

CALIFORNIA DEPARTMENT OF TRANSPORTATION

# Journal

January-February 2002 Volume 2-Issue 4



## INNOVATION ISSUE:

### What's Inside...

- Context Sensitive Solutions
- Giant Beam Static Pile Load Test
- Partnership for Integrated Planning
- The Lincoln Bypass Mitigation Plan
- Fast-Setting Concrete



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## Letter from the Director

For several years, I had the honor of working for then-Vice President Al Gore on the National Performance Review — the task force to reinvent the federal government. Fundamentally, our job was innovation. While there, I saw that organizations, if given the freedom and encouragement to pursue more productive ideas, could not only save tremendous amounts of money annually; they could be more responsive to the people who paid their wages: the taxpayers.

We have a tremendous challenge to meet our mission of improving mobility across California. Given the size of our task, it is critical that we continually seek out new ways to get the job done. Since joining the department, I have urged everyone to include an element of innovation in all we do.

This issue of the Journal features a few of the innovations currently in motion in the department. A plus B contracting was first tried out in District 4. District 11 has come up with new ways of making constructability reviews integral to project development, not just an add-on. District 3 is trying out an exciting new form of environmental mitigation, and District 10 is working with local officials on a new planning process. That's just for starters.

To me, the most exciting of the initiatives is featured at the very front of this magazine: context sensitive solutions. For Caltrans, this is the year of context sensitivity. It is a feature of the new departmental calendar and several other communications efforts. And you can expect to see at least one article in each upcoming issue that demonstrates how to solve problems while being sensitive to our surroundings.

And what is it?

It is a philosophy that prescribes that community needs be considered in solving transportation problems. Since the department began its effort to incorporate sensitivity to context into its project development process, the name for the effort has changed from context sensitive "design" to context sensitive "solutions." That is because the goal is to find ways to make our projects work within the environment, natural or man-made. Context-sensitive solutions incorporate the features and character of the surroundings through which our projects pass. They recognize that we are making long-term investments that should reflect and even enhance communities and the environment. Our transportation developers must consider:

The constructed and natural environment of the area.

Environmental, scenic, aesthetic, community and preservation impacts.

Access to and incorporation of various modes of transportation.

Governor Gray Davis has provided us with unprecedented resources to address California's transportation needs and has challenged us to deliver results faster and more efficiently. That means innovation. And, with innovation, we will build on the types of initiatives described in this journal, turning problems into solutions.

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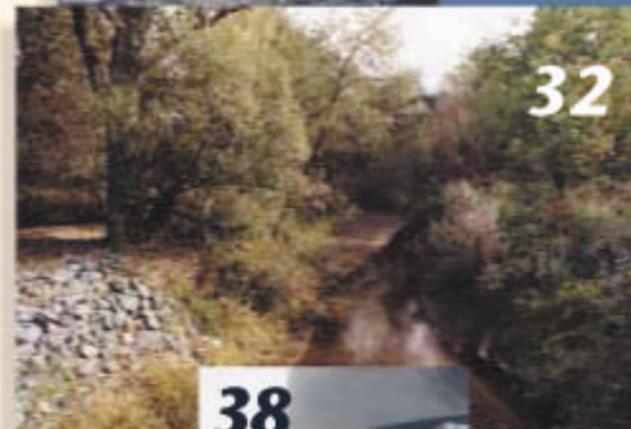
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INNOVATION:

# Context Sensitive Solutions

Marsha Mason  
Senior Landscape Architect, Livable Communities

“Context Sensitive Solutions,” a new policy championed by Director Jeff Morales, outlines an approach that will make it possible for Caltrans to maintain its responsibilities for safe interregional mobility while being responsive to natural, cultural and built environments. The policy takes the best of the department’s creative and collaborative problem-solving approaches and mainstreams them, with the purpose of making projects fit their surroundings more gracefully.

The policy is key to the department’s ability to thrive as a creative, innovative partner in the post-interstate freeway building era. Today, using this approach may be the only way large and complex projects can be delivered successfully. Implemented continuously from the earliest planning stages, it is expected to prevent delays from re-designs and cost overruns and to strengthen relationships within and beyond the department.

You know society is changing when everyone from the Federal Highway Administration to local agencies uses words such as “flexible,” “context sensitive” and “dual-purpose projects” to describe highway facility design and activities. In fact, now that the interstate highway system is nearly complete, the transportation world is turning its sights on local communities and the linkage between transportation systems and surrounding land uses.

Across the nation, “context in-sensitive” highways that function as main streets have been widened so they no longer function as comfortable, walkable shopping streets; sidewalks are narrowed, on-street parking removed and street trees replaced with asphalt. The communities through which those highways pass now are speaking up for what they want: attractive gateways and streetscapes, pedestrian safety features and slower car traffic in downtown areas.

Where freeways have disconnected neighborhoods, communities are asking for crossings to be made convenient and more pleasant and for new crossings for pedestrians and bicyclists. Communities want the pub-

lic space of transportation corridors to reflect the unique identities of the places they go through. They are asking Caltrans to partner with them so that our planning, design, construction, maintenance and operations reflect both transportation and community goals.

In 1991, the Intermodal Surface Transportation Efficiency Act gave design flexibility to states for highways not part of the National Highway System. And that act was followed, in 1995, by the National Highway System Act, which provided that even National Highway System highways other than interstate highways could take the environmental, scenic, aesthetic, historic, community and preservation impacts of any proposed activity into account. Two years later, the Federal Highway Administration published “Flexibility in Highway Design”, which advocated flexible design, particularly for highways running through communities.

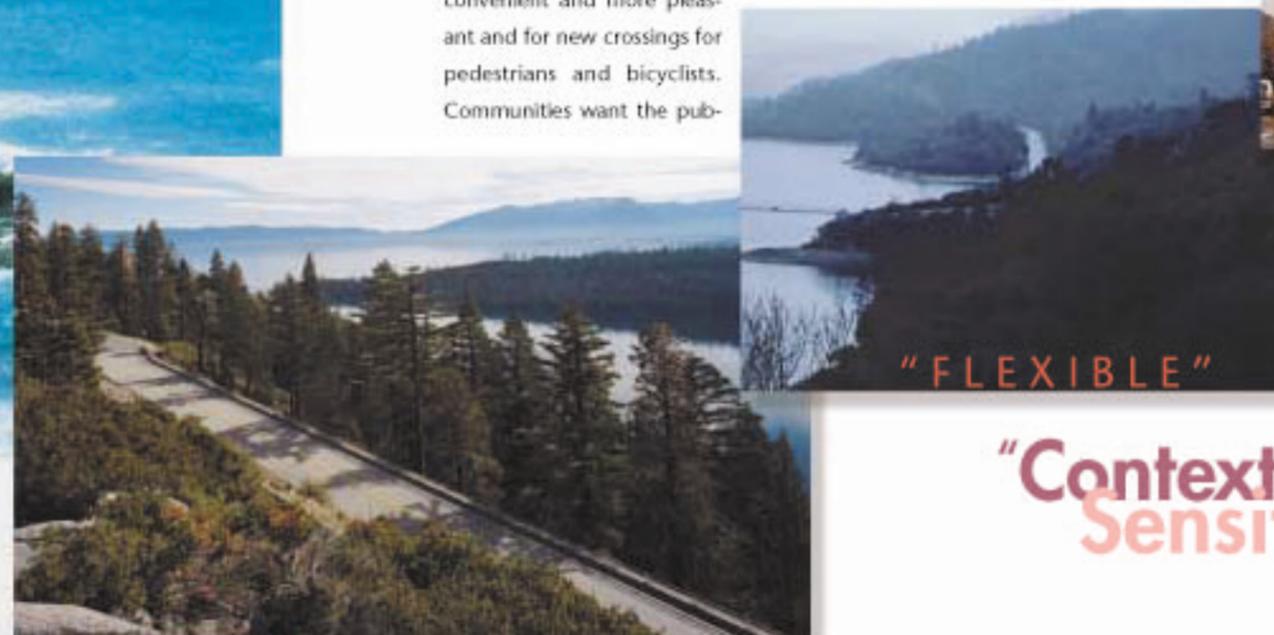
California has the advantage of being in the second wave of states to implement context sensitivity. Five years ago, the Federal Highway Administration chose Connecticut, Kentucky, Maryland, Minnesota and Utah to be pilot states. Through peer-to-peer exchanges and targeted participation in conferences, California is learning what has worked for these states in implementing this approach and, just



*You know society is changing when everyone from the Federal Highway Administration to local agencies uses words such as “flexible,” “context sensitive” and “dual-purpose projects” to describe highway facility design and activities.*

“FLEXIBLE”

“Context Sensitive”



# Communities



*Communities want the public space of transportation corridors to reflect the unique identities of the places they go through.*

Balancing the mobility of transportation system users with other community values is central to the manual's philosophy. Finding a safe solution that meets the community and transportation goals of a particular place, in a fiscally responsible way, is what it's all about. Context sensitive solutions and good design standards are entirely compatible. Design exceptions will remain the exception, not the rule. Good design is good design.

Caltrans will also consider, connect and balance all modes of transportation. Funding for non-motorized transportation facilities exploded in 1991 with enactment of the Intermodal Surface Transportation Efficiency Act. In the past decade, departments of transportation have rethought the relative importance of driving, walking, bicycling, and transit. The Oregon Department of Transportation, in its "Main Street... When a Highway Runs Through It: A Handbook for Oregon Communities," goes so far to say, "Urban streets need to serve all users as well as possible, but pedestrians are the priority (their emphasis) when safety and space allocation must be balanced between modes."

In California, recently-issued Deputy Directive 64 commits the department to consider the needs of non-motorized travelers fully in all planning, maintenance,

operations and project development activities and products. This includes incorporating into transportation infrastructure the best available standards and adopting the best practice concepts of the U. S. Department of Transportation's policy on integrating bicycling and walking.

The directive requires that attention be given to the following issues:

- Safe and efficient transportation for all users of the highway system.
- Support for the Americans with Disabilities Act.
- Attainment of community goals and objectives.
- Transportation needs of low-mobility disadvantaged groups.
- Support of the state's economic development.
- Eliminating or minimizing adverse effects on the environment, natural resources, public services, aesthetic features and the community.
- Realistic financial estimates.
- Cost-effectiveness.

As a good partner, Caltrans is providing interim guidance to local agencies on the parameters under which certain features can be considered. And when local requests for improvements are well beyond what might normally be done, Caltrans, as a good steward of state resources, will help identify funding opportunities and incorporate those improvements where feasible.

No one size fits all. Mirroring its case-by-case approach to projects, Caltrans will approach public involvement project-by-project. The type of public involvement will match the objective at any given point in time. For example, while a public workshop may be ideal for informing a community of a non-controversial activity, it would be less effective for learning about a community's values when a proposal is hotly contested.

The biggest changes will be in how we think about transportation and how we go about our business. Success requires even more consistent, earlier and wider interdisciplinary collaboration. It also requires meaningful early knowledge of community values. Ideally, before projects are funded, much of the context and much of the acceptance of the purpose and need for projects would be worked out in corridor studies that tie in to local General and Specific Plans.

Too, the stakeholders must receive enough information so they can be full partners in reaching collaborative, interdisciplinary solutions when defining, developing and evaluating options.

How can we tell if a project or activity is successful? Ask the stakeholders. This isn't about making everyone happy; that could mean abdicating our responsibility to provide a safe transportation system. It is about balancing and meeting a broader universe of goals to provide a lasting public works legacy.

as important, what hasn't. The focus in these states has been on process and people. Training has been at the top of the list. Many also have eased their state's engineering constraints.

Caltrans expects to take a comprehensive approach in making this change in culture. Training, a priority, will take a number of years to reach everyone. Changes to procedures in affected areas will require increased awareness of where the 'bugs' are in getting successful results, and will take some time. Support for consistent, creative, collaborative problem-solving will evolve incrementally.

## Design Flexibility

Ten states have adopted new policies or standards applicable to main street highways. Is the Highway Design Manual flexible enough for Caltrans to be innovative and responsive?

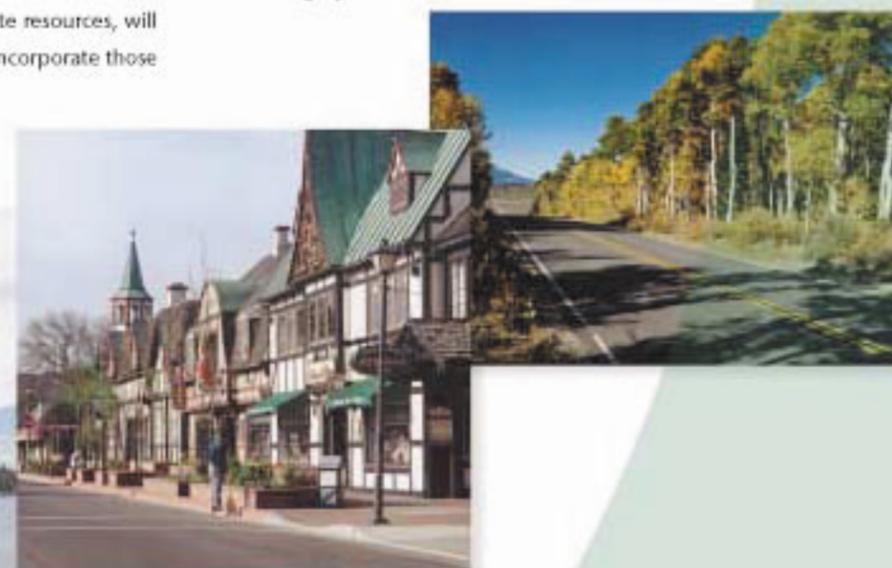
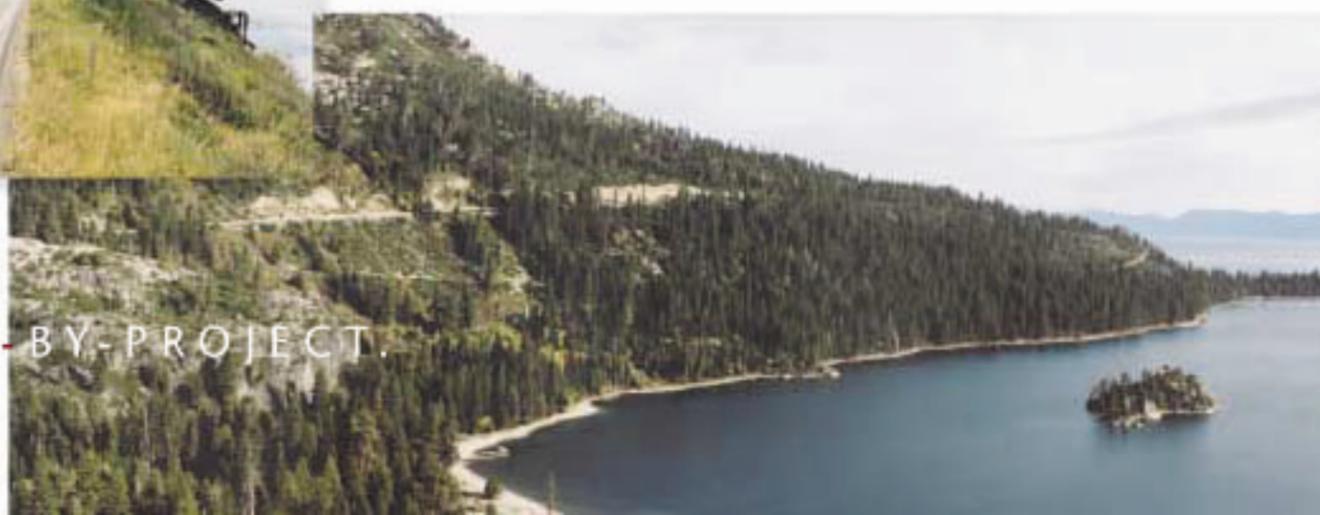
It may surprise some, but the answer is yes.



In all planning, maintenance,

# No one size fits all.

Mirroring its case-by-case approach to projects, Caltrans will approach public involvement **PROJECT-BY-PROJECT.**



INNOVATION:

MODERN TECHNOLOGY FOR

# archaeology

By Bill Silva

hearth

stone wall

foundation

burial

**C**altrans currently employs about 70 archaeologists. And what these people do, day to day, is first to study records of where historic and prehistoric activities are known to have taken place, then to hoof it along the path of a proposed project, looking for evidence of that activity.

**And when they find it, they dig. They've gotten pretty good at digging, but that activity remains something of a hit-or-miss proposition. It's hard to know what lies under the soil. But now, Caltrans archaeologists are using one particular piece of equipment, the magnetometer, that shows promise of reducing the guesswork in excavations.**

The G858 Cesium Vapor Magnetometer, in some ways similar to a metal detector, was developed to help locate geological features such as faults by measuring soils' magnetic susceptibility. But if all the device did was detect the presence or absence of metal, it would have very limited applicability, since archaeologists study much that is not metallic. The magnetometer sees not only metal, but minute changes in the magnetic susceptibility of the soil that can indicate the passage of such features as stone walls, foundations, housefloors, hearths, burials and many others.

For the Caltrans archaeologist, this means subsurface features can be located by remote sensing and targeted for excavation with an accuracy of 70 to 95 percent. Compare that with random sampling, which may yield one-to-four percent accuracy and it's easy to see why Caltrans has begun to employ this technology.

When soils are laid down, iron particles align to the magnetic orientation of the earth. Human actions alter

that orientation by compacting soils in house pits or hearths or by digging postholes, storage pits and burials. The magnetometer reads these tiny fluctuations by introducing an electric current into a rod encased within a cylinder filled with cesium gas, which creates a magnetic field around the rod.



*Bill Silva uses a Cesium Vapor Magnetometer to find subsurface resources.*

When an archaeologist carries the magnetometer perpendicular to the magnetic field of the earth, it reads the fluctuations as subsurface anomalies. The magnetometer detects these changes and registers them in a data logger where they are stored until processed.

The common practice in archaeology is to grid a site, using a combination of ropes and stakes so that data can be collected in an orderly fashion in order to keep control of the context and stratigraphy unique to it. Because of cost or time constraints, only a sample of the gridded area generally is collected or excavated.

For remote sensing, grids are used, but in a slightly different manner. A typical 20 x 20 meter remote sensing

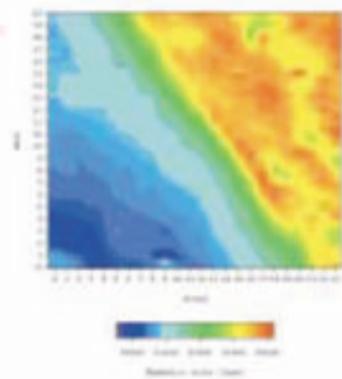


Figure 1

grid is oriented north and south to allow for walking perpendicularly to the earth's magnetic field. The magnetometer collects data continuously over the entire grid, giving 100 percent coverage. Subsurface anomalies are targeted specifically for testing,

allowing the researcher to collect data quickly and easily to determine eligibility for data recovery.

The samples shown here illustrate the potential of the magnetometer. The first is from a historic site that was to be impacted by a curve correction project that was part of a local assistance project in the Northern Region. Figure 1 shows a 20 x 23-meter grid with a large anomaly (shown in red) that dominates the right third of the image. At least two test excavation units were to be placed randomly within the area and another unit or two in the blue and green sections.

Thousands of dollars and several days would have been wasted testing this area, which is a sheet of granite, most of it lying 200 to 300 millimeters beneath the surface. And random sampling would have missed the small anomaly in the bottom portion of the unit (bracketed). In fact, there was only a one chance in 460 of hitting it. The anomaly indicated a ceramic sewage pipe in a late 1800s home-stand/mine. Identification of this sewage system was instrumental in helping to determine the site's eligibility for the National Register.

In the second example, random soil samples screened for artifacts during trenching for a safety project in the Central Region had revealed few or no artifacts. Standard archaeological practice is that if 200 millimeters of soil are removed

and no artifacts are found, the test unit is terminated. But in this case, the darker blue to purple area in the upper left was a shell lens at a depth of 1.3 meters, later revealed by a test trench using a backhoe. Shell lenses may show the presence of cultural activity relating to food procurement/processing. It is important, not only for determining eligibility, but for larger research questions.

Occasionally, remote sensing benefits the public in other ways. Recently, a local group wanted to construct a 465 m<sup>2</sup> structure at a busy rest stop. But remote testing being done for archaeological purposes turned up a leach line and field that ground crews thought were located 20 to 30 m to the west. Constructing in this locale without the remote sensing information would have resulted in thousands of dollars in lost time and potential damage to the leach field.

Though the purpose of the survey was to locate possible cultural features, the other information that was revealed became crucial for the project. Ground truthing was not necessary because of the potential for damage to the leach field and because the image was clear.

Figure 3 shows a grid from the back yard of a historic house whose front driveway was being taken for a realignment project east of the Sierra in the Central Region. The owners of the house wanted Caltrans to relocate their driveway into the back yard but, because of the age of the house, there was a

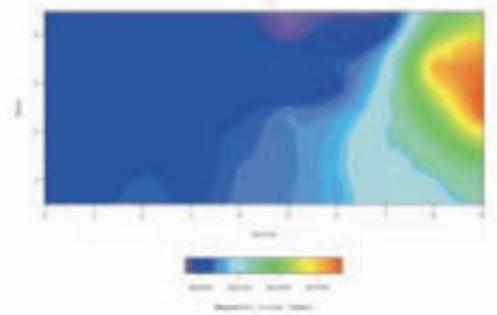


Figure 2

**The magnetometer reads these tiny fluctuations by introducing an electric current into a rod encased within a cylinder filled with cesium gas, which creates a magnetic field around the rod.**

high probability that a privy existed somewhere in the backyard. Two remote sensing grids turned up a linear-shaped subsurface feature (in red) on the right hand side of the image, the probable location of the privy. Ground truthing was not a part of the testing strategy. Instead, it was enough to insure that the new driveway was placed where it would not damage the privy. Again, instead of digging random holes and disrupting the lives of the homeowner further, we simply located the anomaly and instructed the local Caltrans archaeologist to convey the information to the appropriate people.

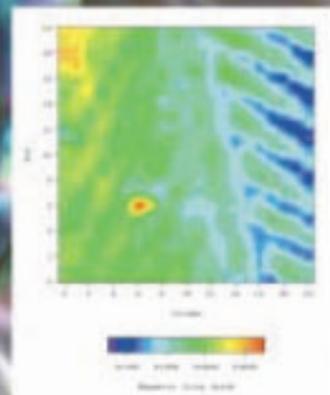


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Geophysical equipment has shown great utility throughout the world in dealing with a wide range of site types, conditions and anomalies. Newer technology, including the cesium vapor gradiometer, promises even more detailed and

useful subsurface information, including the ability to detect and differentiate resources such as housefloors that lie atop one another. The importance of this information to archaeologists is that it implies that one of the structures was built at an earlier date, was subsequently buried by erosion and then another group came along and built its dwellings on the same landform.

Though still new to Caltrans archaeology, remote sensing is beginning to play an important role. Currently, the information is used in-house when Caltrans archaeologists complete test excavations. Caltrans consultants are also using it in developing research designs, cost proposals and schedules. Courses designed for Caltrans employees are being developed in cooperation with California State University, Long Beach, which has the only geophysical remote sensing program east of the Mississippi River.

These courses will help Caltrans archaeologists become aware of the many applications of this technology across a wide range of land types and resources and, ultimately, will make the cultural resources process faster, less expensive and more effective.

INNOVATION:

# Giant Beam Static Pile Load Test

Senior Engineer Brian Liebich demonstrates the heights to which Caltrans will go to build a better bridge.

To say this idea is big would not do it justice. It's gigantic!

By Jim Drago

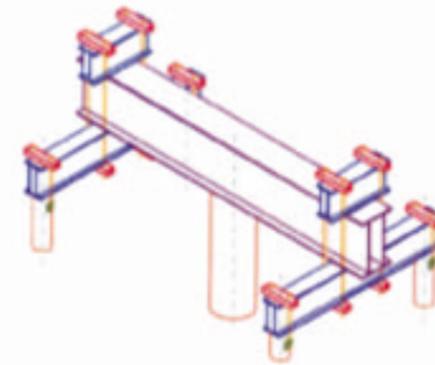
Bridges over troubled water may be built cheaper and faster in the future thanks to the Foundation Testing and Instrumentation Branch at Caltrans' Transportation Laboratory. Foundation Testing engineers and technicians, along with their counterparts in Structures Design, have developed a new testing system for high capacity piles that will save the state's taxpayers millions of dollars and months of construction on bridges over streams that are subject to severe scouring.

To say this idea is big would not do it justice. It's gigantic!

The test employs a steel beam 19.5 m-long, 2.8 m-high and 1.8 m-wide that is subjected to loads as heavy as 3.6 million kilograms, the largest testing contraption of its kind in the world.

The beam is so big it must be stored at the former home of McClellan Air Force Base in Sacramento because it would not fit in the back lot at the Translab. It was so heavy that when temporarily parked at the Dixon Maintenance Station before coming to California's capital city, it nearly punched through the pavement.

"We are always looking for new and better ways to do things," Brian Liebich, senior engineer for Foundation Testing, says matter-of-factly. "Design came to us with a challenge and, working together, we were able to take an idea and bring it to fruition in about 18 months."



Caltrans' new testing system for high capacity piles can apply 3.6 million kilograms of pressure.

Historically, Caltrans has used groups of piles with capacities of about 280 kips each to support most structures. (A kip is equal to 1,000 pounds) Each pile is about 300 mm wide and composed of reinforced concrete or a steel closed-end pipe or "H-beam". A group of piles is driven into the ground and, using a pile cap, tied into the column that supports the bridge superstructure.

In streams where aggregate mining is common, scouring can erode the soil and dig down close to the pile tip, weakening the bridge and requiring

expensive and timely repairs. To compensate, piles and pile caps must be driven to below the maximum scour level, which can make for pile caps that are as much as 10 m below the ground surface, and difficult cofferdam construction.

That was the dilemma facing Jim Foster, who was senior bridge designer on the I-5 Santa Clara River Bridge in Ventura County.

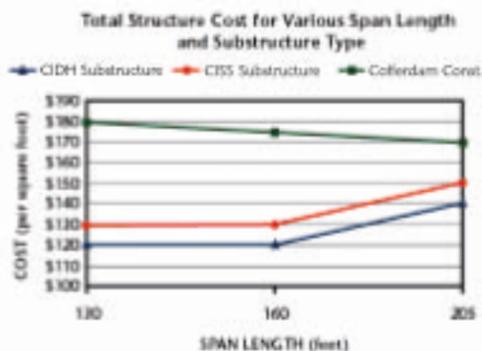
Because of the severe scour condition at the Santa Clara River, designers working on the new bridge faced the prospect of installing the footing caps 12 m below the existing ground elevation. "It was possible to build it using the traditional method but it would be very expensive, difficult

Engineer Suzanne McNaughton shows that even the small pieces on this project are big.



# savings

*"The savings are clear. You would require fewer piles, you could build longer spans and you would not need to construct coffer dams to accommodate the construction," says Mark Willian, Chief of the Office of Geotechnical Support at the Translab.*



to construct and time-consuming. I knew there had to be a better way," Foster says.

Foster, who had worked on a bridge along I-5 near Cottonwood in Shasta County that used CIDH (cast-in-drilled-hole) piles, thought a similar approach might be an option for Santa Clara River. But artesian conditions at Santa Clara River made that option unworkable. Foster then turned his sights to CISS (cast-in-steel-shell) piles.

"I asked, is it possible? I was told it was possible but that it had never been tested at the strength we would need. Our only limitation was the lack of a testing mechanism," Foster

urging and with the support of Caltrans management, a quality team was formed to examine the idea in depth to see if it would work.

Bridge designers have long recognized the potential cost savings from using large diameter, high-capacity CIDH or CISS piles.

"The savings are clear. You would require fewer piles, you could build longer spans and you would not need to construct coffer dams to accommodate the construction," says Mark Willian, Chief of the Office of Geotechnical Support at the Translab.

The great unknown for Caltrans bridge designers was determining the capacity of the foundation system with high capacity piles.

Structures Design and Foundation Testing joined forces in the quality team to look at how to validate the geotechnical capacity of the pile and to make sure it made financial sense.

The team found that using the high-capacity pile design would save an estimated \$5.8 million on the I-5 bridge over the Santa Clara River and the Highway 32 span over Stony Creek between Orland and Hamilton City in Glenn County in Northern California. In the case of the Santa Clara River Bridge, the \$3 million savings represents about 15 percent of the total cost of the bridge. At Stony Creek, the \$2.8 million savings is about 25 percent of the bridge's total cost.

High capacity piles can be driven through the water and erodible upper soil layers and do not require construction of a cofferdam.

"The bottom line is that you can realize immediate cost and time savings," says Liebich.

Foster adds, "This system allows for optimal structural proportioning, which results in the most efficient placement and use of the materials to construct the bridges. Typically, it could take a month to install one support. With this system, one support could be installed in a week. In the case of Santa Clara River Bridge, it reduced the anticipated three construction seasons to two."

With the benefits clearly spelled out, the next challenge for the Caltrans team was to validate the strength of the high capacity pile to withstand the loads it would be required to carry.

Foundation Testing zeroed in on imitating Caltrans' highly successful existing pile test system, which is capable of applying 907 200 kg of pressure. This type of load test verification has been standard practice on large bridge projects.

"Since the load capacity varies from bridge to bridge, it is important that we set the outside limits high enough to consider all possibilities," Liebich says.

With the new pile load test system, department engineers can apply as much as 3.6 million kg of pressure – four times as much pressure as the old system.

The new \$1 million test system was designed including the 19.5 m-long main beam and cross beams measuring 9.1 m in length, 1.8 m high and weighing 11 300 kg. Four hydraulic jacks, each capable of applying 907 000 kg of pressure, are placed to jack against the test beam and the test begins. The super piles, whose casings measure 44 mm thick and up to 51.8 m long at Stony Creek, are driven by construction crews using equipment normally only seen by the offshore drilling industry.

Caltrans engineers will keep a close eye as the pressure increases to determine at what point the pile yields. To the uninitiated eye, this test will be akin to watching grass

*"Since the load capacity varies from bridge to bridge, it is important that we set the outside limits high enough to consider all possibilities," Liebich says.*

grow, but to the five Caltrans engineers and technicians conducting the experiment, the information gauges will light up like a Christmas tree.

At Stony Creek, engineers are looking for strength of three million kg. "We'll know right away whether our expectations of the capacity of this design are valid," says Liebich. "We're confident, but you always want to make sure especially where public safety is the issue."

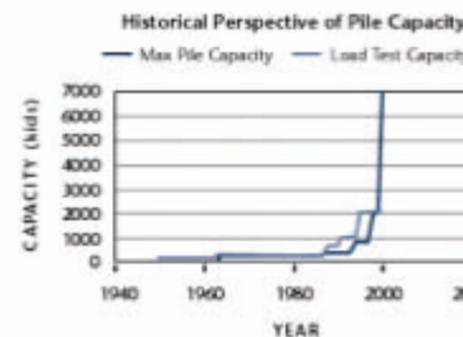
With completion of the test, the hollow steel shell pile column is filled with reinforced concrete and the remainder of the bridge erected.

"We have the best of both worlds. We can conduct an actual field test to determine the capacity and then use the work for the bridge," Liebich says.

Successful completion of the test using high-capacity piles will give Caltrans designers another proven alternative for use when building bridges over water. One possibility is the new eastern span of the San Francisco-Oakland Bay Bridge where designers are considering using 3.0 m diameter, high-capacity piles measuring more than 100 m long for the supporting columns.

This new pile load test system was developed from conception to testing in 18 months. It demonstrated that the Caltrans Quality and Continuous Improvement Program is working well and saving the state's taxpayers time and money.

And when they say they have big news at the Translab, they aren't kidding.



Above: The nuts and bolts on this project are a handful for Brian Liebich.

Right: The two hydraulic jacks with engineer Hernan Perez each can apply more than 900 000 kilograms of pressure.



# Load Capacity

# Partnership *for* Integrated Planning

## MERCED PILOT

The County of Merced, lying in the heart of the San Joaquin Valley, exists in a vortex of local aspirations, changing land uses, development pressures and environmental tensions.



Nothing illustrates this better than the attempt to develop a new campus of the University of California to the east of the city of Merced. The effort started in the early 1990s, when the Virginia Smith Trust offered several thousand acres of land on which to locate a new university campus. In the foothills of the Sierra, the largely unused grasslands seemed ideal. The Smith trust was offering scholarships to Merced area

high school seniors so they could stay near their home town for higher education. The property was some distance to the east of Merced; its surrounding area offered a new locus for development that would not result in converting more valuable farmland for houses and streets. There was enormous local support for the university campus.

Eagerly, the local agencies got together to plan for a valuable new institution in Merced County.

But in the mid-1990s, the campus proposal stumbled. The U. S. Fish and Wildlife Agency declared several species of fairy shrimp, which were abundant in vernal pools, an endangered species. And on the Smith property was an array of vernal pools that biologists judged to be among the richest in California. The Environmental Protection Agency and the U. S. Fish and Wildlife Agency could not provide approvals

to allow the campus to go forward. Ultimately, the campus had to be moved to an already-developed golf course near valuable farmland, engendering inevitable pressures for additional development and a reduction in California's stock of farmland.

And because the access highway to the university crossed several jurisdictions, three separate agencies began preparing three separate environmental documents to get it approved. Caltrans began work on a Negative Declaration to clear the Mission Interchange with Route 99; the county is doing an Environmental Impact Statement on the portion in Merced County, and the University of California is writing an environmental document for the portion on its campus.

Jesse Brown, of the Merced County Association of Governments, and Bill Nicholson, Director of the Merced County Planning and Community Development Department, in later discussions, felt that there had to be a better solution. Local and regional planning had been extensive. But they had not had an adequate understanding of the requirements of the state and federal permitting agencies.

Elsewhere, Caltrans and the permitting agencies were running into similar problems. They were arriving at project development stages only to find that they had not identified potential problems in the permitting process. Caltrans needed to understand the missions and needs of the permitting agencies as well as potential future changes that could bring projects to a halt. The Mare Island Accord, an

agreement between Caltrans and the permitting agencies that was signed in 1999, contained several provisions to improve communication, quality and timeliness, and to address environmental issues early in transportation planning through frequent communications, cross training and rotational assignments between the agencies.

And Caltrans, Jesse Brown and Bill Nicholson decided to move quickly to try to make the process work better for Merced

County. They developed the Partnership for Integrated Planning, a pilot project. Directed by representatives of the founding agencies, it has assembled representatives of federal, state and local agencies and other interested parties to bring differing perspectives to bear on problems early.

The two-year project will assemble and integrate data within the context of the Merced Council of Governments' 20-year Regional Transportation Plan. The data may also be used in the Merced County General Plan framework. Data will be modeled and displayed in several scenarios for participants to evaluate and develop plan-level recommendations on optimal locations for development and transportation infrastructure.

Participants will evaluate the effort and recommend ways to identify environmental issues before the project development process starts. The intent is for the lessons learned and the methodologies developed to be used as a model throughout California and showcased nationwide.

Participants and environmental resource agencies will address environmental impacts and mitigation for land development and transportation projects. An outcome of this effort should be strengthened cumulative impact analysis at the plan stage and improved identification of sensitive

environmental resources early in the planning process. This information can then be used to guide planning decisions on the most appropriate locations for land use development and transportation infrastructure.

Merced County is located in the San Joaquin Valley east of the San Francisco Bay area. Primarily a rural county with

the city of Merced its only urbanized area, it contains rich agricultural lands and environmental areas that are being crowded by changing land uses. The county is also a gateway to recreational opportunities at Yosemite and other Sierra destinations. Interregional travel and resulting problems derive from sources outside the county. Air quality is a major issue in the entire eight-county San Joaquin Valley air basin, which does not meet federal air quality standards.

*Merced County, Caltrans and a number of resource agencies are working together to reduce the possibility of trial-and-error planning.*

INNOVATION:  
**Partnership  
 for  
 Integrated  
 Planning**  
 MERCED PILOT

The Merced County Association of Governments, the federally recognized metropolitan planning organization for transportation planning, was selected as a partner for several reasons, including its understanding of the pitfalls of a lack of communication. The agency was known for innovative planning efforts and possessed a working geographic information system that contained parcel-level base maps, street and road configurations, soils information, wetland and cultural limits and hazardous materials sites, all the stuff of avoidance.

In addition, development of the agency's new regional transportation plan was just starting, and large development projects had been proposed that would impact environmentally sensitive areas. The EPA, Caltrans and FHWA, all actively involved in the region, were able to channel resources to the partnership.

Merced County needed the partnership for a number of reasons. State Route 99, its main north-south route, and State Route 152, its main east-west route, were being overwhelmed by new commuters who were escaping higher real estate prices outside the county. Both routes carried high levels of interregional travel from outside the county, particularly truck travel. And both routes were in need of substantial upgrades.

Elsewhere, new towns were being proposed at Santa Nella, Villages of Laguna San Luis, Fox Hills and Yosemite Lakes Estates. Castle Air Force Base had been retired by the U. S. Air Force and new uses for the base were being explored. And, as with most of the rest of the San Joaquin Valley, population pressures were threatening both the sensitive wetlands of the south and western portions of the county and valuable farmland elsewhere. If the county were to develop the infrastructure necessary to serve the growth while minimizing impacts to these valuable resources, it would have to have a strong working relationship with all the agencies whose missions involved their protection. The local agencies signed on.

The partnership has been in place since mid-2001. Among its first tasks was an effort to create among the members of the partnership an understanding of their various missions. This

*If the partnership is successful, it will result in:*

- 1 *Preservation of natural resources*
- 2 *Cleaner water and air*
- 3 *Efficient use of public funds*
- 4 *Better planning tools for long-range planning*
- 5 *A forum to implement 1999 California Regional Transportation Plan Guidelines*
- 6 *Resolution of issues in the planning process, before project development begins*
- 7 *Early "buyoff" from regulatory agencies on approach to projects*
- 8 *Quicker project delivery*
- 9 *Stronger consideration by local agencies of environmental goals*
- 10 *Rules of engagement and tools to resolve issues that can be applied statewide*
- 11 *Ultimately, a more efficient intermodal transportation system*



*Busy State Route 99 is in for a number of improvements in coming years; early integration of planning is bound to make that easier.*

*Planning lessons learned in identifying environmental issues before project development starts will be used as a model throughout California and showcased nationwide.*

would be necessary as a basis for principled negotiation later on. Over the life of the project, the participants will gather planning and environmental information for inclusion in the GIS, identify and rank strategic issues, integrate transportation, environmental and land use strategies and model them and, ultimately, develop and distribute project recommendations.

"Nobody is assuming this is going to be easy," Brown says. "These agencies have missions that are often at cross purposes. But we must get them involved in the planning process. We will have to struggle with major issues, but ultimately, the better we know each other, the better our chances of a successful future for Merced County."

— Gene Berthelsen

## Governor Davis Spearheads Transportation Renaissance

By Maria Contreras Sweet

*Secretary, Business, Transportation and Housing Agency*

As we begin a new year I want to thank the employees of Caltrans for your dedicated service in 2001. With your help, we made a record investment in improving California's transportation infrastructure. Nearly \$6 billion worth of transportation improvements projects are currently underway—many of them at an accelerated rate.



Over the next year, California will have over \$6 billion in transportation projects alone under construction, the largest in state history. California's transportation budget is now twice the size of that of any other state.

The goal of the Davis administration is to enhance the safe, efficient and reliable movement of people and goods. We have set out to do something about gridlock, so that people can travel to and from work more quickly and spend more time with their families or do whatever activity they enjoy in this great state.

The state has identified \$200 million in transportation projects that will be delivered at accelerated speed, providing a quick kick-start to the economy. Many projects are being brought on line a year or more in advance of their original construction dates.

We've formed a unique and effective partnership with Caltrans, the Resources Agency and Cal-EPA to expedite the approval process for transportation construction. Governor Davis, Director Morales and I will be looking for additional ways to speed these projects. Foremost, we will reach out to our partners in local and regional governments to support that goal, and we will do it in an environmentally friendly way.

So, on behalf of Governor Davis, thanks again for all that you do. Here's wishing each of you a happy New Year.

# Electronic Bridge Site Data Submittals

By Paul Knox,  
Caltrans Student Assistant,  
Division of Engineering Services



Big bridges are mammoth engineering projects that require extensive materials, construction equipment and personnel to complete; even small ones require a complex set of data in order to be designed correctly. To tailor a bridge design to its physical location involves reviewing and producing dozens of separate pieces of data, including survey reports, right of way and vertical and horizontal clearance requirements, flood plain levels and others.

The method for submitting a Bridge Site Data Application, which had been in place for decades at Caltrans, often resulted in applications that were incomplete or that contained inaccuracies. But today, an innovation by the Preliminary Investigations unit in the Division of Engineering Services, known as the Electronic Bridge Site Data Submission Application, is streamlining the process and improving its accuracy. And it stands as a national leader in technology application.

District design teams, until recently, submitted printed Bridge Site Data Submittal applications to the Preliminary Investigations unit through the mail, a process that often allowed errors in the application to get through. Before 1999, Preliminary Investigations did not have a consistent, reliable and efficient procedure to ensure that the applications were complete and accurate before delivery to Structure Design. Occasionally, the Preliminary Investigations Unit would have to return to square one and resurvey the construction site, increasing the overall cost of the project, sometimes significantly.

When Chuck Pazzi took over as Branch Chief for Preliminary Investigations in December 1999, he became aware of the problems with site data submissions and began investigating ways to improve them. He saw three problems. The existing system allowed inaccuracy of the data; the process for correcting inaccuracies was cumbersome, and processing of the data for bridge design was time-consuming. To address these problems, he convened a quality team tasked with designing a more efficient process. His supervisor, Roberto LaCalle, was the team's sponsor.



The team consisted of specialists not only from Preliminary Investigations but also from various districts, as well as technology support. As it began to examine the submission process, it collected verbal and written complaints, suggestions and recommendations made by clients through telephone

inquiries as well as in on-site meetings. It also contacted the Design Division to identify areas of confusion. Of particular interest were spaces on the Bridge Application form then in use that were often left blank or were filled in incorrectly.

After gathering and analyzing information on problems with the existing system, the team concluded that an electronic submittal process would be the best solution and began to investigate the logistics of implementing such a process. Pazzi's team discovered that although it was possible to implement such an application process, to do so would require a significant amount of work. The team spent the next few months designing an electronic version of the paper application.

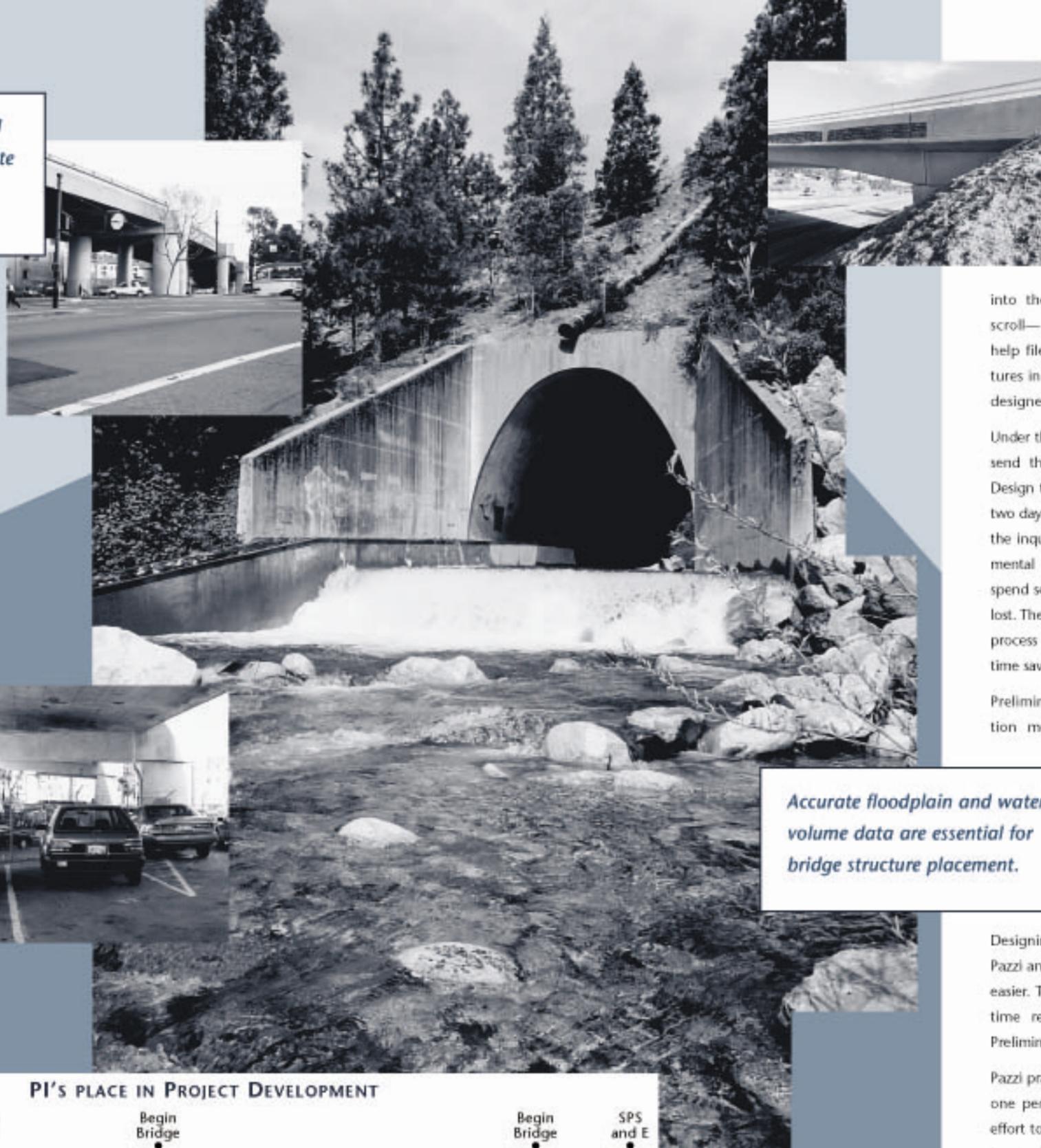
The team had originally planned to attach Electronic Bridge Site Applications to emails. However, once it began testing, it discovered that the electronic applications were too large to send as an email attachment. After discussions with technical support specialists at headquarters, the team decided that compressing the Electronic Bridge Site Application would be the most elegant solution. Preliminary Investigation's web site now contains links to Electronic Bridge Site Application forms, a link to a popular file compression utility and a full set of instructions for how to use the file compression software to "zip" the applications.

*Putting a structure on the ground requires a large volume of accurate data, including clearances and traffic data.*

The team recognized that the electronic application would have to appear as similar as possible to the print version while being capable of direct electronic submission to the investigations unit. Using this feature, clients could easily compile and submit their applications, eliminating the week or more required for the application to arrive by mail. If questions arose, Preliminary Investigation's request for clarification and the district's response could be almost simultaneous, saving a couple weeks on a typical project and as much as several months on a large, complex project.

**How it works** — When a district design team is ready with its site data submittal, a designer sits down at a computer and, using software recommended by Pazzi's Intranet and ISSC team members, keys site data—including floodplain, hydrology, traffic and other data—into the report. To make the electronic form as easy to use as possible, the team divided it into separate information-specific sections.

The software contains a number of internal controls that assure that the data is consistent and requires correction of inaccuracies before submission, including an electronic nanny that will give hints and suggestions automatically when the cursor touches the highlighted portions. The designer then transmits it to the Preliminary Investigations unit, which checks the application to ensure that it is complete, that it was taken at the correct location and that special forms are completed. When the branch finds that the information is reasonably complete and accurate, it initiates data collection and processing to produce a Preliminary Site Report for use by Structure Design.



*Accurate floodplain and water volume data are essential for bridge structure placement.*

The electronic form not only offered nearly instantaneous communication between Structures and client districts but also the opportunity to build quality control directly into the system. Quality controls include innovative scroll-down menus, pop-up boxes and an electronic help file. The team supported the quality control features in a new electronic instruction manual specifically designed for the Electronic Bridge Site Application.

Under the old system, the district engineering staff would send the Preliminary Investigation report to Structures Design through interdepartmental mail, taking as long as two days. Should the engineers have substantial questions, the inquiries and responses would travel through departmental mail again. Overall, an individual inquiry could spend several days to a week in interoffice mail or even be lost. The Electronic Bridge Site Data Submission Application process shortcuts this exchange, providing a significant time savings.

Preliminary Investigations now can track each application more easily and accurately with a specialized spreadsheet. Moreover, customers can access an online version of the spreadsheet to investigate their project's progress. They can review the dates the survey crew will be on site, the status of their application and the projected date of delivery to design.

Designing a bridge will never be quick and easy, but Pazzi and his team have made it a good deal quicker and easier. The new process shaves as much as a third of the time required to deliver a complete and accurate Preliminary Investigation Report to Structure Design.

Pazzi praises the team. "This project was just too large for one person to complete. It took the team's combined effort to bring us to where we are today. They were willing to do whatever it took to complete the project."

**PI'S PLACE IN PROJECT DEVELOPMENT**

	Site Data Received	Begin Bridge	Begin Bridge	SPS and E
Prelim Invest	PI Report	Fdn Plans		
Hydraulics		Hyd. Report		
Structure Design		GP Dev/ Type Sel	Unchecked Details	Check Details
Struct Found (Geology)		Prelim FR	Drilling/ Final FR	O's
Specs & Estimating		GP Estimate		Specs/ Estimate

INNOVATION.



# A+B Contracting

By Larry Jones and Raquel Vargas  
Design Senior, District 4

The westbound Interstate 80 to eastbound I-580 and southbound I-880 freeway-to-freeway connector at the San Francisco-Oakland Bay Bridge Distribution Structure, commonly called the "maze" by Bay Area travelers, is a heavily traveled artery that for many years had been one of the San Francisco Bay Area's worst traffic bottlenecks. A crucial passageway, it was a common subject of complaints in newspapers and a platform for public figures to criticize the transportation network.

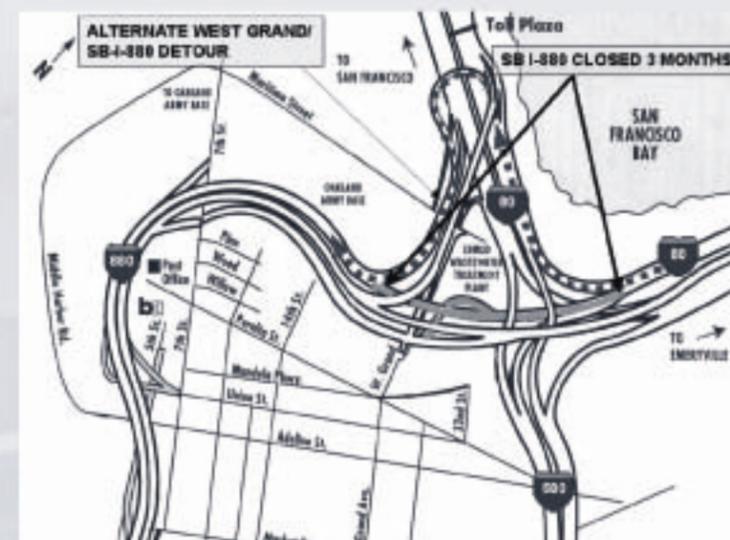
At the maze, commuters from all over the heavily populated north and east regions of the San Francisco Bay Area cross paths to head for the San Francisco-Oakland Bay Bridge and to a major artery to Silicon Valley. And after the 1989 Loma Prieta earthquake, which took out its Interstate 880 component, what had been merely a headache for drivers became a royal pain in the neck.



*The new connector between westbound 80 to eastbound 580 and southbound 880 was completed in about a third of the original time estimate.*

Now, however, thanks to the innovation and hard work of a team of Caltrans engineers, a new method of contracting, and a highly motivated contractor, the maze has become the focus of public praise and appreciation after the replacement of the freeway-to-freeway connector.

The connector replacement project was born out of the need to accomplish the near impossible. This included easing the traffic bottleneck while keeping traffic moving with minimal impact to the surrounding area. In addition, it had to be completed in the least amount of time with the highest standards of safety, constructability and cost effectiveness, at a location where the design parameters were restricted horizontally and vertically but had to conform to the existing facilities at the project limits.



*The contractor's nearby project made possible an alternate route during the three-month closure.*

**Thanks to the innovation and hard work of a team of Caltrans engineers, a new method of contracting, and a highly motivated contractor, the maze has become the focus of public praise and appreciation after the replacement of the freeway-to-freeway connector.**

The conditions under which Caltrans designers had to work could not have been more challenging. The roadway portion of the connector where it diverged from westbound I-80 was a three-lane facility that merged into two 3.66 m lanes with shoulders varying from 0.91 to 3.05 m. The roadway was about 396 m long. The portion of the connector that split into southbound I-880 had been built in 1935. Eastbound I-580 was constructed in 1953. The southbound I-880 branch of the structure was 9.75 m wide, while eastbound I-580 branch was 8.53 m.

Based on these conditions, an original design was prepared that incorporated a sliver widening to the existing structure. However, this hindered plans for a future eastbound HOV lane project that was intended to pass under the connector, because the existing columns encroached into the HOV lane's alignment. With these factors in mind, designers came up with a design that replaced, rather than widened, the connector. This design brought

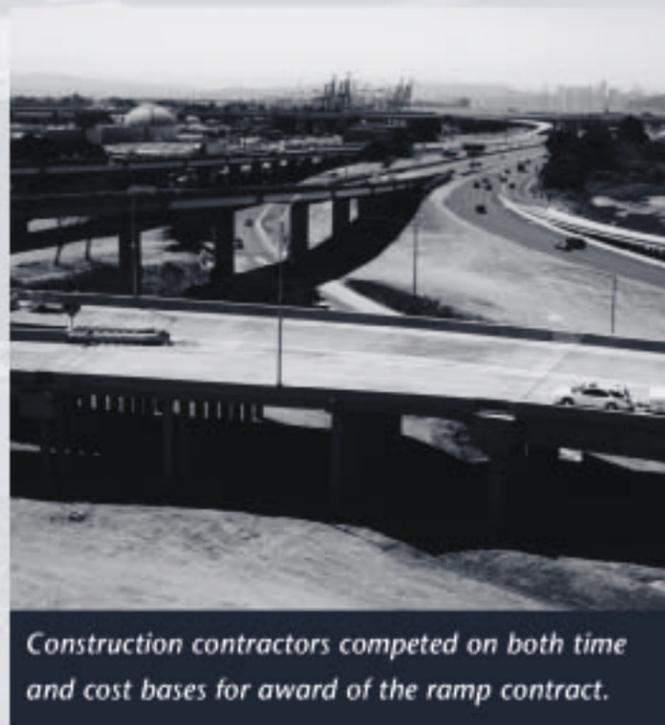
the roadway up to current standards of safety and design and allowed replacement of the existing support columns.

Replacing such an important connector proved to be a real challenge, for several reasons. The design had to be such that traffic would suffer minimal impact; it had to accommodate the new HOV lane; and it had to conform to the existing connector at the project limits without compromising Caltrans standards. The final design included slender columns strategically placed to allow enough room for the future HOV lane. To improve safety, the roadway portion of the new connector had three 3.6 m lanes, standard 3.0 m shoulders and improved sight distance. In addition, the design incorporated new state-of-the-art crash cushions that met safety standards and were cost-effective from a maintenance point of view.

But the supreme challenge of the connector project was not its design, although that was in itself a significant

challenge. The biggest challenge was in executing the design on an operating roadway that carried about 75,000 vehicles daily. A daily peak-hour delay of up to 30 minutes had existed for years at the merge point on the connector on westbound I-80 destined for eastbound I-580 and southbound I-880. To minimize the impact on travelers, District 4, using every measure it knew of to speed construction, scheduled completion of the job in 420 calendar days.

And to achieve this accelerated schedule, the district initiated an unconventional method of construction contracting: A+B contracting. Under this method, prospective contractors competed on the number of working days, as well as the total project cost. The engineer's estimate on the project was \$10.5 million. Bidders were asked to estimate the number of days it would take to complete the project, and to include \$20,000 for each



Construction contractors competed on both time and cost bases for award of the ramp contract.

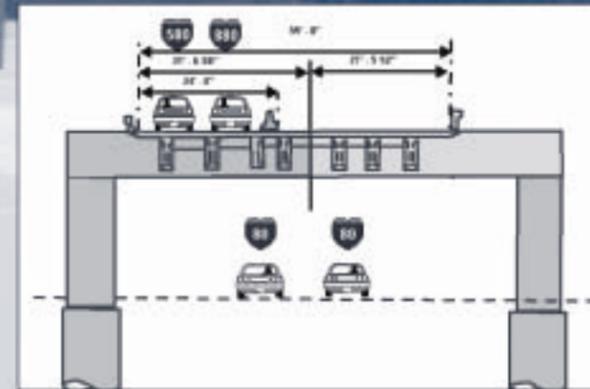


construction day in their bid amount. The \$20,000 figure, based on the cost of each day's traffic user delay, was calculated by the district's highway operations branch.

Under A+B contracting, a firm that bid, say, \$10 million on the project and planned to complete it in 400 days would include an additional \$8 million in its bid amount. If the firm planned to complete the project in 300 days, it would bid an additional \$6 million. In this way, the firm that planned to complete the project in the shortest amount of time, other things being equal, would be the low bidder. If the contractor were unable to complete the project in the time specified in the bid, a deduct of \$20,000 for each day over would be assessed.

A+B contracting proved effective, since it brought positive responses from six potential contractors. The awarded contractor, R&L Brosamer, estimated that it could complete the project in about a third of Caltrans' estimated completion time: 150 days. (The second bidder estimated that it could complete the project in 260 days.)

And, in fact, Brosamer did make the 150 days. Saeed Shahmirzai, the Resident Engineer on the project, attributes the contractor's ability to complete the project in such a short time to several factors. One of these was Shahmirzai's own suggestion for a staging change that reduced the number of stages from five to two. "Right away, we knew we had a problem because the footings



*R&L Brosamer built the new connector a half width at a time, rerouting traffic, demolishing the existing connector, then building the other half. Traffic continued, not only on the connector itself, but also on busy eastbound I-80 beneath it.*

for the new bridge were at the exact location of those for the existing bridge. To put the footings in, we had to demolish the old ones."

Shahmirzai partnered with Brosamer to make a change to demolish the old structure. "We were lucky that Brosamer was also the contractor for the adjacent contract (doing seismic work on the nearby Route 980)," Shahmirzai says. "They expedited the work on Route 980 and opened the additional lane necessary for the increased volume of

traffic as a result of the stage change for this contract." The stage change called for the closure of the 880 connector ramp for two months and a detour was set up for the traffic to take 580 to 980 and back to 880. This was the same detour route used for 10 years after the Loma Prieta earthquake, when the Cypress freeway collapsed. The stage change eliminated several traffic switches,

thereby reducing the confusion and delay for travelers. And it also allowed Brosamer to work two daily shifts, seven days a week."

This change had a direct cost savings of \$600,000 and accounted for most of the time savings.

The district also expedited all submittals of falsework, and anything else that needed submittal approval, and made other efforts to reduce the contract time.

The stage construction involved building the new connector a half width at a time, rerouting traffic, demolishing the existing connector, and building the other half. This was done under traffic, not only on the connector itself, but also on busy eastbound I-80 traffic beneath it. Brosamer succeeded in meeting its ambitious goal of completing the project in 150 calendar days, nine months ahead of schedule. The new connector opened to traffic on July 23, 2000, exceeding all expectations.

The Connector Replacement Project is a tribute to engineering ingenuity and construction know-how. It represents all the innovative engineering in design and construction that a team is capable of putting together. A+B contracting is a process that puts a contractor's focus specifically on "how can we complete the job in the shortest amount of time," especially with an imposed user delay cost of \$20,000 a day out there. It is a process that should be considered for any project where there is great public pressure to get the job done quickly.



INNOVATION:

# RURAL TRANSPORTATION MANAGEMENT

By Jim Drago  
Photos by Don Tateishi



The Sacramento River Canyon seems an unlikely place to be at the forefront of a revolution.

Yet, this scenic treasure north of Redding along the shores of Shasta Lake has become the northernmost outpost in Caltrans' high tech battle against traffic congestion.



Deployed along a 69 km-long segment of I-5 is a virtual highway of advanced technology sensors to collect up-to-the-minute traffic data. That information, coupled with a network of cameras, gives Caltrans District 2 managers a catbird's seat from which to watch the flow of traffic at the narrowest stretch of I-5 between Mexico and Canada.

In a place as rustic and beautiful as the Sacramento River Canyon, it is hard to imagine the scourge of traffic congestion anywhere near. But it happens, particularly over holiday weekends and during the summer when thousands of people head for Northern California's pristine lakes and mountain campgrounds and little communities like Weed, Burney Falls and Weaverville, comfortably nestled in the surrounding landscape.

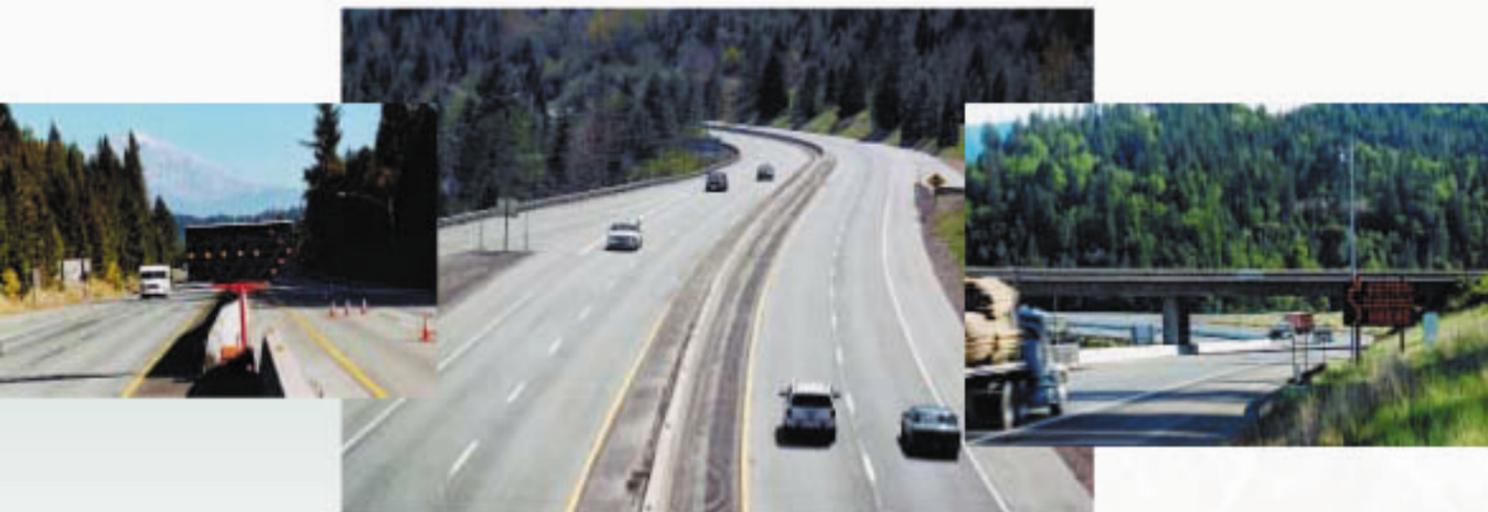
We start our journey at Redding, the county seat of Shasta County. Once a town dependent on the railroad and the surrounding lumber industry, Redding has transformed itself into a diverse, thriving business center of 80 000 people.

Redding was named in 1872 for Benjamin B. Redding, the first land agent for the California and Oregon Railroad. Two years later, the local state assemblyman spearheaded an effort to

change the city's name to honor Mayor P. B. Reading on whose land grant the community was located. For six years, it was known as Reading but ultimately reverted back to Redding because the railroad refused to recognize the change. For the poor mayor, Hiram Johnson's campaign to break Big Rail's grip on the Golden State in the early 1900s wasn't soon enough.

*California's high tech battle against traffic congestion is being waged in the shadow of spectacular Mount Shasta.*

"When transportation discussions focus on traffic congestion, the tendency is to think immediately of urban areas like Los Angeles and the Bay Area," says District 2 Director Thom Niesen. "But mobility is every bit as important in areas like Shasta County and the north state. Northern California is an important element of the state's economy. How successful we are at keeping traffic moving here not only affects those of us who live and work here but has a direct impact on the jobs and economic well being of people living hundreds and in some cases thousands of kilometers from here."



*Advanced technology sensors collect information, which traffic managers relay to motorists traveling through the Sacramento River Canyon.*

From its home base in Redding, District 2's 700 people work tirelessly to build, maintain and manage the transportation system at the top of California.

Driving north from Redding on I-5, travelers come upon the southern tip of the Cascade mountain range. With 4316 meter Mount Shasta as a backdrop, we reach Shasta Lake and the massive dam that stores more than 4 billion cubic meters of the Sacramento, McCloud and Pit rivers. Shasta Lake is the launching point of the Central Valley Project, the massive federal system that delivers water to the Pacific, the fertile fields of the San Joaquin Valley and Southern California swimming pools.

Which Way L.A? Follow the stream. You can't miss it!

The Sacramento River Canyon represents I-5's narrowest point on its more than 1300 km journey between Mexico and Oregon. South of the canyon are millions of hectares of the most productive farmland in the world and the teeming urban centers of Sacramento, Los Angeles/ Orange County and San Diego.

North of the canyon are the wide vistas of Siskiyou County and the Willamette Valley in Oregon.

Here is where the traffic pressure surfaces. On heavily traveled holiday weekends like Thanksgiving, traffic increases by more than 30 percent. When the snow starts to fly or when accidents happen, traffic can be brought to a standstill.

Longtime traffic watchers in District 2 recall a Turkey Day weekend backup about 10 years ago that stretched 40 km from the Gibson Maintenance Station to Dunsmuir. That episode served as the catalyst for the high tech transportation revolution in the canyon.

"There's very little elbow room in the canyon," says Dino Johnson, manager of District 2's Transportation Management Center. "There are no easy alternate routes. If I-5 is closed because of an accident, detours add two, four or even six hours to a trip. Every minute we can save in clearing an accident is crucial in getting traffic flowing again.

Given the physical and environmental constraints of the canyon, District 2 engineers developed a strategy to improve the department's ability to react when an incident occurs. The solution involved installation of a network of sensors to collect traffic information and cameras, strategically placed at five locations along the roadway, that tie directly into the District 2 traffic management center in Redding.

"From the center, we know the traffic volume and can see the actual conditions on the freeway. If an incident occurs, we take action immediately," Johnson says.

Those actions include dispatching maintenance and other emergency personnel, activating a series of changeable message signs to alert traffic north and south of any delays and broadcasting the latest information on highway advisory radio.

The Sacramento River Canyon section was the last segment of I-5 in California to be brought up to full freeway status. The final 20 km stretch, which included six bridges and four interchanges at a cost of \$110 million, was completed in 1992.

"I-5 in the canyon is a magnificent piece of transportation engineering given the spectacular terrain and the traffic demand. Department engineers in the district and structures produced a roadway that moves traffic efficiently while offering travelers a front row seat at nature's handiwork," says Niesen. "Our maintenance crews take very good care of it. I-5 in the canyon is something we are proud of."

The combination of a modern freeway designed for high speeds and magnificent scenery can cause a driver's attention to drift. To help drivers stay focused on their speed and

*"I-5 in the canyon is a magnificent piece of transportation engineering given the spectacular terrain and the traffic demand. Department engineers in the district and structures produced a roadway that moves traffic efficiently while offering the travelers a front row seat of nature's handiwork," says Niesen.*



enhance safety, Caltrans District 2 installed a \$100 000 advanced curve warning and traffic monitoring system along Interstate 5.

While the numbers of accidents are low, the ones that do occur can be very severe due to the high speed at which motorists travel. The warning system is intended to slow speeders as they approach curves.

The system links radar detectors with changeable message signs. As drivers approach, the message sign displays the advised speed and the current speed of the motorist, if it is higher than the posted speed.

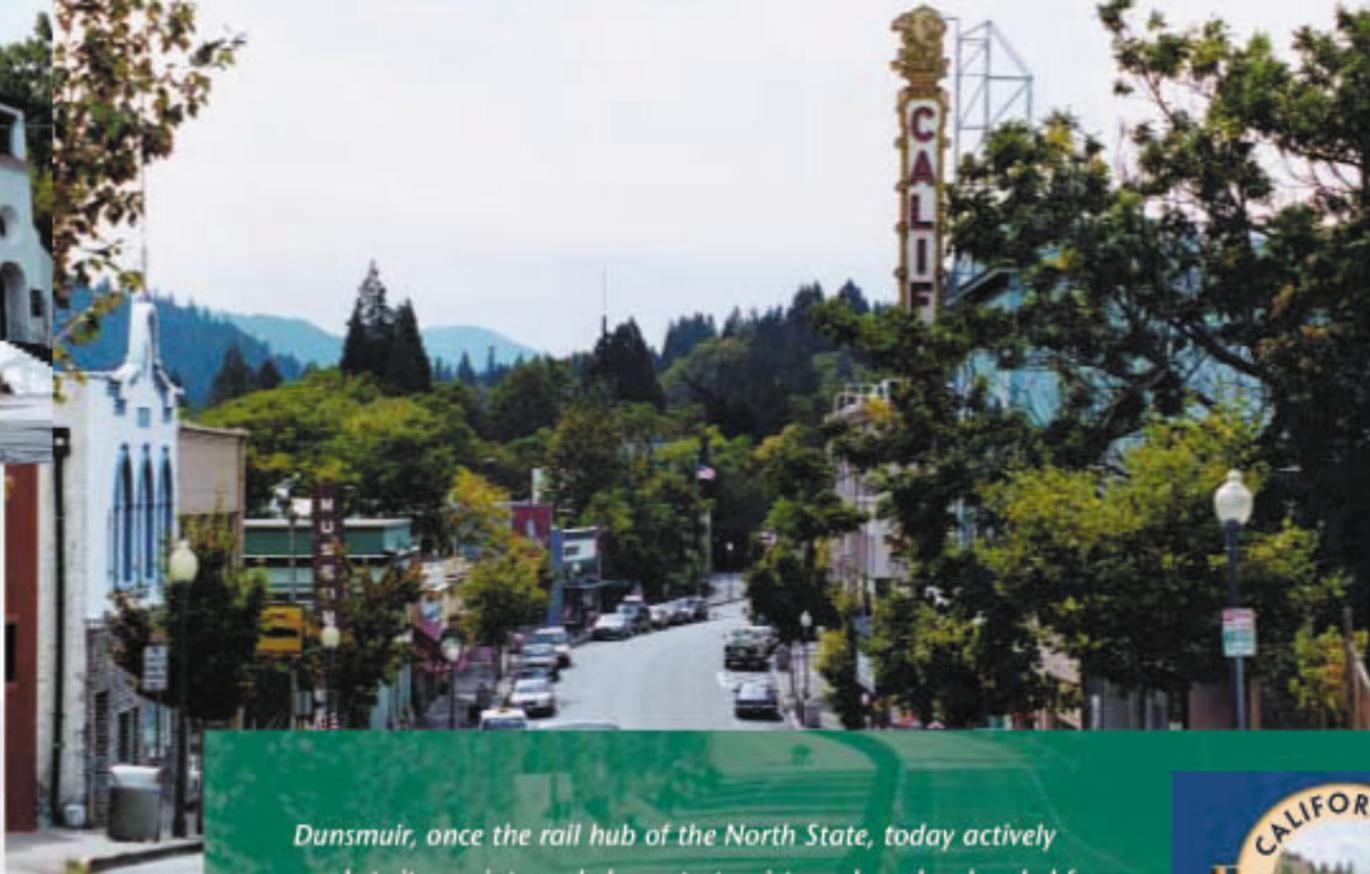
Even on a mild autumn afternoon, we get a glimpse of the potential problem that can occur. Just above the O'Brien interchange, midway in the canyon, a partially jackknifed big rig is blocking two of the three southbound lanes.

"You don't expect it on a nice day with dry pavement but if you're going too fast, you can lose control. We're fortunate in this instance that the rig could be easily redirected and that traffic volumes are light so there's no backup,"





*Siskiyou County towns of Dunsmuir and Mount Shasta seem mostly untouched by California's century-long land rush.*



*Dunsmuir, once the rail hub of the North State, today actively markets its quaint rural charm to tourists and anglers headed for the nearby pristine waters of the Sacramento River.*



A fellow by the name of Dunsmuir ambled into town and asked the city fathers to rename it in return for the gift of an ornamental fountain. Both kept the bargain and the fountain, originally placed outside the train station, now sits in the city park.

Dunsmuir was burned into the national consciousness 10 years ago when a freight train carrying a toxic chemical derailed, pouring thousands of gallons of poison into the Upper Sacramento River. The devastation was total with the fish kill stretching well downstream and forcing evacuation of countless campers and residents.

The spill also underscored the remarkable recuperative powers of Mother Nature. Today, the waters of the river are once again crystal clear, teeming with fish and the Upper Sacramento River remains a favorite place for anglers.

Between Dunsmuir and Weed at the base of Mount Shasta lies the town of Mount Shasta. Like other communities in this area, the railroad and timber were the reasons for its founding.

Now, tourism powers the economic engine in these parts. Nearby skiing, and the natural beauty of the surrounding area have turned Mount Shasta into a destination point for tourists. Eureka! The yuppies have found it.

Continuing north, I-5 opens up into the Shasta Valley as we come upon Weed.

Weed took its name from Abner Weed, a lumberman who was looking for a windy place to speed the drying of lumber. The lumber industry dried up, but the wind has kept blowing.

Caltrans high tech applications have found their way here. The department expects to have a warning system in place next summer to alert motorists to real time wind conditions along the highway.

Johnson says. "If this happens on the day before Thanksgiving, look out."

Based on its positive experience in the canyon, District 2 is planning to install cameras on all its major routes including Highway 36 from Red Bluff to Lassen Park, Highway 44 in Redding, Highway 299 in Modoc County and Highway 70 through the Feather River Canyon. In all, more than 37 cameras will be installed to help the district keep a handle on traffic.

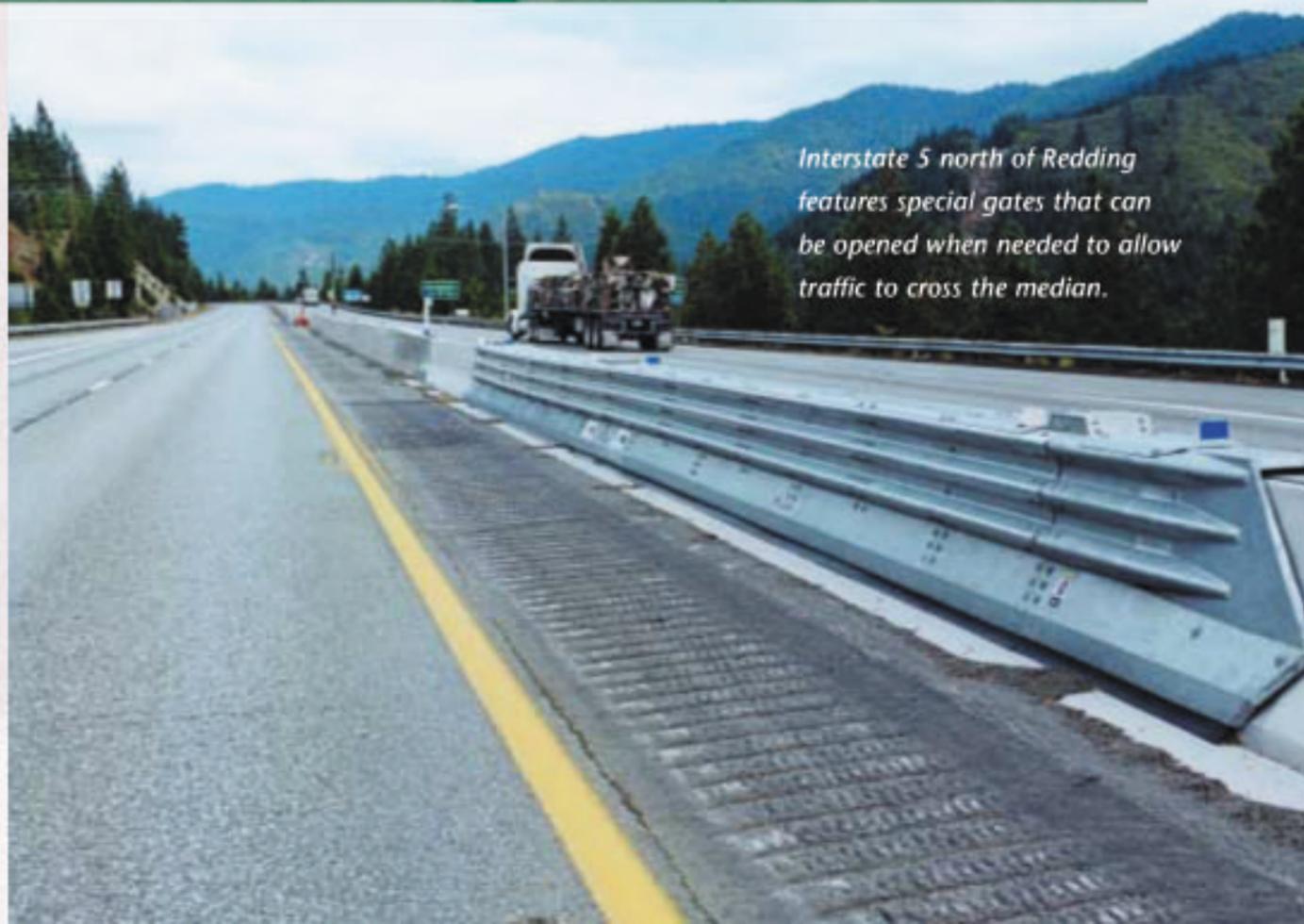
The district also pioneered the use of barrier gates on the stretch of Interstate 5 in the canyon. At six locations, the district installed gates in the median barrier that can be opened to assist emergency crews responding to accidents as well as to detour traffic around the closure when circumstances warrant.

The 60 or so kilometers along I-5 from Redding to Dunsmuir offer the traveler an opportunity to see nature at its finest. Even with a modern freeway knifing its way through the mountains, much of what you see hasn't changed since early man first laid eyes on these hills.

We pass Lakehead and arrive in Dunsmuir, a town of just over 2000 that could be the definition for old railroad towns. Dunsmuir was once the transportation hub in the north state, the home of a major repair facility for steam locomotives.

Dunsmuir's romance with the railroad goes back to its founding. Located at the southern end of a very steep grade, Dunsmuir became the place where additional engines or "pushers" were placed at the end of the train to provide that extra oomph to get over the hill.

These "pushers" also gave the town its original name.



*Interstate 5 north of Redding features special gates that can be opened when needed to allow traffic to cross the median.*

# The Lincoln Bypass Mitigation Plan

**L**ong-term mitigation of the environmental effects of a major transportation project poses a thorny problem for project developers. All projects of any magnitude have major impacts upon the environment through which they pass. Caltrans project staffers fully understand this and are conscientious about pursuing their responsibility to mitigate for the effects of their projects.

**Y**et cost estimates are prepared early in the life of a project when it is very difficult to estimate the environmental effects and, particularly, the cost of mitigating. What often slips through the cracks is a reservation of the resources to oversee the long-term establishment of plant and animal colonies to replace those impacted by the project. Often, this work ends up "coming out of the hide" of an already overburdened environmental program and staff.

But what if a "turnkey" environmental mitigation program were available when the project's effects were determined and negotiations with permitting agencies completed? And what if that program included all of the establishment and monitoring costs for a period of up to 10 years?

That is what is happening on the Aitken Ranch, just south of the burgeoning town of Lincoln in fast-growing Placer County. On a spectacular November day, an ecological stew of bugs, Swainson's hawks, great blue herons and great egrets soar, scrub jays and flickers sing, deer graze and wild turkeys gobble. Blue oaks, Oregon ash, cottonwoods and grasslands rustle in the breeze. Curious deer prick up their ears, then amble into the willows behind a curtain of Oregon grape. Pristine waters from the Auburn Ravine ripple through this riparian fairyland.

It is through here that the Lincoln Bypass, a \$190 million, 20 km, four-lane expressway proposed to replace the overburdened State Route 65, would run, impacting farmland, vernal pools and swales, marsh wetlands, mixed riparian forest, oak trees and grasslands.

*Blue oaks, Oregon ash, cottonwoods  
and grasslands rustle in the breeze.*





*A snowy egret keeps an eye out for a snack on the Aitken Ranch.*

Currently, Wildlands Inc. operates 10 mitigation banks – locations where agencies or developers can buy “credits” against their projects’ impacts – totaling more than 2000 ha. And when the Lincoln Bypass project began to round toward final shape, he returned to Caltrans, this time with an even more interesting proposal.

Placer Legacy, an independent foundation dedicated to preserving open lands in Placer County, had purchased an agricultural easement on the Aitken Ranch, which Wildlands owned. That easement was intended to keep the ranch in agricultural uses in perpetuity.

Wildlands surveyed its property and determined that virtually all of the mitigation requirements for the Lincoln Bypass could be met through habitat restoration on the Aitken Ranch. Morgan approached Caltrans with a proposal. He and his 37-person staff would remove the existing turkey barns, design the mitigations, grade and develop new vernal pools and swales to replace those taken by the project, plant 5000 oak trees and several Valley elderberry bushes and restore 20 hectares of riparian forest. Non-native upland grasses would be controlled by grazing: Wildlands owns 200 head of Texas longhorn cattle. The company would also produce an Environmental Impact Report for the mitigation project to satisfy the requirements of the California Environmental Quality Act.

And it is here, on a 128 hectare former turkey ranch, that Caltrans District 3, Placer County and a private firm, Wildlands, Inc., are forging a partnership to ease the department’s task of providing long-term mitigation for the Lincoln Bypass’ environmental effects. “This partnership will result in a landmark approach to project mitigation and enhance our environmental stewardship role and credibility,” says Kome Ajise, acting District 3 Deputy for Planning.

Wildlands, Inc. of Citrus Heights, California, headed by CEO Steve Morgan, was founded in 1991 after Morgan discovered that the proposed project would cross property that he owned near Lincoln. Morgan, who was in the land development business, knew that the department would have to mitigate for the project’s effects and, at that time, proposed that he develop the mitigation on his property. The proposal did not pan out at that time, but Morgan saw the concept as a workable one and has since developed several other mitigations for various agencies of government – for profit.

*Aerial view of the State Route 65 alignment as it crosses the outflow from Auburn Ravine near Lincoln.*



Morgan proposed reaching an agreement with the permitting agencies – the U. S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game – on a conceptual plan for the mitigation. When a final alternative was chosen for the project, he would then develop the mitigation, manage it through establishment, and establish a permanent conservation easement that would protect the property in perpetuity. Morgan has since received correspondence from the agencies, including the Environmental Protection Agency, agreeing to the concept.

The proposed agreement with Wildlands required a big step from Caltrans. The Environmental Impact Statement for the proposed project still lay in FHWA’s review basket and had not been circulated for public comment yet. The department did not have a Biological Opinion from U. S. Fish and Wildlife Service, required to produce a final agreement on the mitigations. A final decision had not been made on the least environmentally damaging proposed alternative.

The agreement thus required the department to take the risk of securing the property before approval of the Environmental Impact Statement by the Federal Highway Administration.

District 3, on a risk basis, has set aside state-only funds to do that. If the project goes ahead as planned, Caltrans will seek reimbursement from the federal government for the right-of-way funds. The department is currently negotiating with Wildlands regarding whether to purchase the Aitken Ranch outright or develop some other agreement with the company to assure that it remain as the mitigation site.

“The work our staff did was crucial to this deal,” Ajise says. “We did the fieldwork to assess the potential impacts of the various alternatives to create the basis of the Wildlands proposal. Environmental Senior Ken Van Velsor worked tirelessly to keep the proposal solid on its relevance to the project and gave Wildlands guidance throughout the process on our needs, making it easy for them to deal with resource agencies.”

*Wildlands Inc. will graze its Texas Longhorn cattle at the Aitken Ranch to reduce the encroachment of non-native grasses on vernal pool uplands.*



*A trove of vernal pools on the proposed alignment of Route 65 requires extensive mitigation.*



*A deer hides in the bushes in the riparian habitat along Auburn Ravine Creek.*

*On a spectacular November day, an ecological stew of bugs, Swainson's hawks, great blue herons and great egrets soar, scrub jays and flickers sing, deer graze and wild turkeys gobble.*



"In fact, Ken and staff facilitated meetings to get the idea fleshed out and at one of those meetings got verbal support for the approach from Fish and Game. Clay Nystrom and his right-of way staff were told 'No!' to begin with on advance purchase, but they found ways to make it work out. Without the fronting of those funds, the Wildlands proposal was DOA."

**The benefits of the arrangement are many:**

- The site has already been determined to have the habitat necessary for mitigation.
- The mitigation will be installed at a large site rather than at several small ones, an approach preferred by permitting agencies.
- The mitigation would occur prior to construction, demonstrating an early Caltrans commitment to protect the environment.
- Environmental document approval will be advanced with mitigation already under way.
- The project addresses recent court decisions to ensure that mitigation is under way by the start of construction.
- Cost savings are expected as a result of having a turnkey mitigation arrangement.

The Wildlands, Inc. staff develops mitigation banks, does feasibility analyses, works with Global Positioning and Geographic Information Systems and CADD, designs ecologically based restorations, performs long-term stewardship and monitoring, supervises grading and earthwork and plant installation.

Perhaps the most elegant outcome of the Lincoln Bypass mitigation project is one that will delight economists forever. That is that a private interest has, once again, seen a need and filled it. Adam Smith's "unseen hand" has been at work, producing what may be well be the start of a whole new mitigation industry, one that has every promise of easing project approvals, establishing high-quality mitigations of project effects, and doing it at a lower cost than could be done by government.

Caltrans and other government agencies will be the winners when other entrepreneurs see the potential profit and join Wildlands, Inc. in competing for environmental mitigation projects.

— Gene Berthelsen



*Wildlands Inc. has obtained letters from resource agencies that provide conditional advance approval to the turnkey project.*



INNOVATION:

# Bridge Fenders of Recycled Plastic

The soda bottles, broken toys and superannuated TV dinner packages that you've been tossing into the recycling bin are finding their way into bridge fenders.

By Gene Berthelsen

*Marine borers make quick mush of bridge fenders, even those treated with now-banned creosote.*



Social scientists are fond of citing the law of unintended consequences when situations change for the worse as a result of some human-produced action. One of those has been occurring over the past few years as efforts to reduce pollutants running into the San Francisco Bay have reduced levels of impurities in the water.

One of the unintended outcomes is that Teredos (marine borers) are multiplying and they're getting healthier as the bay water is cleaned up. And they like nothing better than wood. They establish relay teams that bore into treated wood bridge fenders, reducing them to useless pulp in a few years. Dealing with the borers has meant finding a new material from which to manufacture the fenders.

Now, the soda bottles, broken toys and superannuated TV dinner packages that you've been tossing into the recycling bin are finding their way into bridge fenders.

Fenders are the first line of defense for a bridge pier. Part of an overall system that may include "dolphins" – piles driven into locations where ships are likely to drift into the piers – and concrete skirts, they are designed to take the hit from a major watercraft and to deflect it away from the pier. They are "sacrificial," in that they are designed to absorb the energy of a ship, often taking damage and having to be replaced. Better to replace a fender than to raise a sunken cargo vessel or replace a bridge pier.

Ken Brown is Chief of Structures Maintenance Investigations in Caltrans District 4 and Mark Woods the Structures Resident Engineer on a \$2.5 million project to sheath the San Francisco-Oakland Bay Bridge piers that lie in navigational lanes with recycled plastic fenders. The project began in May of 2001 and was completed in November. Eventually all piers in navigational lanes of all the San Francisco Bay bridges will be fitted with plastic fenders.

"At least one of the toll bridge fenders will take a hit each year," says Brown. "Very often, the hits come from barges that have gone adrift, but occasionally we do get ships. The last major one, from a 32 000 tonne ship traveling at 11 knots, resulted in more than \$200 000 in damage, which was limited to the fender system with none to the main pier. The ship ended up with part of the fender system sticking out of its side."

Bridge hits are a headache. Pilots of vessels that hit the systems, unless they are seriously damaged, rarely stop and report the hit, since their companies are assessed for the cost of repairing the damage. "Often we end up with debris from the fenders in the water, and that becomes a hazard to smaller vessels. We have to go out and try to pick up everything that has gone into the water," says Brown.

*Mark Woods is Structures Resident Engineer on a \$2.5 million project to sheath Bay Bridge piers.*





*Wooden structures show evidence of the attack by Toredos.*

Caltrans began experimenting with recycled plastic fenders in the early 1990s after environmental agencies started looking askance at the creosote-treated wood being used in the fenders at that time. But the decade's massive seismic program took every available resource to make bridges safer. With that program now in its final stages, the department has turned back to replacing the wood fenders with recycled plastics. The extended period of time has allowed the department to evaluate different materials and methods of placing them, and vendors to investigate new and better materials.

Pilot programs were carried out on the Dumbarton Bridge and the west span of the San Francisco Oakland Bay Bridge. Over the years, the department has evaluated plastic-only fenders, which cracked, then plastic-coated two-inch pipe, which refused to stay in place. Later materials have included reinforced, recycled plastic with fiberglass rebar at the corners, which has proven to have both strength and elasticity.

Also tested were a composite that included a fiberglass shell encasing polymer concrete, filament-reinforced plastic and fiberglass mesh with plastic molded around it through a synthetic process. "The filament reinforced system is being used on the east span of the Bay Bridge as a pilot,

since that bridge is scheduled for replacement and the material will not have to be in place for an extended time. We are unlikely to use it on other upcoming fender jobs," Brown says. "While it is cheaper in price, we do not believe it to be an equal product to the rebar-reinforced system."

Recycled plastic with fiberglass rebar at the corners is the current standard. In cost it is about twice as expensive as treated wood. However, it is expected to have a useful life about three times that of the wood, providing a life cycle savings. It is also more forgiving, bending and returning to

**They are "sacrificial," in that they are designed to absorb the energy of a ship, often taking damage and having to be replaced. Better to replace a fender than to raise a sunken cargo vessel or replace a bridge pier.**



*The condition of plastic fenders contrasts sharply with that of wood fenders.*

its original shape rather than shattering if a hit is not catastrophic. But it is its relatively benign effect on the marine environment that is important. The recycled plastic, which has been manufactured to provide the same structural value as wood, is inert.

The recycled plastic is slightly heavier than wood, which has caused minor but not insurmountable problems for the contractor, Power Engineering. It was Power Engineering that suggested using the reinforced, recycled plastic on the Bay Bridge project, through a Cost Reduction Incentive Proposal. Power uses its shops at the former Alameda Naval Air Station to assemble the fender segments and floats them on barges to the work site.

In most cases, the members are attached to the piers by posts, but at Piers E4 and E5, they are attached to the piers on "walers," horizontal members either of wood or galvanized steel, with galvanized bolts recessed into the plastic in order to eliminate the danger of sparks from any impact. Such a spark could be produce a disaster if the fender were struck by a vessel carrying highly flammable materials. "Chocks," or spacers, provide lateral stability.

Concrete skirts lie behind the fender system as a second line of defense against a hit.

"Power Engineering has been a real resource for us on this project," says Mark Woods. "With this first full-scale use of recycled plastic for fender systems, we believe that we are producing a system that will ultimately provide much greater value for California's taxpayers and a much more favorable aquatic environment in the San Francisco Bay. Everybody wins."



*Plastic promises to triple the life-span of bridge fenders*



*Expanded constructability reviews include a "buddy" arrangement, where designers and construction engineers meet regularly in the field to check on accuracy of plans.*

Constructability is the term that Caltrans engineers apply to the delicate nexus between the end of design and when the bulldozers start pushing soil.

It is in this handover, where the world of design theory encounters the world of dirt, traffic, environment and machinery, that contract change orders and construction claims are born. And each year, change orders amount to about \$250 million; the total of construction claims against Caltrans by its contractors currently stands at about \$154 million.

Constructability reviews – interdisciplinary reviews to make plans more buildable – were instituted by then-Design Chief Bob Buckley in 1997. These reviews have been a work in progress ever since, implemented in

differing fashion in differing districts. And today, District 11 in San Diego is reducing claims and change orders through an expanded concept of constructability reviews.

"The manufacturing world discovered the concept of team development of products with the writing and lectures of W. Edwards Deming in the 1960s," says Jim Linthicum, District 11 Construction Chief. "We are now applying those principles to transportation design."

Pushed by Mohammed Khan, representing Construction, and Rick Hopkins, the district deputy for design, District 11 has developed a two-pronged approach to constructability. One of these is to establish, as many districts have done, a constructability

review unit, now under the supervision of Fardad Behboody. This unit tracks all projects in the district that are at PS&E development stages and orders constructability reviews at 30, 60 and 95 percent completion stages. If necessary, the reviewers will be supplemented by reviewers from outside consulting firms, on contract.

"At 30 percent, we are looking at broad design issues pertaining to geometrics (layout, profiles, cross sections), construction staging and detours, hydraulics, materials and geotechnical, right of way, utility, and environmental and permitting requirements or restrictions," says Behboody. "Those issues include drainage, earthwork, environmentally sensitive areas, systems planning that may involve nearby projects, potential difficulties in maintenance areas, and so on. We are looking to reduce conflicts and avoid scope creep. This is 'change control.'"

"At 60 percent, we should have a complete set of draft plans in addition to the information provided at 30 percent. We should be getting structures plans, traffic con-

trol and a critical path for the number of working days and quantities. It is submittal of 100 percent of unchecked plans."

Traffic handling is a big issue at this stage. "There are lots of detail issues at this stage," says Behboody. "We are interested in design issues, staging, quantities for balancing, proximity to potentially interfering features, disposal areas and considerations for upcoming weather during construction."

At the 95 percent stage, a complete set of draft plans, including all revisions of the 60 percent stage, special provisions and best engineering estimates should be available, along with plans, special provisions, and standard special provisions. At this stage, the plans, specifications and estimates should be ready for submittal to the Office Engineer.

*Expanded constructability reviews include examinations by all Caltrans disciplines, including maintenance.*



# EXPANDED CONSTRUCTABILITY REVIEWS

By Gene Berthelsen



Projects estimated at \$25 million or more are required to go through all the reviews, as are those under \$25 million that are very complex. For smaller, less complex projects, reviews are performed only at project initiation and at 30 and 95 percent stages. Projects estimated at less than \$2 million are reviewed only at Project Initiation and 95 percent.

"But we're thinking that this is a process that could get us better projects at all levels of expenditure," says Jim Linthicum.

The second prong of the district's constructability effort goes far beyond the notion of reviews. What it seeks to do is to involve construction all the way through design by assigning a construction "buddy" to each project. And it also involves the construction industry in getting more buildable and biddable projects. "This is the team concept," says Linthicum.

**Buddy System:** Under the buddy system, a resident engineer with broad construction background is teamed with the design engineer at the beginning of the PS&E stage, to provide guidance and analysis of constructability issues until the project is ready to list. After project report approval and preparation of skeleton layout plans, the project engineer teams up with the resident engineer assigned for review and consultation. The project engineer meets with the resident engineer once a month at the project site, with a maintenance chief.

*Involvement by construction contractors in constructability issues is expected to provide more biddable and buildable plans.*

"We want to see work windows, traffic control, that items in the PS&E are internally consistent, and we want to look at anything we haven't reviewed at earlier stages," Behboody says. "We are especially interested in copies of relevant permits and a suggested working day schedule."

At each of these reviews, all reviewers receive plans two weeks before a scheduled interdisciplinary review meeting. Each reviewer has a set of check lists with which to do his or her project review. "The check lists are constantly evolving," says Dave Stebbins, Senior Transportation Engineer in charge of constructability reviews.

Each review includes a field review and meeting with all disciplines involved. "This has forced project teams to have Project Development Team meetings that had kind of dropped by the wayside," Stebbins says.

During this meeting, the two go over contract items, construction staging, method of payment, quantities, safety aspects, equipment usage, materials, traffic control, night or day work, production rates and contract working days. Suggestions made by the resident engineer are discussed with the design manager and other functional units, then incorporated into the PS&E. Issues with time constraints and scope changes are elevated to design and construction chiefs for further direction. Issues requiring resolution by the division chiefs are handled in a quarterly meeting attended by the resident engineer, project engineer, design manager and the district claims engineer.

Along the way, the participants divide constructability issues into ones that are potentially fatal flaws and those that can be handled by change order.

**Contractor Review:** District 11 is also making draft project plans, specifications and estimates available to prospective contractors for review and comment when they are 90 percent complete.

"The contractors have been very supportive of this concept," Linthicum says. "They love to make suggestions. We believe the prospective bidders will recommend better stage construction, innovative construction techniques, enhanced specifications and

material use and allow us to evaluate the constructability issues and make appropriate changes before the bid. With the contractor review, we will also divide the constructability issues into those that are potential fatal flaws and those that can be handled during construction.

Contractors can access draft project plans through the Caltrans Office Engineer website at <http://www.dot.ca.gov/hq/esc/oe/>. Draft project plans will be posted for review for a two-week period, during which contractors can submit comments via the website. Caltrans will direct the comments to the appropriate district and designer for consideration in the final design. Comments submitted, whether incorporated into the final design or not, may be posted on the Office Engineer website.

A \$16 million project with a list date in November and a \$62 million project slated for late December underwent this process.

"Overall, the enhanced constructability review process will reduce the complexity of the constructability

issues, allow us to assess the merits of revising contract plans and specifications, produce more biddable and buildable contract plans and specifications and give us a better basis for estimating resources, costs and schedules," Linthicum says.

*Enhanced constructability reviews should produce more biddable and buildable contract plans.*



INNOVATION:

# Fast-Setting Concrete

By Jim Drago

Watching concrete harden is said to be about as exciting as watching grass grow.

Not any more.

The Office of Rigid Pavement at the Translab, in cooperation with the concrete industry, has developed a revolutionary process that may mark the most significant advance in concrete road building since the Appian Way carried its first caravan of Roman Legions.

If one were to compare grass growing to concrete hardening, Caltrans' new fast-setting concrete is like planting grass seed, going out for a long lunch and coming back to a full lawn with ankle-high grass needing to be mowed.

This is critical for the army of contractors and inspectors who work at night to remove and replace entire lanes of concrete pavement before the morning light brings the first wave of traffic.

"Caltrans' experience is that this new concrete is different from the specialty concretes that have been used recently," says Tom Pyle, Chief of the Caltrans Office of Rigid Pavement. "The specialty concretes are being slowed down so that we can work with them. But this is the same faithful old cement that has been around for ages—on speed. Earlier specialty concretes can be expensive and sometimes have been difficult to use.

Just how revolutionary can concrete be?

*Putting concrete to sleep at the plant and waking it up at the jobsite provides adequate time to produce a smoothly finished roadway.*

With the new process, construction crews can pour a slab with Portland cement concrete and run traffic over it in four hours, about one-third of the time required by a regular concrete mix."

"It's remarkable," Pyle says. "We've been looking for a rapid strength Portland cement concrete mix for years. This concrete is fast and versatile enough to be used in the worst of situations. It can be produced by most any batch plant and used on bridges, pavements, in adverse weather, and for considerably less than what we've been paying."

California has about 24 000 km of concrete pavement lanes, mostly constructed in the 1960s and 70s, with a 20-year design life. Many of these now need repair that, because of the crush of traffic, must be done at night during very short work windows.



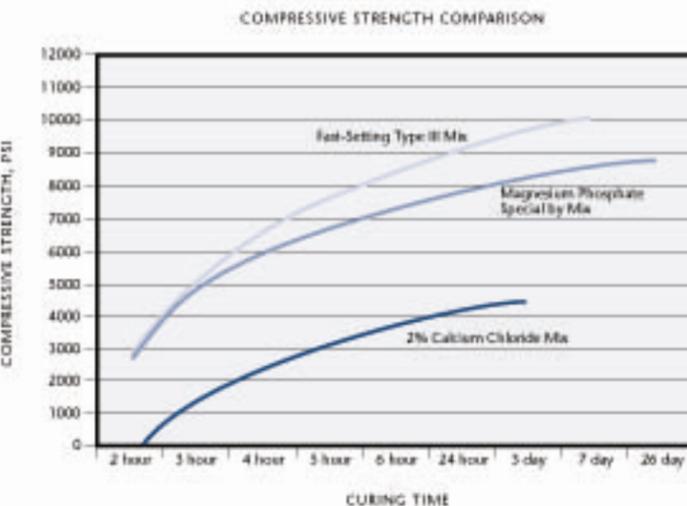
With more than \$500 million worth of concrete pavement rehabilitation and repair scheduled over the next four years, Susan Massey, chief of Caltrans Office of State Roadway Rehabilitation, says that improving construction efficiency is critical to easing the impact of that work on traffic.

"Our construction windows are very tight. Deviations can severely impact traffic," says Massey. "We need a dependable, fast-setting concrete to get the new slabs ready to carry traffic when it is time to open."



**"It's exciting," says Tom Pyle, chief of the Office of Rigid Pavement. "Think of it, the strength needed in a third of the time."**

"In construction, the clock starts ticking when the demolition team starts removing the old pavement," Pyle says. "One of the problems Caltrans has experienced is the limited time, an hour or so, to get fast-setting concrete poured and in place. Some of the first mixes we used did not give the workers time to get the work done and it spilled over into the commute. Some of the slabs gave a rough ride because there wasn't time to get a smooth finish. The public is vocal about getting a smooth ride on the freeways."



To meet these challenges, Translab's Office of Rigid Pavement, together with Tom Salata, of the Western States Chapter of the American Concrete Paving Association, put out a call to the concrete industry to develop a fast-setting mix that would provide the required strength in a shorter time.

The industry responded with various products, and Translab technicians even tried a few mixes of their own. All failed to provide the required strength.

Then the lab switched course.

"We told industry to be creative, look outside the box and try materials that had not been used before," Pyle says.

That did it.

Master Builders Inc., a Cleveland, Ohio-based manufacturer, developed a system of additives that produced high early strength in just four hours. Master Builders solved the time problem by applying Glenium, a product that made a liter of water behave like two, at the plant. Less water was needed, and less water made for stronger concrete. The company then added Delvo, a chemical that put the cement to sleep. The result was concrete in slumber until it was needed. At the job site, when the work area was ready, the company added an accelerator to wake it up.

"At first we couldn't believe they had attained such strength in four hours," Pyle says. "We knew the specialty cements could get this strength, but ordinary cement simply had not achieved it outside our laboratory."



**We told industry to look outside the box and try materials that had not been used before.  
That did it.**

"The concrete has performed just as we expected. It is setting up within four hours, giving the crews the time and flexibility to get it poured, finished and opened to traffic," says Peter Chan, District 7 Deputy Director for Construction. "The ride is smooth and we have no cracking."

Chan says that for urban areas like Los Angeles, the material will help reduce the risk that night or weekend concrete replacement jobs will open late and adversely affect traffic. "Our next challenge is to develop a fast-setting concrete that can be

*Chumo Construction has poured 170 smooth slabs using the new fast-setting process. None have experienced cracking.*

placed by a paving machine," says Chan, a longtime Caltrans construction veteran. "I am confident the industry will do it."

"Now, because field conditions could be very different from those in the lab, we asked Master Builders to try the mix in a concrete truck," Pyle says. "After working with the mix all summer, they gave us a demonstration. In two tests, they successfully mixed the concrete at a plant, shipped it and poured full-size slabs. The results far exceeded our expectations. There was no problem getting the material out of the truck; the slabs had a smooth finish, and we could put a loaded concrete truck on the slab four hours after placement with no damage."

A District 7 Construction Inspector, Ahed Moussa, and the contractor of his ongoing project, George Chumo of Chumo Construction, were at the demonstration. Chumo was satisfied with the results and poured a trial slab with the material a week later. Chumo's slab gained the strength in three hours.

Over the next two months, Chumo repaired more than 170 slabs on Interstate 405 in Los Angeles with the new concrete. None of them developed cracks. Worker productivity doubled with the easy-to-finish material.

"We're very encouraged," says Susan Massey. "The material so far has performed very well. It allows us to get in, get the work done and get out of the way."

"Because the accelerator is a non-chloride, it can be used on structures without producing corrosive effects that could damage the steel," Pyle says. "The material has a projected life span of 20 years, comparable to a regular concrete mix. It is cost competitive, and the price will continue to come down as other suppliers get into the market and contractors become familiar with it."

**Who says watching concrete harden isn't exciting?**

INNOVATION:

DHIPP,

THE  
DIGITAL

HIGHWAY

INVENTORY

PHOTOGRAPHY

PROJECT

Aerial photography has been an essential tool in the project development process for the past 40 years. Aerial photographs are used to identify environmental resources, spot potential right-of-way issues, analyze legal situations, plot rough alignments, illustrate potential effects for public displays and in numerous other ways.

For the past 40 years, Caltrans has acquired its highway inventory aerial photography in the same way: contractors fly about a fifth of the state highway system each year, covering the entire 24 000 km every five years, recording black-and-white images on film negatives. The most current photography for any given location is usually no more than five years old. Older photography, a vital tool in documenting changes to the state highway system over time, is stored as film negatives and available on order.

But today, that system is being revolutionized. By end of this fiscal year, seamless digital color imagery of the entire California highway system will be available to anyone with access to the Caltrans Intranet. The geo-referenced images will cover a swath 600 meters wide centered on each route at a ground resolution of 0.3 m per pixel and be compatible with Caltrans CADD and GIS software. The two images below compare DHIPP color digital imagery with the conventional black-and-white film photography:

*The new Digital Highway Inventory Photography system provides color images and allows users to calculate the area of pictured features.*



Users will have viewer tools at their disposal that will allow them to measure horizontal distances and calculate the area of any feature depicted in the imagery, in user-defined units, or to select an area of imagery and paste it into other software applications, such as a Microsoft Word document. They will be able to select areas of imagery by county, route and km-post. The color imagery will allow users to identify vegetation, wetlands and cultural resources much more accurately than with the existing black-and-white photos. Moreover, the full 24 000 km system will be flown in a single year. The reduced costs of acquiring digital imagery will allow a revisit cycle of just two or three years.

"We expect that once people begin to use DHIPP, its applications will multiply exponentially," says Jim Appleton, Chief of the Office of Photogrammetry in Sacramento. "Each time I give a presentation to Caltrans staff, someone will suggest a new application. Recently a planner developing park-and-ride lots told me that when this tool becomes available, it could reduce his need to perform site inspections by up to fifty percent. Talking to the more than 1500 Caltrans staff statewide who have attended our forums, I have seen first hand how inventive they can be. These forums are always started by encouraging negative feedback on what is being demonstrated, but I have rarely received any. The most frequent feedback is that they love what they have seen and want it yesterday!"

By the mid-1990s, the Caltrans Office of Photogrammetry began to find it difficult to engage aerial photography contractors to perform the conventional highway inventory photography. The 24-inch focal length, 9" x 18" image format cameras were the problem. These cameras were 30 to 40 years old and manufacturer support had long since disappeared. The lack of available parts and service was beginning to result in highway inventory photography delivery problems.



**The DHIPP calculation tool could reduce the need for field inspections by 50 percent.**

In 1997, the Photogrammetry Branch began evaluating a variety of replacement systems that included high-resolution commercial satellites, digital aerial cameras and several conventional aerial mapping camera configurations. Caltrans wanted reliable operational availability, a reasonable number of potential contractors and the ability to deliver photography that fulfilled as many client requirements as possible.

Digital imaging was not a practical solution at the time, so an interim format change was made to use current generation film-based mapping cameras with a 9" x 9" image format. According to Appleton, "We learned a great deal about how to manage change from this experience. We had failed previously to communicate clearly to our customers why we had to make an unpopular change to a product they were familiar with and that met their needs. That is why we have made such an extensive customer outreach effort with the digital inventory."

By 1999, the commercial aerial imaging industry and Caltrans were ready to go digital. Caltrans staff desired a product that had working characteristics (scale, image quality, ground resolution, limited relief displacement, ground coverage, etc.) that would closely match the old film-based format. Digital availability on-demand was also a high priority with clients.

The digital inventory, on an accelerated schedule, is the result. "It will have gone from concept approval to an operational system in just over a year," Appleton says. "This is all the more impressive when you realize that it is not only compressing five years of photography into a single year; it also encompasses a complete informational technology project."

"We have had great support from the Caltrans Information Technology Program," Appleton says. "They have helped us to accelerate development of the Feasibility Study Report and will be full partners in the implementation of the Digital Viewer and Storage System for imagery."

The digital inventory is a great example of internal and external partnering. "Photogrammetry could not implement a project like this on our own," Appleton says. "We have a number of internal partners: the Information Technology Division, Capitol Program and District Photogrammetry Coordinators, not to mention the 1500 Caltrans imagery users who participated in statewide forums. Our external partners are just as important: IK Curtis Aerial Photographers, a California-based, certified small business with a 30 year history of working with Caltrans, and its partner AirPhoto USA. It takes a team approach to make a project like this succeed."

Caltrans will own the exclusive rights to the digital imagery and the Digital Viewer and Storage System, making it possible for them to be shared with external agencies and the public. "Availability of this information via the internet is the ultimate goal," Appleton says. "However, we need to ensure that mechanisms are in place to protect the department's interests first. We have had some preliminary discussions with Caltrans Legal on this issue and continue to move forward."

*With the DHIPP cut and paste tool, users can select a feature from the inventory and paste it into a Word document.*

"We're seeing a continuing revolution in these technologies," Appleton says. "In 1998, the best we could have obtained would have been one-meter resolution digital imagery. Today it's nine times better than that. It would have been black-and-white images rather than color. And the imagery would have cost about four times what it costs today. There are exciting possibilities in the future, including infrared images, multi-spectral images, a continuing reduction in cost and increasing resolution."

Current information regarding specifications and availability can be found on the Division of Engineering Services, Office of Photogrammetry web page on the Caltrans onramp.

- Gene Berthelsen



### Grace, Joy and Hope

One of the hallmarks of Caltrans people is their desire to work in their larger communities to make them better places. For Caltrans District 10 employee and harp therapist Betty Kibble, sharing a precious gift of music is a natural.

Betty, an office technician in the district's travel forecasting unit by day, heard a harp therapist four years ago at a medical assistance conference. It was love at first note. Shortly after that, she bought her first harp, began to

study and since has graduated from the International Harp Therapy Program in San Diego.

Betty's harp, "Grace," is a Dusty Strings Celtic Harp. She also owns a smaller Westover Therapy Harp, or folk harp, that she calls "Joy," which has specially designed strings to soften the tone for therapy purposes.



Betty Kibble and her harps provide therapy to those in distress.

Betty and her harps have been busy lately. On September 11, along with the rest of the world, she awoke to the terrorist attacks on the East Coast. And along with the rest of Caltrans, she was sent home. Previously having been asked to play at a cancer survivor celebration at Saint Joseph's Medical Center in Stockton, Betty followed her heart and played. At Saint Joseph's, amid large, white tents on a plush green lawn, the cancer survivors' good fortunes were juxtaposed with those of the victims of the terrorist attack. "As I played, Grace gave forth the most powerful notes I had ever produced," Betty says. "At that instant, I knew I was helping to bring peace."

On September 13, at District 10's United Way carnival, Betty played "Tranquil Moments," her own composition, after a moment of silence and prayer for New York, Pennsylvania and Washington. "The cancer survivors inspired the composition," Betty says. The tenderness, compassion and generosity of the work touched the entire event.

Harp consists of strings that are strung across a soundboard and plucked manually. Each string has a lever that the harpist moves to produce sharps or flats. Since ancient times, the harp has been a symbol of relief and comfort, and harp therapy is an ancient practice that has been newly reborn in today's world. For those in physical, mental or spiritual pain, the resonant music of the harp helps bring release into a state of peace.

Betty had to learn hand and seating positions and took it one note at a time. She experienced a sense of immediate gratification while learning to play. Asked how she cares for her harps, she says, "I treat them with a lot of 'tender loving care.'" I keep them out of damp places and away from extreme temperature changes."

Betty plays at least every other weekend at church rosaries, weddings, skilled nursing facilities, group and individual therapy sessions and Monday nights at a Tai Chi school. "But the most satisfying is playing for the patients at the Saint Joseph Cancer Center." Unlike other musicians, Betty is often pleased if she is able to lull her listeners to sleep. At other times, families are benefited. "I want people to feel significant," she says.

Betty Kibble, who is looking forward to "Hope," a new addition to her family of harps, has found a gift within herself that has remapped her life. Her harp therapy nurtures the soul. And Grace, Joy and Hope provide comfort for our hearts.

— Stacy Dukes, District 10

### Man of the Year

The Project Management Institute Government Specific Interest Group has named Caltrans Supervising Transportation Engineer Nigel Blampied as its Member of the Year for 2001. Blampied is Chief of the Office of Project Management Process Improvement in headquarters in Sacramento.

The worldwide organization is honoring Blampied for leading a 26-member team in writing a guide to project management for government agencies to supplement "A Guide to the Project Management Body of Knowledge," the globally recognized standard for the project management profession. Called the PMBOK Guide, that publication describes practices needed to complete projects successfully. Blampied's team wrote a 40-page supplement to the guide that takes into account the special circumstances under which government agencies operate.

Recognizing these differences, Blampied put together a team to write a supplement to the institute's standards for management of projects. "Obviously, there are a lot of inconsistencies. The general principles of managing costs, schedules and resources are similar. But governments operate under different conditions from private companies," Blampied says. "They can't staff up and down the way private organizations do. Their budgeting processes are more

complicated, the incentives are different and processes for reassigning people, given the requirements of civil service, are different."

"Developing this supplement was a very interesting process," Blampied says. He worked with project managers from all over the world. "It was fun. We did it on our own time, by email and over a website. I was trading emails with project managers from all over the world — Australia, Mexico, Brazil, England — we had wonderful representation."



Nigel Blampied, Project Management Institute's Member of the Year.

Blampied's interest in project management was actually kindled in his first work experience as a construction contractor in his native South Africa. He came to Caltrans in 1982 as a transportation engineer in District 7, then took assignments in headquarters and in District 3 before assuming his present position.

The Caltrans Division of Project Management has responsibility for providing managerial tools for the management of risk, cost, schedules and resources for the more than 1000 projects completed annually by the department. Blampied recently

headed the highly successful Capital Skills Development effort, which resulted in allocation of \$12 million per year for three years to provide 1.8 million student hours of training for project development staff.

— Gene Berthelsen

## National Award for Caltrans Bridge Engineers

Caltrans engineers Lian Duan and Jason Lynch received the prestigious 2001 Arthur M. Wellington Prize at the recent American Society of Civil Engineers (ASCE) National Convention in Houston, Texas. The award citation reads "for the paper, 'Section Properties for Latticed Members of San Francisco-Oakland Bay Bridge, Journal of Bridge Engineering, May 2000.'" It is the first time that any Caltrans engineer or ASCE Sacramento local member has received the Arthur M. Wellington Prize - national recognition for Caltrans' pioneering work and innovative approach to retrofitting long span steel truss and suspension bridges.



Jason Lynch and Lian Duan, national award winners.

former editor of Engineering News and author of a well-known and widely respected treatise on railway location. The prize is awarded annually for papers in transportation related areas. Dr. Duan and Jason Lynch shared the award with Mark Reno, a Senior Engineer with Quincy Engineering, Inc. of Sacramento.

Dr. Lian Duan is a Senior Bridge Engineer and Structural Steel Committee Chairman with the Division of Engineering Services. He has worked with Caltrans since 1991 and has more than 20 years of bridge and building design experience. He was lead engineer for the development of seismic retrofit design criteria for San Francisco-Oakland Bay Bridge West Spans. He is co-editor of the Bridge Engineering Handbook, winner of a Choice magazine's Outstanding Academic Title award for 2000, and Structural Engineering Handbook CRCnetBase 2000.

A registered Professional Engineer in California, he

Caltrans since 1991. Most recently, he has been involved as project engineer for the seismic retrofit design of the San Francisco-Oakland Bay Bridge east span and for the rehabilitation/replacement of 84 bridges on Interstate 80 through the Sierra Nevada Mountains. He is a registered Professional Engineer in California. He received his Bachelor's and Masters Degrees in engineering from the University of California at Berkeley.

- Gene Berthelsen

## Learning the Ropes

Public employees get lots of experience with red tape, operating on a shoestring and hanging by a thread. But the management team of the Division of Business, Facilities, Asset Management and Security recently traded in those clichés for a sturdy rope harness, 25 meter-high platform and plenty of open space between them and terra firma.

The leap of faith from 25 meters in the sky, one of the appropriately named high elements of the TNT Skill Builders Challenge Ropes Course, was the climax of a two-day teambuilding program that took the managers out of their modular comfort zones and into the beauty of a mature ponderosa pine forest in Grass Valley.



A bird? A plane? No, Steve Alston, finding new potential.

It may seem like a stretch to see how depending on a teammate to help navigate an obstacle course with unsteady rocks and wobbly logs can apply to working together on budget allocations or shifting workload priorities. But the training gives participants a safe place to talk and listen to each other and to work together on problems, guided by experienced coaches. As a bonus, it's fun.

Diane Mariana, Chief of the Office of Statewide Facilities Operations and Planning, found that the change in scene helped everyone relax and start to know each other as people, not just coworkers. The first exercise, the low-risk blind trust walk, created interdependence among the participants. It's a simple exercise in which one person with eyes open leads his or her co-workers with eyes shut

on a walk. Each new exercise created greater interdependence and brought different people into leadership roles at different times depending upon the skills needed. Everyone had something usable to contribute.

The high elements were more of a personal challenge. They included an 8 m walk back and forth between two

trees on a rope 12 meters above the ground while holding onto a single overhead rope. Another was walking on a log between trees that were 8 m apart with no overhead support. Still another included jumping off the log to grab a flag about two meters away, dropping about a meter and a half, then rappelling to the ground.

While the rest of the team was supportive, Diane says, "It was your choice to do the exercise or not. It

was an opportunity to push yourself in a safe environment." Although not initially comfortable on the high elements, Diane found that it wasn't as bad as she had anticipated. "This experience has helped me to try things I would never have considered before."

Attending the training were Steve Alston, Gwen Arafiles, Steve Longhofer, Diane Mariana, Ron McCann, Louie Samudio and Glenn Yee. The results were so positive that the division plans to include all front-line supervisors in a workshop in the spring.

Any division with the necessary training allocations and management approval can make use of a program of this type.

- Steve Alston, Division of Business, Facilities, Asset Management and Security

### Dave Oldenberg

At the onset of what had the look of a blistering day near Olancha on the eastern side of the Sierra 30 years ago, Dave Oldenberg, then an inspector with Lahonton Irrigation District, noticed a hitchhiker in a business suit at the side of the highway in front of the Ranch House Cafe. "I'd been instructed not to pick up hitchhikers in an official car but I just couldn't pass this guy up," he says.

The suit-clad hitchhiker turned out to be Bob Watkins, then the Caltrans District 9 director. After two hours in the car, Watkins suggested that Dave consider working for Caltrans. Oldenberg was persuaded, and shortly afterward, he began his 30-year career with the department, from which he recently retired.

Oldenberg had graduated from Washington State with a major in Agricultural Engineering before being drafted into the Marines. While stationed in the Mojave Desert, he fell in love, married, became an environmental inspector for San Bernardino County, then moved to a job with Lahonton, living and working in Bishop.

After his ride with Watkins, Oldenberg's career with Caltrans started in District 9's materials lab, testing the air quality in Mammoth Lakes. With State Highway 203 to be widened, Caltrans needed to test whether or not the increased traffic would affect the air quality. (It turned out that the widening not only didn't affect the air quality but improved it, because it reduced congestion.)



*After a career that included rescuing a high Caltrans manager, Dave Oldenberg has gone fishin'.*

From 1991 to 1993 Dave prepared a Project Study Report for the Mojave bypass. "That meant two years, wandering through the desert in Mojave." But 10 years later, the project is being built according to his recommendations.

Oldenberg then moved from design to maintenance engineering. "Short and sweet; I like seeing immediate results." The last part of his career was spent in construction where he worked on his favorite job: that job took him to the top of Mt. Downs on his 60th birthday to supervise the installation of Gaz Ex exploders to control avalanches on State Highway 158.

Dave's hobbies are hiking and poetry. His love is his family and the country he lives in. He has spent 28 years exploring the Eastern Sierra and says, "You could never hike all of it in a lifetime. The best part of my career was that I was able to combine my love of the outdoors with my career. I guess I have Watkins to thank for that." After his retirement, Oldenberg returned to work as a retired annuitant, inspecting the Gaz Ex exploders, a project he dearly loves because it takes him back into the mountains.

He has four children, all of whom he and his wife are very proud. His son, a Marine Corps major, copiloted one of the two CH53Es that rescued a downed American pilot in Bosnia a couple years back.

— Susan Lent, District 9

### DPAC Teams with KVIE

Back by popular request, members of the Headquarters Division of Procurement and Contracts (DPAC) showed their community support recently by joining the ranks of phone bank volunteers at KVIE-Channel 6, the Sacramento area's highly popular public-supported television station.

Recently, 17 DPAC members, family and friends spent an energetic afternoon in support of the KVIE Art Auction 2001. This year's auction netted a total of \$114,000, which exceeded the previous year's total by \$23,000! It is good to know that DPAC's contribution of time and effort helped the station achieve this success. KVIE also noted that DPAC's group effort during last June's Great Escapes raised \$15,535 for the station in the three-hour period that they managed the phone bank.

Volunteers had a great time at all events and reaped the reward of experiencing a fun activity that contributes

positively to good local television programming. At the same time, all enjoyed the camaraderie that ensued between management and staff outside the work environment.

Caltrans and the Division of Procurement and Contracts got mentioned in the station's Volunteer Voice newsletter and our organization established a reliable reputation for helping the community, along with recognition as an organization of people who enjoy themselves while doing it! KVIE volunteer coordinators said that they look forward to our joining the station in future fundraising events. DPAC thanks Martha Martinez for organizing this event for the second year in a row.

— Ann Blazine, Division of Procurement and Contracts



*Procurement and Contracts comes to the rescue of public television.*

**Bill Silva**

Bill Silva entered the Air Force in 1971, hoping to become a paramedic.

The Air Force granted his wish. Almost. It assigned him to be a military meat cutter.

And thereby hangs a tale that led to 25 years coaching women's and men's volleyball, including three years at the college level, one national championship and three top five finishes at the NCCAA National Championships and national Coach of the Year. Not bad for an archaeologist in the Headquarters Environmental Division.

"After the Air Force had decided to make me a military meat cutter, it assigned me to Langley Air Force Base in Virginia, where I quickly found out that it had stopped using military meat cutters 10 years before. I was then offered a choice: to become a military policeman, a cook, or an administrative specialist. I took administrative specialist."

Silva then worked for six excruciatingly dull months as the company clerk at Dodd Hall, which served the foreign and political dignitaries who stayed at Langley AFB. Looking for something more interesting, he wangled a tryout on the Air Force's volleyball team, a USO operation that had the job of entertaining troops in Southeast Asia.

"I'd never played volleyball, but I could jump 40 inches in the air, so the coach took me under his wing," Silva says. And in the hopes of never again working as a company clerk, Silva doubled for himself the four-hour workouts and discovered not only a way out of the purgatory of company clerkdom, but a love of volleyball.



*Bill Silva and his national championship volleyball team.*

After the Air Force, Silva coached volleyball at high schools, junior national leagues and, eventually, at Pacific Christian College (now Hope University) in Fullerton, where he achieved his national distinction. It was through his desire to coach college volleyball that he came to his present career in archaeology. "You had to have something on your resume besides volleyball," Silva says. "So I took a course or two in anthropology and found the second love of my life."

Silva now has a Master's Degree in Anthropology from CSU Long Beach and, after a stint with the U. S. Forest Service, a new position with Caltrans, where he is busily putting magnetometers and gradiometers to work in search of subsurface archaeological features.

With regard to his work as a Caltrans archaeologist, Silva says, "I can't quite believe they're paying me to play in the dirt."

Busy with his career and family, Silva has not been on a volleyball court for awhile, but intends to get back into it this year. He'll

get into a City league, and has been asked to play on a team to compete in the "Golden Master's Nationals." And Lodi's junior national volleyball club has asked him to coach a team for eighteen-and-under volleyballers.

"There is much in sport to apply to daily life," Silva says. "As a coach, I learned that the skills transfer, while certainly important, is not what wins national championships. It's character. And if you can really instill honesty, courage and integrity in your athletes, you have an excellent chance at competing at the very top. And the bonus is helping people achieve their potential as human beings."

— Gene Berthelsen

*Editor's Notebook*

The Journal, hoping to establish an annual tradition, is devoting its first edition of the new year to the innovations that keep Caltrans at the forefront of public agencies throughout the world. Intending to write about new stuff all over the department, not just engineering, we recently put out a call for story ideas on areas in which we were breaking new ground. The Journal wanted to know about administrative practices, planning, maintenance, computer systems, and right-of-way — the whole range of what we do.

We thought we'd receive eight or 10 suggestions — maybe a dozen at the most.

Imagine our surprise and wonder when, instead, a deluge of story ideas rained down on us. Around 200, in fact.

Since the Journal usually contains about 50 pages, and our average story runs to four or five pages, we would have to put out a thousand-page issue to tell you about all of them. We now have 285 ideas on our story list for future issues. Their depth and breadth is inspiring.

Alphabetically, they range from the Advanced Highway Maintenance and Construction Technology Research Center, to statewide use of the XPM project scheduling tool to keep projects on time and on budget.

Altitude? They range from advanced guidance systems that keep snowplows from eating up guardrails at the top of the Sierra at 2500 meters, to dampening the sound of pile driving at 100 meters under the San Francisco Bay for protection of marine life. Speed? From 300 km/h trains to movable guardrails systems to protect maintenance workers (wa-a-a-a-y less than 1 km/h).

Structure type? From orthotropic bridge decks to the seismic retrofit of the Posey Tube that connects Alameda with Oakland. Project type? From environmental mitigations

to new freeway construction contracting techniques. Mode? From proposed ferries along the coast near San Diego, to research into the Indian trails that were precursors to the California Highway system.

For the current issue, we furrowed our brow and worried over the list to present a dozen innovations that are mostly distinguished by their impending nature, rather than because they are more creative or exciting. The whole list is creative and exciting and you can expect to see its fruits over the upcoming issues of the magazine.

Your editor has been at Caltrans since 1968. Most of our earlier contemporaries have

flowed away to the Elysian Fields of retirement. But as they rolled up their careers, they usually took pause to worry about whether or not the department would be left in good hands after they were gone. "Who'll be there to do what we did?" they ask.

Well, several generations of new Caltrans hands are now out there, busily thinking about ways they can serve the public better. And we can't think of a better illustration of that than a

comparatively new hand, Bill Silva, (Page 6) who is helping bring a whole new technology to bear on finding subsurface archaeological features so our projects don't unknowingly bang into them. He is excited about his technology. You can see it in his eyes and hear it in his voice when he talks about it.

But beyond that, Bill is a full-time citizen who believes in using a volleyball court (Page 60) to teach young people the value of honesty and integrity and courage and hard work.

There are thousands like Bill Silva at Caltrans. The Journal cautions the old hands not to worry.



*Bill Silva's interests extend well beyond excelling on his job.*

