

#### **Category 4 – Best Building Project**

The historic Denver Union Station redevelopment created a new energy in Denver, Colorado. By bridging the history of the old Denver with the new exciting developments, progress now flourishes on this iconic site. Colorado Hardscapes had the honor of being part of the historical redevelopment. Colorado Hardscapes worked with Kiewit for the redevelopment project. The most exciting part Colorado Hardscapes had the opportunity to part of is the grand water feature which graces the front of the historic building. This water feature activates the new plaza space where Union Station is once again a hub to the City. The sequenced water feature along Wynkoop Street dances with the hustle and bustle of the city. Carefully crafted by Colorado Hardscapes, many of the components and details of the feature will never be seen again and are buried beneath the plaza. Colorado Hardscapes started construction on the feature in 2012 and celebrated with Denver in July of 2014 when it officially opened to the public. Colorado Hardscapes is honored to be part of the team to make this water feature come to life and to be part of such a historical project which will be enjoyed for decades to come.

People who know Colorado Hardscapes, typically know them for their decorative concrete, not water features. So, when walking through the new plaza in front of the historic Denver Union Station Building, they may be surprised to discover the elaborate water feature dancing in the plaza is a masterpiece installed by this decorative concrete company. Colorado Hardscapes added water features to their services about a decade ago because they discovered a need for a specialty water feature contractor to provide turnkey features. General contractors and owners desired to have one contractor to take ownership of the construction of such complex features. Water feature construction includes everything from plumbing, electricity, concrete, and everything in between, and is most successful when harnessed by one contractor. Otherwise, errors, hidden costs, and malfunctions tend to arise. Colorado Hardscapes' water feature portfolio grew rapidly and now contains the grand water feature in front of the historic Union Station.

The water feature took years to plan and construct. Colorado Hardscapes first met with Kiewit and the design team in September of 2008 to discuss ideas and budgets. Since then, the plans evolved and became a reality. In 2011, Kiewit contracted Colorado Hardscapes to place concrete

in the bus box beneath all of the terrazzo paving. The bus box is the underground bus terminal that runs perpendicular to the Historic Union Station. The access and control standards were tricky underground due to the site limitations and the terrazzo sub-slab requirements. However, the most beneficial part of placing the concrete in the bus barn was to learn the complexities of the site and the hoops required to jump through in order to please the ownership group and the city.

Working on site at the Union Station redevelopment posed its own challenges. The redevelopment group required strict safety and quality measures to be taken on all work performed on-site. This meant daily and weekly meetings with Kiewit and the team as well as an extensive amount of paperwork and documentation. The crew attended daily toolbox meetings each morning to go over the tasks for day and to discussed the risks. Kiewit's safety crew regularly observed the work and the working condition to ensure safe working conditions. They also had a weekly safety meeting with Kiewit to discuss any near misses or accidents and a monthly safety meeting with everyone working on site. Safety was an important part of the project and resulted in safe working conditions.

Because of the project's DBE goals, Colorado Hardscapes brought on a subcontractor for some of the earthwork and underground concrete to help achieve at least 20% DBE for the water feature. Colorado Hardscapes also ensured all parts and pieces of the water feature were built and assembled in America.

Toward the end of the concrete paving in the bus box, Kiewit wrote a change order to Colorado Hardscapes' contract for the water feature in 2012. While beautiful on the surface, much of what makes the feature unique is buried underground. With over 3700 lineal feet of piping, 1700 cubic yards of flow fill, a 12-foot wide by 50-foot long underground vault, and 92 individually sequenced nozzles with lights, the feature took extraordinary time and care to perfect. Kiewit had a BIM model of the water feature and all of the pipes and surrounding pipes. This helped eliminate some confusion early on and helped solve conflicts prior to construction.

Access was tricky for the earthwork. Because of the underground requirements for the water

feature, the area needed to be excavated at least 5-6' deep for the water feature, and 10 feet deep at the vault. They often stored material on other locations on the development site and hauled most of it off-site due to space limitations. With limited site access and storage, this required patience and coordination with Kiewit, other subcontractors, and a lot of pre-planning efforts to help it go smoothly.

The majority of the underground work took place in the spring. Unfortunately, Colorado's weather in the spring makes water feature construction challenging. The fluctuating temperatures throughout the days and nights caused the pipes to expand and contract. At times when the pipes expanded, audible sounds came from the pipes. Some mornings it sounded like an orchestra warming up for a performance. The crews also constantly drained the lines for fear of freezing in many of the cold snowy days. The design required the final elevation of each nozzle canister to be set within a 1/32 of an inch tolerance. So every movement in the pipes required fine-tuning and re-adjusting. The superintendent of Colorado Hardscapes' water feature crew came up with an innovative solution. He installed a base slab concrete platform. This helped create a stable platform to work, secure the pipes and drains, and help maintain elevations. They utilized a survey crew to layout the points and elevations for the cans and drains. Then, Colorado Hardscapes used all-thread to set the drains and cans to the proper elevation and location, and welded stabilizing cross braces to the all-thread. Colorado Hardscapes utilized the survey crew countless times to verify correct location and elevation for the drains and cans and the all-thread allowed them to adjust the elevations as needed.

The crew implemented another wise construction technique the crew used to help secure the canisters. After they placed, tested, and readjusted the pipes and canisters, they installed flow fill (a low strength concrete) in lifts around all of the pipes. This technique secured the pipes and canisters locations and elevations. There is approximately 4 feet of flow fill from the base platform slab to the waterproofed layer beneath the pavers. The typical cross section of this water feature is:

- 6 inches of a concrete platform
- 4 feet of flow fill encasing the pipes and drains
- 6 inches of waterproofed concrete which also encases each nozzle

- And on the top layer: mortar set granite pavers (installed by others)

The crews tested and re-tested all of the plumbing multiple times to ensure there were no leaks. The vault measured 12 feet wide by 50 feet long, and 9 feet tall. Water storage and circulation took up 23 of the 50 feet. Mechanical control equipment such as the UV sanitizer, two pumps, three sand filters, a 10-foot long stainless steel manifold and the control panels took up the remaining 27 feet. The pumps circulate 1,400 gallons per minute. The water drains back to the 10,000-gallon water vault next to the equipment vault. The pumps circulate the water through an elaborate filtering system, which filters the water to a safe condition and recycles it back through the water feature.

Colorado Hardscapes worked with Commercial Aquatic Engineering, the water feature designer and programmer, to ensure the feature ran as intended. Commercial Aquatic Engineering inspected the feature several times and worked closely with Colorado Hardscapes' crew. Ed Benck, owner of Commercial Aquatic Engineering, spoke of Colorado Hardscapes' foreman with great praise, "I spent a week with Doug at the site in early June when we started it up for the first time. It was fun to work with Doug- he a stickler for doing things the right way which I love!" Commercial Aquatic Engineering did the design, start-up and programming for the feature.

Walking through downtown Denver today almost always requires a walk by the historic Union Station. In front of this city hub, children and adults play in the splashing water, people dine on the new restaurant patios, and people gather to meet friends and colleagues. The water feature and surrounding developments activate the space once more. Denver Union Station is iconic in the revitalization of this district of downtown. Colorado Hardscapes takes pride in being part of such a historical event and presenting the city with the new water feature as a welcome home feature.









