United Methodist Children Center Drain Project

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The United Methodist Children Center in San Luis Obispo is a preschool for young children in our community. Some of these students are the children of Cal Poly faculty and staff. The previous drain was not draining water properly and was uneven with bumps and dips that became a hazard for the children. Children would trip, fall, and hurt themselves on the drain. A team of two Cal Poly Construction Management students Ethan Lin and Andy Abdelnour worked together to estimate, design, coordinate, demolish, and construct a new section of the drain that would be safe for the students. The roles were divided on the project with both members working on aspects of the preconstruction and construction phases. Ethan did the estimate, owner communications, schedule, and safety plan. Andy drew the schematic sketch, organized material shipments, and coordinated with Cal Portland for the concrete truck. Both students contributed significantly to the completion of the construction aspect of the project. The construction included the demolition of the existing drain, formwork, rebar layout, dowel drilling, pouring concrete, and finishing the concrete. The project was successful in not only removing the tripping hazards but also improving the water flow of the drain. Now the space is safe for the children to walk on.

Key Words: Concrete, Demolition, Drain, Trip Hazards

Background
I knew after taking CM 460 that I was going to be interested in doing a project-based Senior Project. I also wanted to participate in a project that would benefit the San Luis Obispo community. I have enjoyed my time learning about construction management but being responsible for my own project seemed like a great learning opportunity. I went into Dan Knight's office to not only do my mandatory advising but also get some ideas for a senior project. Dan mentioned that there was potential projects at The United Methodist Childrens Center and that he could be my SME if I took on a project there. I then gave one of the staff there named Liz a call. She gave me a tour of the campus and showed me the area where kids were tripping (figure 1). This is where she said she would be happy if I took on the project of demolition and repouring the drain. In addition to that, we were to excavate the corner of the drain where there was a conflicting concrete drain going in the opposite direction and with no purpose. The goal was to extend the drain to the corner (figure 2). Being that this was the first construction project that I would be responsible for, I started off by doing a job walk of the site and taking pictures. I quickly realized that the demolition alone would take many hours of work and that I would want to do the project with a partner. That is when I decided to contact my friend who was also going to work for Largo Concrete, Andy Abdelnour. I thought he and I would both benefit from the experience of running our own concrete job.
Funding

The funding for this project was donated by the United Methodist Church. Cal Portland brought the concrete required for the job. They negotiated with us to sell us the concrete for half price. The concrete pumping services were donated by Paul’s Concrete Pumping. The project also received assistance from Cal Poly Construction Management majors, Henry Miller who runs Henry Miller Enterprises, and Sam McClintock. Dan Knight also contributed significantly to the concrete finishing at the end of the project.

Equipment and Procurement

For equipment, I started by writing down the equipment we could borrow from the SST building to save on costs. This included stakes, 2x4s, a rivet buster, a sludge hammer, batteries, a saw, shovels, levels, a wheel barrel, an extension cord, brooms, and lights. Andy and I agreed that we should rent a jackhammer from Home Depot so that he and I could perform demolition simultaneously. Another piece of equipment we needed to rent was a grinder to cut the rebar. An issue we had was that both the jackhammers and grinders were all rented out on the days we needed them, this required us to rent from the Home Depot in Lompoc, nearly an hour away. Another equipment aspect Dan made sure I was aware of was safety. This included getting face shields, ear plugs, gloves, and fencing. Andy was mainly in charge of our field coordination, but I’ll still touch on that in the next paragraph.

Scheduling and Coordination

I created a rough schedule in TouchPlan just so that we had an idea of the sequence and durations for our construction. I found it extremely challenging to understand just how much time each task would take. I broke the construction into four days. The first day would be a half day on Friday and would be solely dedicated to the demolition of the existing drain. We coordinated with Home Depot in San Luis Obispo to ship the 20ft rebar, 3ft rebar, concrete dobies, and fencing and had them ship the materials on our second day of work assuming our demolition would have been completed. Saturday would be an all-day demolition, concrete haul, and excavation day. Sunday was reserved for rebar and formwork. This day Andy and I had to be wary as we were not permitted to make loud noises during the Methodist church service hours from 10AM to 11:30 AM. Finally, Andy coordinated with Cal Portland and Paul’s Concrete Pumping for a 9 AM pour on Monday. While I was able to easily put this
into TouchPlan and make a basic schedule, Andy and I were both unsure how long each of the tasks would take two people with limited experience (figure 3).

Figure 3. TouchPlan Schedule

**Estimating**

Andy and I originally thought we were going to demolish and redo all 65ft of the drain. Andy created the schematic design and based on that I created the estimate. The estimating process was highly beneficial in understanding the cost and scope of the project. I split the concrete portion of the takeoff into two parts, the drain, and the curve. I estimated the total volume of concrete I was going to need and then added an extra cubic yard just in case. This came out to about 6 cubic yards. The next part was estimating the amount of rebar required. Referencing the schematic sketches, we decided we needed 4 rows of longitudinal rebar. Three rows in the slab and one in the 6”x8” curb. In the design, we also included horizontal rebar 2 feet O.C. and would drill dowels into the existing slab adjacent to the drain. The horizontal rebar would also be bent upwards to reinforce the curb. For formwork, we bought 30ft worth of 2x6 from Hayward Lumber.

**Construction**

**Day 1**

The first day was really a half day as Andy and I wanted to get more hours for our demolition portion of the project which we knew would be the most labor-intensive. The first step was gathering the materials. Andy and I got access to the SST building and grabbed equipment. After getting the jackhammer and grinder from Home Depot in Lompoc and gathering equipment from the SST, we were ready to begin construction. We started at 4:00 PM on that Friday and began by laying out our material. I had a key with access to all the rooms at the preschool and decided we would store our material and equipment in the room adjacent to the drain. After suiting up with our PPE, Andy and
I began the demolition of the existing curb. Andy and I rotated using the rented jackhammer and the rivet buster. This is where we faced some challenges. First, the jackhammer and rivet buster were both heavy and strained on the lower back making the task tiresome. Second, the existing drain had wire mesh inside of it making removing the concrete more challenging. The final challenge was that both chippers would get stuck inside the slab and with the lack of experience between Andy and me the demolition process became extremely tedious. After about twenty minutes of work, we realized that we should change the drill bit on the jackhammer as the one we were using was more for crushing rocks instead of breaking slabs. While this did make our work more efficient, we were only able to demolish about 15ft of the slab in three hours. At this point, Andy and I realized we would not be able to demolish the entire 65ft of the drain. This not only would require much more time, but it would also require us temporarily remove an existing fence that was bolded into the drain. We then gave Dan Knight a call and explained the situation. We agreed that the best course of action was just to demolish the first 25ft of the drain and curb and stopped just before the fence. This would take care of the tripping hazards and give us the time to be prepared for the concrete coming on Monday.

Figure 4. Chipping the slab

Day 2

Saturday started bright and early at 7 AM. We continued chipping and breaking up the slab. With all this demolition, we needed a place to pile the broken concrete. The wire mesh connecting all the concrete together made it difficult to get pieces of concrete to pile up, so we decided to use the grinder and cut the wire mesh connections. We also had to chip the pieces down to easier sizes to move. After doing this, we created a pile of large concrete pieces in the back corner of the drain (figure 6). Once we got close to the fence, Andy used the grinder to cut a straight line indicating where we would stop the demolition. By 10 AM, demolition was complete, but we have tons of concrete to haul out. The only way to get the concrete out was by handpicking the pieces, throwing them into a wheel barrel, and walking it up the walkway to the parking lot above (figure 8). For smaller pieces, we used shovels to scoop the gravel and dirt into buckets and walked them up the stairs. A challenge we had
to face was drilling out and cutting the wire mesh out of the concrete blocks as we were not permitted to dump metal with our concrete. Separating metal from the concrete took lots of time and effort. We then loaded the large pieces into the back of a pickup truck using a tarp to line the bed. The buckets full of the finer pieces were then loaded on top. We would then drive the material to the concrete dump on campus and dump the material. Andy and I repeated this laborious process about twenty times.

![Figure 5. Start of project](image1)
![Figure 6. Demolition Progress](image2)
![Figure 7. Rebar cutting](image3)

During one of our trips, we met a freshman named Sam McClintock. We asked him if we wanted to help with our project and he agreed. The next step was to bend and cut the rebar. We used a bon tool to bend the 3ft pieces of rebar. We made sure to bend the rebar in a way that there would be about 8 in vertical and 8 in horizontal. This would make sure the rebar did not poke out of the 12 in tall curb while sitting on a dobie. After making the bends, we used the grinder to cut the rebar (figure 7). With the rebar cut, Andy and I noticed we had created a huge mess. A sign of a good job site is also a clean one so we made sure to sweep excess dirt off of the walkway and wet the hole to help compact the soil and limit the dust. Another precaution we took was putting all of our equipment in one of the classrooms and locking it up before we left.

![Figure 8. Concrete Haul Process](image4)

**Day 3**

We started at 7 AM again started by preparing the back corner. This existing corner was still dirt, so we had to excavate it to the same level as the rest of the pit. To do this, Andy used a rivet buster to loosen up the soil while I
used a shovel to scoop the loose dirt into buckets. This was more work than anticipated because the soil was quite compacted. After loading the buckets, we spent a few trips hauling the dirt off-site.

For the formwork, we needed three pieces of 8ft 2x6 lumber. We started by lining up a string line to the existing curb and lined up to the end of where the new curb would be poured. We lined the string about 6in away from the existing wood backing. Then we laid down our first formboard on the existing drain and handheld the board level with the string line. While one of us held the formboard, the other nailed the stakes to the board. For the nails, we used duplex nails to make taking them out easier. We repeated this process until we formed the entire curb (figure 11). To nail the forms together, we used a toenail on the outside face of the form as well as the top of the form. To support the stakes and prevent them from moving, we put nails into the existing backing and used tie wire to tie the stakes to the backing. This helped reinforce the position of the forms.

Once the formwork was complete, we drilled the dowels. We decided to drill the dowels about every 2ft in the horizontal direction and for the vertical rebar we decided to only have 2 rows instead of the planned 3 while still having an extra row inside the curb. To drill the dowels, we used a rotary hammer. At first, we were using a 12in drill bit, but attached to the rotary drill there was no way to pull the drill out of the hole without bumping into the formwork. So we decided to use a 6in drill bit so that we could easily pull it out. After drilling the holes, we put the rebar in the holes and here we made the mistake of drilling 1/2in holes for 3/8in rebar (figure 10). This meant that the rebar would not gain tension. We then tied the bent rebar to the concrete dobies and set them in line with the dowels. To make our rebar connections, used tie wire. For the longitudinal rebar, we placed dobies every 2ft for support. We also tied each of the horizontal rows of rebar to the 2 longitudinal rows (figure 9). One of the challenges of tie wire was learning how to use it, I had no prior experience for it took some time to get the hang of the process. After working a nearly 12-hour day, we were almost ready for the concrete truck so we saved the last bit of work for the next morning.
Day 4

On Presidents Day, I arrived with Andy and Sam, and we had to finish the rebar and prep the hole for Cal Portland and Paul’s Concrete Pumping who were going to arrive around 9 AM. We realized that there were still some uneven points and pieces of old concrete. We divided the work up; I would dig out any bumps in the soil while Sam and Andy finished the last rebar ties. At this point, we were in need of assistance and that is when Henry Miller came and brought an extra set of hands to the site. Then Dan Knight arrived with his children and finishing tools. They set up the plastic sheeting to cover Schweitzer Hall as protection from any concrete splashing. Dan also assisted in creating a screed out of our spare 2x6s with a curved bottom to help us get a sloped concrete finish.

Paul’s concrete company arrived first and set up the pump. The drain is located on the bottom of the hill next to the church parking lot (figure 12). We then carried the pump down the stairs for access to the pit. Soon after, Cal Portland arrived in a mobile concrete mixer. Paul then used the pump to fill the pit. We also filled the wheel barrel with concrete to have extra for the finishing process. Once the forms and pit were full, the finishing process began.

The finishing process was another part of the process I was highly unfamiliar with. Henry Miller and Dan Knight were the most experienced so they taught us and led the way. First, we removed any excess concrete sitting above the forms using a margin trowel. Henry also went over the forms with a 3in finishing trowel to begin shaping the concrete. Dan showed us how to use the screed to go across the drain and begin forming the shape. I followed along using a level to make sure we achieved a slope for the water to run. All of us then gained experience using magnesium floats to shape the drain. For the edges, we used the edger tools to create that line separation of the new drain from the existing walkway. As the concrete began to dry, we used brushes and scrapers to remove excess concrete on the edges and continued to use floats to keep the shape and smooth finish of the drain. Once the concrete had dried enough, we removed the forms and began the finishing process. For this, we used finishing trowels and through time and repetition began to create a smooth finished surface on the drain (figure 13). For the curb finish, Henry used our extra concrete in the wheel barrel to apply a smooth coat of concrete on the top and outside face of the curb. Once the curb and drain were solidifying, we tested the slope. Thankfully, the water we poured ran down and off the drain meaning we had succeeded in sloping the concrete. Once we established the drain was sloped correctly and the concrete face had been finished and dried, the last thing to do was the broom finish. Dan used a broom and brushed the surface of the drain and curb to give it texture. Doing this will allow the kids who run on it to have traction and reduce the chance of slipping. We then washed the tools, swept the site, and used a blower to clear the dust. For the extra concrete, Andy and I placed them into piles of plastic wrap and waited for them to dry before dumping them the next morning. A few weeks later, Andy and I added quickcrete to finish the transition from the existing walkway to the new drain to smooth out any remaining trip hazards.
Conclusion

The United Methodist Children Center was pleased with our work, and it is now the only section of drain that currently drains water properly. This project was the first step to creating a safer environment for the children. I am personally very thankful for Henry Miller whom the day before work started told us he could assist us in finishing and Sam McClintock who I am also thankful for Paul who assisted in pumping the concrete. I also appreciate Dan Knight for his assistance in the thought process behind the project, guidance as the SME, and help with the finish of the job. Andy and I were encouraged to hear back from Liz that the drain was to her liking and functioning properly. One of the teachers at the school gave us cookies and potato chips while we worked. Overall, the staff's patience, kindness, and generosity made the project work environment a positive place. It feels rewarding to be a part of a project that has helped the United Methodist Childrens Center and made it a safer place.