Demonstration Projects Program
Technology Transfer
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DEMONSTRATION PROJECT NO. 39

RECYCLING ASPHALT PAVEMENTS

Jackson County, Missouri

Prepared for
and
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U.S.DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTATION
REGION 15
DEMONSTRATION PROJECTS DIVISION
1000 NORTH GLEBE ROAD
ARLINGTON, VIRGINIA 22201

NOTICE

COWHERD ROAD COLD ASPHALT RECYCLING PROJECT

Report for FHWA
Demonstration Projects Division

By

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November 15, 1979

Jackson County Public Works Department
Jackson County, Missouri

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INTRODUCTION

Jackson County is comprised of 607 square miles, of which approximately 240 square miles are unincorporated. County forces maintain approximately 470 miles of roads, of which about 90 percent are composed of oiled earth and the accumulation of years of chip and seal treatments. An additional two percent of the County roads are untreated gravel. Coupled with the rising costs of asphalt overlays and sealing applications and the County's need for the replacement of many structurally-deficient or functionally-obsolete bridges and regular maintenance, an alternative method for improving roadways of the road and bridge network is needed.

The need is twofold: stretching the available funds and conserving the unrenewable resources. In the past several years, construction material costs, especially the cost of liquid asphalt, have risen drastically. Asphalt oil has increased from $17 per ton to over $100 per ton in the past few years. Fuel costs have also increased by several hundred percent adding to the total construction cost of any roadway improvement program.

Jackson County, as is the case with many governments, gets a major portion of its revenue from property taxes -- a system that dictates budgets that cannot respond to price increases and inflation. The result is fewer miles of road per dollar that can be improved or properly maintained.

Aside from their skyrocketing costs, asphaltic cement, gasoline, and diesel fuel are natural resources that cannot be replaced. Aggregates, crushed stone, and natural sand used in conventional asphalt hot mix, while plentiful in some areas are, nevertheless, nonrenewable natural resources. Expanding cities, Federal air-quality regulations, and zoning requirements are limiting quarrying operations, causing transportation costs to dictate more and more the price of aggregates.

Recognizing the problems of fixed or shrinking revenues, the rising prices and nonrenewability of crude oil derived fuels and by-products, the engineering community, over the past few years has developed alternate methods to stretch the dollar and reuse our material resources.

In the past, the existing pavement was broken up and hauled away to disposal sites or incorporated into the new roadway fill. This is now considered to be an unncessary waste. The existing pavement represents a large expenditure of capital funds over the years and a vast reservoir of materials for roadway construction. To haul this material to a sanitary landfill site (a scarce commodity), and further, to incorporate this material into the roadway fill represents a very high-priced embankment.

Thus, after a review of various methods of recycling using available technology, the County chose to use the process known as "Cold Asphalt Recycling." The choice was made over a "Hot Recycling" process because greater savings would be realized in

both dollars and energy by recycling in place without the necessity of haul vehicles or externally applied heat required by the hot method.

Hot-mixed plant asphalt requires vast amounts of energy just to bring aggregates and asphaltic cement to proper mixing temperatures, not to mention the energy required to transport the finished mix as much as 25 miles from the plant to the job site.

Cold Asphalt Recycling involves combining the existing aggregates of the roadway and the residual oil in these aggregates with additional small amounts of new oil and sometimes additional virgin aggregate.

Cold Asphalt Recycling can save dollars and Btu's from each link of the chain of procedures required to produce a plant-mixed, hot mix asphalt concrete pavement. Since little, if any, aggregate may be needed to add to the recycled road, not only a savings in dollars to produce and transport aggregate is realized but a savings in a resource as well.

Influenced by the possibility of savings to County taxpayers, the Engineering Division of the Public Works Department began to explore the possibility of a demonstration project in which Cold Asphalt Recycling could be put to the test. Beginning late in 1976, it was learned that obtaining Federal funds for a recycling project was a possibility.

Ten roads were selected from road surveys for the purpose of testing existing pavement thicknesses and subgrade conditions. The ten roads were selected on a basis of traffic counts, width, surface condition, and alignment.

PROJECT HISTORY

Cowherd Road, a few miles south of the City of Blue Springs, was selected as our demonstration road. Cowherd Road is 2.2 miles in length and has an average width of 21.5 feet. Traffic counts indicated that average daily traffic was between 125 and 225 vehicles. The road has been a maintenance problem as the roadway was cracked and potholed, and required patching on an almost annual basis. Borings and laboratory tests indicated that the problem, however, was not the subgrade.

On October 17, 1978, Jackson County negotiated a contract with the United States Department of Transportation, Federal Highway Administration. The Federal Highway Administration would reimburse the County for up to $30,000 or $1 per square yard of pavement recycled and $15,000 for testing and evaluation.

In a professional services agreement with Jackson County, Kansas City Testing Laboratory, Inc. provided the testing, evaluation, and design in connection with the asphalt recycling on Cowherd Road.

To evaluate the existing road material, over 100 test cores were taken. The cores were taken from random locations to get an accurate picture of the quantity and quality of material available. Laboratory tests were made to determine the percent of asphalt in the mix. Portions of the extracted oil were saved for penetration tests. Gradation analyses were

run on all samples. Test borings were also made into the subgrade and soil samples were obtained for moisture density relationships and California Bearing Ratio data.

Cowherd Road is composed of 30-plus years of chip and seal and cold-mix applications. Sieve analyses indicated that the aggregate in our test samples was primarily made up of 3/8-inch maximum-sized material. Through meetings between the County Engineering Division's staff and Kansas City Testing Laboratory, Inc., it was decided that any mix that was to be designed would conform to the gradation of an APWA Type I mix. An APWA Type I gradation was desirable because of its good density curve and proven record of performance. To accomplish this, larger sized aggregate would have to be added to the existing roadway material.

Oil extractions made from roadway samples indicated an average oil content of five percent. It was determined that additional oil would be needed to develop the necessary stability strength of the recycled pavement.

With laboratory data compiled, Kansas City Testing Laboratory, Inc. began combining trial asphalt mixes composed of existing roadway material, added aggregate in amount and size to conform to the required gradation, and various types of oils and additives.

After experimenting with different emulsified asphalts and cutback asphalts (RC's, MC's) and oil softeners and rejuvenators such as SA-1 and Cyclogen, a decision was reached to use an emulsion, SS-1h, as the additional asphaltic cement in the

recycled mix. The selection of SS-1h mix was based on the Marshall characteristics of stability and flow. The oil additives were ruled out because of their price and the fact that results were very similar to the mixes containing the SS-1h.

The final design mix for the project was composed of four parts: existing pulverized bituminous base made up 60 percent of the aggregate, virgin limestone aggregate represented 20 percent; the remaining 20 percent was comprised of cold-planed millings available from a nearby surface milling project; and to the total aggregate mixture SS-1h was added to form a combined mixture of residual bitumen between four and seven percent.

On August 5, 1978, Jackson County advertised for bids for construction of the project. Upon opening and analyzing the bids, City-Wide Asphalt Company, Inc., Sugar Creek, Missouri, was awarded a contract. The contract price for all portions of the asphalt recycling for the 2.2 miles was $61,287.33. This yields a unit price of $2.22 per square yard.

CONSTRUCTION

Construction began on September 25, 1978. Kansas City Testing Laboratory, Inc. was responsible for all testing and written evaluations required by the United States Department of Transportation. Jackson County handled the administration of the project and supplied a resident engineer from its staff. County sign crews were responsible for all construction signing on the project.

Construction consisted of five major portions:

1. The existing pavement was ripped by a motor grader with rear-mounted ripper teeth and serrated edges on the mold board. The pavement was ripped to full depth in eight-foot wide strips. Ripping the pavement was a problem throughout this first section of the project due to the fact that the existing pavement thickness varied greatly.
2. The large pieces resulting from ripping were then pulverized by utilizing a Pettibone Speed Mixer-SM750. Generally, three passes were required to pulverize the existing roadway surface to produce 3/4-inch maximum-sized particles. This phase of the construction sequence was quite time consuming and problems were encountered with the shear bolts on the speed mixer which broke frequently. Experimentation with equipment speeds and gained operator experience solved some of the shear bolt problems. One complete set of thirty-six tines was used in pulverizing the first .7 of a mile of the project.

3. After measuring the amount of recycled material available with a windrow proportioner attached to a motor patrol, a premix combining equal amounts of virgin aggregate and cold-planed millings by use of the contractor's pugmill was delivered and incorporated with the pulverized roadway by additional passes of the SM750. The premix was tail-gated and spread by motor grader in tons per station to keep the ratio of existing material to premix to the correct proportions of the design mix. With the addition of the premix, the aggregate mixture was now ready for the SS-1h application. When any subgrade problem areas were found, unsuitable material was removed and replaced with premix.

4. Three applications of SS1h were made using a standard asphalt distributor. After each application of emulsion, the roadway was watered using a standard water truck and mixed three times by the SM750.

5. When all of the materials had been mixed thoroughly, the mixture was blade-laid, shaped, and finally compacted with a vibratory roller. The loose depth of the recycled material was eight inches and compacted to six inches, plus or minus. There was no problem in achieving the desired compaction. After compaction, a chip seal was applied by County forces. A decision was made to apply the chip seal because while the pavement seemed durable, it did tend to ravel with traffic.

Throughout the project fuel usages and hours of operation data were kept on all equipment used on the project.

In October of 1978, the chilly temperatures forced the postponement of the project for the winter with only one-third of the project completed. As the project was broken into thirds, the two remaining portions were opened to traffic and the completed segment was also opened and left to be monitored through the winter.

As with any relatively new construction process, problems were encountered. Temperature was found to be a big factor in the recycling process. To insure good pulverization and mixing, the temperature of the pavement must be at least 70° F. A temperature below 60° F greatly hampers ripping and pulverization; also proper mixing to take advantage of the existing oil in the road surface and cold-planed millings is accomplished more easily with higher temperatures. The number of shear bolts broken was also lower on days when the pavement temperature was 70° or above.

With the start of the next construction season in the spring of 1979, it was decided that certain changes would be made to see if improvements could be made in the recycling process.

First, it was decided at the 1979 preconstruction meeting to wait until mid-summer to begin work and take advantage of the high average temperatures of July and August. Second, the contractor would recycle to a specified depth unlike recycling

the varying depths of the existing material as in the first section of the project. It was hoped that this change would speed up the process of pulverization and also keep down the amount of earth subgrade incorporated with the recycled material that resulted from trying to recycle all of the varying and undulating pavement. This also eliminated need for proportioning passes.

A decision was also made by the contractor to use a larger machine for the pulverizing and mixing stages of recycling process. It was felt that considerable time could be saved and possibly pulverization and mixing steps could be cut by one or two passes.

It was further decided that the first or completed section of the project would serve as a haul road for construction materials for the remainder of the project, as a test of its durability.

Construction for the second section of the project began on July 18, 1979. The five major construction steps remained the same as in the portion completed in October of 1978.

Due to the higher pavement temperatures, the ripping of the pavement on the second section was kept to a minimum, and when necessary the pavement was only ripped to a depth of four inches. When ripped, the resulting pieces broke up easier and were smaller in size than in the October 1978 section of the project.

The Contractor, for the second section of project, chose to use a Pettibone Speed Mixer-SM790 for the pulverization and mixing processes. This machine was larger and more powerful

than the SM750 used in the first section of the project. The SM790 cut down the number of passes required to pulverize the existing roadway to produce 3/4-inch maximum-sized particles, from three passes for the SM750 to one pass.

After experimentation, it was found that only two applications of SS-1h emulsion with one mixing pass each was needed with the use of the SM790. The rate of SS-1h emulsion placed by the distributor was increased and the same amount of oil added in three applications in the 1978 section was added in two applications in the 1979 section. In using the larger SM790 machine, one oil application was saved and seven mixing passes were eliminated over the 1978 completed section.

COST ANALYSIS

The total 2.2 mile portion of Cowherd Road that was recycled cost $58,548.28, plus an additional $13,791.08 for chip seal applied by County forces and resulted in a pavement 22 feet wide and six inches deep. At area asphalt prices of $20.00 minimum per ton for in-place hot mix asphalt, a savings over a new four-inch mat is in the neighborhood of $54,000. A four-inch hot mix mat was used to compare with the six-inch mat of recycled pavement since the two are not thought to be structurally equivalent on an inch-to-inch basis.

The recycling of existing in-place material will have value in subdivisions and similar areas where repeated overlays tend to alter drainage and established curb and gutter sections. At the present time, the only way to handle these areas after a few overlays is either to remove and waste some of the material or surface recycle it. These methods do not allow for subgrade improvement or the correcting of failed areas of pavement.

Further savings may come as construction contractors become familiar with the techniques of cold recycling. At the time of advertising for bids, only three contractors showed any interest in bidding on this project. It further appears that equipment manufacturers need to continue with their development work to avoid problems of excessive shear bolt failure and to extend the tine or cutting teeth replacement time.

Since Cold Asphalt Recycling is accomplished with a minimum amount of equipment, it is conceivable that County highway maintenance forces could perform the recycling tasks by renting or purchasing any needed equipment that they do not already have.

CONCLUSION

To date, the first .7 of a mile of the project has been in service for over one year, which included one of the hardest winters in area history. The pavement survived the snow, below freezing temperatures and spring thaws with only a few scars left by the snow plows.

This same .7 mile section of Cowherd Road served as the material haul road for the remainder of the project completed in August of 1979. In the summer heat, some problems were encountered in the surface chip seal bleeding and picking up on the haul vehicle tires. Some of this problem was solved by scheduling material delivery for early in day before pavement temperatures reached their maximum.

The entire project will continue to be monitored over the next few years, with the possibility of a portion of Cowherd Road receiving a 1½" hot mix overlay in the summer of 1980.

The evaluation of the project that has been completed is encouraging. It is already evident that asphalt recycling can be a valuable tool in curbing the cost of upgrading light to moderately traveled roads.

Asphalt recycling is now an experiment, but it seems to work in conserving our natural resources, dollars, and energy; and, in years to come, it may be a standard procedure in road maintenance. In the meantime, we all must continue to study new methods and materials which can be used to alleviate the

situation of fixed or shrinking revenues and dwindling natural resources. With the cooperation of engineers, contractors, and decision makers at all levels, we can and must improve our methods of using the materials available to us.

It has been estimated that Cold Asphalt Recycling can save as much as one fourth of the total energy used in the production and transportation of conventional hot-mixed asphalt. Transportation of materials hauled to the job site is confined to liquid asphalt and added aggregates, if any.

TESTING & DESIGN SECTION

JACKSON COUNTY MISSOURI PROJ. #2072
FEDERAL DEMONSTRATION PROJ. #39
ASPH. CONC. PAVEMENT RECYCLING
COWHERD ROAD
FROM MISSOURI HWY. #7 TO BOTEN ROAD

REPORT OF LITERATURE SURVEY

Objective:

Contact Federal, State and County officials who have participated in Cold Recycle operations to determine if any Chip/Seal surfaced roads have been Cold Recycled to Stabilized Base, without hot mix surface application, on a contract basis with technical and performance specifications.

Information Source:

Federal: J. J. Jordan, B. Elkins, Steve Beckett
State: C. Campbell, B. Sheahan, H. Wallace
County: J. Sargent, C. W. Smith

Conclusions:

Reports of several Recycle Projects were obtained and reviewed. It was concluded that no demonstration project has been conducted that is representative of the objectives of Jackson County Project 2072. The information obtained from referenced sources was utilized to refine the scope of project, obtain a better understanding of the equipment and process requirements for Cold Recycling.

It was further concluded that most projects were conducted by State or County forces utilizing "in house" or rental equipment; generally without technical or performance specifications and not bid on a general contract basis.

JACKSON COUNTY MISSOURI PROJ. #2072
FEDERAL DEMONSTRATION PROJ. #39
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REPORT OF LITERATURE SURVEY (continued)

The equipment required is locally available to the contractors on a lease, purchase, or rental basis; specifically designed for this type project. Preliminary contacts indicate several general contractors are interested in bidding the project.

Cold Recycle Projects conducted in Republic County, Kansas and Elkhart County, Indiana were similar, in scope, to Jackson County Project 2072. In each project, a chemical "rejuvinator", Cutback Asphalt MC, Emulsion or a combination of additives were used for stabilization of the recycled materials.

A frequently used asphalt dispersant, produced by Saunders Petroleum Company, SA-1 will be utilized in conjunction with Cutback Asphalt (MC-70) for preliminary stabilization evaluation.

The Stabilized Base will be cured under conditions to be determined and surface treated with a standard application of Chip/Seal.

The existing surface represents 30 $\pm$ years of Chip/Seal applications over unimproved subgrade with asphalts of unknown composition.

Preliminary Investigation
Cowherd Road
Pavement Core Samples

% EXTRACTED ASPHALT

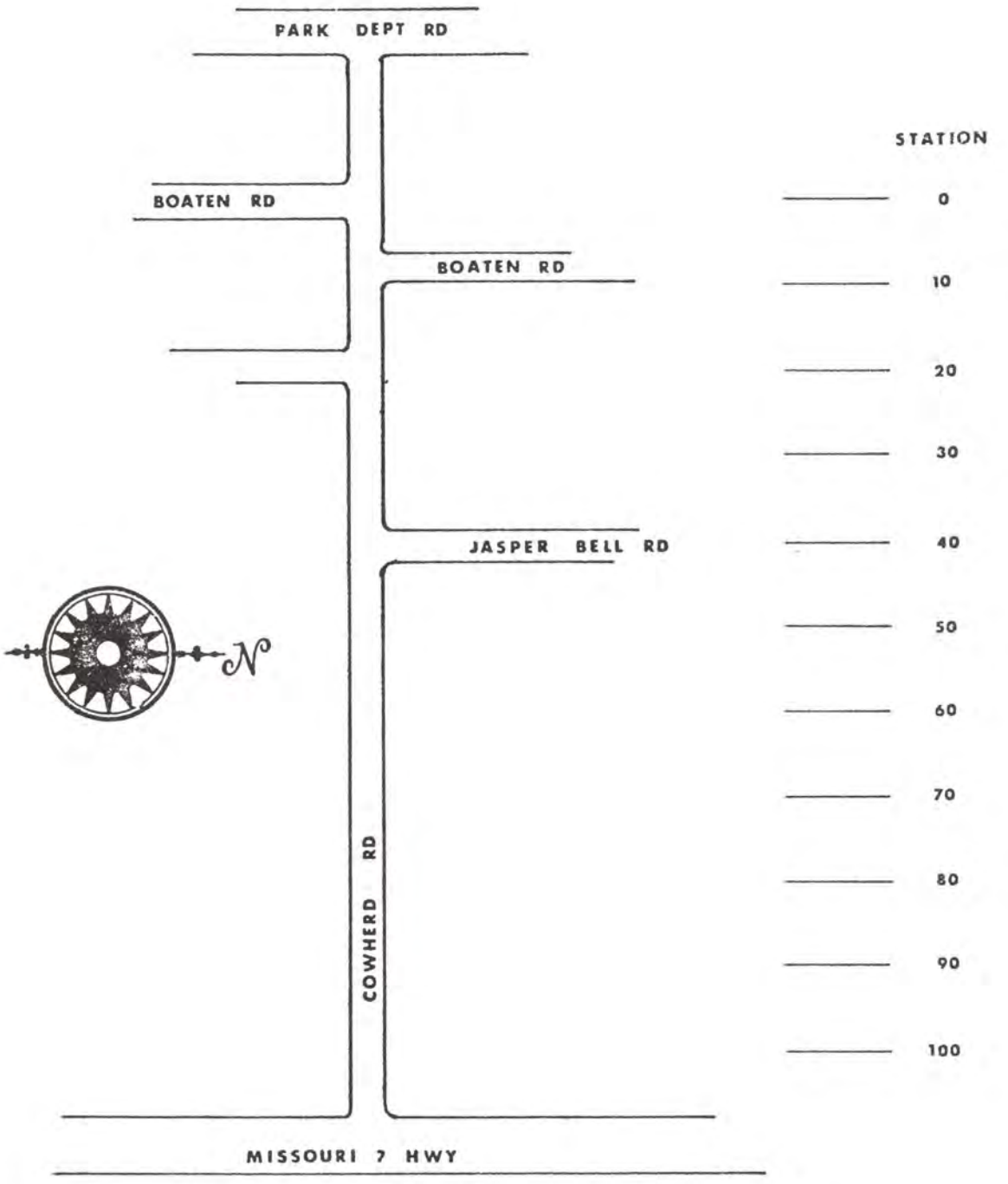
SAMPLE NO.	LOCATION	% OIL
2 Top 1/3	Station 5+00; centerline	3.4
2 Middle 1/3	Station 5+00; centerline	6.1
2 Bottom 1/3	Station 5+00; centerline	4.9
5 Top 1/2	Station 20+00; 6' right of centerline	4.9
5 Bottom 1/2	Station 20+00; 6' right of centerline	3.2
12 Top 1/3	Station 55+00; centerline	10.0
12 Middle 1/3	Station 55+00; centerline	10.2
12 Bottom 1/3	Station 55+00; centerline	6.7
20 Top 1/4	Station 95+00; centerline	10.9
20 Middle	Station 95+00; centerline	8.1
20 Middle	Station 95+00; centerline	5.8
20 Bottom 1/4	Station 95+00; centerline	6.6

PRELIMINARY INVESTIGATION
COWHERD ROAD
PAVEMENT CORE SAMPLES

GRADATION ANALYSIS OF EXTRACTED AGGREGATE % PASSING

SAMPLE NO.	1	2	3	4	5	6	7	8	9	10	11	12
Sieve Size												
1 1/2"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1/2"	88.9	90.2	97.3	77.6	93.2	99.5	99.0	99.3	100.0	100.0	100.0	90.2
#4	45.6	60.6	64.7	48.3	66.3	68.9	65.1	67.9	72.8	67.4	99.3	64.5
10	21.2	25.8	31.4	27.8	31.6	39.3	34.7	39.5	35.8	34.8	71.8	44.9
80	6.0	7.4	7.3	11.1	8.1	15.1	10.9	11.6	13.0	13.3	58.7	18.6
#200	4.3	3.4	4.8	8.5	6.2	9.1	7.4	7.9	6.3	8.8	4.7	14.1

Sample No.	Identification	Sample No.	Identification
1	Station 5+00; Top 1/3	7	Station 55+00; Middle 1/3
2	Station 5+00 Middle 1/3	8	Station 55+00; Bottom 1/3
3	Station 5+00; Bottom 1/3	9	Station 95+00; Top 1/4
4	Station 20+00; Top 1/2	10	Station 95+00; Middle 1/4
5	Station 20+00; Bottom 1/2	11	Station 95+00; Middle 1/4
6	Station 55+00; Top 1/3	12	Station 95+00; Bottom 1/4



KANSAS CITY TESTING LABORATORY
Engineering Consultants

JA. CO. MO. PROJ. #2072 F.D.P. #39

PAVEMENT RECYCLING

DRAWING NUMBER

SCALE: NONE	APPROVED BY:	DRAWN BY
DATE: 1-18-78		REVISED

LANE BLUEPRINT CO. 221-2500

KANSAS CITY TESTING LABORATORY

PRELIMINARY INVESTIGATION
ASPHALTIC CONCRETE
THICKNESS DETERMINATION

JACKSON COUNTY MISSOURI PROJECT NO. 2072
FEDERAL DEMONSTRATION PROJECT NO. 39
ASPHALTIC CONCRETE PAVEMENT RECYCLING
COWHERD ROAD
FROM MISSOURI HWY. NO. 7 TO BOTEN ROAD

STATION	LOCATION	DEPTH
12+00	Center Line	5½"
17+00	L CL	2½"
22+00	6' R CL	2"
28+00	Center Line	3¼"
32+00	5' R CL	3½"
38+00	4' L CL	2"
42+00	Center Line	2"
47+00	9' R CL	2¼"
52+00	9' L CL	2½"
57+00	Center Line	4½"
63+00	9' L CL	3½"
68+00	7' R CL	2 3/4"
72+00	Center Line	3"
78+00	6' R CL	2½"
83+00	9' L CL	2½"
88+00	Center Line	4½"

KANSAS CITY TESTING LABORATORY

PRELIMINARY INVESTIGATION
ASPHALTIC CONCRETE
THICKNESS DETERMINATION

JACKSON COUNTY MISSOURI PROJECT NO. 2072
FEDERAL DEMONSTRATION PROJECT NO. 39
ASPHALTIC CONCRETE PAVEMENT RECYCLING
COWHERD ROAD
FROM MISSOURI HWY. NO. 7 TO BOTEN ROAD

STATION	LOCATION	DEPTH
92+00	9' R CL	2"
97+00	9' L CL	2"
102+00	Center Line	2½"
107+00	9' R CL	3½"
110+00	9' L CL	2½"
114+00	Center Line	3½"

Average Thickness

This second coring - 2.94" (22 Cores)
Previous Coring - 4.1" (42 Cores)

All cores reported in this report were taken by Kansas City Testing Laboratory.

Previous cores were taken by Jackson County and their representative.

All cores were to be taken at nine (9) feet left or right of center line. Mud was encountered at the surface in several places.

Average Thickness All Cores

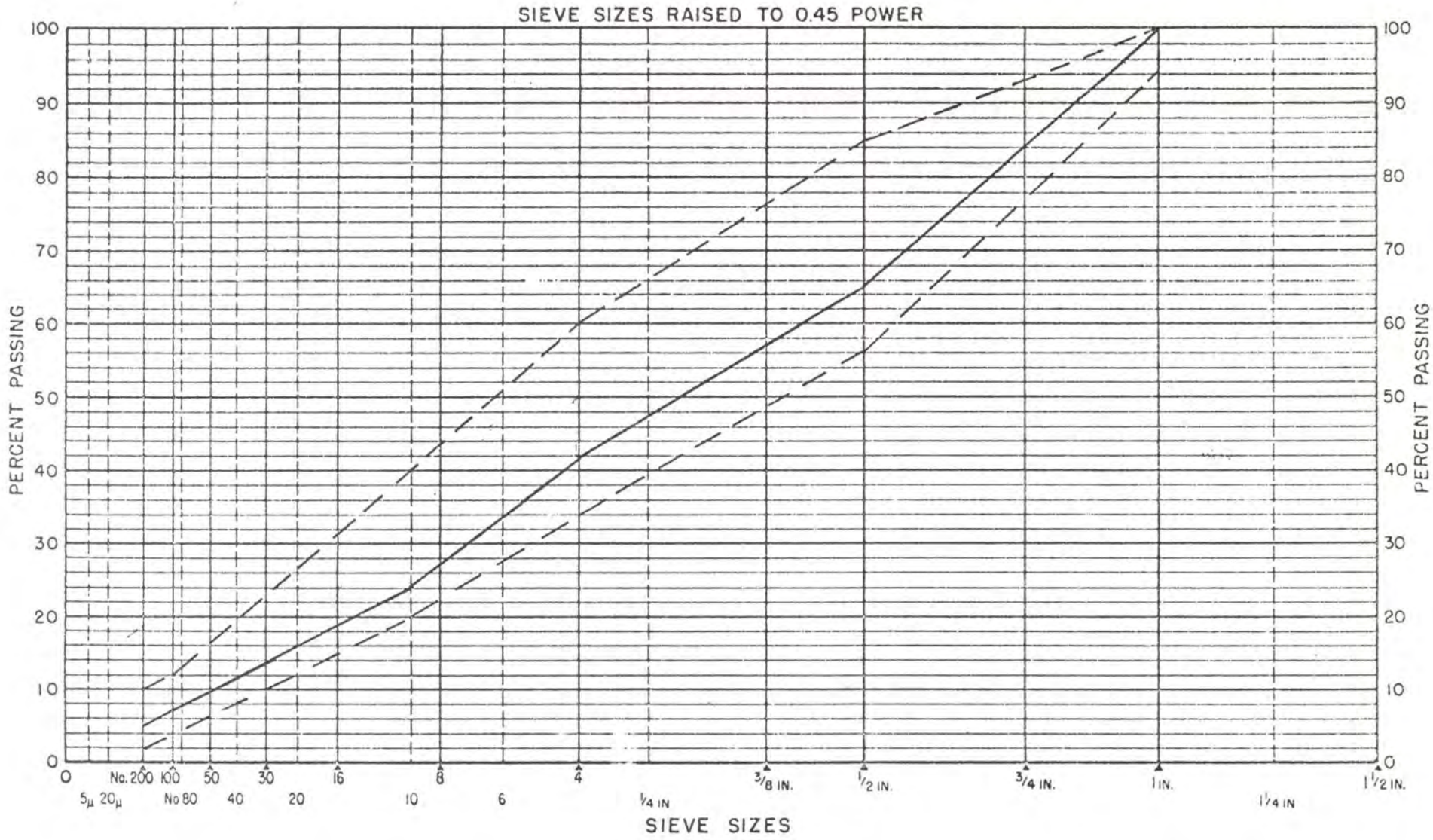
3.7" (64 cores)

EXPERIMENTAL MIX - A.P.W.A. TYPE I BASE

SIEVE SIZE	AVG. GRADATION EXISTING ROADWAY	3/4" CRUSHED LIMESTONE	MIX 62.2% EXISTING 37.8% 3/4"	APWA TYPE I SPECIFICATIONS
1½"	100.0	100.0	100.0	100
1"	100.0	100.0	100.0	95-100
½"	94.6	17.1	65.3	55-85
No. 4	66.0	1.1	41.5	35-60
No. 10	36.6	1.0	23.2	20-40
No. 80	11.2	0.7	7.3	5-12
No. 200	7.1	0.7	4.7	2-10

These combined gradations used for trial mixes using liquid asphalts MC-800 and SS-1H

Kansas City Testing Laboratory



▲ THIS SYMBOL IDENTIFIES SIMPLIFIED PRACTICE AND COMPATIBLE SIEVE SIZES	Identification of gradations: APWA Type I Specification 37.8%-3/4" Rock 62.2% Mix Aggregate	Sheet No. / Date 6-6-78

This combined gradation used for trial mixes using liquid asphalts MC-800 and SS-1H.

Form No 76

EXPERIMENTAL MIX - APWA TYPE I BASE

2% MC-800 Added

DENSITY DETERMINATION P.C.F.				AVERAGE
Sample No.	1	2	3	
	137.4	140.0	132.5	136.6

MARSHALL STABILITY & FLOW @ 73° ± 2° CURED 24 HOURS				AVERAGE
Sample No.	1	2	3	
Stability lbs.	535	869	1257	887
Flow 1/100 in.	18	16	18	17.3

PROCEDURES

1. Aggregate at 100° F
2. Liquid Asphalt at 250°-300° F
3. 1/2 oil mixed to 3/4" rock then 1/2 oil to combined aggregate

EXPERIMENTAL MIX - APWA TYPE I BASE

3% MC-800 Added

DENSITY DETERMINATION P.C.F.			AVERAGE
Sample No.	1	2	
	137.5	132.7	135.1

MARSHALL STABILITY & FLOW 73° ± 2° CURED 24 HOURS			AVERAGE
Sample No.	1	2	
Stability lbs.	990	1070	1030
Flow 1/100 in.	16	15	15.5

PROCEDURES

1. Aggregate at 100°
2. Liquid Asphalt at 250°-300° F
3. 1/2 oil mixed to 3/4" rock then 1/2 oil to combined aggregate

EXPERIMENTAL MIX - APWA TYPE I BASE

3% SS - 1H Emulsion Added

DENSITY DETERMINATION P.C.F.				AVERAGE
Sample No.	1	2	3	
	129.3	129.3	124.4	127.7

MARSHALL STABILITY & FLOW @ 73° ± 2° CURED 24 HOURS				AVERAGE
Sample No.	1	2	3	
Stability lbs.	1082	1540	1102	1242
Flow 1/100 in.	14.5	14	15.5	14.7

PROCEDURES

1. Aggregate at 100° F
2. Liquid Asphalt at 100° F
3. 1/2 oil mixed to 3/4" rock then 1/2 oil to combined aggregate

EXPERIMENTAL MIX - APWA TYPE I BASE

4% SS-1H Emulsion Added

DENSITY DETERMINATION P.C.F.				AVERAGE
Sample No.	1	2	3	
	129.5	130.2	126.2	128.6

MARSHALL STABILITY & FLOW @ 73° ± 2° CURED 24 HOURS				AVERAGE
Sample No.	1	2	3	
Stability lbs.	1305	1324	1146	1259
Flow 1/100 in.	20	22	13	18.3

PROCEDURES

1. Aggregate at 100° F
2. Liquid Asphalt at 100° F
3. 1/2 oil mixed to 3/4" rock then 1/2 oil to combined aggregate

EXPERIMENTAL MIX - APWA TYPE I BASE

2% - Cyclogen Additive

DENSITY DETERMINATION P.C.F.											AVERAGE
Sample No.	1	2	3	4	5	6	7	8	9	10	
	133.7	133.3	134.7	133.8	133.5	134.6	134.3	134.7	134.6	134.6	134.2

MARSHALL STABILITY & FLOW 140° F WATER BATH				AVERAGE
Sample No.	3	6	9	
Stability lbs.	439	503	321	421
Flow 1/100 in.	---	---	---	---

MARSHALL STABILITY & FLOW @ 73° ± 2° AIR			AVERAGE
Sample No.	4	5	
Stability lbs.	482	417	450
Flow 1/100 inc.	20	22	21

EXPERIMENTAL MIX - APWA TYPE I BASE

3% - Cyclogen Additive

DENSITY DETERMINATION P.C.F.

Sample No.	1	2	3	4	5	6	7	8	9	10	AVERAGE
	133.7	133.6	130.6	133.1	133.2	135.6	136.2	134.2	133.1	135.8	133.9

MARSHALL STABILITY & FLOW @ 140° WATER BATH

Sample No.	3	8	10	AVERAGE
Stability lbs.	268	321	289	293
Flow 1/100 in.	---	---	---	---

MARSHALL STABILITY & FLOW @ 73° 2° AIR

Sample No.	1	2	9	AVERAGE
Stability lbs.	546	696	589	610
Flow 1/100 in.	22	16	23	20

KANSAS CITY TESTING LABORATORY

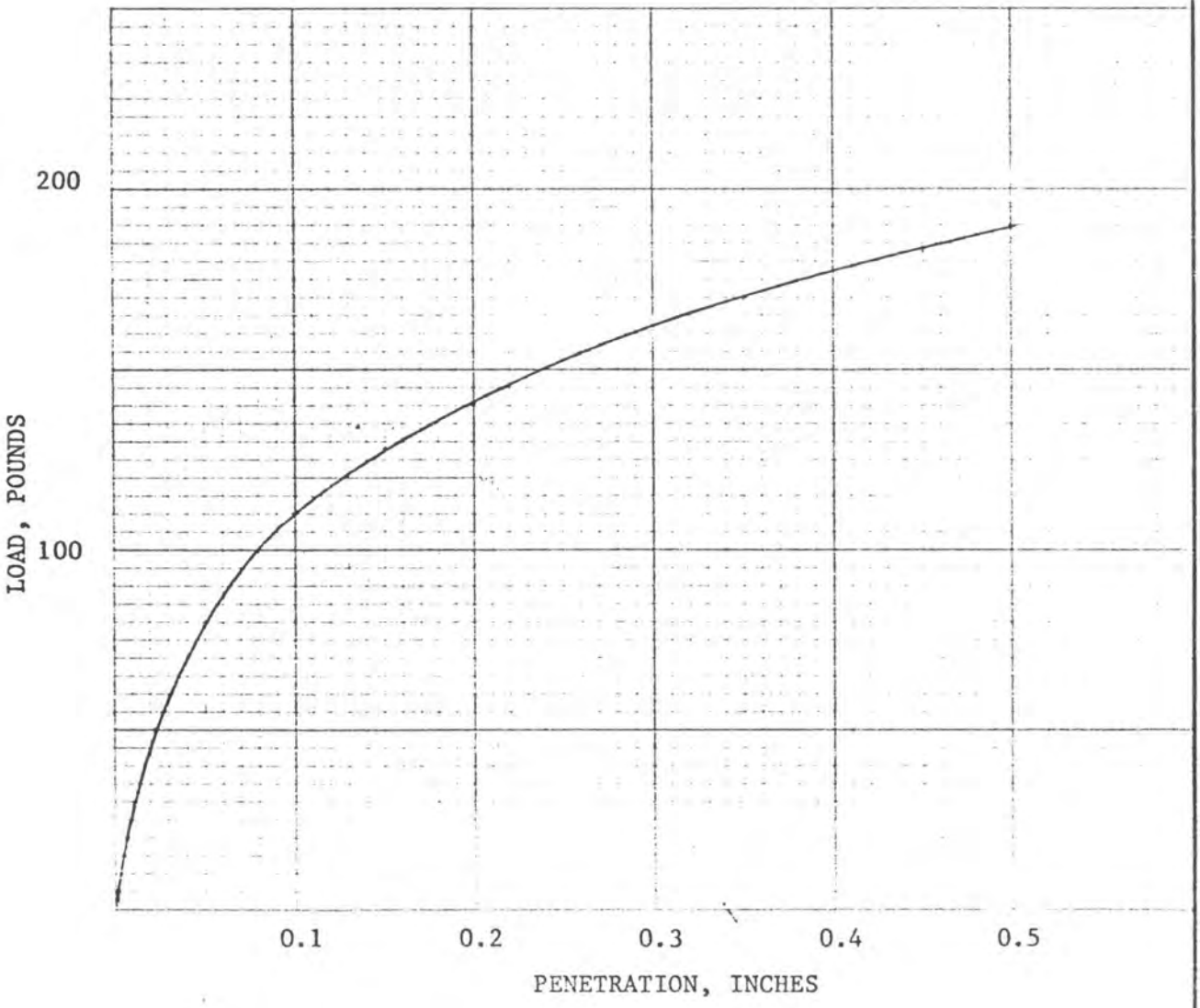
COWHERD ROAD PROJECT

CALIFORNIA BEARING RATIO - ASTM D 1883

Experimental mix "B"

% CBR @ 0.1" penetration = 11.1

Compaction method ASTM D 698, method D
Air cured
10# surcharge



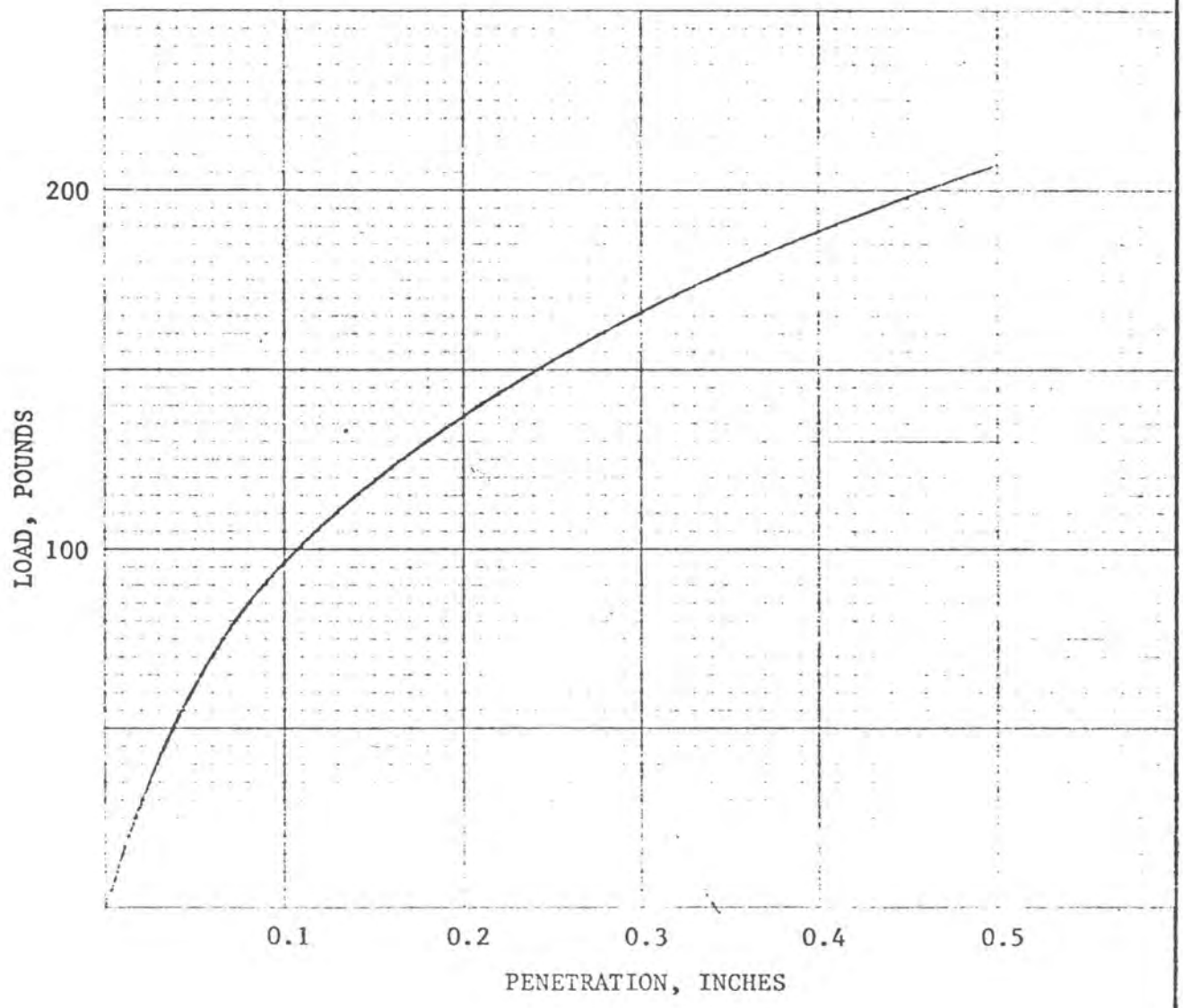
COWHERD ROAD PROJECT

CALIFORNIA BEARING RATIO - ASTM D 1883

Experimental mix "A"

% CBR @ 0.1" penetration = 9.5

Compaction method ASTM D 698, method D
Air cured
10# surcharge



JOB SPECIFICATIONS

PROJECT SPECIFICATIONS

The following Recycled Asphaltic Base Specifications for Cowherd Road were prepared by Jackson County Public Works Department and Kansas City Testing Laboratories, Inc. to serve as a base from which the project could be bid and construction begin. Portions of the Project Technical Specifications were altered throughout the project as required and as explained in this report in the construction section.

RECYCLED ASPHALTIC BASE

These specifications include requirements that are applicable to the removal of existing bituminous pavements, equipment and operations for recycling the bituminous aggregate, and relaying the reprocessed bituminous mixture. This work shall be performed in accordance with these specifications and in close conformity with the lines, grades, thickness and typical cross sections shown on the plans or as established by the Engineer.

Missouri Standard Specifications for Highway Construction 1977 Edition shall be used where a reference is made to a sub-section or a section number.

Composition of Mixtures

The recycled bituminous base shall be composed of a mixture of existing pulverized bituminous aggregate, additional aggregate, and cold-planed millings and bituminous material. The several aggregate fractions shall be sized, uniformly graded and combined in such proportions that the resulting mixture meets the specified grading requirements. (Note: Extensive testing of the existing pavement has been done in order to specify realistic requirements for the characteristics and gradation of this aggregate.)

The proportions of aggregate and bituminous materials shall be as follows:

1. 60% - Existing Cowherd Road pulverized bituminous aggregate

2. 20% - Virgin limestone aggregate

3. 20% - Cold-planed millings as supplied by the Owner

Recycling Equipment

Pulverizer - The equipment shall be rotary reduction machine capable of pulverizing in-place pavement material while maintaining positive depth control which can be adjusted in increments of one-half inch and capable of reducing pavement material six inches or less in thickness to a 1" minus size.

Mixers - Mixers shall be self-propelled and may be combination scarifier, pulverizer, mixer and liquid distributor. The mixing rotor or rotors shall have a positive depth control to insure a uniform depth of mixing. The spray bar for distribution of the liquid shall operate in such a manner that all asphalt will be uniformly applied through the mixer at the time of mixing. The equipment for distributing the bituminous material shall be adjustable and shall measure accurately the amounts of bituminous material being applied. The bitumen pump shall be a positive displacement type pump. It shall be equipped in such a manner as to make it possible to check accurately the rate of application of the bitumen at any time.

Additive Materials

Aggregate: In addition to aggregate now on the existing roadway, virgin limestone of the following gradation will be added to result in a gradation equal to that of American Public Works Association (APWA) Type I Asphaltic Concrete Base

ADDITIVE VIRGIN LIMESTONE AGGREGATE

U.S. STANDARD SIEVE SIZES	TOTAL PERCENT PASSING BY WT.
1½"	100
1"	100
½"	15-25
#4	0-5
#10	---
#80	---
#200	---

Additive Millings

A product of cold-planed millings will be supplied by the Owner and stockpiled on Boten Road north of Cowherd Road. It is the Owner's intent to mix these millings with the additive aggregate described above. It is the Contractor's responsibility to transport these millings on the job site for purposes of mixing with existing and additive materials.

Bituminous Material - An SS-1h asphalt emulsion will be added to the mixture to form a combined mixture of residual bitumen between 4 and 7 percent. The exact rate will be as determined by the Engineer.

Pulverizing Existing Bituminous Pavement

The existing bituminous pavement shall be broken by scarifying with conventional equipment such as a grader or bulldozer mounted with ripping, scarifying teeth or other equivalent devices. The bituminous pavement shall be removed in a manner which will prevent unnecessary intermixing with the underlying subbase soil. No equipment or devices shall be used which might damage structures or properties that are to be preserved and retained. After breaking the existing pavement in this manner, the removed pavement, macadam and underlying aggregate shall be windrowed on an undisturbed section of existing roadway and further processed in place by a traveling hammer mill or other approved pulverizing equipment until all material is reduced to pass a one-inch square mesh sieve.

Combining of Existing & Additive Materials

After the existing material has been removed and further processed as described above, the virgin limestone aggregate shall be placed on top of the removed pavement. Following this the first coating of SS-1h is added to the materials at the rate of 0.8 gallons per ton.

The limestone will be added at the general rate of 11.30 tons per station. This quantity may vary based on depth of existing pavements.

The bituminous material will be added concurrently with the first mixing process. After this mixing is complete then the cold-planed millings will be added at the general rate of 11.3 tons per station. The second coating of bituminous material will be added concurrently with the second mixing process. The bituminous material will be applied at the rate of 0.8 gallons per ton. Finally, a third mixing process will be performed. The third coating of bituminous material will be added to the previously mixed aggregates at the rate of 0.8 gallons per ton.

After the three mixing sequences the Engineer will determine whether the material is ready for replacement and compaction. If it is determined that additional bituminous material is necessary, the Contractor will be paid for additional mixing sequences on the basis of the unit price for the bituminous material. If additional bituminous material is not necessary, but additional processing is, the Contractor will be paid on the basis of unit price for "Additional Mixing."

Replacing of Mixed Material

Once the material has been properly mixed it will be transported to the prepared subgrade. It will be placed with a motor patrol to a specified depth of 5½ inches ± 1/2 inch. The final pavement surface shall be finished with an electronic grade control device on the motor patrol.

An alternate to the above method is to place the recycled base with a conventional asphalt paver. This paver will be required to contain the standard electronic control device.

Rolling and Compacting

The material will first be rolled with a steel-wheel 8-10 ton roller. Then a pneumatic roller will be required to make a minimum of one pass over the entire surface. Finally the steel-wheel roller will make one final pass to finish the surface. The combination of the compacting effort will provide a minimum density of 98 percent of the unit weight obtained by ASTM D-1559.

Time of Mixing-Placement

Combining of existing and additive materials shall not precede the replacing, rolling and compaction of the mixture by time greater than one calendar day.

Subgrade Preparation

Section 209 of the Standard Specification shall govern subgrade preparation. Delete Sub-Section 209.3.4. If needed, suitable soil material is available on site in the hill excavation areas on the plans.

Measurement of Payment

1. Subgrade Preparation - Soft spots or unstable material removed and placed with suitable material will be paid for at the unit bid price per cubic yard (C.Y.).

2. Recycled Asphaltic Base - Including pulverizing of existing base, combining or mixing process including the hauling and addition of cold millings and replacing of the recycle mixture will be paid for at the unit bid price per square yard.

3. Bituminous Material - Additive bituminous material (SS-1h emulsion) will be paid for at the unit bid price per gallon.

4. Additive Aggregate - Virgin (3/4") limestone aggregate will be paid for at the unit bid price per ton.

5. Additional Mixing - Mixing performed without the addition of bituminous material (See subsection - "Combining of Existing and Additive Materials") will be paid for at the unit bid price per hour.

DAILY REPORTS
PRECONSTRUCTION MEETING #1 NOTES
PRECONSTRUCTION MEETING #2 NOTES
MISCELLANEOUS

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 1

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 20, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

KCTL WAS INFORMED THAT WORK ON CONSTRUCTION WOULD BEGIN WEDNESDAY, SEPTEMBER 20, 1978.

KEITH PAYNE WAS ON THE JOBSITE AS WELL AS RUSS BUEHLER (CITY WIDE ASPHALT), A REPRESENTATIVE FROM THE PETTIBONE COMPANY, AND KIRK PHILLIPS FROM JACKSON COUNTY. IT WAS DECIDED THAT THE WEATHER AND OTHER INCLEMENT CONDITIONS WOULD PREVENT WORK FROM BEGINNING TODAY.

CITY WIDE EQUIPMENT WAS ON THE JOBSITE. EVEN THOUGH NOT USED, THE FOLLOWING EQUIPMENT WAS INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE, FRONT AND BACK RIPPER
3. ONE BLADE WITH WINDROWER

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 2

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 25, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: AIR TEMP 60°-80°; CLOUDY TO CLEAR % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN AT 8:00. TWO OPERATORS AND ONE SUPERINTENDENT WERE PRESENT. ALSO, BILL STENIS ALONG WITH 2 OTHER MEN FROM THE PETTIBONE CORPORATION WERE ON THE JOB TO GIVE TECHNICAL ADVICE TO THE CONTRACTOR.

WORK BEGAN WITH A BLADE LAYING BACK GRASS FROM THE EDGE OF THE ROAD. BLADE 45-8 WAS USED TO RIP THE EXISTING ROADWAY. ALTHOUGH DIFFICULTIES WERE ENCOUNTERED WITH THE RIPPING AT FIRST, BOTH LANES WERE EVENTUALLY RIPPED FROM STATION 115+75 TO STATION 102+00. ONE WINDROW WAS PULVERIZED TWICE FROM STATION 115+00 TO STATION 102+00 WITH THE SM 750.

EQUIPMENT ON THE JOB INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH A WINDROWER

THE 3/4" AGGREGATE STOCKPILE AT THE CITY WIDE PLANT WAS THEN CHECKED. TESTS RESULTS ARE AS FOLLOWS ON NEXT PAGE.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 2 (Con't)

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 25, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

REPORT OF TEST RESULTS

SIEVE SIZE	% PASSING	SPECIFICATIONS
1"	100.0	100
1/2"	51.9	15-25
#4	5.4	0-5

AGGREGATE WAS REPORTED UNSUITABLE.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 3

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 26, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: CLEAR AIR TEMP 47°-89° % ACTUAL WORK COMPLETED:

REMARKS:

THE CONTRACTOR BEGAN WORK AT 7:00 A.M. WORK CONTINUED FROM YESTERDAY. THE WORK AREA WAS THE SAME AT 9-25-78.

EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 4

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 27, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: PARTLY CLOUDY; AIR TEMP 76°-90° % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN AT 9:00 A.M. J. JORDON, A REPRESENTATIVE OF THE FEDERAL GOVERNMENT, WAS PRESENT TODAY. RIPPING AND PULVERIZING CONTINUED FROM STATION 114+75 TO 78+00.

EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER.

ALSO, THE NEW 3/4" AGGREGATE AT THE CITY WIDE PLANT WAS CHECKED TODAY. SOME MATERIAL WAS IN AND SOME WAS NOT.

MORE TESTS ARE TO BE RUN.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 5

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 28, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: CLEAR; AIR TEMP 60°-85° % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN AT 9:00 A.M. CONTINUING BETWEEN STATION 114+75 TO 78+00.

EQUIPMENT ON THE JOBSITE INCLUDED.

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 6

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: SEPTEMBER 29, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: PARTLY CLOUDY; AIR TEMP 56°-88° % ACTUAL WORK COMPLETED:

REMARKS:

THE SM-750 WAS USED TODAY FROM STATION 114+00 TO STATION 78+00. THE WINDROWER WAS USED TO MEASURE THE MATERIAL BETWEEN STATION 114+00 AND STATION 102+00.

THE EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER

ALSO, THE AGGREGATE AT THE CITY WIDE PLANT WAS CHECKED TODAY. TEST RESULTS ARE AS FOLLOWS:

REPORT OF TEST RESULTS

SIEVE SIZE	% PASSING	SPECIFICATIONS
1	100.0	100
1/2	24.0	15-25
#4	1.7	0-5

THE STOCKPILE IS CONSIDERED SATISFACTORY.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 7

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: OCTOBER 2, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: PARTLY CLOUDY; AIR TEMP 65°-85° % ACTUAL WORK COMPLETED:

REMARKS:

AT 11:00, 1229 TONS OF 3/4" AGGREGATE WAS DELIVERED TO THE JOBSITE. IT WAS DETERMINED THAT THERE ARE 37 TONS OF EXISTING MATERIAL PRESENT AT EACH STATION FROM STATION 115+00 THRU STATION 101+00. TWENTY FIVE TONS ARE PRESENT AT STATION 101+00 THRU STATION 78+00.

AN 8' TEST STRIP FROM STATION 114+00 TO STATION 113+00 WAS MIXED. FIFTY THREE GALLONS OF A MIXTURE THAT WAS EQUAL PARTS WATER AND SS1H WAS USED ON THE STRIP. IT WAS ROLLED 3 TIMES.

ALSO, STATION 113+00 TO STATION 101+00 WAS SHOT WITH THIS SAME MIXTURE 2 TIMES. THIS SECTION WAS THEN ROLLED TO PROTECT AGAINST RAIN.

THE EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER
4. ONE DISTRIBUTER AND TANKER
5. ONE ROLLER

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 8

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: OCTOBER 3, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: PARTLY CLOUDY TO CLEAR; AIR TEMP 58°-68° % ACTUAL WORK COMPLETED:

REMARKS:

THE SECTION FROM STATION 114+00 TO STATION 101+00 WAS COMPLETED TODAY. ONE LANE WAS COMPLETED FROM STATION 101+00 TO STATION 78+00, AND THE OTHER LANE WAS OILED AND MIXED ONE TIME.

TODAY, 4500 GALLONS OF SS1H WAS USED. ONE DISTRIBUTER LOAD OF A MIXTURE EQUAL PARTS WATER AND SS1H WAS USED. THE REMAINDER WAS APPLIED UNDILLUTED AFTER THE SURFACE OF THE STRIP HAD BEEN WATERED DOWN.

THE EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER
4. ONE DISTRIBUTER AND TANKER
5. ONE ROLLER
6. TWO WATER TRUCKS

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 9

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: OCTOBER 4, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: CLEAR, AIR TEMP 52°-81° % ACTUAL WORK COMPLETED:

REMARKS:

THE AREA BETWEEN STATION 101+00 AND STATION 114+00 WAS REWORKED (BLADED) AND ROLLED. TWO 8' WIDE STRIPS BETWEEN STATION 101 AND STATION 78 WERE OILED AND MIXED TODAY; 1 STRIP TWICE AND 1 STRIP 3 TIMES.

EXCEPT FOR FINAL SHAPING AND COMPACTION THE AREA BETWEEN STATION 114 AND STATION 78 IS COMPLETE.

THE EQUIPMENT ON THE JOBSITE INCLUDED:

1. ONE PETTIBONE SM-750
2. ONE BLADE (45-8) FRONT AND BACK RIPPER
3. ONE BLADE (45-7) WITH WINDROWER
4. ONE DISTRIBUTER AND TANKER
5. ONE ROLLER
6. TWO WATER TRUCKS

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 10

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: OCTOBER 5, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

CONTRACTOR ARRIVED ON JOB AT 8:00. THE SECTION BETWEEN STATIONS 101+00 AND STATIONS 78+00 WAS BLADED AND ROLLED.

NUCLEAR DENSITY TESTS WERE TAKEN. MAXIMUM DENSITY ACHIEVED ON THE TEST STRIP WAS 144.2 LBS./CU.FT. AVERAGE DENSITY ON THE EXPERIMENTAL MIX WAS 128 LBS./CU.FT. RESULTS ARE AS FOLLOWS ON NEXT PAGE.

THE EQUIPMENT ON THE JOB WAS THE SAME AS 10-4-78.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

Reference: Cowherd Road, UNINC.
Date: 10-5-78
Jackson County, Missouri
Project #2072

REPORT OF TEST RESULTS

LOCATION	DENSITY LBS./CU.FT.
115+00; 5' right of C_L	132.5
114+00; 5' right of C_L	132.5
113+00; 5' right of C_L	132.5
112+00; 5' left of C_L	127.5
111+00; 7' right of C_L	127.5
110+00; 6' left of C_L	130.5
109+00; 5' left of C_L	132.5
108+00; 7' right of C_L	132.5
107+00; 7' right of C_L	125.5
106+00; 8' left of C_L	127.5
105+00; 5' left of C_L	130.5
104+00; 7' right of C_L	130.5
103+00; 7' right of C_L	132.5
102+00; 7' left of C_L	132.5
101+00; 5' left of C_L	130.5
100+00; 5' right of C_L	132.5
99+00; 6' right of C_L	132.5
98+00; 6' left of C_L	132.5
97+00; 7' left of C_L	130.5
96+00; 6' right of C_L	130.5
95+00; 5' right of C_L	132.5
94+00; 8' left of C_L	125.5
93+00; 9' left of C_L	127.5
92+00; 5' right of C_L	132.5
91+00; 6' right of C_L	132.5
90+00; 6' left of C_L	127.5
89+00; 7' left of C_L	132.5
88+00; 7' right of C_L	130.5
87+00; 6' right of C_L	132.5
86+00; 5' left of C_L	132.5
85+00; 8' left of C_L	130.5
84+00; 6' right of C_L	132.5
83+00; 5' right of C_L	127.5
82+00; 7' left of C_L	127.5
81+00; 5' left of C_L	132.5
80+00; 5' right of C_L	130.5
79+00; 6' right of C_L	130.5
78+00; 5' left of C_L	132.5

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 11

PROJECT: COWHERD ROAD, UNINC. INSPECTION DATE: OCTOBER 6, 1978

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: PROJECT #2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: PARTLY CLOUDY % ACTUAL WORK COMPLETED:
AIR TEMP 48°-70°

REMARKS:

IT HAS BEEN DECIDED THAT DUE TO THE COOLER WEATHER THE PROJECT WILL BE ENDED FOR THE YEAR. KCTL WAS NOTIFIED OF THIS DECISION EARLY THIS MORNING AND, THEREFORE, I DID NOT REPORT TO THE JOBSITE. THE SECTION FROM STATION 115+75 TO STATION 78+00 HAS BEEN COMPLETED. THE CONTRACTOR WILL ROLL THE WORK AREA AND REMOVE THE EQUIPMENT FROM THE SITE. THE COUNTY WILL BE RESPONSIBLE FOR THE CHIP AND SEAL PROCESS AND THE REMOVAL OF SIGNS.

KEITH PAYNE Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 12

PROJECT: COWHERD ROAD

INSPECTION DATE: 7-18-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 11:00 AM WORK ENDED: 8:30 PM STA. 9+50 TO 31+25

AIR TEMPERATURE: 83° HIGH 70° LOW

PAVEMENT TEMPERATURE: 90° HIGH 70° LOW

INITIAL WORK BEGAN AT STA. 9+50 WITH RIPPING OPERATION BY GRADER WITH BACK-MOUNTED RIPPER. ONE PASS WAS THEN MADE WITH SPEED MIXER, BUT LARGE PIECES REMAINED UNBROKEN. A SECOND PASS IMPROVED THIS PROBLEM. PULVERIZING WAS CONTINUED WITHOUT RIPPING FOR APPROXIMATELY 1/2 OF AREA COMPLETED. THEN WE WENT BACK TO RIPPING AND PULVERIZING TO DECREASE DOWN TIME FOR MIXER BECAUSE OF SHEAR BOLT FAILURES. APPROXIMATELY 2/3 OF AREA WAS PULVERIZED TODAY WITH WORK CONTINUING UNTIL 8:30 PM. TECHNICIAN WENT TO CITY WIDE TO RUN A GRADATION ON VIRGIN AGGREGATE STOCKPILE. GRADATION WAS WITHIN SPECIFICATION.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 13

PROJECT: COWHERD ROAD

INSPECTION DATE: 7-19-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 6:30 AM WORK ENDED 8:30 PM STA. 9+50 TO 32+00

AIR TEMPERATURE: 84° HIGH 70° LOW

PAVEMENT TEMPERATURE: 93° HIGH 70° LOW

THE REMAINDER OF ROADWAY FROM STA. 9+50 TO 32+00 WAS PULVERIZED. ROAD WAS THEN SHAPED WITH BLADE, AND 498.20 TONS OF 50-50 VIRGIN AGGREGATE AND MILLINGS WERE PLACED FROM STA. 9+50 TO 31+25, OR 22.6 TONS/100'. ONE APPLICATION OF WATER WAS USED FOLLOWED BY ONE APPLICATION OF SS1h, USING 1870 GALLONS. A TOTAL OF 22 TRUCKLOADS OF AGGREGATE/MILLINGS WERE DELIVERED AT 38 MILES R.T. ADDITIONAL EQUIPMENT WAS BROUGHT ON SITE WHICH INCLUDED; WATER TRUCK, DISTRIBUTOR TRUCK, OIL TRANSPORT TRUCK AND VIBRATORY ROLLER. ROLLER BROUGHT ON SITE BY LOW-BOY.

OIL USED: 1870 GALLONS SS1h

ADDED AGGREGATE: 498.20 TONS

MIKE FRIHART

Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 14

PROJECT: COWHERD ROAD INSPECTION DATE: 7-20-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 8:00 AM WORK ENDED: 11:30 AM STA. 31+50 TO 51+00

AIR TEMPERATURE: 85° HIGH 68° LOW

PAVEMENT TEMPERATURE: 89° HIGH 70° LOW

CONTINUED RIPPING AND SPEED MIXING OF ROAD FROM STA. 31+50 TO 51+00. PREPARED FOR OIL AND WATER, BUT SM790 BROKE DOWN. JOB WAS SHUT DOWN FOR THE DAY.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 15

PROJECT: COWHERD ROAD INSPECTION DATE: 7-23-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 8:00 AM WORK ENDED: 5:00 PM STA. 9+50 TO 51+00

AIR TEMPERATURE: 88° HIGH 70° LOW

PAVEMENT TEMPERATURE: 95° HIGH 70° LOW

WATER AND OIL WERE ADDED FROM STA. 9+50 TO 31+00 AND IT WAS ROLLED. TECHNICIAN RAN TWO (2) PILLS AT DENSITIES OF 119.0 AND 115.8 PCF.

OIL USED: 1530 GALLONS

ADDED AGGREGATE: 0 TONS

LYNN FIELD Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 16

PROJECT: COWHERD ROAD INSPECTION DATE: 7-24-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED 8:15 PM STA. 32+00 TO 78+00

AIR TEMPERATURE: 80° HIGH 72° LOW

PAVEMENT TEMPERATURE: 89° HIGH 72° LOW

COMPLETED PULVERIZING FROM STA. 32+00 TO 50+00 AND THEN SHAPED BY BLADE. NINETEEN (19) LOADS OF 50/50 AGGREGATE/MILLINGS; TOTAL OF 407.20 TONS WERE SPREAD AT THIS LOCATION. ADDED AGGREGATE AND BLADED TO LEVEL, PULLED BACK FROM SIDES OF ROAD.

RIPPING OF SOUTH SECTION OF ROAD FROM STA. 50+00 TO STA. 78+00 CONTINUED AFTER NOT BEING ABLE TO GET OIL (SS1h). RIPPED MATERIAL LEFT OPEN (UNROLLED).

OIL USED: 0 GALLONS

ADDED AGGREGATE: 407.20 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 17

PROJECT: COWHERD ROAD

INSPECTION DATE: 7-25-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 8:00 AM WORK ENDED: 4:00 PM STA. 31+50 TO 77+00

AIR TEMPERATURE: 90° HIGH 71° LOW

PAVEMENT TEMPERATURE: 92° HIGH 71° LOW

IT RAINED DURING THE NIGHT, 3" TOTAL. STA. 31+50 TO 50+00 WERE IMPASSABLE. REWORKED TO HELP DRY FROM STA. 31+50 TO 50+00; ROAD CLOSED TO TRAFFIC. PULVERIZING CONTINUED ON SOUTH LANE FROM STA. 50+00 TO 77+00, 2/3 AT 4" DEPTH, 1/3 AT 2" DEPTH (MAKING TWO PASSES WITH SPEED MIXER). STA. 50+00 TO 77+00 ROLLED TO SEAL FOR THE NIGHT. PULVERIZATION WAS THE ONLY PRODUCTIVE WORK DONE. REMAINDER WAS LOST DUE TO RAIN THE PREVIOUS NIGHT.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART

Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 18

PROJECT: COWHERD ROAD

INSPECTION DATE: 7-26-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 4:30 PM STA. 31+50 TO 77+00

AIR TEMPERATURE: 80° HIGH

PAVEMENT TEMPERATURE: 80° HIGH

RAINED 2" OVERNIGHT. REBLADED AND REROLLED FROM STA. 31+50 TO 50+00. MIXED SOUTH SIDE STA. 50+00 TO 77+00, 4" DEEP; BLADED AND REROLLED. WORK STILL AFFECTED BY HEAVY RAINS.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 19

PROJECT: COWHERD ROAD

INSPECTION DATE: 7-27-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 6:30 PM

AIR TEMPERATURE: 88° HIGH

PAVEMENT TEMPERATURE: 95° HIGH

OILED AND MIXED FROM STA. 31+50 TO 50+00; SHAPED AND ROLLED (COMPLETED).

PULVERIZED ENTIRE BASE ON SOUTH SIDE FROM STA. 50+00 TO 77+00 TO DRY.

OIL USED: 2887 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART

Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 20

PROJECT: COWHERD ROAD INSPECTION DATE: 7-28-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 8:00 AM WORK ENDED: 1:00 PM

FIVE (5) HOURS WERE NEEDED TO CHANGE TIRES ON SPEED MIXER. NO PRODUCTION, NO OPERATION OF EQUIPMENT.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART

Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 21

PROJECT: COWHERD ROAD INSPECTION DATE: 7-30-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 4:00 PM STA. 31+50 TO 78+00

AIR TEMPERATURE: 87° HIGH

PAVEMENT TEMPERATURE: 90° HIGH

SHAPED AND ROLLED FROM STA. 31+50 TO 50+00. COMPLETED 4" CUT ON ALL SOUTH SIDE

STATIONS FROM STA. 50+00 TO 78+00. WORKED STOPPED AT 3:00 BECAUSE OF RAIN.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 22

PROJECT: COWHERD ROAD INSPECTION DATE: 7-31-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 5:00 PM STA. 50+00 TO 67+00

AIR TEMPERATURE: 82° HIGH

PAVEMENT TEMPERATURE: 87° HIGH

COMPLETED INTERSECTION AT STA. 50+00. IT WAS BLADED BUT NOT ROLLED. COMPLETED 4" CUT ON NORTH SIDE FROM STA. 50+00 TO 67+00. SHAPED WITH BLADE FROM 52+00 TO 50+00.

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART

Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 23

PROJECT: COWHERD ROAD INSPECTION DATE: 8-1-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 6:30 PM STA. 50+00 TO 78+00

AIR TEMPERATURE: 80° HIGH 60° LOW

PAVEMENT TEMPERATURE: 86° HIGH 60° LOW

COMBINED AGGREGATE/MILLINGS APPLIED FROM STA. 50+00 TO 67+00. ONE COAT OF SS1h (1487 GALLONS) APPLIED AND MIXED; BLADED AND ROLLED. CONTINUED PULVERIZATION FROM STA. 67+00 TO 78+00; ROLLED FROM STA. 50+00 TO 78+00.

OIL USED: 1487 GALLONS

ADDED AGGREGATE: 421.0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 24

PROJECT: COWHERD ROAD

INSPECTION DATE: 8-2-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 6:45 PM STA. 32+00 TO 78+00

AIR TEMPERATURE: 85° HIGH 70° LOW

PAVEMENT TEMPERATURE: 91° HIGH 71° LOW

COMBINED AGGREGATE APPLIED FROM STA. 67+00 TO 78+00; TOTAL OF 278.20 TONS. TWO (2) COATS OF OIL AND WATER WERE APPLIED. MIXED AND BLADED OILED AGGREGATE AND PULVERIZED MATERIAL. ROLLED UPON COMPLETION OF OILING AND SHAPING. SHAPED AND ROLLED FROM STA. 32+00 TO 50+00 AND 50+00 TO 67+00 FOR FINE GRADE.

OIL USED: 861+1118 = 1979 GALLONS

ADDED AGGREGATE: 278.20 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 25

PROJECT: COWHERD ROAD INSPECTION DATE: 8-3-79

LOCATION: JACKSON COUNTY, MISSOURI CONSTRUCTION STARTED:

CONTRACT NO.: 2072 CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 7:00 AM WORK ENDED: 12:30 PM STA. 31+50 TO 78+00

AIR TEMPERATURE: 90° HIGH 75° LOW

PAVEMENT TEMPERATURE: 92° HIGH 75° LOW

SAHPED AND ROLLED STA. 31+50 TO 50+00. SHAPED AND ROLLED STA. 50+00 TO 78+00.

FURTHER WORK WAS POSTPONED UNTIL 8-6-79 BECAUSE ALL WORK COMPLETED EXCEPT 200'

AT HIGHWAY 7, COWHERD ROAD INTERSECTION. DENSITY TESTS RUN AT EVEN STATIONS FROM

STA. 50+00 TO 78+00.

STATION	DENSITY	% COMPACTION
50+00	130.4	109.6%
51+00	115.5	97.1%
52+00	124.3	104.5%
53+00	125.7	105.6%
54+00	119.8	100.7%
55+00	115.7	97.2%
56+00	118.5	99.6%
57+00	125.7	105.6%

MIKE FRIHART Inspector

(CONTINUED NEXT PAGE)

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 25 (continued)

PROJECT: COWHERD ROAD INSPECTION DATE: 8-3-79 Page 2

LOCATION: CONSTRUCTION STARTED:

CONTRACT NO.: CONTRACT COMPLETION DATE:

CONTRACTOR: % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

STATION	DENSITY	% COMPACTION
58+00	118.5	99.6%
59+00	131.8	110.8%
60+00	113.0	95.0%
61+00	129.9	108.4%
62+00	121.3	101.9%
63+00	131.8	110.8%
64+00	121.4	102.0%
65+00	128.8	68.2%
66+00	121.3	101.9%
67+00	128.8	108.2
68+00	127.2	106.9%
69+00	113.0	95.0%
70+00	133.6	112.3%
71+00	118.5	99.6%
72+00	130.3	109.5%
73+00	114.3	96.1%

MIKE FRIHART Inspector

(CONTINUED NEXT PAGE)

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 25 (continued)

PROJECT: COWHERD ROAD INSPECTION DATE: 8-3-79 Page 3

LOCATION: CONSTRUCTION STARTED:

CONTRACT NO.: CONTRACT COMPLETION DATE:

CONTRACTOR: % TIME ELASPED:

WEATHER: % ACTUAL WORK COMPLETED:

REMARKS:

STATION	DENSITY	% COMPACTION
74+00	125.7	105.6%
75+00	118.5	99.6%
76+00	118.5	99.6%
77+00	113.0	95.0%
78+00	127.2	106.9%

OPTIMUM DENSITY - 119.0 PCF

OIL USED: 0 GALLONS

ADDED AGGREGATE: 0 TONS

MIKE FRIHART Inspector

KANSAS CITY TESTING LABORATORY

DAILY INSPECTION REPORT NO. 26

PROJECT: COWHERD ROAD

INSPECTION DATE: 8-6-79

LOCATION: JACKSON COUNTY, MISSOURI

CONSTRUCTION STARTED:

CONTRACT NO.: 2072

CONTRACT COMPLETION DATE:

CONTRACTOR: CITY WIDE ASPHALT

% TIME ELASPED:

WEATHER:

% ACTUAL WORK COMPLETED:

REMARKS:

WORK BEGAN: 8:00 AM

STA. 114+25 TO 116+25 - ALSO ROLLED

STA. 78+00 TO 114+25 (COMPLETED LAST YEAR)

AIR TEMPERATURE: 87° HIGH 69° LOW

PAVEMENT TEMPERATURE: 90° HIGH 70° LOW

MATERIAL FROM EDGE OF ROAD WAS RIPPED, PULVERIZED AND BLADED FROM STA. 114+25 TO 116+25. ADDITION OF VIRGIN AGGREGATE/MILLINGS AND TWO APPLICATIONS OF SS1h AND WATER WITH MIXING BETWEEN THE TWO CYCLES. SHAPED WITH BLADE AND ROLLED WITH ADDITIONAL WATERING DUE TO RAPID WATER LOSS. RECYCLING NOW COMPLETE EXCEPT FOR FINAL TESTING TO BE DONE BY JACKSON COUNTY PUBLIC WORKS.

OIL USED: 577 GALLONS SS1h

ADDED AGGREGATE: 50 TONS

MIKE FRIHART

Inspector

NOTES OF PRECONSTRUCTION CONFERENCE #1

Jackson County Public Works

Project: Cowherd Road Recycling
County Project #2072

A preconstruction conference was held on Tuesday, September 5, 1978, at 1:30 p.m., in the Jackson County Courthouse, 306 West Kansas Ave., Independence, Missouri, to initiate coordination of the construction of the project between all parties having responsibility for any work on the job. The following attended:

Name	Representing	Phone
Mac McConnell	Pettibone Corporation	741-8845
Harry Ingels	Pettibone Corporation	741-8845
Bill Stanis	Pettibone Corporation	(414)679-2181
Russell Buehler	City-Wide Asphalt Co., Inc.	257-1332
Tom Cutler	City-Wide Asphalt Co., Inc.	257-1332
Dennis Heuszel	Kansas City Testing Lab., Inc.	648-2302
Jim Kissick	County Dept. of Public Works	881-4530
Jerry Martin	County Dept. of Public Works	881-4510
Kirk Phillips	County Dept. of Public Works	881-4510

Addendum No. 2 was reviewed.

Russell Buehler stated that work could start as early as Wednesday, September 13, 1978; however, it may be as late as September 20, 1978.

The Pettibone Corporation will supply a SM-750 machine which is in the area now and being fitted with special mixing tines. Bill Stanis with Pettibone stated that the oil metering system on the SM-750 was not suited for the small amounts of SS-1h that the contractor will be adding to the recycled material. He recommended the use of a standard distributor. After discussion, it was decided to use the distributor.

Russell Buehler and Bill Stanis described the recycled process as follows:

1. Ripping of pavement with ripper
2. Two pulverizing passes with SM-750 at 40 fpm
3. The addition of asphalt millings and virgin aggregate
4. Three mixing passes at which one-third of SS-1h will be added each time with distributor
5. Placement by blade and compaction.

Jim Kissick asked the contractor for equipment rental rates as the County expects there will be some force-account work.

It was pointed out that, because of the varying width of the existing pavement on Cowherd Road, it may be necessary to move some road material to other areas on the road. It was decided that this would be handled using a 613 scraper on a force-account basis.

The possibility of the use of SS-1 in place of SS-1h was discussed, but it was decided that, based on the testing results from Kansas City Testing Laboratories, Inc., we would begin the project using SS-1h and change to another oil only if problems were encountered.

Jim Kissick informed the contractor that the County would be responsible for the construction signing of the project. It was pointed out that there would have to be close communication between the contractor and the County for the daily sign placement.

Work will begin at 7 Highway and proceed west. Cowherd Road will be closed to all but local traffic. The control of traffic should not be a major problem; however, passage for school busses must be provided.

The contract was informed that County forces would install a cross-road pipe at Station 24+21 the week of September 11. It was agreed that this should not cause a conflict with the contractor's operations.

Dennis Heuszel of Kansas City Testing Laboratories, Inc. stated that his organization would have an inspector on the job throughout the project. Tests will be made for gradation, pavement, and records of existing subgrade conditions. Kansas City Testing Laboratories, Inc. would also inspect the aggregate stockpile at the City-Wide plant.

Russell Buehler reported that Harold Moody also with City-Wide Asphalt Co., Inc. would supply daily equipment hours and fuel consumption needed for final reports on energy consumption for the project.

NOTES OF PRECONSTRUCTION CONFERENCE #2

Jackson County Public Works

Project: Cowherd Road Asphalt Recycling
Federal Demonstration Project #39
County Project #2072

A preconstruction conference was held Thursday, June 28, 1979, at 1:30 p.m., in the Jackson County Courthouse, 306 West Kansas Ave., Independence, Missouri, to initiate coordination of the construction of the project between all parties having responsibility for any work on the job.

The following attended:

Name	Representing	Phone
J. J. Jordan	Federal Highway Admin.	314-636-7104
Loyd Buehler	City Wide Asphalt	257-1332
Don Sesso	Kansas City Testing Labs	648-2303
Ann Floersch	Kansas City Testing Labs	648-2303
Jim Iliff	Jackson County Public Works	881-4530
Jerry Martin	Jackson County Public Works	881-4510
Kirk Phillips	Jackson County Public Works	881-4510

Construction startup for the final two-thirds of the Cowherd project was discussed. It will take Jackson County Public Works Department two weeks to install construction signs and haul additional asphalt cold plane millings to the City Wide plant. Kansas City, Mo. Street Dept. will not sell the County any millings this year, and another source will need to be located. Kansas City Testing Labs will approve the virgin aggregate stockpile prior to construction.

Loyd Buehler stated he would like to begin work as soon as he has completed the County's 1979 Overlay Program, approximately the week of July 18th. City Wide expects no problem in

getting the Speed Mixer SM750 from Pettibone Corp. at that time. The temperature of the existing pavement should be at a maximum at this time in the summer and this will aid in the recycling process.

The construction problems of last year's completed section were discussed. There was an overrun on added aggregate and asphalt millings due to the fact that the existing Cowherd Road pavement was thicker in places than test cores had indicated. Also, after completion of the first third of the project last year there was a problem in compiling the energy analysis information. It was agreed that there will have to be a more concentrated effort by all involved to keep the energy data current. J. Jordan offered to supply FHWA owned equipment recorder time clocks for the remainder of the project if these clocks can be located.

It was suggested by Loyd Buehler that we try recycling to a specified depth of 4" as opposed to total pavement thickness. This would solve the overrun of added aggregate and the problems of mixing in small amounts of sub-base in with the recycled pavement. Subgrade problems, if any arise, will be corrected before recycling is completed in those areas. All agreed to try this method.

It was further agreed to begin this year's work at the west end of the project and work easterly. This method would keep haul trucks off of most of finished pavement.

CITY-WIDE ASPHALT CO., INC.

1701 N. M 291 Highway
SUGAR CREEK, MISSOURI 64058
257-1332

STREETS AND HEAVY CONSTRUCTION
ASPHALT MANUFACTURERS

RUSSELL C. BUEHLER
President

August 28, 1978

Mr. Lloyd J. Kissick III, Director
Department of Public Works
Jackson County, Missouri
306 W. Kansas Avenue
Independence, Missouri 64051

Re: Bid No. 137-78
Cowherd Road
Project No. 2072

Dear Sir:

Pursuant to our discussion on August 25, 1978 regarding means of reducing the cost of the above referenced project, we submit herewith our revised proposal covering only items 6 thru 9 of the original bid. The other items are to be deleted in their entirety.

Item No.	Description	Unit	Quantity	Unit Price	Total Price
6.	Recycled Asphaltic Base	Sq. Yd.	27,571	1.23	$33,912.33
7.	SS-1h Emulsion	Gal.	18,500	0.62	11,470.00
8.	Additive Aggregate	Ton	1,445	9.00	13,005.00
9.	Additional Mixing	Hour	10	290.00	2,900.00
	Total revised cost				$61,287.33

We propose to mix the cold planed millings and the additive aggregate in a pugmill mixer at our plant, located at 291 Highway and Kentucky Road, and haul this pre-mixed material to the job site. It is believed this procedure would reduce the inconvenience to local traffic and provide more accurate proportioning of these ingredients. The County's cost of hauling the millings would be reduced approximately one-half. The above changes have been considered in our revised proposal.

Very truly yours,

CITY-WIDE ASPHALT CO., INC.

Thomas H. Cutler, Jr.

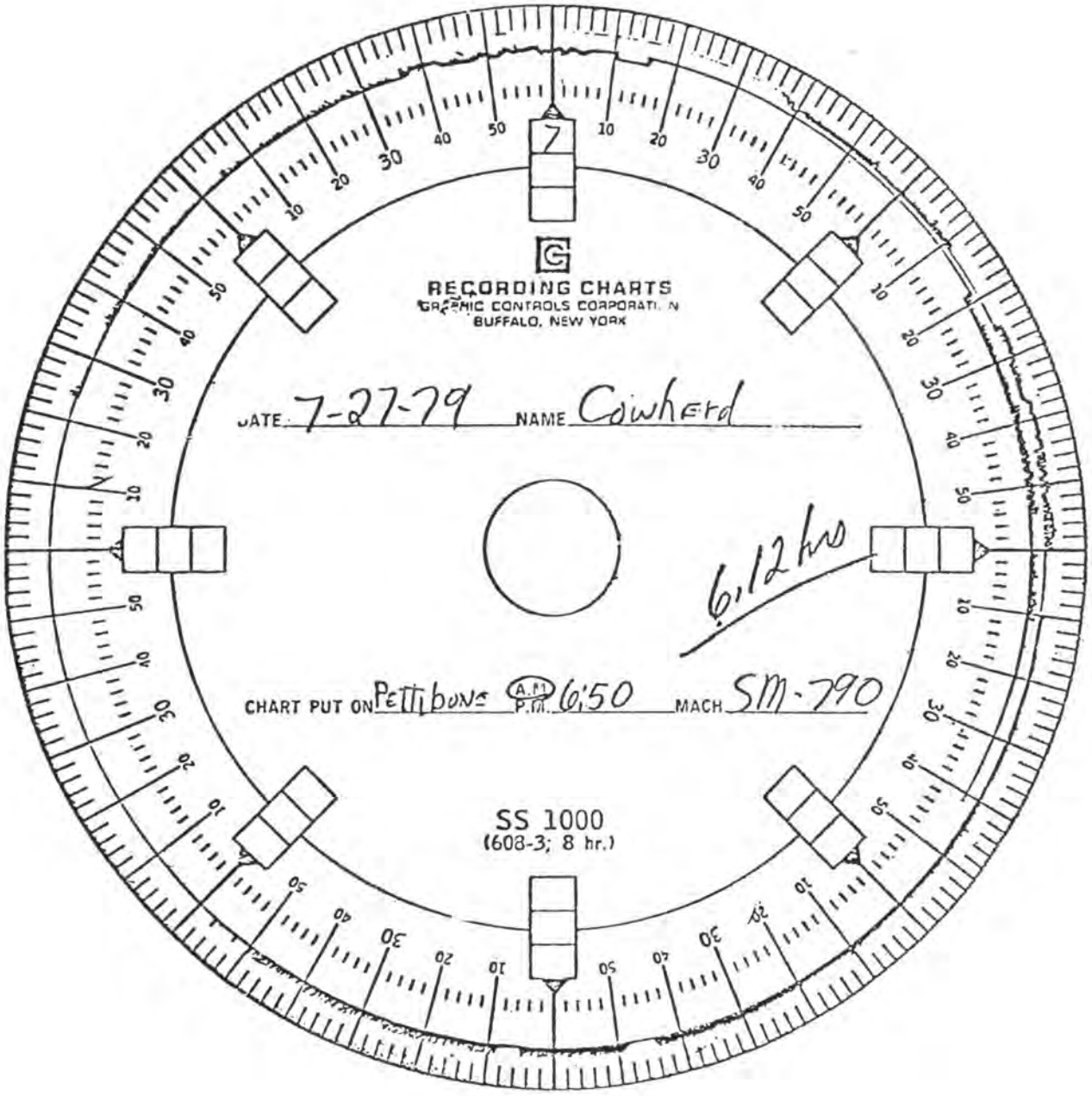
Thomas H. Cutler, Jr.

THC/c

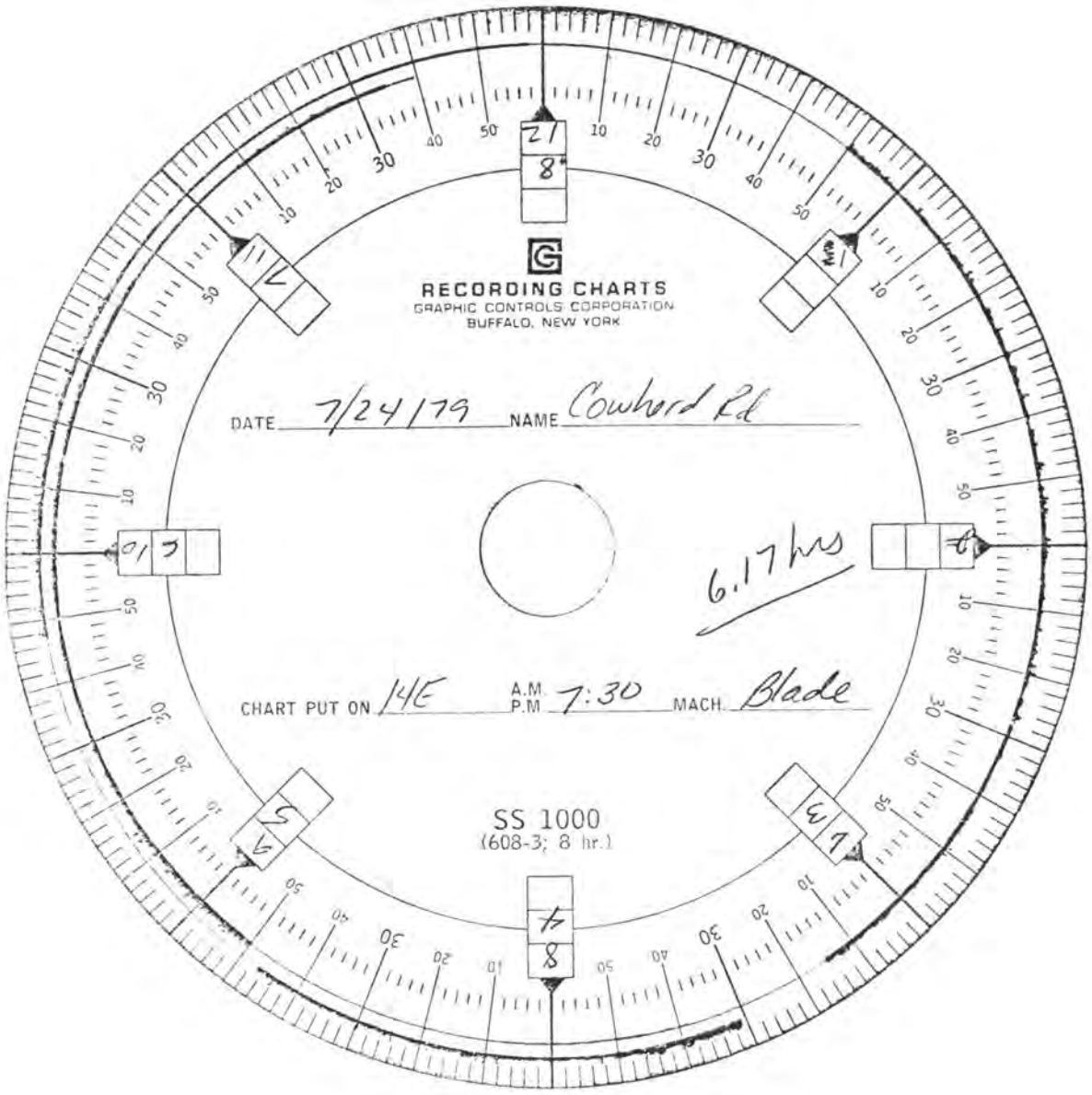
ITEMIZED PROPOSAL

Project Cowherd Road Sheet 1 of 1 Sheets

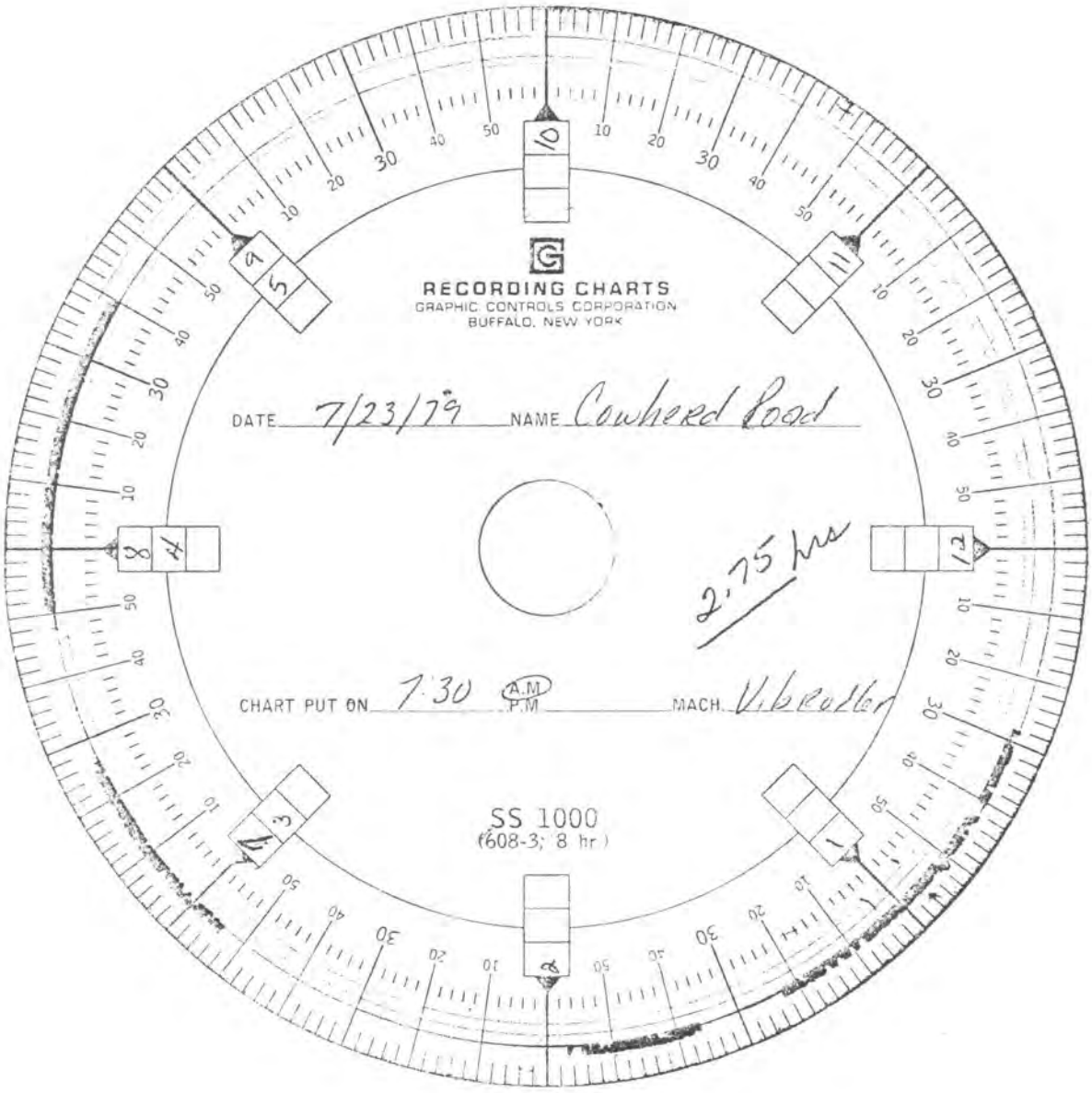
DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
Recycled Asphaltic Base	Sq. Yd.	27,571	1.23	33,912.33
SS-1h Emulsion	Gal.	18,500	.62	11,470.00
Additive Aggregate	Ton	1,445	9.00	13,005.00
Additional Mixing	Hours	10	290.00	2,900.00
				61,287.33



EXAMPLE OF SERVICE RECORDER TIME CHARTS
USED DAILY ON THE PETTIBONE SPEED MIXER SM790



EXAMPLE OF SERVICE RECORDER TIME CHARTS
USED DAILY ON THE MOTOR GRADER



EXAMPLE OF SERVICE RECORDER TIME CHARTS
USED DAILY ON THE VIBRATORY ROLLER

ENERGY ANALYSIS

ENERGY ANALYSIS
COWHERD ROAD
JACKSON COUNTY, MISSOURI
1978 - 1979

ENERGY ANALYSIS

The comparison between the energy requirements for this base recycling process and a conventional hot mix replacement program is based upon the field data obtained during the project and energy data from the Asphalt Institute publication "Energy Requirements for Roadway Pavements, "Apr. 1975, MISC-75-3.

The following information and calculations apply to the recycling project.

The asphaltic cement, SS1H was hauled 33 miles in a 5-axle diesel powered truck to the jobsite. The recycled bituminous base was composed of a mixture proportioned as follows:

1. 60% - Existing Cowherd Road pulverized bituminous aggregate.
2. 20% - Virgin limestone aggregate manufactured at City Wide. The average moisture content was 3% by weight.
3. 20% - Cold planed millings supplied by Jackson County. Since the cold planed millings are a by-product, no additional energy requirements are considered for manufacture. The average moisture content was about 1.5% by weight. The cold planed millings were hauled 15 miles in a 2-axle gasoline powered truck.

The limestone aggregate and the cold planed millings were combined at City Wide and hauled 19 miles to the jobsite using 3-axle, 4-axle and 5-axle diesel powered trucks.

ENERGY REQUIREMENTS

Materials

Manufacture of SS1H	
1980 BTU/gal* @ 235 gal/ton	465,300 BTU/t
Haul of asphaltic cement from Manufacture to Cowherd Road	
33 miles x 2 @ 1,960 BTU/TM*	129,360 BTU/t
Total for asphaltic cement	594,660 BTU/t

Crushing of limestone aggregate	
1467 x 70,000 BTU/t*	102,690,000 BTU
Hauling of limestone aggregate	
(3-axle) 19 miles x 2 @ 3,800 BTU/TM* x 1234.7 x 1.03	183,639,400 BTU
(4-axle) 19 miles x 2 @ 3,270 BTU/TM* x 72.45 x 1.03	9,272,716 BTU
(5-axle) 19 miles x 2 @ 1,960 BTU/TM* x 159.85 x 1.03	12,262,797 BTU
Manufacture of cold planed millings	
No additional energy requirements (Waste Material)	0 BTU
Hauling of cold planed millings from origin (KC MO)	
To City Wide 15 miles x 2 @ 11,000 BTU/TM* x 1087.4/t x 1.015	364,224,630 BTU
Hauling of cold planed milling from orgin (Bowen)	
to City Wide 2 miles x 2 x 11,000 BTU/TM x 379.4/t x 1.015	16,944,004 BTU
From City Wide to Cowherd Road	
(3-axle) 19 miles x 2 @ 3,800 BTU/TM* x 1234.7 x 1.015	180,965,040 BTU
(4-axle) 19 miles x 2 @ 3,270 BTU/TM* x 72.45 x 1.015	9,137,677 BTU
(5-axle) 19 miles x 2 @ 1,960 BTU/TM* x 159.85 x 1.015	12,084,212 BTU
Plant Operations	
Mixing of cold planed millings and aggregate	
2934/t x 3,920 BTU/t	11,501,280 BTU
Total for aggregate	902,721,756 BTU
Pulverizing, oil distribution, mixing and rolling	
Pettibone Model SM-750 Speed Mixer	
238.7 gal. x 139,000 BTU/gal.* D	33,179,300 BTU
Pettibone Model SM-790 Speed Mixer	
554.1 gal. x 139,000 BTU/gal.* D	77,019,900 BTU
12E Cat Motor Grader--45-7	
19 gal. x 139,000 BTU/gal.* D	2,641,000 BTU
14E Cat Motor Grader--45-8	
567.8 gal. x 139,000 BTU/gal.* D	78,924,200 BTU

615 Vibratory Heister Roller	
36.0 gal. x 139,000 BTU/gal.* D	5,004,000 BTU
Dynopac Vibro-Plus	
93.7 gal. x 139,000 BTU/gal.* D	13,024,300 BTU
Low Boy 35-16	
8.0 gal. x 139,000 BTU/gal.* D	1,112,000 BTU
Chevy C-60 Water Truck	
3.7 gal. x 125,000 BTU/gal.* R	462,500 BTU
Ford 600 Water Truck	
25.0 gal. x 125,000 BTU/gal.* R	3,125,000 BTU
335 Cummings in '69 Kenworth Water Truck	
15.0 gal. x 139,000 BTU/gal.* D	2,085,000 BTU
Service Truck 38 miles x 14 service days	
532 miles x 6 mpg x 139,000 BTU/gal.* D	12,324,667 BTU
Oil Distribution	
16526 gal. @ 144 BTU/gal.*	2,379,744 BTU
Total for pulverizing, oil distribution mixing and rolling	231,281,611 BTU

Summary of energy used for base recycling

SS1H Manufacture and Haul (16526 gal.)	
70.32 tons @ 594,660 BTU/t	41,816,491 BTU
Aggregate Manufacture, Mix and Haul	902,721,756 BTU
Pulverizing, oil distribution, mixing and rolling	231,281,611 BTU
Total for base recycling	1,175,819,858 BTU

The following information and calculations apply to a typical conventional hot-mix replacement program for the same road section.

Assume the asphaltic cement is hauled three miles in a 5-axle diesel powered truck to the City Wide plant. The aggregate is manufactured at the plant. The mix will have a 5% asphalt content. The aggregate will consist of 60% crushed stone, 35% natural sand, and 5% mineral filler. Energy requirements for producing the filler are assumed to be the same as for crushed stone. The aggregate has an average moisture of 3%, and it will be dried and heated from 70 degrees fahrenheit to 300 degrees fahrenehit. The mix has a nineteen mile haul distance in 3-axle diesel powered trucks. Compacted density will be 150 lbs/ft^3.

Materials

Manufacture of asphaltic cement	587,500 BTU/t*
Haul 3 miles x 2 @ 1,960 BTU/TM*	11,760 BTU/t
Total for asphaltic cement	599,260 BTU/t
Sand @ 15,000 BTU/t*, 35%	5,250 BTU/t
Crushed stone @ 70,000 BTU/t*, 60%	42,000 BTU/t
Mineral filler @ 70,000 BTU/t*, 5%	3,500 BTU/t
Haul 2 miles x 2 @ 3,800 BTU/TM*, 1.03	15,656 BTU/t
Total for aggregate	66,406 BTU/t

Mix Composition

Asphalt, 5% of 599,260 BTU/t	29,963 BTU/t
Aggregate, 95% @ 66,406	63,085 BTU/t
Total for mix	93,048 BTU/t

Plant Operations

Dry aggregate, 3% @ 28,000 BTU/%*, 0.9t**	75,600 BTU/t
Heat 230°F @ 470 BTU/°F/t*, 0.9t**	97,290 BTU/t
Other plant operations	19,800 BTU/t*
Total plant operations	192,690 BTU/t

Existing Road Removal

Roadway removal (assume utilization of 12E and of 14E)	124,997,637 BTU
Hauling (assume utilization of 621 Scraper)	42,685,395 BTU
Total for existing roadway removal	167,683,032 BTU

Haul and Place

Haul mix 19 miles x 2 @ 3,800 BTM/TM*	144,400 BTU/t
Spread and compact	16,700 BTU/t*
Total Haul and Place	161,100 BTU/t

SUMMARY OF ENERGY USED FOR TYPICAL CONVENTIONAL PROGRAM

10,825' Roadway, 22' Width (Recycled in 1978 and 1979)
Assume conventional hot mix 4" thick, 150 PCF
4" x 22' = 7.33 cu.ft./1ft. 7.33 cu.ft./1ft x 10,825 = 79,347 cu.ft.
Required 79,347 cu.ft. @ 150 PCF = 5951 tons

Existing Roadway Removal	167,683,032 BTU
Mix Composition	
5951 tons @ 93,048	553,728,648 BTU
Plant Operations	
5951 tons @ 192,690 BTU/t	1,146,698,190 BTU
Haul and Place	
5951 tons @161,100	958,706,100 BTU
Total for conventional program	2,826,815,970 BTU

Comparison of Energy Requirements

Total used for base recycling	1,175,819,858 BTU
Total used for conventional program	2,826,815,970 BTU
Energy Savings	1,650,996,112 BTU***

Energy Equivalent - 11877.67 gallons of diesel

*Information taken from Asphalt Institute publication "Energy Requirements for Roadway Pavements" MISC-75-3, dated April 1975.

**Adjustment for 90% of mix to be dried. Mineral filler and asphaltic cement are excluded.

***Not including County applied chip and seal

ENERGY ANALYSIS FOR THE
CHIP SEAL PROCESS ON THE 2.2 MILE
SECTION OF COWHERD ROAD

Materials

601.7 tons buckshot @ 70,000 Btu/Ton	42,119,000 Btu
6614 gal. MC800 @ 36,200 Btu/gal.	239,426,800 Btu
5852 gal. EA150 @ 2,000 Btu/gal.	11,704,000 Btu

Hauling and Placement

500 gal. of gasoline @ 125,000	62,500,000 Btu
*Total Energy for Chip Seal	355,749,800 Btu

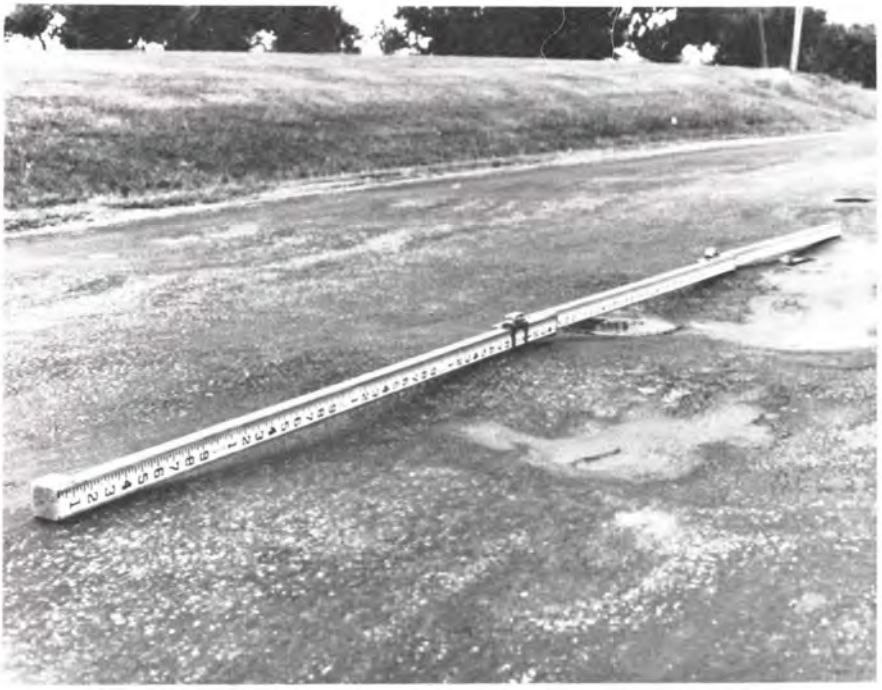
Energy Equivalent = 2,846 gal. gasoline or
355,749.8 cu. ft. of natural gas

Totals

Total Energy for conventional asphalt	2,826,815,970 Btu
Total Energy used for recycling & chip sealing	1,531,569,658 Btu
Energy Savings Completed Project	1,295,246,312 Btu

*Information taken from Asphalt Institute
publication "Energy Requirements for Roadway
Pavements" MISC-75-3, dated April 1975

PHOTOGRAPHIC SECTION



Surface conditions of Cowherd Road prior to recycling. The pavement was potholed, rutted, cracked and shoved.

The first step in the recycling process was to rip the existing pavement with rear-mounted ripper teeth on a motor grader.

Serrated teeth on the mold board of a motor grader also aided in the ripping phase of the process.

The pieces of ripped roadway were then pulverized to 3/4-inch size. The Cowherd Road project used both the Pettibone SM750 and SM790.

The added aggregate on this project consisted of 50% cold planed asphalt millings and 50% virgin crushed limestone.

With the use of the Contractor's pug mill, the cold planed millings and crushed limestone were combined to form a premix that was hauled to the project.

The premix was tailgate spread onto the pulverized roadway. Previous laboratory testing had determined the number of tons of material per station.

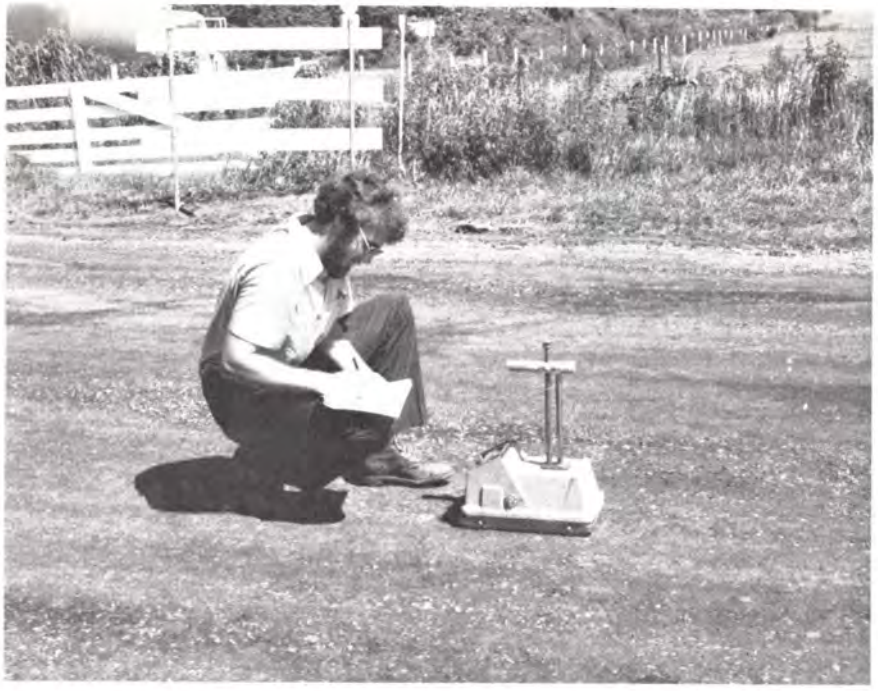
With the use of a motor grader, the roadway was rough shaped and readied for the oil application.

SS1h asphalt emulsion was applied with a standard asphalt distributor. Preconstruction testing had determined the application rates.

The Pettibone SM750 was used to mix the emulsion into the recycled roadway.

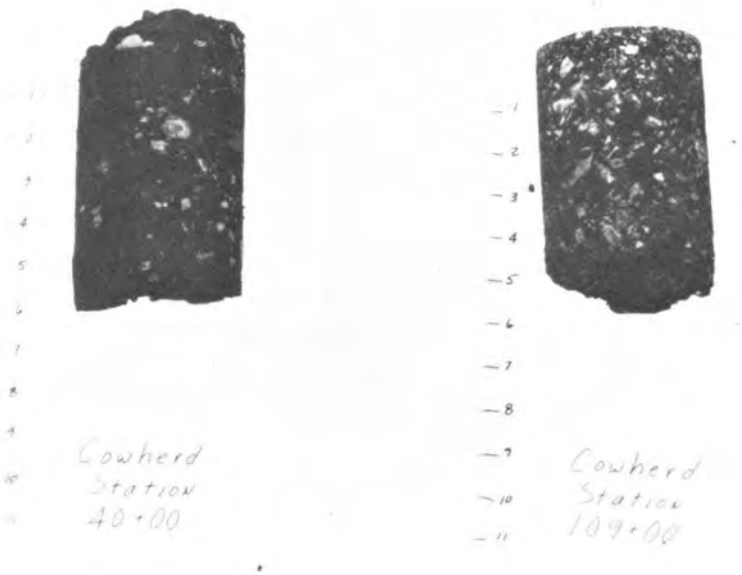
In the portion of the project completed in 1979, the larger Pettibone SM790 was used in the pulverizing and mixing phases of recycling.

After the roadway had been oiled and mixed, it was shaped by a motor grader and compacted using a vibratory roller.



Density tests were taken with a Troxler nuclear gauge to assure uniform compaction.

The recycled pavement shaped and compacted. Because traffic raveled the surface, it was decided that County forces would apply a chip seal coat.



Sample cores were obtained from the completed project. These core samples showed proper mixing and good densities.

The completed recycled pavement with the chip seal in place.

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