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16. Abstract

The recycling of asphaltic concrete pavements by a hot process in conventional bituminous mix plants is in the development stage. A primary problem is the air pollution created by dust and burning of asphalt fines during heating of the crushed pavement in a conventional dryer or a dryer-drum plant. Design of mixtures to achieve a functional and durable bituminous pavement with recycled materials is also in the experimental stage. This report covers the testing and design methods as well as production, construction and the monitoring of efforts to reduce air pollution for material recycled through a dryer drum plant and utilized as a surface course in the lower Rio Grande Valley area of Texas.

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DEMONSTRATION PROJECTS DIVISION
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DEMONSTRATION PROJECT 1-9-76-524

RECYCLING ASPHALTIC CONCRETE PAVEMENT

by

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DISCLAIMER STATEMENT

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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ABSTRACT

The recycling of asphaltic concrete pavements by a hot process in conventional bituminous mix plants is in the development stage. A primary problem is the air pollution created by dust and burning of asphalt fines during heating of the crushed pavement in a conventional dryer or a dryer-drum plant. Design of mixtures to achieve a functional and durable bituminous pavement with recycled materials is also in the experimental stage. This report covers the testing and design methods as well as production, construction and the monitoring of efforts to reduce air pollution for material recycled through a dryer drum plant and utilized as a surface course in the lower Rio Grande Valley area of Texas.

Figure 1. A typical Farm to Market Road in the Lower Rio Grande Valley area. Palm trees were planted to line these roads many years ago.

INTRODUCTION

Early in 1974, as the critical effects of inflation, material and energy shortages were growing more obvious every day, the Texas Department of Highways and Public Transportation initiated a project entitled Project 214, "Engineering, Economy and Energy Considerations in Design, Construction and Materials". As the title suggested it was intended to study any area of possible conservation of money, material and energy. Obviously the concept of recycling, in a very broad sense, was one of the most fertile areas to study and to encourage experimental work to consider utilization of salvaged materials. The work in other States has been monitored with interest and Texas has been very active in all areas of experimental recycling work. One of the first trials in the United States of hot recycling of asphaltic concrete materials through a dryer-drum plant took place in 1974 in our District 21 near McAllen, Texas. A very small amount of material was processed, but this first trial and the indication of possible successful recycling led to the project to be reported herein.

As can be seen from the following photographs there was no lack of interest and expertise among the visitors present on this project. (Figures 2 thru 12) For the affiliations of those not indicated, please see listing in the Appendix.

Figure 2. District 21 experimental hot mixed asphalt overlay project on Old U.S. 83, west of Mission, Texas. The project utilized recycled asphalt pavement and base material which was removed from N. 10th St. in McAllen, Texas.

Figure 3. Manuel Aguirre discusses air pollution with Tom Hanna, District 21 Designing Engineer, and G. G. Garcia, District Engineer for District 21.

Figure 4. Wade Barnes, Asst. District Engineer and Jack Trammell, District Laboratory Engineer discuss progress of this plant operations.

Figure 5. Signing the roster at the plant the following were from left to right, Douglas Bernard, Ken Jacobs, Bill Foster, Porfirio Villalon, and Steve Beckett.

Figure 6. Tim Shearer from Boeing Co. of Seattle, Washington, was the inventor of this modification to the Dryer-Drum plant.

Figure 7. Bobby Moore, Bob Lindley, N. A. Billingsley and Wade Barnes

Figure 8. Charles Hughes, Tom Kennedy and Jon Epps observe the lay down of the recycled HMA.

Figure 9. Douglas Bernard, Steve Beckett, Harry Goss, Sim Giles, Arthur Hill, Chuck Looney, and M. Israel observe modification during the welding of a new opening for the return dust line to the dryer drum.

Figure 10. The Barber-Greene group from Aurora, Ill. (B. M. Bonnell and Bill Tillman are at the right side of the group.)

Figure 11. M. Israel, employee of Motheral Contractors and John Nixon observe a large plume that developed during the use of flux oil in the recycling of the old pavement before proper adjustment was made.

Figure 12. Mr. Harry Goss of WEGO Corp. discusses modifications with Chuck Looney from the Boeing Co.

PROJECT HISTORY

This experimental project was unique and demonstrated what can happen when the several different interests involved in the highway business get their heads together to get a job done. Our District 21 in the Rio Grande Valley part of South Texas was the prime mover in this project. With the active help of Motheral Contractors, Inc., Boeing Construction Equipment Company, various material suppliers and several Divisions within the State Department of Highways and Public Transportation (SDHPT) as well as the Demonstration Projects Division, Region 15 of the Federal Highway Administration (FHWA), Texas Transportation Institute of Texas A&M (TTI), University of Texas Center for Highway Research (CFHR), Texas Air Control Board and many others, this project was conceived, planned and implemented in a remarkably short period of time.

The salvaged asphaltic material was removed from Texas State Highway 336 in Hidalgo County during construction on an active project. The thickness of the salvaged material averaged about 2.5 inches. Information from construction records on State Highway 336 indicated the pavement section contained hot mix asphaltic concrete and chip or aggregate seal coats as surface treatments. Details are shown in Table I on the following page.

The recycled material was scheduled as an overlay of about 1.5 inches for Loop 374 between FM 2062 and US 83 for a distance of about 1.5 miles. Just prior to the overlay the skid number at forty miles per hour was 0.26; the serviceability index as obtained from Mays Meter surveys was 1.0 and the "Pavement Rating Score" was 72. This score, which is a number calculated

TABLE I
MATERIAL INFORMATION

Date of Construction	Surface Type	Materials
June, 1955	Two Course Surface Treatment	
	1st Course	Asphalt OA-135 - Humble Oil & Refining, Baytown, Texas @ 0.128 gallons per square yard Aggregate - Uvalde Rock Asphalt Precoat Grade 1 @ 1 cubic yard per 40 square yards
	2nd Course	Cutback Asphalt MC-1 - Humble Oil & Refining, Baytown, Texas, @ 0.154 gallons per square yard. Aggregate - Uvalde Rock Asphalt Precoat Grade 4 @ 1 cubic yard per 110 square yards
September 1959	Hot Mix Asphaltic Concrete, Texas Type D @ 125 lbs/sq.yd. or about 1.2 inches	Asphalt - OA-90, Southwestern Refinery, Corpus Christi Tack - RC-2, Southwestern Refinery, Corpus Christi % Asphalt = 6.0% Tack Coat = 0.031 gal/sq.yd. Aggregate - Caliche from Beck Pit
October 1964	One Course Surface Treatment	Asphalt - AC-10 - Gulf States, Corpus Christi @ 0.32 gal/sq.yd. Aggregate - Siliceous gravel, Grade 5, Fordyce Co., Sullivan City @ 1 cu.yd/120 sq.yd.

from a roadway visual survey system reported in Research Study 2-18-71-151 in September, 1974 by TTI, indicates road condition on a scale of 100 to 0 with 100 being a perfect condition. The score on this section of Loop 374 indicated the rather severe cracking of all types present as well as a badly deformed section.

TESTING AND EVALUATION

Since this was one of the first opportunities to design a testing program for a recycling project, considerable effort was expended to coordinate sampling, testing and evaluation. It was a cooperative effort between the District 21 personnel, the Texas Transportation Institute, the University of Texas Center for Highway Research and the Materials and Tests Division of the Department. The general plan followed is outlined below. The specific data which is rather voluminous may be found in the Appendix.

Task A - Obtain field samples - District 21 personnel

1. 3 samples from 3 different points along the pavement to be recycled. Samples to be approximately 100 lbs each and to include total thickness to be processed through the plant.

2. 3 sets of 3-4" diameter cores from same location as (1) above.

   All samples to D-9 Austin.

Task B - Initial Testing - D-9 Laboratory

1. Extraction to Determine: % Asphalt
   Gradation

2. Recover asphalt: Penetration
   Ductility
   Viscosity

3. Blend additives in various percentages with recovered asphalt and perform:
   Penetration
   Ductility
   Viscosity
   Test residues from thin film oven test

Task C - Mixture Design - D-9 Lab

1. Crushed samples of old asphaltic concrete pavement to approximate size anticipated from field operations or where possible obtain field crushed material.

2. Blend additives and/or asphalt with crushed material at determined %.

3. Mold Hveem Specimens (6)
   Test (3) for stability
   density
   Cohesiometer

4. Extract asphalt, recover asphalt (from 3 specimens tested and run tests as noted in Task B - No. 3.

5. Resilient Modulus - TTI & UT
   & Fatigue Tests
   & Split Tensile
   D-9 to furnish 3 Hveem specimens of each trial and sufficient loose mixture for molding fatigue specimens.

6. Evaluate all tests and recommend mix design - D-9
   TTI
   UT

Task D - Field

1. Preconstruction - District 21
   a. Dynaflect
   b. Skid number of pavement to be recycled
   c. Visual pavement rating on section to be overlayed

2. During Construction - D-9, TTI & District 21
   a. Extractions — Stockpile samples
      Production samples
   b. Temperatures during mixing
      laydown
      compaction
   c. Hveem Specimens
   d. Loose mix samples - 3 - 100#/day (for Resilient Modulus, fatigue, split tensile asphalt tests, etc.)
   e. Nuclear densities (establish rolling pattern & control)
   f. Actual pavement densities
   g. Cores (3 locations, 3 sets)
   h. Polish values on pavement cores and samples

Task E - Post Construction - District 21

1. Skid values

2. Dynaflect

3. Pavement rating

The extracted asphalt from samples of the old pavement indicated a very hard oxidized asphalt with a penetration of 9 at 77°F. Asphalt content of samples ranged from about 6.8 to 7.4 percent. This amount of asphalt is somewhat misleading since the rock asphalt material in one of the layers would cause an apparent higher asphalt content due to the asphalt naturally impregnated in the rock. The limestone rock asphalt could also cause lower penetration on recovered asphalt. Cores were tested for Hveem stability, Marshall stability and flow and by the Schmidt test for the Resilient Modulus. A study of these data in the Appendix will show that the lab molded samples without additives were significantly stiffer than the field cores probably due to air void content and the reheating necessary for molding. The lab molded specimens served as a basis for comparing the effect of the three additives on stiffness. Fatigue testing was performed in a controlled stress mode which generally indicates higher fatigue strength for stiffer mixtures. Since controlled stress tests for fatigue strengths are generally more applicable to thick pavement sections it was necessary to exercise some judgment as to the need for more flexibility for the relatively thin overlay to be utilized in this project. Normally a controlled strain fatigue study would be a better indication for design of the flexible pavement with thin surfacing normally utilized in Texas.

The final decision for design of the recycled mix was based on several factors. The desire of the SDHPT to learn as much as possible from this study influenced the decision to try three different mixes and three trial sections. The first section was set up with an AC-3 asphalt. Tests indicated the salvaged material could tolerate added asphalt up to 2.5% by weight without loss

of stability. This asphalt, the highest penetration grade normally available, had very little effect on the properties of the old oxidized asphalt present in the salvaged material. Apparently when asphalt is as hard as that extracted from this old pavement, blending with high penetration material does not result in expected properties usually found with blending. The 2.5% mixture indicated about the same reduction in modulus as 1% flux oil or 1% Reclamite. Similarly the mixtures with 1% Reclamite, 1% flux oil, and 2.5% AC-3 had essentially the same fatigue lives. Tensile strength of the AC-3 mixture was slightly higher than that of the 1% flux oil or Reclamite mixtures.

The second section was designed with a flux oil specified in our Standard Specification Item 300 and normally used as a fluxing agent in the production of cold mix limestone rock asphalt mixtures. This additive oil did bring the penetration up to about 35 at 77°F when blended in the amount of 1.6% by weight. The stability of the mix was still acceptable at this flux oil content.

The third section was designed with a proprietary material called Reclamite and utilized the base oil from which the better known emulsified material is made. Tests indicated that this material was most effective in restoring the properties of the asphalt when blended with extracted asphalt from the old pavement. At 1.6% by weight, the penetration was about 43 at 77°F, the ductility 141+ and the viscosity was about 7,700 stokes at 140°F. Stabilities of this mix were about 10 points higher than the flux oil mixtures; however, since the mix appeared to be rather sensitive to small increments of additional material, 1.6% appeared to be the most desirable amount of this base oil.

The solution to the problem of air pollution in any trials of recycling has, of course, been of paramount importance. Fortunately in Texas, the Texas Air Control Board has been extremely interested and cooperative in any well planned efforts to solve this problem. In this instance they were fully advised in the initial planning stages and throughout the project. They were very helpful in making the necessary observations with trained personnel during actual operation of the plant recycling trials.

EQUIPMENT

The dryer-drum plant utilized in this recycling trial belonged to Motheral Contractors, Inc., and was located 2 miles north of US 183 and 2 miles west of FM 492 in Hidalgo County. It was manufactured by the Boeing Equipment Company (Model Number 400). The drum is about 9 feet in diameter and 38 feet in length and utilizes the Shearer process for mixing. Rated production capacity is about 400 tons per hour. The dust collection system is a dry centrifugal type with a provision for return of the fines to the dryer-drum during production. Asphaltic materials are added to the drum through a spray bar which may be inserted at variable distances into the drum. The plant has four cold bins of approximately 15 tons capacity each. A surge bin with about 150 tons capacity temporarily stores material during normal production.

The specific modifications made by Boeing were as follows:

1. A grid was fabricated from ceramic tubes and stainless steel rods and was mounted on a framework inside the drum. The distance of the grid from the burner flame could be adjusted by sliding the grid on the mounting frame system. At one time during production the grid was located about 11 feet from the burner and about six feet from the burner shroud. This arrangement placed the grid about 3.5 feet inside the drum from the burner end. (See Figures 13, 14, 15, 16 and 17.)

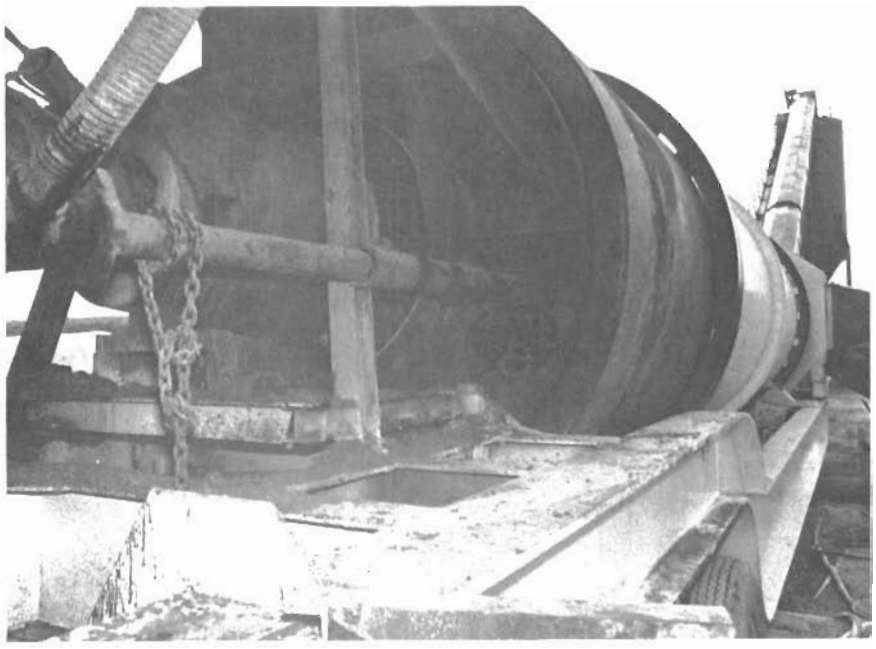

Figure 13. The modified end of the dryer drum shows the ceramic grid thru the port holes. Flexible pipe line connects to pipe feed to the dryer drum.

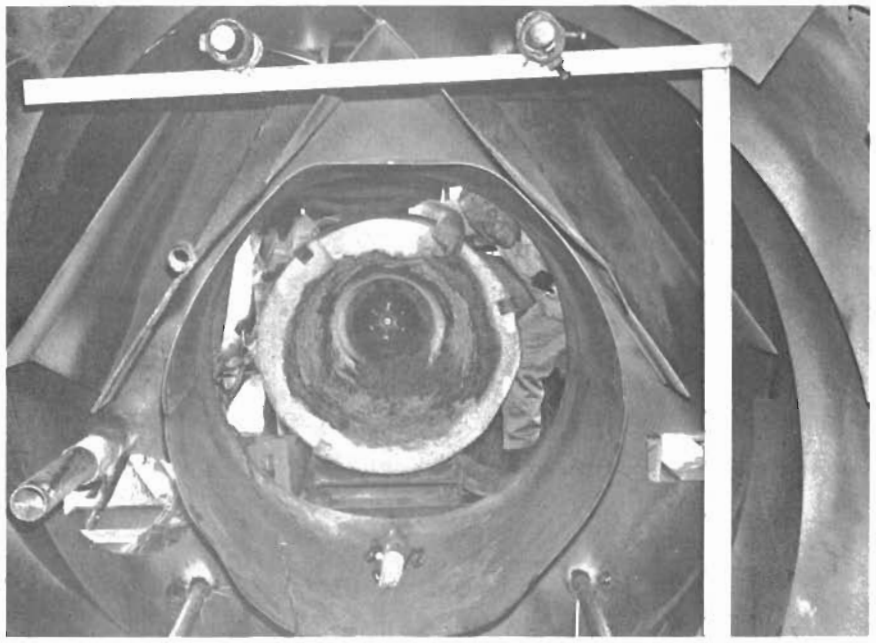

Figure 14. Interior view of burner end showing gas jet nozzle and protector cone. The stainless steel square frame will hold the ceramic grid when it is replaced prior to restarting operations.

Figure 15. Ceramic grid glows red under proper operations.

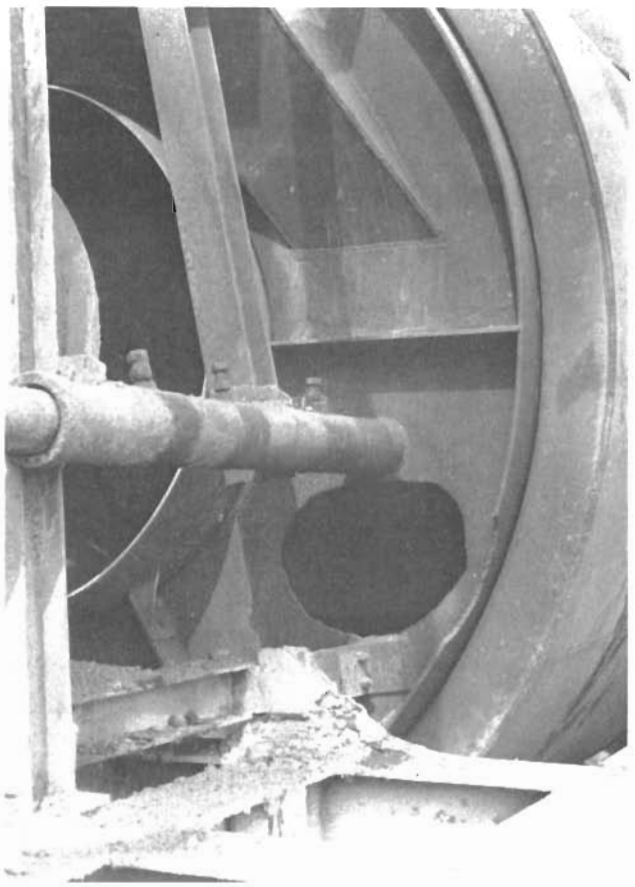

Figure 16. The outer-pipe with set-screws allows the inner-pipe to be adjusted for the flow of asphalt (Flux Oil, Reclamite, etc.) material at various positions within the dryer drum to aid in pollution control.

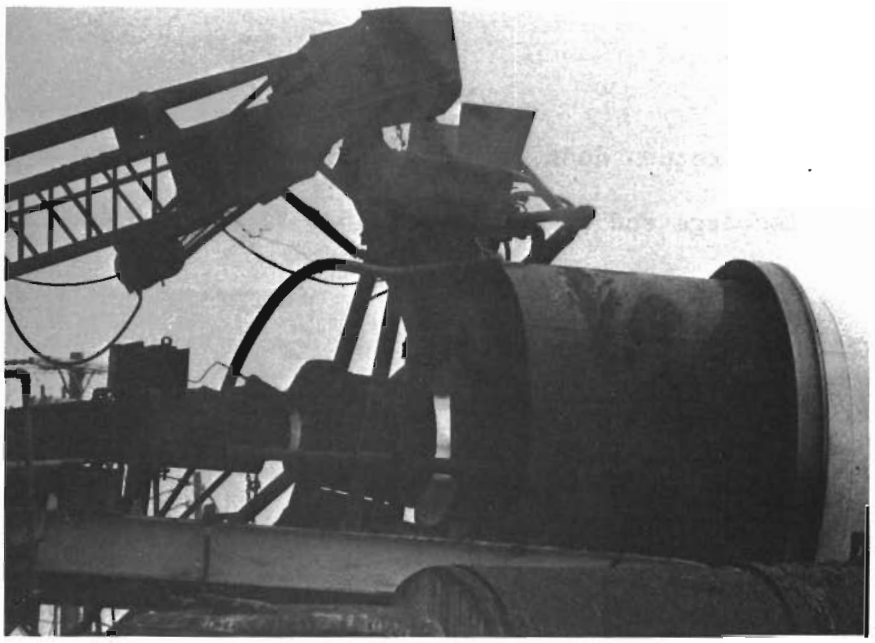

Figure 17. Crushed material from the belt drops into splitter hopper that feeds in on both sides of the flame area.

2. A water spray bar was added at the cold feed belt to moisten the material. (See Figure 18.)

Figure 18. The control box for change of direction of flow of material on conveyor belts.

3. The fines return duct from the dust collection system was moved to the discharge end of the drum. (See Figures 19 and 20.)

Figure 19. Dust collector system showing the main pipe to the stack and the larger particle return line to the materials output end.

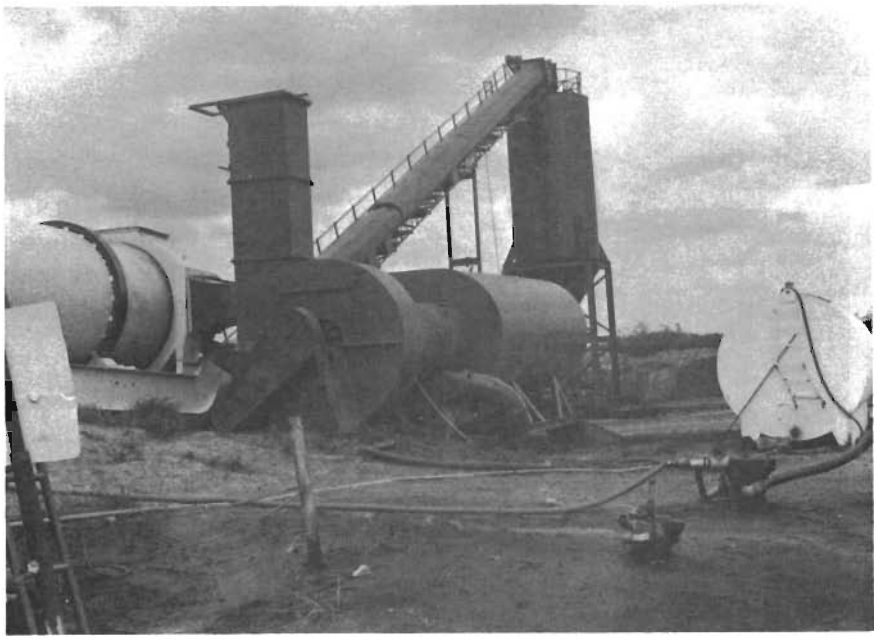

Figure 20. Overview of dust collector system and stack. Water is pumped through the blue hoses by a small pressure pump located near water tank trucks.

4. Fresh air flow through the drum and through the dust collection system was regulated by an adjusting door on top of the dust going to the dust collection system. (See Figure 21.)

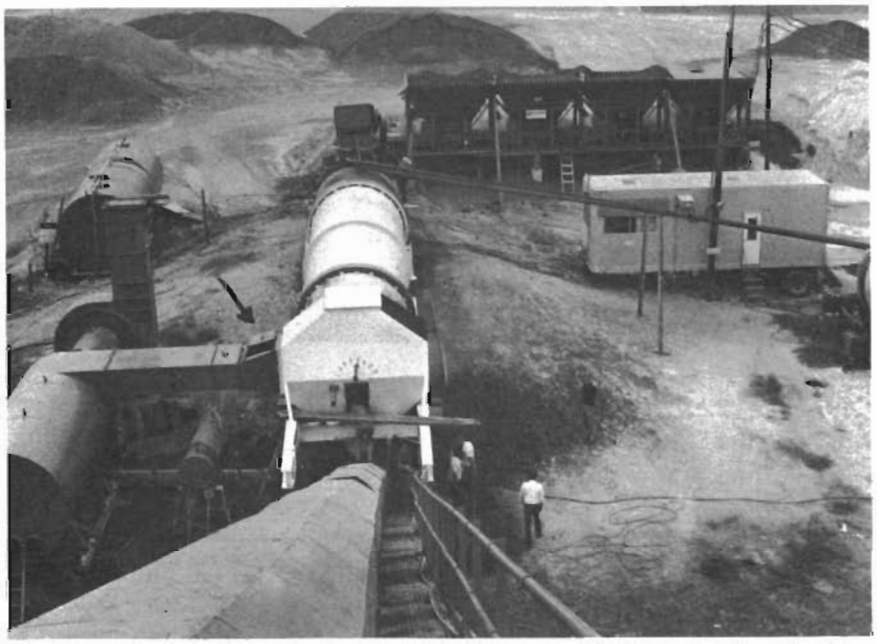

Figure 21. Overview from top of the hot-mixed storage bin looking at the plant while it was being repaired. The dust collector line has been reinstalled below the frame of the dryer-drum frame.

5. A spray bar was added at the discharge end of the drum to introduce the more volatile or lower flash additives to be utilized in this trial. The distance into the drum that material could be added was variable with a slide type of arrangement of the pipe. (See Figure 22.)

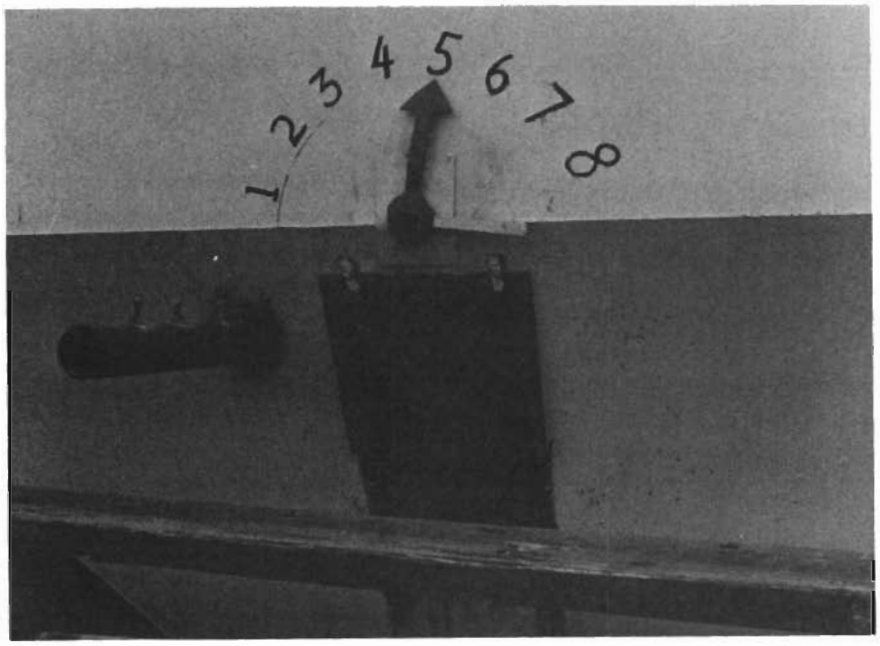

Figure 22. Material output end showing pipe for insertion of asphalt line into the lower end of the processing. The dial has been disconnected due to modifications.

6. An "air flow modulation" on the discharge end was added. It had an arrow indicator to numbered adjustments. The function of this modification was indeterminate to the author but it was of considerable interest to all of the observers. It appears to have been provided for the sole purpose of a conversation piece. (See Figure 23.)

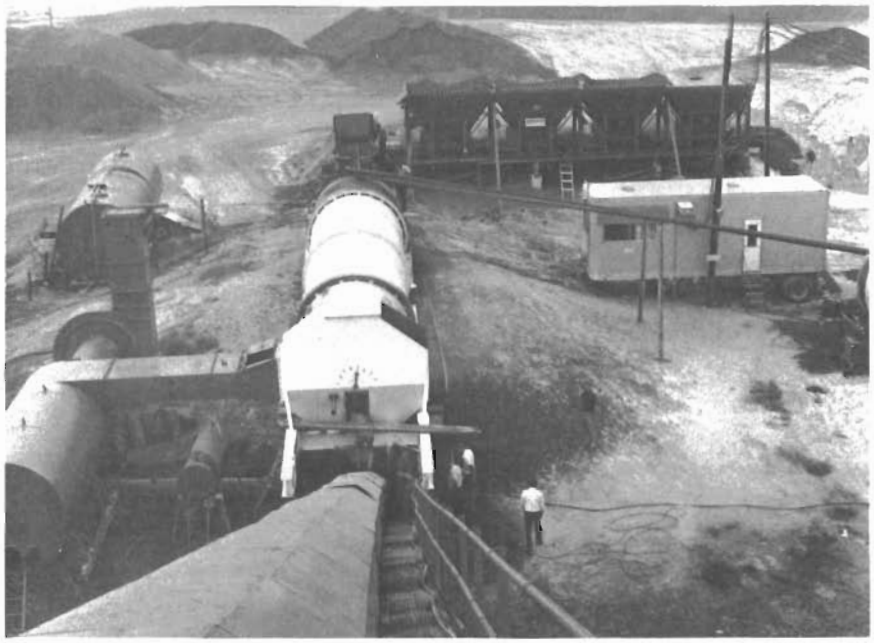

Figure 23. Overview from top of the hot-mixed storage bin.

PLANT PRODUCTION

The actual hot recycling through the modified dryer-drum plant was scheduled to begin on May 5, 1976. Material to be recycled was divided into three stockpiles and loaded into the plant cold bins with a front end loader. (See Figures 24, 25, 26 and 27.)

Figure 24. Three sizes of coarse aggregate were used. This is the small size cut on the 1/2" screen.

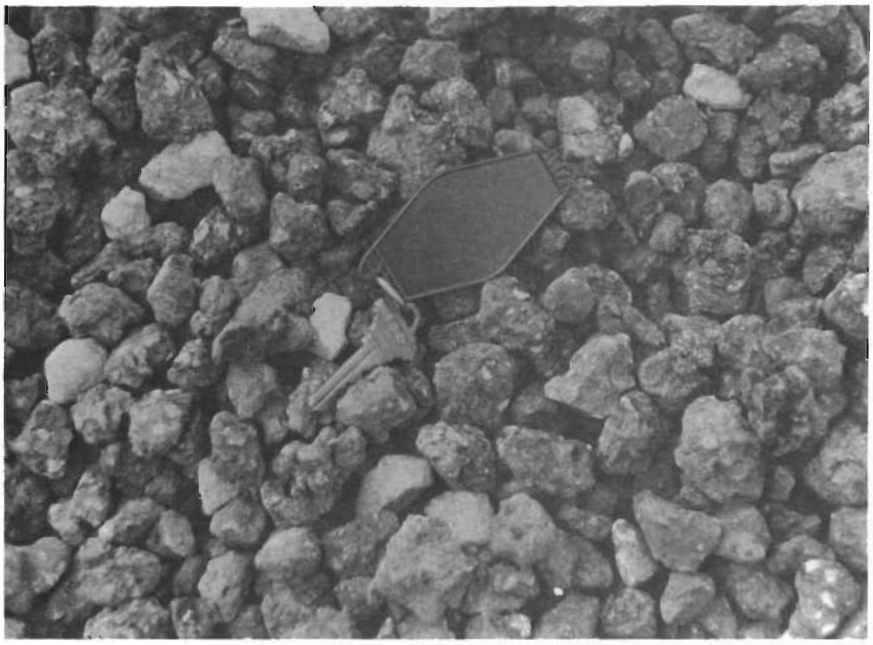

Figure 25. This was the medium size coarse aggregate cut on the 7/8" screen.

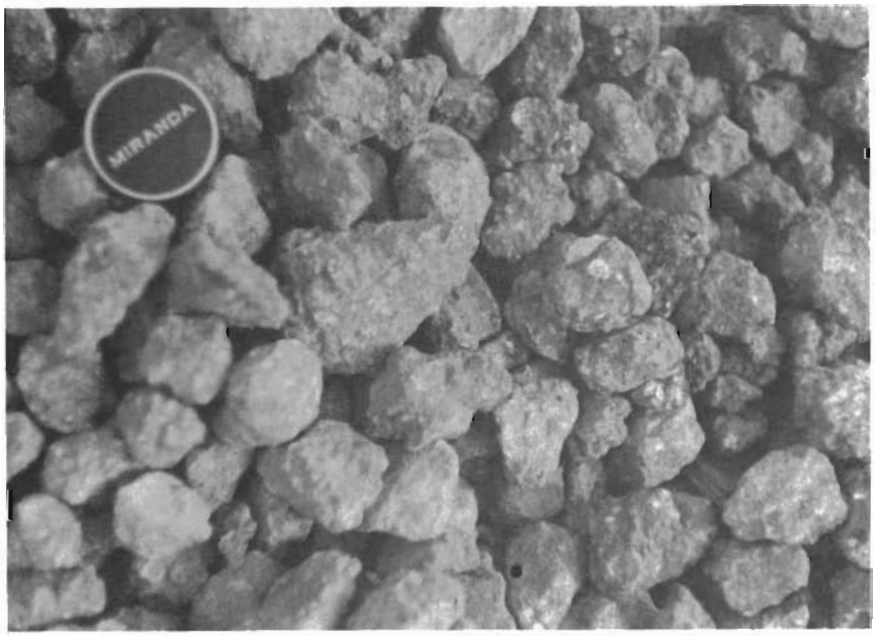

Figure 26. Maximum size was anything over the 7/8" screen which included some 2" material from the old base.

Figure 27. Front-end loader fills the three bins that are being used for this project.

For blending purposes the bins contained gradations, split as follows: Bin 1, 7/8"-2"; Bin 2, 1/2"-7/8"; Bin 3, -1/2" to dust. Initially the material was proposed to be crushed to all minus 1" but crusher plant capability mandated a 2" maximum size in the crushing operation. Cold feed flow was adjusted to the approximate percentages of the three sizes found during the crushing and screening operation, Bin 1 - 10%, Bin 2 - 26% and Bin 3 - 64%. The "Daily Laboratory Activity" reports in the Appendix include gradations of material from cold feed belt samples as well as extraction test results on plant mixed materials.

Prior to the scheduled run for this project, the plant was operated for short periods on May 3 and 4 to check the plant and make final adjustments. For these trial runs AC-10 was added in the amount of 2.5% by weight of the salvaged material. The mix produced looked good and was discharged at about 275^{o}F with very little smoke visible from the plant.

Wednesday morning the plant was started using 1.6% Reclamite base oil as an additive. The Reclamite was pumped directly from a transport and entered the drum at about 9' from the cold feed end. In addition to problems with clogging of the dust collector system, the amount of smoke and dust made it evident that a different method of introducing the relatively low flash point materials would be necessary. This along with dust collector problems made uniformity of production very difficult. (See Figures 28 and 29.)

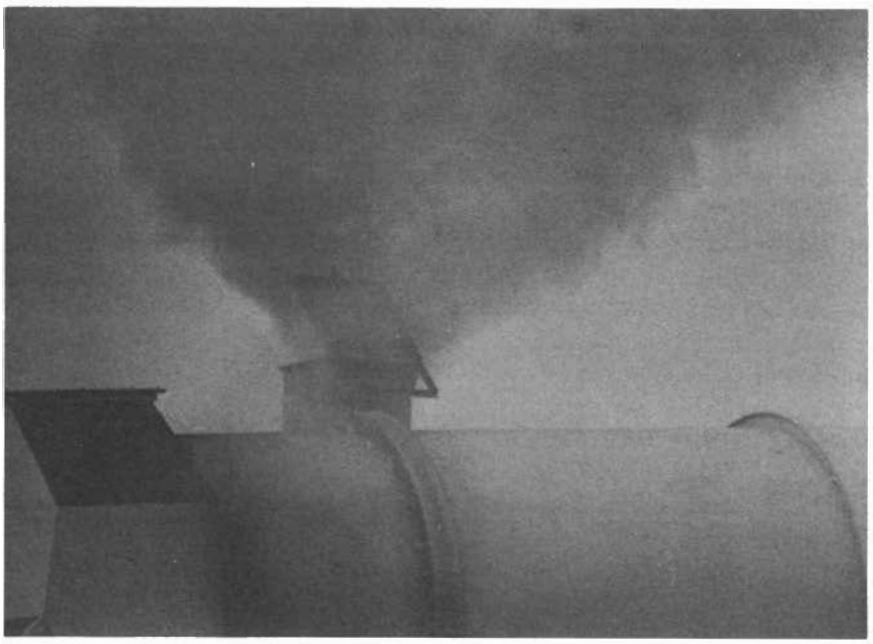

Figure 28. Time - 10:26 a.m. - Increased additions of Reclamite cause fairly heavy pollution. Readjustment of the dryer-drum plant was necessary.

Figure 29. East end of dust collector. Excessive dust was collected which was not returned to the dryer drum, resulting in a required modification of plant.

With the excessive smoke problem and the need to make other plant modifications to utilize the other additives, it was decided to change to the mix with AC-3 being added at about 2.5% by weight. This mixture was designated as Design No. 1 and consisted of 2.5% Exxon AC-3 asphalt, 10% coarse aggregate, 26% intermediate and 64% fine. During the morning, Design No. 2 containing 2.5% AC-3, 14% coarse, 18% intermediate and 68% fine aggregate was used to balance use of salvaged material. Still later the AC-3 was increased to 3.0%.

During production with the AC-3 mixtures there were several problems in controlling the mixture. Due to loss of the probe for automatic burner control the temperature of the mixture had to be controlled by obtaining mixture temperature at discharge manually and relaying this to the plant operator. (See Figures 30 and 31.)

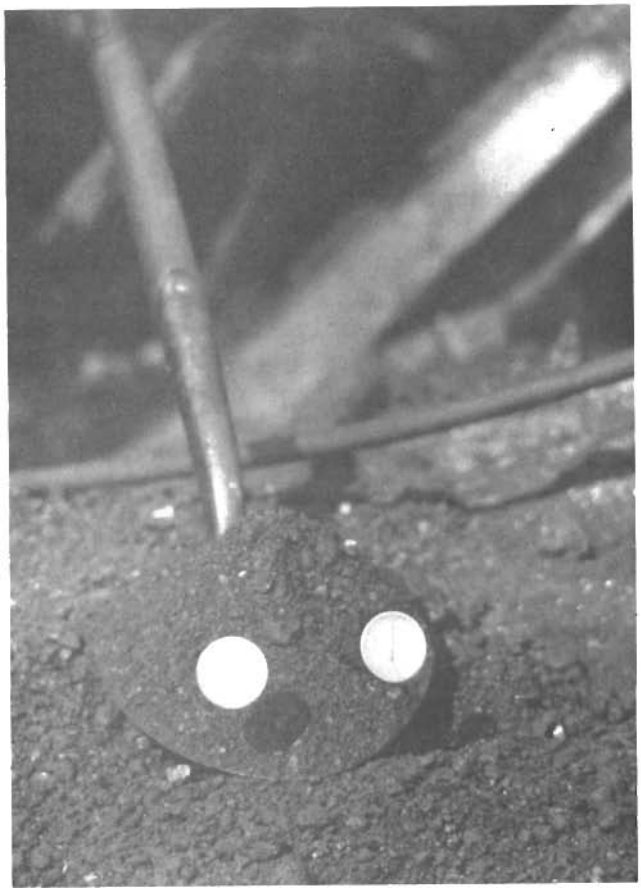

Figure 30. The temperature was taken of samples that came directly from the dryer drum end.

Figure 31. The plant automated control room for the processing of recycled asphaltic materials.

Examination of the report by the observer from the Texas Air Control Board indicates that the plant successfully met the opacity limits for about an hour and forty minutes. Apparently the variables such as air flow through the drum, flame adjustment and operation of the dust collector were proper for the mix being processed. (See Figures 32 and 33.)

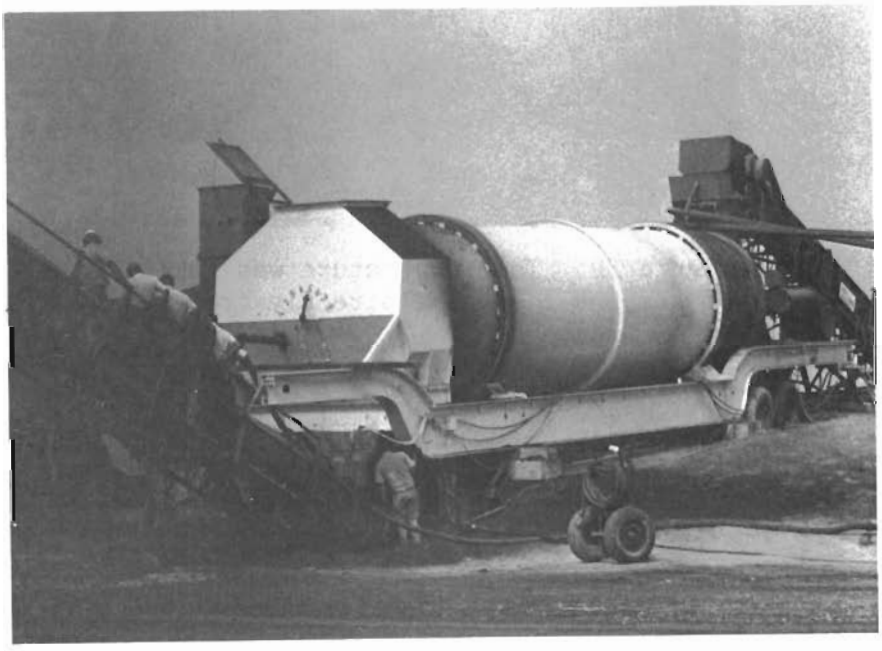

Figure 32. Time: 10:47 a.m. - Plant has been readjusted, the plume barely visible, so the various experts are examining the finished recycled hot mixed asphalt.

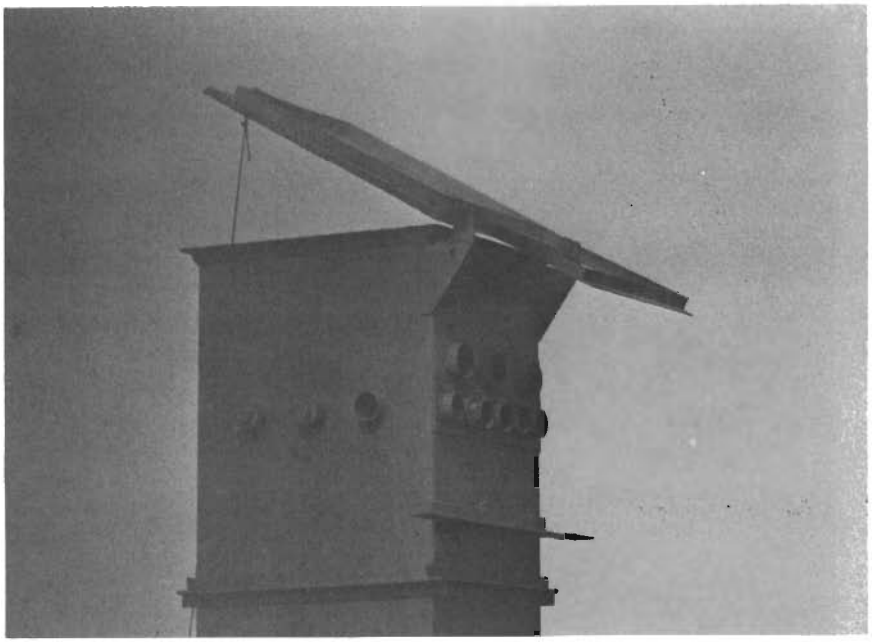

Figure 33. May 5, 1976. Proper adjustment finally passes approval.

Most of this time the plant was processing about 100 tons per hour. In an effort to determine maximum production without pollution the plant operators pushed production to about 180 tons per hour and caused the temporary grid to fail. Apparently the steel rods supporting the ceramic tubes making up the grid failed due to loss of strength at high temperatures of over 2000°F in the area of the grid. (See Figures 34 and 35.)

Figure 34. The broken ceramic tubes which were recovered after the support mounts failed.

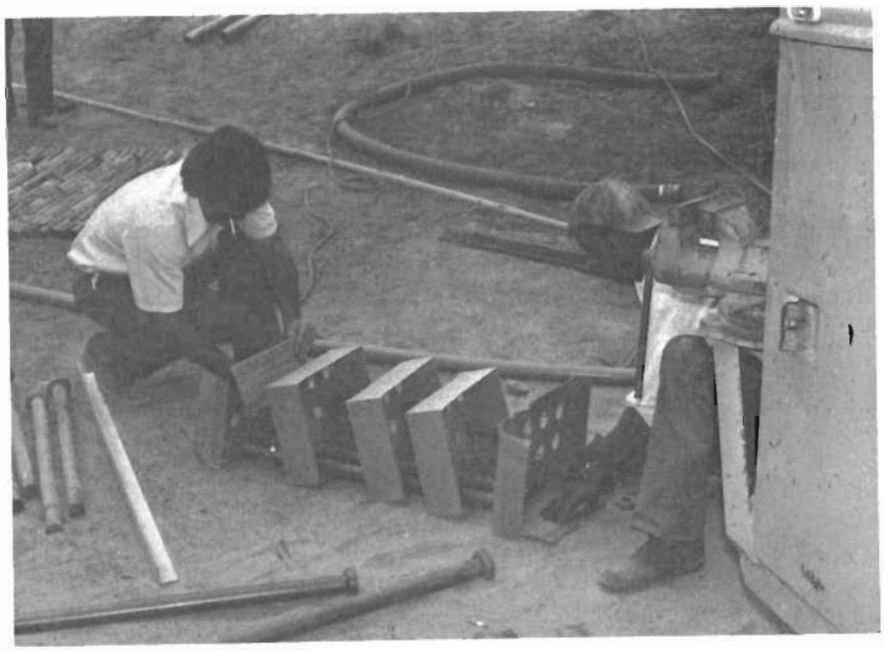

Figure 35. New ceramic tubes being unpacked to form new grid for the dryer drum.

Locating replacement ceramic tubes to reconstruct the grid delayed continuation of the production until Friday, May 7. During the wait the dust collector was modified by moving the return duct to a lower position at the discharge end where it was thought that more fines would be returned to the mixture. (See Figures 36, 37 and 38.)

Figure 36. The fine particle lines were lowered below the dryer drum frame to give a better mixing of the fines with the rest of the out-flow of hot mixed asphalt.

Figure 37. Interior view of the portal in which the fine particle return line feeds the particles back into the dryer drum.

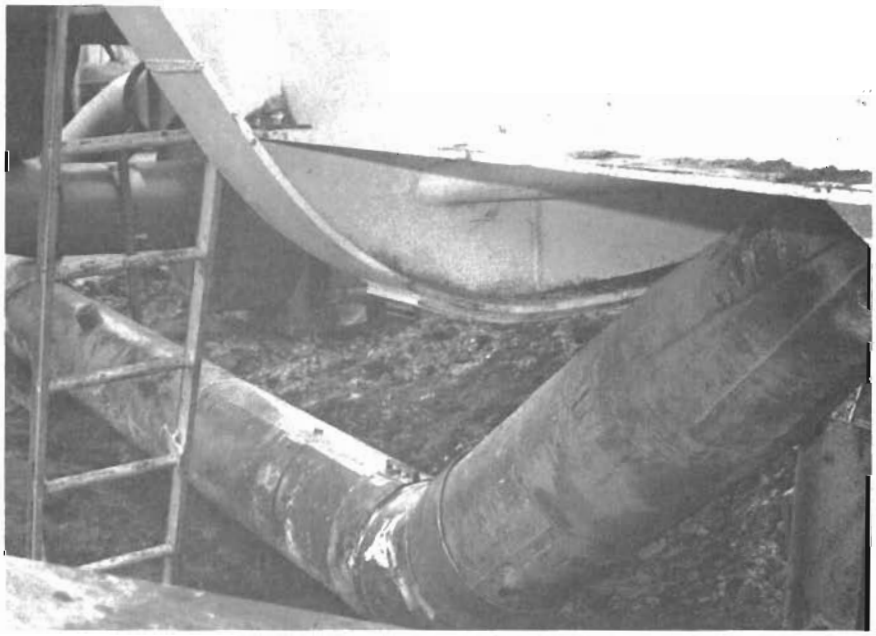

Figure 38. The completed modified return line for the fine particles from the dust collector.

In addition, provision was made to introduce the additives, Reclamite and flux oil, to the mix at the discharge end of the drum. Initially the pipe was a distance of five feet into the drum and later moved five additional feet to obtain additional mixing time with the heated material.

Production with AC-3 was continued at 9:00AM and then changed to Design No. 3 with 1.6% Reclamite at 10:00AM. Temperature fluctuation and smoke problems were continuing problems during the production with this design. At about 1:45PM the change to flux oil at 1.6% was made. At times the resulting mixture looked good and the stack emission appeared to be acceptable, however, temperature control continued to be a problem and the production was highly variable. The dust collector continued to become clogged with fines and required frequent cleaning. (See Figure 39.)

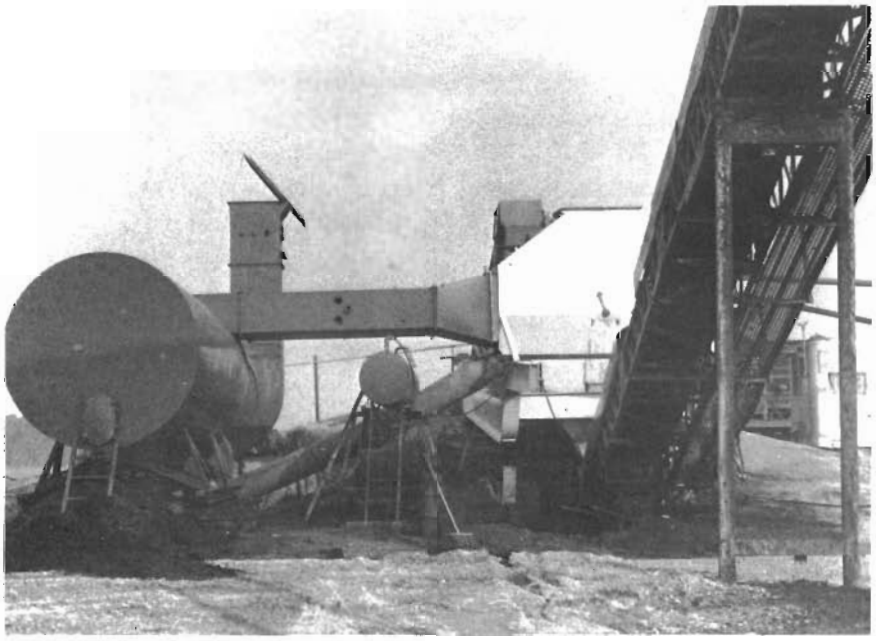

Figure 39. The round dust collector return line entry port into the dryer drum was too close to the square exhaust line that leads to the stack. A blockage occurred at this point in the dryer drum leading to a rapid increase in temperature to over 2200°F. Automatic sensors were not in operation at this time. At this high temperature the stainless steel frame for the ceramic grids gave way allowing the grid to be blown out. Major modification was necessary.

On Saturday the plant started at 8:30AM with the flux oil additive and with about the same problem with smoke and temperature fluctuation as experienced with the Reclamite. After using all of the flux oil the remainder of the project was completed with AC-10 added to the salvaged material.

CONSTRUCTION

As set out in the original plan the overlay was to be about 1.5 inches thick. The presence of the 2" size rock in the salvaged material (picked up from the base) required the paver to lay at about 200 lbs per square yard or 2.5 inches to avoid tearing and segregation of the material. (See Figures 40 and 41.)

Figure 40. The electronic control rides on a guidewire between two points which multiply down to eight sliding shoes. This smoothes out the rough spots of the old pavement.

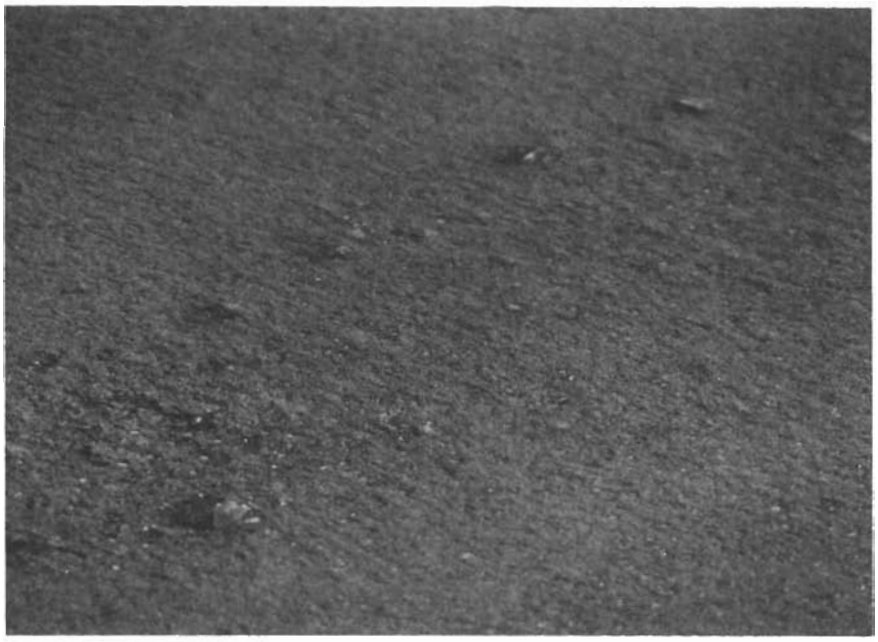

Figure 41. These are some over-sized rocks that had to be picked out and thrown aside. This was later eliminated when all plus 7/8" material was discarded, and the mix re-designed.

Later it was found that about 170 lbs per square yard or 1.75 inches could be handled by the paver. As one would expect the mix varied in appearance and handling qualities over a wide range. The inability of the plant to control temperature of the production made the mixtures produced appear to vary from dry to rich, tender to stable, and from segregated to uniform. (See Figures 42, 43, 44, 45 and 46.)

Figure 42. The temperature was checked on every load leaving the plant with a Bi-metal dial thermometer.

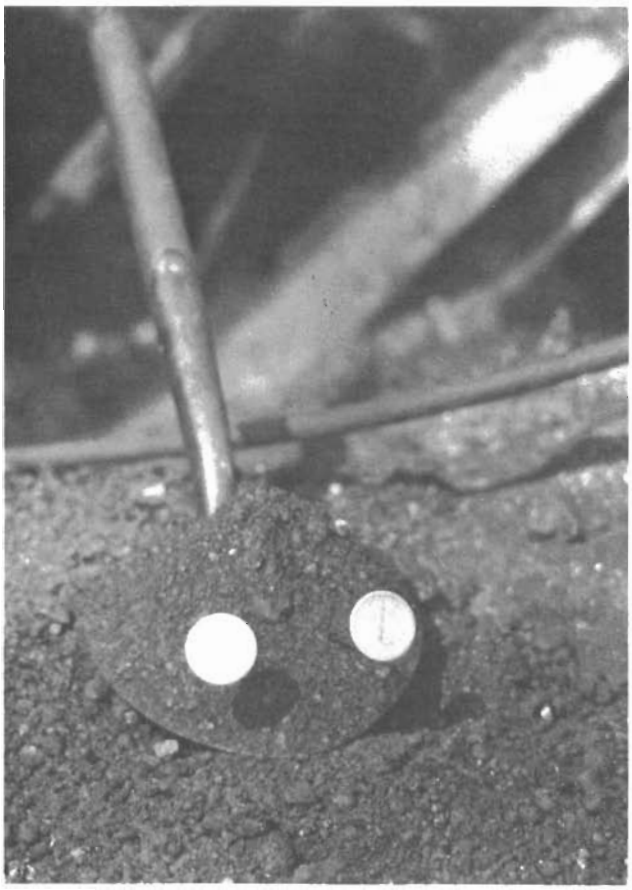

Figure 43. The temperature was taken of samples that came directly from the dryer drum end.

Figure 44. Flat wheel rollers were used first in the compaction of the hot mixed asphalt overlay.

Figure 45. Nuclear Density Testing of recycled hot mixed asphalt overlay.

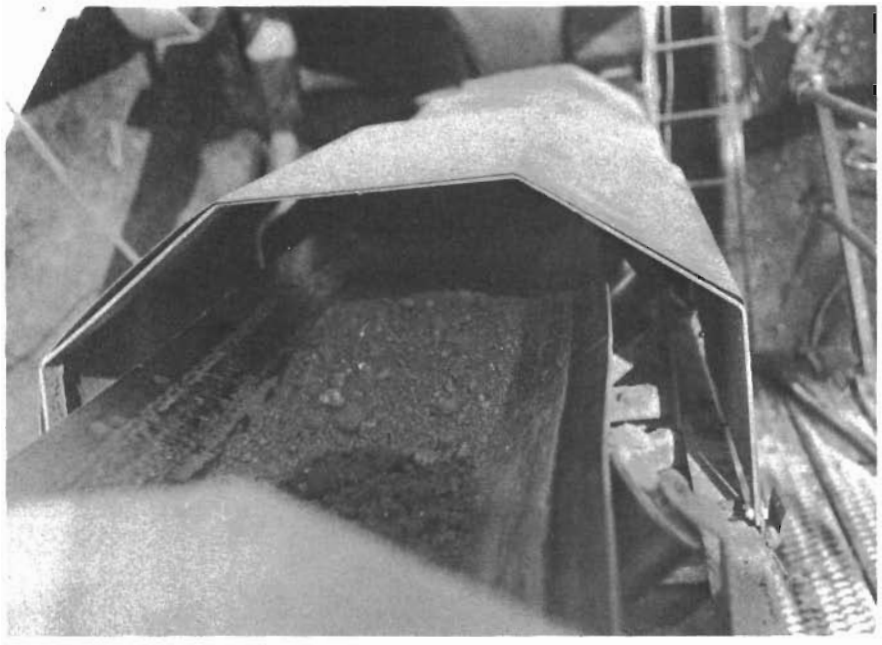

Figure 46. Some large aggregate was processed through. The plus 1-1/2" coarse aggregate was not screened out. This large material caused problems in the laydown phase.

Control of density and rolling patterns made the work of the inspection forces extremely difficult. The fact that a fair laying job was done despite these difficulties is a credit to their ability and interest in the work. Although several different rollers and rolling patterns were tried, the 2-wheel tandem followed by a pneumatic roller gave the best results. (See Figures 47 and 48.) See "Field Data" sheets in the Appendix for rolling patterns and densities.

Figure 47. Steel flat wheel rollers followed the lay-down machine as closely as possible to get good compaction.

Figure 48. Rubber tired rollers followed the steel flat wheel roller for final compaction.

Nuclear density was utilized to establish the best rolling patterns initially. These data together with temperatures of the mixture are included in the Appendix. The appearance of the design using Reclamite was unusual in that it appeared dry as produced and gradually changed to a more workable, richer appearance with time. At times the rolling had to be held back due to tenderness of this mix.

The flux oil mixture appeared to lay and compact fairly well but again the temperature fluctuation resulted in a very non-uniform mixture. Since the flux oil mix that was produced and laid Friday appeared to be raveling and rain was forecast over the weekend, it was decided to overlay most of the test section containing flux oil. This was done with AC-10 and the salvaged material. The plant shut down on Saturday, May 8, and the laying and rolling operations were completed at approximately 5:00PM. (See Figures 49, 50, 51 and 52.)

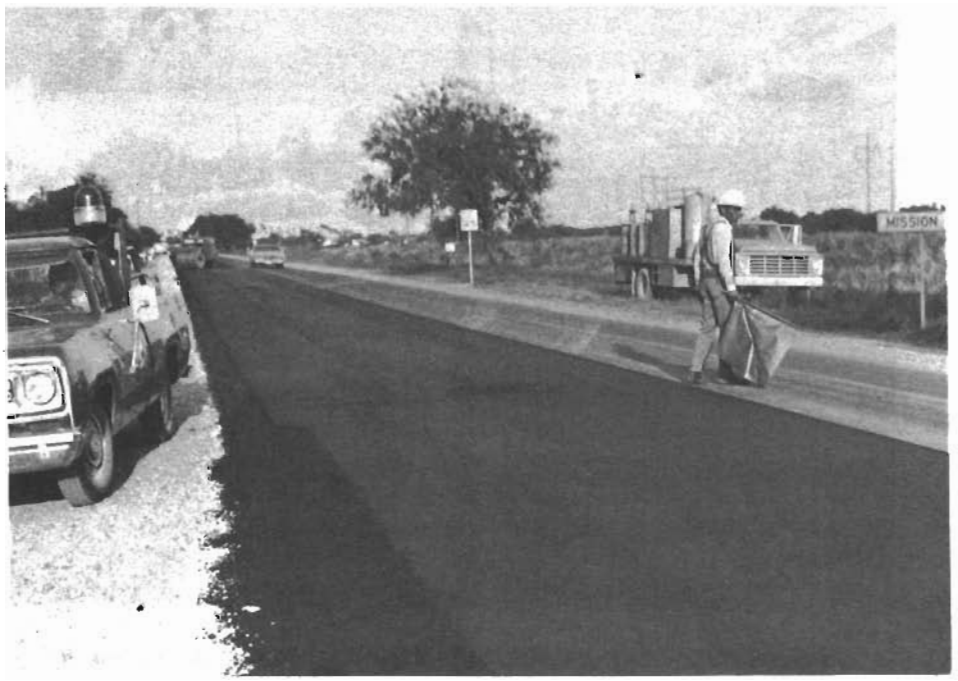

Figure 49. Final rolling on Friday afternoon, May 7, 1976, at 6:45 p.m. of the recycled HMA using flux oil.

Figure 50. May 7, 1976. Lay down of HMA using flux oil (6:40 p.m.).

Figure 51. May 7, 1976. Evening traffic was a small problem (6:42 p.m.).

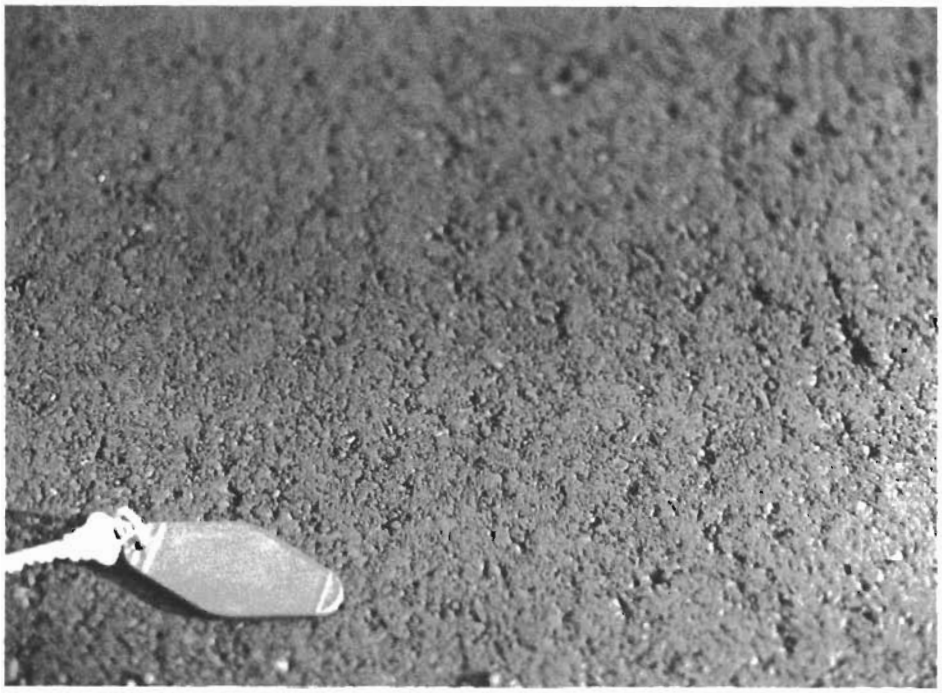

Figure 52. May 7, 1976. Texture of the surface of the HMA with flux oil following the laydown machine (6:50 p.m.).

EQUIPMENT, MATERIALS, FUEL AND LABOR COSTS

ITEM 1. Salvage Removal from SH 336

Equipment	Hrs.	Cost/Hr.	Costs	Operator Labor Rate
Cat	30	$ 40	$ 1200	$ 6.24
Blade	15	30	450	7.02
Loader	18	30	540	6.24
				4.68

Total Equipment	$ 2190
Est. Fuel	219
Labor	489.06

$ 2898.06 or $1.16/ton

ITEM 2. Salvage Haul to Crusher (2500 tons)

Equipment	Hrs.	Cost/Hr.	Total
Trucks	168	$ 13.76	$ 2311.73
Labor	168	5.46	917.28
Est.Fuel	168	3.30	554.40

$ 3783.41 or $1.51/ton

ITEM 3. Crushing Salvage & Haul to Hot Mix Plant

Equipment	Hrs.	Cost/Hr.	Total	Fuel	Labor
Crusher	-	-	$ 1510.42	$ 500	$ 120.12
2 Loaders	11	$ 40	440	33	68.64
4 Trucks	22	50	1100	88	102.96
3 Scrapers	16.5	50	825	66	145.86
			$ 3875.42	$ 687	$ 437.58

TOTAL - $ 5000 or $2.00/ton

ITEM 4. Screening Crushed Salvage

Equipment	Hrs.	Cost/Hr.	Total	Fuel	Labor
Plant	-	-	$ 1105.44	$ 500	-
2 Trucks	8	$ 50	400	32	$ 37.44
2 Loaders	8	40	320	24	81.12
			$ 1825.44	$ 556	$118.56

TOTAL - $ 2500 or $1.00/ton

Item 5. Recycling Salvage (1700 tons)

Equipment	Hrs.	Cost/Hr.	Total	Fuel	Labor
Plant	-	-	$ 4228.88	$ 2125	$ 761.46
Loader	23	$ 40	920	69	143.52
2 Trucks	23	8	184	12	107.64
Distributor	23	13.34	306.82	26.40	215.28
			$ 5639.70	$ 2232.40	$ 627.90

TOTAL - $ 8500 or $5.00/ton

Item 6. Haul Recycled Salvage to Loop 374 (Actual tons - 1743.63)

Equipment	Hrs.	Cost/Hr.	Total	Fuel	Labor
Trucks	121	$ 13.76	$1644.96	$ 399.30	$ 660.66

TOTAL - $ 2722.50 or $1.56/ton

Item 7. Laying Recycled Salvage (Contractor-

Equipment	Hrs.	Cost/Hr.	Total	Fuel	Labor
2 Stl.Whl. Rollers	29	$ 19.94	$ 578.26	$ 78.30	$ 271.44
1 Pneu.Roller	29	9.96	288.84	50.75	124.41
1 Paver	29	94.56	2742.24	50.75	165.01
1 Distributor	29	13.34	386.86	95.70	271.44
Equip.Truck	12	16.24	194.88	39.60	65.52
			$ 4191.08	$ 315.10	$ 897.82

Item 8. Flagging, Barricades, etc. (State)

Lump Sum - $670.24 - Labor
101.67 - Misc.

$771.91 or $0.44/ton

Item 9. Additives

AC-3 Asphalt	$ 1294.98
Reclamite - $0.78/gal.	1687.51
Flux Oil - $0.26/gal.	789.38

$ 3771.87 or $2.16/ton

SUMMARY OF COSTS

ITEM	COST/TON
1	$ 1.16
2	1.51
3	2.00
4	1.00
5	5.00
6	1.56
7	3.10
8	0.44
9	2.16
	$ 17.95

These costs were developed on the basis of information obtained from the several participating parties to this project. Some are estimated and some are supported by bids or invoices. It is the opinion of the individuals developing these cost figures that a more realistic figure would be about $13.00 per ton or slightly less. This is based on the time loss due to equipment problems, actual haul distances involved and some equipment and labor costs which were estimated by others involved. In spite of this, the costs of this recycled material are about the same as would have been expected for a new hot mix asphaltic concrete mixture in place.

ENERGY ANALYSIS

The variations in production and experimental designs which were utilized on this project do not facilitate a very exact breakdown of the total energy for this particular recycling operation. A good indication as to the potential for energy savings can be shown by calculations based on the factors that are substantially different in this recycling operation as opposed to conventional production from this plant. A calculation to determine energy requirements for conventional production can also be made so as to determine energy savings through recycling expressed as a percentage of the conventional production.

For the purpose of these calculations a 6.0% asphalt content is assumed for the conventional mix and the recycle mix design with 2.5% added asphalt will be used. The asphalt is hauled 380 miles in a 4-axle truck to the plant. Aggregate will average 3% moisture and will consist of 60% crushed gravel, 20% screenings and 15% sand. Aggregate will be hauled in 3-axle trucks with an average haul of about 6 miles. The mix will have an average haul distance of 7.5 miles in 3-axle trucks. Energy calculations are made utilizing methods and factors found in the Asphalt Institute publication MISC-75-3, April 1975.

Conventional Production

Materials

Manufacture asphalt cement	=	587,500 Btu/t
Haul 380 mi. X 2 @ 5,040 Btu/tm	=	3,830,400 Btu/t
Total for Asphalt	=	4,417,900 Btu/t
Crushed Gravel @ 40,000 Btu/t, 60%	=	24,000 Btu/t
Screenings @ 40,000 Btu/t, 20%	=	8,000 Btu/t
Sand @ 15,000 Btu/t, 15%	=	2,250 Btu/t
Haul 7.5 Mi. X 2 @ 4,270 Btu/tm,1.05	=	67,252 Btu/t
Total	=	101,502 Btu/t

Mix Composition

Asphalt, 6% @ 4,417,900 Btu/t	=	265,074 Btu
Aggregate, 94% @ 101,502 Btu/t	=	95,411 Btu
Total for Mix	=	360,485 Btu

Plant Operations

Dry Aggregate, 3% @ 28,000 Btu/%, 0.9t	=	75,600 Btu
Heat 200°F @ 470 Btu/F/t, 0.9t	=	84,600 Btu
Other plant operations	=	16,550 Btu
Total Plant Operations	=	176,750 Btu

Haul and Place

Haul mix 7.5 mi. X 2 @ 4,270 Btu/tm	=	64,050 Btu
Spread and compact	=	16,700 Btu
Total for Haul & Place	=	80,750 Btu
Total for 1 ton asphalt concrete (Conventional Dryer-Drum Production)	=	617,985 Btu

A calculation of the differences between the conventional and the recycled mix makes the following assumptions:

1. The total energy involved in aggregate production, haul and handling would be essentially the same as that required to scarify, haul, crush and handle the pavement to be recycled.

2. Plant operations require essentially the same energy for the two operations.

3. Haul and Placing requires the same energy for recycled and conventional.

4. In this particular case the basic differences in total energy would seem to be the difference in energy required to manufacture, haul and store the asphalt in the recycled and conventional mixtures.

Recycled Energy Savings

Materials

Manufacture Asphalt Cement	=	587,500 BTU/t
Haul 380 mi x 2 @ 5,040 BTU/tm	=	3,830,400 BTU/t
Total for asphalt	=	4,417,900 BTU/t
Difference in Asphalt Content (Added) of Conventional Mix and Recycled Mix	=	6.0-2.5 = 3.5%
Asphalt: 3.5% @ 4,417,900 BTU/t	=	154,627 BTU/t
Asphalt Storage: $\frac{3.5}{6.0}$ X 6,400 BTU/t	=	3,733 BTU/t
Total Energy Savings per Ton of Recycled Mixture	=	158,360 BTU
$\frac{158,360}{617,985}$ X 100	=	25.6%

DISCUSSION

The evaluation of the materials produced and the finished pavement on this project has been made very difficult by the many variables present throughout the production of the recycled mixture. In addition to the highly variable temperatures during production, the amounts of additives actually used were somehwat indeterminate due to plant controls variables and possible flash or "burn-off" of the lighter oils in the additives. At times these oils actually were heard to detonate due to ignition within the drum. Extractions from the plant mixed material indicate about the same asphalt contents as those from the preliminary laboratory mixes where the additive was AC-3. The plant mixed materials generally reflect lower asphalt content on extraction than the laboratory mixtures where the lighter oils were used as an additive. This again demonstrates the problem of "burn-off" of the relatively low flash oils in the dryer drum mixer. The extracted asphalt from the plant mixtures did have about the same characteristics with regard to penetration and ductility as noted in the laboratory mixtures. In both cases the Reclamite base oil had the greatest effect on these properties with the flux oil and AC-3 showing a decreased effect. Penetration of the AC-3 mixes ranged from 19-24, ductility 7.5 to 19; those mixtures made with Reclamite base oil ranged in penetration from 37-49, ductility was always improved to 141+ while those mixtures made with flux oil ranged from penetration of 35 to 69 with ductilities from 28 to 80.

Hveem stabilities were generally in the same range for both laboratory and plant mixes except for the flux oil where the Hveem was about twice the value in plant mixes as those in the laboratory. The stability of the cores

taken from the compacted roadway were all much lower than laboratory compacted specimens. The much lower density achieved on the roadway accounts for part, if not all, of this difference. The laboratory compacted specimens of the plant mixed materials ranged from 5.1% to 7.8% air voids while the field cores averaged 15.9% air voids.

Resilient Modulus testing on materials from preliminary laboratory designs, plant mixed materials as well as pavement cores, was performed at both the University of Texas Center for Highway Research as well as the Texas Transportation Institute at College Station. Except for core samples all of the specimens were companion specimens molded from the same material in the SDHPT laboratory. Table II is a summary of some of the pertinent data showing comparative laboratory data on these specimens and may be found on the following page. Complete data may be found in the Appendix. It should also be noted that the Resilient Modulus test equipment is different at the two universities and may possibly account for some of the radical differences in values. The preconstruction design specimens tested by TTI indicated M_R values of about 2.0×10^6 psi for the old pavement remolded with no additive, about 1.0×10^6 psi with 2.5% AC-3 and about 0.38 to 0.54×10^6 psi with the flux oil and Reclamite base oil at 1.6%. The UT CFHR values were on the order of about half of the above values for the remolded old asphaltic concrete pavement and the mix with 2.5% AC-3 added. The values with Reclamite base oil and flux oil were in the same range. The post construction specimens tested by TTI did not show the same trends in stiffness as their preconstruction testing on all mixtures while the tests by UT CFHR were very close to the values obtained on the same mixtures in the design stage. The field cores taken from the completed pavement showed the same general range of stiffness on all mixtures as the laboratory compacted specimens tested by UT CFHR.

TABLE II

SUMMARY OF TESTS*
(See Appendix for All Data)

PRECONSTRUCTION	EXTRACTED ASPHALT PROPERTIES PEN	DUCT	%ASPHALT	HVEEM STABILITY D-9	TTI	DIST.21	RESILIENT MODULUS psi X 10^6 TTI	UT
Old pavement	9	-	7.2	80	70	-	2.0	0.838
1.6% RBO**	43	141+	8.0	46	-	38	0.386	0.343
1.6% FO***	35	9	7.8	33	22	-	0.537	0.286
2.5% AC-3	18	7.5	8.8	32	28	-	1.04	0.452
POST CONSTRUCTION								
2.5% AC-3	19	12	7.3	40	-	36	-	0.427
3.0% AC-3	24	19	8.2	24	48	27	1.9	0.481
3.0% AC-3	20	10	7.8	61	-	29	-	0.485
1.6% RBO**	37	141+	6.9	72	58	53	1.01	0.371
1.6% RBO**	49	141+	6.0	58	44	62	0.850	0.381
1.6% FO***	50	28	6.8	62	50	63	1.01	0.282
2.0% FO***	64	42	6.7	63	62	60	1.10	0.281
2.0% FO***	69	80	7.2	72	50	71	0.89	0.277

Cores(TTI): 23 (TTI 48); 17 (TTI 58, 44); 17 (TTI 50, 62, 50)

Cores(TTI): 0.4 (TTI 1.9); 0.3 (TTI 1.01, 0.850); 0.25 (TTI 1.01, 1.10, 0.89)

*Numbers reported are averages of 3 or more tests.
**RBO - Reclamite Base Oil
***FO - Flux Oil

While the differences in test values cannot be explained, the rational pattern of the specimens tested by UT CFHR would seem to be more reliable. This is particularly true since all specimens were molded under the same conditions in the same laboratory and were true companion samples. The possibility of different values due to testing at different ages or curing time of the specimens has also been mentioned as a cause for some difference.

In the author's opinion the stiffness values obtained on specimens molded from the plant mixtures answer the question frequently asked with regard to additives in recycled mixes. Do they really affect the properties of the completed mixture? It can be noted that the additives reduce the stiffness in every case to the same range usually expected in a mix made from all new materials. Tests on the cores taken from the compacted pavement also seem to support this conclusion.

One other comment on the recycled mixtures with additives was made by the researcher at TTI with regard to Resilient Moduli of samples tested with water saturation and subsequent drying. It was to the effect that samples containing no additives showed a sharp decrease in Resilient Modulus with saturation. The flux oil, Reclamite base oil and AC-3 samples show an increase in stiffness after saturation. This test was made because one theory supposes that the decrease in stiffness with saturation indicates a susceptibility to water induced damage with the most susceptible showing the sharpest decrease in stiffness with saturation. In this case all samples containing various concentrations of additives showed only minor decrease in stiffness.

The completed pavement was inspected after about nine months of service. While the variations in all phases of this project are somewhat evidenced in the surface it is still performing well with good acceptance by the road users in that area.

CONCLUSIONS

The highly experimental nature of this project, the many problems and variations in all areas do not lend themselves to firm conclusions; however, it is believed the project does at least indicate the following trends:

1. Recycling through a conventional dryer drum, with an improved version of the experimental modification used in this project, will be feasible and will probably meet air pollution minimums.
2. An acceptable recycled mixture can be produced at equal or lesser cost with obvious savings in energy in material, production, transportation and reuse of aggregates and asphalt.
3. Some type of additive is necessary and does improve the physical properties of the recycled mixture.
4. The design and testing procedures developed by this project are suitable for recycled mixtures.
5. Utilization of a continuous pug mill in conjunction with the dryer drum plant would provide better control of additive quantity and provide a more uniform mix while avoiding the pollution problems associated with low flash materials.

ACKNOWLEDGEMENT

The author would like to express appreciation for the cooperation and assistance of the following without whom this project and report would not have been possible.

District 21 of the State Department of Highways and Public Transportation and in particular the close cooperation and guidance of Mr. Wade Barnes and Mr. Jack Trammel.

Motheral Contractors, Inc.

Boeing Construction Equipment Company and Mr. Tim Shearer.

Wego Equipment Company and Mr. Harry Goss.

Texas Air Control Board and in particular Mr. Manuel Aguirre and Mr. Doyle R. Pendleton.

Demonstration Projects Division, Region 15 FHWA and in particular Mr. Stephen Beckett and Mr. Douglas Bernard.

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Dr. Jon A. Epps of the Texas Transportation Institute.

Dr. Thomas Kennedy of the University of Texas Center for Highway Research.

Mr. Billy N. Banister of the Materials and Tests Division for the splendid photography in this report.

A P P E N D I X

TEXAS HIGHWAY DEPARTMENT

STATE PROJECT NO. M 39-2

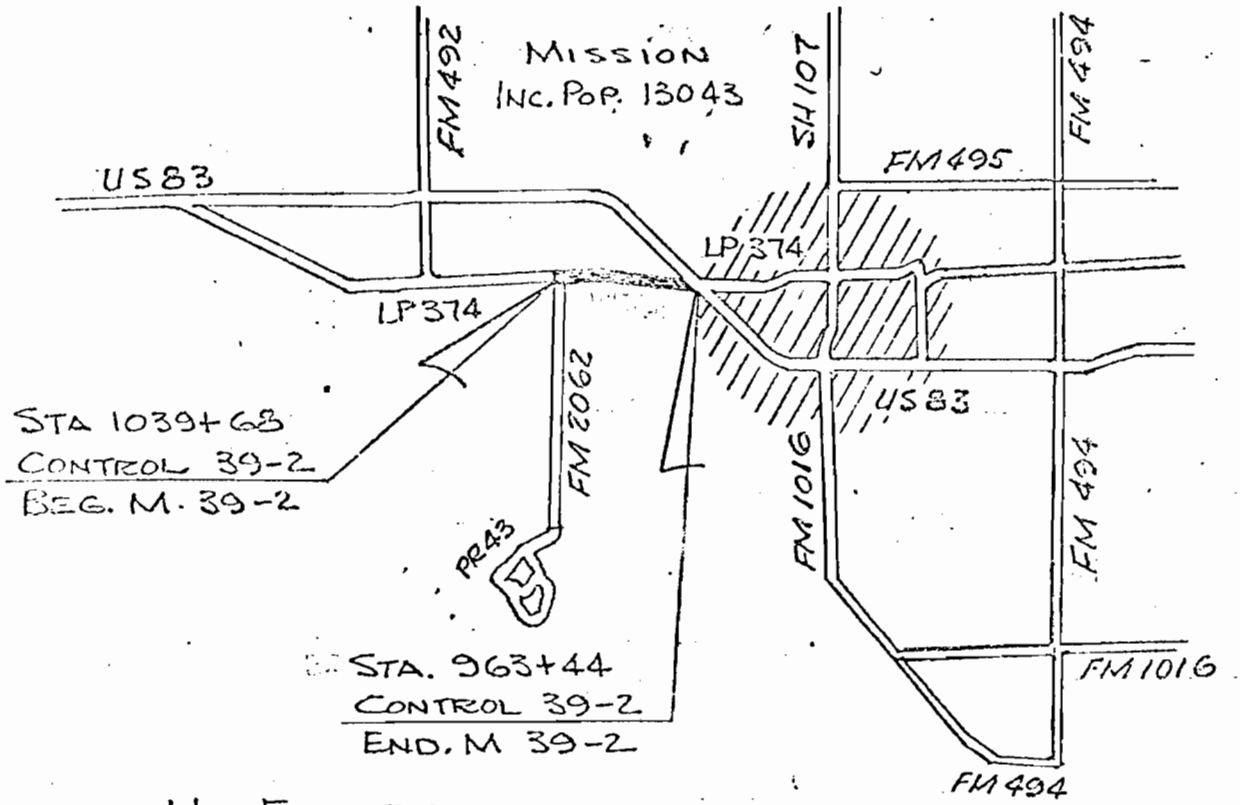
FROM: FM 2062 EASTERLY

TO: US 83 WEST FRONTAGE ROAD

PROPOSED CONSTRUCTION

OVERLAY WITH RECYCLED ASPHALTIC CONCRETE PAVEMENT

NET LENGTH 7624.0 FT. = 1.444 MILES



NO EXCEPTIONS
NO EQUATIONS

RECOMMENDED FOR APPROVAL: _____

DISTRICT ENGINEER

D.O. USE ONLY
PREP BY: _____
PR'D: _____

SCALE: 0 2 MILES

DIST. NO.	COUNTY	CONT.	SECT.	JOB	HWY. NO.
21	HIDALGO	39	2		LP 374

District 21 Experimental Recycling Project on Loop-374, West of Mission-Hidalgo County

harles H. Hughes	S. D. H. P. T.	Austin
John F. Nixon	"	"
rthur Hill	"	"
Billy N. Banister	"	"
Roger Welsch	"	Abilene
ob Lindley	"	"
N. A. Billingsley	"	"
ade D. Barnes	"	Pharr
Jack T. Trammell	"	"
Jimmie M. Giles	"	"
. E. Cannon	"	"
George Flores	"	"
orfirio Villalon	"	"
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elvin R. Vyvial	Air Control Board	Harlingen
ictor F. Springer	Automation Proving Grounds	Pecos
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homas W. Kennedy	University of Texas Center for Highway Research	Austin
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Herman Lloyd	J. H. Strain & Sons	Abilene
rnest Strain	"	"
anuel Aguirre	Air Control Board	Austin
Steve Beckett	FHWA, Demonstration Proj.	Virginia
. E. Soaros	White Mines, Company	San Antonio
Cecil Holloway	"	"
erry Boyles	"	Corpus Christi

[illegible]	P. C. E. C.	Seattle
[illegible]rey E. Coss	Wellring Coss Equipment	San Antonio
[illegible]ward Bevers	Wego Company	
John D. Ferris	Boeing Company	Seattle
[illegible]uck Looney	"	
Forrest Stone	Peter Kiewit Sons, Co.	Salt Lake
[illegible]bby Moore	Texas Emulsions, Inc.	Corpus Christi

[illegible]riday, May 7, 1976

[illegible]obert L. Mendenhall	Las Vegas Paving & R. M. I. International	Las Vegas
Bill Foster	South Prairie Constr.	Oklahoma
[illegible]en Jacobs	"	"
[illegible]. M. Bonnell	Barber-Green Company	Aurrora-Ill.
Bill Tillamn	"	"
[illegible]. G. Garcia	S. D. H. P. T.	Pharr
[illegible]om Hanna	"	"
[illegible]rt Vela	"	"
[illegible]. E. Fagala	"	"
Richard Buchen	"	San Benito

SAMPLING AND TESTING INSTRUCTIONS

Pre-Construction

1. Fill out "Dryer-Drum Plant Questionnaire",
2. Check calibration of plant:
   a. Scales.
   b. Aggregate flow.
   c. Asphalt pump.

During Plant Production

1. Minimum of two moisture determinations per day on the cold bin materials.
2. Minimum of two sieve analyses per day of the cold bin materials.
3. Minimum of three extractions per day of normal production. Cure to constant weight prior to extraction.
4. Minimum of three moisture determinations per day on the mixture. This value is obtained during the curing of the extraction sample in No. 3 above.
5. Mold a minimum of three Hveem stability specimens per day from a portion of the cured material used for the extraction in No. 3 above.
6. Determine the actual specific gravity of the molded specimens.
7. Take three 100 pound samples of mixture and one (1) gallon bucket of mixture per day at approximately the same time the sample is taken for extraction and the Hveem stability specimens.
8. Take the temperature of the mixture in the truck at the plant at the time the extraction and Hveem stability specimens sample is taken.
9. Take the temperature of the mixture on the belt every two hours.
10. Record the temperature of the mixture and the asphalt indicated on the plant instruments every 2 hours.
11. All of the above must be done when the type of asphalt is changed.
12. The above data is to be recorded on the "Daily Laboratory Activity Report" form.

On Roadway

1. Take the temperature of the mixture in the laydown machine at placement.
2. Take the temperature of the mixture at the beginning of the rolling.

3. Establish the rolling sequence and list the sequence.

4. List the number of passes for each type of roller.

5. List the weights of rollers and the tire pressure for the pneumatic rollers, and the data for the vibratory roller, if used.

6. Establish the location for cores to be taken at a later date.

7. The above data is to be recorded on the "Field Data" form.

8. Check the rolling efficiency with the Troxler nuclear moisture-density gauge.

9. Send D-9 a copy of the "Daily Construction Report-Asphaltic Concrete Pavement", Form No. 404 Rev. (2).

DRYER-DRUM PLANT QUESTIONNAIRE

Company Name: Motheral Contractors, Inc. Date: May 5, 1976

Owner: Motheral Contractors, Inc.

Location: 2 Mi. N. of US-83 & 2 Miles W. of FM-492 in Hidalgo County

Instructions: Fill in the blanks and put a "X" in the parenthesis (X) by each word that applies. If information is not available, write N/A.

1. Plant Brand Name: Boeing Equipment Co. Model No. 400

2. Dryer-Drum
   Method of Mixing: Shearer (x); McConnaughay ( )

   Other ( )

   Size: Diameter = 9 ft.; Length = 38 ft.

   Rated Production Capacity = 400 tons per hour.

   Location of the addition of asphalt to aggregate:

   Prior to mixing ( ); Spray bar within dryer drum (x); Both ( )

   If spray bar, is location of spray variable? Yes (x); No ( ). Distance in Drum 21-12'

   Remarks:

3. Plant is equipped to supply the following to the dryer-drum:

   Asphalt (x); Additives (x); Water ( ); Primer ( ).

4. Additives

   Asphalt: Type: Asphalt Cement. AC-3, AC-10 and AC-20 have been used.

   Where added? Tank ( ); Line to dryer-drum (x); Other ( ).

   Remarks:

   Other additives: Type: Bechlinite and Flux Oil have been used.

   Where Added? Through a line to the Dryer-Drum. Additives have been added at both

   Remarks: ends of the Dryer-Drum.

5. Scales and Metering Devices:

Metering Devices:

Asphalt: Flowmeter ( ); gals. ( ); lbs. ( ).

Other: _____

Water: Flowmeter ( ); gals. ( ); lbs. ( ).

Other: _____

Primer: Flowmeter ( ); gals. ( ); lbs. ( ).

Other: _____

Do flowmeters have permanent provisions for checking the meter output?

_____

Are flowmeters located so that the operator can see them readily?

_____

Do flowmeters have accurate accumulative meters installed?

_____

Does the plant provide scales and container of such size that the asphaltic material may be weighed? Truck Scales Only

Scales:

Are belt scales used? Yes (x); No ( ); Other _____

Scale brand name Kolberg Manuf. Co.

Capacity = 600 Tons/Hr.; Smallest division = 10 Tons/Hr.

Are asphalt flowmeter readings and belt scale readings indicated on console in control room? Yes (x); No ( ); Other Belt Scale Only

6. Burner for Dryer-Drum

Type of fuel used: Diesel

Type of burner control: Automatic (x); Manual ( ).

7. **Is the dryer-drum equipped with a dust collector? Yes (x); No ( ).**

If yes, are fines returned to dryer-drum? Yes (x); No ( ). To the System.

Is water used to help control dust? Not with regular hot mix material. Water added during recycling of salvage asphalt.

8. **Thermometers**

Is there a dryer-drum mix temperature recording chart?

Yes (x); No ( ). If yes, give range: Min. 0 **°F.; Max.** 600 **°F.**

Where is sensing element located? Exit End Of Drum

Is there a recording thermometer for the asphalt? Yes (x); No ( ).

If yes, give range: Min. 0 **°F.; Max.** 600 **°F.**

Where is the sensing element located? Storage Tank

Does each asphalt storage tank have its own temperature control? Yes (x); No ( ).

Indicate the range of each:

Min. 0 **°F. Max.** 500 **°F.** 25,000 Gal. Recording

Min. 0 **°F. Max.** 500 **°F.** 25,000 Gal. Recording

Min. - **°F. Max.** - **°F.**

Is there a recording thermometer on each tank? Yes (X); No ( ).

Are all temperature indicating devices located so that the operator can see them? Yes ( ); No (x).

Remarks: None are visible from the console trailer

9. Asphalt

Asphalt heater brand name: Sellers **; Model** _____

Type of heater: Steam coil ( ); Direct fire ( ); Hot oil ( );

Other Electric Coil

Type of heater controls: Automatic (x); Manual ( ).

List each storage tank with capacity and name and grade of asphaltic material:

1.	25,000 Gal	Sellers	AC-10
2.	25,000 Gal	Sellers	AC-10

10. Cold Bins

Number of cold bins = 4

Approximate capacity of each = 15 Tons

How are cold bins filled? Front End Loader

How is cold feed from each bin controlled? Adjustable hopper gates ( );

Variable speed belt feeders (X); Other

Are cold bins equipped with moisture sensing and indicating instrumentation?

Yes ( ); No (X). If yes, is indicator on control console? Yes ( ): No ( ).

In what units does it read? Percent by weight ( ); Other

Do cold bins have depth of material indicators? Yes ( ); No (x).

If yes, where is indicator readout located?

11. What provisions are made for sampling the combined aggregates from the aggregate feed system? There are none. Sample is removed from belt between cold bins and Dryer-Drum.

12. What provisions are made for sampling the mix prior to placement in the surge/storage bin? None

13. What is the rated capacity of the surge/storage bin? 150 Tons

14. Does the surge/storage bin (bins) have indicators that indicate depth of mix in the bin? Yes (x); No ( ).

If yes, where is indicator readout located? Light on storage bin

15. Is the surge bin heated? Yes (X); No ( ).

16. Is the surge bin insulated? Yes (x); No ( ).

17. Does plant have indicating device that shows production output at all times?

Mixture T. P. H. Yes (x); No ( ). Agg. T. P. H. Yes (x); No ( ).

Asphalt gals/min. or hr. Yes (x); No ( ).

18. What method is used to allow for moisture present in aggregates in adjusting plant to produce design mixture? Automatic

19. List plant modifications since original installation

1. Change Asphalt Tanks.
2. Added Vibrators to Cold Bins #3 & #4
3. Installed cone in silo.
4. A dust collection system was added.
5. Lowered the drum.
6. Changed from propane to diesel fuel.

Texas Highway Department
Form 231

GENERAL TEST REPORT

No Charge

Laboratory No C7637099b
Date Received 5-14-76 Date Reported 5-27-76
Dist. or Res. Engr. G. G. Garcia
Address Pharr
Sampler S. M. Giles
Sampler's Title Engr. Tech. V
Contractor
Sampled from Transport
(pit, quarry, car or stockpile)
Producer Tesoro Petroleum Corp.
Quantity represented by sample
Has been used on
Proposed for use as
Aggr. Prod. - Salv. Asph. Conc.

Material FLUX OIL

INFORMATIONAL
Control No. Sect. No. Job No.
Hidalgo
County Federal Project No. Loop 374
Hwy. No.
21
District No. Req. No. 5-7-76
Date Sampled
Indentification marks
Specification Item No.
Material from property of

DETERMINATIONS

FLUX OIL

Specific Gravity @ 60°F. --------- 0.9291; @ 77°F. ----------	0.9251
Flash Point, C.O.C. ----------	445°F.
Furol Viscosity @ 122°F. ----------	79 Sec.
Loss on Evaporation 50 g., 5 hrs. @ 325°F ----------	1.20%
Water ----------	Nil
Asphalt Content of 85-115 Penetration (by Evap.Method) ----------	47.6% *
Evaporation Asphalt Content Residue Penetration @ 77°F. ---------	90

* Reduced by Vacuum and Evaporation Method.

Texas Highway Department
Form 231

GENERAL TEST REPORT

No Charge

Laboratory No. C76370995
Date Received 5-14-76 Date Reported 5-27-76
Dist. or Res. Engr. G. G. Garcia
Address Pharr
Sampler S. M. Giles
Sampler's Title Engr, Tech. V
Contractor
Sampled from Transport
(pit, quarry, car or stockpile)
Producer Witco Chemical Corp.
Quantity represented by sample
Has been used on
Proposed for use as
Aggr.Prod. - Salv. Asph.Conc.

Material RECLAMITE

INFORMATIONAL
Control No. Sect. No. Job No.
Hidalgo
County Federal Project No. Loop 374
Hwy. No.
21
District No. Req. No. 5-7-76
Date Sampled
Indentification marks
Specification Item No.
Material from property of

DETERMINATIONS

RECLAMITE BASE OIL

Viscosity (Furol) @ 122°, secs. ---------- 100

Specific Gravity @ 60°F. ---------- 0.9840

Flash Point C.O.C. °F. ---------- 405

SAMPLE	ASPHALT PROPERTIES: EXTRACTED ASPHALT (% BY WT.)	VISC. @ 140°F (STOKES)	PEN @ 77°F	DUCT. @ 77°F (cm)	ADDITIVE: TYPE	% BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
Old Pavement, Crushed & Sized (Samples from SH 336)								
Station: 276+55	7.4		9					
	7.3							
Station: 338+00	6.8		9					
	6.8							
Station: 322+00	7.3		9					
	7.4							
Station: 308+00	7.2		9					
	7.2							
Old Pavement - Combined as Graded Mixed @ 250°F, Molded							81	
Trial Specimen remixed @ 285°F, molded					Amer.Pet. AC-3	1.5*		
Old Pavement - Combined as Graded Mixed @ 285°F, Molded							84	990
Old Pavement - Combined as Graded Mixed @ 285°F, Cured for 1 hour @ 250°F, Molded.					Flux Oil	2.0*		
Mixed @ 285°F, Cured 30 minutes @ 250°F					Flux Oil	1.6*	19	
Mixed @ 285°F, Cured 30 minutes @ 250°F, Molded.					Reclamite Base Oil	1.6*	22	

*Moisture in material not considered in the determination of this value

MATERIALS & TESTS DIVISION - D-9

SAMPLE	ASPHALT PROPERTIES: EXTRACTED ASPHALT (% BY WT.)	VISC. @ 140°F (STOKES)	PEN @ 77°F	DUCT. @ 77°F (cm)	ADDITIVE: TYPE	ADDITIVE: % BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
Mixed @ 285°F, Cured 1 hour @ 250°F, Molded					Flux Oil	1.6*	19	
Mixed @ 285°F, Cured 1 hour @ 250°F, Molded					Flux Oil	1.0*	35	
Old Pavement - Combined as Graded. Extraction Sample = the 3 Hveem specimens tested in Bituminous Section. Mixed @ 285°F, Molded.	7.5		20	6	Flux Oil	1.0	58	613
Old Pavement - Combined as Graded. Extraction Sample = the 3 Hveem specimens tested in Bituminous Section. Mixed @ 285°F, Molded.	7.2		25	24	Reclamite Base Oil	1.0	60	532
Old Pavement - Combined as Graded. Mixed @ 285°F, Molded.					Flux Oil	2.0	29	455
Old Pavement - Combined as Graded. Mixed @ 285°F, Molded.					Reclamite Base Oil	2.0	27	352
Old Pavement - Combined as Graded. Extraction Sample = the 3 Hveem specimens tested in Bituminous Section. Mixed @ 285°F, Molded	7.8	29,937	35	9	Flux Oil	1.6	33	497

*Moisture in material not considered in the determination of this value

MATERIALS & TESTS DIVISION - D-9

SAMPLE	ASPHALT PROPERTIES: EXTRACTED ASPHALT (% BY WT.)	VISC. @ 140°F (STOKES)	PEN. @ 77°F	DUCT. @ 77°F (cm)	ADDITIVE: TYPE	ADDITIVE: % BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
Old Pavement - Combined as Graded. Extraction sample = the 3 Hveem specimens tested in Bituminous Section. Mixed @ 285°F, Molded.	8.0	7,732	43	141+	Reclamite Base Oil	1.6	46	416
Recycled Pavement Mixture from District 21. Produced in Motheral Dryer/Drum Plant @ 260°F. Mixture heated to 250°F, Molded.							85	876
Mixture Headed to 250°F, Molded.					AC-10	2.0	89	849
MixturedHeaded to 250°F, Molded.					AC-10	3.0	27	484
Old Pavement - Combined as Graded. Mixed @ 285°F, Molded.	8.8		18	7.5	Exxon AC-3	2.5	32	480
F76510074 Sample No. 1 - Plant Loop 374, Station No. 11+00 NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	7.3	32,469	19	12	Exxon AC-3	2.5	40	756
F76510075 Sample No.8 - Roadway Loop 374, Station No. 11+00SML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	8.2	23,178	24	19	Exxon AC-3	3.0	24	635
F76510076 Sample No.2 - Plant Loop 374, Station No. 17+00SML Bucket Sample, Moist.Cont.=0.2% by wt. Heated just enough to break up. Then molded.	7.8	53,850	20	10	Exxon AC-3	3.0	61	784

SAMPLE	EXTRACTED ASPHALT (% BY WT.)	ASPHALT PROPERTIES: VISC. @ 140°F (STOKES)	ASPHALT PROPERTIES: PEN @ 77°F	ASPHALT PROPERTIES: DUCT. @ 77°F (cm)	ADDITIVE: TYPE	ADDITIVE: % BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
F76510077, Sample No.3 - Plant Loop 374, Station No. 28+00NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	6.1	7,571	37	141+	Reclamite Base Oil	1.6	72	648
F76510078, Sample No. 4-Plant Loop 374, Station No. 31+00NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	6.0	4,760	49	141+	Reclamite Base Oil	1.6	58	750
F76510079, Sample No.5-Plant Loop 374, Station No. 42+00NML Truck Temp = 207°F Bucket Sample, Moist.Cont.=0.4% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	6.8	6,123	50	28	Flux Oil	1.6	62	560
F76510080, Sample No.6-Plant Loop 374, Station No. 53+00NML Truck Temp = 220°F Bucket Sample, Moist.Cont.=1.4% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	6.7	4,069	64	42	Flux Oil	2.0	63	571
F76510081, Sample No.7-Plant Loop 374, Station No. 47+00SML Truck Temp = 210°F Bucket Sample, Moist.Cont.-0.3% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	7.2	3,092	69	80	Flux Oil	2.0	72	781

MATERIALS & TESTS DIVISION - D-9

SAMPLE	ASPHALT PROPERTIES: EXTRACTED ASPHALT (% BY WT.)	VISC. @ 140°F (STOKES)	PEN. @ 77°F	DUCT. @ 77°F (cm)	ADDITIVE: TYPE	ADDITIVE: % BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
Old Pavement - Combined as Graded. Extraction sample = the 3 Hveem specimens tested in Bituminous Section. Mixed @ 285°F, Molded.	8.0	7,732	43	141+	Reclamite Base Oil	1.6	46	416
Recycled Pavement Mixture from District 21. Produced in Motheral Dryer/Drum Plant @ 260°F. Mixture heated to 250°F, Molded.							85	876
Mixture Headed to 250°F, Molded.					AC-10	2.0	89	849
MixturedHeaded to 250°F, Molded.					AC-10	3.0	27	484
Old Pavement - Combined as Graded. Mixed @ 285°F, Molded.	8.8		18	7.5	Exxon AC-3	2.5	32	480
F76510074 Sample No. 1 - Plant Loop 374, Station No. 11+00 NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	7.3	32,469	19	12	Exxon AC-3	2.5	40	756
F76510075 Sample No.8 - Roadway Loop 374, Station No. 11+00SML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	8.2	23,178	24	19	Exxon AC-3	3.0	24	635
F76510076 Sample No.2 - Plant Loop 374, Station No. 17+00SML Bucket Sample, Moist.Cont.=0.2% by wt. Heated just enough to break up. Then molded.	7.8	53,850	20	10	Exxon AC-3	3.0	61	784

MATERIALS & TESTS DIVISION - D-9

SAMPLE	EXTRACTED ASPHALT (% BY WT.)	ASPHALT PROPERTIES: VISC. @ 140°F (STOKES)	ASPHALT PROPERTIES: PEN @ 77°F	ASPHALT PROPERTIES: DUCT. @ 77°F (cm)	ADDITIVE: TYPE	ADDITIVE: % BY WT.	HVEEM STABILITY AVG.	COHES. VALUE AVG.
F76510077, Sample No.3 - Plant Loop 374, Station No. 28+00NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	6.1	7,571	37	141+	Reclamite Base Oil	1.6	72	648
F76510078, Sample No. 4-Plant Loop 374, Station No. 31+00NML Bucket Sample, Moist.Cont.=0.3% by wt. Heated just enough to break up. Then molded.	6.0	4,760	49	141+	Reclamite Base Oil	1.6	58	750
F76510079, Sample No.5-Plant Loop 374, Station No. 42+00NML Truck Temp = 207°F Bucket Sample, Moist.Cont.=0.4% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	6.8	6,123	50	28	Flux Oil	1.6	62	560
F76510080, Sample No.6-Plant Loop 374, Station No. 53+00NML Truck Temp = 220°F Bucket Sample, Moist.Cont.=1.4% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	6.7	4,069	64	42	Flux Oil	2.0	63	571
F76510081, Sample No.7-Plant Loop 374, Station No. 47+00SML Truck Temp = 210°F Bucket Sample, Moist.Cont.-0.3% by wt. Hydro.Vol.Cont. = 0.1% by wt. Heated just enough to break up. Then molded.	7.2	3,092	69	80	Flux Oil	2.0	72	781

DISTRICT 21 - RECYCLED PAVEMENT FIELD SAMPLES OF MIXTURE PRODUCED

EXTRACTION & RESIDUAL BITUMEN TEST DATA

	F76510074 Sample 1 2.5% by Wt. AC-3 (% by Wt.)	F76510075 Sample 8 3.0% by Wt. AC-3 (% by Wt.)	F76510076 Sample 2 3.0% by Wt. AC-3 (% by Wt.)	F76510077 Sample 3 1.6% by Wt. Reclamite (% by Wt.)	F76510078 Sample 4 1.6% by Wt. Reclamite (% by Wt.)	F76510079 Sample 5 1.6% by Wt. Flux Oil (% by Wt.)	F76510080 Sample 6 2.0% by Wt. Flux Oil (% by Wt.)	F76510081 Sample 7 2.0% by Wt. Flux Oil (% by Wt.)
Ret. 1½"								
1½" - 1¼"								
1¼" - 1"			0			0		
1" - 7/8"			1.2	0		1.1	0	0
7/8" - 5/8"			0.6	1.2	0	0	1.7	0.9
5/8" - 1/2"	0	0	0.4	0.3	1.1	1.5	1.3	1.1
1/2" - 3/8"	6.3	1.4	4.6	6.3	4.2	2.5	3.2	1.5
3/8" - No. 4	22.6	13.4	14.8	26.6	18.8	18.8	19.8	12.3
No. 4 - No. 10	18.2	23.4	16.4	18.6	23.4	20.9	20.9	17.2
Ret. No. 10	47.1	38.2	38.0	53.0	47.5	44.8	46.9	33.0
No. 10 - No. 40	16.3	20.7	21.4	15.2	19.2	19.8	18.0	24.8
No. 40 - No. 80	10.4	10.7	12.0	8.6	9.8	10.3	10.6	16.0
No. 80 - No. 200	8.0	9.4	9.2	7.7	7.9	8.0	8.0	9.4
Pass No. 200	10.9	12.8	11.6	9.4	9.6	10.3	9.8	9.6
Residual Bitumen	7.3	8.2	7.8	6.1	6.0	6.8	6.7	7.2
			TESTS ON RESIDUAL BITUMEN					
Viscosity @ 140°F (stokes)	32,469	23,178	53,850	7,571	4,760	6,123	4,069	3,092
Pen. @ 77°F	19	24	20	37	49	50	64	69
Duct. @ 77°F (cm.)	12	19	10	141+	141+	28	42	80

DISTRICT 21 - RECYCLED MATERIAL
HVEEM SPECIMEN MOLDED IN DISTRICT 21 FIELD LAB

LAB NO.	SAMPLE	HVEEM STAB.(%)	COHES.VALUE
F76510096	2.5% by wt. Exxon AC-3 Truck @ plant - Sample #1	36	852
F76510097	3.0% by wt. Exxon AC-3 Roadway - Sta.No. 11+00 S.L. - Road Sample #8	27	592
F76510098	3.0% by wt. Exxon AC-3 Truck @ plant - Sample #2	29	637
F76510099	1.6% by wt. Reclamite (Witco Chemical Corp.) Truck @ plant - Sample #3	53	623
F76510100	1.6% by wt. Reclamite (Witco Chemical Corp.) Truck @ plant - Sample #4	62	564
F76510101	1.6% by wt. Flux Oil (Tesoro Petroleum Corp.) Truck @ plant - Sample #5	63	569
F76510102	2.0% by wt. Flux Oil (Tesoro Petroleum Corp.) Truck @ plant - Sample #6	60	577
F76510103	2.0% by wt. Flux Oil (Tesoro Petroleum Corp.) Truck @ plant - Sample #7	71	694

DATA OBTAINED BY

UNIVERSITY OF TEXAS

CENTER FOR HIGHWAY RESEARCH

STATIC TEST RESULTS FOR LAB MIXED - LAB COMPACTED

Treatment	Location	Tensile Strength, psi	Modulus of Elasticity $\times 10^6$ psi	Poisson's Ratio
No Additive	—	315.4	0.3920	-0.04
2.5% AC-3	—	181.6	0.2456	0.37
1.0% RBO	—	146.4	0.2222	0.30
1.6% RBO	—	97.5	0.1466	0.27
1.0% FO	—	139.8	0.1380	0.23
1.6% FO	—	96.1	0.1207	0.26

STATIC TEST RESULTS FOR PLANT MIXED - LAB COMPACTED

Treatment	Location	Tensile Strength, psi	Modulus of Elasticity $\times 10^6$ psi	Poisson's Ratio
2.5% AC-3	—	235.0	0.1793	0.28
3.0% AC-3	—	216.4	0.1719	0.31
3.0% AC-3	Sta. 17	274.0	0.2132	0.23
1.6% RBO	Sta. 28	183.4	0.1401	0.33
1.6% RBO	Sta. 31	93.7	0.0645	0.33
1.6% FO	Sta. 42	122.9	0.1115	0.36
2.0% FO	Sta. 47	147.4	0.1308	0.33
2.0% FO	Sta. 53	123.3	0.1001	0.28

FATIGUE AND REPEATED-LOAD TEST RESULTS FOR LAB MIXED - LAB COMPACTED

Treatment	Location	Stress Strength Ratio, %	Stress Level, psi	Fatigue Life, cycles	Resilient Modulus of Elasticity, psi	Mean Modulus psi	Resilient Poisson's Ratio	Mean Poisson's Ratio
No Additive	—	26.2	82.6	6,617	1,003,673	838,809	-0.06	-0.02
		18.4	58.0	71,635	673,944		0.01	
2.5% AC-3	—	30.3	55.1	3,147	450,260	452,217	0.34	0.36
		20.7	37.7	21,065	454,173		0.38	
1.0% RBO	—	39.6	58.0	1,624	489,211	465,652	0.41	0.37
		19.8	29.0	52,945	442,093		0.32	
1.6% RBO	—	29.7	29.0	2,578	357,356	343,854	0.69	0.61
		17.8	17.4	18,765	330,352		0.53	
1.0% FO	—	39.4	55.1	1,651	402,750	378,852	0.42	0.39
		26.9	37.7	17,473	354,954		0.35	
1.6% FO	—	30.1	29.0	6,703	305,986	286,152	0.52	0.44
		21.1	20.3	21,780	266,317		0.36	

FATIGUE AND REPEATED-LOAD TEST RESULTS FOR PLANT MIXED - LAB COMPACTED

Treatment	Location	Stress Strength Ratio, %	Stress Level, psi	Fatigue Life, cycles	Resilient Modulus of Elasticity, psi	Mean Modulus psi	Resilient Poisson's Ratio	Mean Poisson's Ratio
2.5% AC-3	—	30.8 18.5	72.5 43.5	1,383 25,565	442,306 413,431	427,869	0.30 0.17	0.24
3.0% AC-3	—	26.8 16.7	58.0 36.2	4,459 44,680	518,757 445,118	481,938	0.35 0.30	0.33
3.0% AC-3	Sta. 17	26.4 14.8	72.5 40.6	2,308 102,144	478,623 491,945	485,284	0.20 0.15	0.18
1.6% RBO	Sta. 28	40.3 15.8	74.0 29.0	308 19,809	398,346 343,940	371,143	0.37 0.30	0.34
1.6% RBO	Sta. 31	40.2 30.9	37.7 29.0	12,150 50,140	384,720 378,077	381,399	0.32 0.35	0.34
1.6% FO	Sta. 42	33.0 15.3	40.6 18.9	1,052 84,651	249,235 315,333	282,284	0.39 0.43	0.41
2.0% FO	Sta. 47	39.3 15.7	58.0 23.2	452 40,005	291,365 270,882	281,124	0.33 0.22	0.28
2.0% FO	Sta. 53	35.2 15.2	43.5 18.9	769 72,432	252,788 301,595	277,192	0.33 0.26	0.30

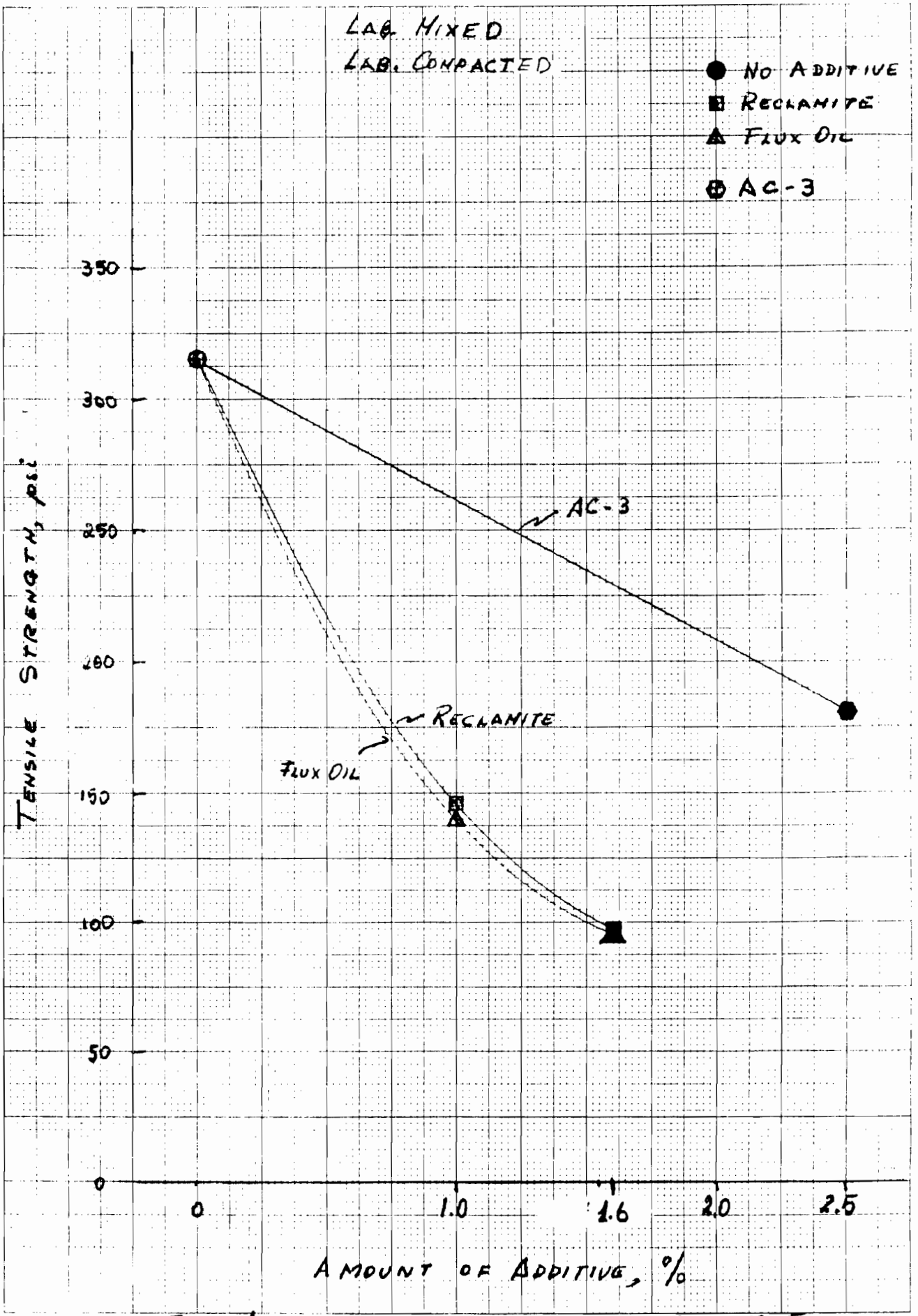


FIG. 1. TENSILE STRENGTH VS ADDITIVE FOR LAB MIX - LAB COMPACTION

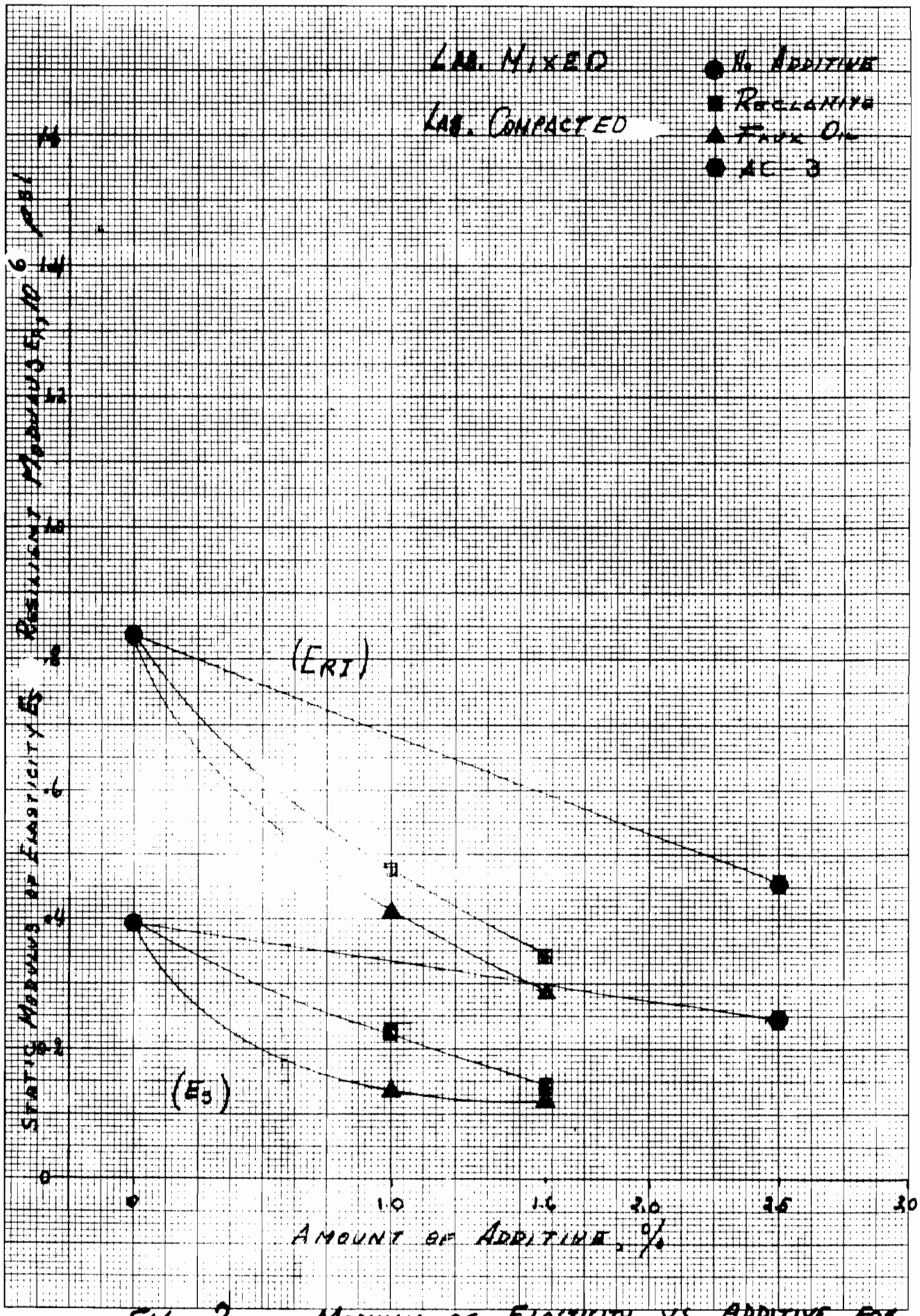


FIG. 2. MODULUS OF ELASTICITY VS ADDITIVE FOR LAB MIX - LAB COMPACTION.

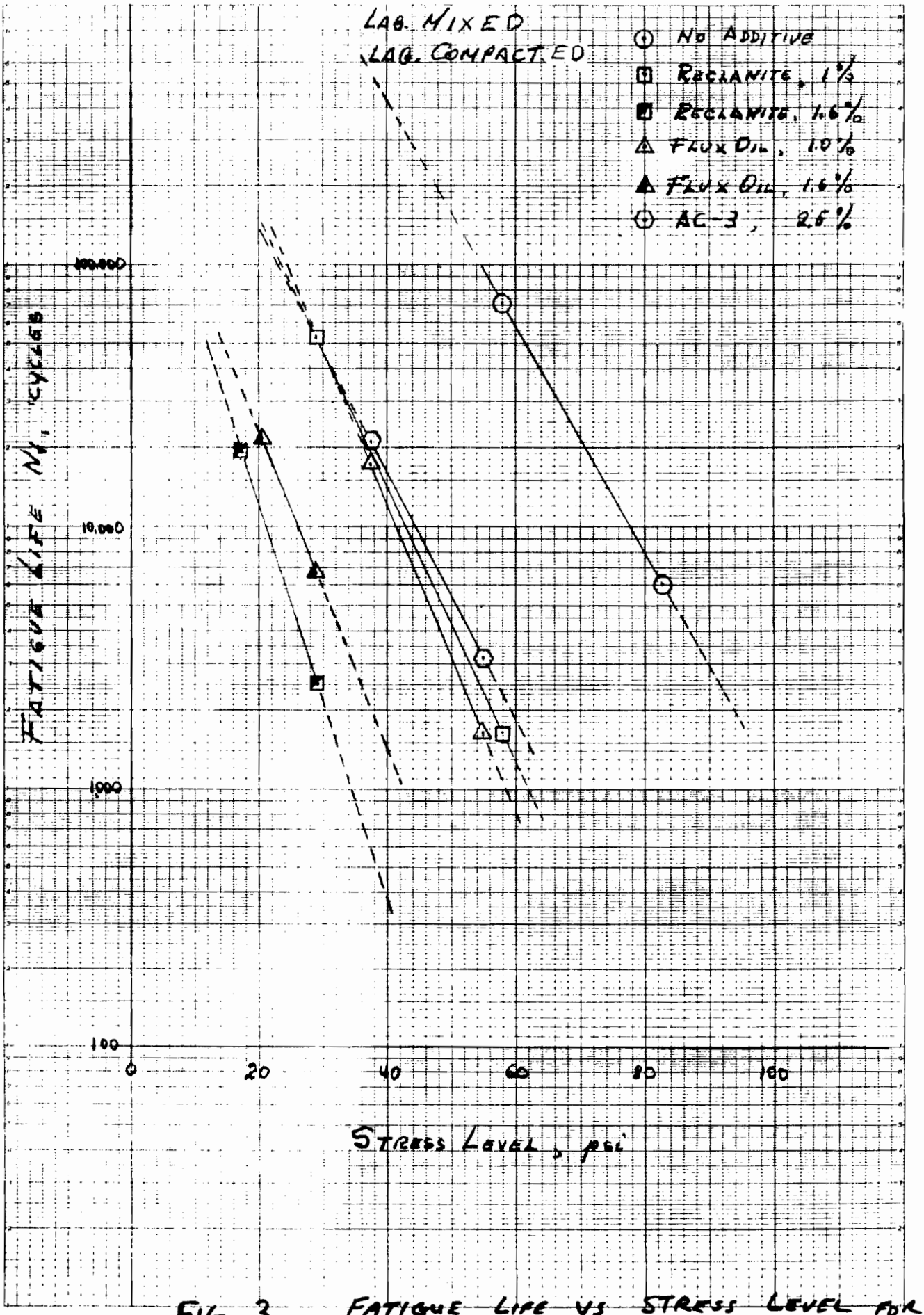


FIG. 3. FATIGUE LIFE VS STRESS LEVEL FOR LAB MIX - LAB COMPACTION.

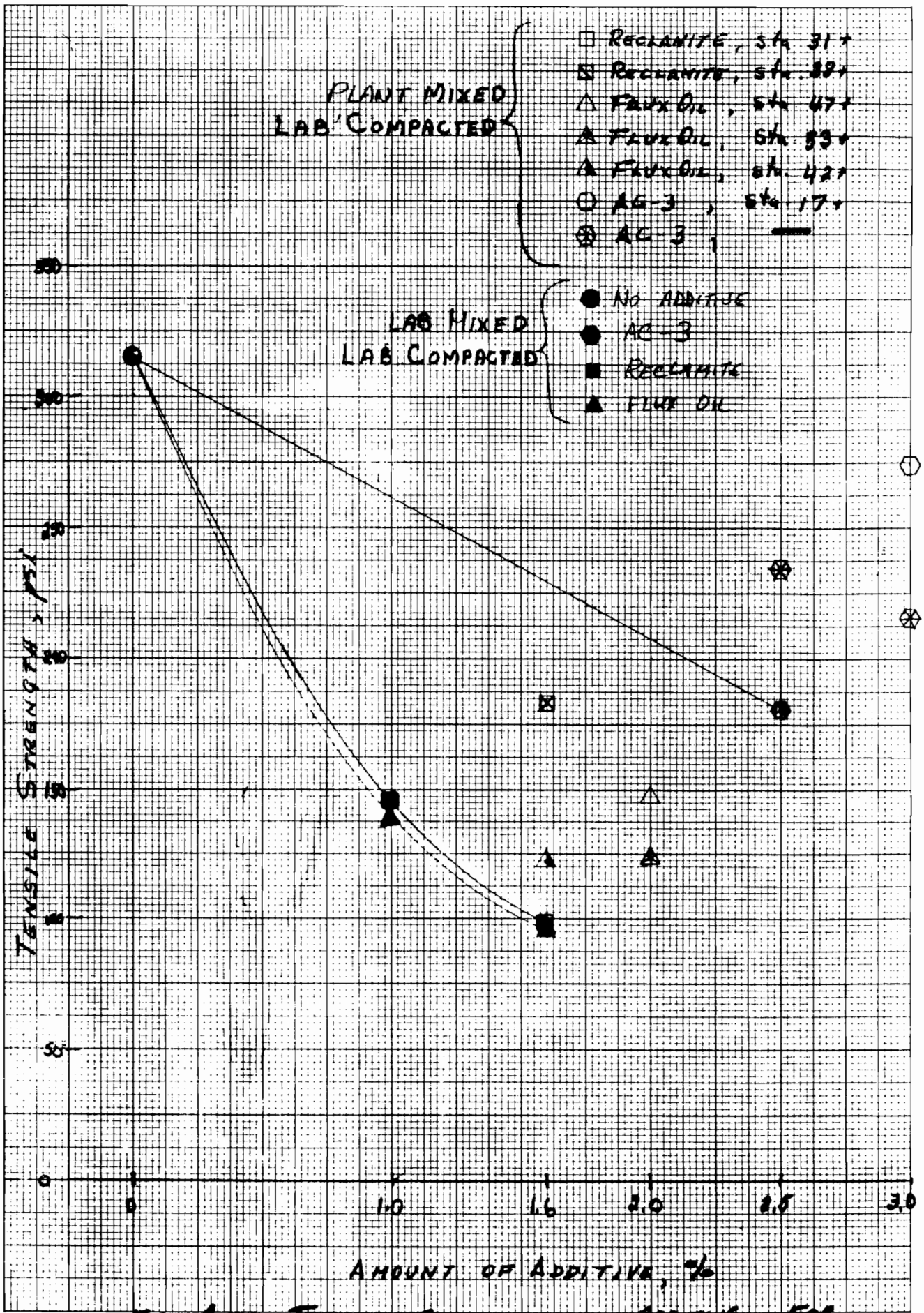


FIG. 4. TENSILE STRENGTH VS ADDITIVE FOR PLANT MIX - LAB COMPACTION AND LAB MIX - LAB COMPACTION

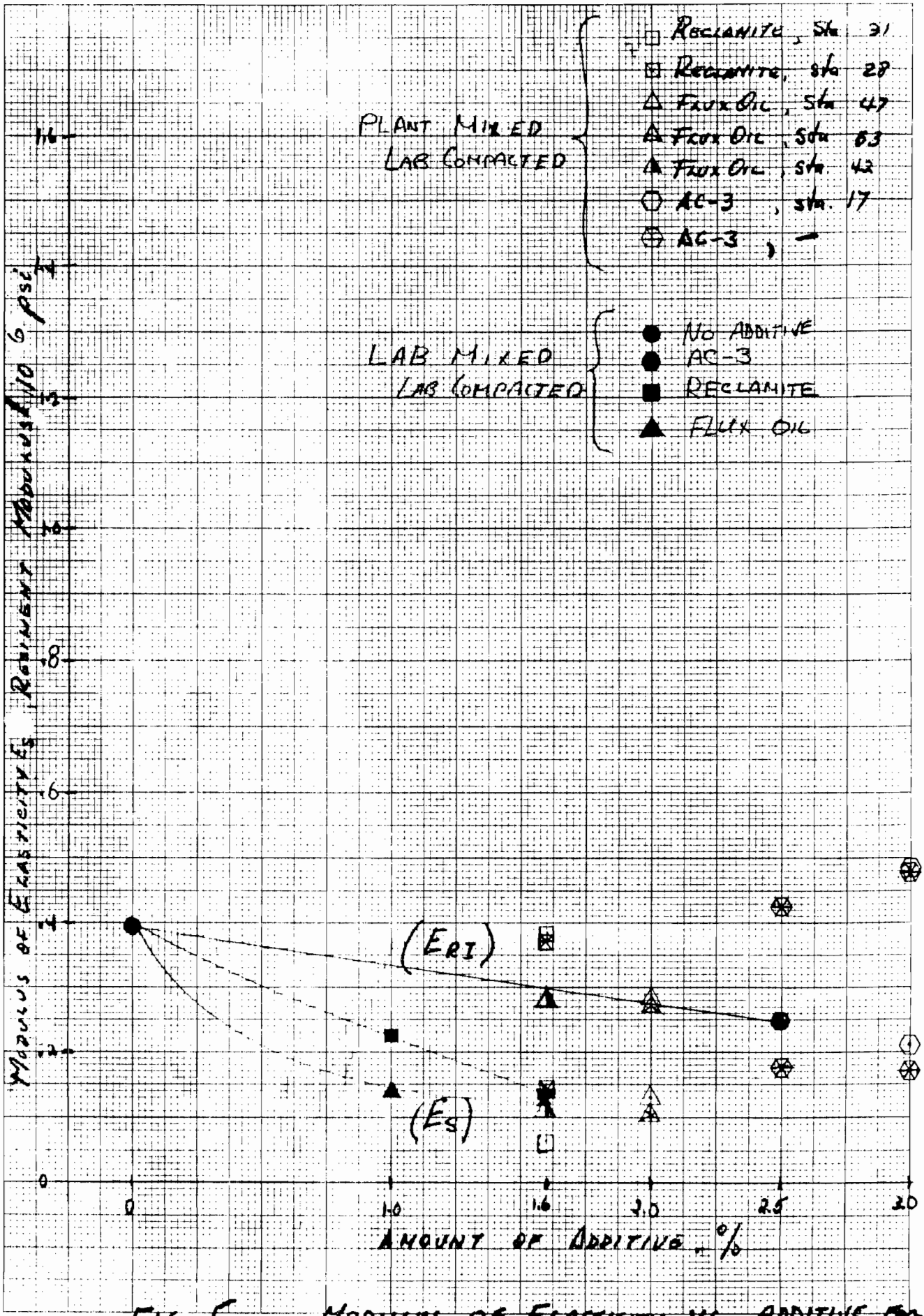


FIG. 5. MODULUS OF ELASTICITY VS ADDITIVE FOR PLANT MIX - LAB COMPACTION AND LAB MIX-

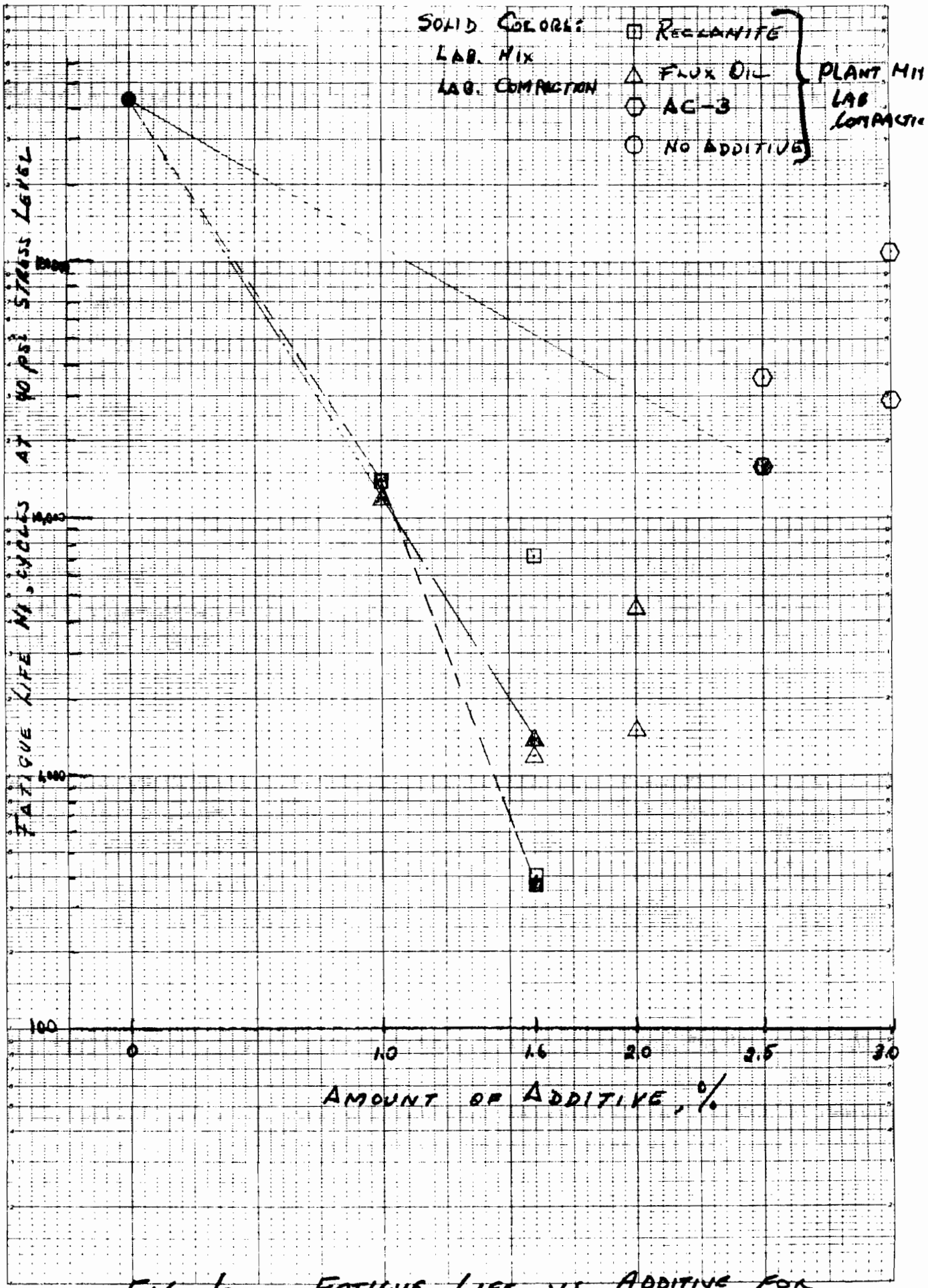


FIG. 6. FATIGUE LIFE VS ADDITIVE FOR PLANT MIX - LAB COMPACTION AND LAB MIX - LAB COMPACTION

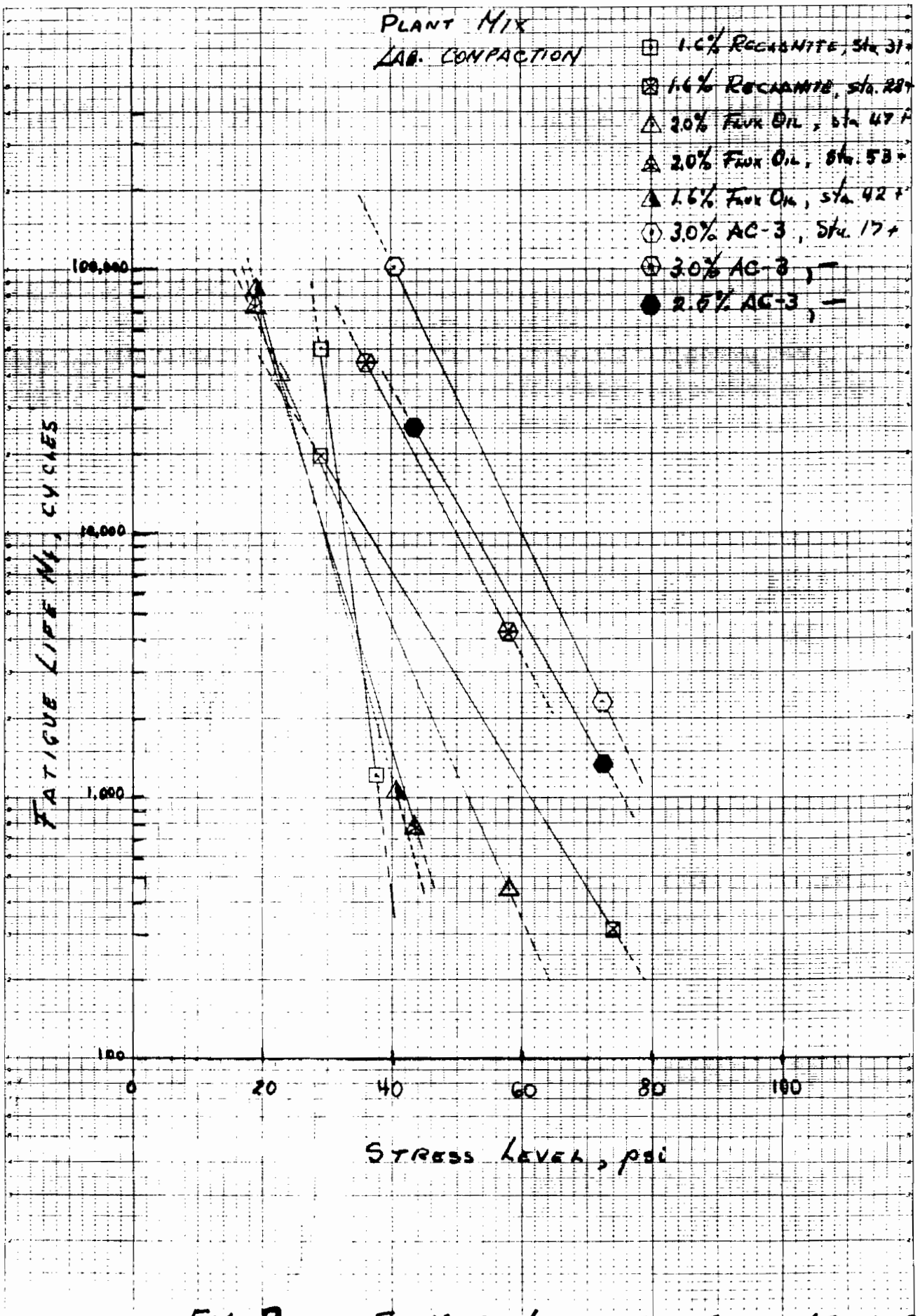


FIG. 7. FATIGUE LIFE VS STRESS LEVEL FOR PLANT MIX - LAB COMPACTION.

DATA OBTAINED BY TTI

MIX DESIGN	SPEC. NO.	STARTING MR @ 68°psi	MR SATURATED AT 68°F	MR AFTER DRYING	HVEEM CORRECTED STAB.	MARSHALL CORR. LOAD	MARSHALL FLOW	INDIRECT TENSION MODULUS	ASPHALT EXTRACTION % ASPH. BY WT.	ASPHALT EXTRACTION PENE. 77°F	ASPHALT EXTRACTION VISCOS. 140°F	% AIR VOIDS
Field												
322+00	1	0.909	0.536	0.664								9.78
	2	1.036			26	4212	20		8.15	4	312660	8.52
	3	0.837						47600			poises	8.74
	Avg.	$9.27X10^5$										9.01
338+00	1	0.412	0.229	0.598								9.39
	2	0.865			52	3808	26					9.30
	3	0.973						169477				9.73
	Avg.	$9.19X10^5$										9.47
276+55	2	1.039	0.694	1.006								9.47
	3	0.759			26.25	4342	19					9.04
	4	0.928						128429				9.26
	Avg.	$9.09X10^5$										9.26
308+00	1	0.924	0.601	0.515								11.47
	2	0.842			36.5	4142	19					10.04
	3	0.730						61524	7.71	14	35880	10.26
	Avg.	$8.32X10^5$									poises	10.59
Lab Samples	1	2.074	0.680	0.966								
Mixed 250°	2	1.720			69.5	7350	14					
Molded 250°	3	2.352						779579				
35-250°	4	2.105	0.700	0.898								
	5	2.067	0.759	0.782								
	6	1.810			68	6174	15					
	7	2.357						205465				
	8	1.893						495038				
	9	1.851			65	5880	14					

DATA OBTAINED BY TTI

MIX DESIGN	SPEC. NO.	STARTING MR @ 68°psi	MR SATURATED AT 68°F	MR AFTER DRYING	HVEEM CORRECTED STAB.	MARSHALL CORR. LOAD	MARSHALL FLOW	INDIRECT TENSION MODULUS	ASPHALT EXTRACTION % ASPH. BY WT.	ASPHALT EXTRACTION PENE. 77°F	ASPHALT EXTRACTION VISCOS. 140°F	% AIR VOIDS
Second Group	1	1.753						121070				
Mixed 285°	9	1.999	0.885	0.902								
Molded 250°	18	1.991			59.5	6468	12					
35-285	20	2.280	1.203	1.206								
	12	1.757						199676				
	3	2.203			57.5	5880	10					
	11	1.970						210486				
	7	1.907			61.5	5773	13					
	4	1.911	0.892	1.003								
	Avg.	$1.974X10^6$	$1.023X10^6$	$1.037X10^6$	59.5	6040	11.7	177077				
Third Group	7	0.455						90207				
35-1.6% Flux	13	0.598	0.789	0.698								
	18	0.635			31.5	2499	22					
	1	0.523						55691				
	12	0.429	0.732	0.659								
	21	0.462			29.5	2352	20					
	11	0.635						63640				
	19	0.621	0.716	0.639								
	20	0.478			30.5	2264	24					
	Avg.	$5.37X10^5$	$7.46X10^5$	$6.65X10^5$	30.5	2372	22	69846				
35-1.0% Flux	14	0.844						118930				
	18	0.853	1.150	1.039								
	19	0.912			49.5	3837	20					
	3	0.662						63890				
	7	0.832	1.276	0.956								
	10	0.700			40.25	3381	12					
	6	0.895						107497				
	11	0.813	1.175	0.975								
	16	1.043			54	3528	16					
	Avg.	$8.39X10^5$	$1.200X10^6$	$9.90X10^5$	47.9	3582	16	96772				

DATA OBTAINED BY TTI

MIX DESIGN	SPEC. NO.	STARTING MR @ 68°psi	MR SATURATED AT 68°F	MR AFTER DRYING	HVEEM CORRECTED STAB.	MARSHALL CORR. LOAD	MARSHALL FLOW	INDIRECT TENSION MODULUS	ASPHALT EXTRACTION % ASPH. BY WT.	ASPHALT EXTRACTION PENE. 77°F	ASPHALT EXTRACTION VISCOS. 140°F	% AIR VOIDS
Third Group	5	1.056						103990				
35-1% RBO	6	0.952	0.873	0.645								
	15	0.856			38	3528	15					
	7	0.924						87594				
	9	0.955	0.908	0.719								
	10	1.083			47.5	3587	18					
	13	0.724						83559				
	14	0.967	0.850	0.688								
	18	0.999			49.5	3690	17					
	Avg.	$9.46X10^5$	$8.77X10^5$	$6.84X10^5$	45	3602	16.7	91714				
Fourth Group												
2.5% AC-3	1	0.896						86707				
	3	1.090	0.932	0.949								
	21	1.146			23	2999	19					
	2	1.065						82912				
	15	1.040	0.949	1.146								
	17	1.079			31.75	2881	16					
	11	1.022						120919				
	14	0.970	0.932	1.149								
	16	1.064			27	3381	18					
	Avg.	$1.041X10^6$	$9.38X10^5$	$1.081X10^6$	27.25	3087	17.7	96846				
35-1.6% RBO	3	0.310						50770				
	15	0.369	0.398	0.445								
	17	0.450			37.5	2617	15					
	7	0.349						38062				
	13	0.367	0.369	0.381								
	18	0.482			42	2822	17					
	5	0.308						33740				
	8	0.382	0.440	0.548								
	19	0.457			32.75	2587	14					
	Avg.	$3.86X10^5$	$4.02X10^5$	$4.58X10^5$	37.42	2675	15.3	40857				

DATA OBTAINED BY TTI

MIX DESIGN	SPEC. NO.	STARTING MR @ 68°psi	MR SATURATED AT 68°F	MR AFTER DRYING	HVEEM CORRECTED STAB.	MARSHALL CORR. LOAD	MARSHALL FLOW	INDIRECT TENSION MODULUS	ASPHALT EXTRACTION % ASPH. BY WT.	ASPHALT EXTRACTION PENE. 77°F	ASPHALT EXTRACTION VISCOS. 140°F	% AIR VOIDS
Group Five	17	0.936						128835				
51-75	6	1.290	1.033	0.970								
AC-3 - 3%	10	1.177			26.5	3381	22					
	1	1.403						148733				
	3	0.958	1.143	1.217								
	4	1.081			32	3027	21					
	2	1.182						122094				
	9	1.051	1.406	1.305								
	21	1.087			24.5	4116	24					
	Avg.	1.129	1.194	1.164		3528	22					
Group Five	9	1.246						152835				
51-74	12	0.932	1.136	1.427								
AC-3 - 2.5%	17	1.282			41	5072	25					
	16	1.708						124869				
	1	0.879	1.353	1.658								
	8	1.253			31	4292	17					
	4	1.240						125094				
	20	0.976	1.291	1.299								
	14	1.195			46.5	4072	23					
	Avg.	1.190	1.260	1.461		4479	22					

POST CONSTRUCTION (TTI)

SAMPLE I.D.		HVEEM	MARSHALL LOAD	FLOW	AV.M_R X 10^6	% AID VOIDS
Reclamite	#2	57	5434	12	1.132	
51-77, 1.6%	3	58	5733	14	1.011	7.83
#3	4	60	5577	13	1.056	
Flux Oil	2	53	4228	15	0.940	
51-79, 1.6%	16	51	4530	12	1.012	5.13
#5	21	48	4228	13	0.854	
Reclamite	1	45	4205	15	0.890	
51-78, 1.6%	11	45	4350	14	0.792	7.83
#4	20	42	4350	14	1.233	
Flux Oil	4	62	5112	13	1.040	
51-81, 2%	13	65	4640	12	1.165	7.58
#7	20	62	5434	12	1.071	
Flux Oil	1	51	3650	11	0.875	
51-80, 2%	16	50	3969	19	0.844	5.88
#6	18	48	4321	13	0.719	
AC-3	4	44	5075	13	1.930	
51-76, 3%	15	48	5538	15	1.627	7.00
#2	21	55	5840	14	1.940	
FIELD	1B	23	1470	17	0.388	
CORES	2B	10	2500	19	0.459	
	3B	23	1362	23	0.287	
	4B	18	2497	16	0.394	
	5B	17	1248	20	0.196	15.91
	6B	17	1220	26	0.244	
	7B	19	1562	24	0.351	
	8B	15	384	24	0.115	
	9B	16	750	23	0.202	

SATURATION TEST

PROJECT _____ DATE 7/1/76 OPERATOR KW

MATERIAL District 21 Recycling, 6th Group Rec 7/13/76, Field Samples

	WEIGHTS			68^{o} MR X 10^{6}		
SAMPLE I.D.	START	7 DAY SSD	DRY	START	7 DAY SSD	DRY
8A	684.2	757.8	Broken	0.133	0.014	Broken
9A	748.0	833.4		0.205	0.042	0.069

SATURATION TEST

PROJECT _____ DATE 7/76 OPERATOR KW

MATERIAL District 21 Recycling, 6th Group Rec. 7/13/76

	SAMPLE I.D.	WEIGHTS START	WEIGHTS 7 DAY SSD	WEIGHTS DRY	68^{o} MR X 10^{6} START	68^{o} MR X 10^{6} 7 DAY SSD	68^{o} MR X 10^{6} DRY
Oil	51-80 2.0% 12	909.5	941.0	915.7	1.020	0.136	0.162
Oil	13	910.0	934.0	914.3	1.006	0.251	0.302
Oil	17	908.0	949.9	913.7	1.080	0.179	0.202
AC-3	51-76 3.0% 3	913.0	936.0	915.1	1.621	0.935	0.919
AC-3	9	912.7	935.7	915.2	1.894	0.766	0.870
AC-3	12	913.1	936.1	914.8	1.773	1.008	1.016
Field Samples	1A	1035.2	1097.6	1047.6	0.422	0.233	0.171
Field Samples	2A	619.2	671.2	619.0	0.541	0.248	0.377
Field Samples	3A	598.8	654.5	598.1	0.344	0.143	0.244
Field Samples	4A	623.8	674.5	625.2	0.407	0.154	0.223
Field Samples	5A	683.1	753.0	681.2	0.168	0.035	0.068
Field Samples	6A	856.7	919.9	856.9	0.322	0.089	0.003
Field Samples	7A	780.6	844.2	775.9	0.315	0.079	0.191

SATURATION TEST

PROJECT _____ DATE 8/76 OPERATOR KW

MATERIAL District 21 Recycling, 6th Group Rec. 7/13/76

	SAMPLE I.D.	WEIGHTS START	WEIGHTS 7 DAY SSD	WEIGHTS DRY	68^{o} MR X 10^{6} START	68^{o} MR X 10^{6} 7 DAY SSD	68^{o} MR X 10^{6} DRY
Reclamite	51-77 1.6% #1	908.2	950.4	913.0	0.957	0.416	0.321
	#10	908.6	949.1	913.5	1.615	0.409	0.382
	#16	909.8	948.6	913.8	1.240	0.458	0.382
Flux Oil	51-79 1.6% #1	898.2	936.0	904.0	0.925	0.137	0.069
	#17	897.1	929.8	902.7	1.038	0.189	0.116
	#20	896.8	929.3	903.4	1.069	0.210	0.118
Reclamite	51-78 1.6% #4	910.2	941.7	915.3	1.079	0.540	0.451
	#15	910.7	939.2	914.4	1.301	0.860	0.658
	#19	912.0	940.8	916.3	1.115	0.714	0.594
Flux Oil	51-81 2% #2	910.2	954.5	915.0	1.379	0.146	0.123
	#9	911.3	953.8	916.8	0.968	0.137	0.123
	#14	911.6	959.0	916.0	1.164	0.130	0.132

TEXAS DEPARTMENT OF HIGHWAYS & PUBLIC TRANSPORTATION

RECYCLE ASPHALT TESTS
LaJOYA - 5/5/76

Aggregate: 10% heavy, 26% medium, 64% light
Additives: Reclamite, Flux Oil, AC-3 Asphaltic Oil

TIME	% OPACITY	AGGREGATE TEMP. °F	COMMENTS
8:30	4		Reclamite
31	100		"
32	100		"
33	100		"
34	100		"
		SHUT DOWN	
9:10	100		Reclamite
11	100		"
12	100		"
9:13		SHUT DOWN	
9:16	90		Reclamite
17	50	200	"
18	30		"
20	80		"
22	100		"
24	100		"
26	100	275	"
28	100		"
30	100		"
32	100		"
9:44	50		AC-3
45	40	224	"
46	40	240	"
48	90		"
50	60		"
52	60		"
54	70		"
56	40		"
58	30		"
10:00	20		"
10:02	10	220	Fire Died

TIME	% OPACITY	AGGREGATE TEMP. °F	COMMENTS
10:04	0		AC-3
06	25	270	"
08	35		"
10	40		"
12	40	274	"
14	50		"
16	50	280	"
18	60		"
20	80		"
22	100	280	"
24	100	310	"
26	100	350	"
28	100	320	"
30	90	300	"
32	60	220	"
34	60		"
36	50		"
38	50	290	"
40	50		"
42	50		"
44	60	300	"
46	60	310	"
48	60		"
50	60		"
52	70		"
54	60	300	"
56	20		"
58	10		"
59	0	285	Flame out on fuel
11:05	25		AC-3
06	0		"
08	0		"
10	0	230	"
12	10		"
14	15	250	"
16	20	260	"
18	10		"
20	5		"
22	25	250	"
24	5	250	"
26	5		"
28	0		"
30	10	230	"
32	10	240	"
			SHUT DOWN

TIME	% OPACITY	AGGREGATE TEMP. °F		COMMENTS
11:36	100			AC-3
38	100			"
40	60			"
42	15			"
44	15	250		"
46	20	260		"
48	15	265		"
50	15	270		"
52	20			"
54	20			"
56	15	270		"
58				"
12:00				"
02				"
04				"
06	20		180 Tons/hr.	"
08	25			"
10	25			"
12	20	275		"
12:45		280	SHUT DOWN	"

TEXAS DEPARTMENT OF HIGHWAYS & PUBLIC TRANSPORTATION

RECYCLE ASPHALT TESTS
LaJOYA - 5/7/76

Aggregate: 10% heavy, 26% medium, 64% light
Additives: Reclamite, Flux Oil, AC-3 Asphaltic Oil

TIME	% OPACITY	AGGREGATE TEMP. °F		COMMENTS
9:00	50			AC-3 3%
02	40			"
04	100	170		"
06	100			"
08	50	275		"
10	90			"
12	80	240		"
14	80			"
16	60	280		"
18	50			"
20	40			"
22	30			"
24	25	280		"
26	25			"
28	20			"
30	25	275		"
32	20			"
34	25			"
36	20			"
38	20	270		"
40	15		100 T/hr.	"
42	15	270		"
44	20			"
46	25			"
48	35			"
50	50			"
52	40			"
54	35	290		"
56	20	293		"
58	10	280		"
10:00	5	255		"
02	0			"
04	5	270		"
06	10			"
08	5			"
10	10			"
12	10			"
10:14	30			Reclamite
16	50			"
18	90	240		"
20	90	290	Feed at Upper End	"
22	90		of Drum	"
24	80	290		"

TIME	% OPACITY	AGGREGATE TEMP. °F	COMMENTS
10:26	90	280	SHUT DOWN Cyclone partially block & inoperative
10:32			Start up with Reclamite
34	40		Reclamite injected "
36	35		at lower end "
38	80	255	"
40	75		"
42	50	257	"
44	45	260	"
46	40		"
48	20	240	1.6% with some varia- "
50	15		tion "
52	10	210	"
54	80	250	"
56	100		"
58	100		"
11:00	100	250	"
11:02	90		"
			SHUT DOWN to alter feed jet for Reclamite
12:10			4 ft.extension welded Reclamite
22	40		on to Reclamite feed "
24	5	205	injector "
26	20	220	"
28	25		"
30	25		"
32	30		"
34	40		"
36	100		"
38	100		"
40	100		"
42	30		"
44	100	260	"
46	40		"
48	60	220	"
50	50		"
52	40		"
54	60	230	"
56	50	240	"
58	80		"
13:00	100	240	"
02	100		"
04	100	250	"
06	100		"
08	100	250	"
10	100		"
12	100	300	"
14	80		"

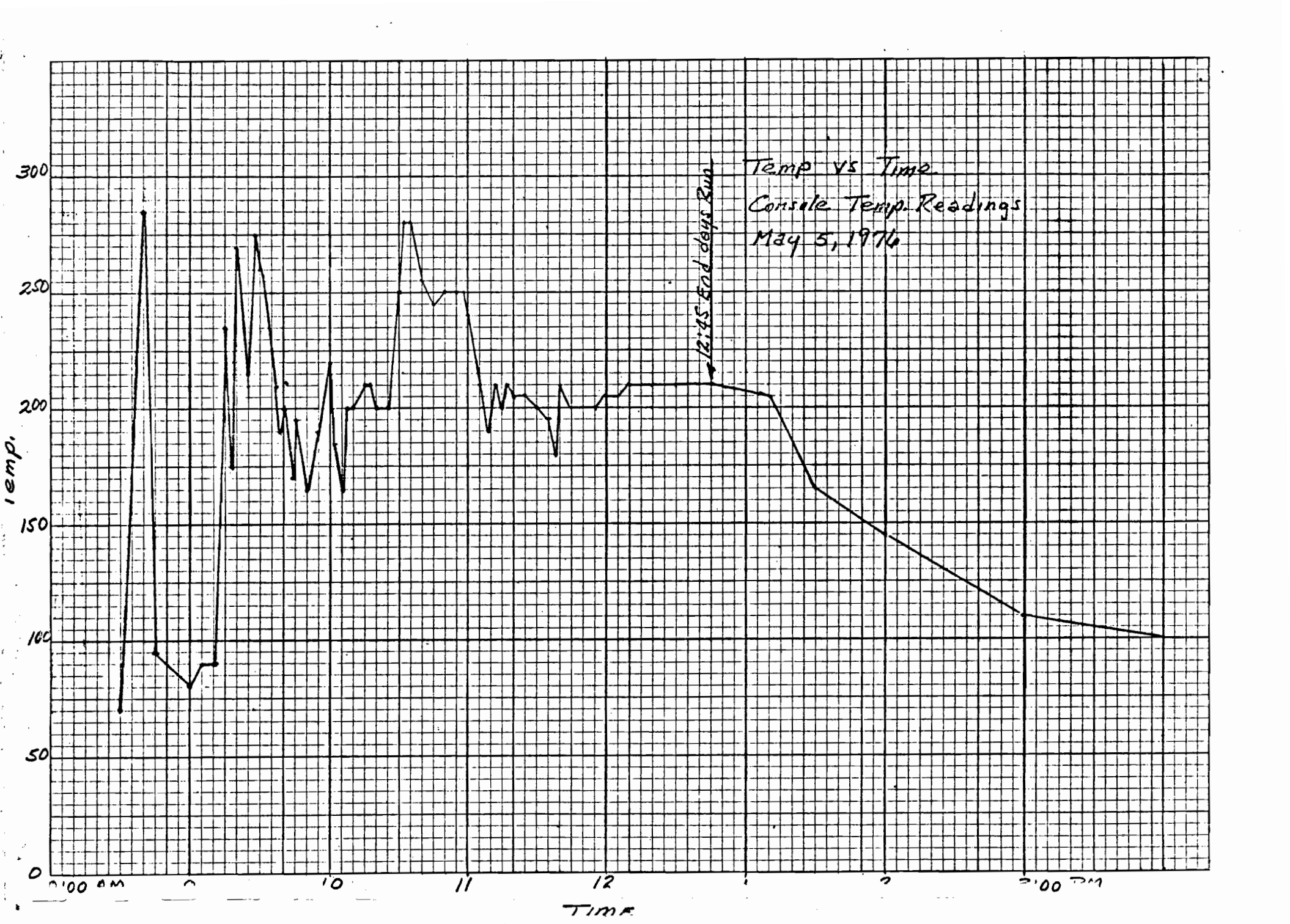
TIME	% OPACITY	AGGREGATE TEMP °F		COMMENTS
13:16	50	210		Reclamite
18	60			"
20	60			"
22	60	240		"
24	55			"
25				"
			SHUT DOWN	
13:27				Reclamite
28	65			"
30	60			"
32	65			"
34	70			"
36	60			"
38	65	260		"
40	80			"
42	100			AC-10 Flux Oil
43	100			"
44	100			"
46	100			"
48	100	285		"
50	20	275		"
52	10			"
54	30	225		"
56	35	250		"
58	60			"
14:00	80	245	2 minute shut down	"
02	80		at 13:42	"
04	40			"
06	50			"
08	40			"
10	30			"
12	35			"
14	20	220		"
16	80	225		"
18	75	230		"
			SHUT DOWN due to lack of trucks	
15:14	20		Start Up	AC-10 Flux Oil
16	20	180		"
18	30			"
20	40	200		"
22	30			"
24	30			"
26	20			"
28	10	230		"

TIME	% OPACITY	AGGREGATE TEMP. °F		COMMENTS
15:30	5			AC-10 Flux Oil
32	20	225		"
34	50	200	150 T/hr.	"
36	100			"
38	100	240		"
40	80			"
42	85	250		"
44	60			"
46	30	275		2% Flux Oil
48	20			"
50	30			"
52	35		100 T/hr.	"
54	25			"
56	20			"
			SHUT DOWN	
15:58	40		Start Up	
16:00	55		SHUT DOWN	

5/5/76

Console Temperature Readings

Time	Temp.(°F)	Time	Temp.(°F)	Time	Temp.(°F)
8:30	70	10:10	200	11:38	180
8:40	285	10:15	210	11:40	210
8:45	95	10:18	210	11:45	200
9:00	80	10:20	200	11:55	200
9:05	90	10:25	200	12:00	205
9:10	90	10:30	250	12:05	205
9:15	235	10:32	280	12:10	210
9:18	175	10:35	280	12:15	210
9:20	270	10:40	255	12:30	210
9:25	215	10:45	245	12:45	210
9:28	275	10:50	250	1:10	205
9:30	260	10:55	250	1:30	165
9:37	210	10:58	250	2:00	145
9:38	190	11:00	240	3:00	110
9:39	200	11:05	210	4:00	100
9:43	170	11:08	190		
9:45	195	11:12	210		
9:48	165	11:15	200		
9:55	190	11:18	210		
10:00	220	11:20	205		
10:02	185	11:25	205		
10:05	165	11:30	200		
10:07	200	11:35	195		


Temp vs Time
Console Temp. Readings
May 5, 1976
12:45 End days Run
Temp.
300
250
200
150
100
50
0
9:00 AM
10
11
12
3:00 PM
TIME

5/7/76

Console Temperature Readings

Time	Temp.(°F)	Time	Temp.(°F)	Time	Temp.(°F)
9:00	75	10:40	260	1:05	255
9:05	155	10:45	275	1:08	275
9:10	240	10:50	225	1:10	340
9:15	210	10:55	270	1:15	255
9:20	235	11:00	285	1:25	278
9:25	260	11:10	100	1:28	120
9:30	235	11:25	100	1:30	250
9:38	300	11:35	90	1:40	300
9:40	275	11:55	90	1:42	205
9:45	290	12:00	85	1:45	310
9:50	290	12:10	275	1:50	280
9:55	315	12:13	235	1:55	220
9:58	285	12:15	270	1:58	250
10:00	290	12:20	305	2:00	265
10:05	240	12:25	230	2:08	275
10:08	260	12:35	250	2:10	245
10:10	225	12:40	300	2:15	250
10:15	280	12:42	250	2:20	260
10:20	265	12:45	260	2:28	145
10:25	310	12:47	240	2:30	115
10:30	95	12:50	235	2:45	100
10:35	220	12:55	275	2:50	105
10:38	200	12:58	255	3:00	150

5/7/76

Time	Temp.(°F)	Time	Temp.(°F)	Time	Temp.(°F)
3:12	120	5:00	200	7:10	125
3:15	210	5:08	285	7:15	150
3:28	250	5:10	270	7:20	105
3:30	230	5:12	110	7:25	135
3:35	200	5:18	120	7:30	120
3:40	260	5:22	100	7:45	100
3:45	265	5:37	110	7:50	125
3:48	285	5:40	110	7:55	100
3:50	245	5:45	250	8:00	90
3:55	190	5:48	220		
3:58	245	5:50	230		
4:00	160	5:55	240		
4:10	105	6:00	235		
4:15	210	6:05	170		
4:20	245	6:10	230		
4:25	280	6:30	230		
4:28	220	6:38	135		
4:30	250	6:40	200		
4:38	185	6:45	150		
4:45	240	6:50	130		
4:48	205	6:55	170		
4:50	315	7:00	145		
4:55	290	7:05	185		

Temp VS Time
Console Temp Readings
May 7, 1976

G130 End of Days Run

300
250
200
150
100
50
0

9:00 AM 10 11 12 1 2 3 4 5 6 7 PM

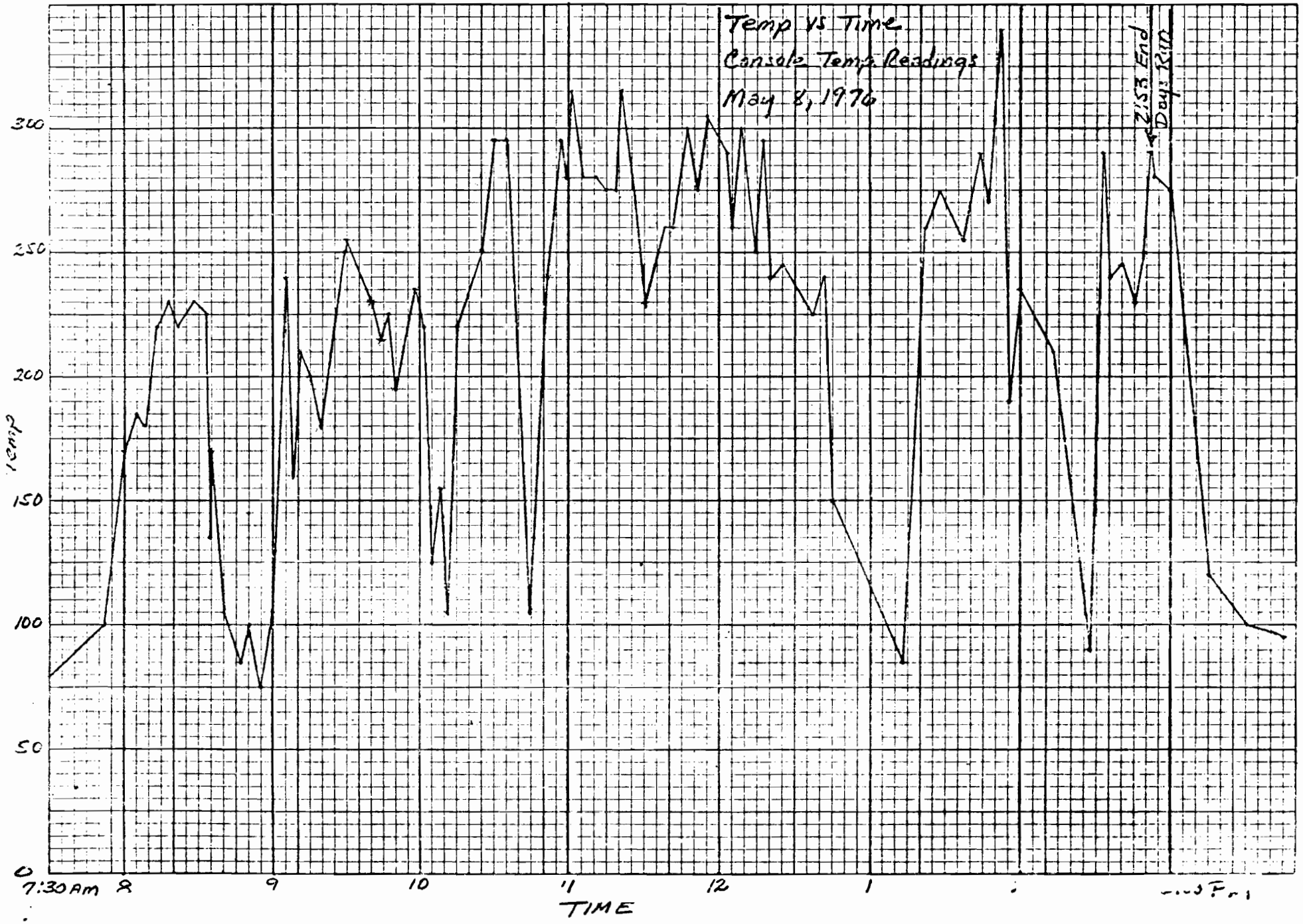
Console Temperature Vs. Discs

5-8-76

Time	Temp.	Time	Temp.	Time	Temp.
7:50	80	9:30	255	11:22	315
7:53	100	9:40	230	11:27	270
8:00	170	9:43	215	11:30	230
8:05	185	9:47	225	11:38	260
8:07	180	9:50	195	11:42	260
8:13	220	9:58	235	11:47	300
8:18	230	10:02	220	11:52	275
8:22	220	10:05	125	11:55	305
8:28	230	10:08	155	12:03	290
8:33	225	10:12	105	12:05	260
8:34	195	10:15	220	12:08	300
8:35	170	10:25	250	12:14	250
8:40	105	10:30	295	12:17	295
8:47	85	10:35	295	12:20	240
8:50	100	10:45	105	12:25	245
8:55	75	10:52	240	12:37	225
9:00	105	10:57	295	12:42	235
9:05	240	10:59	280	12:45	150
9:08	160	11:02	315	1:13	85
9:11	210	11:06	280	1:22	260
9:15	200	11:11	280	1:27	275
9:18	180	11:15	275	1:37	255
9:28	250	11:18	275	1:44	290

5-8-76

Time	Temp.
1:47	270
1:52	340
1:55	190
2:00	235
2:13	210
2:27	90
2:33	290
2:35	240
2:40	245
2:45	230
2:49	250
2:52	290
2:53	280
3:00	275
3:15	120
3:30	100
3:45	95


Temp vs Time
Console Temp Readings
May 8, 1976
2:53 End Day Run
300
250
200
150
100
50
0
Temp
7:30 AM
8
9
10
11
12
1
TIME

RECYCLED SALVAGE

TEMPERATURE READINGS AS THEY WERE RECORDED
FROM THE TRUCKS ON THE JOB SITE.

LOOP-374 HIDALGO COUNTY SAMPLED BY: R.E. CUELLAR &
J.A. LOPEZ

CONTRACTOR & PRODUCER: MOTHERAL CONTRACTORS

Date: 5-5-76 Weather: Windy & Cloudy 85°

Truck No.	Temperature (F°)	Arrived On Project	Type
408	225	10:50	AC-3 2.5%
400	250	11:15	AC-3 2.5%
408	240	1:30	AC-3 3.0%
402	200	2:30	AC-3 3.0%

DATE: 5-7-76 Weather: Windy & Cloudy 88°

TRUCK NO.	TEMPERATURE (°F) TRUCK FRONT	TEMPERATURE (°F) TRUCK BACK	ARRIVED ON JOB SITE	TYPE
408	275	260	9:45	AC-3 3.0%
400	265	255	10:15(Test Location #4)	
407	270	275	10:20	
406	270	240	10:40	
		**********		
400	210	215	11:10	Reclimite 1.6%
408	250	225	11:20	
407	215	210	11:37(Test Location #5)	
400	260	225	12:55(Test Location #6)	
406	255	245	1:05	
408	225	210	1:15	
407	225	265	1:40	
400	225	235	2:15	
		**********		
406	290	240	2:20	Flux Oil 1.6%
408	225	270	2:25	
407	250	225	3:50	
400	225	210	3:55(Test Location #7)	
406	225	250	4:00	
408	255	250	4:05	
		**********		
400	250	240	5:00	Flux Oil 2.0%
407	240	225	5:05(Test Location #8)	
406	200	240	5:15	
408	240	230	5:20	
400	220	270	5:50	
407	240	225	6:15	
406	225	210	6:35	

****

Date: 5/8/76 Weather: Windy & Cloudy 80°

Truck No.	Temperature (°F) Truck Front	Temperature (°F) Truck Back	Arrived On Job Site	Type
408	220	225	8:40	Flux Oil 2.0%
400	240	230	8:50	
406	240	235	9:35	
407	190	195	9:50	
408	235	220	10:00	
400	215	220	10:05 (Test Location #9)	
406	250	240	10:30	
		**********		
408	250	280	10:45	AC-10
407	220	225	11:00 (Void)	
400	265	250	11:15	
406	275	280	11:30	
408	270	260	11:45	
407	265	260	12:00	
400	240	225	12:10	
406	270	255	12:15	
408	280	275	12:36	
407	250	265	1:05	
400	225	240	1:07	
406	250	250	1:15	
408	230	240	2:20	
407	290	275	2:35	
400	295	280	2:50	
406	295	275	3:10	
408	250	250	3:25	
407	300	300	3:55	

core # 1

FIELD DATA

District No. 21 County Hidalgo Date 5/5/76

Project Loop-374 Producer Notheral Contr., Inc.

Material Recycled Salvage (AC-3 2.5% Asph.)

TEMPERATURES:

1. Mixture in laydown machine hopper 210 (°F.)
2. Mixture at beginning of rolling sequence 225 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
4	Flatwheel	12 Tons		Density was recorded immediately after
1	Pneumatic	25 Tons	10 Tires @ 40	every pass. A Maximum Density was obtained
1	Tandem	8-12 Tons		after 4th Pass w/Flatwheel. Pneumatic
				Roller increased Density very little.
				Ruts & Heavy Roller Marks were made by
				Pneum.-It was removed from rolling
				pattern. Density on freshly laid mat'l.
				was 107.5 #/cu.ft.-Max. Density was
				126.0 #/cu.ft.-Density taken day after
				rolling was 134.0 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	W.Bound	3+00	Outside Wheelpath South East ℄ of
				Trailer Park St.--23' South from North
				R.O.W.
				3 cores were taken 5-6-76

REMARKS On all Test Locations, Temp. was recorded before & after every pass

A 10' strip of foil was placed beneath mat'l. for future tests

"Maximum Density" -The Highest Density Obtained From The Roller Operation

Core #2

FIELD DATA

District No. 21 County Hidalgo Date 5-05-76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (AC-3 2.5% Asph.)

TEMPERATURES:

1. Mixture in laydown machine hopper 250 (°F.)

2. Mixture at beginning of rolling sequence 250 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
4	Flatwheel	12 Tons		Rolling pattern obtaining good density
1	Tandem	8-12 Tons		results. Number of passes could be re-
				duced. Freshly laid mat'l. had a density
				of 106.0 #/cu. ft. - Max. Density was
				128.0 #/cu. ft.
				Density taken the day after rolling was
				130.0 #/cu. ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	W.Bound	11+00	10' E. of 1st. culvert (HWL) 24' from
				North R.C.W.
				3 cores were taken 5-6-76 outside
				wheel path.

REMARKS On all test locations, temp. was recorded before & after every pass. 10' strip of foil was placed beneath mat'l. for future tests.

"Maximum Density" - The Highest Density Obtained From The Roller Operation

Core #3

FIELD DATA

District No. 21 County Hidalgo Date 5-5-76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (AC-3 3.0% Asph.)

TEMPERATURES:

1. Mixture in laydown machine hopper 200 (°F.)
2. Mixture at beginning of rolling sequence 200 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Flatwheel	12 Tons		Number of passes not sufficient to
1	Tandem	8-12 Tons		obtain real good density. Flatwheel
				should make at least three passes.
				Freshly laid mat'l. had a density of
				106.0 #/cu.ft. - Maximum Density was
				118.5 #/cu.ft. Density taken the day
				after rolling was 122.0 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	E.Bound	11+00	10' E. of 1st. culvert (Hdwl) 41' from
				North R.O.W.
				3 Cores taken on 5-6-76

REMARKS On all Test Locations, Temp. was recorded before & after every pass

10' strip of foil was placed beneath mat'l. for future test.

"Maximum Density" - The Highest Density Obtained From The Rolling Operation.

Core #4

FIELD DATA

District No. 21 County Hidalgo Date 5-7-76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (AC-3 3%)

TEMPERATURES:

1. Mixture in laydown machine hopper 255 (°F.)
2. Mixture at beginning of rolling sequence 260 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
3	Flatwheel	12 Tons		Good Density. Very little displacement.
1	Tandem	8-12 Tons		No roller marks. Density on freshly laid
				mat'l. was 114.5 #/cu.ft. Max. Density
				was 132.0 #/cu.ft. Density taken day
				after was 132.5 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	E.Bound	17+00	19' W. of 1st. County Rd. W. of the Expwy
				43 1/2' So. of North R.C.W. Outside
				wheel path.
				3 cores were taken 5-8-76

REMARKS On test locations, temp. was recorded before & after every pass. 10' strip of foil was placed beneath mat'l. for future tests.

"Maximum Density" - The Highest Density Obtained from The Roller Operation.

Core #5

FIELD DATA

District No. 21 County Hidalgo Date 5/7/76

Project Loop-374 Producer Motheral Contr. Inc.

Material Recycled Salvage (Reclimite 1.6%)

TEMPERATURES:

1. Mixture in laydown machine hopper 200 (°F.)
2. Mixture at beginning of rolling sequence 205 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Tandem	8-12 Tons		Heavy displacement & roller marks. Flat-
2	Pneumatic	25 Tons	10 Tires @ 40	wheel removed from rolling pattern. Density not as high as on AC-3. Max. Density however was obtained. Density on freshly laid mat'l. was 109.0 #/cu.ft. Max. Den. was 122.5 #/cu.ft. Density the day after was 125.5 #/cu.ft. Compacters had to wait before rolling. Mat'l. looked dry.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	W. Bound	28+00	55' E. of 2nd. County Rd. 19' So. of North R.O.W. Outside Wheel Path
				3 Cores were taken 5/8/76

REMARKS On all Test Locations, Temp. was recorded before and after every pass.

A 10' strip of foil was placed beneath mat'l. for future tests.

"Maximum Density" The Highest Density Obtained From the Roller Operation

Core #6

FIELD DATA

District No. 21 County Hidalgo Date 5-7-76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (Reclimite 1.6%)

TEMPERATURES:

1. Mixture in laydown machine hopper 240 (°F.)
2. Mixture at beginning of rolling sequence 230 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Tandem	8-12 Tons		Same rolling pattern was used as on
2	Pneumatic	25 Tons	10 Tires @ 40	previous test location. Same Results.
				Density on freshly laid mat'l. was
				111.5 #/cu.ft. Max. Density was
				126.0 #/cu.ft. Density taken day after
				was 126.0 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	W.Bound	31+00	247' W. of ℄ of 2nd. County Rd. W. of
				Expwy. 28' So. of North R.O.W. Outside
				Wheel Path.
				3 cores were taken 5/10/76

REMARKS On all Test Locations, Temp. was recorded before and after every pass

A 10' strip of foil was placed beneath mat'l. for future tests

"Maximum Density" - The Highest Density Obtained From The Roller Operation.

Core #7

FIELD DATA

District No. 21 County Hidalgo Date 5/7/76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (Flux 1.6%) Overlay (AC-10)

TEMPERATURES:

1. Mixture in laydown machine hopper 200 (°F.)
2. Mixture at beginning of rolling sequence 200 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Tandem	8-12 Tons		Same Rolling Pattern as on reclimite
2	Pneumatic	25 Tons	10 Tires @ 40	1.6%. Same Results. Density on freshly
				laid mat'l. was 105.0 #/cu.ft. Max.
				Density was 125.5 #/cu.ft. Density taken
				day after was 121.0 #/cu.ft. Reason for
				lower Density unknown.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	W.Bound	42+00	100' E. of ℄ of Scott Lane-17' So. of
				North R.O.W.--3 cores were taken on
				5/10/76--Outside Wheel Path--Overlay was
				used on this test location

REMARKS On all Test Locations, Temp. was recorded before & after every pass.

A 10' strip of foil was placed beneath mat'l. for future tests.

"Maximum Density" - The Highest Density Obtained From The Roller Operation.

Core #8

FIELD DATA

District No. 21 County Hidalgo Date 5/7/76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (Flux 2.0%)

TEMPERATURES:

1. Mixture in laydown machine hopper 205 (°F.)
2. Mixture at beginning of rolling sequence 200 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Tandem	8-12 Tons		Three Pass was sufficient to obtain
1	Pneumatic	25 Tons	10 Tires @ 40	Max. Density. Good Surface Structure in
				some Sections. Exposed Aggregates in
				others. Density on freshly laid mat'l.
				was 108.5 #/cu.ft. Max. Density was
				126.5 #/cu.ft. Density taken day after
				was 126.5 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	N. Bound	53+00	28' W. of W. Side of Block House. 21'
				South of North R.O.W. Outside Wheelpath
				3 cores were taken 5/10/76 - There was no
				overlay on this test location.

REMARKS On all test locations, temp. was recorded before & after every pass

A 10' strip of foil was placed beneath mat'l. for future tests

"Maximum Density" - The Highest Density Obtained From The Roller Operation

Core #9

FIELD DATA

District No. 21 County Hidalgo Date 5-8-76

Project Loop-374 Producer Motheral Contr., Inc.

Material Recycled Salvage (Flux 2.0%)(Overlay AC-10)

TEMPERATURES:

1. Mixture in laydown machine hopper 210 (°F.)
2. Mixture at beginning of rolling sequence 200 (°F.)

ROLLING SEQUENCE				
SEQ. NO.	TYPE OF ROLLER	WT. OF ROLLER (LBS.)	PNEUM. TIRE PRESS. (PSI)	ROLLING PROCEDURE AND REMARKS (Number of pases, compaction mode for vibratory roller, etc.)
2	Tandems	8-12 Tons		Same Rolling Pattern as on Test Sect. #8
1	Pneum.	25 Tons	10 Tires @ 40	Density on freshly laid mat'l. was
				116.0 #/cu.ft. - Max. Density was
				120.0 #/cu.ft. - Density taken day after
				was 121.5 #/cu.ft.

LOCATION FOR CORES				
COUNTY	HWY. NO.	LANE	STATION NUMBER	REFERENCE DATA
Hidalgo	Lp-374	E.Bound	47+00	77' W. of Palmview City Limits Sign
				Outside Wheel Path
				3 Cores taken on 5-10-76
				Overlay was used on this test section

REMARKS On all test locations, temp. was recorded before and after every pass

10' strip of foil was placed beneath mat'l. for future tests

"Maximum Density" - The Highest Density Obtained From the Roller Operation.

Date: 5/5/76	Test Location #1	Station 3+00 W.B.L.	Truck No. 408	AC-3 2.5%	Cloudy/Windy 85°

	Density Lbs/Cu. Ft.	Temperature (°F)	Time of Temp. Readings
Hopper		210 (mass) 180 (surf)	10:55 10:55
Lay Down Machine	107.5	225 (mass) 180 (surf)	11:00 11:00
1st Pass 3-Wheel	116.5	175 (mass) 125 (surf)	11:20 11:20
2nd Pass 3-Wheel	117.0	170 (mass) 130 (surf)	11:30 11:30
3rd Pass 3-Wheel	121.0	155 (mass)	11:40
4th Pass 3-Wheel	126.0	150 (mass)	11:55
5th Pass Pneumatic-Roller	126.0	140 (mass)	12:10
Density Taken Day After	134.0		

Date: 5/5/76	Test Location #2	Station 11+00 W.B.L.	Truck No. 400	AC-3 2.5%	
Hopper			250 (mass) 200 (surf)		11:15 11:15
Lay Down Machine	106.0		250 (mass) 160 (surf)		11:16 11:16
1st Pass 3-Wheel	120.5		180 (mass) 160 (surf)		11:26 11:26
2nd Pass 3-Wheel	124.0		175 (mass)		11:40
3rd Pass 3-Wheel	124.5		160 (mass)		11:55
4th Pass 3-Wheel	127.0		155 (mass)		12:05
5th Pass Tandem	128.0		150 (mass)		12:10
Density Taken Day After	130.0				

RECYCLED SALVAGE

ROLLING PATTERNS AND THE CORRELATION OF THE DENSITY AND TEMPERATURE READINGS TAKEN AT TEST AND RANDOM LOCATIONS.

LOOP-374 HIDALGO COUNTY SAMPLED BY: R.E. CUELLAR & J. A. LOPEZ

CONTRACTOR & PRODUCER: MOTHERAL CONTRACTORS, INC.

Date: 5/5/76	Test Location (Random)	Station 6+00 E.B.L.	Truck No. -	AC-3 3.0%

	Density Lbs/Cu. Ft.	Temperature (°F)	Time of Temp. Readings
Hopper		230 (mass) 220 (surf)	1:30 1:30
Lay Down Machine		240 (mass) 190 (surf)	1:35 1:35
1st Pass 3-Wheel		230 (mass) 180 (surf)	1:45 1:45
2nd Pass 3-Wheel		220 (mass) 175 (surf)	1:55 1:55
3rd Pass Tandem		200 (mass) 150 (surf)	2:15 2:15

Date: 5/5/76	Test Location #3	Station 11+00 E.B.L.	Truck No. 402	AC-3 3.0%

Hopper		200 (mass) 180 (surf)	2:00 2:00
Lay Down Machine	106.0	200 (mass) 150 (surf)	2:05 2:05
1st Pass 3-Wheel	113.0	175 (mass) 130 (surf)	2:10 2:10
2nd Pass 3-Wheel	116.0	160 (mass)	2:20
3rd Pass Tandem	118.5	150 (mass)	2:35
Density Taken Day After	122.0		

Date: 5/7/76	Test Location (Random)	Station 15+00 W.B.L.	Truck No. -	AC-3 3.0%	
		Density Lbs/Cu.Ft.	Temperature (°F)		Time of Temp. Readings
Hopper			275 (mass) 250 (surf)		9:45 9:45
Lay Down Machine			270 (mass) 230 (surf)		9:47 9:47
1st Pass 3-Wheel			230 (mass) 215 (surf)		10:00 10:00
2nd Pass 3-Wheel			200 (mass) 195 (surf)		10:15 10:15
3rd Pass Tandem			180 (mass) 160 (surf)		10:35 10:35

Date: 5/7/76	Test Location #4	Station 17+00 E.B.L.	Truck No. 400	AC-3 3.0%	
Hopper			255 (mass) 240 (surf)		10:30 10:30
Lay Down Machine		114.5	260 (mass) 210 (surf)		10:31 10:31
1st Pass 3-Wheel		125.5	235 (mass) 170 (surf)		10:40 10:40
2nd Pass 3-Wheel		130.5	220 (mass) 150 (surf)		10:50 10:50
3rd Pass 3-Wheel		131.5	205 (mass) 145 (surf)		10:55 10:55
4th Pass Tandem		132.0	195 (mass)		11:05
Density Day After		133.0			

Date: 5/7/76	Test Location #5	Station 28+00 W.B.L.	Truck No. 407	Reclimite 1.6%

	Density Lbs/Cu.Ft.	Temperature(°F)	Time of Temp. Readings
Hopper		200	1:45
Lay Down Machine	109.0	205	1:50
1st Pass 2-Wheel	121.5	190	2:15
2nd Pass 2-Wheel	121.0	185	2:35
3rd Pass Pneumatic Roller	122.5	170	2:55
4th Pass Pneumatic Roller	122.5	150	3:00
Density Taken Day After	125.5		

Date: 5/7/76	Test Location #6	Station 31+00 W.B.L.	Truck No. 400	Reclimite 1.6%

Hopper		240	2:25
Lay Down Machine	111.5	230	2:30
1st Pass 2-Wheel	122.5	200	2:50
2nd Pass 2-Wheel	124.0	180	3:10
3rd Pass Pneumatic Roller	125.0	165	3:20
4th Pass	126.0	160	3:30
Density Taken Day After	126.0		

Date: 5/7/76	Test Location #7	Station 42+00 W.B.L.	Truck No. 400	Flux Oil 1.6% (Overlay AC-10)

Hoppper		200	3:55
Lay Down Machine	105.0	200	4:00
1st Pass Tandem	115.5	160	4:10
2nd Pass Tandem	119.0	150	4:25
3rd Pass Pneumatic Roller	125.5	140	4:?0
4th Pass Pneumatic Roller	125.5	140	4:40
Density Taken Next Day on overlay	121.0		

Date: 5/7/76	Test Location #8	Station 53+00 W.B.L.	Truck No. 407	Flux Oil 2.0%	
		Density Lbs/Cu. Ft.	Temperature (°F)		Time of Temp. Readings
Hopper			205		5:10
Lay Down Machine		108.5	200		5:12
1st Pass Tandem		122.5	165		5:35
2nd Pass Tandem		126.5	160		5:40
3rd Pass Pneumatic Roller		126.5	150		5:50
Density Taken Day After		126.5			

Date: 5/8/76	Test Location (Random)	Station 39+00 E.B.L.	Truck No. 406	Flux Oil 2.0%	
Hopper			235		9:40
Lay Down Machine			230		9:42
1st Pass Tandem			210		9:55
2nd Pass Tandem			195		10:00
3rd Pass Pneumatic Roller			150		10:15

Date: 5/8/76	Test Location #9	Station 47+00 E.B.L.	Truck No. 400	Flux Oil 2.0%	
Hopper			200		10:20
Lay Down Machine		103.5	200		10:22
1st Pass Tandem		116.0	185		10:30
2nd Pass Tandem		121.0	165		10:35
3rd Pass Pneumatic Roller		121.0	140		11:00
Density Taken Day After on Overlay		121.5			

Date: 5/7/76 Sta. 63+00 E.B.L. Truck #406 AC-10

	Temperature (°F)	Time of Temp. Readings
Hopper	240	12:20
Lay Down Machine	250	12:22
1st Pass Tandem	225	12:50
2nd Pass Tandem	220	12:52
3rd Pass Pneumatic Roller	210	1:00

Date: 5/8/76 Sta. 47+00 W.B.L. Truck #406 AC-10

	Temperature (°F)	Time of Temp. Readings
Hopper	240	1:30
Lay Down Machine	230	1:33
1st Pass Tandem	200	1:40
2nd Pass Tandem	175	1:50
3rd Pass Pneumatic Roller	155	2:00

Date: 5/8/76 Sta. 63+00 W.B.L. Truck #408 AC-10

	Temperature (°F)	Time of Temp. Readings
Hopper	200	2:35
Lay Down Machine	200	2:36
1st Pass Tandem	185	2:46
2nd Pass Tandem	180	2:51
3rd Pass Tandem	145	2:56

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. Sample #8 (Road Sample)
Date Received ..... Date Reported 5-16-76
Dist. or Res. Engr. G. G. Garcia
Address Pharr, Texas
Sampler R. E. Cuellar
Sampler's Title Engr. Tech. I
Contractor Motheral Contr., Inc.
Sampled from Sta. 11+00 South Lane
(pit, quarry, car or stockpile)

Material H.M.A.C.

Salvaged Asph. Conc. Project
Control No. Sect. No. Job. No.

Hidalgo Loop-374
County Federal Project No. Hwy. No.

21 5-5-76
District No. Req. No. Date Sampled

Producer
Quantity represented by sample
Has been used on
Proposed for use as

Identification marks
Specification Item No.
Material from property of
Salvaged Asph. Conc. & 3.0% AC-3

DETERMINATIONS

Extraction Tests

Sieve Size	Percent
2" - 1 1/2"	0
1 1/2" - 7/8"	0
7/8" - 5/8"	0.5
5/8" - 3/8"	3.7
3/8" - #4	15.2
#4 - #10	20.6
+10	40.0
#10 - #40	22.5
#40 - #80	9.2
#80 - #200	10.1
Pass #200	10.0
Bitumen	8.2

Note: This sample was secured from the job site and no test results are included in the daily plant reports.

DAILY LABORATORY ACTIVITY REPORT

District No. 21 County Hidalgo Date 5-5-76

Project loop-374 Producer Lotheral Contr., Inc.

Material Salvaged Asph. Conc. Pavement & AC-3

SIZE	COLD FEED BELT SAMPLE COMBINED AGGREGATE SIEVE ANALYSES (Min. 2/Day) (% BY WT.)					EXTRACTION TEST RESULTS (Min. 3/Day) (% BY WT.)			
	1	2	3	4	5	1	2 *	3	4
Ret. 1½"							0		
1½"-7/8"		22.0				0	1.0		
7/8"-5/8"		8.5				3.0	0		
5/8"-3/8"		16.7				10.0	6.4		
3/8"-4		20.7				25.4	14.0		
4-10		15.5				21.1	16.8		
Ret. 10						59.5	38.2		
10-40		14.6				11.9	22.0		
40-80		1.4				6.5	10.5		
80-200		0.4				6.0	9.3		
Pass 200		0.2				9.2	11.7		
Asphalt		-				6.9	8.3		
Moisture		4.9				0.3	0.28		

TEMPERATURES (°F.)				
	EXTRACT.	MIX	PLANT INSTR.	
TIME	SAMPLE	ON BELT	(2hr. Intervals)	
		(2hrs.)	MIX	ASPHALT
10:30 A	1	260°	280°	250°
11:00 A	2	240°	220°	250°

MOLDED SPECIMENS		
SPEC.	ACTUAL	HVEEM
I. D.	SP. GR.	STAB.
AC-1	2.251	
AC-2	2.246	
AC-3	2.239	
AVG.	2.245	
AVG.		
AVG.		

ADDITIVE AC-3 (2.5% Added)

REMARKS * Specimens Molded From This Sample
Also L-9 Sample #1

Report No. 1
AC-3

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Hidalgo Highway Loop-374 Project Salvaged Asph. ~~Conc.~~ Conc. Project.
Location of Plant 6 Mi. W. of Mission Type of Plant Drum-Dryer Contractor Motheral Contractor, Inc.
Date 5/5/76 Specification Item _____ Type _____ Plant Started 9:50 A M. Plant Stopped 12:30 P M.

Location No.							
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Sieve Size	Design No.	Combined Bin Analysis 1	2	3	4	5	6	7	8	Extractions 1	2	3
2-1 1/2		0									0	
1 1/2-7/8		22.0								0	1.0	
1¾" - ⅞"												
⅞" - ⅝"		8.5								3.0	0	
⅝" - ⅜"		16.7								10.0	6.4	
½" - ⅜"												
⅜" - 4		20.7								25.4	14.0	
¼" - 10												
4 - 10		15.5								21.1	16.8	
+ 10		83.4								59.5	38.2	
10 - 40		14.6								11.9	22.0	
40 - 80		1.4								6.5	10.5	
80 - 200		0.4								6.0	9.3	
Pass 200		0.2								9.2	11.7	
Asphalt		-								6.9	8.3	
Total		100.0								100.0	100.0	

Bin Analy. No.	Extr. No.	Time	Location No.	Course of	Courses	Station No.	Mix Temp. °F. Plant	Road	Specimen Nos.	Lab Dens.	% Stab.
	1	10:30	1	1	1	3+00	260	250			
1	2	11:00	1	1	1	11+00	290	250	AC-1,2,3	2.245	
			*D-9	Sample #1							

Materials Used AC-3	Asphalt (Tons)	Aggregate (Tons)
Previous Report	-	-
This Report	10.19	378.92
Total To Date	10.19	378.92

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	78.15 %
Percent Complete—All Types	%

Location No.	Course of	Courses	Station	to Station	Width (Feet)	Days Run / Rate of Application: Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons
1	1	1	0+00 N. L.	19+88 N. L.	11	2430	244.32				
1	1	1	0+00 S. L.	14+80 S. L.	11	1809	144.79				
			Change AC-3 From 2.5% to 3.0% At Sta. 4+12 S. L.								
Total Today											
Previous Report											
Total To Date											
Avg. Rate To Date						Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.	

Weather Partly Cloudy & Mild
Min. Temp. 70 °F.
Max. Temp. 80 °F.

Remarks 295.85 Tons @ 2.5% AC-3 & 93.26 Tons @ 3.0% AC-3
Moisture in Mix = 0.28% Cold Feed Belt Moisture = 4.9%

Inspector

Type _____ Date 5-5-76 Report No. 1

AC-3

DAILY LABORATORY ACTIVITY REPORT

District No. 21 County Hidalgo Date 5/7/76

Project Loop-374 Producer Motheral Contr., Inc.

Material Salvaged Asph. Conc. Pavement & AC-3

SIZE	COLD FEED BELT SAMPLE COMBINED AGGREGATE SIEVE ANALYSES (Min. 2/Day) (% BY WT.)					EXTRACTION TEST RESULTS (Min. 3/Day) (% BY WT.)			
	1	2	3	4	5	1	2	3	4
Ret. 1½"						0			
1½"-7/8"	7.4					3.4			
7/8"-5/8"	5.5					1.8			
5/8"-3/8"	11.7					5.1			
3/8"-4	25.9					18.2			
4-10	25.5					17.1			
Ret. 10	76.0					45.6			
10-40	19.2					18.3			
40-80	3.4					9.4			
80-200	1.1					8.2			
Pass 200	0.3					10.3			
Asphalt	-					8.2			
Moisture						1.5			

TEMPERATURES (°F.)				
	EXTRACT.	MIX	PLANT INSTR.	
TIME	SAMPLE	ON BELT	(2hr. Intervals)	
9:15 AM	1	(2hrs.)	MIX	ASPHALT
		270°	250°	250°

ADDITIVE AC-3 (3.0% Added)

REMARKS *D-9 Sample #2

MOLDED SPECIMENS		
SPEC.	ACTUAL	HVEEM
I. D.	SP. GR.	STAB.
AC-4	2.252	
AC-5	2.248	
AC-6	2.231	
AVG.	2.244	
AVG.		
AVG.		

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Hidalgo Highway Loop-374 Project Salvaged Asph. Control Conc. Project
Location of Plant 8 Mi. W. of Mission Type of Plant Drum-Dryer Contractor Rotheral Contr., Inc.
Date 5/7/76 Specification Item - Type - Plant Started 9:00 A M. Plant Stopped 10:00 A M.

Location No.							
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Sieve Size	Design No.	Combined Bin Analysis 1	2	3	4	5	6	7	8	Extractions 1	2	3
2-1½												
1½-7/8		7.4								3.4		
1¾" - ⅞"												
⅞" - ⅝"		5.5								1.8		
⅝" - ⅜"		11.7								5.1		
½" - ⅜"												
⅜" - 4		25.9								18.2		
¼" - 10												
4 - 10		25.5								17.1		
+ 10		76.0								45.6		
10 - 40		19.2								18.3		
40 - 80		3.4								9.4		
80 - 200		1.1								8.2		
Pass 200		0.3								10.3		
Asphalt		-								8.2		
Total		100.0								100.0		

	Bin Analy. No.	Extr. No.	Time	Location No.	Course of	Courses	Station No.	Mix Temp. °F. Plant	Road	Specimen Nos.	Lab Dens.	% Stab.
*	1	1	9:15 AM	1	1	1	17+00	265	265	AC-4,5,6	2.244	
			*D-9 Sample #2									

Materials Used AC-3

	Asphalt (Tons)	Aggregate (Tons)
Previous Report	10.19	378.92
This Report	3.26	105.50
Total To Date	13.45	484.42

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	100 %
Percent Complete—All Types	%

Days Run

Location No.	Course of	Courses	Station	to Station	Width (Feet)	Rate of Application: Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons
1	1	1	14+80 S. L.	24+20 S. L.	11	1149	108.76				
Total Today											
Previous Report											
Total To Date											
Avg. Rate To Date							Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.

Weather Cloudy & Mild
Min. Temp. 70 °F.
Max. Temp. 87 °F.
Remarks AC-3 = 3.0%
Moisture in Mix = 0.15% Cold Feed Belt Moisture = 7.8%

Inspector Type Date 5/7/76 Report No. 2
AC-3

DAILY LABORATORY ACTIVITY REPORT

District No. 21 County Hidalgo Date 5/7/76

Project [illegible]-272 Producer Rothe[illegible] Contr., Inc.

Material Salvaged Asph. Conc. Pavement & Reclimite

SIZE	COLD FEED BELT SAMPLE COMBINED AGGREGATE SIEVE ANALYSES (Min. 2/Day) (% BY WT.)					EXTRACTION TEST RESULTS (Min. 3/Day) (% BY WT.)			
	1	2	3	4	5	1	2	3	4
Ret. 1½"	0					0	4.4		
1½"-7/8"	5.3					0	0		
7/8"-5/8"	6.5					0	2.6		
5/8"-3/8"	13.5					8.3	5.7		
3/8"-4	25.0					22.0	18.0		
4-10	24.3					18.2	19.1		
Ret. 10	74.6					48.5	49.8		
10-40	22.3					19.0	20.3		
40-80	2.5					9.7	7.6		
80-200	0.4					7.0	8.3		
Pass 200	0.2					8.7	7.4		
Asphalt	-					7.1	6.6		
Moisture						0.23	0.20		

TEMPERATURES (°F.)				
	EXTRACT.	MIX	PLANT INSTR.	
TIME	SAMPLE	ON BELT	(2hr. Intervals)	
		(2hrs.)	MIX	ASPHALT
1:20 PM	1	240°	280°	134°
1:40 PM	2	230°	250°	134°

MOLDED SPECIMENS		
SPEC. I. D.	ACTUAL SP. GR.	HVEEM STAB.
R-1	2.263	
R-2	2.263	
R-3	2.262	
AVG.	2.263	
R-4	2.236	
R-5	2.236	
R-6	2.243	
AVG.	2.238	
AVG.		

ADDITIVE Reclimite (1.6% Added)

REMARKS D-9 Samples No. 3 & 4

Report No. 1
Reclimite

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Hidalgo Highway Loop-374 Project Salvaged Asph. ~~Control~~ Conc. Proj.
Location of Plant 8 Mi. W. of Mission Type of Plant Dryer-Drum Contractor Rotheral Contr., Inc.
Date 5/7/76 Specification Item – Type – Plant Started 10:00 A M. Plant Stopped 1:40 P M.

Location No.							
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Sieve Size	Design No.	Combined Bin Analysis 1	2	3	4	5	6	7	8	Extractions 1	2	3
2-1½		0								0	4.4	
1½-7/8		5.3								0	0	
1¾" - ⅞"												
⅞" - ⅝"		6.5								0	2.6	
⅝" - ⅜"		13.5								8.3	5.7	
½" - ⅜"												
⅜" - 4		25.0								22.0	18.0	
¼" - 10												
4 - 10		24.3								18.2	19.1	
+ 10		74.6								48.5	49.8	
10 - 40		22.3								19.0	20.3	
40 - 80		2.5								9.7	7.6	
80 - 200		0.4								7.0	8.3	
Pass 200		0.2								8.7	7.4	
Asphalt		–								7.1	6.6	
Total		100.0								100.0	100.0	

	Bin Analy. No.	Extr. No.	Time	Location No.	Course of	Courses	Station No.	Mix Temp. °F. Plant	Road	Specimen Nos.	Lab Dens.	% Stab.
	1		12:00									
*		1	1:20	1	1	1	28+00	237	200	R-1,2,3	2.263	
**		2	1:40	1	1	1	31+00	215	240	R-4,5,6	2.238	
		*	D-9 Sample #3									
		**	D-9 Sample #4									

Materials Used	~~Asphalt~~ Reclimite (Tons)	Aggregate (Tons)
Previous Report		
This Report	3.38	207.98
Total To Date		

Percent Complete-Asphaltic Concrete Pavement		
Percent Complete—This Type	100	%
Percent Complete—All Types		%

Days Run

Location No.	Course of	Courses	Station	to Station	Width (Feet)	Rate of Application: ____ Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	____ Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	____ Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons
1	1	1	24+20 S. L.	32+00 S. L.	11	953	76.82				
1	1	1	19+88 N. L.	38+20 N. L.	11	2239	134.54				
				Total Today							
				Previous Report							
				Total To Date							
				Avg. Rate To Date		Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.	

Weather Cloudy & Mild
Min. Temp. ____ °F.
Max. Temp. 87 °F.
Remarks Moist. in Mix = 0.23 & 0.20 Respectively
Cold Feed Belt Moist. = 0.20%

Inspector
Type ____ Date 5/7/76 Report No. 1
Reclimite

DAILY LABORATORY ACTIVITY REPORT

District No. 21 County [illegible] Date 5/7/76

Project Loop-374 Producer [illegible] Contr., Inc.

Material Salvaged Asph. Conc. Pavement & Flux Oil

SIZE	COLD FEED BELT SAMPLE COMBINED AGGREGATE SIEVE ANALYSES (Min. 2/Day) (% BY WT.)					EXTRACTION TEST RESULTS (Min. 3/Day) (% BY WT.)			
	1	2	3	4	5	1	2	3	4
Ret. 1½"	0	0				0	0		
1½"-7/8"	15.8	2.0				1.6	0		
7/8"-5/8"	9.1	3.5				0	1.9		
5/8"-3/8"	18.9	15.3				6.2	8.5		
3/8"-4	28.2	28.3				19.6	19.2		
4-10	15.0	26.7				19.1	19.4		
Ret. 10						46.5	49.0		
10-40	11.0	20.5				19.6	19.5		
40-80	1.3	2.4				9.7	8.4		
80-200	0.4	0.8				8.6	8.3		
Pass 200	0.2	0.5				8.8	7.8		
Asphalt	-	-				6.8	6.9		
Moisture						0.65	0.34		

TEMPERATURES (°F.)				
	EXTRACT.	MIX	PLANT INSTR.	
TIME	SAMPLE	ON BELT	(2hr. Intervals)	
		(2hrs.)	MIX	ASPHALT
3:35 PM	1	260°	260°	170°
4:45 PM	2	275°	260°	170°
	B-9 Samples No. 5 & 6			

ADDITIVE Flux Oil ([illegible] 1.4)

([illegible])

REMARKS

MOLDED SPECIMENS		
SPEC.	ACTUAL	HVEEM
I. D.	SP. GR.	STAB.
FO-1	2.243	
FO-2	2.249	
FO-3	2.247	
AVG.	2.246	
FO-4	2.246	
FO-5	2.249	
FO-6	2.249	
AVG.	2.248	
AVG.		

Report No. 1
Flux Oil

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Hidalgo Highway Loop 374 Project Salvaged Asph. ~~Control~~ Conc. Proj.
Location of Plant 8 Mi. W. of Type of Plant Dryer-Drum Contractor Lotheral Contr., Inc.
Date 5/7/76 Mission Specification Item – Type – Plant Started 1:45 P.M. Plant Stopped 6:30 P.M.

Location No.	1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
	2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Sieve Size	Design No.	Combined Bin Analysis 1	2	3	4	5	6	7	8	Extractions 1	2	3
2-1½		0	0							0	0	
1½-7/8		15.8	2.0							1.6	0	
1¾" - ⅞"												
⅞" - ⅝"		9.1	3.5							0	1.9	
⅝" - ⅜"		18.9	15.3							6.2	8.5	
½" - ⅜"												
⅜" - 4		28.3	28.3							19.6	19.2	
¼" - 10												
4 - 10		15.0	26.7							19.1	19.4	
+ 10		87.1	75.8							46.5	49.0	
10 - 40		11.0	20.5							19.6	19.5	
40 - 80		1.3	2.4							9.7	8.5	
80 - 200		0.4	0.8							8.6	8.3	
Pass 200		0.2	0.5							8.8	7.8	
Asphalt		–	–							6.8	6.9	
Total		100.0	100.0							100.0	100.0	

	Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses		Station No.	Mix Temp. °F. Plant	Road	Specimen Nos.	Lab Dens.	% Stab.
	1		2:20									
		1	3:35	1	1	1	42+00	207	200	FO-1,2,3	2.246	
	2		4:15									
*		2	4:45	1	1	1	53+00	220	240	FO-4,5,6	2.248	
			*D-9	Sample	#5							
			**D-9	Sample	#6							

Materials Used	~~Asphalt~~ Flux Oil (Tons)	Aggregate (Tons)
Previous Report		
This Report	6.58	361.01
Total To Date		

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	65.54 %
Percent Complete—All Types	%

Location No.	Course of Courses		Station	to Station	Width (Feet)	Days Run / Rate of Application: Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons
1	1	1	38+20 N.L.	68+30 N.S.	11	171.49	367.59				
			Changed Flux Oil from 1.6 to 2.0% at Sta. 45+12								
			Total Today								
			Previous Report								
			Total To Date								
			Avg. Rate To Date			Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.	

Weather Cloudy & mild
Min. Temp. ____ °F.
Max. Temp. 87 °F.
Remarks Extraction Sample #1 = 1.6% added & #2 = 2.0% added
Moisture in Mix = 0.6 & 0.34 Respectively Cold Feed Belt Moisture = 3.3%

Inspector Type ____ Date 5/7/76 Report No. 1
Flux Oil

DAILY LABORATORY ACTIVITY REPORT

District No. 21 County [illegible] Date 2-7-76

Project Loop-374 Producer Rotheral Contr., Inc.

Material Salvaged Asph. Conc. Pavement & Flux Oil

SIZE	COLD FEED BELT SAMPLE COMBINED AGGREGATE SIEVE ANALYSES (Min. 2/Day) (% BY WT.)					EXTRACTION TEST RESULTS (Min. 3/Day) (% BY WT.)			
	1	2	3	4	5	1	2	3	4
Ret. 1½"						0			
1½"-7/8"						1.4			
7/8"-5/8"						3.3			
5/8"-3/8"						7.6			
3/8"-4						16.5			
4-10						15.9			
Ret. 10						44.7			
10-40						21.1			
40-80						9.0			
80-200						9.8			
Pass 200						8.7			
Asphalt						6.7			
Moisture						0.30			

TEMPERATURES (°F.)				
	EXTRACT.	MIX	PLANT INSTR.	
TIME	SAMPLE	ON BELT	(2hr. Intervals)	
		(2hrs.)	MIX	ASPHALT
9:45 AM	1	230°	270°	170°
	D-9 Sample #7			

MOLDED SPECIMENS		
SPEC. I. D.	ACTUAL SP. GR.	HVEEM STAB.
FO-7	2.217	
FO-8	2.219	
FO-9	2.231	
AVG.	2.222	
AVG.		
AVG.		

ADDITIVE Flux Oil (2.0% Added)

REMARKS Flux Oil mix did not compact under roller and was over laid with an AC-10 mix.

Report No. 2
Flux Oil

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT--ASPHALTIC CONCRETE PAVEMENT

County Hidalgo Highway Loop-374 Project Galveyard Asph. ~~Contract~~ Conc. Proj.
Location of Plant S. M. R. of Mission Type of Plant Dryer-Drum Contractor Lethoral Contr., Inc.
Date 5/8/76 Specification Item - Type - Plant Started 7:45 A M. Plant Stopped 10:15 A M.

Location No.								
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7		
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8		

Combined Bin Analysis										Extractions		
Sieve Size	Design No.	1	2	3	4	5	6	7	8	1	2	3
2-1½										0		
1½-7/8										1.4		
1¾" - ⅞"												
⅞" - ⅝"										3.3		
⅝" - ⅜"										7.6		
½" - ⅜"												
⅜" - 4										16.5		
¼" - 10												
4 - 10										15.9		
+ 10										44.7		
10 - 40										21.1		
40 - 80										9.0		
80 - 200										9.8		
Pass 200										8.7		
Asphalt										6.7		
Total										100.0		

Bin Analy. No.	Extr. No.	Time	Location No.	Course	of Courses	Station No.	Mix Temp. °F. Plant	Road	Specimen Nos.	Lab Dens.	% Stab.
	1	9:45	1	1	1	47+00	210	200	FO-7,8,9	2.222	
	*D-9 Sample #7										

Materials Used

	~~Asphalt~~ Flux Oil (Tons)	Aggregate (Tons)
Previous Report	6.58	261.01
This Report	4.83	182.42
Total To Date	11.41	549.13

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	100 %
Percent Complete—All Types	%

Days Run

Location No.	Course	of Courses	Station	to Station	Width (Feet)	Rate of Application: Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons	Inches ____ Lbs/Sq. Yd. Sq. Yds.	Tons
1	1	1	32+00 S.L.	51+00 S.L.	11	2322	193.25				
Total Today											
Previous Report											
Total To Date											
Avg. Rate To Date						Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd	

Weather Cloudy
Min. Temp. 63 °F.
Max. Temp. 70 °F.
Remarks 2.0% Flux Oil Added
Moisture in mix = 0.30%

Inspector

Type ____ Date 5-8-76 Report No. 2

Flux Oil