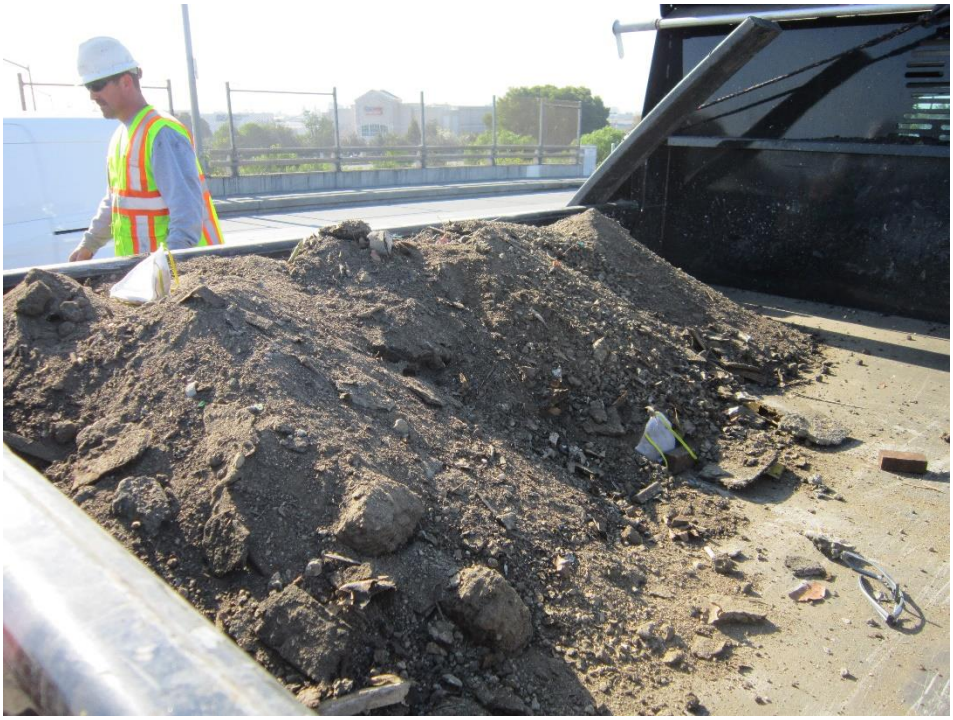
2016 Winton Overpass Piping Project

City of Hayward

Photo Journal by Bert Weiss, Utilities Operation and Maintenance Manager

There was a very unceremonious beginning to the project. Our 20 inch pipe in the Winton Street/880 overpass had developed a leak and needed to be replaced. Note the debris that had accumulated over the decades. The first challenge to overcome was how we would clean the interior of the structure. The space was limited and the debris kept clogging the vacuum truck hose. We finally resigned ourselves to having to go in and clean the interior by hand, with dustpans, foxtail brooms, and five gallon buckets.



The cleaning process went on for days but got done. What compounded the challenge is that we had to make sure that none of the debris rained down on the 880 freeway below. After considering many options to ensure that cars traveling below didn't get hit with falling debris, we resigned ourselves to simply having to be very careful. Lane closures and falsework under the freeway were simply too costly to even consider.

The fact that the Winton project team kept smiling and simply took all of this work in stride speaks volumes about their character and devotion to the residents and businesses of Hayward, that we serve.

After getting the okay to proceed with the project from Utilities and Environmental Services Director, Alex Ameri, we started to place the order for the parts in the last few months of 2015. The EBAA Flex-Tends, above, were the longest lead time items. They were shipped in the middle of February 2016, which meant a project start time of March 2016.

These parts and pipe were hands down the largest that City staff had ever personal worked on.

Day one of the pipe replacement project was ushered in with the arrival of the heavy equipment.

Unfortunately, we didn't get far before encountering the first unexpected revelation. There were large veins of pea gravel near the overpass structure. It started to pour out of the sides of the trench walls and threatened to undermine the very busy West Winton. We immediately had to backfill to prevent that from happening and shifted to Plan B.

Thanks to the expertise of United Trench Safety folks, “Plan B” effectively became driving ¾” steel plates into the ground with the excavator to keep the pea gravel in place thereby preventing the undermining of the very heavily traveled roadway.

Staff then welded braces in place and the excavation process promptly resumed.

We didn’t get far before the next challenge. When the overpass and pipeline were originally constructed, the pipe size and material selected included a 30 inch AC line on either side of the overpass, and that was transitioned down into a 20 inch welded steel line in the overpass.

In the transition area from 30 inch to 20 inch, a substantial reinforced concrete wall was poured over the transition coupling. It took staff three days to break through the wall with a backhoe mounted breaker and concrete chainsaws. While no one was thrilled with the work, staff attacked it with a vengeance.

Of course, the years long drought ended when we finally started this project. Despite the wet weather staff pushed on and prepared the west side “loading pit.”

When we finally had the pit excavated enough, we called the Cal West wire saw guys in to help us open the 3 foot thick ends of the overpass.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The wire saw set-up took hours, and City staff worked with the Cal West people to assist with that process. Once the wire saw was started, it made short work of the reinforced concrete wall.

The next challenge was cutting the asphaltic coated, welded steel and mortar lined 20 inch pipe. Things got smoky and dusty in the overpass and required the use of forced-air respirators. This had to be done because the overpass end walls were formed around the pipe. In order for us to remove the wire sawed concrete plug that surrounded the pipe, we had to cut the pipe in the interior of the overpass.

The respirator equipment worked like a charm, as did the 4-1/2 inch mini-grinders equipped with A2Z cut-off wheels!

After a few very clean cuts, we were ready to pull the cut concrete plug ends out of the overpass.



And then, out came the reinforced concrete cut sections as well as the first of the old 20 inch pipe. Another challenge was overcome.

It was exciting to see the old pipe getting pulled out of the overpass. We were not sure how well the 50 year old roller supports would work but they did great, and the Deere 245 pulled the pipe out with ease. It was also the first time that we would see the gap in overpass directly from above. Before this point we had only seen it with a hand mirror held under the pipe as we carefully cleaned the overpass and pulled broken concrete from the gap to ensure that it wouldn't drop on the vehicle traffic below.


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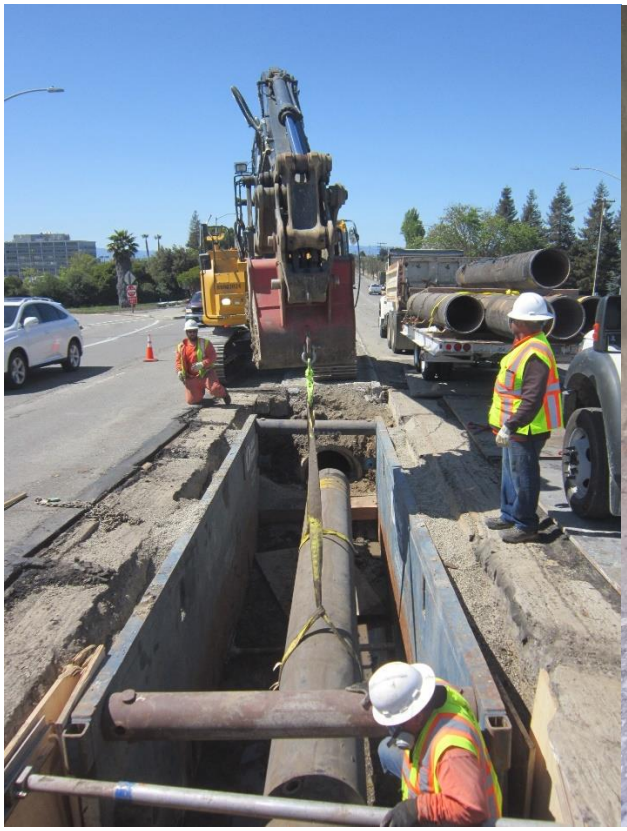
We now had to remove about 35 feet of AC (Asbestos Concrete) pipe so that we could create our new pipe loading pit, and to facilitate the pulling out the old pipe from the overpass structure.

While properly shored and totally safe, it was obvious that we wouldn’t be able to work with all of the speed shore braces in the way.

So, the folks at Untied Trench Safety, a Hayward business and community partner, delivered a shoring box that would allow us to have the space we needed to remove the old pipe and pull in the new.

We could now start pulling out and cutting longer segments of the old pipe. The many months of planning were starting to pay dividends!



…out with the old…

This is a good picture of the freeway below, as seen through the gap. The pencil and glove are included for scale to show both the width of the gap and the roughness of the floor of the overpass. That floor roughness would ultimately prove to be one of the bigger challenges that we had to overcome with this project.

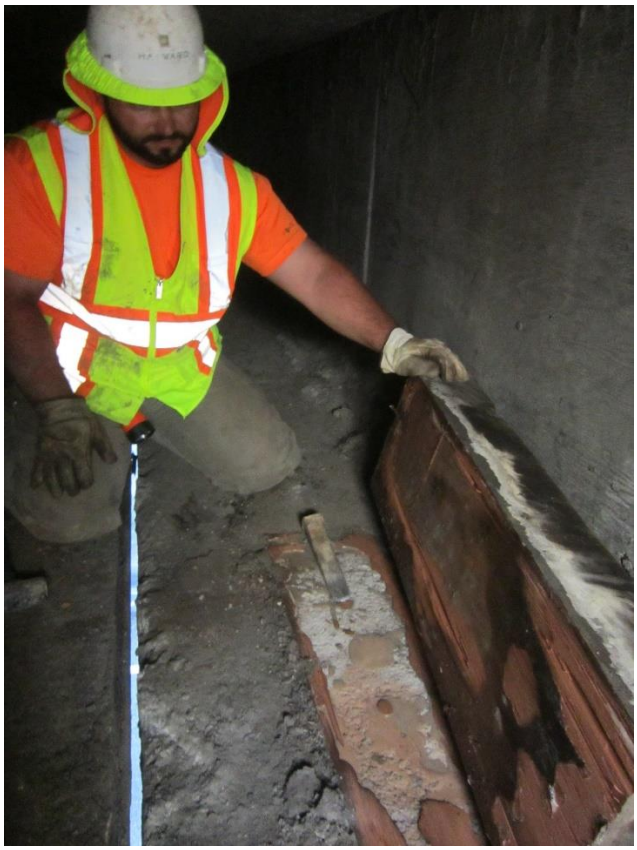
We then shifted gears in the project because we needed to settle on the piping insulator materials and manufacturer so that we could get those materials on order. But first it was time to install the massive TR Flex pulling head on an 18-1/2 foot long stick of pipe and see how some sample insulators would perform as they got dragged over a rough surface. This head is very heavy, the pad-eye on the front of the head is made out of 3-1/2 inch thick steel plate.

This was technically the very first TR Flex joint that the crew had ever assembled. It took about 15 minutes for everyone to wrap their heads around the design and to become complete proficient in the assembly process.

City staff prepared for the first pipe casing insulator material pull test.

The test was simple. We would drag the pipe behind the front loader to determine the wear rate of the plastic blocks on the insulator bands.

The results of the test were both dismal and very discouraging. One material wore out in 80 feet. The next did slightly better and hit about 120 feet before the wear was so great that the pipe's bell end started to drag on the ground. We had a serious challenge ahead of us to come up with something that could withstand the full pull of 300 feet through the overpass and over the unfinished concrete floor that was much rougher than the asphalt we were dragging the test pipe on. Not only that, but staff decided that it was necessary to be able to make a 600 foot pull, in the event that something went wrong with the hydro test and that the pipe had to be pulled out of the overpass again. We absolutely couldn't afford for the bell ends of the pipe to drag in the gap of the center of the structures, thereby raining spalled chucks of concrete down on the traffic below, if the pipe needed to come out again.



As we went back to the drawing board on how we would support the new pipe as it got pulled into the overpass, we started to pull the old roller supports out of the overpass. The 50-year-old epoxy used under the wood blocking was extremely tenacious. Also, No, we couldn't reuse the old rollers – a question everyone asked. The size of the new pipe and the bell-end configuration prevented this from even being an option.

This photo shows the old roller supports coming out of the overpass. Notice the air monitor and the confined space entry permit in the foreground. Safety first!

The overpass was finally being cleared of all internal obstructions. Despite the limited ingress and egress, the crew working on this project had no real issues. It was just one more challenge to overcome on a project filled with challenges, and the crew took all the challenges in stride.

Since there was ambiguity about the new pipe supports, and an associated lead time issue once we decided what we would use, staff elected to, again be safe, rather than sorry. By this time, we had hand cleaned the overpass no fewer than 6 times. Once the pipe was removed, however, there was nothing that would deflect any debris that feel through the seam on the ceiling of the overpass, from traveling through the gap in the floor between the two structures that made up the overpass until the new pipe was in place. We elected to use the Aramark carpet runners to cover the gap. The rental of these made sense because that way we wouldn't end up buying a 300 foot long carpet runner, and then discarding by sending to a landfill.

The runners worked great and they made crawling through the structures much easier on the knees. Of course, after we laid them out, it rained again – in drought stricken "Sunny California." California could thank the Winton crew for effectively ending the drought in Northern California.

It was time to start on the receiving pit on the east side of the overpass. Streets Department helped us by grinding a relief in the street where the 1-1/2 inch thick trench plates would sit. This precaution would avoid subjecting the motoring public's tires from being negatively impacted by the project.

Staff was also finally completing an in-house pipe sled design. The scale drawing "napkin sketch" drawn with sidewalk chalk in the foreground is the beginning of the solution to one of the biggest challenges encountered in this project.

It was time to break ground on the east side. The Deere 300 that was going to be used to pull the new pipe in the overpass made short work of the process. We also applied all of the lessons learned from the west side experience, which made this excavation very straight forward.

The east side receiving pit was dug in very short order.

The shoring box got delivered and dropped into place. It was as if City staff had been doing this for years…

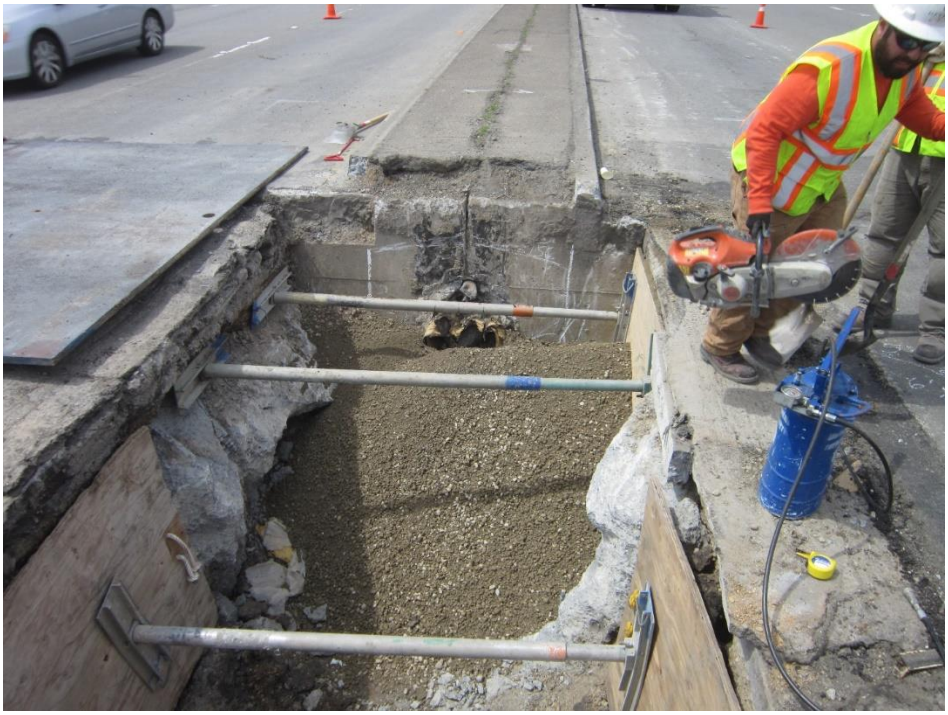
…and this time when an even larger wall of reinforced concrete was revealed, it was all smiles because we had a Plan B. There would be **NO** backhoe mounted breaker and the concrete chain-sawing would be kept to an absolute minimum…

…and this was “getting through the latest concrete wall Plan B.” A 5,000-pound breaker for our rental Deere 245. Staff came to love “Plan B” after one “thunk, thunk, thunk” blow caused a 24 inch chunk off concrete to blow off of the reinforced concrete wall. The progress made with one trigger pull took the backhoe mounted breaker hours to accomplish on the west side. The crew was very impressed!

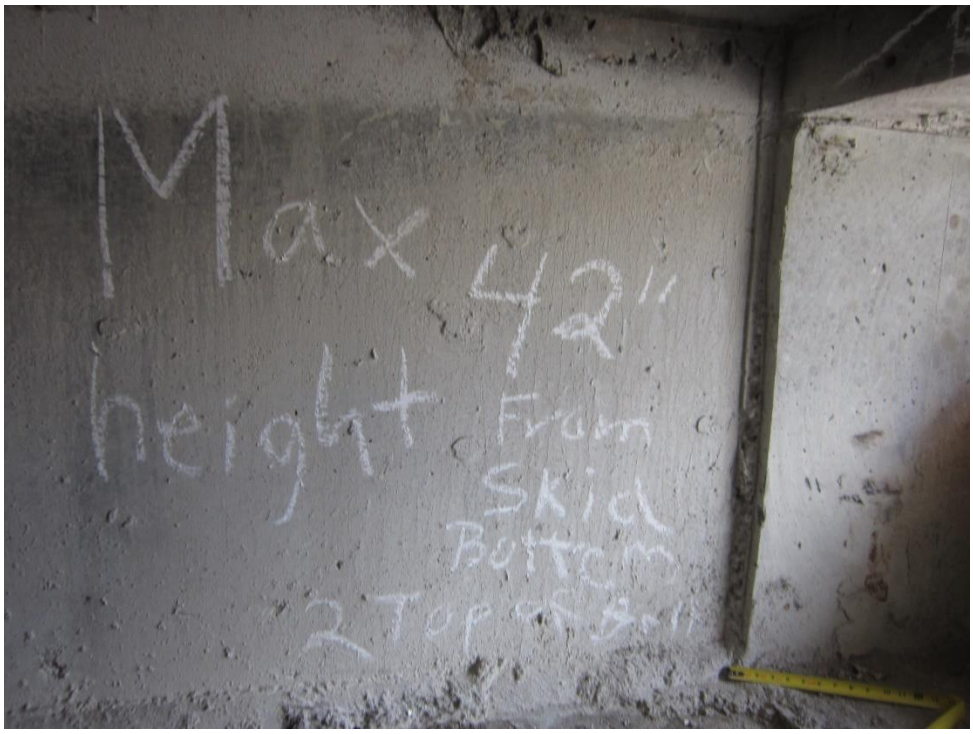
About 20 minutes later we were already threading a lifting chain through the demolished reinforced concrete encased transition coupling…

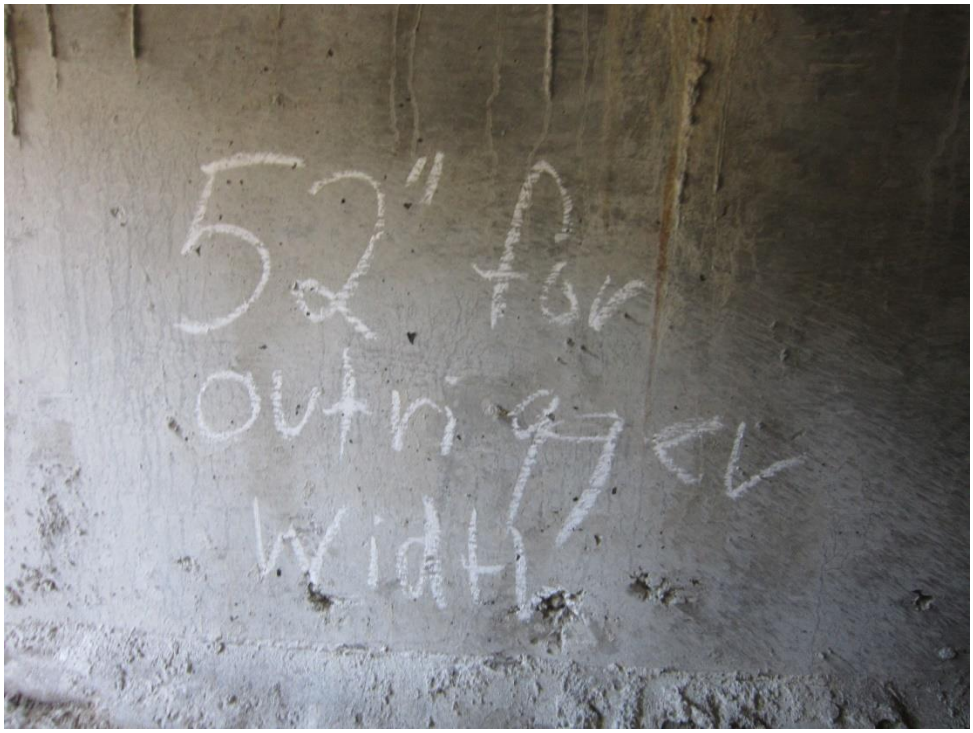
…and shortly after that, the much larger transition coupling, when compared to the west side, was being pulled out of the rubble. While the one day rental of the breaker cost approximately $1,000.00 we ended up saving money and time, hand over fist. These win-win situations are what we live for!

In virtually no time flat, staff was trimming some small protruding pieces of rebar…



…and we added a little temporary base rock backfill to retain the pea gravel until we could get the plates ordered for this side.





While we waited for the pea gravel plates, we refined the in-house designed pipe sled dimensions.

It also became clear that we would have to do some additional wire saw trimming on the west side when we had Cal West come out and wire saw through the east side end wall. Most things in this project proved to be an evolution in design…

…but again, what was learned on the west side was immediately incorporated on the east side.

Cal West, and their amazing wire saw, were called out again.

It was a good thing that staff elected to lay out the rental carpet runners. Once again, the pen and the glove are included for scale. This is debris that could have fallen on the freeway traffic below.

Then, one day, we got word that our prototype pipe sleds were ready, and staff picked them up from RA Metal, in South San Francisco.

Staff waisted no time getting the sleds ready for their pull test. Again, the approval criteria was that the sleds had to be able to withstand being pulled for a minimum of 600 feet.

The massive 55-ton shackle was needed to span the 3-1/2 inch thick pad-eye on the pulling head.

Staff also incorporated a dynomometer into the sled pull test to make sure that the 300 Deere excavator would have the ability to pull the entire pipe train through the overpass. Carpenter Rigging in San Francisco, is the go to place for all things rigging. Then the test started. All appeared to be in order for the first few feet. We continued to pull, and pulled past the 80 foot make without incident. And then we passed the 120 foot mark without incident. And then we pulled for 1,000 plus feet without incident…

…and then we moved the 644 hybrid loader to the other end of the pipe and pulled the prototype sleds back the entire way…

…and finally through a turn, back to the place where the sleds had been bolted to the pipe – all without incident! When all was said and done, there was no visible wear to the runners and, while very warm, they could still be touched with a bare hand!!!

The next step was to deliver the prototype sled and pipe assembly to the overpass to see if it would work as planned there.

The next round of testing was soon to start.

Staff carefully loaded the pipe into the overpass.

Everything looked absolutely great…

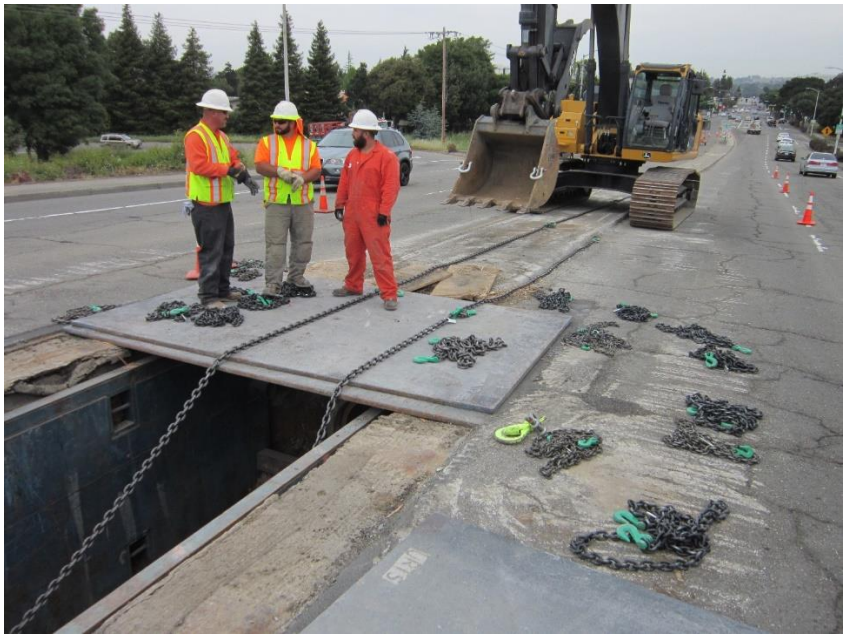
…from both inside and outside of the hole!

Staff dragged the lifting chains into place, dropped the spreader beam that was needed to keep the chains away from the gap in the center, and hooked everything up for the test pull. Note the modular, off-the-shelf spreader bar, and the City of Hayward designed, RA Metal Fab constructed sled runners that was needed to keep the center flanges on the spreader bar from dropping down into the gap between the structures. The carpet runners had obviously been removed for the pull test.

The bucket of the Deere 300 was flipped to be in a “shovel mode” so that the chain would be restrained in the event of a failure.

The test was about to start…

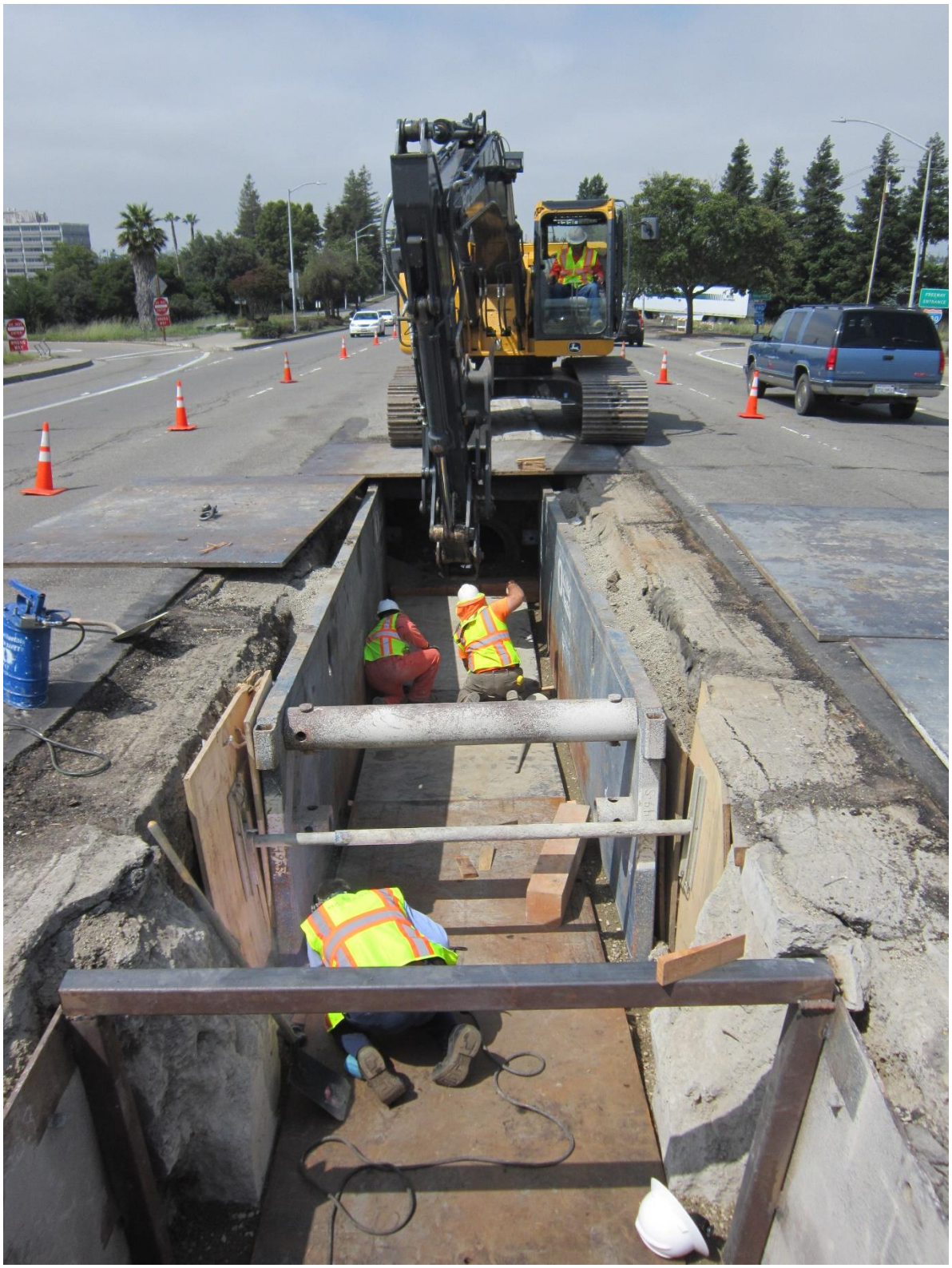
…staff carefully monitored the pipe throughout the duration of the pull. Every time the pulling chain tension was relieved, staff dropped into the overpass to check on: the alignment of the pull, the wear on the floor of the structures, and the like. Everything was once again exceeding every ones' wildest expectations, and the pipe was pulled through the overpass without incident.



Staff elected to simply pull the pipe through the far side. We knew that the outriggers didn't have the clearance but elected to give the prototypes, that had served us very well, a final destructive test. This would give the welds the acid test. Despite the extreme deformation of the hot roll flat bar, the welds held. The base metal is what ended up finally tearing. The weld procedures employed by RA Metal were beyond reproach, as usual.

The mangled lead sled was removed and inspected one last time. Extremely minor design changes would be incorporated and the order for 47 sleds was immediately placed.

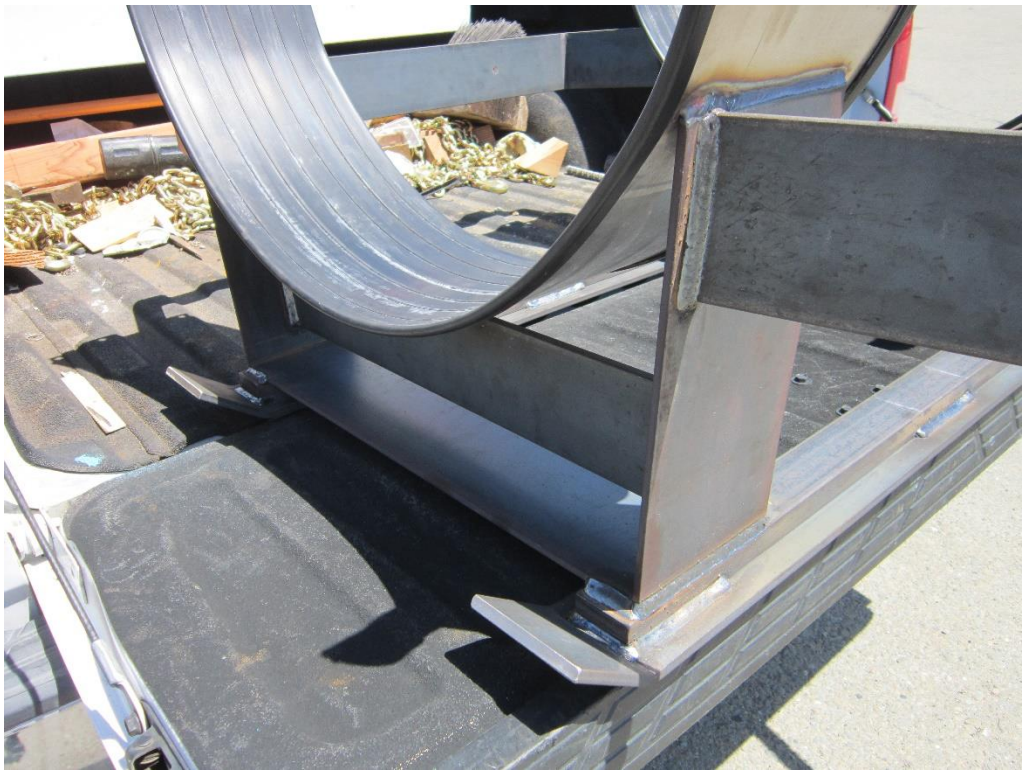
While the “final design” sleds were being constructed, staff created a nice approach to the overpass opening on the west side. The pipe train would be assembled and pulled in one stick at a time.



Steel trench plates were added to the floor of the receiving pit after the Class II base rock approach was finished.

Also, while waiting for the new sleds, staff roughed up the polished wire saw cut walls. There would be no room to do this when the new pipe was in place, and the rough surface would provide maximum adhesion for the reinforced concrete plug that we had to restore, after the new pipe and the casings were in place.

Staff got a call from Scott Silverthorn from Groeniger. Scott is one of the greatest technical help resources any one in our industry could hope for, and unlike costly engineering consultants that end up calling resources like him for answers and then charge utilities dearly for the information, Scott is free. He is worth 13 times his weight in platinum – but is free. Scott suggested that we fusion bond epoxy the carbon steel sleds. Staff jumped on that idea, and he made that happen too. We couldn't wish for a better community partner.



The new sleds incorporated some minor design improvements, but substantially mirrored the prototypes' design.

About ten days later the fusion bonded epoxy sleds started to arrive.

Staff wasted no time in bolting the sleds onto the pipe for the final test. Our Director requested that the crew perform one final test pull of a three stick pipe train through the overpass to ensure that nothing changed when the pipe was pulled through as a train.

The lead stick was loaded on the trailer and the next sticks and their sleds were assembled. It should be noted that staff elected to use three sleds per stick to ensure that the pipe has a solid and redundant cradle system for decades to come. It should also be noted that each stick of pipe, when filled with water, would weigh approximately 9,000 pounds.

Staff took this opportunity to do a “dry run” with the come-along method of pulling the pipe sticks together.

This very tried and true method of assembling the TR Flex DIP pipe worked exactly as advertised…

…and it was show time, once again.

The lead stick of the pipe train was loaded into the loading pit. This pipe would never come out of the overpass again. Despite being pulled all the way through in the form of a three-stick train, that train would be pulled back to the loading pit, and from there the fourth stick, and fifth stick… …were added.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United
Rentals

The three-stick train got loaded, made a full pull without incident to the east, was pulled back to the west end, and then the permanent pipe install started.

Everything was going exactly as planned. The months of planning out every detail and revising the plans to accommodate existing conditions were paying off.

The wear to the floor of the overpass was for all practical purposes, nonexistent.

The pipe moving past the halfway point. This opening in the overpass is larger than the other two because an Air Release valve is located on the top on the pipe under this steel cover.

The pipe approaching the 2/3 way mark, as viewed through the manhole on the east side of the over pass.


JOHN DEERE
644K
DEERE
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We are getting closer to home. We could no longer see the traffic through the gap once the pipe passed the eastern manhole. It was actually an odd feeling for the crew. We had become very accustomed to moving freely through the very dynamic overpass.


Last
Full
Stick!
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…and then one day the end was in sight. Maybe the end of pulling the pipe through, but there was still much work remaining in the project. The casing pipes needed to be added, the fittings still need to be added for the hydro test, the hydro test had to be passed, the tie-ins on both sides needed to be completed, the walls had to be restored, the trenches needed to be backfilled… Regardless this scene was a long time in the making, and it felt great!


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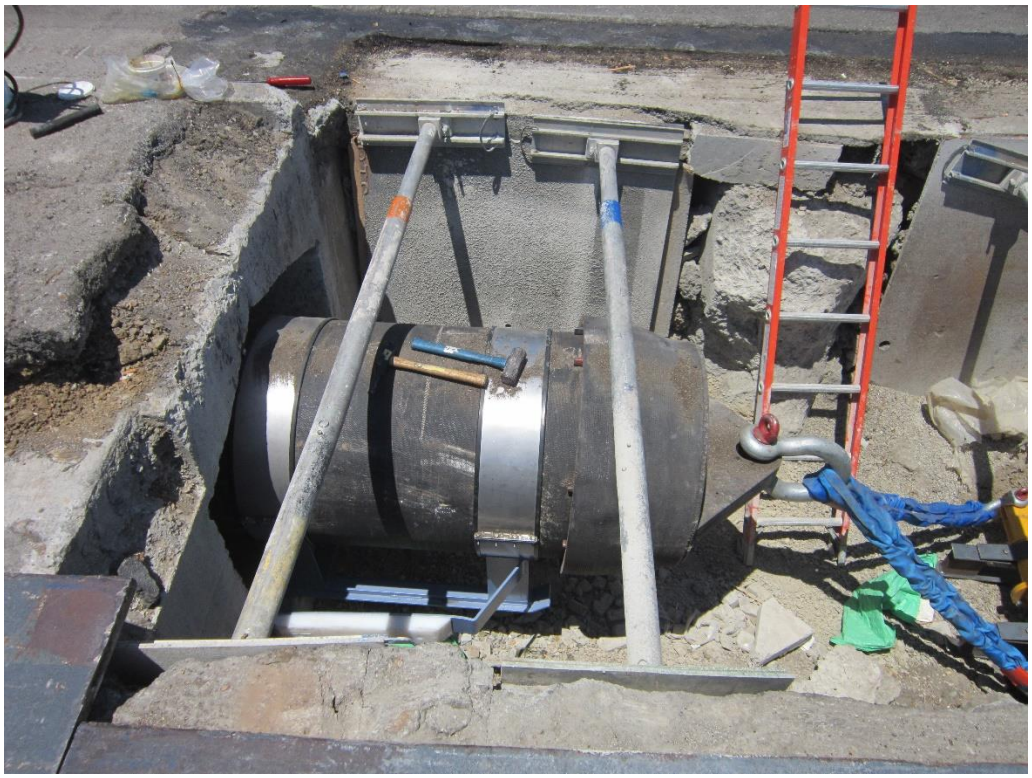
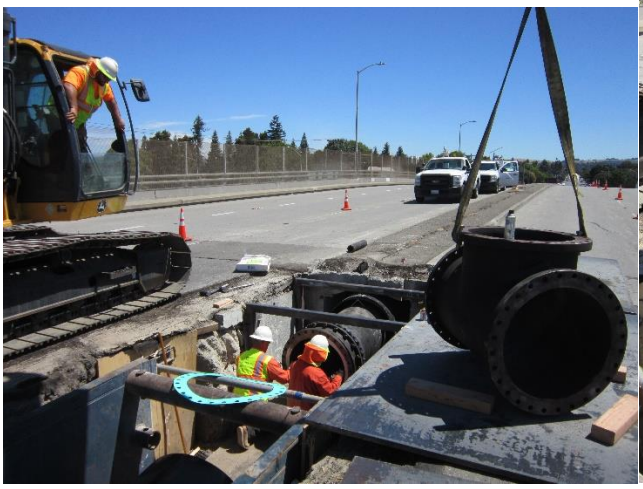
The last part of the pipe in the overpass was pulled through.

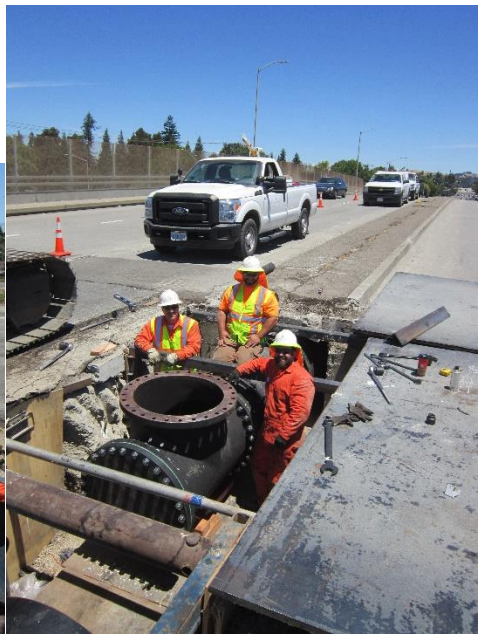


The west side (above), the east side (below). The Deere 300 had made the full pull like a champ!


Hertz Equipment Rental

The pulling head was no longer needed and was returned to Pac States Pipe for the next job somewhere.





The hydro test fittings were the next order of business. It should be noted that staff elected to include the Tee fittings because there was very little room in the overpass anymore. In the event that a repair to a small hole would ever have to be made in the future, the repair would have to me from inside the pipe. Though it is very unlikely that the pipe will fail before the overpass ends its useful service life, we can also use the Tee's to slip line the pipe or run a hydro hose through the overpass with ease. That is the forward thinking that City of Hayward prides itself in.

The mirror image fittings were then installed on the eastside.


Note the tight clearances between the top of the Tee and the trench plate. This clearance actually dropped to 0.035 inches (the thickness of about 10 human hairs) in certain areas after the upper flange and bolts were installed. The precise dimensional tolerances were yet another challenge throughout the project, but successfully overcoming any challenge thrown our way also made the project fun.

Large fittings translated directly to a large number of large bolts. All of the bolts were tightened in proper sequence, first by hand with oversize wrenches, and then got gunned home with a pair of Ingersoll Rand pneumatic impact guns, furnished by yet another community partner, Western States Tool and Supply.

This was one of the aforementioned tighter clearance locations. By good fortune, this fitting is actually located in the raised center divide section. If it was located in the street, staff would have had no option but to rotate the tee 90 degrees and provide access to the pipe from the side, but that would also disrupt a lane of traffic, if this feature was to be utilized.

Once the tee fittings were in place on both sides of the overpass, staff tapped into a 12 inch distribution system line east of the overpass but still near the center divide. This allowed us to run approximately 300 feet of fire hose to the pipe in the overpass. We needed to flush, the line, chlorinate the line to disinfect it, and to hydrotest the pipe that we had installed. The hydro test consisted of pressurizing the line to 200 psi, and then letting it sit for a minimum of 4 hours with no more than a 5 psi drop in pressure.

The line was actually left pressurized over the 4th of July weekend, and when we returned, the pipe was still holding at 195 psi. The pipe, obviously passed the pressure test with flying colors.

The final tie-in to the existing 30 inch lines were started after staff relieved the pressure in the line and drained the pipe. The original 30 inch AC line was not exceptionally well aligned with the overpass, but that was not going be an issue because of the large gimbled ball ended and telescoping sleeve EBAA Flex Tends that were required by Caltrans on either side of the overpass.

Staff started the tie-in on the east side first. The large spool and valve assembly were built at the Hesperian laydown area a few miles away, delivered to the jobsite, and lowered into place.

The custom fabricated transition couplings made by Romac in Washington State, and furnished to us by Scott Silverthorn of Groeniger, fit perfectly. They are what allowed us to tie-in the new ductile iron pipe to the existing AC pipe.

The EBAA Flex-Tends were used to complete the tie-in. As mentioned these impressive, heavy and costly (approximate $30,000.00 each) fittings easily accommodated any minor misalignment of the old and new pipe.

While it would seem that a fitting that telescopes in and out, and has the swiveling gimbled ball flange ends would be a pipe fitters dream, the various moving parts all seem to move in every way other than the one that you want. In the end, everything came together beautifully.

These fittings are required by Caltrans anytime a pipe transitions from the ground into one of their structures. In the event of an earthquake, they compensate for the differential movement between the approaches and the structure itself.

As costly as the fittings might be, the purchase price pales in comparison to the unbelievable damage that would result from a 30 inch, 110 -150 psi water hydro cannon a sheared line would become. The bottom line is that these fittings are not only required, but are money very well spent.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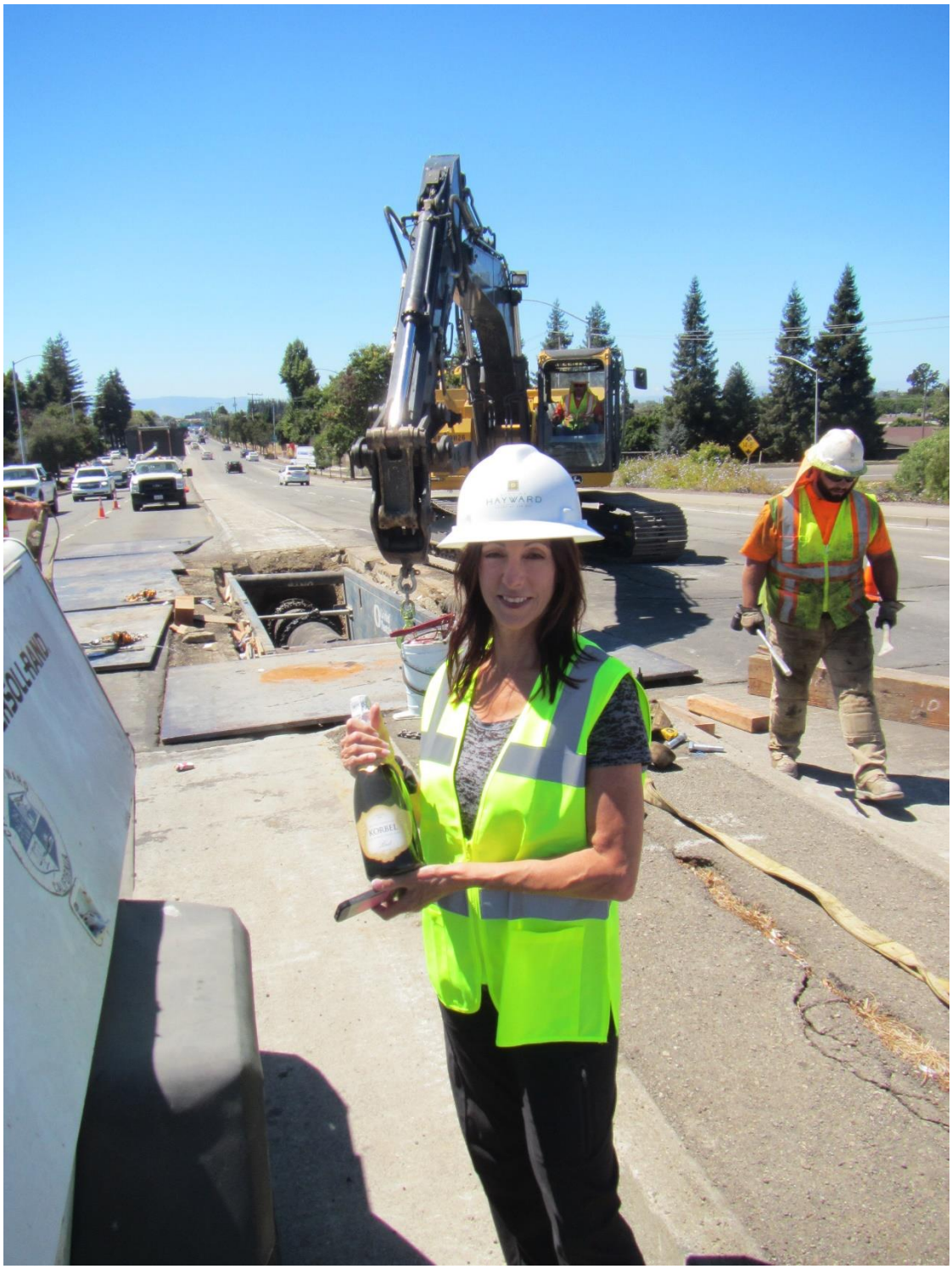
With a final check of the level on the flange of the tee, the east side of the project was tied in. The pipe still needed to be wrapped in plastic to further reduce corrosion, the reinforced concrete plugs in the end of the overpass still needed to be restored, and the trench obviously still had to backfilled, but the piping work on the east side of the project was done!

Staff was justifiably proud of their monumental achievement. Note, that on any given day there were only 3 to 5 people working on this project.

The lean and mean crew philosophy employed was both a function of intention efficient staffing levels and the fact that this project was effectively a very large side job. The City of Hayward, like most every other utility in the Bay Area, does not have “extra people” available to do this type of work. The same staff still had to repair leaks and breaks in our 350 miles of distribution system, had hydrants to repair and replace, had new water services to install in the numerous developments, installed meters, tested backflow devices, read meters, responded to customer service calls, operated and maintained the tanks, pressure reducing stations, and pump stations of the system, and all of the other responsibilities associated with operating a distribution system in one of the larger cities in the SF Bay Area. Some might say that we really couldn’t afford to dedicate scarce human resources to a project like this, but in actuality, we can’t afford not to do the this type of work because the problem solving skills and professional development that projects like this offer are absolutely priceless.

With east side tied in, work started on the final tie-in of the west side. The steel plates that made up the floor of the loading pit got removed as did some of the base rock fill. This additional space was needed to provide the crew with the clearance under the pipe need to tighten the many nuts and bolts that holding everything together. The collection system guys lent much needed assistance and their vac trucks to the effort throughout the project. They were an integral part of the team that made all of this possible.

In relative short order the west side transition coupling, valve and pipe spool were in place. Then came the final tie-in day as the EBAA was delivered to the jobsite, lowered into place, and bolted up. This was a very special day. The City's biggest and most complex in-house piping project was coming to an end.



Staff celebrated the completion of the Winton overpass pipe job! For the record, no alcohol was consumed, at least not during the work day, on final tie-in celebration day!

A project like this needed to be celebrated with a very quick christening. Thought was even put into making sure that no broken glass ended up in the trench. The bottle of champagne (technically domestic sparkling wine) was wrapped in a burlap bag that the gaskets for the pipe came in, tied to one of our polyester lifting strap, and officially swung by Barbara Sullivan, the Water Pollution Source Control Secretary that walked over to the jobsite on her lunch hour to christen the pipe!

The ends of the overpass were plugged, both sides were backfilled and the line was placed back into service. As is often the case with projects like this, the project wound down to a rather anti-climactic end. On the following day, focus already started to shift to other in-house projects that were starting to spool up. The next "first time in the History of Hayward" project that was spooling up involved isolating, bypass pumping, and cutting in a section of 27 inch diameter force main, and another involved adding a 16 inch blow-off line to a 36 inch inter-tie line that connects two regional water systems through the very pipe that feeds this Winton 30 inch cross town transmission main, but those projects are yet another story!