World's Strongest

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The sign on the corner of Williams and Margaret Streets in downtown Thornton, Illinois, reads "Thornton Quarry, Largest Limestone Quarry in the World." The quarry is the largest ever mined with up to 50,000 tons of stone produced each day. The only way in and out of Thornton is through the intersection of Williams and Margaret Streets, the site of the "World's Strongest Intersection."

The Thornton Quarry provides the majority of the mineral aggregates used throughout south Chicago and northwest Indiana. Aggregate from the quarry gets trucked as far as Michigan because of its excellent quality, inherent to a quarry formed from a coral reef. The vast majority of this aggregate travels by truck through the intersection at Williams and Margaret.

Braking, Stopping and Turning Strongest

The intersection must be able to sustain the stresses of high load braking, stopping and turning. The pavement endures around-the-clock pounding of thousands of fully loaded semi-trailers hauling stone and hot mix asphalt to construction sites and material producers. Several of the intersection's distresses have occurred because the pavement never fully relaxes. Over 1200 heavy trucks per day enter the intersection, most of them stopping at the traffic light or making turns in 11-foot-wide lanes.

On several previous occasions, the intersection had been paved, repaved, and even reworked to the sub-base. Until recently, regardless of the effort or dollars expended, the performance of the pavement surface continually fell short of Illinois DOT (IDOT) expectations. Typically, it required maintenance or rehabilitation even before one year had passed.

24-Hour Repair Strongest

One of the significant challenges facing the IDOT was not only how to effectively repair the intersection but how to repair it in a cost-effective manner within a 24-hour period. No one wanted the intersection to shut down, even for a few hours, let alone a full day. "There is no way Williams and Margaret can be closed down, even for a day," says Don Gallagher, President of Gallagher Asphalt Corp., located next to the quarry. Meeting the time-constraint challenge required extensive analysis and a true collaborative effort between IDOT, Asphalt Institute engineers, AI member companies and hot mix producers. This "tough mix" team of experts met for numerous technical talks and analysis sessions.

Both the surface mix and the substructure would have to handle the torture of the extraordinarily high traffic load in order to meet the mix team's high expectations. The team drew upon its experience and expertise to create a specification that would outperform any previous specifications and rehabilitation attempts. IDOT and JFG Technical Center analyzed the existing materials by cutting out a trench portion of the existing pavement and analyzing its structure for deformation at various depths below the existing surface course.

Steel Slag SMA Strongest

As a result of the analysis, IDOT and JFG concluded that a previously placed stone matrix asphalt (SMA) overlay had not failed. But the plastic mix below the SMA showed signs of serious deformation to a depth of approximately 6 inches. After extensive analysis, the team recommended using a properly applied SMA mix over a completely restructured foundation. IDOT decided to mill the existing intersection pavement full depth to ensure that the SMA would be placed on a solid foundation. IDOT specified that an SMA dolomite binder course be placed directly on the milled surfaced, then topped with a 2-inch steel slag, SMA surface mix.

Surface Course Job Mix Formula

Sieve Size in mm	% Passing
19.0	100
12.5	86
9.5	68
4.75	29
2.36	17
1.18	14
.600	10
.300	9
.150	8
.075	7
asphalt cement	**5.5 %**

St Intersection

Surface Course Job Mix Formula

Sieve Size in mm	% Passing
19.0	100
12.5	76
9.5	48
4.75	21
2.36	17
1.18	13
.600	11
.300	10
.150	9
.075	7.5
asphalt cement	**5.8 %**

The plastic mix below the SMA course showed signs of serious deflection.

The steel slag SMA mix was specified for the surface course to provide a high-friction surface and the stone-on-stone contact needed to handle the 750,000 equivalent single axle loads (ESALs) per year.

The SMA mix has been down for over a year now and has out-performed any previously laid material. IDOT was so confident in the SMA mix's ability to perform that in the summer of 1998 they let a major resurfacing job on I-94 in Chicago using a similar steel slag mix. This was the largest steel slab SMA project built to date.

SMA is now being used in other high load, high traffic situations where a rut-resistant mix is essential. At the Margaret and Williams intersection, asphalt technologists are showing how hot mix asphalt remains capable of producing the world's strongest intersection.▲