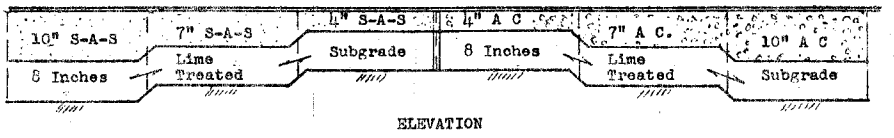
SAND-ASPHALT-SULPHUR PAVEMENT EXPERIMENTAL PROJECT

HIGHWAY U.S. 77, KENEDY COUNTY, TEXAS

Proj 519



ELEVATION

TEXAS TRANSPORTATION INSTITUTE

Texas A&M University
College Station, Texas

SAND-ASPHALT-SULPHUR PAVEMENT EXPERIMENTAL PROJECT
HIGHWAY U.S. 77, KENEDY COUNTY, TEXAS

A HANDOUT

INCLUDING:

Brief Description of Test Items

Participating Agencies and List of Personnel

Bibliography

MARCH 1977

TEXAS TRANSPORTATION INSTITUTE
College Station, Texas

SAND-ASPHALT-SULPHUR PAVEMENT EXPERIMENTAL PROJECT
HIGHWAY U.S. 77, KENEDY COUNTY, TEXAS

Sponsored By

TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

and

THE FEDERAL HIGHWAY ADMINISTRATION, OFFICE OF DEVELOPMENT

in cooperation with

U.S. BUREAU OF MINES

and

THE SULPHUR INSTITUE

Other Participants Include:

Shell Canada Limited

Texasgulf, Inc.

Barber-Greene Company

Motheral Contractors, Inc.

Foremost Paving, Inc.

Texas Air Control Board

Texas Transportation Institute

For additional information on sand-asphalt-sulphur paving materials, please contact:

THE SULPHUR INSTITUTE
1725 K Street, N.W.
Washington, D.C. 20006

Or other participants.

SAND-ASPHALT-SULPHUR PAVEMENT EXPERIMENTAL PROJECT

FOREWORD

Sand-asphalt-sulphur pavement material is composed of mineral aggregate (sand), elemental sulphur and asphalt in which by weight, the amount of sulphur may exceed that of the asphalt. The pavement mixture is prepared in asphalt hot-mix plants equipped with an auxiliary system for handling molten sulphur. It is hauled in heated dump truck bodies to prevent the formation of cold lumps and is placed with a paver modified to support the screed assembly over the plastic hot mixture.

Sand-asphalt-sulphur mixtures are soft and plastic at the time of placement, and no rolling is required.

The amount of asphalt in the sand-asphalt-sulphur pavement mixture is about the same as used in conventional asphalt pavement mixtures. In the typical sand-asphalt-sulphur mixture one pound of sulphur and 6 pounds of sand produces the same volume of pavement as 8 pounds of graded aggregate. Each of these mixtures demands about the same percent of asphalt cement and they perform equally well in service. [1*]

Sand-asphalt-sulphur pavement material together with the special equipment needed for preparation and placement was developed by Shell Canada Limited.

PROPERTIES OF THE PAVEMENT MATERIAL

The molten sulphur added to the hot mixture of asphalt-coated sand conforms to the geometric configuration of the voids and, as the mixture cools below the melting point of sulphur, the sulphur solidifies to provide an interlocking or structuring effect throughout the pavement.

Project Specifications

Job-Mix Formula: The sulphur content of the mineral aggregate-asphalt-sulphur base mixture varies from about 11 to 16% by weight, the asphalt content from 5 to 7% by weight, and the mineral aggregate from 77 to 84% accordingly.

Sand Gradation:

Sieve Size	Percent Passing by wt.
3/8 inch	100
No. 4	90-100
No. 8	85-100
No. 16	80-95
No. 30	65-85
No. 50	30-60
No. 100	10-25
No. 200	5-15

*Superscript numbers refer to bibliography on page 10.

Test Requirements:

(1) Modified Marshall Stability Test

Stability at 140 F - 1200 lbs. (min.)
Flow Value - 0.06 inch (min.)
Air Voids - 15% in mixture (max.)

(2) Slump Test

Workability - 1½ in. (min.) to 6 in. (max.)

PAVEMENT DESIGN AND ANALYSIS

The test items were designed by the Texas Transportation Institute to "---give a fair comparison of the relative performance of sand-asphalt-sulphur pavements and a deep asphalt concrete pavement."[2]

Elastic and fatigue properties of the sand-asphalt-sulphur pavement materials were studied in considerable detail over a period of years. The material moduli and fatigue properties were used to calculate stress, strain and deflections under an 18-kip dual tire, single axle load using computer programs. Thicknesses of the test items were selected in accordance with expected load and service life.

Post construction testing of the experimental project will be conducted by Texas Transportation Institute in cooperation with the Texas Department of Highways and Public Transportation over a period of three years.

THE NEED

In sand-asphalt-sulphur pavement mixtures, sand and sulphur replace crushed and graded aggregates. This makes it economically attractive in areas where inexpensive, poorly graded sands are readily available. Too, there is a growing shortage of economically available coarse aggregates for asphalt concrete pavements.

As a result of air pollution regulations, the amounts of sulphur recovered from petroleum and coal are expected to increase beyond the expected industrial requirements for this material. A practical use for this excess sulphur will be a future need.

Sand-asphalt-sulphur pavements are intended to make use of readily available and inexpensive sands and, in time, available sulphur and sand will serve as replacements for crushed and graded aggregates.

SULPHUR

Sulphur is one of the elements, with an atomic number of 16 and atomic weight of 32.06. The specific gravity of solid sulphur is about 2.00, or twice as heavy as asphalt, at ambient temperatures and 1.70 at 275F.

Sulphur is not considered a hazardous material in commerce. About 90% of the elemental sulphur used in the U.S. is shipped in the liquid state. Truck transports are widely used with a typical truck hauling 20 to 22 long tons. Practices for hauling, heating, storage and safety are well established in the trade.

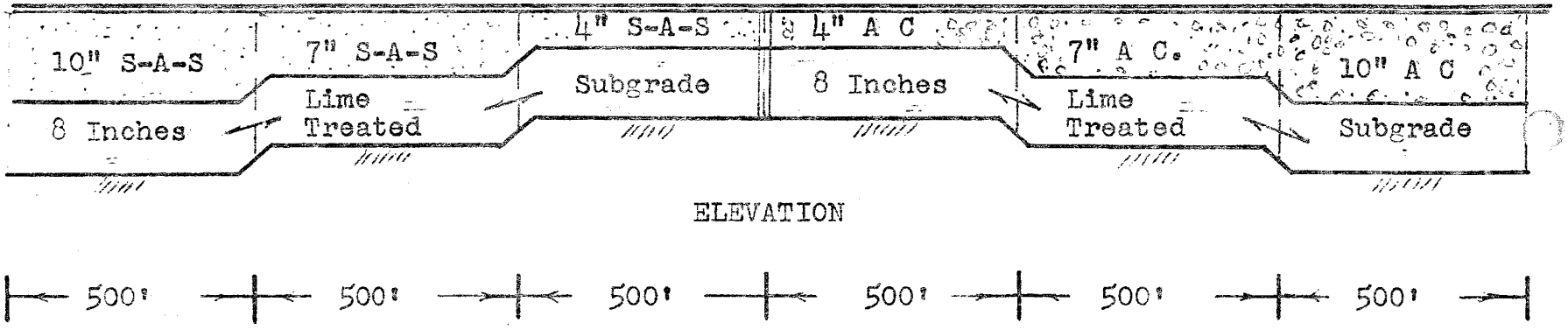
Sulphur melts at 240F. The working temperature range for molten sulphur is about 255 to 300F. At higher temperatures, the molten sulphur becomes very viscous.

When heated, the concentrations of toxic gases formed are low or non existant in the temperature range of 250 to 300F but increase rapidly as the temperature rises above this range. Sulphur dust and fumes from molten sulphur can cause eye irritation.

Briefly, liquid sulphur is hot and poses the same dangers in this respect as hot asphalt or any other hot liquid. Molten sulphur at 300F will burn in air if ignited and sulphur fumes and hydrogen sulphide gas will also burn under extreme conditions. As with asphalt handling and, in particular, with 'liquid asphalts', all sources of ignition such as smoking, open flames and sparks must not be permitted near the liquid sulphur.

Safety precautions include attention to temperature control and measuring and monitoring the H_2S content of the air in critical areas during paving operations. Methods and equipment for these purposes have been developed in cooperation with the U.S. Bureau of Mines.

MINERAL AGGREGATE-ASPHALT-SULPHUR RESEARCH PROJECT
KENEDY COUNTY - HIGHWAY U.S. 77
(Schematic - Showing Test Items)



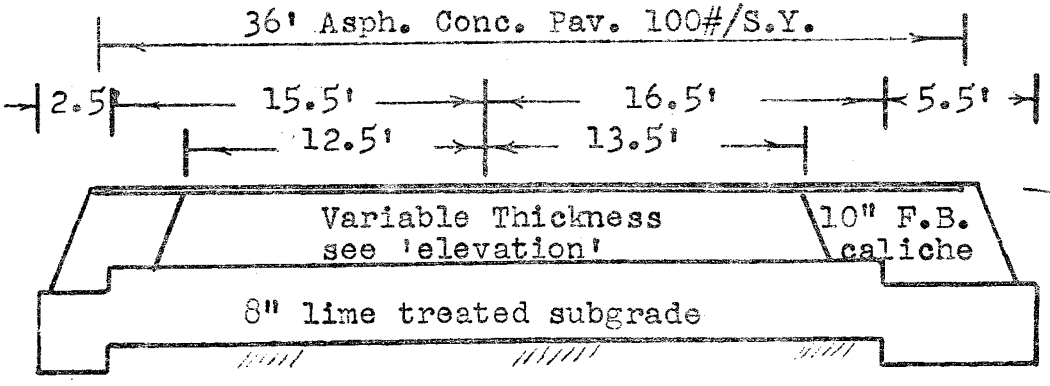
ELEVATION

Note: This Research Project will occupy both traffic lanes (26' width) on U.S. 77 for 3,000 lineal feet.

S-A-S Sand-Asphalt-Sulphur Pavement Material

A C Asphalt Concrete Pavement, Type D

Schematic does not scale



X - SECTION
N-S RIGHT LANES

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Pete Leal, Paving Foreman

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James Cunningham, (van instrumentation and measurements)

Fred Hartmann, Source Evaluation
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Donald Saylak, Associate Research Engineer
Robert N. Barnett, Research Assistant
Ed Ellis, Laboratory Assistant
John O. Izatt, Consultant

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