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A MAGNIFICENT MILE
INTERLOCKING CONCRETE PAVEMENT REPLACES A LONG, BUSY ASPHALT ROAD IN WESTLEY, CALIFORNIA

By David R. Smith

a magnificent mile

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Located in between mountains and Roadside America off Exit 441 of Interstate 5 at Westley, California, Howard Road handles much heavy truck traffic to and from "The 5." Faced with worn asphalt pavement in need of replacement, the Stanislaus Public Works Director, Matt Machado, PE, LS, accepted the challenge of designing a long-term, economical pavement solution for the road using interlocking concrete pavement. This resulted in the largest publicly owned stretch of concrete pavers in California, about one mile (1.6 km) long.

Continued on page 10

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CROSS SECTION:

- 14 in. (350 mm) thick Caltrans Class 2 road base over a biaxial geogrid
- 1 in. (25 mm) of coarse bedding sand
- 3 1/8 in. (80 mm) thick concrete pavers in a herringbone pattern

170,000 sf (15,794 m²) of concrete pavers span this mile-long section of Howard Road.

Photo Credit: Allen Photography

a magnificent mile

Built over a weak soil subgrade (R-value < 5 or California Bearing Ratio < 2%) and to a Caltrans Traffic Index of 11, or just over 5 million 18,000 lb. (80 kN) lifetime equivalent single axle loads (ESALs), the design required 14 in. (350 mm) thick Caltrans Class 2 road base over a biaxial geogrid. The Class 2 base supports one inch (25 mm) of coarse bedding sand and 170,000 sf (15,794 m²) of 3 1/8 inch (80 mm) thick, machine-installed concrete pavers placed in a herringbone pattern.

Stanislaus County received six bids from $4.50 to $6.00/sf ($48 to $64/m²) to install the concrete pavers and bedding sand. Completed in fall 2014, the pavers were manufactured by Basalite Concrete Products in Dixon, CA, and machine installed by Earth Shelter Developers from Lodi, CA. Both are Interlocking Concrete Pavement Institute (ICPI) members. With Roadside America businesses like Denny's, Chevron, McDonald's and Joe's Travel Plaza open 24 hours along Howard Road (speed limit 35 mph), an extensive traffic control plan required the contractor to maintain drive lanes to accommodate truck traffic during construction.

PREVIOUS PAVER EXPERIENCE

Mr. Machado used interlocking concrete pavement while working in a previous position as City Engineer for Ripon, CA (pop. ~15,000), a farm community in San Joaquin County. Mr. Machado developed interlocking concrete pavement as a roadway standard adopted by City Council for new roads and for some pavement rehabilitations. (See **www.cityofripon.org/StandardSpecs/StandardSpecIndex.html** for the design standards.) With the new design standard in place, developers and the City constructed more than 1.3 million sf (120,774 m²) of roads between 2005 and 2008.

The Ripon City Council approved interlocking concrete pavement when comparing the cost of expanding the city asphalt road network by developers and then forecasting insufficient future funds for periodic grinding and resurfacing. While the additional initial developer costs for concrete pavers were transferred to the homebuyers, the increase was marginal compared to the full price of single-family homes.

THE LIFE-CYCLE SELLING POINT

After finding success in Ripon with lighter-load street applications (and conservative structural design assumptions), interlocking concrete pavement presented a durable pavement rehabilitation alternative for heavily trafficked Howard Road. A benefit of interlocking concrete pavements is not requiring periodic resurfacing. For Ripon's residential streets, life-cycle costs were studied over a generous 100-year period resulting in concrete pavers having about 75% lower life-cycle costs than asphalt. Maintenance costs for concrete pavers for the same period were approximately 20% the cost of asphalt. Heavier trafficked streets such as Howard Road with interlocking concrete pavement often have even lower life-cycle costs because resurfacing costs for asphalt roads increase under such traffic.

According to Mr. Machado, "This (Howard Road) project was built to show the structural value of concrete pavers and their economic value for heavy truck traffic." Interlocking concrete pavements offer high compressive strength concrete with the flexibility of asphalt pavement. Research in the United States and overseas demonstrates that the pavers in a herringbone pattern progressively stiffen or interlock while receiving traffic loads. The resulting stiffness of the paver and bedding layers, or their resilient modulus, is equivalent to the same thickness of asphalt. In some cases, their stiffness well exceeds asphalt during hot summers as experienced in Westley, CA, where asphalt weakens under temperatures typically around 100 deg. F (38 deg. C).

In other words, the 3 1/8 in. (80 mm) thick pavers and 1 in. (25 mm) bedding sand have an AASHTO layer coefficient (an expression of stiffness) equivalent to the same thickness of asphalt. This is demonstrated in ASCE/ANSI 58-10: *Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways* published by the American Society of Civil Engineers as well as in Tech Spec 4: *Structural Design of Interlocking Concrete Pavements* from ICPI. Pending successful performance with some years under its belt, Howard Road might mean a design standard for Stanislaus County in the future. O

Example of worn asphalt ready for replacement along Howard Road in Westley, CA.

Machine-assisted installation of interlocking concrete pavement in Westley, CA.

Main Street in historic downtown Ripon features 50,000 sf (4,645 m²) of interlocking concrete pavement.