COLUMN ONE

A smooth idea for the 710 Freeway

By Thomas Curwen
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A worker sweeps the new asphalt surface on a portion of the 710 Freeway in Long Beach. The I-710 Long Life Pavement Project, as Caltrans calls it, began in 2001, is scheduled for completion in the next five years and is a projected to cost $650 million. (Stefano Paltera / For the Times / July 19)

Caltrans is thickly layering different mixes of asphalt atop the damaged old concrete to resurface the bone- (and coffee-) jangling roadway.

The sensation is palpable, if not slightly remarkable.

There you are hurtling southbound in the No. 3 lane on the Long Beach Freeway. Your car is rattling, your tailbone jumping to the rhythm of a concrete washboard abused by years of heavy trucks and piecemeal repairs.

Then it happens, between the 105 and Rosecrans. You hit a bump, and suddenly your tires purr, your coffee settles in its cup and the radio reception seems more crisp. You may not know why -- it is the nature of freeways that we seldom consider their mechanics -- but you are now experiencing the I-710 Long Life Pavement Project, as Caltrans calls it.

Begun in 2001 and scheduled for completion in the next five years, the transformation of one of Southern California's most neglected freeways is hardly an exercise in speed.

Think of it instead as a projected $650-million art installation with its centerpiece an asphalt roadway set in a sea of concrete; and with a new phase rolling out next month, more commuters will discover what is arguably the smoothest ride in the state -- and a possible model for freeway reconstruction in the years ahead.

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Unless you're a location scout for a gangster noir, there is nothing appealing about the 710 Freeway.

Taggers find its sound walls, railroad crossings and unguarded billboards enticing canvases. Adjacent neighborhoods have long complained of the pollution it throws off, and when the center divider was a mere sliver of timber and metal, it was the scene of a number of tragic head-ons.

The roadway is a Braille text of rain grooves and uneven seams. Concrete slabs, broken into pieces like shattered panes of glass, have been replaced or resurfaced with an overlay of asphalt. It resembles a postmodern Mondrian in black and white, and it produces wobbles and vibrations that have prompted some drivers to switch to the 110 or the 605.

When John Harvey drove the freeway more than 10 years ago, his reaction was no different than most commuters'. It was so rough, he recalls, "that it hurt to drive it at 55 mph," and the number of trucks made the experience scary.

Harvey is one of the architects of the new roadway. In addition to teaching engineering at UC Davis, he is the principal investigator at the UC Pavement Research Center, a little-known testing facility in Northern California. Working beside him is a team of engineers including Carl Monismith, regarded in some circles as the dean of California pavements.

Monismith, 83, belongs to the generation of engineers who transformed California in the '50s and '60s. Their work was made easier by a Legislature that felt comfortable raising gasoline taxes and automobile registration fees, and they dreamed big.

By September 1950, according to historian Kevin Starr, the state was spending nearly $100 million a year on its highway program. When the first segment of the 710 Freeway opened in '52, it was but a small chapter in what Starr calls "an epic of freeway construction" that would define California.

In the succeeding decades, resources have dwindled, forcing younger engineers like Harvey to do more with less, or as a professor once told him: "An engineer is a person who can do for 50 cents what any damn fool can do for a dollar."

Economizing sometimes took the form of piecework, until in 1998 Caltrans decided to develop a more substantive strategy for fixing its deteriorated freeways. The agency singled out the 710 Freeway and assembled pavement designers, specialists from paving industries, academics, engineers and contractors, and began listening to proposals.

The prospect of repairing the 710 was daunting because of the challenges of the job site.

In engineering jargon, the 710 is one of the most heavily loaded highways in the state.

On any given weekday, nearly 155,000 vehicles stream north and south on the 710 past Pacific Coast Highway, 16% of which are 18-wheelers carrying up to 40 tons to and from the Port of Long Beach and the Port of Los Angeles.

Given this volume, Caltrans divided the rehab into phases and weighed the options for rerouting traffic. Recommendations included closing the freeway in increments and diverting truck traffic into the channel of the Los Angeles River.

The agency finally settled upon a weekend schedule that diverted southbound traffic into two of the four northbound lanes, switching direction on different weekends, allowing one side to be shut down completely for construction.

More significantly, though, Caltrans chose asphalt over concrete for the job.

Engineers will argue that every road is sui generis, that no one material -- asphalt or concrete -- can be perfect for all environments. Such factors as ambient temperatures, costs, traffic and construction space have to be considered, and though 94% of the 2.27 million miles of the paved roads and highways in the country are surfaced with asphalt, California is slightly different.

As the interstate highway system was developed, each state decided its own plan. California chose primarily concrete in urban areas because at the time it was the easiest material to maintain. That assessment remains popular, and the decision to use asphalt on the 710 still rankles some of the engineers on the project.

"We typically use asphalt pavements on lower-volume roads," says Kirsten Stahl, a senior transportation engineer with Caltrans. "Concrete is chosen for roads with higher volumes and heavier loads."

Stahl, like representatives from the concrete industry, believes that concrete is less expensive to repair over its life.

Doug Failing, Caltrans director for Los Angeles and Ventura counties, explains the choice as less practical than philosophic. Both materials met the standards for the job, and the costs were comparable after factoring in maintenance. Caltrans, however, wanted to develop an alternative to concrete. The agency wanted to give asphalt a shot.

"We were using concrete for other freeway rehabilitation projects," Failing said, "and it is important to develop more than one technique for this work."

As Stahl's colleague, Scott McKenzie, also a senior engineer with Caltrans, points out, "The story of road construction is the story of always trying to find the best solution to an ancient problem." Each job, he says, no matter the materials or the process involved, is an opportunity to improve upon what has been done in the past.

There is nothing special about asphalt. Take some carbon, add a little hydrogen, sulfur, oxygen, nitrogen and a few trace metals, and you have the sticky, black, odorous compound found in the tar pits and a common byproduct in the refining of crude oil.

Combine it with a mixture of stones, or aggregate, and you have the pavement that covers most city streets and is a quick patch for the broken concrete on freeways. Often it goes down in one layer, no more than 4 inches thick. Compactors follow, squeezing out pockets of air, and the work is traffic-ready in less than 24 hours.

But not so for the 710.

The asphalt for the 710 is a more sophisticated mixture, a blended Scotch to a glass of water, the culmination of testing and experimenting that goes back to the 1960s. What makes the blend unique is the different types of asphalt being layered onto the roadway and its thickness, almost 12 inches that sits upon the old concrete roadbed (thus saving the cost of removal).

The advantage of this Dagwood sandwich, as the engineers at the center learned, is that it disseminates weight from the point of impact, broadening and lessening the load into the deeper layers.

As the old concrete beneath the road jumps -- inevitable, beneath the weight of moving traffic -- the asphalt flexes and recoils, preventing the formation of cracks.

In addition, pieces of rubber have been stirred into the top layer to mute the sound of traffic and divert water to stop hydroplaning.

With regular maintenance, scraping and replacing this layer every eight to 12 years, the pavement is expected to last at least 30 years (the typical asphalt pavement lasts 10 years, and concrete, such as the design used for the 710 Freeway, can last 40 years with maintenance).

Aside from the aesthetics -- the white and yellow stripes stand out against the blacktop -- the result is a soft and smooth ride.

How smooth is smooth? Ask Harvey, and he'll give you two answers.

First, he'll get technical, citing the International Roughness Index developed by the World Bank in the 1970s as a way of helping governments decide whether borrowing money to improve roads was a wise decision.

The index runs from 1 to more than 1,200. Airport runways and superhighways typically rate between 12 and 100; unpaved roads can hit 800. When interstate highways measure 160, the Federal Highway Administration recommends maintenance or rehabilitation, Harvey says.

Sections of the 710 measured in 2006 before resurfacing averaged 250, and recent measurements on a resurfaced stretch -- from the ports to the 405 -- averaged 89.

Then Harvey will tell you about the coffee test. If you can drive with a cup of hot coffee held between your legs and not scald yourself, he'll be happy.

For centuries, engineers have dreamed of creating the perfect road. The Romans came close with curbstones, crushed rocks and a tortoise-shell camber, but as they -- and generations of civil engineers since -- have learned: What's right for today is often worn down by tomorrow.

Designing a smooth road is a losing proposition. No sooner has the paving machine laid down an ideal grade than the deterioration begins.

When architectural critic Reyner Banham wrote about L.A. in 1971, he observed that the freeway was not "a limbo of existential angst" as some observers had it. Instead it was for Angelenos "the place where they spend the two calmest and most rewarding hours of their daily life."

Almost 40 years later, his words carry the weight of a lost dream. Deferred maintenance and diminished budgets have spelled the end of our calm.

No one knows how innovative or exactly how costly the new 710 roadway will be, or whether it seems smooth because other freeways in comparison are so rough.

For now though, the purring of tires and the quieting of that cup of coffee might just be the only acceptable measure of success.

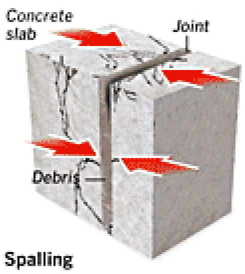
Graphic: How to repair a broken freeway

Like many freeways in Southern California, the 710 Freeway was initially constructed of concrete, but after some 50 years of heavy truck traffic, the roadway began to break down. Repairs had included concrete slab replacement and asphalt patches, but in 2001, Caltrans initiated a comprehensive rehabilitation project that would cover nearly 20 miles in asphalt.

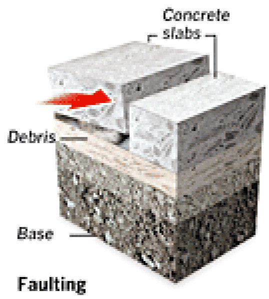
The problems

When the concrete for the 710 Freeway was initially placed in 1952, it lacked dowels and tie bars to connect the slabs. Small differences in the height of the slabs created a bouncy ride and contributed to the deterioration of the roadway.

Cracking
Fatigue resulting from traffic load and weather causes cracking to occur over time.



Spalling
Joints allow space for concrete to expand, but when there is debris in the joints the concrete can't expand, and cracks.



Faulting
When debris works its way beneath the slabs or the base moves, the slabs are displaced.

The solution

What makes the rehabilitation project unique is not only the different asphalt mixes in various layers but also the thickness of the asphalt, which is meant to keep the road from cracking as the weight of trucks causes the concrete beneath to shift.

The asphalt overlays

Rubberized, porous (*½ inch*)
Reduces tire splash, hydroplaning, noise

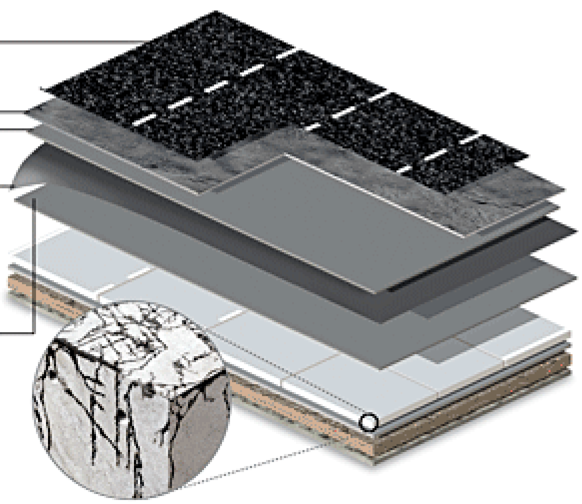
Impermeable asphalt (*3 inches*)
Contains polymers to reduce cracking and rutting

Conventional asphalt (*5 inches*)
Reduces bending of the road under the load of traffic

Reinforcing fabric
Slows cracking from the lower layers

Conventional asphalt (*1 to 5 inches*)

Preparing the existing pavement
Machinery breaks the top layer of concrete before the new asphalt is placed on it.



Repaving the 710

By the time it's completed, the project will have taken nearly 15 years and cost an estimated $650 million.

Final phase: Slauson Avenue to the 10 Freeway (as funding permits)
Construction: To begin 2012
Completion: 2014 or 2015

4th phase: Firestone Boulevard to Slauson Avenue
Construction: to begin 2009
Completion: 2012

3rd phase: North of 105 Freeway to Firestone Boulevard
Construction: Began July 2009
Completion: 2011

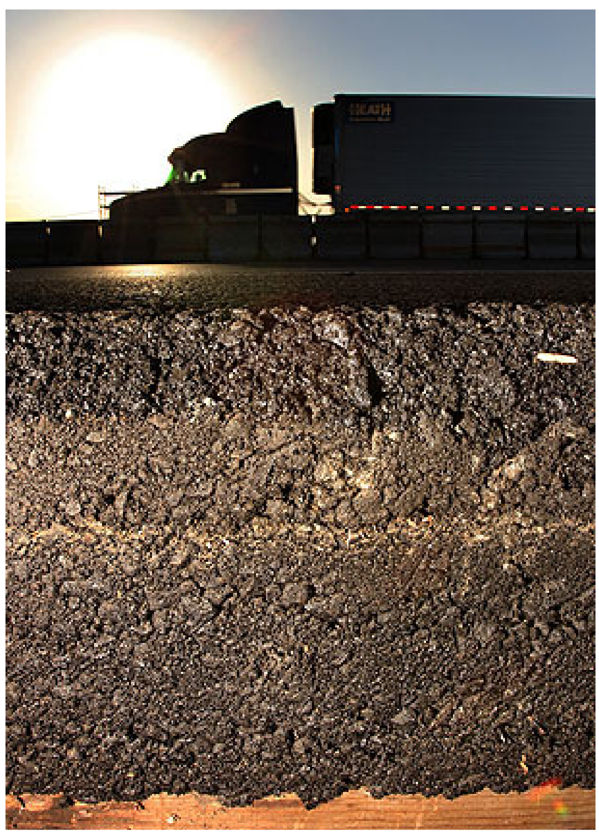
2nd phase: 405 Freeway to north of 105 Freeway
Construction: Began 2007
Completion: 2010

1st phase: From Pacific Coast Highway to the 405 Freeway
Construction: Began 2001
Completion: 2004

Sources: Caltrans, University of California Pavement Research Center. Graphics reporting by THOMAS CURWEN

LORENA I. ELEBEE Los Angeles Times

710 Freeway repaving
(Stefano Paltera / For The Times / July 19, 2009)
Work continues on the I-710 Long Life Pavement Project in Long Beach. Caltrans is repaving 20 miles of the freeway with a high-tech surface. The nearly foot-thick cushion of various mixtures of asphalt, layered atop the old concrete, provides a smoother and quieter ride and could last longer than previous surfaces.



710 Freeway repaving
(Stefano Paltera / For The Times)
A truck drives on a newly repaved portion of the 710 Freeway, where a nearly foot-thick layer of various mixes of asphalt creates a smoother ride.