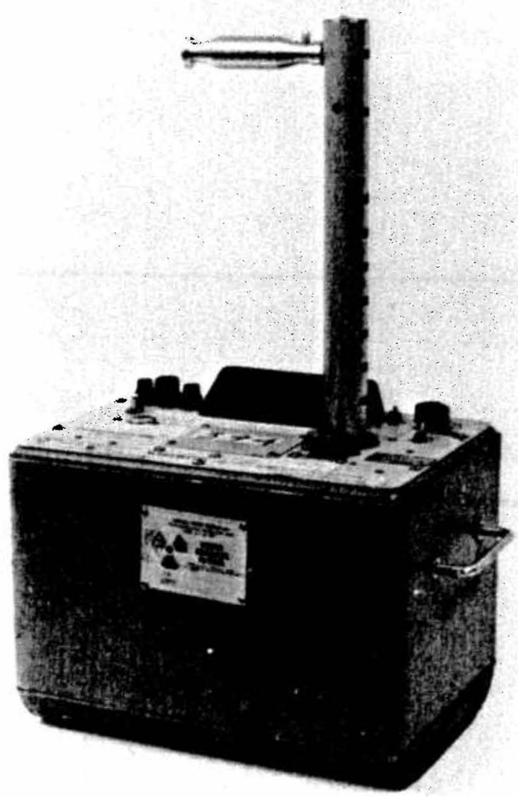
(H) In Situ Density

Tests with a nuclear gage (Figure 25) to measure density indicated that about 90% relative compaction was obtained (relative to laboratory test density - See Tables A-5 and A-6).



Nuclear Density Gage
Figure 25

Compaction in the four foot trench section was done with a 8-12 ton Tandem steel wheel roller (Hyster Model C-350A). However, the roller wheel was slightly wider than the trench (Figure 26). To avoid bridging the trench, the recycled AC was placed almost 1" high to provide complete support of the roller by the mix. A vibratory roller (Figure 27) was used for compaction of most of the 10-foot wide, 0.10' thick AC lift (Dynapac CC50A).

Hyster Tandem Steel Wheel Roller
Figure 26

Vibratory Roller
Figure 27

(I) Pavement Friction Data

Using a towed trailer, a ribbed tire, and ASTM Test Method E-274, an average skid number at 40 mph (SN_{40}) of about 55 was measured for the conventional mix. The 50/50 mix had an average SN_{40} skid number of 59 where 3.2% AR-2000 had been ordered and 53 where 3.5% AR-2000 had been ordered. The average SN_{40} for the 70/30 mix was 57. (See Table A-7 for all the skid number data.) These results are considered excellent from the standpoint of providing a good, non-skid surface.

(J) Air Pollution Data

The plant emissions met all the requirements of Placer County. With the high vapor content of the stack emissions from the asphalt plant at Gold Run, the following Placer County Air Pollution Control District regulation applied:

> "Rule 204 Wet Plumes - Where the presence of uncombined water is the only reason for the failure of an emission to meet the limitation of Rule 202 (opacity equal to Ringelman No. 1) that rule shall not apply. The burden of proof which establishes the application of this rule shall be upon the person seeking to come within its provisions."

Although white steam was in evidence on most occasions, opacity readings of over 15% were rare. The grain loading measured by a private agency and observed by Placer Co. APCD personnel for production during the week of August 21, 1978, showed the plant to be within county regulations (0.043 grains/standard cubic foot vs. a regulation limit of 0.1 grains/standard cubic foot).

The plant also complied with the process weight regulation by producing 25 to 26 lbs/hr including condensible emissions. These condensibles are assumed to be hydrocarbons from the heating of recycled asphalt and were probably the cause of the light blue smoke present in the plume after the steam dispersed. For a plant rated at 310 tons/hr production not counting idle time (rating provided by contractor). the maximum allowable emission rate was 40 lbs/hr. Therefore, the plant met all Placer Co. APCD regulations.

(K) Energy Considerations (Construction Only)

A major impetus to recycle asphaltic concrete is the potential savings of energy and materials. Thus, the actual amount of energy consumed by this project was estimated and compared with an estimate of the energy that would have been consumed if all the paving had been accomplished using conventional mix (100% virgin mix).

In order to identify the most energy-intensive operation, an attempt has been made to break down the energy usage into distinct operations within the project. The distinction between two operations was not always self-evident (such as between the setup and operation of the plant), so discretion was used. In the end, it made little difference which operation the energy usage was assigned to, as long as it was accounted for somewhere.

The majority of this analysis deals only with the energy associated with direct fuel consumption. Although additional indirect energy was consumed as a portion of the service life of the equipment was depleted, and by equipment maintenance, these factors have been considered separately due to a lack of data concerning this aspect.

A number of different techniques was used to determine the quantities of direct energy used in this analysis. In decreasing order of desirability, they were:

A) Directly add cumulative fuel records obtained from the contractors. This is considered as the most accurate method but, due to gaps and inadequacies in the contractor's fuel records, it was only possible in a few cases.

B) Obtain estimates of the fuel consumption rate from the contractor's records or from the equipment operators and calculate from this the total fuel consumption.

C) Obtain energy usage values from a literature search. This was used only if no other estimate of fuel consumption could be obtained for this specific project.

In addition, the following assumptions and techniques were used:

1) Most of the material quantities used for the computations were calculated on an as-paid-for basis. If rejected materials were included, the materials energy equivalent might have been 10% higher.

2) Asphalt was considered as a byproduct of the refining process and was treated as a construction material rather then a potential fuel source. Only the refining, processing and transportation energy was considered when determining the energy equivalent of asphalt.

Detailed Energy Calculation

(a) Setup and Removal of AC Plant

Because the plant used was mobile, energy was expended for its setup and removal. This includes the energy necessary to build access roads, prepare the plant site and erect the equipment. All energy used to make the hot plant operational is considered as setup energy (with the exception of the energy used to run the crusher, which became operational before the hot plant).

Because less earth moving was involved for removal of the plant than that required for setup, it was assumed that removal energy equalled 25% of the setup energy. It was also assumed that although there was a small amount of additional equipment in the form of hoppers, conveyor belts, and a grizzley required for recycling, the plant setup and removal energy was essentially identical to that required for 100% new mix.

In tabulated form, the setup and removal energy was broken down as follows:

Equipment	Gal. Gasoline Used	Gal. Diesel Used	Energy (in 10^6 BTU)
Grease truck	20	279	41.3
Welding truck	68		8.5
Flat bed truck	149		18.6
Cat D-8		1,921	267.0
Cat 12 grader		264	36.7
Crane		62	8.6
Pick up truck used at plant (#1.133, 1.212)	562		70.3
		Sub Total	451.0
Plant Removal (assumed as 25% of erection energy)			112.8
		Grand Total	563.8

Virgin mix assumed same as above.

(b) Electrical Power Consumed in Plant Operation

For purposes of energy use calculations, it was assumed that the plant operated at an average rate of 150 tons per hour during this job. All electrical power used for vibrators, feeders, conveyors, blowers, dust collection equipment, elevators, etc., was provided by Cummings and Murray diesel powered generation vans. It is not known exactly how much fuel was consumed by these generators. Although this data was requested several times, no data was provided so an estimate from the literature(8) was used for the dryer and mixer (using a 100% virgin mix) of 13,430 BTU/ton. Since additional cold bins, vibrators, and feed belts are necessary for the recycle mix, it is estimated that it will take 25% more energy to operate a recycle plant than to operate the same plant producing virgin mix.

For Recycle Mix

(43,365 tons finished mix) (13,430 BTU/ton)(1.25) = 728.0×10^6 BTU

For Virgin Mix

(43,365 tons) (13,430 BTU/ton) = 582.4×10^6 BTU

(c) Asphalt

(c-1) Manufacturing and Processing Asphalt

The manufacturing and processing energy required will change both with the refining process and asphalt content of the original crude. Normally, asphalt is extracted after the vacuum distillation and propane deasphalting process. In a rather extensive paper on the refining process, McEwin and Skinner(9) determined the energy equivalent of this production to be 511,000 BTU/Bbl. Other estimates range from 105,000(10) to 200,000 BTU/Bbl(11). For these calculations, the value of 511,000 BTU/Bbl was used.

For Recycled Mix: A total of 1,424 tons of asphalt was used for the job as constructed.

$$(1{,}424 \text{ tons})(5.6 \text{ Bbl/ton})(511{,}000 \text{ BTU/Bbl}) = 4.075\text{x}10^{9} \text{ BTU}$$

For Virgin Mix: This mix would have had 6% asphalt. Thus, about 2,455 tons of asphalt would have been used in lieu of the 1,475 tons actually used.

$$(2{,}455 \text{ tons})(5.6 \text{ Bbl/ton})(511{,}000 \text{ BTU/Bbl}) = 7.025\text{x}10^{9} \text{ BTU}$$

(c-2) Transportation of Asphalt

Asphalt was shipped from the refinery's secondary storage facility about 100 miles from the job site. At 20 ton/load and 4 mpg, the transportation energy would be as follows:

For Recycle Mix

$$(1{,}424 \text{ tons})\left(\frac{1 \text{ trip}}{20 \text{ ton}}\right)\left(\frac{200 \text{ miles}}{\text{trip}}\right)\left(\frac{1 \text{ gallon}}{4 \text{ miles}}\right) 139{,}000 \text{ BTU/gallon} =$$

$$494.8\text{x}10^{6} \text{ BTU}$$

For Virgin Mix

$$\left(\frac{2455}{1424}\right)(494.8\text{x}10^{6}) = 853.0\text{x}10^{6} \text{ BTU}$$

(d) Burner Fuel Consumption (To heat aggregate & old AC)

A 10,000 gallon tank of #2 diesel fuel was used for heating the mix. A small (unknown) amount of this fuel was used for cleaning and lubricating truck beds, tools, hot elevators, dryer-drum, etc.

For Recycle Mix: Field measurements indicated that approximately 1.5 gal of fuel was used for each ton of mix.

$$(1.50 \text{ gal/ton})(43{,}365 \text{ ton})(139{,}000 \text{ BTU/gal}) = 9.042 \times 10^{9} \text{ BTU}$$

For Virgin Mix: Not enough virgin mix was produced at one time to determine an average fuel consumption rate. The plant operator indicated that it would be approximately the same (1.5 gal/ton). This appears reasonable, so the difference between heating for a virgin or recycle mix was assumed to be zero.

(e) Aggregate

(e-1) Excavation

The virgin aggregate was purchased from an independent contractor. No production data was available regarding the energy involved in the excavation and other processing. One estimate (ref. 10) is that it takes 15,000 BTU/ton to produce the aggregate. Assuming the virgin mix would require twice as much aggregate as the recycle mix, the following estimates were developed:

For 50:50 Recycle Mix

$$(20{,}970 \text{ ton})(15{,}000 \text{ BTU/ton}) =$$
$$314.6\times10^6 \text{ BTU}$$

For Virgin Mix

$$(41{,}940 \text{ ton})(15{,}000 \text{ BTU/ton}) =$$
$$629.1\times10^6 \text{ BTU}$$

(e-2) Transport

Virgin aggregate was transported from a site on the Bear River, 9 miles from the plant site. Approximately 1/2 of this distance was on the freeway and 1/2 was on a paved road with a 4 to 10% grade. One truck driver determined by measurement that he got approximately 2.5 miles/gal on this run using a 5 axle bottom-dump tractor-trailer with an average total load of 23 tons.

Recycle Mix (50:50)

$$(20{,}970 \text{ tons})\left(\frac{1 \text{ load}}{23 \text{ tons}}\right)\left(\frac{18 \text{ miles}}{\text{load}}\right)\left(\frac{1.0 \text{ gal}}{2.5 \text{ miles}}\right)\left(\frac{139000 \text{ BTU}}{\text{gal}}\right) =$$
$$912.5\times10^6 \text{ BTU}$$

Virgin Mix

$$(912.5\times10^6 \text{ BTU})(2) = 1{,}825.0\times10^6 \text{ BTU}$$

(e-3) Crushing

Power used for the aggregate crusher, shaker, and conveyor belts was provided by 2 Murphy diesel generator vans. The aggregate consisted mostly of quartzite which is extremely hard to crush. The operator estimated that it takes 50% more energy to crush this material as opposed to an average aggregate. The material had a specific gravity of 2.64.

Obviously, a harder aggregate with a larger initial size will take more energy to crush than a smaller, softer aggregate. However, the contractor has not provided any information on the amount of energy used for the crusher. Therefore, a value obtained in the literature search of 40,000 BTU/ton was used (Ref. 10).

For 50:50 Recycle Mix

$$(20{,}970 \text{ ton})(40{,}000 \text{ BTU/ton}) = 838.8\times10^{6} \text{ BTU}$$

For Virgin Mix

$$(838.8\times10^{6} \text{ BTU})(2) = 1{,}677.6\times10^{6} \text{ BTU}$$

(f) Peripheral Plant Operation

Peripheral plant operation includes all the energy consumption not directly associated with the crusher, electrically driven hot plant motors, or the setup and removal of the plant. It includes the operation of all equipment that must be individually supplied with fuel such as loaders, tractors, pumps, the asphalt heater, pick-ups, and support facilities.

used for production of a 100 virgin mix because removal of the top 0.1 foot would have been required even if all new AC were used. This section does not include the energy necessary for the removal of the 4 foot by 0.15 foot section of the shoulder. That operation is the subject of section (i) of this report.

Milling Salvaged AC

Equipment	Gal Fuel	Energy Equivalent (in 10^6 BTU)
PR-750	6,024(diesel)	837.3
Broom*	640(gasoline)	80.0
Pickups	980(gasoline)	122.5
Water Trucks	2,000(gasoline)	250.0
	Total	1,289.8

*It took 320 gal gasoline for 1 month of operation. Brooming operations lasted 2 months.

(g-2) Transportation - Salvaged AC

To be incorporated into the recycled mix, the milled AC had to be transported to the plant site, an average distance of 25 miles most of which was on a 4 lane freeway with grades of 2% to 6%. The calculated fuel milage for this run was about 3 mpg (round trip).

$$(20{,}970 \text{ ton})\left(\frac{1 \text{ load}}{23 \text{ tons}}\right)\left(\frac{25 \text{ miles}}{\text{load}}\right)\left(\frac{1 \text{ gallon}}{3 \text{ miles}}\right)$$
$$\left(\frac{139{,}000 \text{ BTU}}{\text{gallon}}\right) = 1{,}056.1\text{x}10^6 \text{ BTU}$$

(h) Removal and Transportation of Excess Asphalt Concrete

(h-1) Removal

This section includes the energy required to remove the 4-foot wide by 0.15 foot thick section of the shoulder. This operation was carried out separately from the milling operation. A number of different techniques were attempted, each of which used different pieces of equipment. Because of the varibility of the operation, it was impossible to identify the energy consumed by each piece of equipment during each of the procedures attempted. Therefore, the energy expenditure is calculated as if the entire operation used the technique that was most successful and, therefore, finally adopted. The daily production was about 2 miles. The average daily equipment fuel consumption was multiplied by 25 to account for the 50± miles of removal that was required.

Excess AC Removal

Equipment	Total Fuel Gallons		Energy Equivalent (in 10^6 BTU)
PR-225	2,000(diesel)		278.0
Sweeper	375(gasoline)		46.9
Water Truck	1,000(diesel)		139.0
Nison Elge Shoulder Machine	625(diesel)		86.9
Pickups	650(gasoline)		81.3
		Total	632.1

(h-2) Transportation - Excess AC

The engineer's estimate for the amount of 0.25 foot thick AC to be removed was 13,364 yd^3. This included 5,474 yd^3 of 0.25 foot thick removal at isolated shoulders locations and at ramps. For the other locations, the contractor chose to remove the top 0.1 foot of the shoulder and then remove the additional 0.15 foot in a second operation. Therefore, the actual quantity removed during this second process was approximately (0.15 ft/0.25 ft)(13,364 - 5,474) = 4,734 yd^3. This material was dumped at two disposal sites after an average round trip of 10 miles.

$$(4{,}734\ yd^3)(1.83\ ton/yd^3)\left(\frac{1\ load}{23\ ton}\right)\left(\frac{10\ mi}{load}\right)\left(\frac{1\ gal}{3\ mi.}\right)$$

$$\left(\frac{139{,}000\ BTU}{gal}\right) = 174.5\times10^6\ BTU$$

(i) Paving Operations

The paving operation for the 4 foot x 0.15 foot section and the 10 foot by 0.25 foot section were handled differently. For the purpose of this report, tney are combined.

Equipment	Fuel Consumed, Gals.		Energy Equivalent ($\times10^6$ BTU)
Paver	1,119 diesel		155.5
Tandem Rollers	347 diesel		48.2
Vibratory Roller	794 diesel		110.4
Grader	285 diesel		39.6
Pickup	550 gasoline		68.8
		Total	422.5

(i-1) Transport

The trucks used to transport AC from the plant to the street traveled an average of approximately 25 miles per round trip at 3.0 miles/gallon.

$$(43{,}365 \text{ ton AC})\left(\frac{1 \text{ load}}{23 \text{ tons}}\right)\left(\frac{25 \text{ mi}}{\text{load}}\right)\left(\frac{1 \text{ gallon}}{3.0 \text{ miles}}\right)\left(\frac{139{,}000 \text{ BTU}}{\text{gallon}}\right)$$
$$= 2{,}184.0 \times 10^6 \text{ BTU}$$

(j) Supervision and Inspection

Although some energy was expended in transporting visiting government inspectors and officials around the job site, only the energy expended by the Resident Engineer and his staff was considered for this analysis.

Averge number of inspectors:	5
Average daily mileage per inspector:	70 miles
Average vehicle gas mileage:	14 mpg
Duration of project:	4-1/2 months

$$(5)\left(\frac{70 \text{ miles}}{\text{day}}\right)\left(\frac{1 \text{ gallon}}{14 \text{ miles}}\right)(110 \text{ days})\left(\frac{125{,}000 \text{ BTU}}{\text{gallon}}\right) =$$
$$343.8 \times 10^6 \text{ BTU}$$

(k) Miscellaneous Petroleum Products - Paving and Sealing

Miscellaneous petroleum products used for primes, tack coats, and seals were also used for this construction project. Thus, their fuel equivalent has also been included in this analysis.

Paving and Sealing Products

Material	Quantity Used	Density	Potential Energy	Energy Equivalent (10^6 BTU)
Tack Coat (AR2000)	75.4 ton	5.6 bbl/ton	511,000 BTU/bbl	215.8
Seal (Reclamite)	15.21 ton	241 gal/* ton	2,000 BTU/* gal	7.3
Primer (MC-250)	7.73 ton	249 gal/* ton	47,000 BTU/* gal	90.5
			Total	313.6×10^6 BTU

*From reference 10

(k-1) Transportation

The distributor truck operator determined that it took 81 gallons of gasoline a day to transport and spread the AR-2000 tack coat. Spreading operations took a total of about 60 man-days.

$$(60 \text{ days}) \times \left(\frac{1 \text{ trip}}{\text{day}}\right) \times \left(\frac{81 \text{ gal}}{\text{trip}}\right) \times (125{,}000 \text{ BTU/gal}) = 607.5 \times 10^6 \text{ BTU}$$

(1) Indirect Energy

Indirect energy includes the energy expended in the manufacture and maintenance of the equipment used on the project. Although information was gathered concerning this, the lack of a general data base does not allow for detailed calculations of this energy use. Therefore, the following assumptions were made: 1) indirect energy for tractor trailer trucks is 12,900 BTU/mi(12), 2) indirect energy for other equipment is considered as 30% of the direct energy(13).

(1-1) Indirect Transportation Energy Calculation

Material Transported	Direct Energy Recycle Mix	Direct Energy New Mix
Asphalt	494.8($x10^6$ BTU)	853.0($x10^6$ BTU)
Aggregate	912.5 "	1825.0 "
Milled AC	1056.1 "	1056.1 "
Waste AC	174.5 "	174.5 "
Paving AC	2184.0 "	2184.0 "
Tacks & Sealers	607.5 "	607.5 "
Total Direct Energy	$5429.4x10^6$ BTU	$6700.1x10^6$ BTU

These values were then used to estimate the indirect transportation energy use as follows:

Equivalent gal diesel @ 139,000 BTU/gal	38,300 gal	50,200 gal
Equivalent miles traveled @ 3 mpg	114,800 mi	150,600 mi
Indirect energy @ 12,900 BTU/mi	$1.481x10^9$ BTU	$1.943x10^9$ BTU

(1-2) Indirect Equipment Energy

All energy not used for transportation or materials would be equipment energy.

Row		Recycle Mix*	New Mix*
1	Total energy	26,677	31,863
2	Transportation energy	5,318	6,978
3	Materials energy (total)	13,429	16,339
4	asphalt		
5	burner fuel		
6	primes and sealers		
7	Equipment energy row (1-(2+3))	7,931	8,546
8	Indirect equipment energy (30% of row 7)	2,379	2,564

*All units in 10^6 BTU

Total Indirect Energy

Recycled Mix: $1481 \times 10^6 + 2379 \times 10^6 = 3860 \times 10^6$ BTU

New Mix: $1943 \times 10^6 + 2564 \times 10^6 = 4507 \times 10^6$ BTU

(m) Total Project Energy Consumption (in 10^6 BTU)

Operation	50-50 Recycled Mix	100% New Mix
Setup and removal of AC plant	563.8	563.8
AC plant generator fuel	728.0	582.4
Burner fuel	9042.0	9042.0
Asphalt energy		
Manufacture and processing	4075.0	7025.0
Transport	494.8	853.0
Other plant operations	2602.5	2602.5
New aggregate production energy		
Excavation	314.6	629.2
Transport	912.5	1825.0
Crushing	838.8	1677.6
Total for Plant Operations	19572.0	24800.5
Reclaimed AC		
Milling	1289.8	1289.8
Transport	1056.1	1056.1
Waste (excess asphalt concrete)		
Removal	632.1	632.1
Transport	174.5	174.5
Paving Operation		
Paving	422.5	422.5
Transport	2184.0	2184.0
Primes and Sealers		
Material energy	313.6	313.6
Transport	607.5	607.5
Total for Street Paving Operations	6680.1	6680.1
Supervision and Inspection	343.8	343.8
Indirect Energy	3860.0	4507.0
GRAND TOTAL ($\times10^6$ BTU)	30,455.9	36,331.3

This analysis indicates that an energy savings of approximately 15% was realized by recycling AC on this job. Other approximate energy equivalences are presented below.

Operation	50-50 Recycled Mix	100% New Mix
Energy per ton of AC	705,000 BTU/ton	843,000 BTU/ton
Equivalent gal gasoline per ton of AC	5.64 gal/ton	6.75 gal/ton
Equivalent bbl oil per ton of AC	0.122 bbl/ton	0.145 bbl oil/ton

(L) Conservation of Natural Resources

Considering natural resources, the savings in quantity alone were estimated to be:

(1) Raw Aggregates:

Total agg. needed for all new AC	= 43,880 tons
Actual agg. used with a 50/50 mix	= 21,940 tons
Savings	= 21,940 tons

(2) Asphalt:

Total tons required if a conventional mix were used (6.0% asphalt)	= 2,632.8 tons
Tons used in the recycled mix (based on an avg. 3.3%)	= 1,455.4 tons
Savings	= 1,177.4 tons

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APPENDIX

TABLE A-1

DEFLECTION DATA

03-Pla,Nev-80-40.0/69.8,0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER* DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 40.00	1.23	0.81	17	10
40.05	0.58	0.49	6	4
40.10	1.23	0.50	17	4
40.15	0.71	0.65	8	7
40.20	0.56	0.42	5	3
40.25	0.87	0.54	11	5
40.30	1.17	0.53	16	5
40.35	0.66	0.53	7	5
40.40	0.56	0.44	5	3
40.45	0.59	0.55	6	5
40.50	0.54	0.65	5	7
40.55	0.69	0.45	8	3
40.60	1.02	0.54	14	5
40.65	0.47	0.58	4	6
40.70	0.48	0.44	4	3
40.75	0.96	1.14	12	16
40.80	0.66	0.56	7	6
40.85	0.71	0.38	8	2
40.90	0.75	0.43	9	3
40.95	0.76	0.76	9	9
41.00	1.02	0.69	14	8
41.05	0.34	0.33	1	1
41.10	0.39	0.36	2	2
41.15	0.51	0.99	4	13
41.20	0.74	0.90	8	11
41.25	0.65	0.58	7	6
41.30	0.75	0.87	9	11
41.35	1.05	0.99	14	13
41.40	0.78	0.75	9	9
41.45	0.60	0.77	6	9
41.50	0.93	0.74	12	8
41.55	1.11	0.68	15	7
41.60	0.78	0.41	9	2
41.65	0.73	0.57	8	5
41.70	0.99	0.67	13	7
41.75	0.87	0.67	11	7

*Equivalent deflections determined per Figure 11 of the procedure for California Test 356, "Methods of Test to Determine Overlay Requirements by Pavement Deflection Measurements".

TABLE A-1 (Cont'd) DEFLECTION DATA

03-Pla, Nev-80-40.0/69.8, 0.00/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3 EB RIGHT SHOULDER	DYNAFLECT DEFLECTION, INCHES x 10^-3 WB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3 EB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3 WB RIGHT SHOULDER
P.M. 41.80	0.66	0.60	7	6
41.85	0.67	0.49	7	4
41.90	0.76	0.68	9	7
41.95	0.42	0.53	3	5
42.00	0.78	0.56	9	5
42.05	0.61	0.40	6	2
42.10	0.82	0.61	10	6
42.15	0.62	0.65	6	7
42.20	0.56	0.65	5	7
42.25	0.79	0.53	9	5
42.30	0.52	0.60	4	6
42.35	0.67	0.87	7	11
42.40	0.71	0.73	8	8
42.45	0.62	0.67	6	7
42.50	0.75	0.51	9	4
42.55	1.08	0.39	15	2
42.60	1.05	0.43	14	3
42.65	1.32	0.46	19	3
42.70	1.02	0.57	14	5
42.75	1.17	0.37	16	2
42.80	1.02	0.54	14	5
42.85	0.90	0.47	11	4
42.90	0.82	0.63	10	6
42.95	0.96	0.59	12	6
43.00	0.75	0.53	9	5
43.05	0.66	0.72	7	8
43.10	0.35	0.47	1	4
43.15	0.26	0.29	1	1
43.20	0.54	0.40	5	2
43.25	0.61	0.63	6	6
43.30	1.08	0.50	15	4
43.35	0.84	0.74	10	8
43.40	0.44	0.30	3	1
43.45	0.60	0.56	6	5
43.50	1.14	0.54	16	5
43.55	0.39	0.66	2	7
43.60	0.55	0.35	5	1
43.65	0.56	0.39	6	2
43.70	0.58	0.53	6	5
43.75	0.51	0.29	4	1
43.80	0.36	0.30	2	1

TABLE A-1 (Cont'd) DEFLECTION DATA

03-Pla, Nev-80-40.0/69.8, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETE DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIG. SHOULDE
P.M. 43.85	0.33	0.37	1	2
43.90	0.75	0.34	9	1
43.95	0.60	0.40	6	2
44.00	0.42	0.65	3	7
44.05	0.40	0.50	2	4
44.10	0.30	0.63	1	6
44.15	0.42	0.43	3	3
44.20	0.34	0.49	1	4
44.25	0.38	0.45	2	3
44.30	0.43	0.31	3	1
44.35	0.56	0.31	6	1
44.40	0.47	0.46	4	3
44.45	0.43	0.41	3	2
44.50	0.43	0.37	3	2
44.55	0.46	0.33	3	1
44.60	0.66	0.58	7	6
44.65	0.64	0.56	10	5
44.70	0.70	0.49	8	4
44.75	0.76	0.67	9	7
44.80	0.75	0.84	9	10
44.85	1.32	0.51	19	4
44.90	1.66	0.74	15	8
44.95	0.96	0.73	12	8
45.00	1.05	0.68	14	7
45.05	0.96	0.58	12	6
45.10	1.02	0.84	14	10
45.15	0.98	1.20	11	17
45.20	1.23	0.69	17	8
45.25	1.65	0.87	25	11
45.30	1.17	1.17	16	16
45.35	0.99	0.58	13	6
45.40	0.93	0.81	12	10
45.45	1.02	0.99	14	13
45.50	0.96	0.90	12	11
45.55	1.05	1.38	14	20
45.60	0.78	0.84	9	10
45.65	0.93	0.72	12	8
45.70	0.69	0.73	8	8
45.75	0.87	0.79	11	9
45.80	0.87	0.55	11	5
45.85	2.01	0.55	31	5

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, New-80-40.0/69.8, 0.0/6.0
OCTOBER 1977

EST CATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
y. 45.90	1.89	0.65	29	7
45.95	1.26	0.70	18	8
46.00	0.78	0.87	9	11
46.05	0.78	0.56	9	5
46.10	0.99	0.60	13	6
46.15	0.75	0.67	9	7
46.20	0.90	1.26	11	18
46.25	0.90	0.47	11	4
46.30	0.60	0.70	6	8
46.35	0.72	0.63	8	6
46.40	0.90	0.72	11	8
46.45	0.81	0.74	10	8
46.50	0.69	0.74	8	8
46.55	1.02	0.70	14	8
46.60	0.96	0.60	12	6
46.65	1.14	0.44	16	3
46.70	1.08	0.68	15	7
46.75	0.92	0.73	13	8
46.80	1.11	0.73	15	8
46.85	1.14	0.51	16	4
46.90	1.02	0.94	14	12
46.95	0.78	0.55	9	5
47.00	0.78	0.46	9	3
47.05	0.96	0.63	12	6
47.10	0.90	0.40	11	2
47.15	0.99	0.60	13	6
47.20	1.05	0.58	14	6
47.25	1.04	0.51	14	4
47.30	1.17	0.50	16	4
47.35	0.96	0.54	13	5
47.40	0.81	0.71	10	8
47.45	0.58	0.70	6	8
47.50	1.38	0.65	20	7
47.55	1.41	0.76	21	9
47.60	0.64	0.73	7	8
47.65	0.99	0.71	13	8
47.70	1.11	0.84	15	10
47.75	0.87	0.70	11	8
47.80	1.50	0.69	22	8
47.85	1.26	0.66	18	7
47.90	1.29	0.64	18	7

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, New-80-40.0/69.8,00/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 47.95	1.29	0.59	18	6
48.00	1.20	0.71	17	8
48.05	1.47	0.87	22	11
48.10	1.02	0.91	14	12
48.15	1.44	0.52	21	4
48.20	1.41	1.26	21	18
48.25	1.47	1.20	22	17
48.30	1.59	0.90	24	11
48.35	0.60	0.77	6	9
48.40	1.20	0.76	17	9
48.45	1.23	0.70	17	8
48.50	1.50	0.70	22	8
48.55	1.08	0.83	15	10
48.60	0.96	1.14	12	16
48.65	1.05	0.97	14	13
48.70	1.11	1.00	15	13
48.75	0.99	0.94	13	12
48.80	0.87	0.97	11	13
48.85	1.26	0.78	18	9
48.90	1.20	0.90	17	11
48.95	1.20	0.96	17	12
49.00	1.20	1.62	17	24
49.05	0.90	0.92	11	12
49.10	1.20	0.66	17	7
49.15	1.11	0.94	15	12
49.20	0.84	0.56	10	5
49.25	1.20	0.91	17	12
49.30	1.71	0.75	26	9
49.35	1.08	0.70	15	8
49.40	1.08	0.61	15	6
49.45	0.93	0.60	12	10
49.50	1.65	0.80	25	10
49.55	1.56	0.82	23	10
49.60	1.29	0.80	18	10
49.65	1.17	0.68	16	7
49.70	1.17	0.60	16	6
49.75	1.68	0.69	25	8
49.80	0.93	0.87	12	11
49.85	1.29	1.14	18	16
49.90	0.47	0.62	4	6
49.95	1.35	1.14	20	16

TABLE A-1 (Cont'd) DEFLECTION DATA

03-Pla, Nev.-80-40.0/698,0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 50.00	1.36	0.93	20	12
50.05	1.50	0.96	22	12
50.10	1.56	1.02	23	14
50.15	1.71	0.83	26	10
50.20	1.35	1.08	20	15
50.25	1.71	0.98	26	13
50.30	1.11	0.77	15	9
50.35	1.17	0.87	16	11
50.40	1.53	0.93	23	12
50.45	0.81	0.99	10	13
50.50	1.20	1.32	17	19
50.55	1.05	0.99	14	13
50.60	1.83	0.81	28	10
50.65	0.99	1.08	13	15
50.70	1.38	1.11	20	15
50.75	1.08	1.20	15	17
50.80	1.47	0.58	22	6
50.85	0.87	0.87	11	11
50.90	0.81	0.88	10	11
50.95	0.87	1.20	11	17
51.00	0.84	1.08	10	15
51.05	0.84	1.23	10	17
51.10	0.64	0.56	7	5
51.15	0.79	0.36	9	2
51.20	0.50	0.87	4	11
51.25	0.71	0.54	8	5
51.30	1.11	0.86	15	11
51.35	1.05	0.72	14	8
51.40	1.11	0.52	15	4
51.45	0.96	0.58	12	6
51.50	1.02	0.57	14	5
51.55	1.05	0.52	14	4
51.60	1.26	0.67	18	7
51.65	1.11	0.83	15	10
51.70	1.47	0.84	22	10
51.75	1.29	0.67	18	7
51.80	1.41	0.77	21	9
51.85	1.71	0.86	26	11
51.90	1.38	0.86	20	11
51.95	1.59	0.84	24	10
52.00	1.26	0.61	18	6

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, Nev-80-40.0/69.8, 0.0/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 52.05	1.17	0.69	16	11
52.10	1.23	0.54	17	5
52.15	1.56	0.77	23	9
52.20	1.35	0.76	20	9
52.25	1.92	0.65	30	7
52.30	1.56	0.61	23	6
52.35	1.20	0.86	17	11
52.40	0.99	1.02	13	14
52.45	1.02	0.99	14	13
52.50	1.11	0.77	15	9
52.55	0.99	1.05	13	14
52.60	1.26	0.85	18	10
52.65	1.20	0.83	17	10
52.70	1.26	0.66	18	7
52.75	1.32	0.54	19	5
52.80	1.05	0.93	14	12
52.85	1.29	0.95	18	12
52.90	1.38	0.97	20	13
52.95	0.99	0.83	13	10
53.00	1.14	0.85	16	10
53.05	1.17	0.82	16	10
53.10	0.99	0.80	13	10
53.15	1.14	0.69	16	8
53.20	0.99	0.92	13	12
53.25	1.35	0.69	20	8
53.30	1.29	0.98	18	13
53.35	1.05	0.35	14	1
53.40	1.05	0.84	14	10
53.45	0.99	0.66	13	7
53.50	1.11	0.67	15	7
53.55	1.11	0.82	15	10
53.60	1.08	0.94	15	12
53.65	1.41	0.83	21	10
53.70	1.11	0.96	15	12
53.75	1.41	0.96	21	12
53.80	1.20	0.67	17	7
53.85	1.23	1.05	17	14
53.90	1.26	0.91	18	12
53.95	1.14	0.83	16	10
54.00	1.14	1.26	16	18
54.05	1.23	0.83	17	10

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Ple, Nev-80-40.0/698, 0.0/6.0
OCTOBER 1977

EST CATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
54.10	1.05	0.75	14	9
54.15	1.08	0.96	15	12
54.20	1.11	0.82	15	10
54.25	0.99	0.48	13	4
54.30	1.41	1.11	21	15
54.35	1.02	0.61	14	6
54.40	1.14	0.56	16	5
54.45	1.14	0.62	16	6
54.50	1.05	0.70	14	8
54.55	—	0.81	—	10
54.60	—	0.93	—	12
54.65	—	0.68	—	7
54.70	—	0.63	—	6
54.75	—	0.93	—	12
54.80	—	1.14	—	16
54.85	—	0.37	—	2
54.90	—	0.90	—	11
54.95	—	0.93	—	12
55.00	0.65	0.84	7	10
55.05	0.70	0.84	8	10
55.10	0.90	0.59	11	6
55.15	0.29	0.58	1	6
55.20	0.66	0.20	7	1
55.25	0.53	0.41	5	2
55.30	0.50	0.46	5	3
55.35	0.73	0.79	8	9
55.40	0.63	0.69	6	8
55.45	0.73	0.65	8	7
55.50	0.60	0.76	6	9
55.55	0.99	0.60	13	6
55.60	0.81	0.26	10	1
55.65	0.62	0.26	6	1
55.70	0.84	0.35	10	1
55.75	0.75	0.26	9	1
55.80	1.05	0.47	14	4
55.85	0.60	0.49	6	4
55.90	0.75	0.34	9	1
55.95	0.87	0.54	11	5
56.00	1.02	0.44	14	3
56.05	0.90	0.27	11	1
56.10	0.87	0.56	11	5

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, Nev-80-40.0/69.8, 0.0/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 56.15	0.96	0.62	12	6
56.20	0.65	0.41	7	2
56.25	0.56	0.54	5	5
56.30	0.59	0.60	6	6
56.35	0.87	0.68	11	7
56.40	0.81	0.54	10	5
56.45	0.93	0.56	12	6
56.50	0.84	0.64	10	7
56.55	0.81	0.59	10	6
56.60	0.52	0.68	4	7
56.65	0.68	0.89	7	11
56.70	0.53	0.94	5	12
56.75	0.50	0.65	4	7
56.80	0.96	0.64	12	7
56.85	0.74	0.61	8	6
56.90	1.02	0.72	14	8
56.95	0.93	0.56	12	5
57.00	0.78	0.67	9	7
57.05	0.90	0.57	11	5
57.10	0.90	0.57	11	5
57.15	0.81	0.56	10	5
57.20	0.81	0.67	10	7
57.25	0.90	0.66	11	7
57.30	0.78	0.62	9	6
57.35	0.87	0.60	11	6
57.40	0.87	0.66	11	7
57.45	0.84	0.69	10	8
57.50	1.08	0.73	15	8
57.55	0.96	0.66	12	7
57.60	0.60	0.74	6	8
57.65	0.87	0.65	11	7
57.70	0.90	0.69	11	8
57.75	0.70	0.84	8	10
57.80	0.76	0.63	9	6
57.85	0.90	0.59	11	6
57.90	0.96	0.54	12	5
57.95	0.87	0.58	11	6
58.00	0.81	0.54	10	5
58.05	1.02	0.69	14	8
58.10	0.96	0.65	12	7
58.15	1.05	0.61	14	6

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, Nev-80-40.0/69.8, 0.0/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3} EB RIGHT SHOULDER	DYNAFLECT DEFLECTION, INCHES x 10^{-3} WB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3} EB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3} WB RIGHT SHOULDER
P.M. 58.20	0.99	0.50	13	4
58.25	1.11	0.53	15	5
58.30	0.93	0.72	12	8
58.35	1.08	0.66	15	7
58.40	1.05	0.66	14	7
58.45	0.96	0.72	12	8
58.50	0.99	0.76	13	9
58.55	0.93	0.67	12	7
58.60	0.96	0.55	12	5
58.65	0.96	0.75	12	9
58.70	1.08	0.70	15	8
58.75	0.93	0.78	12	9
58.80	0.90	0.90	11	11
58.85	0.57	0.96	5	12
58.90	0.96	0.84	12	10
58.95	0.99	1.02	13	14
59.00	0.66	1.11	7	15
59.05	0.31	0.88	1	11
59.10	0.84	0.35	10	1
59.15	0.66	0.51	7	4
59.20	0.34	0.59	1	6
59.25	0.78	0.66	9	11
59.30	0.96	0.67	12	7
59.35	0.96	0.69	12	8
59.40	1.02	0.99	14	13
59.45	0.90	0.53	11	5
59.50	—	—	—	—
59.55	—	0.23	—	1
59.60	—	0.67	—	7
59.65	0.60	0.87	6	11
59.70	0.69	0.61	6	6
59.75	0.69	0.74	6	8
59.80	0.78	0.81	9	10
59.85	0.24	0.70	1	8
59.90	0.54	0.55	5	5
59.95	0.34	0.49	1	4
60.00	0.57	0.55	5	5
60.05	0.84	0.52	10	4
60.10	0.54	0.72	5	8
60.15	0.78	0.47	9	4
60.20	0.63	0.30	6	1

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, Ner-80-40.0/69.8, 0.0/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3 EB RIGHT SHOULDER	DYNAFLECT DEFLECTION, INCHES x 10^-3 WB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3 EB RIGHT SHOULDER	EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3 WB RIGHT SHOULDER
PM. 60.25	0.78	0.29	9	1
60.30	0.66	0.40	7	2
60.35	1.05	0.84	14	10
60.40	0.87	0.28	11	1
60.45	0.84	0.24	10	1
60.50	0.57	0.55	5	5
60.55	0.54	0.38	5	2
60.60	1.08	0.39	15	2
60.65	0.84	0.37	10	2
60.70	0.87	0.30	11	1
60.75	0.51	0.85	4	10
60.80	1.53	0.46	23	3
60.85	0.72	0.41	8	2
60.90	0.93	0.53	12	5
60.95	0.60	0.71	6	8
61.00	1.08	0.64	15	7
61.05	0.51	0.38	4	2
61.10	0.69	0.75	8	9
61.15	0.96	0.62	12	6
61.20	0.90	0.28	11	1
61.25	0.54	0.27	5	1
61.30	0.69	0.25	8	1
61.35	0.66	0.75	7	9
61.40	0.60	0.62	6	6
61.45	0.81	0.50	10	4
61.50	0.72	0.53	8	5
61.55	1.02	0.67	14	7
61.60	1.17	0.66	16	7
61.65	1.17	0.48	16	4
61.70	0.93	0.47	12	4
61.75	1.02	0.83	14	10
61.80	0.69	0.57	8	5
61.85	0.51	0.52	4	4
61.90	0.40	0.51	2	4
61.95	0.48	0.87	4	11
62.00	0.30	0.64	1	7
62.05	0.32	0.73	1	8
62.10	0.65	0.53	7	6
62.15	1.11	0.26	15	1
62.20	0.90	0.60	11	6
62.25	0.90	0.67	11	7

TABLE A-1 (Cont'd) DEFLECTION DATA
03 - Pla, Nev - 80 - 40.0/698, 00/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 62.30	1.14	0.52	16	4
62.35	0.60	0.34	6	1
62.40	0.48	0.22	4	1
62.45	0.93	0.32	12	1
62.50	0.81	0.49	10	4
62.55	1.08	0.47	15	4
62.60	0.66	0.34	7	1
62.65	0.60	0.73	6	8
62.70	0.96	0.92	12	12
62.75	1.11	0.52	15	4
62.80	0.78		9	
62.85	0.69	0.57	8	5
62.90	0.57	0.78	5	9
62.95	0.60	0.40	6	2
63.00	0.90	0.64	11	7
63.05	0.99	0.63	13	5
63.10	0.96	0.68	12	6
63.15	0.46	0.44	3	3
63.20	1.11	0.50	15	4
63.25	0.93	0.64	12	7
63.30	0.33	0.75	1	9
63.35	0.48	0.55	4	5
63.40	0.32	0.43	1	3
63.45	0.64	0.42	7	3
63.50	0.84	0.60	10	6
63.55	0.73	0.40	8	2
63.60	0.68	0.48	7	4
63.65	0.83	0.78	10	9
63.70	0.51	0.40	4	2
63.75	0.31	0.65	1	7
63.80	0.55	0.38	5	2
63.85	0.72	0.63	8	6
63.90	0.82	0.64	10	10
63.95	0.72	0.61	8	6
64.00	0.79	0.44	9	3
64.05	0.60		6	
64.10	0.68	0.25	7	1
64.15	0.35	0.60	1	6
64.20	0.88		11	
64.25	0.49	0.38	4	2
64.30	0.60	0.33	6	1

TABLE A-1 (Cont'd) DEFLECTION DATA
03-Pla, Nev-80-40.0/698, 0.0/6.0
OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 64.35	0.58	0.26	6	1
64.40	0.45	0.40	3	2
64.45	—	0.35	—	1
64.50	0.31	0.28	1	1
64.55	0.82	0.32	10	1
64.60	0.41	0.37	2	2
64.65	0.55	0.34	5	1
64.70	0.44	0.36	3	2
64.75	0.45	0.26	3	1
64.80	0.48	0.18	4	1
64.85	0.44	0.50	3	4
64.90	0.46	0.23	3	1
64.95	0.36	0.25	2	1
65.00	0.91	0.27	12	1
65.05	0.69	0.45	8	3
65.10	0.83	0.45	10	3
65.15	1.05	0.60	14	6
65.20	0.93	0.36	12	2
65.25	0.99	0.64	13	7
65.30	0.96	0.57	12	5
65.35	1.11	0.69	15	8
65.40	0.87	0.40	11	2
65.45	0.96	0.40	12	2
65.50	0.93	0.56	12	5
65.55	1.02	0.42	14	3
65.60	1.17	0.32	16	1
65.65	1.23	0.42	17	3
65.70	0.66	0.52	7	4
65.75	1.14	0.33	16	1
65.80	1.23	0.54	17	5
65.85	0.42	0.74	3	8
65.90	0.99	0.47	13	4
65.95	1.02	0.36	14	2
66.00	0.84	0.50	10	4
66.05	0.90	0.63	11	6
66.10	0.60	0.54	6	5
66.15	0.96	0.60	12	6
66.20	0.45	0.44	3	3
66.25	0.69	0.53	8	5
66.30	1.17	0.26	16	1
66.35	0.93	0.48	12	4

TABLE A-1 (Cont'd) DEFLECTION DATA

03 - Pla, Nev - 80 - 40.0/698, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 66.40	0.61	0.53	11	5
66.45	1.02	0.39	14	2
66.50	0.69	0.78	8	11
66.55	0.69	0.88	8	8
66.60	0.93	0.69	12	6
66.65	0.66	0.60	7	
66.70	0.75	0.83	9	10
66.75	0.54	0.75	5	9
66.80	0.48	0.48	4	4
66.85	0.69	0.99	8	13
66.90	0.57	0.74	5	8
66.95	0.60	0.64	6	7
67.00	0.57	0.52	5	4
67.05	0.47	0.57	4	5
67.10	0.76	0.38	9	2
67.15	0.82	0.52	10	4
67.20	0.94	0.64	12	7
67.25	0.64	0.41	7	2
67.30	0.56	0.39	5	2
67.35	0.36	0.40	2	2
67.40	0.74	0.39	8	2
67.45	0.65	0.53	7	5
67.50	0.65	0.32	7	1
67.55	0.60	0.32	6	1
67.60	0.56	0.39	6	2
67.65	0.94	0.54	12	5
67.70	1.08	0.45	15	3
67.75	0.78	0.54	9	5
67.80	0.60	0.50	6	4
67.85	0.54	0.51	5	4
67.90	1.08	0.27	15	1
67.95	0.99	0.77	13	9
68.00	0.38	0.62	2	6
68.05	0.76	0.68	9	6
68.10	0.53	0.55	5	5
68.15	1.11	0.46	15	3
68.20	0.81	0.52	10	4
68.25	0.81	0.50	10	4
68.30	0.75	0.70	9	8
68.35	1.11	0.67	15	7
68.40	0.81	0.53	10	5

TABLE A-1 (Cont'd) DEFLECTION DATA

03 - Pla, Nev - 80 - 40.0/69.8, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
PLACER COUNTY				
P.M. 68.45	0.99	0.69	13	6
68.50	0.90	0.57	11	5
68.55	0.84	0.55	10	5
68.60	0.96	0.87	12	11
68.65	1.38	0.71	20	8
68.70	1.50	0.62	22	6
68.75	0.72	0.61	8	6
68.80	0.78	0.61	9	6
68.85	0.96	0.61	12	6
68.90	1.02	0.84	14	10
68.95	0.50	0.66	4	7
69.00	0.87	0.51	11	4
69.05	0.62	0.63	6	6
69.10	0.48	0.63	4	6
69.15	0.46	0.60	3	6
69.20	0.51	0.51	4	4
69.25	0.47	0.40	4	2
69.30	0.64	0.43	7	3
69.35	1.11	0.48	15	4
69.40	0.30	0.53	1	5
69.45	0.54	0.87	5	11
69.50	0.81	0.58	10	6
69.55	0.82	0.57	10	5
69.60	0.66	0.63	7	6
69.65	0.79	0.47	9	4
69.70	0.69	0.65	8	7
69.75	0.78	0.46	9	3
P.M. 69.80	0.72	0.43	8	3
NEVADA COUNTY				
P.M. 0.00	0.72	0.43	8	3
0.05	0.62	0.39	6	2
0.10	0.80	0.69	10	8
0.15	0.78	0.87	9	11
0.20	0.79	0.45	9	3
0.25	0.77	0.38	9	2
0.30	0.75	0.38	9	2
0.35	0.71	0.57	8	5
0.40	0.62	0.47	6	4
0.45	0.71	0.39	8	2
0.50	0.71	0.43	8	3
0.55	0.64	0.60	7	6

TABLE A-1 (Cont'd) DEFLECTION DATA

03-Pla, Nev-80-40.0/69.8, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
M. 0.60	0.84	0.33	10	1
0.65	0.78	0.40	9	2
0.70	0.78	0.38	9	2
0.75	0.77	0.58	9	6
0.80	0.82	0.71	10	8
0.85	0.80	0.51	10	4
0.90	0.80	0.65	10	7
0.95	0.77	0.50	9	4
1.00	0.77	0.43	9	3
1.05	0.79	0.34	9	1
1.10	0.71	0.42	8	3
1.15	0.48	0.48	4	4
1.20	0.54	0.47	5	4
1.25	0.53	0.59	5	6
1.30	0.59	0.45	6	3
1.35	0.56	0.40	5	2
1.40	0.55	0.43	5	3
1.45	0.43	0.72	3	8
1.50	0.86	0.31	11	1
1.55	0.68	0.40	7	2
1.60	0.58	0.51	6	4
1.65	0.64	0.75	7	9
1.70	0.57	0.64	5	7
1.75	0.64	0.66	7	7
1.80	0.61	0.78	6	9
1.90	0.57	0.29	5	1
1.95	0.50	0.52	4	4
2.00	0.61	0.59	6	6
2.05	0.60	0.41	6	2
2.10	0.84	0.41	10	2
2.15	0.52	0.70	4	8
2.20	0.60	1.23	6	17
2.25	0.55	0.93	5	12
2.30	1.20	0.44	17	3
2.35	0.84	0.53	10	5
2.40	0.90	0.84	11	10
2.45	0.84	0.42	10	3
2.50	0.66	0.50	7	4
2.55	1.14	1.05	16	14
2.60	1.11	0.51	15	4
2.65	0.81	0.71	10	8

TABLE A-1 (Cont'd) DEFLECTION DATA

03 - Pla, Nev - 80 - M.0/69.8, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^-3		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^-3	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 2.70	1.02	0.72	14	8
2.75	0.81	0.87	10	11
2.80	1.05	0.79	14	9
2.85	0.57	0.65	5	7
2.90	0.66	0.60	7	6
2.95	0.62	0.48	6	4
3.00	0.84	0.43	10	3
3.05	0.67	0.25	7	1
3.10	0.84	0.76	10	9
3.15	0.76	0.67	9	7
3.20	0.72	0.64	8	7
3.25	0.96	0.67	12	7
3.30	0.84	0.93	10	12
3.35	0.82	0.45	10	3
3.40	0.60	0.69	10	8
3.45	0.75	0.96	9	12
3.50	0.54	0.87	5	11
3.55	0.62	0.78	6	9
3.60	0.78	0.75	9	9
3.65	0.73	0.81	8	10
3.70	0.92	0.99	12	13
3.75	0.72	0.75	8	9
3.80	0.54	0.65	5	7
3.85	0.76	0.53	9	5
3.90	0.76	0.61	9	6
3.95	0.73	0.81	8	10
4.00	0.83	0.90	10	11
4.05	0.77	0.51	9	4
4.10	0.64	0.39	7	2
4.15	0.78	0.63	9	6
4.20	0.73	0.64	8	7
4.25	0.84	1.11	10	15
4.30	0.93	0.71	12	8
4.35	0.83	0.57	10	5
4.40	1.02	0.79	14	9
4.45	1.08	0.78	15	9
4.50	1.17	0.71	16	8
4.55	0.87	0.81	11	10
4.60	0.72	0.75	8	9
4.65	0.75	0.61	9	6
4.70	0.84	0.73	10	8

TABLE A-1 (Cont'd) DEFLECTION DATA

03-Pla, Hev-80-40.0/69.8, 0.0/6.0

OCTOBER 1977

TEST LOCATION	DYNAFLECT DEFLECTION, INCHES x 10^{-3}		EQUIVALENT DEFLECTOMETER DEFLECTION, INCHES x 10^{-3}	
	EB RIGHT SHOULDER	WB RIGHT SHOULDER	EB RIGHT SHOULDER	WB RIGHT SHOULDER
P.M. 4.75	0.90	0.75	11	9
4.80	0.87	0.73	11	8
4.85	0.70	0.55	8	5
4.90	1.08	0.40	15	2
4.95	0.55	0.78	5	9
5.00	0.71	0.99	8	13
5.05	0.83	0.79	10	9
5.10	0.40	0.69	2	8
5.15	0.72	0.49	8	4
5.20	0.58	1.02	6	14
5.25	0.53	0.99	5	13
5.30	0.59	0.50	6	4
5.35	0.66	0.47	7	4
5.40	0.90	0.67	11	7
5.45	0.91	1.11	12	15
5.50	0.94	0.78	12	9
5.55	0.77	0.93	9	12
5.60	1.05	1.23	14	17
5.65	0.75	0.84	9	10
5.70	0.83	0.45	10	3
5.75	0.70	0.34	8	1
5.80	0.57	0.70	5	8
5.85	0.64	0.59	7	6
5.90	0.73	0.78	8	9
5.95	0.58	0.80	6	10
6.00	0.78	0.84	9	10

TABLE A-2

I-80 RECYCLE PROJECT

03-205404 (502)

LAB TEST NO. 78-1318D

Addition of Cyclogen "M"

ASSUMED 5.0% ASPHALT IN SALV. A.C.
USED ½" B MED GRADING FOR VIRGIN AGGR.

VIRGIN AGGR	% USED	0	50	50	50	50	50	50	50
SALV AC		100	50	50	50	50	50	50	50
CYCLOGEN "M" ADDED (%)		0	0	2.0	2.5	3.0	3.5	4.0	4.5
TOTAL ASPH IN MIX %		5.0	2.5	4.5	5.0	5.5	6.0	6.5	7.0
METHOD OF COMPACTION		CALIFORNIA KNEADING COMPACTOR							
STAB VALUE		44 / 49	45 / 47	39 / 42	45 / 43	44 / 44	43 / 43	37 / 35	— / —
SPEC GRAVITY		2.26 / 2.26	2.14 / 2.13	2.25 / 2.25	2.27 / 2.27	2.29 / 2.30	2.31 / 2.31	2.33 / 2.33	— / —
VOIDS		7.5 / 7.5	15.7 / 16.1	8.9 / 8.9	7.3 / 7.3	5.8 / 5.3	4.5 / 4.5	2.9 / 2.9	— / —
COHESION		560 / 404	186 / 207	96 / 71	91 / 102	115 / 92	119 / 112	201 / 139	— / —
SURF ABRAS (TM 360B)		—	—	—	—	—	11.8g	—	—
M_R X10[5]		7.35 / 7.07	— / —	— / —	— / —	— / —	.47 / .49	— / —	— / —
MVS	STAB	35 / 40	— / —	— / —	— / —	— / —	37 / 37	— / —	— / —
	SP GR	2.25 / 2.27	— / —	— / —	— / —	— / —	2.30 / 2.30	— / —	— / —
	COHES	1200 / 1100	— / —	— / —	— / —	— / —	145 / 220	— / —	— / —
	MOIST. (%)	1.0 / 1.1	— / —	— / —	— / —	— / —	0.5 / 0.4	— / —	— / —
RECOV. ASPH. PEN.		14	—	—	—	—	300*	—	—
FLUSH		NONE	NONE	NONE	NONE	NONE	SLIGHT	HEAVY	—
OPTIMUM ASPH %		—	—	—	—	—	X	—	—

EXTRACTION DATA @ OPT ASPH CONT

SIEVE SIZE	¾"	½"	⅜"	4	8	16	30	50	100	200	% ASPH EXTRACT
% PASSING	100	94	86	69	52	38	28	20	13	9.1	6.1
% THEORETICAL	100	94	84	66	48	34	24	16	11	7	6.0

*Questionable

TABLE A-3

I-80 RECYCLE PROJECT

03-205404 (502)

LAB TEST NO. 78-1318E

Addition of Chevron "H"

ASSUMED 5.0% ASPHALT IN SALV. A.C.
USED ½" B MED GRADING FOR VIRGIN AGGR.

GIN AGGR	%	0		50		50		50		50		50		50		50	
LV AC	USED	100		50		50		50		50		50		50		50	
EVRON Y AGT-HEAVY ADDED (%)		0		0		2.0		2.5		3.0		3.5		4.0		4.5	
OTAL ASPH IN MIX		5.0		2.5		4.5		5.0		5.5		6.0		6.5		7.0	
ETHOD OF OMPACTION		CALIFORNIA KNEADING COMPACTOR															
STAB VALUE		44	49	45	47	—	—	38	36	42	41	38	37	35	37	—	—
SPEC GRAVITY		2.26	2.26	2.14	2.13	—	—	2.25	2.26	2.29	2.29	2.28	2.29	2.31	2.33	—	—
VOIDS		7.5	7.5	15.7	16.1	—	—	8.2	7.8	5.8	5.8	5.8	5.4	3.8	2.9	—	—
COHESION		560	404	186	207	—	—	100	125	145	190	95	150	300	115	—	—
SURF ABRAS (TM 360 B)		—		—		—		—		—		14.69		—		—	
M_R X10[5]		7.33	7.07	—	—	—	—	—	—	—	—	1.57	1.60	—	—	—	—
MVS	STAB	35	40	—	—	—	—	—	—	—	—	33	34	—	—	—	—
	SP GR	2.25	2.27	—	—	—	—	—	—	—	—	2.29	2.29	—	—	—	—
	COHES	1200	1100	—	—	—	—	—	—	—	—	215	125	—	—	—	—
	MOIST (%)	1.0	1.1	—	—	—	—	—	—	—	—	0.4	0.3	—	—	—	—
RECOV. ASPH. PEN.		14		—		—		—		—		112		—		—	
FLUSH		NONE		NONE		—		NONE		NONE		NONE TO SLIGHT		HEAVY		—	
OPTIMUM ASPH %		—		—		—		—		—		X		—		—	

EXTRACTION DATA @ OPT ASPH CONT

SIEVE SIZE	¾"	½"	⅜"	4	8	16	30	50	100	200	% ASPH EXTRACT
% PASSING	100	95	83	67	49	36	27	19	13	9.1	5.7
% THEORETICAL	100	94	84	66	48	34	24	16	11	7	6.0

TABLE A-4

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F) AIR	ASPHALT	MIX PLANT	MIX STREET
8-11-78	1100	85			290*
	1315				270*
8-14-78	1345		275	275	
	1500	90	275	280	270*
	1730		275	270	
8-15-78	1130	82			260
	1400		290	275	↑
	1600		280	275	
	1700		285	270	255-270
	1730		285	280	
	1800		285	280	↓
8-16-78	1115		275	290	↑
	1130		305	305	290-300
	1755		280	275	↓
8-17-78	1230		290	265	
	1300		290	280	
	1455		290	290	
	1530		290.	270	
8-21-78	1100		290	275	
	1330		290	285	
	1515		290	250	
	1645		290	260	
	1730		295	260	
	1800		295	260	
	1915		295	300	
8-22-78	1130		285	275	
	1210		300	295	
	1330		300	295	
	1430		300	265	
	1500		300	285	
	1645		300	270	
	1800		300	275	
8-23-78	0845		290	280	

* Conventional AC. Mix

RAGUT
o. Branch

TABLE A-4 (Cont'd)

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F)			
		AIR	ASPHALT	MIX PLANT	MIX STREET
8-23-78	1000		290	275	
	1130		290	270	
	1200		275	275	
	1300		260	275	
	1630		255	270	
	1830		260	280	
	1930		260	290	
8-24-78	0845		300	270	
	1430		310	260	
	1630		310	260	
	1830		310	260	
8-25-78	0800		290	270	
	1030		290	265	
	1130		290	275	
	1330		290	270	
8-28-78	1130		280	275	
	1430		285	270	
	1700		265	270	
	1830		270	275	
8-29-78	1045		305	270	
	1300		305	260	
	1515		290	285	
	1630		285	260	
8-30-75	0830		290	270	
	1000		290	260	
	1145		290	285	
	1600		325	280	
	1700		325	275	
	1830		325	280	
8-31-78	0730		255	280	
	0945		275	265	
	1100		280	285	
	1300		290	280	

NTS

TABLE A-4 (Cont'd)

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F)			
		AIR	ASPHALT	MIX	
				PLANT	STREET
8-31-78	1730		300	280	
	1930		300	285	
9-7-78	0845		295	265	
	0930		300	290	
	1130		300	280	
	1315		300	295	
	1400				280
	1445		300	300	
	1600		300	290	
9-8-78	0745		300	285	
	0945		300	290	
	1230		300	295	
	1400		300	300	
	1500		300	290	
9-11-78	0815		310	270	
	0830		310	270	
	0900		310	275	
	1015		305	260	
	1030		305	280	
	1230		305	275	
	1400		310	275	
	1645		310	280	
9-12-78	0720		310	265	
	0735		310	280	
	0900		310	270	
	1200		305	280	Av. 265 ±
	1545		310	300	Av. @ Finish Rolling
	1815		275	285	150-180
	2030		280	280	
9-13-78	0715		280	290	
	0745		280	310	
	1045		305	290	
	1330		305	300	

TABLE A-4 (Cont'd)

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F) AIR	ASPHALT	MIX PLANT	MIX STREET
9-13-78	1515		305	290	
	1830		305	300	
	1930		300	295	
	2030		300	300	
9-14-78	0715		285	280	
	0730		285	320	
	1000		285	300	
	1230		285	300	
	1400		300	280	
	1800		300	275	
9-15-78	0715		300	295	
	0800		315	295	
	1015		315	290	
	1230		300	275	
	1345		300	280	
	1445		305	280	
9-18-78	0700		300	290	
	0715		300	325	
	0820		305	280	
	1245		300	290	
	1315	55			275
	1500		300	310	
	1745		320	300	
9-19-78	0715		310	320	
	0745		310	325	
	0900		310	305	
	1200		330	325	
	1330		330	310	
	1530		330	305	
9-20-78	1055		320	310	225-250
	1155		320	310	
	1310		320	310	
	1540		340	320	

NTS

TABLE A-4 (Cont'd)

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F)			
		AIR	ASPHALT	MIX	
				PLANT	STREET
9-20-78	1730		325	305	
9-21-78	0800		320	310	
	0815		320	320	
	0945		320	310	
	1045		320	290	
	1100		325	270	
	1245		335	280	
	1400		335	270	
	1530		330	275	
9-22-78	0700		325	305	
	0830		325	310	
	0945		325	310	
	1045		330	285	
	1215		330	310	
	1305		330	285	
9-25-78	0635		320	295	
	0650		320	310	
	0900		320	295	
	1100		315	285	
	1320		315	265	
	1500		310	290	
9-26-78	0645		290	295	↑
	0700		290	315	
	0830		305	300	
	0945		310	290	250
	1400		315	305	
	1600		310	300	↓
9-27-78	0645		320	305	
	0655		320	295	
	0815		315	280	
	1100				240
	1230		340	290	
	1415	80			265

TABLE A-4 (Cont'd)

A C PLANT AND STREET TEMPERATURE LOG

DATE	TIME	TEMPERATURE (°F)			
		AIR	ASPHALT	MIX	
				PLANT	STREET
9-27-78	1545		340	295	
9-28-78	0655		305	290	
	0715		305	295	
	0845		305	295	
	1000		315	280	
	1015		320	290	
	1230		320	295	
9-29-78	0645		300	285	
	0705		305	285	
	0915		310	280	
	1130		310	275	
	1330		305	290	
10-2-78	0855		300	285	
	1100		305	280	
	1305		310	280	
	1500		312	285	
10-3-78	0715		314	282	
	0900		314	295	
	1120		314	296	
	1345		307	292	
	1530		310	285	
10-4-78	0715		300	295	
	0730		300	290	
	0945		305	295	
	1045		310	290	
	1100				268
	1130		310	290	
	1230		310	295	
	1430	70			240

TABLE A-5

COMPACTION DATA

(OUTSIDE OF TRENCH SECTION)

POST MILE	SHOULDER		FIELD DENSITY (WT/CU FT)	RELATIVE COMPACTION (%)
	DIST FROM EDGE PAVT.	DIREC-TION		
49.18	7	EB	137	93
✓	5	✓	139	95
50.07	6	✓	141	96
50.24	8	✓	135	92
51.00	9	✓	133	90
53.00	5	✓	140	95
56.46	7	✓	139	95
61.00	6	✓	139	95
63.00	8	✓	136	93
✓	5	✓	132	90
64.18	9	✓	131	89
			X = 136.6 PCF	X = 93%
64.00	9	WB	124	84
63.79	6	✓	129	88
63.23	5	✓	137	93
61.10	6	✓	136	93
59.02	8	✓	139	95
55.74	7	✓	134	91
✓	5	✓	135	92
✓	6	✓	139	95
52.73	8	✓	131	89
✓	7	✓	134	91
48.73	5	✓	137	93
			X = 134.1 PCF	X = 91

TABLE A-5 (Cont'd)

COMPACTION DATA

(TRENCH SECTION)

POST MILE	SHOULDER		FIELD DENSITY	RELATIVE * COMPACTION
	DIST FROM EDGE PAVT.	DIREC-TION	(WT./CU.FT.)	(%)
59.29	2.0	WB	132	90
✓	1.0	✓	135	92
✓	3.0	✓	122	83
59.50	1.0	✓	134	91
60.00	1.0	✓	136	93
✓	2.0	✓	124	84
✓	3.0	✓	122	83
60.29	2.0	✓	132	90
✓	1.0	✓	133	90
✓	3.0	✓	124	84
60.50	3.0	✓	124	84
✓	2.0	✓	140	95
✓	1.0	✓	127	86
60.70	3.0	✓	133	90
✓	2.0	✓	135	92
✓	1.0	✓	137	93
61.29	3.0	✓	133	90
✓	2.0	✓	137	93
✓	1.0	✓	129	88
			$\overline{X}$ = 131 PCF σ = 5.44 PCF	$\overline{X}$ = 89% R/C

TABLE No. A-6

ASTM - TOWED TRAILER SKID TEST RESULTS

TEST METHOD: ASTM E-274

Post Mile	Class	Test Speed	ASTM SN_{40} A	ASTM SN_{40} B	Remarks
59.00	Shoulder	40	59	54	50/50 Recycle (3.2% Asph.)
59.15	✓	✓	59	56	✓
59.30	✓	✓	60	57	✓
59.45	✓	✓	62	60	✓
59.60	✓	✓	63	61	✓
59.75	✓	✓	60	60	✓
50.00	Shoulder	40	66	63	50/50 Recycle (3.2% Asph.)
50.15	✓	✓	62	58	✓
50.30	✓	✓	61	58	✓
50.45	✓	✓	61	60	✓
50.60	✓	✓	62	58	✓
50.75	✓	✓	46	46	✓ (Dirt on Surface)
50.90	✓	✓	58	54	✓
51.05	✓	✓	61	58	✓
46.00	Shoulder	40	58	59	50/50 Recycle (3.5% Asph.)
46.15	✓	✓	56	53	✓
46.30	✓	✓	55	55	✓
46.45	✓	✓	58	54	✓
46.60	✓	✓	59	56	✓
46.75	✓	✓	62	57	✓
46.90	✓	✓	64	66	✓
47.05	✓	✓	60	62	✓

TABLE NO. A-6 (Cont'd)

ASTM - TOWED TRAILER SKID TEST RESULTS

TEST METHOD: ASTM E-274

Post Mile	Class	Test Speed	ASTM SN_{40} A	ASTM SN_{40} B	Remarks
51.00	Shoulder	40	47	50	50/50 Recycle (3.5% Asph.)
51.15	✓	✓	34	42	✓
51.30	✓	✓	49	49	✓
51.45	✓	✓	44	42	✓
51.60	✓	✓	49	48	✓
51.75	✓	✓	52	52	✓
51.90	✓	✓	54	54	✓
52.05	✓	✓	50	48	✓
53.00	Shoulder	40	61	56	70/30 Recycle (1.9% Asph.)
53.50	✓	✓	60	55	✓
53.60	✓	✓	55	55	✓
42.00	Shoulder	40	56	52	Conventional Mix (1/2" max. - 6.0% Asph.)
42.65	✓	✓	51	52	✓
42.80	✓	✓	59	58	✓
42.90	✓	✓	54	50	✓
43.10	✓	✓	61	58	✓
43.25	✓	✓	52	58	✓

STATE OF CALIFORNIA
BUSINESS AND TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

NOTICE TO CONTRACTORS PROPOSAL AND CONTRACT

FOR CONSTRUCTION ON

STATE HIGHWAY

IN

PLACER AND NEVADA COUNTIES,
ABOUT 18 MILES EAST OF COLFAX,
FROM 0.4-MILE WEST OF GOLD RUN
OVERCROSSING TO 0.7-MILE WEST OF
HAMPSHIRE ROCKS UNDERCROSSING;
DISTRICT 03, ROUTE 80.

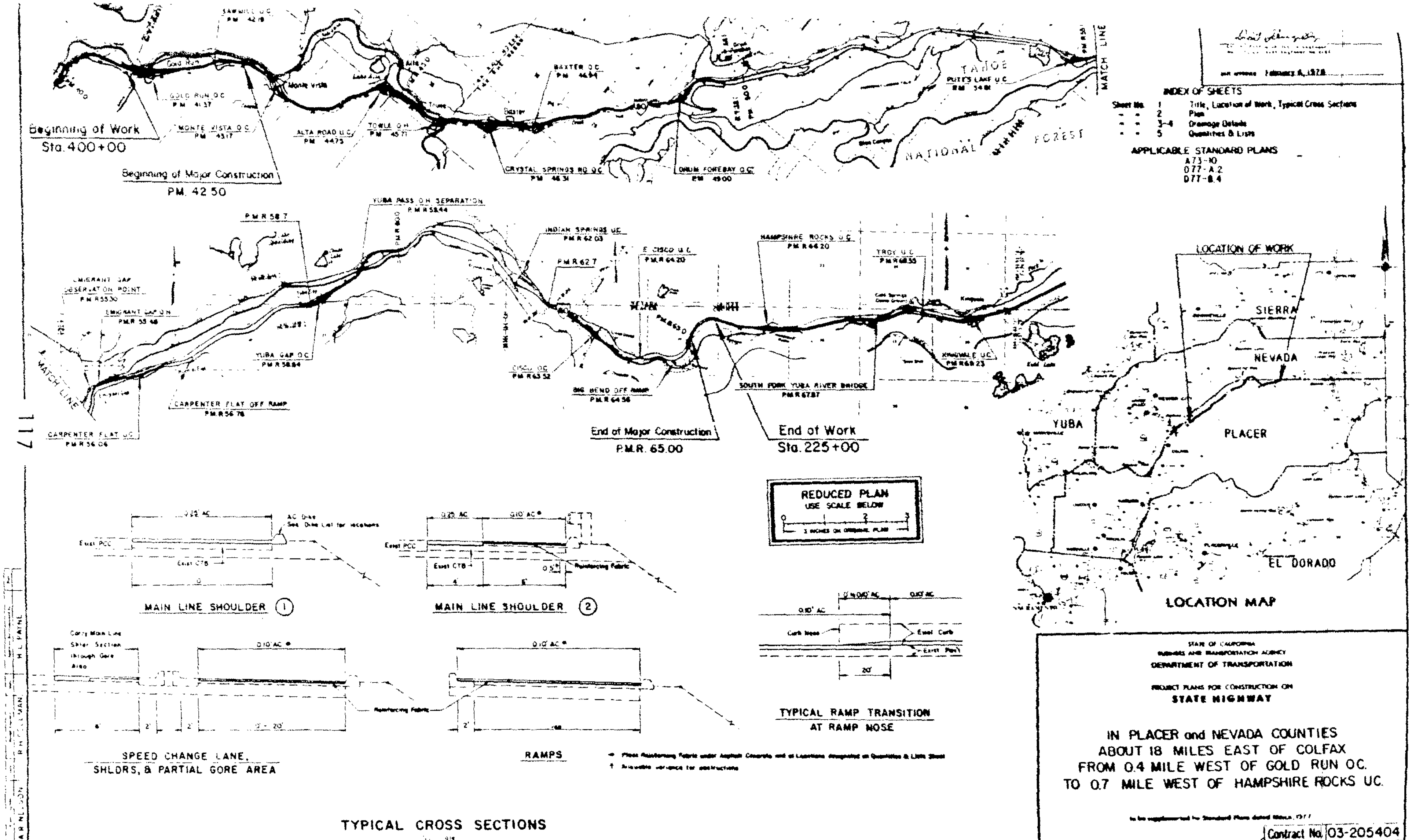
For Use in Connection with Standard Specifications Dated January, 1978, Standard Plans Dated March, 1977, Standard Specifications For Welding Structural Steel Dated January, 1978, General Prevailing Wage Rates Dated March, 1978 and Labor Surcharge And Equipment Rental Rates.

CONTRACT NO. 03-205404

03-PLA-80-41.0/R58.7
03-NEV-80-R58.7/R62.7
03-PLA-80-R62.7/R65.5

Federal Aid Project
IR-080-4(64)140
OFCC Identification No.
Sac-DOT(H)-3-78-166

Bids Open: APRIL 12, 1978



Beginning of Work
Sta. 400+00
Beginning of Major Construction
PM 42.50
GOLD RUN O.C.
PM 41.37
MONTE VISTA O.C.
PM 43.17
ALTA ROAD U.C.
PM 44.73
TOWLE O.H.
PM 45.71
CRYSTAL SPRINGS RD O.C.
PM 46.31
BAXTER O.C.
PM 46.94
DRUM FOREBAY O.C.
PM 49.00
PUTTS LAKE U.C.
TAHOE
NATIONAL
FOREST
MATCH LINE
INDEX OF SHEETS
Sheet No. 1 Title, Location of Work, Typical Cross Sections
2 Plan
3-4 Drainage Details
5 Quantities & Lists
APPLICABLE STANDARD PLANS
A73-10
D77-A2
D77-B4
EMIGRANT GAP OBSERVATION POINT
P.M.R 55.30
EMIGRANT GAP O.H.
P.M.R 55.48
YUBA GAP O.C.
P.M.R 58.84
P.M.R 58.7
YUBA PASS O.H. SEPARATION
P.M.R 58.44
INDIAN SPRINGS U.C.
P.M.R 62.03
P.M.R 62.7
E. CISCO U.C.
P.M.R 64.20
HAMPSHIRE ROCKS U.C.
P.M.R 66.20
TROY U.C.
KINGVALE U.C.
P.M.R 68.23
CISCO O.C.
P.M.R 63.52
BIG BEND OFF RAMP
P.M.R 64.56
SOUTH FORK YUBA RIVER BRIDGE
P.M.R 67.87
CARPENTER FLAT OFF RAMP
P.M.R 56.76
CARPENTER FLAT U.C.
P.M.R 56.06
End of Major Construction
P.M.R. 65.00
End of Work
Sta. 225+00
LOCATION OF WORK
SIERRA
NEVADA
YUBA
PLACER
EL DORADO
LOCATION MAP
REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN
AC Dike
See Dike List for locations
Exist PCC
Exist CTB
Reinforcing Fabric
MAIN LINE SHOULDER (1)
MAIN LINE SHOULDER (2)
Carry Main Line Shldr Section through Gore Area
Reinforcing Fabric
SPEED CHANGE LANE, SHLDRS, & PARTIAL GORE AREA
RAMPS
Curb Nose
Exist Curb
Exist Pav't
20'
TYPICAL RAMP TRANSITION
AT RAMP NOSE
TYPICAL CROSS SECTIONS
STATE OF CALIFORNIA
BUSINESS AND TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION
PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN PLACER and NEVADA COUNTIES
ABOUT 18 MILES EAST OF COLFAX
FROM 0.4 MILE WEST OF GOLD RUN O.C.
TO 0.7 MILE WEST OF HAMPSHIRE ROCKS U.C.
Contract No. 03-205404

[illegible]	Plo. Bay.	[illegible]	[illegible]	5	5

February 6, 1978

OUTER SHOULDER REHABILITATION — EASTBOUND

Post Mile	Length Miles	Remove AC 10 Ft.	Remove AC Inside 4 Ft.	Remove AC Outer 6 Ft.	Pavement Reinf. Fabric Width 6 Ft.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals*		[illegible]	[illegible]	58,391	19,005

*T tals Transferred to Total Quantities for Rehabilitation List

OUTER SHOULDER REHABILITATION — WESTBOUND

Post Mile	Length Miles	Remove AC Various Widths 10 Ft.	Inside 4 Ft.	Outer 6 Ft.	Pavement Reinf. Fabric Width 6 Ft.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals*		[illegible]	[illegible]	61,705	17,073

TOTAL QUANTITIES FOR REHABILITATION

Description	Remove AC 0.25' Thick	Liquid Asphalt Prime Coat	Remove AC 0.10 Thick	Asphaltic Emulsion Paint Binder	Pavement Reinforcing Fabric	Paving Asphalt Paint Binder	Recycle Asphalt Concrete	Aggregate (Type B AC) 1" Max	Paving Asphalt Asphalt Concrete
	CY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS
EB Outer Shoulder	6,376	79.78	58,391	44.29	19,005	26.26	15,871	4,492	540.40
WB Outer Shoulder	5,826	71.00	61,705	47.72	17,073	21.90	13,463		495
WB Median Shoulder	1,067	13.59	19,571	13.59			1,433		109
Ramp and Gore	77	0.96	38,490	29.36	20,338	24.23	9,182		296
AC Dike				0.19				145	10
Roadside DI								8	2
Median DI								42	4
Total	13,346	167.85	178,157	139.15	56,416	72.39	44,000	108	1,435.40

* EB Mainline Shoulder PM 42.5/43.33

REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

MEDIAN SHOULDER REHABILITATION — WESTBOUND

Post Mile	Length Miles	Remove AC Various Widths 0.25' 10 Ft.	0.25' Inside 4 Ft.	0.10' Outer 6 Ft.
		CY	CY	SY
52.53 to 53.96	1.10		137	2,386
54.86 – 55.86	1.00		165	2,937
54.86 – 55.86	1.00		196	3,320
55.66 – 61.86	2.00		393	7,118
Total*			1,067	14,571

Removal Inlet

Median EA	Roadside EA	Ramp EA	Post Mile	Raise Inlet	Place AC Misc. Area (SY)
		1	EB 46.40	6"	18
	1		EB 52.80		11
	1		EB 54.30	12"	11
		1	EB 59.97		18
	1		EB 63.40	6"	11
	1		WB 43.08		11
	1		WB 43.76		11
	1		WB 43.36		11
	1		WB 46.97		11
	1		WB 49.84		11
	1		WB 55.88		11
	1		WB 65.55		11
61			42.50 to 52.82		970
Total 61	10	2			1,122 SY

RAMP & GORE QUANTITIES

	Post Mile	Remove AC 0.25 Thick	Liquid Asphalt Prime Coat	Remove AC 0.10 Thick	Asphalt Emulsion Paint Binder	Pavement Reinforcing Fabric	Paving Asphalt Paint Binder	Recycle Asphalt Concrete	Paving Asphalt Asphalt Concrete
		CY	TONS	SY	TONS	SY	TONS	TONS	TONS
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	77	0.96	[illegible]	[illegible]	[illegible]	[illegible]	826	26
Totals		77	[illegible]	38,490	[illegible]	[illegible]	[illegible]	[illegible]	296

ASPHALT CONCRETE DIKE (TYPE A)

Post Mile	Place Dike LF
WB 50.52/50.58	211
WB 58.43/58.69	211
WB 58.16/58.32	456
WB 58.40/58.22	711
WB 60.73/60.90	898
EB 60.94/60.77	898
EB 61.45/61.33	593
EB 63.62/61.33	863
Total	4,647

QUANTITIES AND LISTS

Except as otherwise provided, full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing existing roadbed as shown on the plans, as specified herein, and as directed by the Engineer shall be considered as included in the contract price paid for the material to be placed on the existing roadbed.

10-1.05B REMODEL INLETS.--Existing drainage inlets shall be remodeled as shown on the plans.

Portland cement concrete shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications, or may be produced from commercial quality aggregates and cement containing not less than 564 pounds of cement per cubic yard.

Existing frames and covers shall be removed and disposed of.

The contract unit price paid for remodel inlet shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in remodeling inlets, including removing portions of inlets, bar reinforcing steel, concrete, structure excavation and structure backfill, removing and disposing of old frames and covers, and furnishing and installing new frames and grates, as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.05C REMOVE ASPHALT CONCRETE SURFACING.--Existing asphalt concrete surfacing shall be removed at the locations and to the dimensions shown on the plans and in accordance with these special provisions.

Attention is directed to "Order of Work" in these special provisions.

When the depth of asphalt concrete to be removed is 0.25-foot, the asphalt concrete, at the option of the Contractor, may be removed either by planing as specified in "Planing Asphalt Concrete Pavement" of these special provisions, or by any other method that does not damage the cement treated base. In the latter case, the asphalt concrete shall be cut full depth to neat longitudinal lines prior to the start of removal operations. The asphalt concrete to remain in place and the portland cement concrete pavement shall not be damaged in any way.

When the depth of asphalt concrete to be removed is 0.10-foot, the asphalt concrete shall be removed by planing or by milling.

The asphalt concrete material removed from the roadway shall be immediately removed from the site. Material that is in excess of the amounts required for recycling shall be disposed of in accordance with the following procedures.

Asphalt concrete material removed by planing or by milling that is in excess of the amount required for recycling shall be salvaged, transported and stockpiled at Disposal Site No. 1 shown on the plans.

Asphalt concrete material, removed by methods other than planing, or milling that is in excess of the amount required for recycling on this project, at the option of the Contractor, may be disposed of:

1. As provided in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

or

2. At Disposal Site No. 2 (optional) shown on the plans. If the Contractor elects to utilize Disposal Site No. 2, he shall maintain existing drainage through the site, and shall leave the site in a neatly graded, well drained condition.

Full compensation for salvaging, loading, transporting and stockpiling the removed asphalt concrete material, including excess material, shall be considered as included in the contract prices paid per cubic yard for remove asphalt concrete (0.25-foot) and per square yard for remove asphalt concrete (0.10-foot).

Removing asphalt concrete, 0.25-foot in depth, will be measured by the cubic yard. The quantity to be paid for will be the theoretical quantity, calculated from dimensions shown on the plans.

Removing asphalt concrete, 0.10-foot in depth, will be measured by the square yard. The quantity to be paid for will be the actual area of original surface planed.

The contract price paid per cubic yard for remove asphalt concrete (0.25-foot) shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals and for doing all work involved in removing and disposing the asphalt concrete surfacing as shown on the plans, as specified in these special provisions and as directed by the Engineer.

The contract price paid per square yard for remove asphalt concrete (0.10-foot) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in planing asphalt concrete and disposing of material removed, as shown on the plans, as specified in these special provisions and as directed by the Engineer.

10-1.05D PLANING ASPHALT CONCRETE PAVEMENT.--Existing asphalt concrete shall be planed at the locations and to the dimensions shown on the plans and in accordance with these special provisions.

Planing asphalt concrete pavement shall, at the option of the Contractor and subject to approval of the local Air Pollution Control Officer, be performed by either cold planing, milling, or heater planing.

The cold planing or milling machine shall have a cutter head at least 30 inches wide and shall be operated so as not to produce fumes or smoke.

The heater planing machine shall have, in combination or separately, a means for heating and cutting the asphalt concrete surface and blading the displaced material into windrows in one continuous forward motion. The cutting width of the blade shall not be less than 3 feet.

Heat shall be applied uniformly to the area to be planed and shall be accurately controlled according to conditions and road surfacing being planed.

Heater planing operations shall not be carried on at any time where, if an open flame is used in the heater, there is danger of igniting entrapped gases from sewers or gas mains.

Heater planing will be considered as "Open Burning" as mentioned in "Fire Plan", of these special provisions.

The depth, width and shape of the cut shall be as indicated on the typical cross sections or as directed by the Engineer. The final cut shall result in a uniform surface conforming to the typical cross sections. The outside lines of the planed area shall be neat and uniform. The road surfacing to remain in place shall not be damaged in any way.

Planing or milling asphalt concrete pavement will be measured and paid for as remove asphalt concrete (0.10-foot) or as remove asphalt concrete (0.25-foot) as specified elsewhere in these special provisions.

10-1.06 PAVEMENT REINFORCING FABRIC.--Pavement reinforcing ıbric shall be placed where shown on the plans, and at locations esignated by the Engineer.

Pavement reinforcing fabric shall be a non-woven polypropylene aterial available from the Phillips Petroleum Company.

Arrangements have been made to insure that any successful idder can obtain the pavement reinforcing fabric from the ollowing source:

Phillips Fibers Corporation
Petromat Marketing Department
Suite 735, Sherman Building
3031 Tisch Way
San Jose, CA 95128

The price per square yard for pavement reinforcing fabric shall be $0.55. This price does not include sales tax and is F.O.B. Seneca, South Carolina.

The above price will be firm for all orders placed through December 31, 1978.

Asphalt binder applied to areas designated by the Engineer for pavement reinforcing fabric shall conform to the provisions of Section 92, "Asphalts," of the Standard Specifications and shall be Grade AR-2000. It shall be applied according to the Standard Specifications and these special provisions.

Asphalt binder for pavement reinforcing fabric shall be applied at an approximate rate of 0.30-gallon per square yard of surface covered. The exact rate of application will be determined by the Engineer. The width of the asphalt binder spread shall be the width of the fabric plus 3 inches on each side. The fabric may be unrolled or hand placed over the asphalt binder.

Before spreading asphalt binder, large cracks, spalls and chuckholes shall be repaired as directed by the Engineer, and such repair work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

A small quantity of asphalt concrete, to be determined by the Engineer, may be spread over the fabric immediately in advance of placing asphalt concrete surfacing in order to prevent fabric from being picked up by construction equipment.

Full compensation for advance spreading of asphalt concrete over the fabric shall be considered as included in the contract prices paid per ton for recycle asphalt concrete or aggregate (Type B asphalt concrete) and paving asphalt (asphalt concrete) and no additional compensation will be allowed therefor.

If manual laydown methods are used, the fabric shall be unrolled, stretched, aligned, and placed in increments of approximately 30 feet.

Adjacent edges of the fabric shall be lapped 3 inches. The preceding roll shall lap 6 inches over the following roll in the direction of paving at ends of rolls or at any break. The fabric shall be placed as smoothly as possible. Wrinkles that are large enough to cause laps shall be cut.

Seating of the fabric with rolling equipment after placing will be permitted. Turning of the paving machine and other vehicles shall be gradual and kept to a minimum to avoid damage.

Public traffic shall not be allowed on the bare reinforcing fabric.

Paving asphalt Grade AR-2000 used as asphalt binder will be measured and paid for by the ton as paving asphalt (paint binder).

Pavement reinforcing fabric will be measured and paid for by the square yard for the actual pavement area covered.

The contract price paid per square yard for pavement reinforcing fabric shall include full compensation for furnishing all labor, materials (except binder), tools, equipment and incidentals and for doing all the work involved in furnishing and placing pavement reinforcing fabric, including lapping, complete in place, as shown on the plans as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.07 ASPHALT CONCRETE.--Asphalt concrete shall be Type B and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The measurement and storage requirements of Section 39-3, "Storing, Proportioning and Mixing Materials," of the Standard Specifications shall not apply to the dust collected in skimmers and expansion chambers (knock-out boxes) or to the dust collected in centrifugal (cyclone) collectors. Dust from these collectors may be returned to the aggregate without being measured or stored separately, provided the dust is returned uniformly at a point in advance of the sampling device in batch-mix and continuous pugmill mixing plants or between the sampling device and the drier-drum mixer in drier-drum mixing plants.

The first, second, third and fourth paragraphs in Section 39-5.02, "Compacting Equipment," of the Standard Specifications are amended to read:

> For each asphalt paver the Contractor shall furnish a minimum of one steel-tired roller weighing not less than 12 tons, one steel-tired roller weighing not less than 8 tons and one pneumatic-tired roller. Each roller shall have a separate operator. All rolling equipment shall be self-propelled and reversible. The minimum number, weight, and type of rollers required may be reduced or modified in accordance with the provisions of Section 39-6.03, "Compacting," for low rates of production or when alternative equipment is approved by the Engineer.

Paving asphalt to be used in Type B asphalt concrete shall be Grade AR 2000.

Thickness transitions of asphalt concrete to be placed over existing pavement shall be feathered out in the last 20 feet as shown on the plans or as directed by the Engineer.

The Contractor shall place only new asphalt concrete on the eastbound mainline shoulder between post mile 42.5 and post mile 43.33.

The miscellaneous areas to be paid for at the contract price per square yard for place asphalt concrete (miscellaneous area) in addition to the prices paid for the materials involved shall be limited to the areas listed on the plans.

The subgrade to receive asphalt concrete (miscellaneous area) shall not vary more than 0.05-foot above or below the grade established by the Engineer.

The aggregate for Type B asphalt concrete shall conform to the 1/2" maximum, medium grading specified in Section 39-2.02, "Aggregate," of the Standard Specifications.

Full compensation for all grading involved in placing asphalt concrete miscellaneous areas, shall be considered as included in the contract price paid per square yard for place asphalt concrete (miscellaneous area) and no additional compensation will be allowed therefor.

At the Contractor's option, paving asphalt may be used for paint binder instead of asphaltic emulsion. If paving asphalt is used, the grade to be used and the rate of application will be determined by the Engineer. The paving asphalt shall be applied at a temperature of not less than 285° F. nor more than 350° F. Paving asphalt used as paint binder, will be measured and paid for as asphaltic emulsion (paint binder).

10-1.08 RECYCLE ASPHALT CONCRETE.--Recycle asphalt concrete shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and the following special provisions.

Recycle asphalt concrete shall consist of a mixture of cold salvaged asphalt concrete material, hot Type B asphalt concrete aggregate, and hot paving asphalt.

Only asphalt concrete removed and salvaged from this project will be allowed for use in the manufacture of recycle asphalt concrete. Cost reduction proposals substituting new asphalt concrete material for recycle asphalt concrete will not be accepted.

The gradation of the salvaged asphalt concrete shall be reasonably uniform from fine to coarse with 100 percent passing the 1-inch sieve.

The Contractor may stockpile salvaged asphalt concrete prior to recycling. The stockpile areas shall be cleared of debris and organic material to the satisfaction of the Engineer. Contamination and segregation of material within such stockpiles will not be allowed.

The moisture content of the salvaged asphalt concrete at the time of introduction into mixer shall not exceed 3 percent as determined by Test Method No. Calif. 310, 311 or 370.

New aggregate to be combined with the salvaged asphalt concrete shall conform to the 1/2 inch maximum medium grading and to the quality requirements for aggregate for Type B asphalt concrete specified in Section 39-2.02, "Aggregate," of the Standard Specifications.

The temperature to which the new aggregate is heated may exceed 325° F, but shall not exceed, in the opinion of the Engineer, the temperature which would damage the paving asphalt when salvaged asphalt concrete and the new aggregate is combined.

The cold salvaged asphalt concrete, the hot new Type B asphalt concrete aggregate, and the hot paving asphalt shall be combined and mixed using either a batch plant or a drier drum type plant. The requirements in Section 39-3.01, "Storage," and 39-3.02, "Drying," of the Standard Specifications will not apply to the cold salvaged asphalt concrete. Positive control of the amount of each ingredient entering the mix shall be provided.

The amount of hot new Type B asphalt concrete aggregate to be added to the cold salvaged asphalt concrete shall be between 45 and 55 percent of the total weight of the combined materials as directed by the Engineer.

A conventional hot batch plant may be modified to feed the cold salvaged asphalt concrete to the weigh hopper of the batch plant. If a batch plant is used the cold salvaged asphalt concrete shall be weighed and deposited in the pugmill first. The hot Type B asphalt concrete aggregate shall be weighed and deposited in the pugmill second. These two materials shall be mixed "dry" for a minimum of 20 seconds before paving asphalt is introduced into the pugmill. Upon completion of the "dry" mixing, as stated above, paving asphalt, Grade AR-2000 and conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications, shall be introduced into the pugmill, and the resulting combination of materials shall be mixed for a minimum of 30 seconds.

If a drier-drum type of plant is used, the cold salvaged asphalt concrete shall be introduced into the drier-drum and combined with the new Type B asphalt concrete aggregate in such a manner that the salvaged asphalt concrete is protected from direct contact with the burner flame by a positive protective device such as a shield, separator, second drum, or other device acceptable to the Engineer. Grade AR-2000 paving asphalt conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications shall be added to the mixture in the drum after the salvaged asphalt concrete and the new Type B asphalt concrete aggregate have been combined.

Attention is directed to Section 39-3.06, "Asphalt Plants," of the Standard Specifications, requiring compliance with Air Pollution standards.

In lieu of the requirements of the first paragraph of Section 39-3.04, "Mixing," of the Standard Specifications, asphalt extraction tests will be performed at least twice daily on salvaged asphalt concrete just prior to entering the mixer and on the final mix. The sample of slavaged asphalt concrete will be taken just prior to sampling the final mix so that the sample will be representative of the salvaged asphalt concrete in the final mix. The amount of new asphalt in the completed mix, according to results of extraction tests, shall not vary more than ± 10 percent from the amount designated by the Engineer. Test Method No. Calif. 310 or 362 shall be used for determining asphalt content extraction.

Unless lower temperatures are directed by the Engineer, recycled asphalt concrete shall be spread and the first coverage of the breakdown compaction shall be performed when the temperature of the mixture is not less than 230° F.

The exposed edge of the portland cement concrete pavement, and all areas which will receive recycled asphalt concrete surfacing, shall be cleaned of all loose material prior to applying bituminous paint binder or prime coat thereto.

Recycled asphalt concrete will be measured by weight. The quantity to be paid for will be the weight of the salvaged asphalt concrete combined with the new Type B asphalt concrete aggregate to produce a combined item, recycle asphalt concrete. The quantity of recycled asphalt concrete to be paid for will be the weight of the completed mixture less the calculated weight of paving asphalt added.

The quantity of paving asphalt to be paid for will be the weight of the paving asphalt as determined by multiplying the weight of the completed mixture by a factor of X/(100 + X) where X is the ordered added paving asphalt content expressed as a percent of the recycled asphalt concrete.

The contract price paid per ton for recycle asphalt concrete and per ton for paving asphalt shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in recycling asphalt concrete, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

CMI ROTO-CYCLER™

CMI Corporation, Oklahoma City, Oklahoma has developed a high production drum mix recycling plant called a ROTO-CYCLER. It is a versatile, clean plant which produces hot mixes from either all new material or from a blend of up to 70% reclaimed material and 30% new material. Current ROTO-CYCLER models are available in production sizes from 160 T.P.H. to 450 T.P.H.

The Production-Pollution Dichotomy

The most stubborn obstacle to the development of a high production hot mix recycling plant has been pollution. Various methods of indirect heating eliminated contact of reclaimed material with the burner flame, but the cure resulted in dramatic production losses, which were worse than the disease. In addition, the modifications which permitted the indirect heating of reclaimed material drastically cut the production capabilities of the plants for normal mixes from all new material. Switching from one mode to the other meant several days of removing or adding special modifications.

With the ROTO-CYCLER, CMI has introduced a plant which solves the production pollution dichotomy. The solution is both simple and complex.

Flop Gate Entry

The simple aspect to the CMI ROTO-CYCLER is the dual feeds, which permits separate entry of new and reclaimed material. New material enters at the standard drum mix inlet. Reclaimed material is added down stream at the burner eliminating contact with the flame. The entry mechanism is a flop gate arrangement shrouded with a metal collar (Zone (C) on the attached drawings). The gates can be easily and quickly locked shut when the plant is scheduled for a long run of standard production; or the plant can be switched from standard to recycled production and back in a continuous operation when supplying hot mix for a job that requires both standard and recycled mixes.

Vari-Flight™ Heat Transfer

The complex aspect of the ROTO-CYCLER is an advanced flighting design called Vari-Flight which maximizes the heat transfer from the burner to the new material and from the new material to the reclaimed material. By varying the flight design and arrangement throughout the length of the drum, CMI engineers have created several distinct zones with varying material densities and heat transfer properties. The attached drawings illustrate the different flighting arrangements and material densities.

Zone (A) includes the area of the burner flame. It has two types of flighting, a small L shape flight which begins a few inches into the zone and a large slotted flight with saw tooth edges. The slots and jagged edges permit the virgin aggregates to tumble through the flame much longer than the conventional drum mix plants. This added retention in the flame area begins a super heating process which continues in Zone (B). The flighting in Zone (B) is identical to that in (A) except that the small flights run the entire length of the zone.

The ROTO-CYCLER flop gate entry system is in Zone (C). Here the reclaimed material joins the super heated virgin materials and the recycling process begins.

The flighting in Zone (D) is identical to the large slotted flights in (A) & (B), but because of the addition of the reclaimed material, Zone (D) has the most dense material flow of any section of the drum. Here the reclaimed material is thoroughly mixed with the superheated virgin material resulting in a fast, even transfer of heat from the new to the reclaimed material.

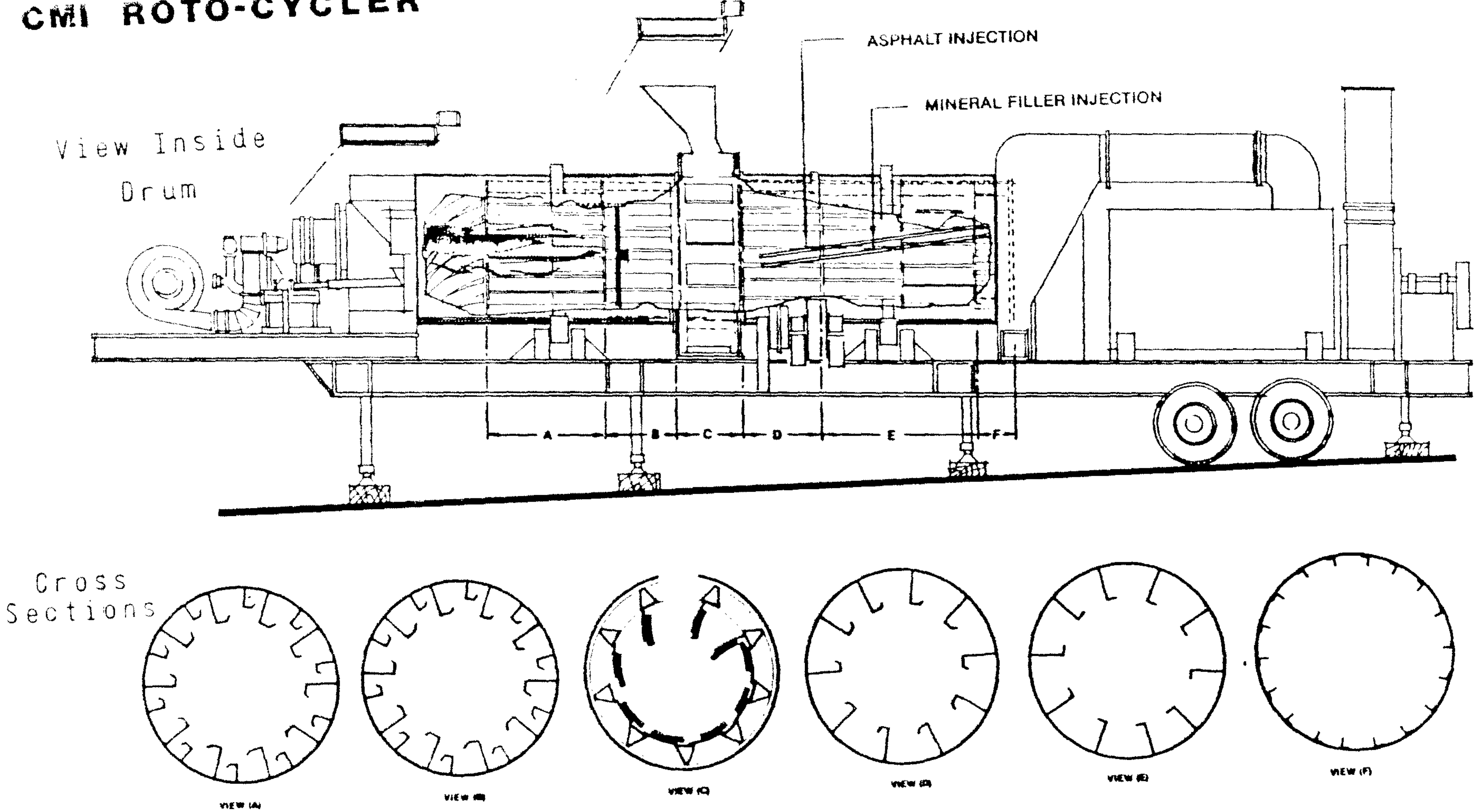
Injection of the liquid asphalt and any needed mineral fillers also takes place in Zone (D).

Zone (E) contains a transitional flight design and arrangement which continues to mix the new and reclaimed material, but speeds the flow of the mix towards Zone (F) and the exit shut.

Bolt-On Flighting

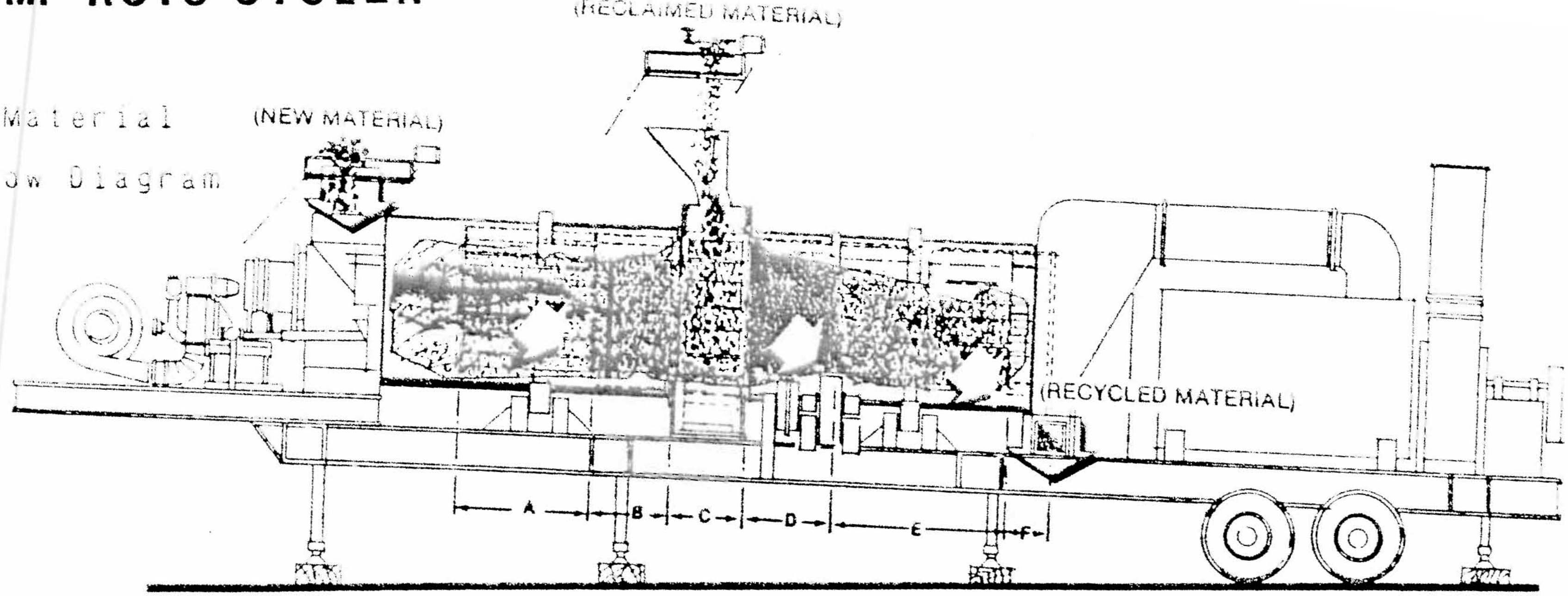
CMI ROTO-CYCLERS feature bolt-on flighting which can be quickly changed if necessary to meet the varying demands of different percentages of recycled blends and different mix designs for new material production. This feature insures that no sacrifice in production need accompany any recycling or standard production job.

CMI ROTO-CYCLER™

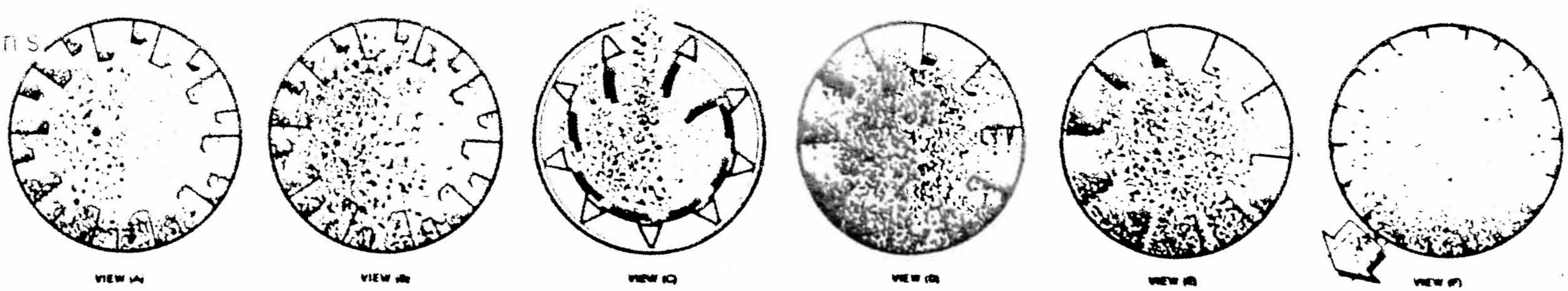


CMI ROTO-CYCLER™

Material Flow Diagram



Cross Sections



127