Case Study **7**

Fly Ash for Stone Matrix Asphalt in Oregon

Stone Matrix Asphalt (SMA) is the latest low wear, long life asphalt pavement. It has a proven track record in Europe and is growing in popularity with State Department of Transportations across the country. Georgia alone placed over two million tons of SMA on its roads in one year. The Oregon DOT is the latest to adopt SMA and is using it as a high durability asphalt wearing surface on 10 miles of I-84 in southeastern Oregon.

Stone matrix asphalt has a much higher percentage of large crushed coarse aggregate (75%) in the asphalt mixture as compared to conventional asphalt, with the balance of the SMA aggregate being made up of fine aggregate (25%) to help fill the voids. Field results confirm that the use of a higher percentage of large aggregate particles that are supported by each other, rather than being supported by smaller "filler" aggregates, can improve rut resistance from studded tires and general tire wear, extending the useful life of five to seven years for conventional asphalt, to eight to ten years with SMA.

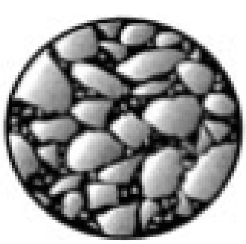
Using fly ash as a mineral filler in SMA helped the Oregon DOT reduce voids between large aggregates and enhance the durability of the new roadway.

Because of the lack of smaller "filler" aggregate particles in SMA, small voids between the large aggregate are visible. To reduce the gap grading of the aggregate, it is necessary to increase the asphalt binder content to 6% or more, and add 5% or more fine mineral filler (fly ash) and some mineral fibers (0.3% rock wool) to the asphalt binder. The fly ash mineral filler and fibers prevent the asphalt binder from draining down between the large aggregate in hot weather.

In the fall of 2000, the Oregon Department of Transportation (ODOT) and contractor J.C. Compton had their first large scale experience producing and installing SMA. The contractor anticipated problems producing the SMA because of changes in the aggregate gradation, increased asphalt binder and the introduction of the fly ash mineral filler (over 5,000 tons of Class F fly ash from the Centralia, WA steam plant was used on the project), but fortunately, production proceeded normally. In fact, in addition to production and transportation, the lay down of the SMA mixture proceeded like any other asphalt paving mixture. It was only during the rolling and compacting phase that the contractor encountered any difficulty with the material on the project.

As with any other asphalt operation, the SMA mixture was heated to 325° Fahrenheit at the asphalt plant before the mix was released to the loading chute. It was anticipated that the asphalt mix would start to cool during transportation and installation, yet during the rolling and compacting phase the temperature would still be in the ideal compaction range of 240° Fahrenheit. At temperatures lower than this, the liquid asphalt binder becomes stiff and viscous, impeding the movement of aggregates that must slide past each other during the compaction phase to decrease voids and provide increased strength and durability.

For reasons still not fully understood, the temperature of the SMA during the compaction phase had dropped to 200° Fahrenheit, requiring the Oregon DOT to accept a compaction rate of 92%, rather than the specified 94%. Despite the difficulties with reaching the proper compaction standard, Ric Young, Oregon DOT project manager, is cautiously optimistic about the future of SMA. "The stuff is setting up real hard; if it can kind of mimic concrete, you'll get a better benefit-cost ratio and a longer lifespan for the roadway."



Stone Matrix Asphalt (SMA)

Conventional Hot Mix Asphalt (HMS)

SMA Typical Mix Design

Coarse Aggregates	17 – 80%
Fine Aggregates	8 – 12%
Mineral Filler	12 – 16%
Total Aggregates	94% of Total Weight
Asphalt Binder	6% of Total Weight
Stabilizing Additives	0.3 – 0.4%

For more information or answers to questions about the use of fly ash in specific applications, contact your nearest Headwaters Resources Technical Sales Representative or call 1-888-236-6236.

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