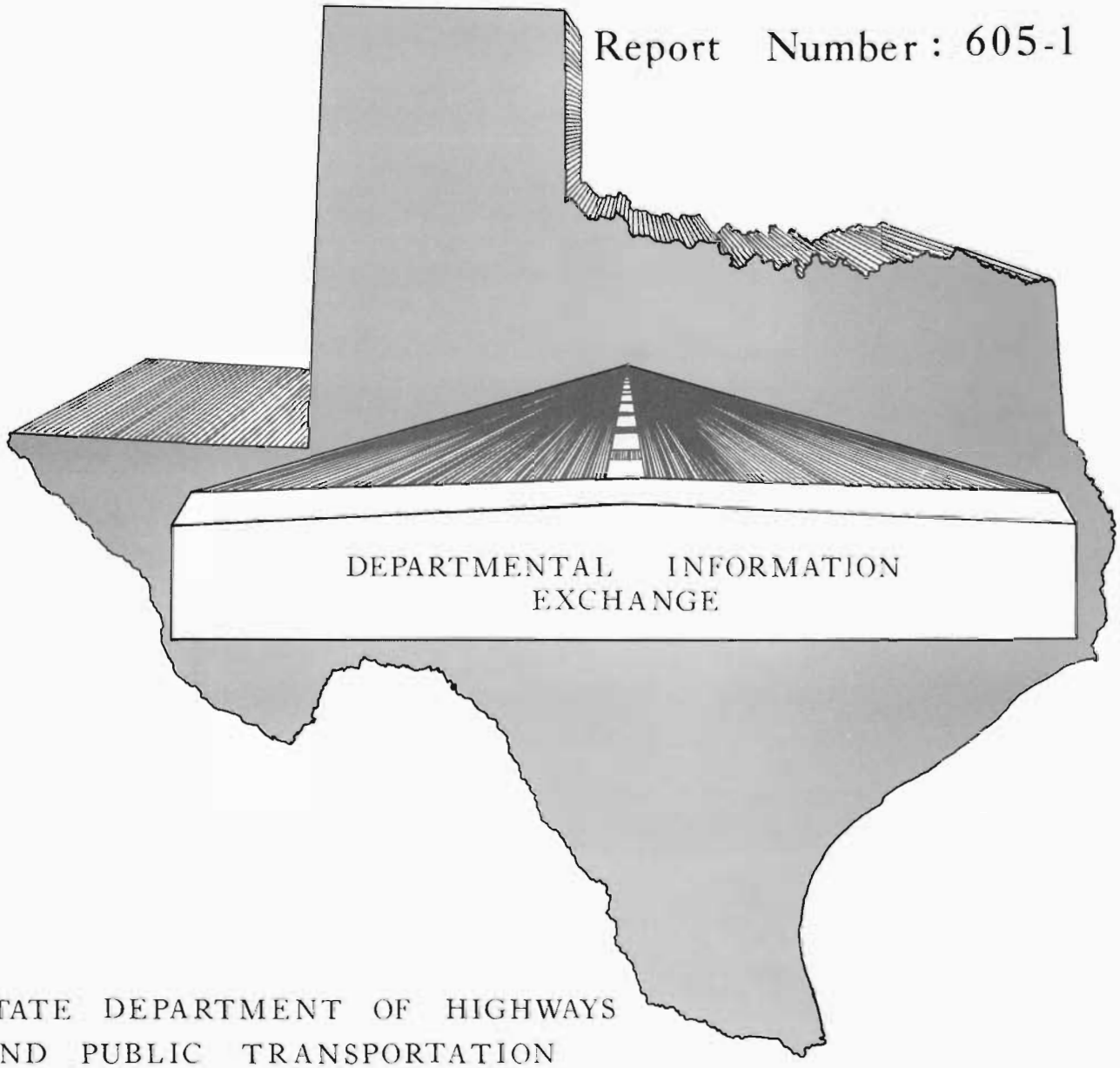
EXPERIMENTAL PROJECTS

PRECOATING AGGREGATES FOR SPRINKLE TREATMENT

Report Number: 605-1



STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

A NARRATIVE REPORT

PRECOATING AGGREGATES FOR SPRINKLE TREATMENT

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This research report is the results from related ideas of precoating aggregates, rates of distribution and actual field construction methods for SPRINKLE TREATMENT of precoated aggregates and the embediment into the surface area of hot mix asphaltic concrete pavement.

In November of 1974, District 14 had received by Departmental Research Reports, Inter-office Memorandums, and Communications from various concerned sources, informational and actual construction data on SPRINKLE TREATMENT FOR ACHIEVING SKID RESISTANT PAVEMENTS.

We in District 14 of Texas Highway Department in Austin decided to pursue the idea of sprinkling precoated lightweight aggregate on a small section of IH-35 in Travis County as a research project and study the results of methods of precoating the aggregates and problems that may be involved in applying these aggregates onto a hot mat of asphaltic concrete pavement.

We began by selecting lightweight aggregates from two separate sources and by trial and error in the district laboratory determined that somewhere between three and four percent of residual asphalt coating on the aggregates might be enough to "stick" the aggregates after being embedded into a hot mat by use of the steel wheel rollers normally used in pavement construction.

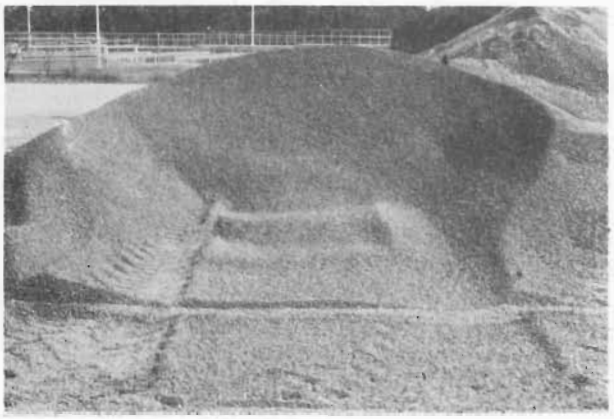
We decided to try to precoat the aggregates in a standard weigh batch hot mix plant using AC-3 Asphalt, HMCL Prime Oil and water.

One of our local producers of Hot Mix Asphaltic Pavement Products agreed to put his plant at our disposal and also furnished one of the aggregates and the asphalt materials free of any charge for this purpose of research.

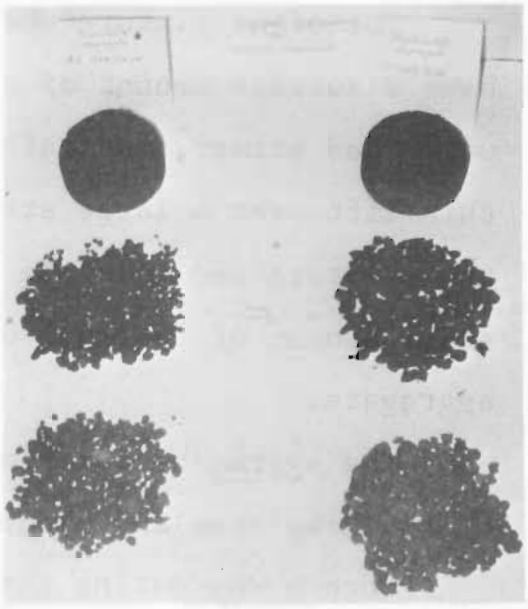
We had already pre-determined in the laboratory that asphalt in the amount of three to four percent by weight would be too adhesive to be immediately processed through the mechanism of any type of aggregate distributing or spreading device.

Since the use of the plant and materials were at our disposal and knowing that the precoated aggregate must be thoroughly cured out of all volatile material before embedding, we decided to go ahead and partially precoat it in a plant, then by spreading it on a clean spot in the maintenance warehouse yard we could then "sweetin" it up to the desired asphalt content by spraying with a solution of water and emulsion, blade mixing, and allowing complete curing time between each application of emulsion.

The initial coating by plant mix consisted of AC-3 Asphalt, Primer and Water. Using two parts of primer to one part asphalt and four percent water, mixing at 210° F and working with dry stockpiles of aggregates, it had been previously determined that it would take at least this amount of water to disperse the asphalt over the surface area of the aggregate for a more uniform coating.



Raw Material
From Superrock



Laboratory Designed Mixes

Plant Precoated
Material Before Curing

Plant Precoated
Material After Curing

The plant mixture when dumped from the plant appeared to have a surplus amount of asphalt at the onset because of the water and primer, but, after being dumped and spread out in a thin lift over a large area in the maintenance warehouse yard, the moisture and volatile began to dissipate, leaving only a small amount of residual asphalt coating on the surface of the aggregate.

The aggregate was blade mixed daily, flattened out over the working area and allowed to continue to cure out.

Once a day during the warm, sunny, fall weather days or after five to ten days if showers or cool weather occurred during the curing out process, the mixture was visually inspected to check for any indication of "balling" or sticking together.

After each curing out period had elapsed and the mixture was ready to receive another coating of asphalt, a twenty percent (20%) solution consisting of one hundred gallons of emulsion to four hundred gallons of water was prepared in an asphalt distributor and sprayed on the flattened out precoated aggregate. The quantity of total solution used for a "sweetening" was at the approximate rate of five gallons per cubic yard of aggregate for each application by hand hose.

The emulsion and water applications were applied to the sprinkled coated aggregates four times over a period of forty days, and always on a clear, sunshiny day. The calculated amount of residual asphalt applied with each spraying was approximately 0.50 percent by weight.

"Sweetening Precoated
Material With Emulsion
In Maintenance Yard

Laydown Machine In Foreground
Aggregate Spreader In Background

Asphalt Coated Aggregate In Hopper
Of Spreader Ready For Sprinkling

Aggregate Spreader
Applying Sprinkle Treatment

For a period of several days after the introduction of water and emulsion, the aggregates were very sticky and would bond together, but after blade mixing and curing for four to six days, the rich looking appearance would dissipate, the aggregate bonding would cease, and the mixture took on a dull dry look and was ready for sprinkling on the roadway.

The aggregate mixture was then bladed for the final inspection to insure that it was totally cured out, dry and with no evidence of sticking together or "balling up" that would prevent it from being processed through the mechanism of an aggregate distributing device.

The mixture was loaded into trucks and stored in a covered shed two days before it was carried out on the road to be then sprinkled on the hot asphaltic concrete mat. This was done as a precaution against showers.

The morning that the sprinkled coated material was applied was partly cloudy, hot and humid with a possibility of 30% showers in the area, but everything was in readiness for this work, so we proceeded to complete the job. No showers occurred during the actual work.

The plus ten mesh material in the asphaltic concrete mixture had been reduced from 62% to 53% for this purpose to better surround the precoated particles with fine materials from the pavement mixture.

The loose mat thickness varied from a 2" longitudinal cold mat joint to a 1 1/2" (when compacted) shoulder. The average

loose thickness of the mat upon which the sprinkle coated material was placed was 1 3/4".

The asphalt content of the Ty-D mixture was 7.0%.

The chip spreader was adjusted to a thin application of aggregate where the aggregate particles were individually spaced one from the other on the hot surface area, yet remain visibly predominate as the surface contact aggregate, and in sufficient quantity to upgrade the skid resistant value of the embedded pavement.

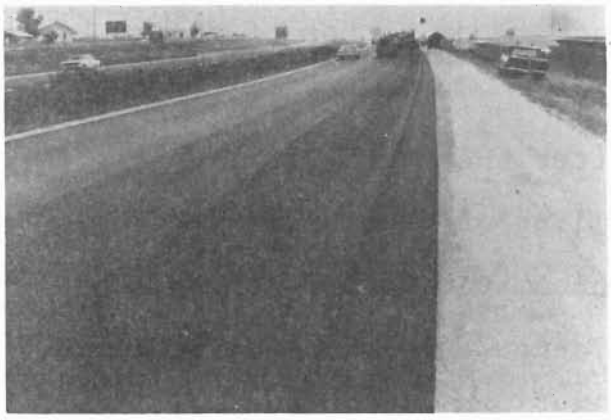
The chip spreader traveled at a speed of from four to six miles per hour. Traveling closely behind the laydown machine on the freshly laid mat and prior to any rolling, no difficulty or problems were encountered from the use of this type aggregate spreader. The only tire marks that may be detected in the completed section was where the spreader was held up while waiting on the paving machine. The sprinkled mat was rolled by a ten-ton three-wheel roller using the same rolling pattern and number of trips as being used for rolling regular hot mix.

The eight ton tandem roller followed the three wheel roller with no change from its usual rolling pattern or number of trips over the mat.

Approximately two to three hours after the steel wheeled rollers had completed the flat wheel rolling of this sprinkled section of pavement, a twenty-five ton pneumatic roller (unloaded) was put to work rolling the sprinkled treated section. This was done primarily to see if this roller would show up any indication of raveling out or picking up of the sprinkled coated material from the completed mat surface. Neither raveling nor aggregate

Sprinkled Aggregate On Hot Mix
ACP Ready For Break-Down Rolling

Rolling With Three
Wheeled Roller In Progress



Rolling With Three Wheeled
Roller Continues To Be Followed
By Tandum Roller

Completed Section
Of Sprinkle Treatment

pickup occurred from the use of this type of roller, so it continued rolling to help seal off the surface of the mat.

All rollers used sufficient water while they were performing their part of the rolling operations, and all traveled between three to five miles per hour.

The work on this section of pavement began at 11:45 a.m. and all operations were completed by 1:45 p.m.

The sprinkled section was opened to IH-35 traffic at 5:30 p.m.

The skid values as shown were recorded approximately ten days after the sprinkling of the asphalt coated aggregate had been in place. The values were taken on each of the sections that were sprinkle treated, as well as a section of untreated pavement immediately prior to and after each treated section.

SKID DATA

Using the nose of the Exit Ramp to Jarrell as control point.

	Average skid value @ 20 mph.	Average skid value @ 40 mph.	Average skid value @ 60 mph.
Control South (Untreated)	60.0	48.4	35.5
Superock 1100' (Treated)	70.5	*58.3	45.0
Featherlite 990' (Treated)	70.2	*55.7	44.5
Control North (Untreated)	67.3	49.2	33.8

*At the standard speed of 40 mph, the skid values on the treated section show an improvement of approximately forty percent over the values as recorded on the new Type "D" mix that had been carrying traffic for ninety days or longer.

INFORMATIONAL DATA AT THE TIME OF SPRINKLE TREATMENT

Placing temperature of Type "D" Mixture = 300° F (Arrival on road)

Loose mat thickness of Type "D" Mixture = 1 3/4" (average)

Asphalt content of Type "D" Mixture = 7.0% (sprinkled section only)

Plus ten material of Type "D" Mixture = 53.0% " " "

Temperature of mat at time of sprinkle treatment = 225° - 250° F

Application rate of Superock aggregate (Gr.5) = 2.60 lbs./ s.y.

Application rate of Featherlite (Ranger) (Gr.4) = 3.25 lbs./ s.y.

	(Bulk) Sp.Gr.	Wt./cu.ft.	Pit location
Superock	1.15	43.0	Streetman
Featherlite	1.50	52.0	Ranger

Total Residual Asphalt Content Of Aggregates from plant and yard mixing by laboratory extraction tests:

Featherlite Aggr. (AC-3 & EA-HVRS) = 3.20 %
Superock Aggr. (AC-3 & EA-HVRS) = 3.36 %

SUMMARY

Since two methods of attempting to precoat aggregates have been discussed in this report, there are also two possibilities of the sprinkling or placing of this kind of treated aggregate.

1. Plant Mixed - Hot Laid

For plant mixing, primer or water should be a part of the processing, particularly while working with dry stockpile materials, some type of dispersing agent is needed to distribute the asphalt material uniformly over the entire surface area of stone particles, otherwise the mixture would come out of the pugmill only as a partially asphalted speckled product.

If enough asphalt material was used to satisfy the amount necessary to properly coat and stick the aggregate within the asphaltic concrete mat, then it would be too wet and ashesive to be applied immediately through an aggregate spreading machine. It could possibly be applied by the use of a regular hot mix lay down machine.

2. Yard Mixed - Chip Spreader Applied.

Although this method appears to require a large amount of work space and several weeks of spraying, blading and curing, enough precoated material could be processed and stockpiled to take care of a normal size overlay project in a period of eight to ten weeks. With the knowledge that a project requiring surface upgrading is planned in advance, the processing responsibility of the sprinkled treated material could be assumed either by state forces or by time extension, if by an awarded contract.