SPS-3 CONSTRUCTION REPORT
SHRP Western Region

FINAL

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1885 S. Arlington Ave., Suite 111
Reno, Nevada 89502

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INTRODUCTION

This report summarizes the SPS-3 "Maintenance Effectiveness Study" experiment activities which have taken place the last one and one-half years. The major emphasis of the report is the construction of the SPS-3 sites. A total of 22 SPS-3 experimental sections were constructed in the Strategic Highway Research Program Western Region between July 2, 1990 and September 11, 1990 with the cooperation of the Federal Highway Administration, Western Federal Lands Highway Division (FHWA-WFLD), Strategic Highway Research Program (SHRP), Texas Transportation Institute (TTI), Western Region Coordination Office Contractor (WRCOC) and the state agencies involved.

DESIGN AND PRE-CONSTRUCTION

The concept of the SPS-3 experiment program was developed at the request of the States. The experiment was designed by Roger Smith of the Texas Transportation Institute under SHRP contract H-101 with input from the states and industry. The purpose of the experiment is to address the questions of cost effectiveness and optimum timing of preventive maintenance treatments on asphalt concrete pavements. The SPS-3 is a nationwide project involving 33 states and 80 projects. Nine states in the western region participated in building 22 separate sites as shown in Figure 1.

The design criteria involved constructing four maintenance treatment sections, a chip seal, a slurry seal, a crack seal, and a thin overlay (1 1/4" thickness). Each individual section was compared to a do-nothing section. Each section would be a minimum length of 500 feet with a 50 foot minimum lead-in and lead-out for destructive testing purposes. No destructive tests are allowed within the 500 foot section. The above repair strategies are to be applied to pavements in varying stages of deterioration, traffic, subgrades and environmental condition (see Figure 2). All states were encouraged to include any additional treatments which they were interested in studying. SHRP agreed to monitor these state supplemental sections and include the data into the SHRP data base, however, SHRP would not perform any analyses on these sections.

The interested western states met in Reno, Nevada on August 16 & 17, 1989 to discuss strategies for carrying out this experiment. A Regional Task Group (RTG) was formed, each stated designated their representative, and Washington DOT was nominated to be the lead state. It was determined that no state could administer a contract to be performed in another state and that perhaps the Western Federal Lands Division of the Federal Highway Administration could function as the Contract Administer. It was agreed that this would be explored prior to the next meeting.

Figure 1

WESTERN REGION SPS-3 SITES

FIGURE 2
SPS-3 AC MAINTENANCE TREATMENTS
WESTERN REGION

MOISTURE		WET								DRY							
TEMPERATURE		FREEZE				NO-FREEZE				FREEZE				NO-FREEZE			
SUBGRADE		FINE		COARSE		FINE		COARSE		FINE		COARSE		FINE		COARSE	
TRAFFIC		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
CONDITION	**SN RATIO**																
G	≤1											UT					
	>1									ID	CO	ID	WA	CA			AZ
F	≤1									CO							
	>1																
P	≤1									NV WY	NV	UT					
	>1							WA		MT		UT WA WY	ID NV	AZ		AZ	AZ

The RTG met again in Reno, Nevada on November 6 & 7, 1989. The Western Federal Lands Division agreed to administer the contract on behalf of the states. FHWA-WFLD discussed the strategy for administering the contract. A tri-party agreement between SHRP, FHWA and each state was also discussed in detail. It was also agreed by the RTG that total cost per site for a state should be the same.

The RTG also agreed to the following:

a) The thin overlay would be built by each of the participating states using their current hot mixed asphalt concrete materials and construction specifications which most closely matched the guide set of specifications developed by TTI.

b) The chip, slurry and crack seals would be built by one contractor utilizing the same equipment, manpower, and materials for all of the sites. This was done to reduce construction and material variables.

c) FHWA-WFLD would prepare the contract documents, award the contract and administer the contract. This would aid the contractor in working in numerous states.

d) The WRCOC would provide the expertise for construction procedures and materials to aid the FHWA-WFLD, and provide individuals to collect required data and samples for testing.

e) A two stage bidding process would be utilized.

f) The specifications for each of the materials would be furnished by TTI.

g) Traffic control for the contractor would be provided by each of the individual states utilizing their maintenance forces.

h) All surface preparation such as crack sealing and pothole repair of the chip and slurry seal sections would be accomplished by the states two months prior to the contractor building the site.

The plans, specifications and estimate (PS&E) package was developed by the FHWA-WFLD with input from the lead state (Washington), the WRCOC and TTI. Once the PS&E package was developed, the two stage bidding process began. The first stage was for any prospective contractors to submit a proposal which included: 1) their experience with this type of work; 2) the equipment they would commit to this project; 3) the manpower and their experience; and 4) a construction schedule. A committee was formed to analyze and select those contractors acceptable to forward a final bid for stage two. These committee members are listed in Appendix A. A total of 13 contractors submitted proposals for stage one, however, only six contractors were qualified to submit a bid for stage two. The second stage was a standard low-bid selection process handled by the FHWA-WFLD. FRW Construction of Tucson, Arizona was awarded the contract on May 10, 1990.

Before the contract was awarded, all potential SPS-3 sites were field reviewed and either accepted and laid out or released from the experiment. The potential candidate sections were selected by TTI in mid 1989, using data from the approved GPS sections. If a section was released, then a replacement section was found if possible. The majority of the section layouts were performed between November, 1989 and February, 1990. Verification cores were extracted from the beginning of each test section at a site and a boring to subgrade was performed to confirm layer types and depths. The cores were saved and later transferred to Western Technologies, Inc. in Phoenix, Arizona for testing.

No more than three months prior to the application of the SPS-3 maintenance treatments, FWD, profile and either PASCO or manual distress surveys were performed on each section. PASCO will perform all post construction distress surveys and the WRCOC plans to perform the FWD and profile measurements in conjunction with the current GPS section schedules. The dates each of the above were performed, as well as the construction dates, are shown on the Sequence of Events forms in the state specific Appendices.

CONSTRUCTION

A pre-construction conference was held in Tucson, Arizona on May 24, 1990. The contractor submitted his proposed schedule. The contractor stated he would build the chip seal sections and the subcontractor, Sahuaro Petroleum of Phoenix, Arizona, would build the slurry seal and crack seal sections and provide the emulsion for the chip and slurry seals. The crack sealant would be Crafco Roadsaver 221. The chip and slurry aggregate would come from a pit near Salt Lake City, Utah.

After several schedule changes, a calibration and demonstration project was scheduled for June 26, 1990 in Phoenix, Arizona. A mix design for the slurry seal was provided by Sahuaro, and Roger Smith provided the mix design for the chip seal.

The slurry truck and the chip spreader were calibrated in Sahuaro's yard in Phoenix. The demonstration placing a chip seal and slurry seal in the Phoenix fairground parking lot failed due to record high temperatures (123^0 F ambient). The chip and slurry failed to set. Upon conferring with Roger Smith, FRW, ADOT and Sahuaro, it was decided to change the slurry mix to utilize aluminum sulfate in lieu of cement and to change the chip seal emulsion to AC20 as a base in lieu of AC10. Both of these changes resulted in improved curing times. It was also decided to move the start of the contract from Arizona to Utah due to the excessively high temperatures.

A second demonstration was accomplished July 1, 1990 near the Panguitch, Utah SPS-3 site. The actual site was 1/2 mile south of the Panguitch SPS-3 site on a section of an old highway which was selected to place a preliminary chip seal and slurry seal for demonstration purposes. The old section of roadway was somewhat overgrown with sagebrush and weeds. The loader was utilized to scrape the brush and weeds from the old pavement and from the edges to provide clearance for the equipment. The pavement was then broomed. The old pavement was cracked and broken severely, heavily oxidized and open.

The contractor took a considerable amount of time setting up his equipment. This was the first time the contractor had mobilized to construct a site and considerable improvement was made throughout the contract as the contractor fine tuned this operation.

A chip seal was placed and the emulsion was shot at 0.30 gallon per square yard. The aggregate was spread and the chip spreader was somewhat out of calibration across all of the openings. The contractor adjusted the chip spreader until it was calibrated to approximately 20 pounds per square yard. The area in which the chip spreader had to work was extremely limited and it was difficult to get the spreader up to speed for the calibration. A slurry seal was placed and this operation went well. The actual calibration of the slurry truck was done in Phoenix, Arizona at an earlier date.

Overall, the calibration and placing the demonstration sections went well. The aggregate was uniformly graded and appeared dirty. The participants felt it was going to be extremely difficult to place a good chip seal with this particular aggregate and the equipment available.

The chip seal emulsion distributor truck was checked again for calibration July 9, 1990 in Gunnison, Utah and July 31, 1990 in Idaho Falls, Idaho.

The first SPS-3 site was constructed July 2, 1990 at Panguitch, Utah and the contract was completed September 11, 1990 in Kingman, Arizona.

Many delays were encountered during the contract due to many different problems, i.e. moving equipment from state to state, changing specifications, rejection of chip seal emulsion, etc. One major delay was the site near Oletha, Colorado which had to be relocated due to the excessive amount of free asphalt on the surface of the existing pavement (see detailed site report on page D-3 of appendix D). These delays caused a considerable inconvenience to many of the states due to rescheduling of their maintenance crews, however, all of the states were extremely cooperative and helpful. Without their efforts, this would have been a very difficult contract. The contractor was extremely qualified and cooperative and many times went beyond the scope of the contract without compensation to ensure a quality product. The working relationship between all parties involved was excellent.

General comments for each of the maintenance construction activities follow. Site specific reports are included in the appendices.

Chip Seal

In placing the chip seal demonstration in Phoenix, Arizona and Panguitch, Utah, plus the SHRP site at Panguitch, Utah, serious concerns were raised as to the quality and gradation of the chip aggregate. For this reason the following people were assembled to discuss changing the chip aggregate: Dennis Jackson, WaDOT; Jim Sorenson, FHWA-WFLD; Roger Smith, TTI; Dave Blake, UDOT; Larry Scofield, ADOT; Ross Widener, RE, FHWA-WFLD; and Jim Nichols and Pete Pradere, Nichols Consulting Engineers.

After inspecting the aggregate and watching construction of the Sevier, Utah site, the tests for the aggregate were reviewed. It was noted that the aggregate was on the fine side of the gradation band and was out of specifications on the percent passing the #200 sieve. The contractor had just received the results of the test and it showed the source failed this specification by one percent.

The aggregate was being made by a combination of material from the White Hill and Walker material deposits near Salt Lake City. Dave Blake of UDOT stated that they had had some problems with the White Hill pit and that could be the source of the problem with the tested material. Dennis Jackson also stated that the uniform graded specification was originally set up with the anticipation of the utilization of a chip spreader which would separate and drop the larger aggregate and then drop the finer aggregate on top in one operation. In putting the specification together, the review committee dropped the requirement of the special chip spreader but did not change the gradation requirements. Also, the aggregate as delivered to the job site had a considerable amount of material on the fine side which makes this gradation particularly difficult to work with and sensitive to application rates of the aggregate and binder.

Dave Blake stated that Utah had a good one size 3/8" chip aggregate specification which could be considered for use. Utah had a small stockpile left from a previous job in the Walker material deposit which we could look at. Ross Widener called the contractor and had him deliver a small quantity to the Gunnison, Utah stockpile site for us to look. In reviewing this aggregate, all present decided this would make a considerably better chip. Ross was instructed to reject the existing material and to negotiate with the contractor for a new chip utilizing Utah's specification, and if the same supplier was to be utilized, the material could only come from the Walker material deposit. The contract was delayed at this time and continued upon delivery of the new chip aggregate.

A new mix design was provided by Roger Smith and the contract resumed July 18, 1990 with the construction of new chip seal sites at Panquitch and Sevier, Utah.

The recommended emulsion application rate from the mix design was consistently on the low side. In order to obtain proper embedment of the aggregate, the design recommendation needed to be increased an average of 0.07 gallon square yard. The emulsion rate was also varied due to the condition of the existing pavement and traffic rate at each site. It varied from a low of 0.26 gallon per square yard to a high of 0.44 gallon per square yard. The three sites in Utah were shot at the design recommendations and some chip loss has been noted.

The recommended aggregate application rate from the pan test was 19 pounds per square yard. The actual application rates ranged from a low of 18.5 pounds per square yard to a high of 23.6 pounds per square yard, however, the majority of the sites were 20 to 21 pounds. On many of the sites the aggregate rolled in the wheel path from the chip spreader, however, this did not create any major problems with traffic.

Other problems were encountered with the chip seal emulsion. There were problems with shot and viscosity. After placing the sites in Idaho, in which Idaho DOT ran viscosity of the emulsion, the FHWA-WFLD provided a field viscometer. Numerous loads of chip seal emulsion were rejected from this point on to the end of the contract due to viscosity problems. We believe the major causes were the extremely long hauling distances and the hauling of partial loads. Partial loads were hauled due to the size of the distributor truck, which allowed the emulsion to cool to as low as 120° F and also allowed considerably more agitation of the emulsion.

A chip seal at the Kingman US 93 site initially failed and was rebuilt in a new location. Three days after construction, we noticed that the chips had come off in the wheel paths (90%) in the SHRP section. The control section looked good. However, the embedment in the control section appeared to be 30 to 40 percent.

In discussing the probable cause of the failure, it appears the following to be contributing factors:

1) Too light asphalt application: This appears to be the major cause. The surface must be more open than it was judged to be.

2) Too long before traffic was placed on the section: By not placing traffic on this section for four and one-half hours allowed more of the asphalt to drain into the existing surface and not embed the chips.

3) High speed traffic: The excessive speed of the traffic has a tendency to pull the chips out and without enough asphalt this appears to be a heavy contributor. This did not occur in the travel lane, however, traffic was placed on this section about one hour after it was placed which did not allow the emulsion to penetrate as much and it was cooler.

Even though some problems were encountered, they were corrected during construction and the sites looked very good after construction. The contractors chip seal crew was excellent. They understood this was an experimental project and worked very hard to provide an excellent product.

Slurry Seal

After changing the mix design to utilize aluminum sulfate, the slurry seal operation went very well. The application rate varied from a low of 24.5 pounds per square yard to a high of 31.7 pounds per square yard.

There were very few problems with the slurry. A few sand balls were encountered, but these were minor. On a couple of sites the slurry remained wet and had to be lightly sanded to allow traffic. This was caused by the aluminum sulfate hanging up. The slurry required an average of two hours cure time before placing traffic on it. Even after two hours, the traffic could not stop on it or the hot tires would pick up small hunks of it.

Sahuaro's crew was extremely knowledgeable, experienced and did an excellent job.

Crack Seal

All cracks between 1/4 inch and one inch wide were routed and sealed unless they were deemed to be fatigue cracks. No fatigue cracks were to be sealed according to the SPS-3 guidelines. The typical crack sealing operation was as follows: Route the cracks 3/4 inch wide by one inch deep, blow out the cracks with compressed air, pass the hot air lance over the crack, fill the crack 1/4 inch below the top of the pavement. The reason for this is to provide a 1:1 height to width ratio of the crack sealant.

Minor problems were encountered with the hot pot, with the hose plugging, and the motor, however, this operation went very well.

A note of interest on the Utah site at Sevier was that a few days after the cracks were routed and filled to 1/4 inch below the surface, the pavement expanded and moved to the point where the sealant was flush or a little above the surface.

Sahuaro's crew did an excellent job sealing the cracks.

Thin Overlay

As previously mentioned, the states agreed to construct the thin overlay sections individually using either state forces or an outside contractor. A set of guide specifications were developed for the thin overlay by TTI. The thin overlay was to be constructed 1 1/4 inch thick (plus or minus 1/4 inch).

To reduce variance among agency constructed overlay treatments, each agency was requested to select and use their hot mixed asphalt concrete materials and construction specifications which most closely matched those in the guide specifications. The states were also responsible for completing the necessary data forms and forwarding them to the WRCOC. The placement of the thin overlay was to be coordinated with the WRCOC. When possible the WRCOC had a representative present at the sites during construction.

Traffic Control

The states provided the traffic control for the construction of each site utilizing state maintenance crews. Many scheduling problems were encountered due to date changes, rejection of materials, contractors equipment being late to the site due to permitting problems crossing state lines, etc. These crews responded and did an excellent job. Many crews worked long hours and weekends to keep this contract moving. This was done during their busiest time, trying to accomplish their betterment work.

Without exception they were extremely knowledgeable, helpful, courteous and cooperative. Without their efforts, this contract would have been difficult to complete, therefore they are highly commended.

SUMMARY AND CONCLUSIONS

This method of development and construction of experimental sections in numerous states was successful and should be considered for future projects. Although many problems were encountered by utilizing the cooperative efforts of all the parties involved, each was resolved successfully with minimal delay. All of the different types of maintenance strategies were placed successfully and without any major difficulties.

Some special consideration should be utilized by any users in constructing any of these maintenance strategies which are discussed below.

Crack Sealing

The method utilized of routing the crack to a depth of one inch and a width of 3/4 inch, then filling to 1/4 inch from the surface looked very good in the field. The principle of the 1:1 height to width ratio of the sealant and the utilization of a high quality sealant appears to have merit. This method is considerably more manpower intensive and may have considerably more initial cost than the bandaid method but may be more cost effective in the long run.

Slurry Seal

The slurry seal placed on this contract was excellent. Any users planning to utilize a slurry seal should consider the following: 1) utilization of a high quality aggregate; 2) a mix design accomplished by a knowledgeable lab with previous experience and design for particular conditions. For example, the slurry on this project required two hours cure time prior to placing traffic on it. This was fine for this contract but may not be for other conditions. This can be altered in the mix design process; 3) a knowledgeable slurry seal crew; and 4) calibration of the slurry truck prior to start of the operation.

Chip Seal

The chip seals placed under this contract were very good. There are many types of emulsions, cut back asphalts and asphalt cements utilized successfully in chip seals. A CRS-2h emulsion was utilized on this contract. Users planning to utilize this maintenance activity should consider the following: 1) a high quality, durable, as close to one size as possible, clean aggregate; and 2) a good mix design wtih verification of embedment depth in the field. On this contract the recommended emulsion rate from the mix design was consistently 0.07 gallon per square yard low, but was corrected in the field. This may be a problem with the mix design method or just inherent with this particular aggregate. A final consideration should be to calibrate both the distributor truck and the chip spreader prior to start of work and on some frequency throughout the project. There was considerable variance of the application rate from each of the aggregate gates of the chip spreader prior to calibration. After calibration only minor adjustments were required. The CRS-2h emulsion utilized on this contract is a good product for chip seals. It provides for a fairly quick set of the emulsion to grab the rock and allow traffic. Some problems were encountered with the viscosity and with asphalt globules. We believe the major cause of our problem was due to the extremely long haul distances and the hauling of partial loads. We started field testing for viscosity of the emulsion approximately one third of the way through the contract and subsequently rejected several loads of emulsion. The specifications for the emulsion were tight, however, we believe this gave us a more consistant product which makes field construction easier. One should also adjust the bar height and check the nozzle on the distributor truck frequently to reduce drilling of the emulsion. Almost every state commented that this was a considerable problem for them. We believe this is an area where industry could help the states by providing good written guidelines on how to correct the problem and distribute these to each of the states.

In closing, each of these maintenance strategies will be compared with the do-nothing section. This should give realistic data to determine the most cost effective time frames to utilize each of these maintenance strategies under many varying conditions. The final total cost per site is yet to be determined, but it will be well under the initial estimate of $50,000 per site for the work under FHWA-WFLD direction.

ACKNOWLEDGEMENTS

Many different people and agencies were involved in this experimental project. All were extremely cooperative and helpful. Without these special efforts this project would have been considerably more difficult if not impossible. All deserve high praise. As is generally the case, certain individuals and agencies are called on to do more which requires a special effort and the following is a list which deserve a special thank you.

Dennis Jackson, Washington DOT

As the state representative, Dennis was called on to provide considerable input to the contract plans and specifications. He also was called on numerous times during the construction activities for direction. Upon request, he visited the construction sites in Utah and was extremely helpful in the chip aggregate specification change and in providing direction on numerous other construction sites. Dennis was very cooperative and easy to work with throughout the contract.

Jim Sorenson, FHWA

Jim was instrumental in having the FHWA-WFLD administer this contract. This was the only way that one contractor could be utilized in the nine states. Jim also provided considerable input throughout the construction phase. He visited the Utah sites and aided in changing the chip aggregate specifications.

Dave Blake, Utah DOT

Dave is to be commended for his efforts in helping with the construction startup and the change in the chip aggregate specifications. He provided a UDOT chip aggregate specification which allowed the construction to proceed considerably quicker. Many scheduling changes occurred in Utah due to the above and Dave was extremely cooperative and helpful in accomplishing these.

Larry Scofield, Arizona DOT

The construction was originally scheduled to begin in Arizona, but had to be moved to Utah due to the record high temperatures. Larry was extremely cooperative and helpful in the rescheduling efforts and also provided input to the chip aggregate change.

Ross Widener, FHWA-WFLD

Ross was the Resident Engineer on this construction contract. This was an extremely difficult contract to administer due to the numerous agencies and individuals involved and the tremendous amount of travel involved. Ross did an excellent job and was very easy to work with.

State SPS-3 SHRP Representatives

Each of the states representatives did an excellent job providing input to the experimental project and scheduling of the flagging crews. Many delays were encountered throughout this contract and many of the states were required to reschedule these crews at a moments notice. Many of the states crews worked on weekends. Without this effort, this contract would not have been completed in one construction season. All of the state representatives were extremely helpful and cooperative.

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SEVIER COUNTY, UTAH

TO : FILE
FROM: MARK POTTER

DAY : WEDNESDAY
DATE: AUGUST 15, 1990

John Morris of UDOT Transportation Planning Division was the SHRP contact on this project. I met with him on Tuesday night and discovered the thin lift overlays had been completed on Monday on SHRP-49A310 and SHRP-49B310. Therefore I was unable to monitor the construction, however, I was told by John Morris the construction procedures are the same as the procedures to be used on Friday, August 17, 1990. Upon visual inspection the sections looked fine. There will be an additional report made for August 17.

Danny W. Washburn is the UDOT Project Engineer on these projects. He was present during all the construction procedures. The contractor on the project is Cox Transport Company.

In construction of the UDOT-49B361 Plant Mix Seal section, the contractor used a Blaw Knox PF220 Paving machine with a 12' paving width. The highway consists of two 6' shoulders with two 12' lanes, north and south bound. The contractor began the project by shooting emulsion on a 24' width of the pavement starting on the south bound side. Paving was started on the south bound shoulder and 6' into the south bound lane, leaving a longitudional joint in the middle of the lane. Paving in this manner left a joint in the middle of the north bound lane also. The contractor used a Dynapac CC50A steel wheel roller for compaction. The rolling was done on static mode, and two complete coverages of the mat were made.

John Morris was monitoring the temperatures of the plant mix seal as it was dumped from the trucks. The operation on this project went very smoothly and resulted in a good finished product. Danny Washburn told me that the Laboratory personnel would complete all the required forms for all three sps projects. The UTAH-49B361 Plant Mix Seal section was completed at approximately 2:30pm. After the contractor cleaned up the project, they moved to the project further south at Garfield county. Plant Mix Seal section UTAH-49A361.

The construction of section UTAH-49A361 was plagued with problems. The specifications on temperatures of the Plant Mix Seal stated that 265 degrees F was the maximum. The trucks were making a haul that took approximately an hour and a half to two hours. There were scattered showers all over the area and the trucks were not tarped, and outside temperatures were in the middle 60's. The combination of the weather and the length of the haul was probably part of the problem in laying the mix. The mix was any where from 225 to 260 degrees in the windrows. It appeared to me that was not hot enough,because the mix was balling up and the screed was dragging clumps through the mat, leaving ruts that had to be filled by hand. The contractor again started on the south bound lane using the same procedure as before. After the second pass of the screed a hard rain started and ended up shutting the contractor down before he could finish. Due to all the inconsistencies in the laying of the mix and the fact that it was completed in two days instead of one, it would be my recommendation that this section not be included in the UTAH test section, rather dedicate another 500' section for the Plant Mix Seal section. I also believe the temperature requirements for the plant mix seal should be looked at because there were temperatures in excess of 270 degrees in the windrows of the UTAH-49b361 section, and the plant mix seal laid down very smoothly with no clumps in the mix.

I talked to Danny Washburn about the temperatures and he agreed that the temperature requirements should be raised. He called the UDOT laboratory and talked to Mr. Larry Gaye. Mr. Gaye said the temperature was set at 265 maximum, because they were afraid they would lose some of the oil in the mix during transport.

Contractor shut down at 5:30 pm.

APPENDIX A

PERSONNEL LISTING

SPS-3 REGIONAL TASK GROUP

Bill Higgins, Arizona Department of Transportation
Ed Delano, California Department of Transportation
Leo O'Conner, Colorado Department of Transportation
Greg Laragan, Idaho Department of Transportation
James Stevenson, Montana Department of Highways
Ken Davis, Nevada Department of Transportation
David Blake, Utah Department of Transportation
Jim Spade, Washington Department of Transportation
Spencer Garrett, Wyoming Highway Department

SPS-3 PROPOSAL REVIEW COMMITTEE

Rich Wasil, FHWA, Western Direct Federal Division
Dennis Jackson, Washington Department of Transportation
Jon Epps, Dean of Engineering, University of Nevada, Reno
Ray Schadt, FHWA, Direct Federal Contract Manager

SPS-3 CONSTRUCTION

Contractor Personnel
Marlin Schweigert, Project supervisor
Mike Tucker, Project Foreman
Tom Sticht, Aggregate Spreader Operator
Ray Fitzgerald, Roller Operator, Mechanic
Bill McKissick, Roller Operator
Barbara Sticht, Roller Operator
Jim Stuart, Roller Operator
Don Sorrells, Distributor Operator
Steve Best, Slurry Seal Squeegee Operator and Crack Sealing Hot Air Lance
Bob Erickson, Slurry Machine and Router Operator and Crack Sealing Applicator Wand

Federal Highway Administration
Ross Widner, Resident Engineer
Al Alonzi, Highway Engineer in Training

Nichols Consulting Engineers
Pete Pradere, Project Technical Advisor
Ron Witt, Technician

SAHUARO PETROLEUM & ASPHALT CO.

June 29, 1990

Mr. Keith Ryan, President
Slurry Seal Division
Sahuaro Petroleum & Asphalt
P O Box 6536
Phoenix, Az 85005

Re: Mix Design for CQS and CPC Aggregate, SHRP Program

Dear Keith:

We have completed a mix design using Sahuaro Petroleum CQS emulsified asphalt and the aggregate supplied by CPC of Salt Lake City, Utah. The materials seem to yield a good slurry mix, and a very durable cured seal coating product.

The cured mix showed good resistance to abrasion and a progressive and positive rate of cure. When properly applied it should serve the needs of this program. Following are recommended ranges for mix formulation:

(Percent by weight of aggregate)
Emulsified Asphalt % 0 11-13%
Water % - 8-12%
NOTE: Water usage to keep the mix fluid but consistent is based on dry aggregate weight and dependent on pavement surface, stockpile moisture, humidity, ambient temperature and wind.
Additives % - .25-.50 Aluminum Sulfate
- .25-.50 Portland Cement
NOTE: Due to normal differences in laboratory and field experiences, temperatures can not be set in the lab. Not knowing what specific climate conditions will persist at the time of treatment, additives to be used to achieve required set and traffic time will be determined on the job site with the 1st option to be aluminum sulfate and changed only if climate conditions insist and all involved concur.

If we can be of further assistance with this or other work, please feel free to contact us.

Respectfully submitted,

Lawrence M. Lerma

Lawrence M. Lerma
Quality Control Manager

SLURRY SEAL DESIGN SUMMARY SHEET

PROJECT: S.H.R.P., Misc. Applications	LAB NO.:
OPERATOR: L. Lerma	DATE: 6-22-90
AGGREGATE: C.P.C. TYPE III	SOURCE: Submitted
EMULSION: Sahuaro CQS-h	SOURCE: Tk. 9
ADDITIVE #1: Portland Cement	ADDITIVE #2: Aluminum Sulfate
REFERENCED DESIGN SPECIFICATIONS: S.H.R.P.	

MIX CHARACTERISTICS

TRIAL	% EMUL.	% H2O	% ADD.1	% ADD.2	SLUMP cem	SLUMP sul	MIX	BLOT	WASH
1	10	7	0.5	N/A	2.3		PASS	PASS	PASS
2	11	7	0.5	0.5	2.3	2.5	PASS	PASS	PASS
3	12	7	0.5	0.5	2.4	2.4	PASS	PASS	PASS
4	13	7	0.5	0.5	2.5	2.5	PASS	PASS	PASS
5	14	7	0.5	N/A	2.7		PASS	PASS	PASS
6	15	7	0.5	N/A	2.8		PASS	PASS	PASS

COHESIVE STRENGTH

TRIAL	SET	CURE
3	<30m	30m

SET: 12 cm.kg, NS or better Classification

CURE: 26 cm.kg, No False set

BOILING TEST - ACCELERATED STRIPPING

TRIAL Cement	Sulfate	3 min (test duration)	20 min (test duration)
1	2	95+	N/A
4	3	95+	N/A
6	4	95+	N/A

SPEC: MIN. 90% retained asphalt film coating after 3 minutes.

WET TRACK ABRASION TEST

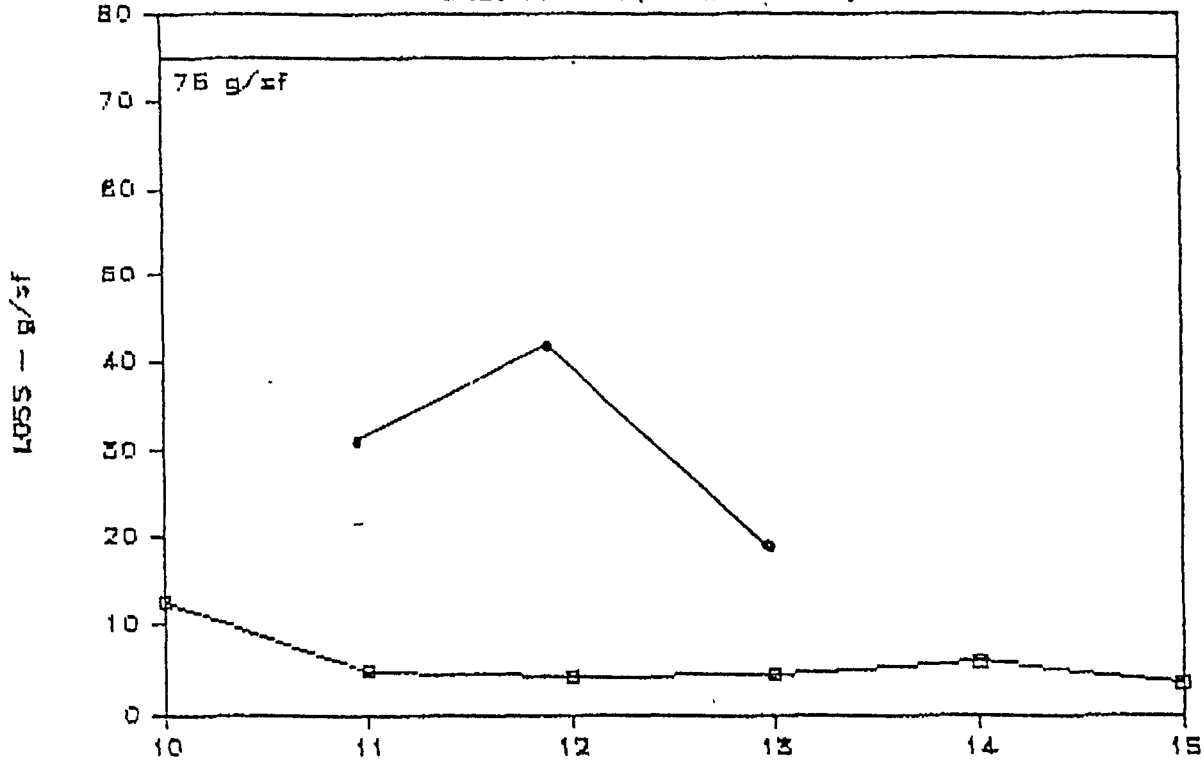
TRIAL	WT. a cement	WT. a sulfate	WT. b cem	WT. b sulfate	LOSS cement	LOSS sulfate	g/sf cement	g/sf sulfate
1	740.0		736.5		3.5		12.6	
2	765.7	784.8	764.1	774.6	1.6	10.2	4.9	31.7
3	750.1	791.9	748.7	777.5	1.4	14.4	4.3	44.0
4	748.3	797.7	746.8	791.2	1.5	6.5	4.6	19.9
5	747.6		745.6		2.0		6.1	

LOADED WHEEL TEST

TRIAL	TACK	SAND ADHESION
2	NO	8.3
4	NO	30.1
6	NO	37.4

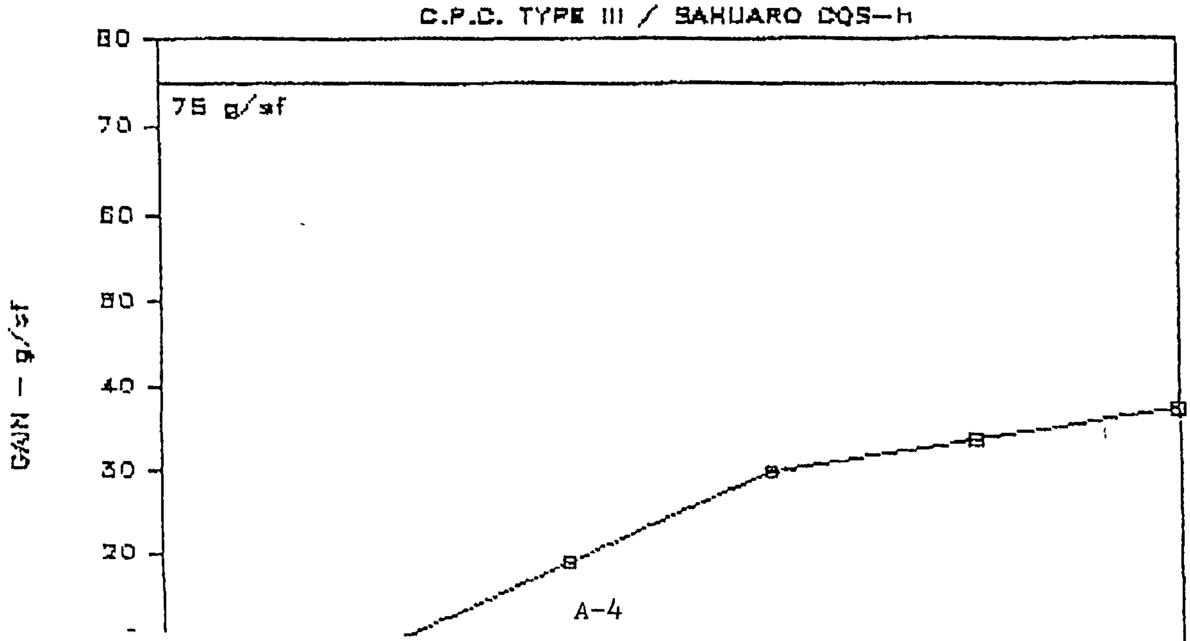
WET TRACK ABRASION TEST

C.P.C. TYPE III / SAHUARO CQS-h



LOADED WHEEL TEST — SAND ADHESION

C.P.C. TYPE III / SAHUARO CQS-h



Chip Seal Mix Design Calculations
MS-19, March 1979

AGGREGATE SPREAD RATE (C) (lbs/sy)

C = M[46.8(1-0.4V)HGE]   V = 1-(W/62.4G)   H = f(FI,D50)

M	W	V	G	H	FI	D50
1.000	86.900	0.461	2.586	0.210	15.000	0.270

E	C
1.00	20.72
1.05	21.76
1.10	22.80

EMULSION APPLICATION RATE (B) (gal/sy)

B = K[2.244HTV+S+A]/R

K	H	V	A	R
1.000	0.210	0.461	0.000	0.670

TABLE OF VALUES FOR B

PAVEMENT CONDITION

ADT	T\S	FLUSHED -0.03	SMOOTH, N-POROUS 0.00	SLIGHTLY POROUS, OXIDIZED 0.03	SLIGHTLY POCKED, POROUS, OXIDIZED 0.06	BADLY POCKED, POROUS, OXIDIZED 0.09
< 100	0.85	0.23	0.28	0.32	0.36	0.41
100 - 500	0.75	0.20	0.24	0.29	0.33	0.38
500 - 1000	0.70	0.18	0.23	0.27	0.32	0.36
1000 - 2000	0.65	0.17	0.21	0.26	0.30	0.34
> 2000	0.60	0.15	0.19	0.24	0.28	0.33

Chip Seal Mix Design Calculations
MS-13, 1975

AGGREGATE SPREAD RATE (S) (lbs/sy)

S = 37.4GHE   H = f(FI,D50)

G	H	FI	D50
2.586	0.210	15.000	0.270

E	S
1.00	20.31
1.05	21.33
1.10	22.34

EMULSION APPLICATION RATE (A) (gal/sy)

A = (1.122TH+V)/R

H	R
0.210	0.670

TABLE OF VALUES FOR A

		PAVEMENT CONDITION				
		FLUSHED	SMOOTH, N-POROUS	SLIGHTLY POROUS, OXIDIZED	SLIGHTLY POCKED, POROUS, OXIDIZED	BADLY POCKED, POROUS, OXIDIZED
ADT	T\V	-0.03	0.00	0.03	0.06	0.09
< 100	0.85	0.25	0.30	0.34	0.39	0.43
100 - 500	0.75	0.22	0.26	0.31	0.35	0.40
500 - 1000	0.70	0.20	0.25	0.29	0.34	0.38
	0.67					
1000 - 2000	0.65	0.18	0.23	0.27	0.32	0.36
> 2000	0.60	0.17	0.21	0.26	0.30	0.35

0.67 Resid. Asphalt

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-6365

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8081

June 29, 1990

FRW Contracting
4235 N. Plum Ave
Tucson, Arizona 85705

Attn: Frank Wagner

Project:	Sharp Chip Design
Source:	Sahuaro
Asphalt Emulsion:	CRS-2
Date:	6-27-90

AASHTO T-59 RESIDUE BY EVAPORATION
Lab #31277

Residue	=	69.2%
Residue	=	69.0%
Average	=	69.1%

If you have any questions, please feel free to call.

Sincerely,

Frank Strickland
Lab Manager

F.R.W. CONTRACTING, Inc.
General Contractors (602) 888-2882
Mailing Address: P.O. Box 37196 · Tucson, Arizona 85740

3

June 22, 1990

U S Department of Transportation
Federal Highway Administration
610 E. 5th St
Vancouver, Wa 98661-3893

Attn: Ross Widner

RE: Contract # DT-FH70-90-C-00005
Final Equipment and Labor Personnel List

Dear Ross:

Per our contract requirements we are writing to submit our intended subcontractor and final equipment and personnel lists for the project. We are also forwarding a copy of our testing plan from GARCO and our materials handling plan for the aggregates which was not addressed in detail in our techinical proposal.

Our subcontractor for the project will be Sahuaro Petroleum Asphalt Company, P O Box 6536, Phoenix, Ariz. 85005. They will be performing the crack seal and slurry seal portions of the project. They will also be the oil supplier for the CRS-2 and slurry seal emulsions.

We hope all this meets with your approval and if you have any questions please contact us at (602)888-2882 in Tucson.

Sincerely,

Frank R. Wagner
President

FRW:sr

Eclosures

Business Location: 4235 North Plum Avenue · Tucson, Arizona 85705
An Equal Opportunity Employer

AGGREGATE MATERIAL HANDLING PLAN

The materials for this project will be produced by Concrete Products Company of Salt Lake City, commonly known as CPC. CPC is a holly owned subsiderary of Gibson and Reed, a major Southwestern Contractor.

The slurry seal sand will be produced at CPC Walker pit near Salt Lake City. The sand will be a 100% crushed product produced specially to meet the gradation requirements of the SHRP program. A special product run is required due to the 5/16" top gradation specified in the contract documents which is not a normal industry slurry sand gradation. The materials for this project will be stockpiled in the Walker pit according to project specifications using a rubber tired loader. (Note: It is our understanding that at the start of production the sand was stockpiled in ten foot lifts rather than four feet as required. This deviation from the contract was corrected during production and the slurry sand stockpile tested uniformly throughout, therefore so this production mistake had no affect on the quality of the end product).

The chips for the project are a combination of two washed products. Both aggregates for the chips will come from CPC Whitehill pit where they were originally crushed. They will then be hauled to CPC plant #3 and run thru a wash plant to remove minus number 10 material and to meet the 0-1.0% 200 sieve requirements. The two products, a courser chip and clean course sand will then be blended together using a rubber tired loader to meet the project gradation requirements. This is required due to the high percentage of material processing 1/4 but the limited quality allowed to pass the #10. The material will then be stockpiled in 4 foot lifts per contract specifications using a rubber tired loader. To insure the quality of the stockpile and eliminate the possibility of contamination the stockpile will be covered with visquine.

The hauling of the aggregates to the individual sites will be done by a commercial trucking firm. The aggregates will be hauled in tarped trucks per the contract specifications to avoid loss of material and contamination. The trucks will be loaded with a rubber tired loader from CPC stockpiles. The aggregates will be loaded from the end of or "face" of the stockpile to ensure uniformity, and care will be excercised to ensure that the loader does not penatrate below the existing stockpile floor. This will be accomplished by leaving a floor of 3" to 6" of the spec aggregates.

The commercial hauling units mentioned earlier for the aggregate delivery are of the end dump variety. This will allow for the aggregates to be dumped at each site in tight uniform piles. To ensure that the aggregates are dumped in the right location, it is our intent to have a party present during this process. After the aggregates are dumped, we plan on covering the stockpiles with visquine to prevent contamination.

Also they will be marked with a sign stating that they are not to be disturbed. We have already forwarded a video tape and map of our first seventeen site stockpile locations, the remaining 5 will follow shortly. Each site has been chosen for its location to the project, existing ground conditions, and the safe access of our hauling vehicles. Each site's condition varies sumwhat and will require different amounts of work to bring them up to an acceptable condition prior to aggregate delivery. We will have an advance party working at each one of these locations prior to the material being delivered. Any clearing, compacting, brooming or subbase work will be done prior to the materials delivery.

To reload the material into a ten wheeler or slurry seal machine for actual incorporation into the work we intend to use a rubber tired backhoe type loader. Again, care will be used to load from the individual aggregate sites stockpiles uniformly to prevent segegration or contimination. We have allowed for ground loss of material at each location, and we will leave a floor of 1" to 4" of spec aggregates. This should eliminate the potential for subbase contamination. If some hand shoveling is required to prevent contamination, this will also be done.

We believe this synopsis covers the aggregate material hauling portion of the contract, and if you have any questions or require more detail, please contact us.

F.R.W. Supervision Personnel

Project Supervisor: Marlin Schweigert Social Security Number 527-78-7204 Mr. Schweigert has over 22 years of construction related experience, the last 5½ years with our firm. While employed with our form he has been a project supervisor, general superintendent. During this time he was party responsible for the completion of a majority of our firms chip sealing work, and the person responsible for the training of our field personnel. Mr. Schweigert is also a very capable operator and has well over fifty lane miles of experience on the following equipment; chip spreader, roller, broom, distributor truck.

Project Foreman: Mike Tucker Social Security Number 527-23-8125 Although mr. Tucker has worked for our firm for the past year he has demonstrated his ability as a supervisor and a confident equipment operator on the following pieces of equipment; Chip Spreader, Pnuematic roller, loader and rough blade. Prior to becoming an employee of our firm he worked for two other local contractors starting out as an equipment operator and moving up into supervision and project manager. Mr. Tucker has five years total experience in road construction. we intend to utilize him on this project as our advance foreman responsible for locating and preparing the individual twenty two project location stockpile/staging sites prior to material delivery.

FRW's Final List of Primary Equipment Personnel
Aggregate Spreader Operators

Tom Sticht Social Security Numner 527-33-5891
Mr. Sticht has been an employee of our firm since 1985, and has over 50 lane miles of aggregate spreader experience on the following projects completed by our firm

* Arizona Department of Transporation
  Project #F-053-1-945 & F-073-504
  Lane miles 21.5
* Town of Apache Junction
  Project # PW-88-08
  Lane miles 12.57
* Arizona Department of Transportation
  Project # I-10-4-938
  Lane miles 32.27

Pnuematic Roller Operators

Bill McKissick Soocial Security Number 485-34-1604
Mr. McKissick, has over 50 lane miles of nine wheel pnuematic roller experience. Some of the projects completed by our firm which he has run a nine wheel roller totaling over 50 lane miles of experience are:

* Arizona Department of Transportation
  Project #F-031-01-954
  Lane miles 17.47
* Arizona Department of Transportation
  Project # S-581-902

Jim Stuart Social Security Number 478-44-6263
Jim Stuart has only been an employee of our firm since May 1990. During this time period and the start of this FHWA project he has obtained 50 lane miles of roller experience on the following projects:

* Arizona Department of Transportation
  Project #F-031-1-950
  Spring portion of this project only
  Lane miles approximately 27.5
  Project completed May 1990
* Arizona Department of Transportation
  Project # S-266-905
  Lane miles 8.68
* National Park Service
  Colorado National Monument
  Contract # CX-1200-0-C014
  Lane Miles Approximately 24.92

Ray Fitzgerald Social Security Number 458-52-5307
Mr. Fitzgerald has been as employee of our firm since 1987, and has over 50 lane miles of nine wheel roller experience on the following projects completed by our firm.

* Arizona Department of Transportation
  Project #F-031-01-954
  Lane miles 17.47
* Arizona Department of Transportation
  Project #F-I-10-4-938
  Lane miles 32.27
* Town of Oro Valley
  Project: 1987-1988 Chip Sealing Program
  Lane miles 2.39

Distributor Operator

Don Sorrells Social Security Number 544-36-2009 Mr. Sorrells has over 15 years experience as an asphalt oil distributor operator. He has well over 50 lane miles of distributor experience on many agency projects

Proposed Chip Sealing Equipment for the Project:

Distrubutor:
Make: Bear Cat Distributor
Year of Manufacture: 1984
Model: 3500 Gallon Capacity
Carrier: Kenworth
Model: C-500
Year of Manufacture: 1976

Chip Spreader:
Make: Entyre Chip Spreader, self propelled
Model # None by manufacture, self propelled
Year of manufacture: 1986

Nine Wheel Pnuematic Rollers
Make: Bros
Model: #SP3000
Year of manufacture: 1986

Make: Bomag
Model # BW12R
Year of manufacture 1987

Make: Ingram
Model #9-2800 PA
Year of manufacture: 1978
(Note: although this is an older machine it is in good to excellent condition. We have used it on many of the agency projects completed by our firm with no problems.

SAHUARO PETROLEUM & ASPHALT

Slurry Seal & Crack Seal Primary Equipment & Personnel

Key Equipment Operators

Slurry sealing squeegee operator:

Steve Best Social Security #483-76-7936
Mr. Best has six years experience in slurry seal itself, with the past three years as a foreman. He has over 50 lane miles of experience both as a slurry machine and squeegee spreader operator. He was a slurry seal squeegee operator on the following projects:

* Deer Valley Airport
  Project # A855822
  Lane miles 72
* City of Tempe
  Project: 1987 Annual Slurry Seal Project
  Lane miles 300

Slurry Machine Operator

Bob Erickson Social Security Number 478-48-5218
Mr. Erickson has over fourteen years of slurry seal experience. He has over 50 lane miles of experience on all types of slurry equipment. Mr. Erickson has been a slurry seal machine operator on the following projects:

* City of Yuma
  Project #1204
  Lane miles 16
* City of Phoenix
  Project: #RS-892042
  Lane miles 102

Crack Sealing Equipment and Operators

Router Operator
Bob Erickson Social Security Number 478-48-5218

Hot Air Lance
Steve Best Social Security Number 483-76-7936

Applicator Ward
Bob Erickson Social Security Number 478-48-5218

Sealant Heating Equipment
Steve Best Social Secutiry Number 483-76-7936

Note: Both of these employees were also listed on the slurry seal crew as primary operators. They both also have over 50 lane miles on the primary crack sealing equipment required as part of the techinal proposal. This experience was gained on many of our projects, but for brevity they both worked on the following multi year contracts which we have had from 1983 to 1989 providing them well over 50 lane miles of experience.

* ,Maricopa County Crack Seal Contract
Contact Person: Dennis Clark
Phone #(602) 233-8668
This Contract totals our at over 738 lane miles alone

Primary Crack Sealing Equipment

Router
Make: Crafco Manufacturing
Year: 1982
Model: #200

Hot Compressed Air Lance
Make: Brewecote
Model #1000
Year: 1990

Sealant Heating Equipment
and Applicator Wand
Make: Crafco Manufacturing
Year: 1982
Model: BC440

Primary Slurry Sealing Equipment LIst

Slurry Seal Machine (Mixer)
Make: Mitchell Manufacturing Co.
Year: 1980
Model: M-18

Slurry Seal Squeegee Box
Make: Herbst Bros
Year: 1987
Model: # None

GARCO TESTING LABORATORIES

NVLAP Accredited

532 West 3560 South, Salt Lake City, Utah 84115, Phone 266-4498
5826 South 1900 West, Roy, Utah 84067, Phone 776-5355
5071 So Arville, Las Vegas, Nevada 89118, Phone (702) 364-8031

6/08/90

[redacted]ITE PRODUCTS COMPANY
[redacted] 4115 S
[redacted] UTAH
157-0006

LAB NO.: 20964
MATERIAL CHIPS SEAL ~~C-1~~ 299.
PIT/PLANT C-C # 3

PROJECT QUALITY CONTROL
[redacted]TIFICATION STOCKPILE SAMPLE #4
SPECIFICATION

TEST DATE 6/08/90
SAMPLE BY JASN RUN BY JAY

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
[redacted] 2"	0.0			100.0	
3/8"	98.5	8.2	8.2	91.8	
[redacted] 4"	332.3	27.6	35.8	64.2	
#10	719.0	59.7	95.5	4.5	
200	43.5	3.6	X 99.1	.9	

O[redacted]AL WT. 1204.4
W[redacted] WT. 1196.0
D[redacted] W.O. 8.4
CO S.D. 2.3
AL -#200 10.7 = .9%

F.M. 1.39
DESIGN F.M.

SINCERELY,

MANAGER

National Voluntary Laboratory Accreditation Program — NVLAP — United States Department of Commerce Accredited

Member ASTM, ACI, AGC

GARCO TESTING LABORATORIES

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Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

6/07/90

..RETE PRODUCTS COMPANY
[redacted] 4115 S
C[redacted] UTAH
157-0006

LAB NO.: 30948

MATERIAL CHIPS SEAL AGG
PIT/PLANT. CPC # 3

[redacted] PROJECT: FFW CONTRACTING
C[redacted]IFICATION STOCKPILE QUALIFIC
SPECIFICATION STATE

TEST DATE 6 07/90

SAMPLE BY: JASN RUN BY: SUE

[redacted]

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
[redacted]/2"	0			100.0	100
3/8"	85.8	5.6	5.6	94.4	90-100
[redacted]/4"	312.4	20.5	26.1	73.9	50-75
#10	1078.0	70.6	96.7	3.3	0-10
-200	40.9	2.7	X 99.4	.6	0-1

INITIAL WT. 1527.0
SH[redacted]D WT. 1518.7
%[redacted] W.O. 8.3
%[redacted] S.D. 1.0
TTL -#200 9.9 = .6%

F.M. 1.22

DESIGN F.M.

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Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

5/08/90

CONCRETE PRODUCTS COMPANY
[redacted] 4115 S
L[redacted] UTAH
1[redacted]7-0006

LAB NO. 20949

MATERIAL CHIPS SEAL AGG
PIT/PLANT IPC # 3

PROJECT QUALITY CONTROL
IDENTIFICATION PROD A.M.
SPECIFICATION STATE

TEST DATE. 5/07/90

SAMPLE BY JACN RUN BY SUE

U[redacted]A SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
1/2"	0			100.0	100
3/8"	87.5	8.3	8.3	91.7	90-100
1/4"	224.9	21.2	29.5	70.5	50-75
#10	695.5	65.6	95.1	4.9	0-10
#200	43.4	4.1	X 99.2	.8	0-1

TOTAL WT. 1060.0
SHFT WT. 1053.6
[redacted] W.O. 8.4
[redacted] S.O. 0.1
TAL -#200 8.5 = .8%

F.M. 1.32
DESIGN F.M.

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MANAGER

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GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

6/08/90

C[redacted]RETE PRODUCTS COMPANY
1[redacted] 4115 S
L[redacted] UTAH
4157-0006

LAB NO. 30959
MATERIAL CHIPS SEAL AGG
PIT/PLANT CPC # 3

=[redacted]===

PROJECT QUALITY CONTROL
TEST DATE 6/07/90
ID[redacted]TIFICATION.
SPECIFICATION STATE
SAMPLE BY JASH RUN BY JAY

==

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
1/2"	0			100.0	100
3/8"	116.4	6.8	6.8	93.2	90-100
1/4"	440.0	25.8	32.6	67.4	50-75
#10	1071.0	62.9	95.5	4.5	0-10
#200	59.5	3.5	X 99.0	1.0	0-1

==

ORIGINAL WT. 1702.3
T[redacted]ED WT. 1689.8
[redacted] W.O. 12.5
200 S.O. 3.0
TOTAL -#200 15.5 = .9%

F.M. 1.34
DESIGN F.M

SINCERELY,

MANAGER

UTAH DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION

FORM R-249
(LO-5 REV. 7-?

SOIL AND AGGREGATE PREPARATION

Project Name: SHRP-Test Sections Date: July 5, 1990
Project No ____ Prospect No ____ Sample No 90-3-A-
Test For: Statewide Chips (gradation & H2O)

AS RECEIVED GRADATION				GRADATION AFTER CRUSHING			
Screen Size	Weight (a)	Percent Retained	Percent Passing	Weight (b)	Weight (a+b)	Percent Retained	Percent Passing
3"				Sample submitted by:			
1 1/2"				Ross Christensen D3 Maint. E.			
1"							
3/4"							
1/2"							
3/8"							
#4							
Wet Wt. -#4							
Dry Wt. -#4							
Total Wt. Dry							

WASHED GRADATION AFTER CRUSHING (2500 Gm Dry Recombined Sample)

Screen Size	Weight Retained	Percent Retained	Percent Passing
1"			
3/4"			
1/2"			100
3/8"	156.4	5.7	94.3
1/4"	571.2	20.7	73.6
#4	499.7	18.1	55.5
#8 ~~#10~~	1303.4	47.2	8.3
#16	131.5	4.8	3.5
~~#40~~ #50	42.6	1.5	2.0
#200	16.8	0.6	1.4
-#200	40.5	1.5	
Total Wt	2762.1		

MOIST DETERMINATION

Tag #53	+4	-4
Container & Wet Aggregate (gm)	2814.1	
Container & Dry Aggregate (gm)	2762.1	
H_2O Loss (gm)		
Container & Dry Aggregate (gm)		
Container Wt (gm)		
Dry Wt of Aggregate (gm)		
Percent Moisture	1.9	

% Gravel	
% Coarse Sand	
% Fine Sand	
% Silt and Clay	

SAMPLE DISTRIBUTION

L.L. & P.I -#10	200 gm
Absorption 3/4, 1/2 + 3/8, #4	500 gm ea
Swell Rep Sample	1000 gm.
Abrasion 1/2, 3/8	2500 gm ea
Fract Face #4	500 gm
Soundness All Sizes	1000 gm ea.
Stripping #4	1400 gm
Marshall & Emersion	
% Boulders (+3")	

		AASHO Classification
LL		
P.L		
PI		

Tested By: Paul Larsen

____ MATERIALS ENGINEER

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266 4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

[illegible] PRODUCTS COMPANY
4115 [illegible]
[redacted] UTAH
[redacted]7-0006

LAB NO. [illegible]
MATERIAL SLURRY AGG
PIT/PLANT LACKER

PROJECT QUALITY CONTROL
I[redacted]TIFICATION STOCKPILE
SPECIFICATION STATE

TEST DATE 6/13/90
SAMPLED BY ASH RUN BY BILL

SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
3/16"	0			100.0	100
#4	268.9	16.1	16.1	83.9	70-90
#8	517.0	30.9	47.0	53.0	46-70
#16	241.1	14.4	61.4	38.6	28-50
#30	128.0	7.7	69.1	30.9	18-34
#50	112.5	6.7	75.8	24.2	11-25
#100	136.5	8.2	84.0	16.0	7-17
#200	82.8	5.0	89.0	11.0	5-15

ORIGINAL WT. 1671.3
DRIED WT. 1500.8
[redacted] W.O 170.5
[redacted] E.O. 14.3
TOTAL -#200 184.8 = 11.1%

F.M. 3.53
DESIGN F.M.

SINCERELY,

MANAGER

GARCO *TESTING LABORATORIES*

NVLAP Accredited

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

0[redacted].2 6/14/90

CONCRETE PRODUCTS COMPANY
41 W 4115 S
S -, UTAH
E 57-0006

LAB NO.· 31104

MATERIAL : SLURRY AGG
PIT/PLANT· WALKER

PROJECT QUALITY CONTROL
I[redacted]ENTIFICATION STOCKPILE
SPECIFICATION STATE

TEST DATE 6/13/90

SAMPLE BY JASN RUN BY BILL

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
5/16"	0			100.0	100
#4	268.9	16.1	16.1	83.9	70-90
#8	517.0	30.9	47.0	53.0	46-70
#16	241.1	14.4	61.4	38.6	28-50
#30	128.0	7.7	69.1	30.9	18-34
#50	112.5	6.7	75.8	24.2	11-25
#100	136.5	8.2	84.0	16.0	7-17
#200	82.8	5.0	X 89.0	11.0	5-15

[redacted]
ORIGINAL WT. 1671.3
WASHED WT. 1500.8
) W.O. 170.5
) S.O. 14.3
TOTAL -#200 184.8 = 11.1%

F.M. 3.53

DESIGN F.M.

SINCERELY,

Susan Arnold

MANAGER

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

0012
C~NCRETE PRODUCTS COMPANY
4 W 4115 S
S_C, UTAH
84157-0006

6/14/90

LAB NO.: 31066

MATERIAL: SLURRY AGG
PIT/PLANT: WALKER

PROJECT: QUALITY CONTROL
IDENTIFICATION: STOCKPILE
SPECIFICATION: STATE

TEST DATE: 6/13/90
SAMPLE BY: JASN RUN BY: BILL

USA SIEVE NUMBER	GRAMS RETAINED	% RETAINED	ACCUM. % RETAINED	% PASSING	SPECIFICATION % PASSING
5/16"	0			100.0	100
#4	234.1	16.6	16.6	83.4	70-90
#8	475.1	33.6	50.2	49.8	46-70
#16	208.3	14.7	64.9	35.1	28-50
#30	106.6	7.5	72.4	27.6	18-34
#50	84.0	5.9	78.3	21.7	11-25
#100	95.8	6.8	85.1	14.9	7-17
#200	55.4	3.9	X 89.0	11.0	5-15

ORIGINAL WT. 1413.6
WASHED WT. 1270.7
-#200 W.O. 142.9
-#200 S.O. 11.6
TOTAL -#200 154.5 = 10.9%

F.M. 3.67
DESIGN F.M.

SINCERELY,

MANAGER

6-11-90

Fred - For your information

ACCEPTANCE TESTS PERFORMED BY UTAH DOT
ITEM 311(1) AGGREGATE FOR CHIP SEAL IN STOCKPILE

SIEVE SIZE	SPECIFICATION BAND	TEST 1 6-7-90 9:00 pm	TEST 2 6-7-90 10:30 pm	TEST 3 6-7-90 1:00 pm	TEST 4 6-7-90 2:30 pm
1/2"	100	100	100	100	100
3/8"	90 - 100	95.1	93.9	94.0	94.5
1/4"	50 - 75	77.3	72.3	65.1	68.9
No. 10	0 - 10	4.0	5.6	4.2	3.8
No. 200	0 - 1.0	.8	.9	.9	.8

ACCEPTANCE TESTS PERFORMED BY UTAH DOT
ITEM 311(2) AGGREGATE FOR SLURRY SEAL IN STOCKPILE

SIEVE SIZE	SPECIFICATION BAND	TEST 1 5-31-90 2:00 pm	TEST 2 6-1-90 10:00 pm	TEST 3 6-1-90 2:00 pm	TEST 4 6-4-90 2:00 pm
5/16"	100	100	100	100	100
No. 4	70 - 90	83.8	78.5	80.3	82.9
No. 8	45 - 70	54.5	47.5	48.1	50.9
No. 16	28 - 50	40.5	33.7	35.0	37.4
No. 30	19 - 34	32.8	26.7	28.3	30.1
No. 50	12 - 25	24.9	19.8	21.6	22.8
No. 100	7 - 18	17	13	14.8	15.5
No. 200	5 - 15	11.5	8.4	10.1	10.6
SAND EQUIVALENT 55 MIN		55	61	53	56

Summary of Gradation results:

Reported by ______________________ ________
Darrell Giannonatti Date

Accepted by ______________________ ________
Ross Widener Date

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
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Phone 776-5355

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Las Vegas, Nevada 89118
Phone (702) 364-8031

July 3, 1990

Concrete Products Company
41 W. Central Ave
SLC, Utah 84157-0006

Project: Strategic Highway Research Program
Western Region SHRP 101
Material: Slurry Seal Aggregate

AASHTO T-176 SAND EQUIVALENT
Lab #31144

54.0

AASHTO T-96 LOS ANGELES ABRASION
Lab #31141

No. of Revolutions	500
% Loss	23.1%

AASHTO T-210 DURABILITY
Lab #31386

In Progress

AASHTO T-84 WATER ABSORPTION
Lab #31391

In Progress

Sincerely,

Susan Arnold
Q.A. Manager

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

July 3, 1990

Concrete Products Company
41 W. Central Ave
SLC, Utah 84157-0006

Project: Strategic Highway Research Program
Western Region SHRP 101

Material: Chip Seal Aggregate

		Spec.
FRACTURE FACE COUNT		
Lab #31388		
One or more faces:	88.4%	Not less than 75%
CELHD DET 508 FLAKINESS INDEX		
Lab #31389		
15%		Maximum 15%
AASHTO T-279 POLISH VALUE		
Lab #31390		
Before polishing	36.1	Minimum 32
After polishing	28.2	
AASHTO T96 LOS ANGELES ABRASION		
Lab #29016		
No. of Revolutions	500	
% Loss	20.7%	Maximum 25%
AASHTO T21-1 DURABILITY FACTOR		
Lab #31387		
In Progress		

Sincerely,

Susan Arnold
Q.A. Manager

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5326 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

June 26, 1990

FRW Contracting
4235 N. Plum Ave
Tucson, Arizona 85740

Attn: Frank Wagner

Dear Mr. Wagner,

The calculated values on your mix design are as follows:

Aggregate Coverage	=	16.55 lb/sq²
Asphalt Application Rate		
0.224 gal/yd²	=	K Factor 1.0
0.269 gal/yd²	=	K Factor 1.2

Note: A value of 1.0 was used for wastage factor (E) and multiplying factors (M) and (A) since no other values were specified.

Thank you for your business, and if you have any questions please feel free to call.

Sincerely,

Frank Strickland
Lab Manager

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776-5355

5071 So Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

June 27, 1990

FPW Contracting
4235 N. Plum Ave
Tucson, Arizona 85705

Attn: Frank Wagner

Project:	Sharp Chip Design
Source:	Sanuaro
Asphalt Emulsion:	CRS-2
Date:	6-27-90

AASHTO T-59 RESIDUE BY EVAPORATION
Lab #31277

Residue	=	69.2%
Residue	=	69.0%
Average	=	69.1%

If you have any questions, please feel free to call.

Sincerely,

Frank Strickland
Lab Manager

9. When the penetration macadam is to be part of the surface course, a higher amount of asphalt emulsion should be used, followed by a surface treatment.

Aggregates used for this type of construction should meet the same basic requirements (except for gradation) as those used in asphalt surface treatment. Asphalt emulsions used for this purpose should be grades RS-1 or CRS-1 for small voids and RS-2 or CRS-2 for large voids.

With the development, in recent years, of more efficient equipment for other types of pavement, the use of penetration macadam has greatly diminished.

C. SURFACE TREATMENT DESIGN

6.13 SINGLE SURFACE TREATMENTS

When a decision has been made that a surface treatment is to be used, the next step is to find the proper rates of application for asphalt emulsion and aggregate. The objective is to produce a pavement surface one stone thick with enough asphalt to hold the aggregate in place, but not so much that it will bleed. Several methods can be used for this purpose. The one described here was modified by N. W. McLeod* from a method developed by the Country Roads Board of Victoria, Australia. It involves the following principles:

1. When one-size cover aggregate is dropped by a spreader on an asphalt film, the particles lie in unarranged positions. The voids between the particles are approximately 50 percent.
2. Rolling partly reorients the aggregate particles and reduces the voids to about 30 percent.
3. Finally, after considerable traffic, the particles become oriented into their densest positions, with all lying on their flattest sides, and the voids are further reduced to approximately 20 percent.
4. Since the particles lie on their flattest sides, the average thickness of a surface treatment is determined from the overall average smallest dimension of the aggregate particles. This is called the "average least dimension" (ALD) of the cover aggregate.

   The average least dimension of any approximately one-size cover aggregate can be determined by measuring a number of individual aggregate particles with a caliper or by using slotted screens (see Appendix D).
5. For good performance, the quantity of asphalt binder used should fill about 70 percent of the 20 percent void space [see 3 above] if the traffic volume is moderate (500 to 1000 vehicles per day). However, the asphalt binder should fill not more than 60 percent of the 20 percent void space if the traffic volume is high (more than 2,000 vehicles per day).

Note that these principles are based on one-size cover aggregate. Most often, one-size aggregate is not available economically and graded aggregate, which has fewer voids, has to be used. The voids in this material in a loose weight condition will be somewhat less than the 50 percent for one-size aggregate. This means therefore, that the ultimate void space in a surface treatment using graded cover aggregate will be less than 20 percent. A correction must be made in the design method for this condition or a bleeding pavement may result.

---

*McLeod, Norman W., "Seal Coat and Surface Treatment Design and Construction Using Asphalt Emulsions," a paper presented at the First Annual Meeting, Asphalt Emulsion Manufacturers Association, Washington, January 27–29, 1974

These considerations, together with practical experience, have led to the development of the equation below for the quantity of cover aggregate in a surface treatment.

U.S. Customary	*S.I. Metric**
$C = M\,[46.8\,(1 - 0.4V)\,HGE]$	$C = M\,[(1 - 0.4V)\,HGE]$

where

C = cover aggregate applications, lb/yd^2 (kg/m^2)

.399 V = voids in the cover aggregate in loose weight condition, $V = 1 - \frac{W}{62.4G}$ or metric ($V = 1 - \frac{W}{1000G}$) percent, expressed as a decimal

98.61 W = loose unit weight of cover aggregate lb/ft (kg/m^3), AASHTO Method T 19 (ASTM Method C 29), (Appendix E)

2.631 G = bulk specific gravity of cover aggregate, AASHTO Method T 85 (ASTM Method C 127)

* .16 H = average least dimension (ALD) of cover aggregate, in. (mm), (Appendix D)

(1) E = wastage factor to allow for cover stone loss, due to whip-off and unevenness of spread, Table VI-3

(1) M = a multiplying factor that must be evaluated by experience with local conditions of climate, traffic, cover aggregate, etc., and may have a value greater or less than 1.0 which is its normal value.

The quantity of emulsified asphalt to be applied is found by the following equation:

U.S. Customary	*S.I. Metric*
$B = K\left[\frac{2.244\,HTV + S + A}{R}\right]$	$B = K\left[\frac{0.40\,HTV + S + A}{R}\right]$

where

B = emulsified asphalt application, gal/yd^2 ($litre/m^2$)

* .16 H = average least dimension of cover aggregate, in. (mm), (Appendix D)

.60 T = traffic factor (Table VI-4)

.399 V = voids in cover aggregate, loose weight condition (see equation for cover aggregate application above), percent expressed as a decimal

.06 S = correction, gal/yd^2 ($litre/m^2$), for texture of surface on which surface treatment is to be placed.

Texture	*Correction, S* gal/yd^2	$litre/m^2$
Black, flushed asphalt	-0.01 to -0.06	(-0.04 to -0.27)
Smooth, non-porous	0.00	(0.00)
Absorbent — slightly porous, oxidized	0.03	(0.14)
— slightly pocked, porous, oxidized	0.06 ←	(0.27)
— badly pocked, porous, oxidized	0.09	(0.40)

*International System of Units (S.I.) being adopted throughout the world

(0) A = correction, gal/yd² (litre/m²) for absorption of asphalt into cover stone (disregard except for obviously porous stone)

.69 R = residual asphalt in emulsion, percent expressed as a decimal. Typical values are:

Emulsified Asphalt	*R*
RS-1	0.58
RS-2	0.63
CRS-1	0.65
→CRS-2	0.69

K = A multiplying factor that must be evaluated by experience with local conditions of climate, traffic, cover aggregate, etc., and may have a value either less than or greater than 1.0, which may be its normal value. However, experience has shown that for emulsion use in colder northern areas, "K" can have a value of about 1.2.

Example:

Standard size No. 7 crushed granite is to be used on a slightly porous pavement for a surface treatment cover aggregate with CRS-2 emulsified asphalt. Find the quantities of aggregate and emulsion to be applied. Traffic is estimated to be 800 vehicles per day.

—Median size of aggregate = 0.40 in. (10 mm), Figure VI-7

—Flakiness Index = 20, Appendix D

—Average least dimension, H = 0.29 in. (7.4 mm), Appendix D

—Loose unit weight of aggregate, W = 96 lb/ft³ (1538 kg/m³), Appendix E

—Bulk specific gravity, G = 2.65, AASHTO Method T 85

—Voids in cover aggregate, $V = 1 - \dfrac{96}{62.4 \times 2.60} = 1 - 0.58 = 0.42$

or metric $\left(V = 1 - \dfrac{1538}{1000 \times 2.65} = 1 - 0.58 = 0.42\right)$

—Wastage factor, E = 1.04, Table VI-3

—Traffic factor, T = 0.70, Table VI-4 (for 800 vpd)

—Texture correction, S = 0.03 gal/yd² (0.13 litre/m²)

—Aggregate absorption correction, A = 0.00

—Residual asphalt, R = 0.69 percent (CRS-2)

—Multiplying factor "M" = 1.0

—Multiplying factor "K" = 1.0

TABLE VI-3 AGGREGATE WASTAGE FACTORS

Percentage Waste* Allowed for	Wastage Factor, E
1	1.01
2	1.02
3	1.03
4	1.04
5	1.05
6	1.06
7	1.07
8	1.08
9	1.09
10	1.10
11	1.11
12	1.12
13	1.13
14	1.14
15	1.15

**Due to whip-off and handling.*

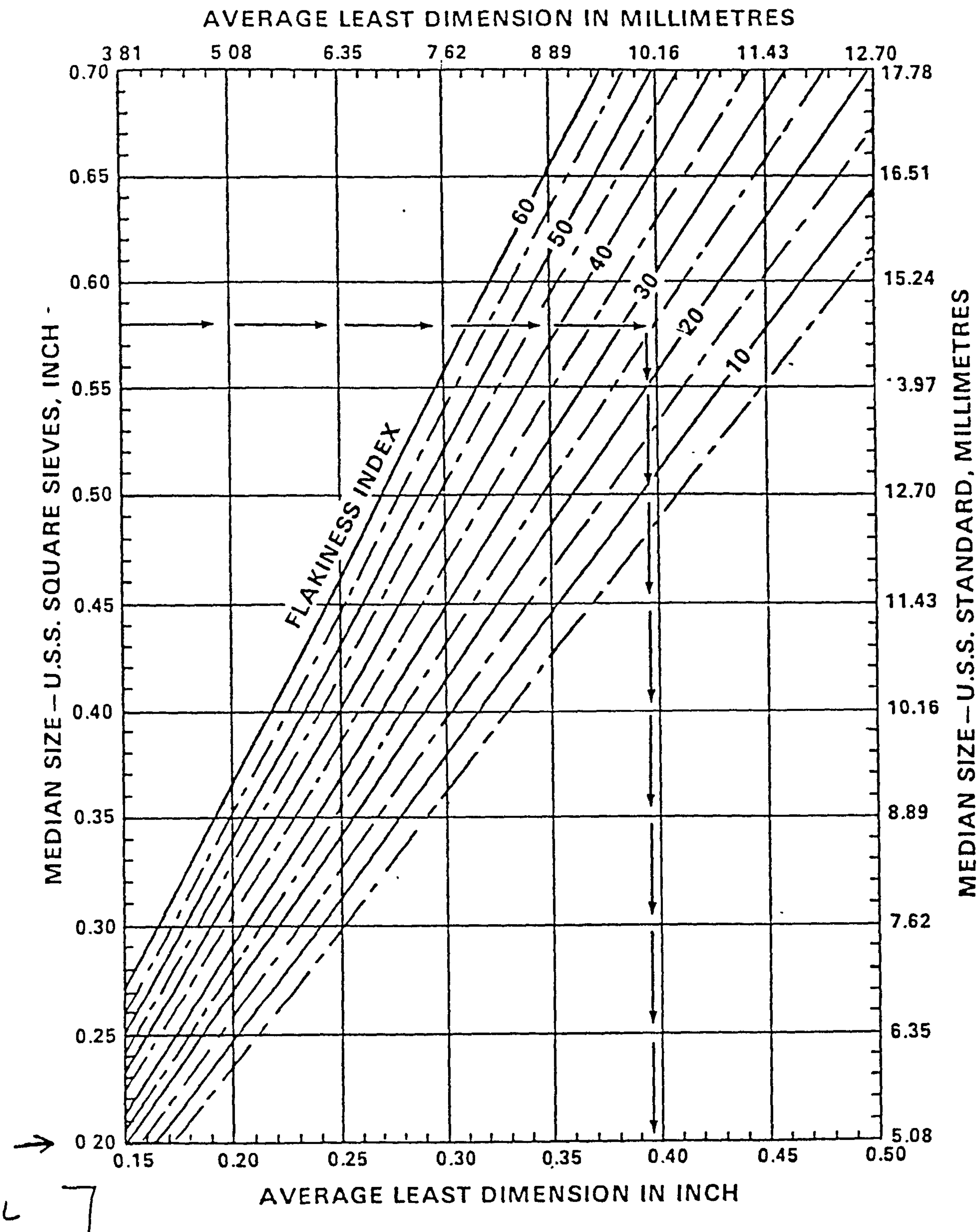
TABLE VI-4 TRAFFIC FACTORS FOR SURFACE TREATMENTS

Aggregate	*Traffic Factor = Percentage (expressed as a decimal) of 20 percent void space in cover aggregate to be filled with asphalt*				
	Traffic—Vehicles per Day				
	Under 100	100 to 500	500 to 1,000	1,000 to 2,000	Over 2,000
Recognized Good Type of Aggregate	0.85	0 75	0.70	0.65	0.60

NOTES:

(1) *The factors above do not make allowance for absorption by the road surface or by absorptive cover aggregate.*

(2) *Values shown in the table are from "Seal Coat and Surface Treatment Design and Construction Using Asphalt Emulsions," by Norman W. McLeod. January 1974.*

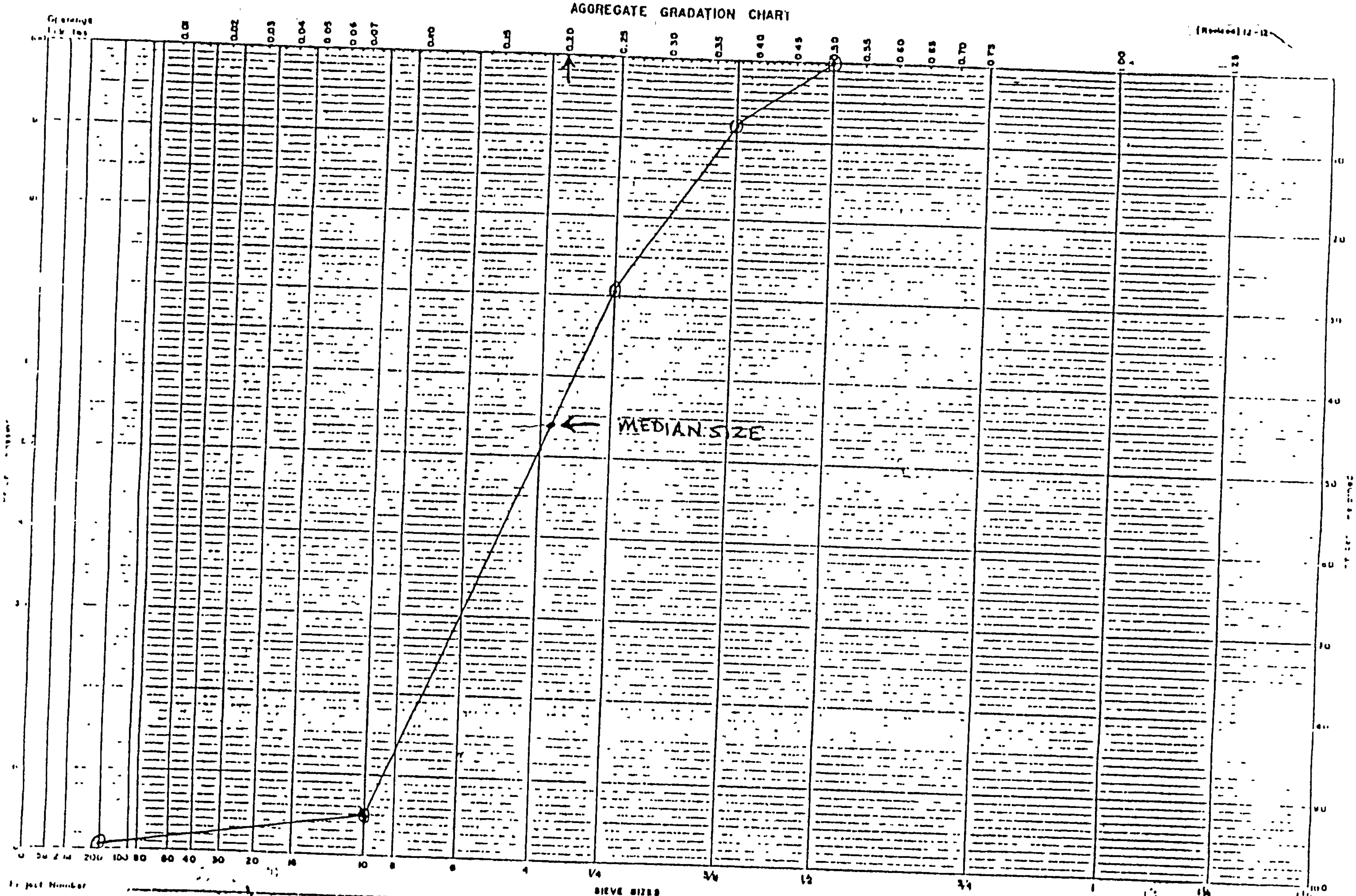


=AL
AKINESS
[redacted]X = 15

Figure D-3 Chart for determining Average Least Dimension of aggregate.

40[redacted]% + #4

AGGREGATE GRADATION CHART



Project Number
Sample Number
Project Name
Station
Date
By

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84067
Phone 776 5355

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

[illegible]-02-90

CONCRETE PRODUCTS COMPANY
[redacted]

LAB NO. [illegible]

MATERIAL CHIPS SEAL AGG
PIT/PLANT CPC # 3

PROJECT [redacted] QUALITY CONTROL
PROD A.M.
STATE

TEST DATE [illegible]

SAMPLE BY JACK RUN BY SUE

SIEVE NUMBER	GRAMS RETAINED	% RETAINED	CUMUL. % RETAINED	% PASSING	SPECIFICATION % PASSING
[redacted] 2"	0			100.0	100
3/8"	87.5	8.3	8.3	91.7	90-100
[redacted]/4"	224.7	21.2	29.5	70.5	50-75
[redacted]10	695.5	65.[illegible]	95.1	4.9	0-10
[redacted]200	43.4	4.1	99.2	.8	0-1

TOTAL WT. 1,0[illegible]2.0
[redacted]
[illegible] 6.5 = .34

F.M. [illegible]

DESIGN F.M.

SINCERELY,

MANAGER

NVLAP Accredited

GARCO TESTING LABORATORIES

532 West 3560 South
Salt Lake City, Utah 84115
Phone 266-4498

5826 South 1900 West
Roy, Utah 84087
Phone 776-5855

5071 So. Arville
Las Vegas, Nevada 89118
Phone (702) 364-8031

June 21, 1990.

Subject: Certification & Accreditation Summary

Gentlemen,

The following is a current list of certifying and accrediting agencies Garco Testing Laboratories uses or participates in. These agencies assist Garco Testing Laboratories to standardize lab and field data.

Inspection Agencies:

1. (CCRL) Concrete & Cement Reference Laboratory .
2. United State Army Corp of Engineers.
3. Calibration-Certification Corp.

Accrediting Agencies:

1. (NVLAP) National Voluntary Laboratory Accreditation Program..
2. United State Army Corp of Engineers.

Reference Samples Program:

1. National Bureau of Standards.

Our equipment certification and calibration is on record with the National Bureau of Standards. Through the (NVLAP) program.

We utilize an internal quality control Manager to maintain our high level of quality. In conjuction with a highly trained staff this produces a quailty service with the shortest possible turn around time for our client.

Sincerely,

Doug Watson,
General Manager

National Voluntary

SCOPE

This procedure will outline and define operations concerning aggregate production, quality control during aggregare production.

AGGREGATE PRODUCTION

All of the aggregates used for all phases of paving will be supplied by Concrete Product Company in Salt Lake City, Utah. Aggregates will be produced at the Walker Pit located at 6500 S. Wasatch Blvd.

The producer will be responsible to provide sufficient space so the individual stockpiles can maintain 10 ft minimum clearance between the finished stockpiles to prevent contamination. The bottom 6" of the pile will be considered a buffer between produced material and the native ground and will not be used as accepted materials. The minimum side slope ratios will be 1.5:1. Construction of piles will be in 4 ft lifts and aggregates shall not be dumped so any portion may run down the sides over previous layers. All material used as ramp materials will be wasted. Also if any production is washed prior to stockpiling, sufficient shelter will be provided to restrict airborne dust from coating exposed aggregates.

The contractor will provide daily production gradations by an approved testing lab at a rate stated in "Testing Frequency".

The QCT will monitor the gradation results and will notify the plan administrator if gradation reaches 75% of the specification range. The plan administrator will notify CPC production manager as to the problem. If any single gradation reaches 90% of the specification range, the QCT will resample. If the second sample corroborates the first sample, the plant administrator will notify CPC that all materials produced during the period of +90% will be rejected and stockpiled separately for other use. Only after the production drops below 75% of range will the contractor accept the production material.

Tentatively, we foresee using one product to obtain our final mix proportions.

PRODUCT SPECIFICATIONS

Chips Seal Aggregate

Screen	Target	Spec	75%	90%
1/2"	100	± 0		
3/8"	95	± 5	3.8	4.5
1/4"	62	± 12	9.0	10.8
#10	5	± 5	3.8	4.5
#200	0.5	± 0.5	0.4	0.5

Slurry Aggregate

Screen	Target	Spec	75%	90%
5/16"	100	± 0	0	0
#4	80	± 10	7.5	9.0
#8	58	± 12	9.0	10.8
#16	39	± 11	8.3	9.9
#30	26	± 8	6.0	7.2
#50	18	± 7	5.3	6.3
#100	12	± 5	3.8	4.5
#200	10	± 5	3.8	4.5

TESTING FREQUENCY

Description	Frequency
Stockpile	
Gradation (each product)	✓ 2 per day AM/PM
Crushed Face Count	

L.A. Abrasion AASHTO T-96	1 per source
Sand Equivalent (Total Sample)	1 per acceptance sample
Flakiness Index	1 per source
Polish Value	1 per source
Durability Factor	1 per source

FINAL ACCEPTANCE TESTING (Stockpile)

Final stockpile acceptance will be performed after the stockpile has been produced and will be accomplished prior to shipment to the job sites.

Testing for acceptance will consist of dividing a stockpile into 3 equal sections and, in accordance with accepted AASHTO Standard sampling procedures, 3 samples will be taken for gradation, sand equivalent, and fracture face count.

The samples will be split between Garco Testing and a representative from the Sharp project for correlation tests. The Sharp representative will select a lab with a certification acceptable to all parties.

If both lab test results indicate compliance with the project specifications, the stockpile will be accepted by the contractor for usage.

ACCEPTANCE TESTS PERFORMED BY UTAH DOT

SEIVE SIZE	SPECIFICATION BAND	TEST 1 5-31-90 2:00 pm	TEST 2 6-1-90 10:00 pm	TEST 3 6-1-90 2:00 pm	TEST 4 6-4-90 2:00 pm
5/16"	100	100	100	100	100
No. 4	70 - 90	83.8	78.5	80.3	82.9
No. 8	45 - 70	54.5	47.5	48.1	50.9
No. 16	28 - 50	40.5	33.7	35.0	37.4
No. 30	19 - 34	32.8	26.7	28.3	30.1
No. 50	12 - 25	24.9	19.8	21.6	22.8
No. 100	7 - 18	17	13	14.8	15.5
No. 200	5 - 15	11.5	8.4	10.1	10.6
SAND EQUIVALENT	55 MIN	55	61	53	56

UTAH DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION

FORM R-249
(LO-5 REV. 7-75

SOIL AND AGGREGATE PREPARATION

Project Name SHRP - Test Section Date 7-6-90

Project No ______ Prospect No ______ Sample No 90-3-A-637

Test For Type "C" Cover Mat'l (gradation & H2O)

AS RECEIVED GRADATION				GRADATION AFTER CRUSHING			
Screen Size	Weight (a)	Percent Retained	Percent Passing	Weight (b)	Weight (a+b)	Percent Retained	Percent Passing
3"				Sample Submitted by:			
1 1/2"				Dave Blake			
1"							
3/4"							
1/2"							
3/8"							
#4							
Wet Wt. -#4							
Dry Wt -#4							
Total Wt. Dry							

WASHED GRADATION AFTER CRUSHING (2500 Gm Dry Recombined Sample)

Screen Size	Weight Retained	Percent Retained	Percent Passing
1"			
3/4"			
1/2"	0.0		100
3/8"	511.2	20.4	79.6
#4	1917.2	76.6	3.0
8 ~~#10~~	39.8	1.6	1.4
~~#16~~			
~~#40~~ #50			
#200	22.1	0.9	0.5
-#200	13.3	0.5	
Total Wt	2503.6		

MOIST. DETERMINATION

Tag 53	+4	-4
Container & Wet Aggregate (gm)	2514.3	
Container & Dry Aggregate (gm)	2503.6	
H_2O Loss (gm)	10.7	
Container & Dry Aggregate (gm)		
Container Wt (gm)		
Dry Wt of Aggregate (gm.)		
Percent Moisture	0.4	
% Gravel		
% Coarse Sand		
% Fine Sand		
% Silt and Clay		

SAMPLE DISTRIBUTION

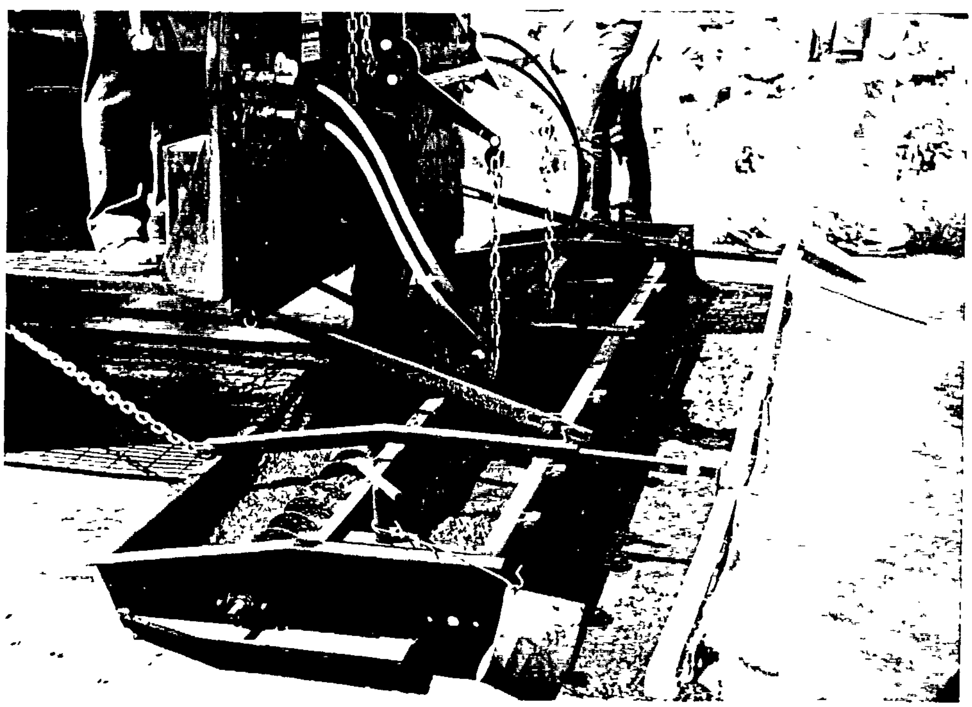
LL & P.I -#10	200 gm
Absorption 3/4, 1/2 + 3/8, #4	500 gm ea
Swell Rep Sample	1000 gm
Abrasion 1/2, 3/8	2500 gm ea
Fract Face #4	500 gm.
Soundness All Sizes	1000 gm ea
Stripping #4	1400 gm
Marshall & Emersion	
% Boulders (+3")	

		AASHO Classification
LL		
PL		
PI		

Te[redacted]ed By Paul Larsen

MATERIALS ENGINEER

Applying a slurry seal treatment.



Slurry seal continuous flow mixing with a flexible rear strikeoff spreader box and burlap drag.