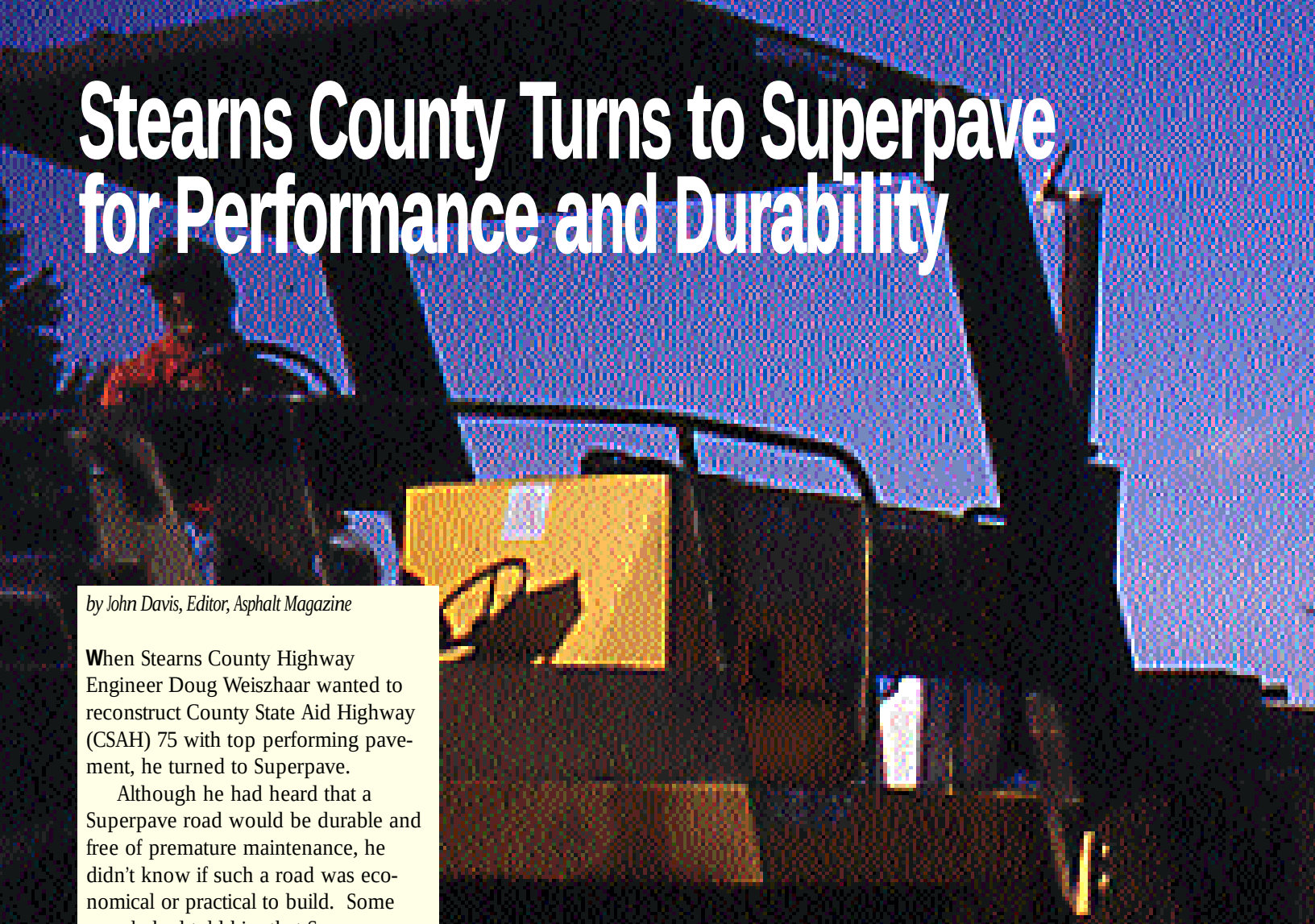
Stearns County Turns to Superpave for Performance and Durability



by John Davis, Editor, Asphalt Magazine

When Stearns County Highway Engineer Doug Weiszhaar wanted to reconstruct County State Aid Highway (CSAH) 75 with top performing pavement, he turned to Superpave.

Although he had heard that a Superpave road would be durable and free of premature maintenance, he didn't know if such a road was economical or practical to build. Some people had told him that Superpave technology was too hi-tech and expensive for counties.

Undaunted, Weiszhaar invited Asphalt Institute District Engineer Al Palmer to discuss the possible use of Superpave on CSAH 75 with him, Assistant County Engineer Mitch Anderson and Senior Asphalt Design Technician Gene Thyen.

Palmer confirmed that Superpave technology would answer their concerns about the aging, cracking and rutting problems that recently appeared on some of the Stearns County roads. He recommended that at least one Superpave test section be included in the CSAH 75 project, and that the section be build in a heavy traffic area.

Pre-Project Partnering

Surprisingly, the Stearns County engineers not only agreed with his recommendation but suggested doing the entire project with Superpave. They had considered doing the project with portland cement concrete (pcc) but the higher costs of pcc prohibited that option.

The county and the Asphalt Institute met again in February 1996 to further discuss the project. This time, the group invited a number of additional asphalt industry representatives. Since Superpave had not been used locally, and the county was operating under a fairly tight federal-aid budget, the group asked Koch Materials and Meridian Aggregates to supply materials for a preliminary mix design to give Stearns County engineers an idea of Superpave material requirements and associated costs.

New Technology

Although the county like the idea of constructing CSAH 75 with Superpave, they were concerned about the possible higher cost of the new technology. Would the higher cost of Superpave materials--aggregate, PG binder and testing procedures--be prohibitive? If the cost of using Superpave was too high, the county would have to choose conventional materials and standard design.

Surprisingly, Stearns County engineers found that Superpave costs were comparable to conventional paving materials. In neighboring states, the use of modified asphalt binders had increased costs substantially--as much as $100 per ton. Although the PG binder grade for CSAH 75 was still undetermined, the PG could range

(from left) Asphalt Institute District Engineer Al Palmer, Stearns County Highway Engineer Doug Weiszhaar, Senior Asphalt Design Technician Gene Thyen, and Assistant County Highway Engineer Mitch Anderson gather in front of an antique grader at Stearns County Highway Department.

from 52-28 to a 58-40, depending on the binder selection criteria used for design.

Even though very high quality aggregates were used for the preliminary mix design work, aggregate costs were competitive. Weiszhaar and Palmer asked the MnDOT research office if any funding was available for constructing Superpave research projects at the local level. They said that research money was available from FHWA to investigate the use of polymer modified asphalt materials in Minnesota. Thus, a PG 58-34 asphalt grade was selected for use on the project. Based on the locally available asphalt materials, it was understood that this would result in a polymer-modified asphalt binder being used on the project. The cost of the polymer-modified was offset by the research money contributed by MnDOT and FHWA.

Superpave Design

Palmer and Stearns County considered the project a real breakthrough for Superpave in Minnesota. The new technology had not been widely used in the state and CSAH 75 provided the ideal forum to promote its use. The County, MnDOT and FHWA decided that Superpave criteria would be used for the entire project.

Materials selection and mix design criteria were strictly followed. Palmer worked with the county, materials suppliers, MnDOT research and the MnDOT central lab to provide preliminary mix designs, and to develop plans and specifications for the Superpave sections. MnDOT did most of the mix design work and the University of Minnesota helped with the aggregate testing.

Specific Aggregate Source

The county decided to designate a specific aggregate source for the Superpave mixes and provide the mix design to all prospective bidders. This was done due to a relatively short time span for completing the project. Also, this would allow for an objective evaluation of the Superpave sections.

Through a cooperative agreement between the county and Meridian Aggregates, the county was assured that all Superpave bids would be based on the same aggregate selection and the same aggregate price. Meridian and Palmer worked on the aggregate blends to achieve proper Superpave criteria. No special aggregate processing was required for the formulation of the Superpave aggregate. All of the aggregates proposed for the blends were currently available at the quarry. MnDOT validated these in the mix design phase.

MnDOT completed the mix design in July and sent materials to the Asphalt Institute in Lexington, Kentucky, for mix design verification. The mix design verification testing showed a very close correlation between the MnDOT laboratory and the Institute lab. A single mixture was used for all Superpave sections on the project.

Typical Section

The primary Superpave sections were designed to be in the westbound lanes of CSAH 75. The typical section for these lanes included a base course layer followed by an intermediate course and a wearing surface layer. The entire base course layer was designed for a conventional MnDOT mix. The binder layer in the eastern half of the project included Superpave

mix, while the other half was paved with a conventional mix. The entire surface layer in the westbound lanes was then designed for Superpave mix.

A typical section included approximately 5 inches of existing aggregate base, 2.5 inches of 3/4-inch maximum size, recycled hot-mix base course, 2 inches of 3/4-inch maximum size intermediate course mix, and 2 inches of surface course mix. The Superpave mix used for the intermediate and surface layers was 19mm nominal size; the conventional intermediate course mix consisted of 3/4-inch maximum size aggregate.

The surface course in the eastbound lanes consisted of 1/2-inch maximum size aggregate meeting an MnDOT Type-47 specification, which is a minimum 70 percent plus #4 crushed with 25 percent manufactured sand. The 10-foot-wide outside shoulders were milled and paved with an overlay that matched the thickness of the newly constructed course.

Construction

Construction of the project began July 30, 1996 and was completed September 15, 1996. Construction on the westbound and eastbound lanes each took three weeks. Actual construction of the three Superpave sections in the westbound lanes took only 4 1/2 days--August 26 to August 30. Duininck Brothers, Inc. of Prinsburg, Minnesota, was the contractor and Jebro, Inc. of Sioux City, Iowa, supplied the PG 58-34 asphalt binder for the Superpave sections.

Eastbound lanes have conventional MnDOT mixes except for a 1-mile section that contains Superpave aggregate materials and 120/150 conventional penetration grade asphalt. The purpose of this section is to compare performance between the conventional sections and the Superpave sections containing PG binders in the westbound lanes.

The contract specified milling out about 6.5 inches of existing pavement in the westbound and eastbound traffic lanes of the 5.78-mile project. MnDOT specifications allowed the contractor to use recycled asphalt pavement (RAP) in all pavement layers unless the special provisions exclude its use. Stearns County prohibited the use of RAP in the surface layers on this project. The contractor chose to use 50 percent RAP in the conventional base and intermediate layers. Approximately 16,000 tons of the 76,000-ton project was constructed using the SBR polymer-modified binder and Superpave mix design.

Quality Control Testing

Superpave did not specifically address the mix production control aspects of construction, although Minnesota has

been working under a quality control system for several years. "So we devised a testing procedure for the Superpave production portion of the project," says Palmer.

"Stearns County was one of the first to adopt the QC/QA concept for asphalt mix production, and they wanted to continue the practice on the Superpave sections. We inserted the Superpave testing equipment and procedural requirements directly into the standard MnDOT QC/QA specifications. This answered concerns expressed by some that Superpave did not include adequate QC/QA procedures."

The biggest hurdle to overcome was the lack of available equipment in the state to perform the testing. The contractor and the Asphalt Institute worked together to leap the hurdle. Asphalt Institute Mix Technologist Gary Irvine transported a Superpave Gyratory Compactor from Institute headquarters in Lexington, Kentucky, to conduct daily gyratory compaction tests on the Superpave mixes. The contractor performed maximum specific gravity (Rice), sieve analysis, asphalt content and pavement density testing, and collected samples for gyratory compaction.

One of the unique aspects of the project was that plant production was based solely on the results of the gyratory samples. During the entire Superpave mix production, no adjustments were required in asphalt content or aggregate proportions to meet the specified mix volumetric criteria. MnDOT conducted the gyratory compaction for the Quality Assurance testing. The FHWA Superpave mobile lab, which was in Minnesota at the time, also conducted tests on the plant-produced mix.

No Segregation

Before construction started, there was some concern that segregation would occur in the Superpave mix. A standard MnDOT mix is typically 65-75 percent passing the No. 4 sieve. The Superpave mix design called for 40 percent passing. But segregation did not occur. Adequate asphalt content and film thickness, along with the highly crushed aggregate resulted in little, if any, segregation during construction.

The project density specifications required the use of a pneumatic tired roller for intermediate rolling passes. After a few passes, however, the contractor requested the use of steel-wheeled rollers because "pickup" on the pneumatic tired-roller was an obvious problem. Once the proper mix temperature was determined for adequate compaction, the contractor was able to achieve consistent density.

The county specified 40-foot-interval sawcut and sealing to relieve thermal cracking on each of the different design sections throughout the project. This was done to compare the low temperature properties of the PG binder materials to sections of pavement with conventional asphalt binder and the stress relief cuts.

Comparing Asphalt and Concrete

Abutting the 5.78-mile Superpave project on the east end is a 1.6-mile stretch of new four-lane concrete. The two pavements have approximately the same traffic volume and percentage of heavy trucks. Stearns County and MnDOT researchers will have an ideal opportunity to compare construction costs and material performance on the two projects.

Stearns County officials, MnDOT, FHWA, the contractor, the aggregate producer and the Asphalt Institute all believe the project went smoothly and successfully because of the cooperation in forming a plan, then working together to bring it to fruition. Stearns County engineers are particularly enthusiastic about the smooth execution of the project and are anticipating good results. Still, they have questions. They want to know if:

- ▲ Superpave will last longer and perform better than conventional asphalt pavements.
- ▲ Superpave will reduce thermal cracking.
- ▲ Superpave will prevent the loss of fine aggregates and avert the need for an early sealcoat.
- ▲ Superpave will prevent rutting under heavy traffic.
- ▲ Superpave will prevent disintegration in the wheel paths.

County engineers also want to know how long a Superpave pavement can last without an overlay, and how long it can last until it requires some form of routine maintenance.

Regardless of the unanswered questions, Weiszhaar and Stearns County sees a bright future for Superpave. "If it performs well, we'll use it throughout the county," he says. "We want to build roads that our customers appreciate. Our customers, the motorists, have been complaining lately because of less than excellent road quality. If Superpave gives us better quality, we'll use it again and again." ▲