(Proposed Roadway)



Contractor to prepare 4" Soil Aggregate Sub-base in accordance with Section 2110 of 1972 Standard Specifications.

1500 tons per mile of granular material will be added in the construction of the soil aggregate sub-base as a separate pay item. The granular material added will be in addition to the salvaged sub-base material.

Contractor will construct nominal 4" Recycled Asphalt Concrete Base using the salvaged material and adding Asphalt Cement as determined by the job mix. Section 2202, 1972 Standard Specifications, shall apply ammended as follows.

1. In any section where Asphalt Treated Base appears it will be assumed to read "Recycled Concrete Base."
2. Delete Section 2202.02B and insert in its place---The Mineral Aggregate used will be the salvaged bituminous material with a maximum size of 2". There will be no other gradation specifications or requirements.
3. Delete Section 2202.02C and insert in its place --- It will be required by the Engr. so that the existing proportions of Type B Class II Asphaltic Concrete Base and Bituminous Treated Aggregate Base be maintained during the salvaging, crushing and placement in the cold feed bins. The additional Asphalt Cement required to be added to the salvaged material will be determined by the job mix. The Asphalt Cement added shall be maintained within plus or minus 0.40 percentage points tolerance of the percent intended
4. Add the following to Section 2202 --- It is not intended to use an asphalt softening agent, however if the Engineer, at the time of production, determines that a softening is required the contractor will add the prescribed agent and will be paid at invoice price plus 10%.

Contractor will construct Type B Class I Asphaltic Concrete in accordance with Section 2203, 1972 Standard Specifications.

*Subject to Engineers approval 2" crown may be used.

The Engineer may require a tack coat of 0.02 to 0.05 gal per sq. yd.

Reclm, Crush and Stockpile Bituminous Concrete Base	Reclaiming and Stockpiling Granular Subbase	Reconstruct Sub-grade	Construct 4" Soil-Aggregate Sub-base	Granular Material	Recycled Asphaltic Conc. Base	Type B Class I Asphaltic Conc Base	Asphalt Cement	Primer or Tack Coat Bitumen
Sq. Yd.	Cu Yd.	Mile	Mile	Tons	Tons	Tons	Tons	Gal.
(5)(10)	(6)	(10)(11)(15)	(10)	(13)(14)	(1)(5)(9)	(1)(2)(9)(13)	(3)(4)(9)	(8)(9)
11,959	1449	0.927	0.927	1391	2984	2099	226	1173

Footnotes:

(1) Drum Mixing equipment complying with Section 2001 may be used for the production of the Recycled Asphaltic Concrete Base and the Type B Class I Asphaltic Concrete Base.

(2) Not less than 30% crushed limestone, graded to meet the requirements of the mix design, shall be incorporated in the Type B Class I upper base course. Cost of the limestone will be incidental to the price bid for the Type B.

(3) Estimated at 5% for Class II

(4) Estimated at 6.5% for Class I

(5) Estimated at 2638 tons salvaged Bituminous Material based on core samples of 5", 5", 4½" & 4½" with an average width of 22' + 130# per cu. ft.

(6) Estimated at 1449 Cu.Yds. based on 3" of salvagable sub-base material 24' width.

(7) Contractor shall use 85-100 penetration Asphalt Cement.

(8) All or any part may be eliminated at the discretion of the Engineer.

(9) Section 1109.03 of 1972 Standard Specifications shall not apply.

(10) Final payment will be based on estimated planned quantities with out re-measurement.

(11) Estimated at 5000 C.Y. based on average cut of 12".

(12) Wedge shouldering, after the Asphaltic Concrete is placed, will be done by others and is not a part of this contract.

(13) Contractor will furnish the gravel source and crush the gravel to meet specifications

(14) Based on 1500 tons per mile.

(15) The contractor shall aerate, compact, and shape all unstable subgrade areas prior to constructing the soil aggregate subbase. Unstable areas that develop during subsequent construction operations shall be repaired in accordance with the specifications and to the satisfaction of the engineer. All aeration, compaction, shaping and repair shall be incidental to the work and not measured for payment.

Appendix B

Tabulation of Bids

TABULATION OF BIDS

County Kossuth
Type of Work Asphaltic Conc. Pavement
Project No. L-502(2)-73-55 (HR-176)
Date of Letting April 1, 1975

			EVERDS BROS. ALGONA, IOWA		KOMATZ CONST. ST. PETER, MINN.		ROHLIN CONST. ESTHERVILLE, IOWA		W. HODGMAN & SONS FAIRMONT, MINN.	
	QUANITY	UNIT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT
Base, Reclaim, Crush & Stockpile Bituminous Concrete	11,959	sq. yds.	1.60	19,134.40	1.80	21,526.20	1.85	22,124.15	2.00	23,918.00
Subbase, Granular Reclaiming and Stockpiling	1,449	cu. yds.	4.00	5,796.00	2.50	3,622.50	4.50	6,520.50	2.00	2,898.00
Reconstruction of Subgrade	.927	miles	6,000.00	5,562.00	8,000.00	7,416.00	6,000.00	5,562.00	8,000.00	7,416.00
Subbase, Const. of Soil Aggregate	.927	miles	3,000.00	2,181.00	3,000.00	2,181.00	3,000.00	2,181.00	3,000.00	2,181.00
Granular Material	1,391	tons	3.50	4,868.50	3.60	5,007.60	3.80	5,285.80	3.70	5,146.70
Base, Recycled Asphaltic Concrete	2,984	tons	7.50	23,380.00	6.90	20,589.60	6.70	19,992.80	8.50	25,364.00
Base, Class I Asphaltic Concrete	2,099	tons	7.50	15,472.50	7.83	16,435.17	8.05	16,896.95	7.60	15,592.40
Asphalt Cement	226	tons	96.00	21,696.00	95.00	21,470.00	93.00	21.018.00	94.50	21,357.00
Primer or Tack Coat Bitumen	1,173	gals.	.60	703.80	.52	609.96	.50	586.50	.49	574.77
TOTAL - - - - -	- - - - -	- - - - -	- - - - -	98,664.20		99,458.03		100,767.70		105,407.87

Appendix C

Laboratory Test Data

Iowa Department of Transportation
Asphalt Concrete Mix Design

Mix, Type and Class: Salvaged Asphalt Concrete. Lab No. ABD5-59

Intended Use:

Size Spec. No. Plans Date Reported: 6/10/75

County: Kossuth Project LRS-502(2)--73-55

Contractor: Everds Brothers, Inc.

Project Location

Agg. Sources The average extraction of the crushed mat was 3.7% of asphalt.

Job Mix Formula Aggregate Proportions: 100% AAT5-186 (Crushed Mat)

JOB MIX FORMULA - COMBINED GRADATION

1-1/2"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
		100	98	93	81	66	50	32	18	12	10

Tolerance:

75 Blow Marshall Density		2.22	
Asphalt Source and Approximate Viscosity		1367 Poises	
Plasticity Index			
% Asphalt in mix	4.50	5.50	6.50
Number of Marshall Blows	50	50	50
Marshall Stability - Lbs.	3530	3797	4267
Flow - 0.01 Inches	10	10	10
Sp. Gr. By Displacement (Lab Density)	2.15	2.20	2.23
Bulk Sp. Gr. Comb. Dry Agg.	2.564	2.564	2.564
Sp. Gr. Asph. @ 77 F.	1.028	1.028	1.028
Calc. Solid Sp. Gr.	2.46	2.42	2.39
% Voids - Calc.	12.4	9.1	6.6
Rice Sp. Gr.	2.50	2.44	2.40
% Voids - Rice	14.0	9.8	7.1
% Water Absorption - Aggregate	1.94	1.94	1.94
% Voids in the Mineral Aggregate	19.9	18.9	18.7
% V.M.A. Filled with Asphalt	37.5	51.8	65.0
Calculated Asph. Film Thickness (microns)	4.2	5.4	6.6

A total content of 6.1% of asphalt is recommended to start the job. This is an addition of 2.5% asphalt to the salvaged concrete.

Copies:

R. P. Henely
Roberts
M. Stump
B. Ortgies
L. Zearley
J. Stober
Everds
C. Jones
G. Perrin

Signed: Bernard C. Brown
Testing Engineer

Kossuth County HR-176, Recycling Project
Laboratory Test Data

Sample No.	Roadway Sta.	Roadway No's.	%AC Added	%AC Extracted	Rec. Pen.	Rec. Viscosity	Mix-Mat Temp. °F.
77	107+00	108+00	2.5	5.8	NA	NA	275°
78	111+00	112+00	2.5	5.8	37	10,220	260°
79	120+00	121+00	3.5	7.5	NA	NA	245°
80	124+00	125+00	3.5	7.0	42	6,040	235°
81	126+00	127+00	3.5	7.2	NA	NA	250°
82	138+00	139+00	3.5	7.0	NA	NA	285°
83	143+00	144+00	4.5	8.3	49	3,990	200°
84	145+00	146+00	4.5	6.9	NA	NA	200°

Sample No. 77-83 aggregate, 100 percent recycled material

Sample No. 84 aggregate, 70 percent recycled material, 30 percent crushed limestone

A.C. added was 85-100 Pen. A.C., original absolute viscosity @ 140°F, was approximately 1300± poises.

Extraction tests on salvaged material indicated 3.6% old A.C.

KOSSUTH COUNTY HR-176 RECYCLING PROJECT
LABORATORY TEST DATA

Sample No.	%AC Added	Gradation % Passing - Extraction 3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200	Field Dens.	% Lab Dens.	% Lab Voids	% Field Voids	Marshall Stab.	Flow
77	2.5	100	98	94	80	66	49	32	17	13	10	2.04	90.3	7.7	16.4	4372	10
78	2.5	100	98	93	80	65	49	31	16	12	10	2.02	89.4	7.9	17.2	4558	10
79	3.5	100	100	96	83	67	50	32	17	13	11	1.98	86.1	3.5	17.6	3613	13
80	3.5	100	100	94	80	65	49	31	17	12	10	2.10	91.3	3.4	12.7	3262	14
81	3.5	100	98	94	82	67	50	32	17	13	11	2.18	94.8	3.4	9.1	3808	12
82	3.5	100	98	93	80	66	49	31	16	12	10	2.17	94.3	3.8	9.7	3900	10
83	4.5	100	99	94	81	66	49	31	17	12	10	2.21	94.4	2.2	8.1	2237	19
84	4.5	100	91	82	66	52	39	25	14	11	9.1	2.25	96.2	2.3	6.4	2547	19

Sample No. 77-83 aggregate, 100 percent recycled material

Sample No. 84 aggregate, 70 percent recycled material, 30 percent crushed limestone

Lab Density - 50 Blow Marshall - specimens compacted at 275° F

Percent Lab Densities based on: Sample No. 77 & 78, 2.26 Lab Density
Sample No. 79-82, 2.30 Lab Density
Sample No. 83 & 84, 2.34 Lab Density

Appendix D

Stack Emission Observations

STACK EMISSION OBSERVATIONS

Mix Temp °F	Production Rate T./Hr.	Aggregates	% H_2O Added	% Asphalt Added	Remarks
300	300	100%Recycled	0	2.5	Smoke Very Dense
260	300	100%Recycled	0	2.5	No Change
260	400	100%Recycled	0	2.5	No Change
260	400	100%Recycled	1	2.5	Some Change, 50-80 Ringelmann
260	200	100%Recycled	3	2.5	Little Change, 40-60 Ringelmann
225	300	100%Recycled	1.5	2.5	Some Change, 40 Ringelmann
225	300	100%Recycled	1.5	3.5	40 Ringelmann
225	300	100%Recycled	1.5	4.5	40 Ringelmann
225	300	70%Recycled 30%Limestone	1.5	4.5	20-30 Ringelmann