

DANCING WITH DANGER

A California contractor uses a PVC alloy pipe to reline a culvert without disrupting the main freeway between San Francisco and Sacramento

By **Scottie Dayton**

Early in 2006, employees of the California Department of Transportation (Caltrans) noticed ponding on the east side of Highway 80 in Vallejo at the 780 interchange.

Blankets, mattresses, sleeping bags, and other trash from homeless people had washed down during winter rains and blocked a 500-foot long, 24-inch corrugated metal culvert passing 13 feet below six traffic lanes with on and off ramps.

Caltrans used its combination machine to remove the blockage, but also extracted 10 yards of compacted pea gravel. Workers tried to televise the line, but the camera fell into the void. Two contractors also failed to televise the culvert.

Larry Orcutt, Caltrans acting maintenance and operations deputy director, knew of Miksis Services Inc. in Healdsburg through work it had done for another area of the department. He called owner Gary Miksis and asked him to look at the situation.

Despite the special skids and outriggers Miksis built to keep his camera tractor in the pipe, it fell out, too. When 5-foot 8-inch tall Monte Rose crawled into the culvert to retrieve the Omni Eye II camera from RS Technical Services Inc., he found a washout so deep that he could stand erect inside it.

In one of the most dangerous jobs of his career, Miksis successfully repaired the culvert using a custom PVC alloy pipe without disrupting traffic, which peaked at 9,500 vehicles an hour traveling at 70 to 75 mph.

Just like spelunking

The culvert from the daylight inlet passed under a ramp and three westbound lanes of traffic, intersected a manhole, then turned and ran 350 feet to the shoulder of the eastbound merge lane. The culvert then sloped 10 feet to a drop inlet (DI)



UltraLiner representative Lee Trotter (right) oversees building the cribbing and special rollers for launching the liner.

with a 24-inch headwall abutment.

"All the drawings indicated that the culvert passed at a 1/16 bend through the manhole in the first westbound lane," Miksis says. "Monte, who pushed the camera ahead of him to the manhole, saw a right-angle bend instead." Using the tractor-mounted camera, they televised the second section of culvert that daylighted at the inlet. It was in better condition.

A Caltrans engineer specified that Miksis repair the culvert using 2-foot sections of interlocking 20-inch pipe. Since the freeway had just been overlaid, he was forbidden to dig down three feet and expose the manhole cover. The repair could not disturb daytime traffic, because Highway 80 is the main artery between San Francisco and Sacramento.

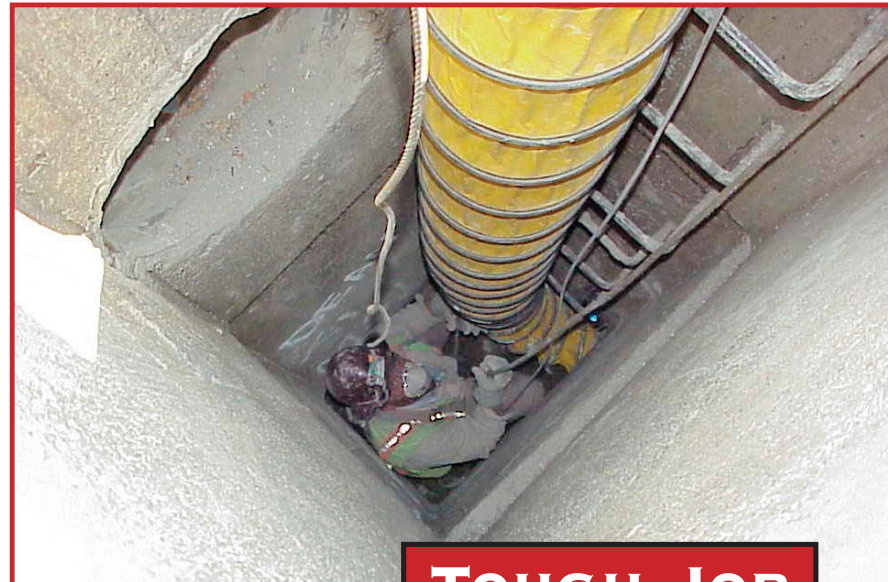
Any disruptions had to occur at night.

"We would have to install the recommended pipe by pushing it into place, but had no room to dig an entrance trench," says Miksis. "The screw-lock couplings couldn't navigate 90-degree bends, and the pipe's smaller diameter reduced the culvert's hydraulic flow by four inches."

Miksis proposed a PVC alloy pipe manufactured by UltraLiner Inc. in Oxford, Ala. Although more expensive, it could go around right-angles and would reduce the flow by only 5/8 inch. "The UltraLiner was the perfect fit," says Miksis. "It's seamless, so there is less friction loss, and that compensates for the change in diameter."

To fill the washout, Salvador Galindo crawled inside the culvert and hand-

Crouched in the drop inlet, Gary Miksis slogs concrete batch mix to Salvador Galindo, who is inside the 24-inch culvert.



TOUGH JOB

PROJECT:

Repair a 24-inch culvert beneath a freeway without disrupting traffic or using the manhole

CONTRACTOR:

**Miksis Services Inc.,
Healdsburg, Calif.**

CUSTOMER:

**California Department of
Transportation**

EQUIPMENT:

**Omni Eye II camera from
RS Technical Services Inc.,
Petaluma, Calif.; 500 feet of PVC
alloy pipe, UltraLiner, Oxford, Ala.**

RESULT:

**Invert re-established, culvert lined,
and no employees injured**

packed 10 yards of concrete. (Where applicable, Miksis personnel followed OSHA confined-space procedures to the letter.) "We devised a skid system and slid square trays of lightweight mortar through the drop inlet," says Miksis. "We hand-mixed the concrete on the shoulder of the freeway."

For three weeks, Galindo folded the mixture of cement, fly ash, and vermiculite into the residual water running beneath the pipe. As he reinstated the invert, groundwater began flowing through the culvert again.

Staying alive

Although Farwest Safety from Lodi, Calif., handled traffic control, the hardest part of the job was staying alive. "Traffic knocked the side view mirrors off our trucks and the flashlights out of our hip pockets, and a mirror clipped my elbow,"



Above, feeding the liner into the culvert. At right, an old 30,000-pound logging winch was crucial to completing the pull.



The folded UltraLiner and its 8-foot-tall wooden spool weighed a combined 16,000 pounds.

says Miksis. “Rubberneckers caused two major accidents right in front of us.”

When working near the 8-foot long K-rail, the men parked against the concrete divider, folded in their mirrors, and crawled out the driver’s window. They didn’t dare open the doors or traffic in the fast lane would tear them off. The men then walked across the top of the K-rail and jumped down behind their trucks.

“The work was so dangerous that we did nothing after sunset,” says Miksis. “Drivers coming at you in the dark are pretty frightening, and productivity at night drops 50 percent.” Every morning, the crew mobilized at a staging area on Mare Island Naval Base.

Once the washout was repaired, the culvert was televised again to determine its length, and then the custom PVC alloy pipe was ordered. The folded UltraLiner pipe on its 8-foot-tall wooden

spool weighed 16,000 pounds. Traffic control closed the eastbound ramp while the spool was set in position beside the concrete drop inlet.

Miksis built a metal frame with two rollers and placed the assembly over the drop inlet. The rollers protected the 5/8-inch steel winch cable from the concrete as it ran 90 degrees for 10 feet, then made another 90-degree bend into the culvert.

The liner, coiled in an H pattern, was almost flat. To help it navigate the 90-degree bend in the manhole, Miksis mounted a 6-inch by 3-foot-tall roller with a 2-inch axle and 2-inch bearing blocks to the inside corner of the manhole. The roller lay on its side. The cable was attached to a 30,000-pound Skagit double-drum yarder powered by a 1952 flathead Ford engine. “I never could have done this job without that logging winch,” says Miksis. He positioned it at the daylight inlet.

Full steam ahead

The crew covered the wooden spool with a tarp, inserted a steam manifold, and heated the 500-foot-long liner for six hours. “It’s a hot medium, so we work fast,” says Miksis. “Once the liner cools down, the pull is over.” When the liner was flexible enough, the tarp was removed and the winch started.

The spool, mounted on a frame with four rollers, sat in a cradle. As the liner winched along, the men turned the rollers to help drive the spool and reduce friction. The pull progressed at 30 feet per minute. Sixty feet from the daylight inlet, the liner had cooled too much and the operation ceased at 8 p.m.

The next morning, they cut the

remaining liner off the spool, inserted an inflatable flow-through pig, ran a steam hose through its 2-inch opening, and started reheating the entire liner. “This was tricky,” says Miksis. “If we steamed too much, the liner would start unfolding and create more drag. If we built up too much back pressure, the liner would start inflating. Hitting a happy medium was trial and error.”

Twenty feet into the pull, the winch’s roller assembly could no longer handle the pressure and blew out of the ground. The 2-inch pillow block bearing was ripped from the frame and broken, and a roller tore off. The pull stopped while Miksis welded the assembly back together. Heat was maintained in the liner.

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Gary Miksis

Meanwhile, Galindo crawled up the culvert and attached a snatch block to the liner’s nose. With this mechanical advantage, half as much force was required to pull the liner the remaining 40 feet.

With the day three-quarters gone, they inserted flow-through pigs with

2-inch openings in both ends of the liner. When inflated, they hooked a steam hose to the 2-inch hole, then to a valve bank with a ball valve. “The valves tell us our inlet temperature and pressure,” says Miksis. “We can determine the drop in temperature and pressure on the other side and regulate accordingly.”

Difficulty factor

As they started forcing 230-degree steam through the liner at 2.5 psi, a thunderstorm with monsoonal rains descended. Within minutes, three feet of water had backed up behind the plugged culvert and submerged the inlet. “We were standing on a platform above the water and were only a few hours away from curing the liner,” says Miksis. “It was too late to get pumps. Fortunately, the rain stopped, but it was like working in a swimming pool.”

When the liner was saturated, they closed the exit valve, enabling pressure to build and expand the PCV pipe. Pressure was increased one pound every five minutes until it reached 10 psi.

As the liner inflated, nothing restricted it from ballooning to 36 inches in the manhole. The danger was that the wall of the liner could become too thin and blow out. By monitoring the liner’s fit to the host pipe on either end, the crew determined when to cut the pressure. “We simultaneously shut down the steam and supplemented 12 pounds of air pressure to maintain the liner’s shape,” says Miksis.

Finally, the air was chilled to 80 degrees through a fan system with a heat exchanger, then maintained for 45 minutes to stabilize the liner. “The fit was so tight that we could see all the rivets in the corrugated culvert showing in the 5/8-inch thick liner wall,” Miksis says. When the pigs were deflated, backed up rainwater drained through the culvert.

Ty Rose reinstated the manhole opening with a cordless reciprocating saw and cut a path for a 12-inch pipe coming into the manhole from another source. It was 9 p.m. when they finished.

Once Orcutt saw what Miksis could do, Caltrans added a dozen 60- to 100-foot culverts with rotten inverts to the contract. The smallest diameter was 15 inches. Galindo backed into that pipe with his arms straight out. The team formed concrete into the size of softballs and threw it at him, then he’d pack it into the pipe. Fulfilling the contract took three months. The only casualty was the air compressor, which fell off the truck when it hit a bump on the way home. ■