

Seattle City Light - Vault 22V-4 Repair and Transformer Installation 117 S. Main Street, Seattle

Project Location

The proposed project is in the street right-of-way within the sidewalk/areaway in front (north) of 117 S. Main Street. Per the King County Assessor's office, the Union Trust Annex (APN 524780-0365) is located at this address. Built in 1902, it is a four-story masonry (brick and stone) building (see maps 1 and 2, photos 1-4). Both the building and the vault are located within the City of Seattle's Pioneer Square Preservation District (PSPD). Seattle City Light (City Light) owns the vault.

Description of Proposed Work

City Light is proposing the installation of a new transformer into Vault 22V-4 to meet increased demand for power in the area and maintain system connectivity, reliability, and redundancy.

Power (or electricity) is produced by City Light's hydroelectric project as exemplified by the Skagit River Hydroelectric Project (see figure 1). Generators in the powerhouses produce electricity which is transmitted to Seattle via high voltage transmission lines to receiving substations. From there it is routed to distribution substations within the City and then to industrial, commercial, and residential customers using a combination of overhead transmission lines of varying voltages (e.g., 230kV, 115kV, 26kV, etc.); above ground transformers of varying sizes that are either pole mounted, in equipment cabinets, or within buildings; and underground cables and conduits to above noted transformers or to those located within underground vaults. Transformers are a passive electrical component that transfers electrical energy from one electrical circuit (path) to another or to multiple circuits. Vaults, typically of concrete, are underground spaces that provide access to public utility equipment and is accessible from a street, or sidewalk. Multiple vaults in an area allow for reliability and redundancy should any path or connection fail (e.g., another pathway exists to re-route power to customers). The installation of a transformer in Vault 22V-4 supports this function. Vault 22V-4 is also the only one within the area that does not have a transformer.

Installing a transformer into a vault, like 22V-4, typically requires heavy machinery for lifting/removing the vault hatch cover (e.g., a single panel or multiple panels) to allow enough space and clearance for work related activities. In cases of severe deterioration, or load restrictions such as the Seattle Department of Transportation's (SDOT) policy issued in 2019 which banned vehicles exceeding 10,000 pounds in weight from roadways adjacent to the areaways in Pioneer Square (see: <https://www.seattletimes.com/seattle-news/transportation/delivery-trucks-to-be-banished-from-fragile-curbsides-of-pioneer-square/>), the demolition and removal of a vault hatch cover is done on-site with the cover broken into smaller pieces for removal without the use of heavy equipment. A replacement vault hatch cover with multiple panels or a single panel is then installed when electrical work is completed. The transformer (e.g., a single component; or multiple pieces that are reassembled in the vault) is then filled with oil, connected to the electrical grid, and brought online.

By design, transformers generate heat and ventilation is needed to dissipate that heat to prevent overheating and failure. Ventilation adjustments to the vault hatch cover are done at this time to accommodate the new transformer. This typically involves using a steel grate hatch cover (e.g., a single grate, or multiple grates) since the steel along with the concrete are extremely fire-resistant materials which can also accommodate large structural loads (e.g., static – building materials; live – people or moving vehicles; and/or environmental – seismic).

Existing Conditions for Vault 22V-4

An inspection of Vault 22V-4 in 2022 observed that the exterior and interior steel framing and concrete hatch cover were showing signs of significant deterioration since their installation in 1977 (see photos 5-10). The outer surface of the cover (e.g., the "sidewalk" surface) is rusted, spalling, and missing pieces of concrete along with cracked and/or missing round glass pavers. Inside the vault, substantial rust was visible on the steel columns, beams, and ceiling decking. The conclusion was that emergency temporary wood supports would be needed in the vault; followed by new permanent steel structural framing, along with a new vault hatch cover before the transformer was installed. Further observation noted the lack of true prisms in the hatch cover and that the purple hued round glass pavers were 2-inches in diameter embedded on the surface and arranged in three rectangular groupings. Within each, the glass paver pattern consisted of 17 rows, alternating between 6 and 5 pavers per row. This treatment did not allow any light into the vault. Due to the clearances needed to install new steel beams and columns within the vault, the condition of the existing single concrete panel with pavers cover, and ventilation requirements for the new transformer, the existing vault hatch cover cannot be reused. A new vault hatch cover will be manufactured and designed as a three-panel hatch cover instead of a single panel due to the previously noted weight restrictions.

In early January 2023, City Light filed an emergency permit application with SDOT to do the temporary improvements (e.g., wood post supports/shoring) and permanent steel reinforcement improvements since the City Light vault is within SDOT's right-of-way (e.g., street and areaways). The original and revised scope of work (as submitted to the Pioneer Square Preservation Board (PSPB) and PSPD Coordinator in January, May, and July 2023, see figures 2-5) proposed the following:

- Demolish the existing vault hatch cover on-site and remove debris.
- Remove portions of the steel beams within the vault.
- Install new steel beams where they have been removed, and new columns within the vault adjacent to the existing columns (e.g., to be left in place) and fasten the new into the concrete vault floor and wall surfaces.
- Install a transformer in the vault.
- Install a vault hatch cover composed of slip resistant steel grate panels (3) to provide ventilation and fire resistance.
- Avoid any work on or impacts to the brick arches in the southern side of the vault.
- Avoid any work on the sidewalk adjacent to the vault hatch opening and/or sidewalk curbs.

Based on feedback from the PSPB and PSPD Coordinator (e.g., January, May, July, and August 2023), City Light documented the existing glass paver conditions and further researched the vault to determine if there was additional information regarding the existing embedded glass pavers. The King County Assessor's Office 1936 aerial photo, which when compared to their 2021 aerial, confirmed that S. Main Street was in the same location and had not been widened over time (see figure 6). A search through City Light files and drawing vault found a few documents, among them: a drawing (by an external source) of what appears to be the rehabilitation of the Union Trust Annex, dated November 1977 (see figure 7); an SCL survey form completed in 2001 noting the conditions within the vault at that time (see figure 8); and two drawings done in-house by City Light staff for this area dating from c. 2004 (estimated date of last revision) and 2022 (see figures 9 and 10, respectively). Of note is the 1977 drawing (figure 7), which indicates "install prism lite replicas in new hatch cover," which appears supported by the existing hatch cover – though, they are not true prisms (e.g., glass prisms are set into sidewalks to reflect natural light from above into basement spaces). The current vault hatch cover has round glass pavers that never penetrated the depth/thickness

of the concrete. At this time, it is unclear whether the 1977 "prism lite replicas" were mitigation for the loss of true prisms at the vault location; or replaced previously installed round glass pavers there; or were added to try and match the adjacent/east panel which appears to have the same embedded round glass pavers albeit a slightly larger dimension; or were salvaged from elsewhere and used at this location.

Existing Vault Hatch Cover

The existing cover as seen in figure 11 (outlined in red) and figure 13 (detail view of figure 11) has round glass pavers with a diameter of 2 inches. The east panel (outlined in blue in figure 11, detail view in figure 12) has round glass pavers that are 2-3/8 inches in diameter. Figure 14 is a partial view of the blue outlined area in figure 11, showing the dimensions of the panel, spacing between pavers and the existing pattern.

Replacement Vault Hatch Cover Options - Configurations and Materials

City Light investigated the following replacement options:

- 1) Replace with a three-panel concrete hatch cover (e.g., no glass pavers, no prisms, and use the existing ladder access opening with the steel grate for ventilation).
- 2) Replace with a three-panel concrete hatch cover with true prisms (e.g., allowing light into the vault, matching other true lite prisms located elsewhere in the City, and use the existing ladder access opening with the steel grate for ventilation).
- 3) Replace with a three-panel concrete hatch cover with surface embedded round glass pavers (e.g., match what was done in 1977 and use the existing ladder access steel grate for ventilation).
- 4) Replace with a hybrid three-panel hatch cover (e.g., one-third concrete with round glass pavers embedded on the surface to match existing and two-thirds steel grate for ventilation plus the existing ladder access opening's steel grate for ventilation).
- 5) Replace with a hybrid three-panel hatch cover (e.g., one-third concrete with true prisms and two-thirds steel grate for ventilation, plus the existing ladder access opening's steel grate for ventilation).
- 6) Replace with an all-steel three-panel grate hatch cover (e.g., as originally proposed to the PSPD, consisting of galvanized steel grating with tight spacing of serrated bars for slip resistance.)
- 7) Leave as-is.

Of the above, Option 4 rose to the top since it would accommodate City Light's needs (e.g., increase ventilation since the size of the existing ladder access grate cover was insufficient, and would also provide fire resistance). This option could also provide for an appearance close to the existing concrete vault hatch cover with the surface embedded glass pavers, albeit reduced to one-third of what it was.

Of the other options, many did not provide the necessary ventilation for the new transformer or potentially promoted a false sense of history at the vault location (see summary below):

- Option 1 would not allow for adequate ventilation and would not appear to meet the PSPD rules (e.g., "XVII Sidewalk Treatment, B. Sidewalk Prism Lights - The glass sidewalk prism lights are one of the unique elements in the District, and their retention is required. The Board maintains the right to require applicants for sidewalk repair to repair sidewalk prism light panels and individual prism lights that have deteriorated into a state of disrepair. (7/99).")
- Option 2 would also not allow for adequate ventilation. Prisms would also not appear to match what is adjacent (to the east) nor existing (e.g., surface embedded round glass pavers). While the use of prisms would be a nod back to a historic era, it is unclear if prisms were at that location pre-1977 and could create a false sense of historical development (see The Secretary of The Interior's Standards for Rehabilitation, #3)

- Option 3 would also not allow for sufficient ventilation but would match the existing hatch cover.
- Option 5 would allow for adequate ventilation. However, the use of prisms here would also not appear to match the existing embedded round glass pavers nor those adjacent to the east. Prisms here could also promote a false sense of historical development since it is currently unknown whether there were prisms at this location pre-1977.
- Option 6 while meeting ventilation requirements and fire resistance, it would not appear to meet the PSPD's rules (e.g., XVII Sidewalk Treatment, B. Sidewalk Prism Lights...et al).
- Option 7 was not acceptable to City Light. Retrofitting the vault as soon as possible is a safety and functionality priority.

Vault Hatch Configuration and Appearance for SCL Preferred Option 4

As noted earlier, the proposed replacement is a hybrid three-panel vault hatch cover. This would have two-thirds steel grate for ventilation and one-third concrete with TBD round glass pavers embedded on the surface to match the existing as close as possible from the options available from CircleRedmont (CR) and with input from the PSPB. The concrete hatch cover with round glass pavers would be manufactured by CR and shipped to City Light. The steel grates are supplied to City Light from another manufacturer (see figures 15 and 16). All three panels (e.g., concrete with glass pavers, and two steel grates) would be installed by City Light in the configuration noted in figure 17.

Options for Glass Pavers—Color, Dimensions, and Shapes

City Light researched glass pavers for Option 4 and found CR Glass Obsession Pavers (see figures 18 and 19) for use in concrete applications. There are three options for installation in a concrete surface and they are, summarized below:

- 1) A 4.5-inch diameter round clear or sandblasted glass paver (CR 4.5R) (see CR Product Brochure excerpt in figure 18). While almost double the size of the existing round glass pavers, the 4.5" pavers can be placed on the surface of the concrete panel as noted in figure 19. While this would match the shape, it would not match the size of the existing round glass pavers, and the pattern would be less pronounced. Figure 20 from CR shows the 4.5" glass paver (qty. 28) placement and the pattern created within the concrete panel;
- 2) A 3-inch diameter round clear glass paver (see figure 21). City Light contacted CR directly (early October 2023) and learned that they had created a mold for a 3" diameter glass paver (clear only) for placement in a concrete base. CR anticipated availability by the end of the year 2023 and thus was not included in their 2023 catalog. Figure 21 is CR's drawing showing the 3" diameter glass pavers (qty. 61), placement and the pattern created within the concrete panel. Figure 17 shows the proposed appearance and dimensions of the 2 steel grates and the CR's 3" pavers option in the concrete panel; and
- 3) A 2.75-inch square paver (CR14 SBT) (see CR Product Brochure excerpt in figure 18). This would approximately match the size/scale but not the shape of the existing round glass pavers. Figure 22 from CR shows it as a 2-3/8-inch square glass paver (qty. 45), along with placement and pattern created within the concrete panel. It also notes that a glass paver in lavender is available.

City Light is open to the above options.

The following pages include – Figures, Maps, and Photos:

- Figures Pages 6 – 23
- Maps Page 24
- Photos Pages 25 – 28

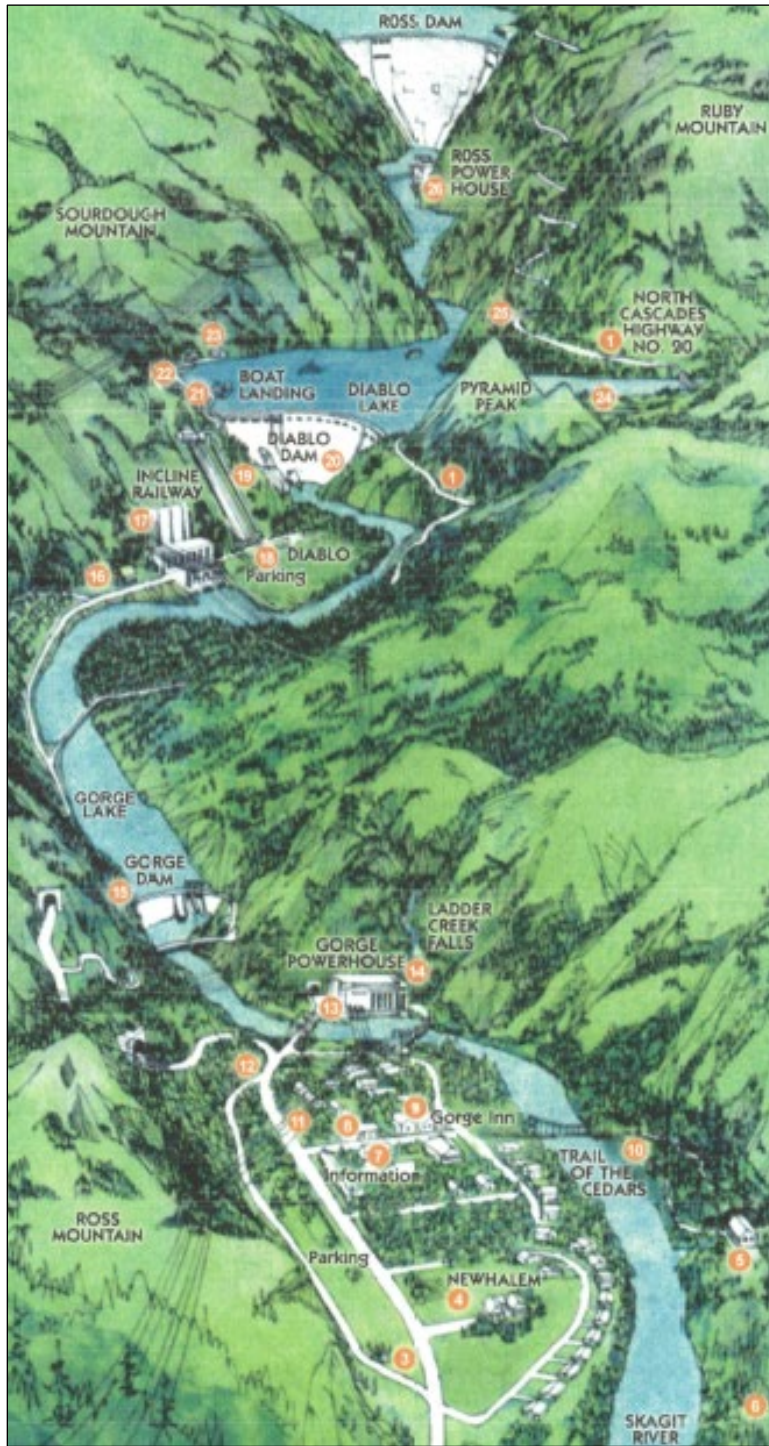


Figure 1 – Seattle City Light’s Skagit River Hydroelectric Project (Source: City Light Collection, 2023.)

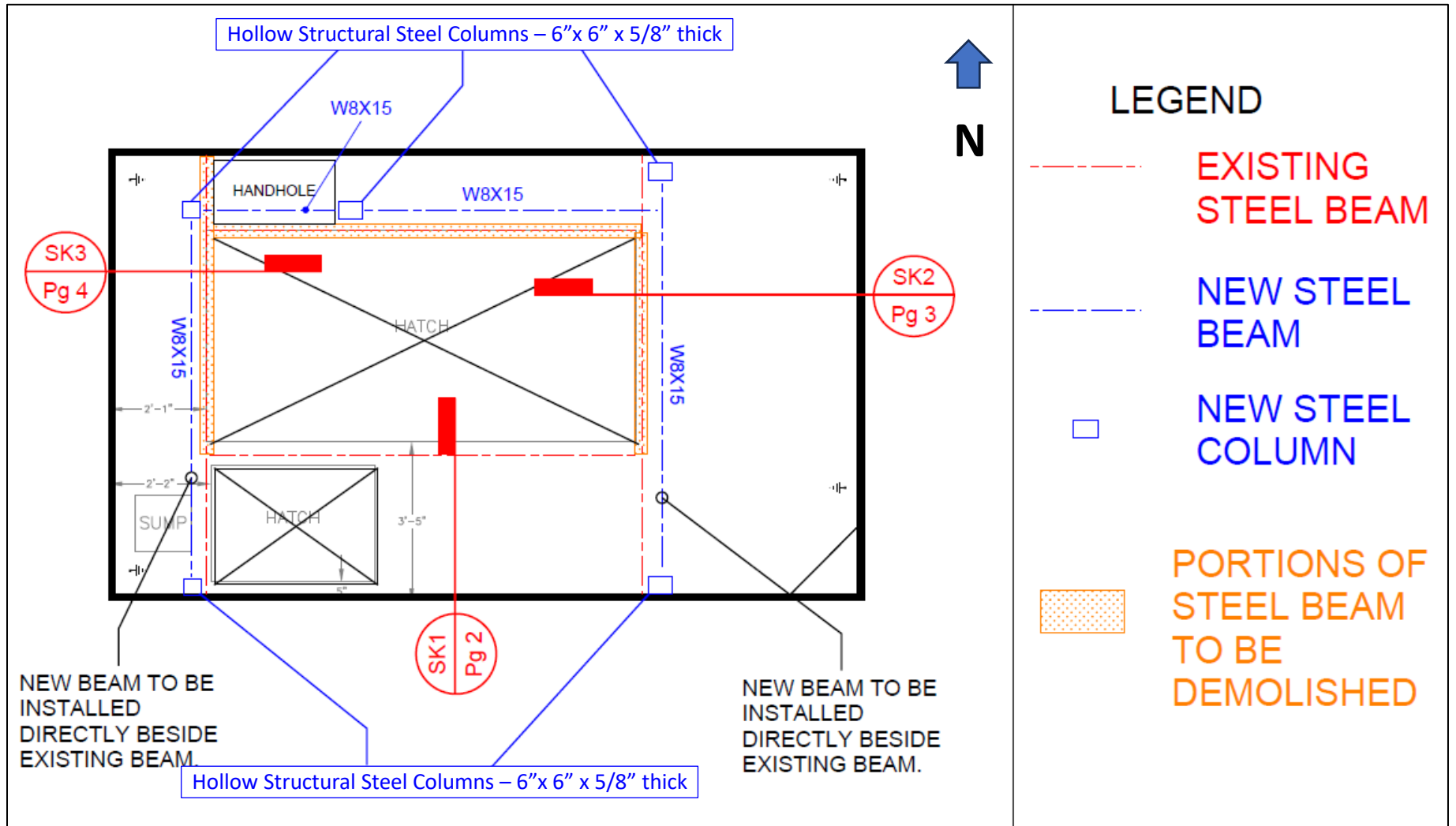


Figure 2 – Plan of Vault V-4 noting proposed changes. Detail sketches for SK1, SK2, and SK3 are included in the figures that follow. (Source: P. Wang, Seattle City Light, 2023.)

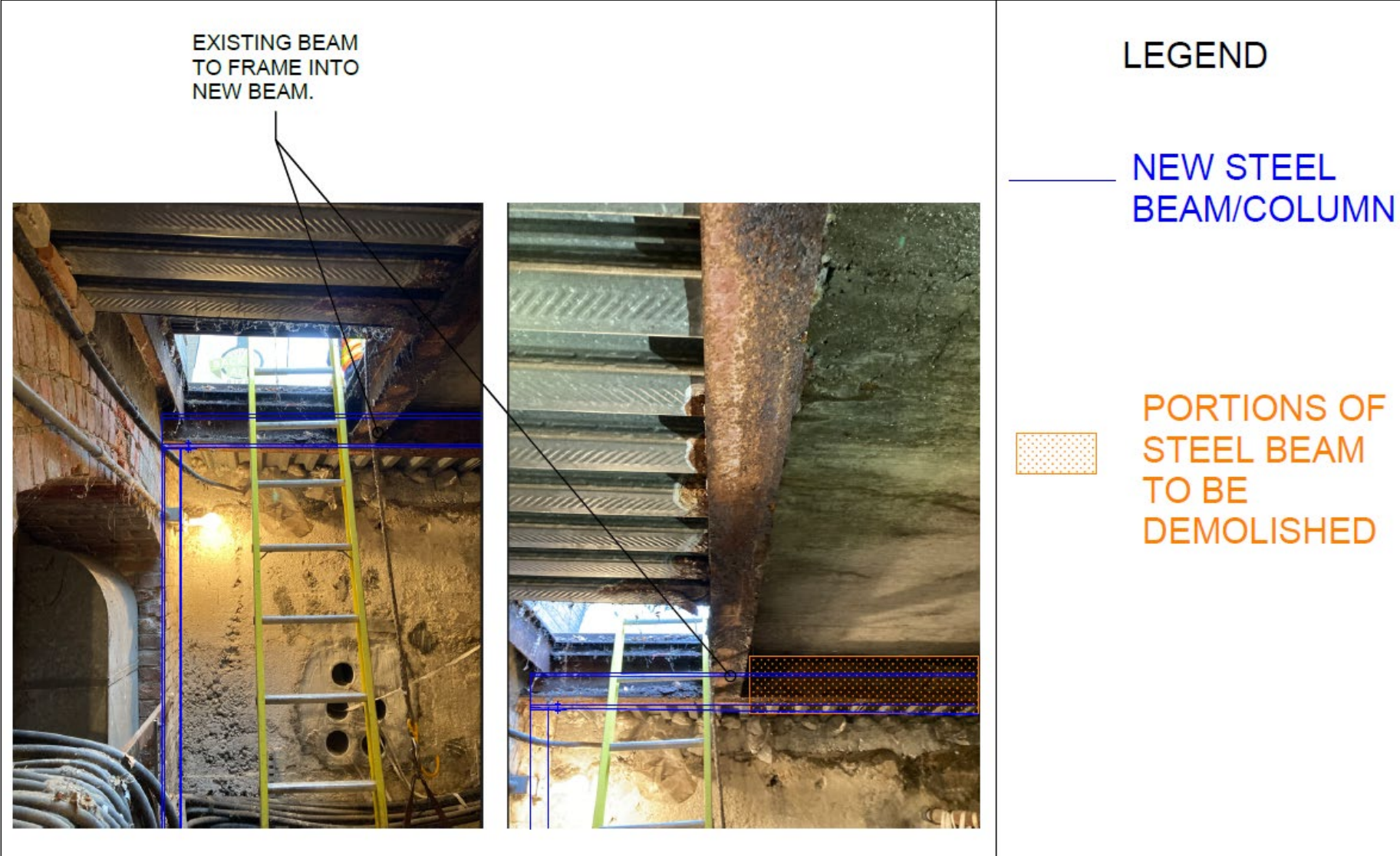


Figure 3 – Proposed placement of steel columns and beams within the vault using photos #5 and #6 as background. This is SK1 from figure 2. (Source: Seattle City Light, 2023.)

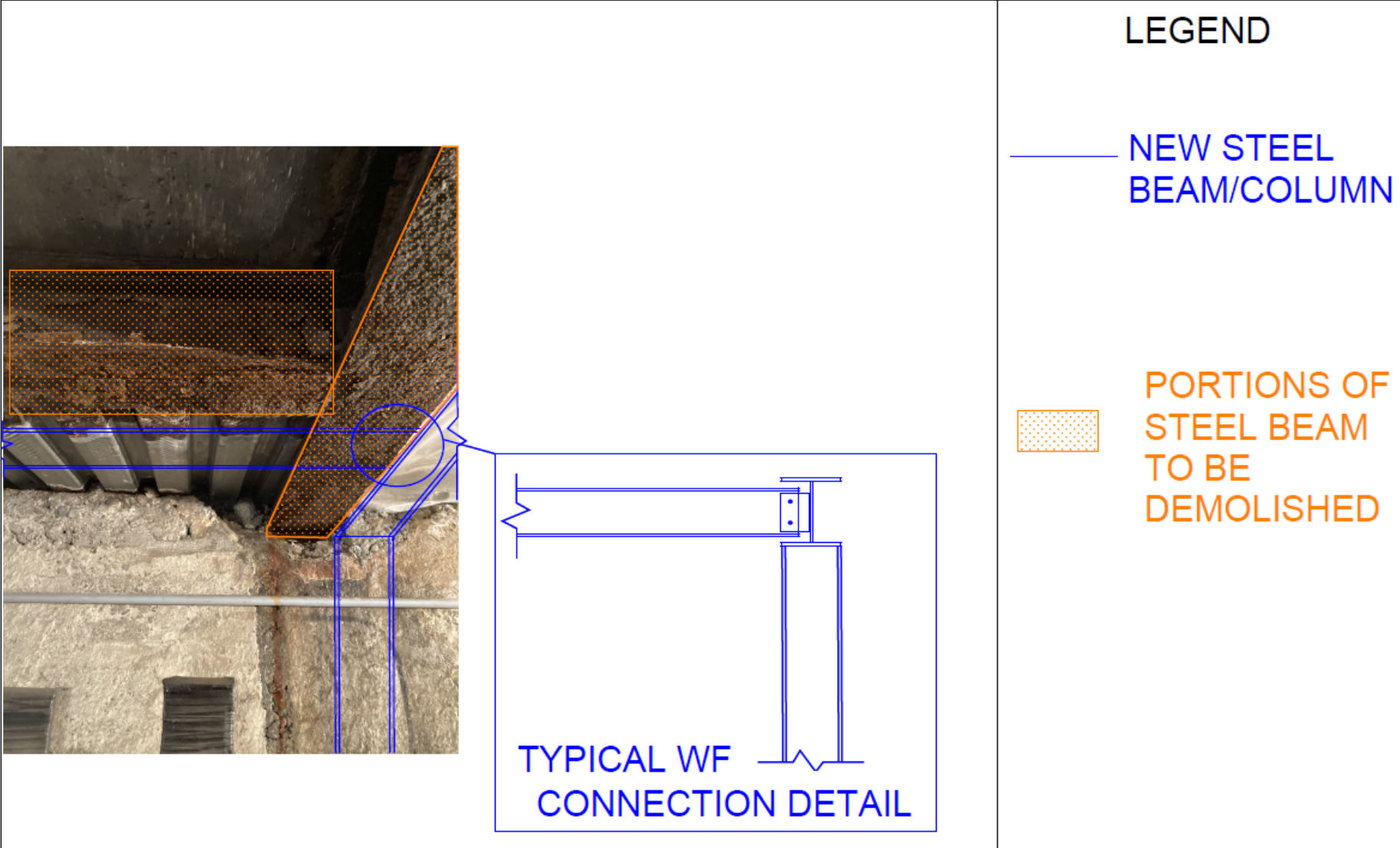


Figure 4 – Proposed installation using Photo #7 as background. This is SK2 from figure 2.
 (Source: Seattle City Light, 2023.)

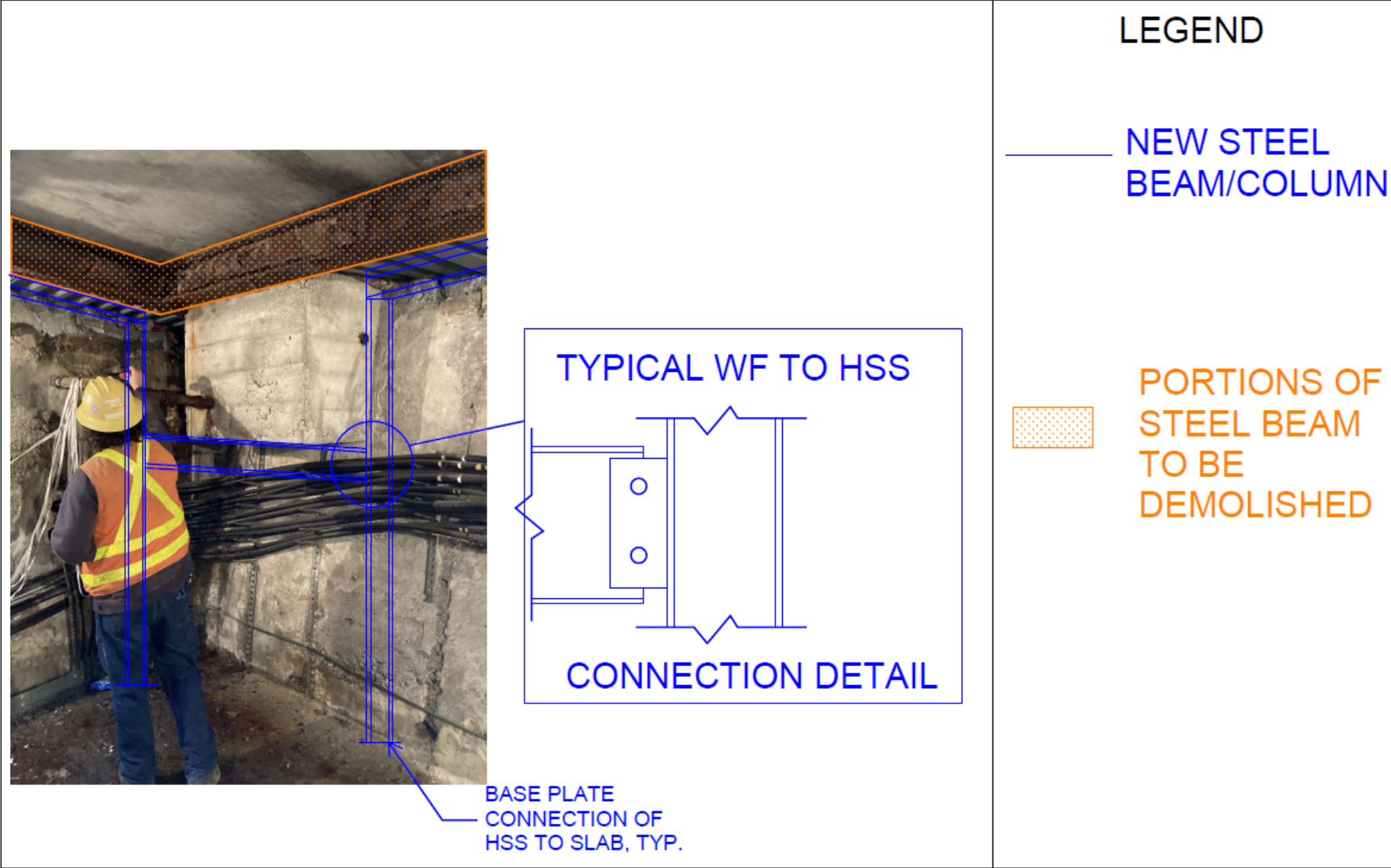


Figure 5 – Proposed installation using Photo #8 as background. This is SK3 from figure 2.
 (Source: Seattle City Light, 2023.)

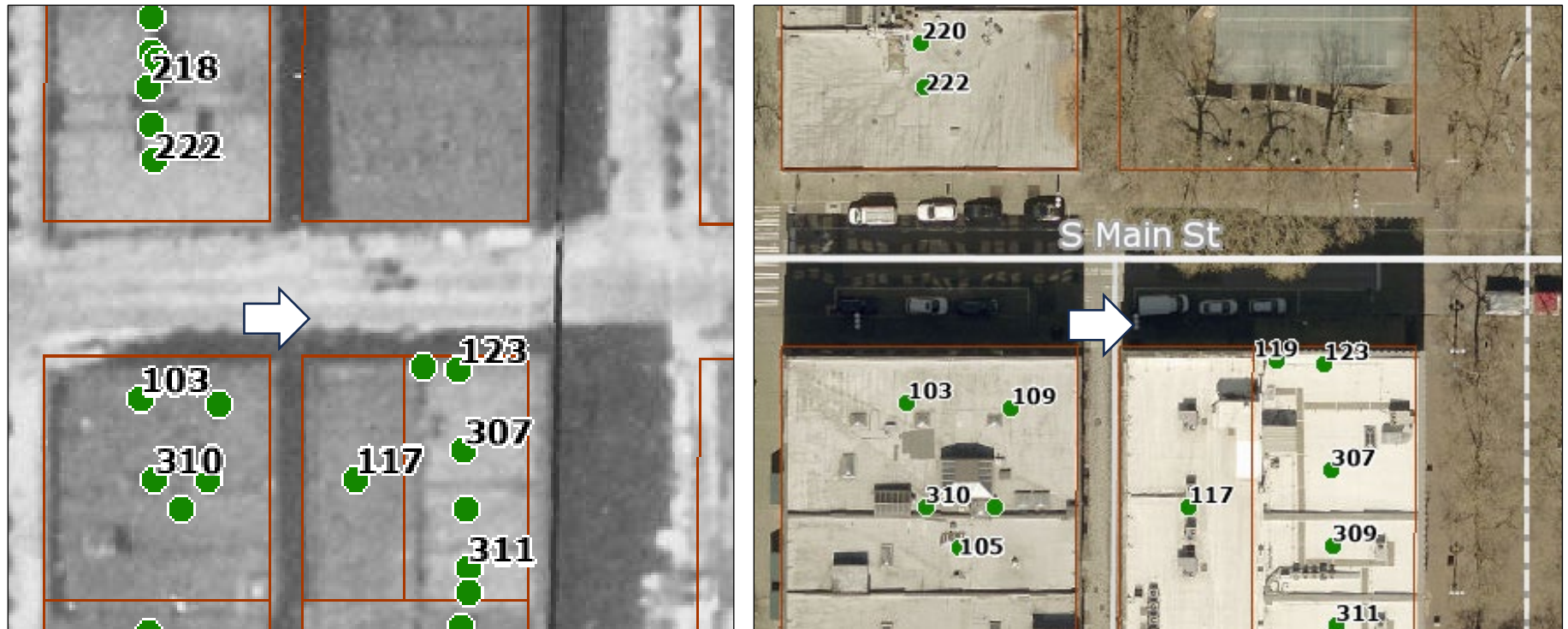


Figure 6 – Aerial from 1936 (on the left) showing the street right-of-way and approximate location of vault (white arrow). Similar is depicted in an aerial from 2021 (on the right). Union Trust Annex is “117” in both photos. (Source: King County Assessor’s Office, Aerial photos, 1936 and 2021.)

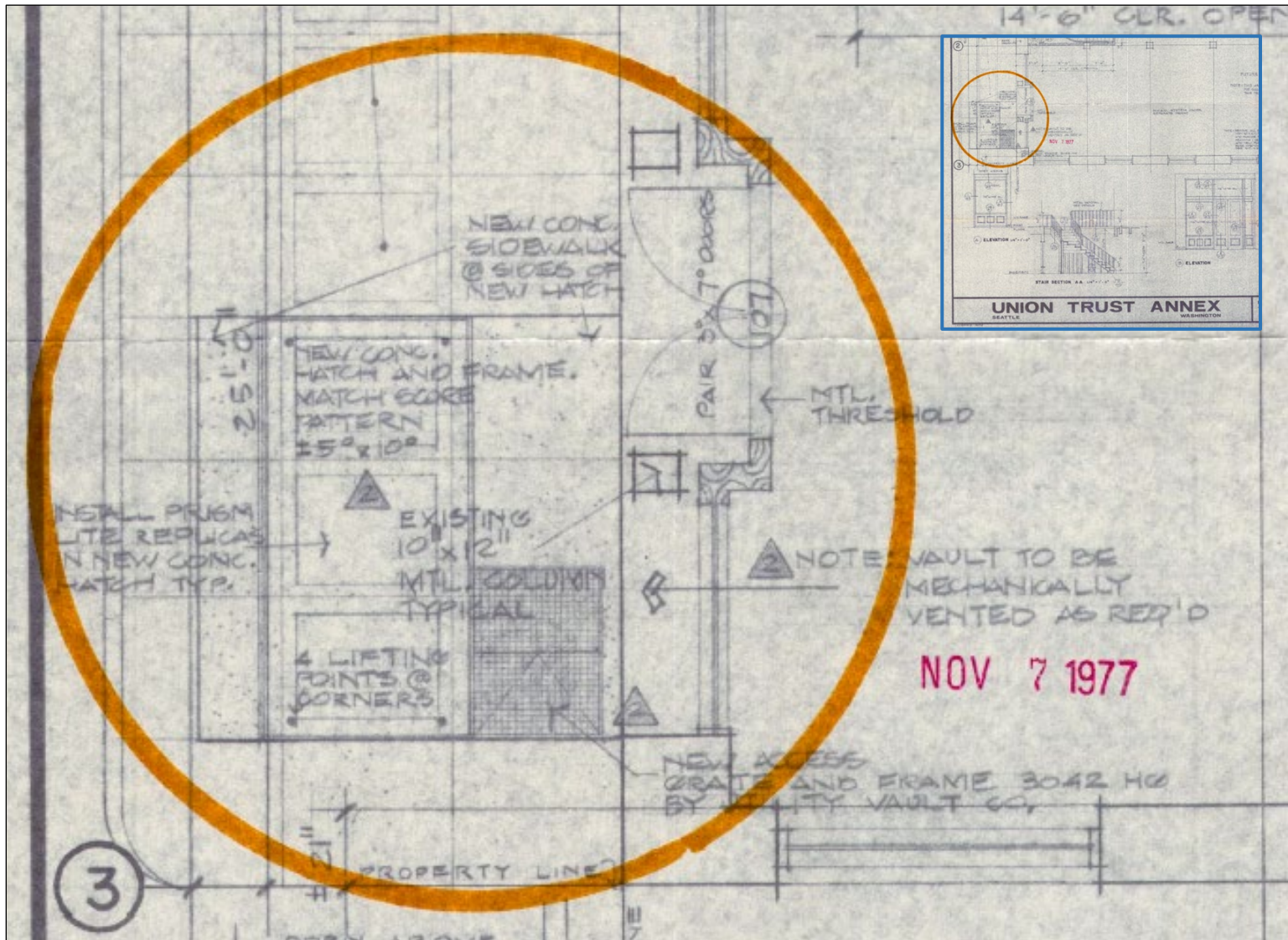


Figure 7 – A non-City Light drawing from 1977, likely from a rehabilitation of the Union Trust Annex (see inset). Zooming into the circled area, it indicates the vault location and notes the creation of a “new concrete hatch and frame” to “match score pattern” and “install prism lite replicas in new concrete hatch.” (Source: Seattle City Light, 1977.)

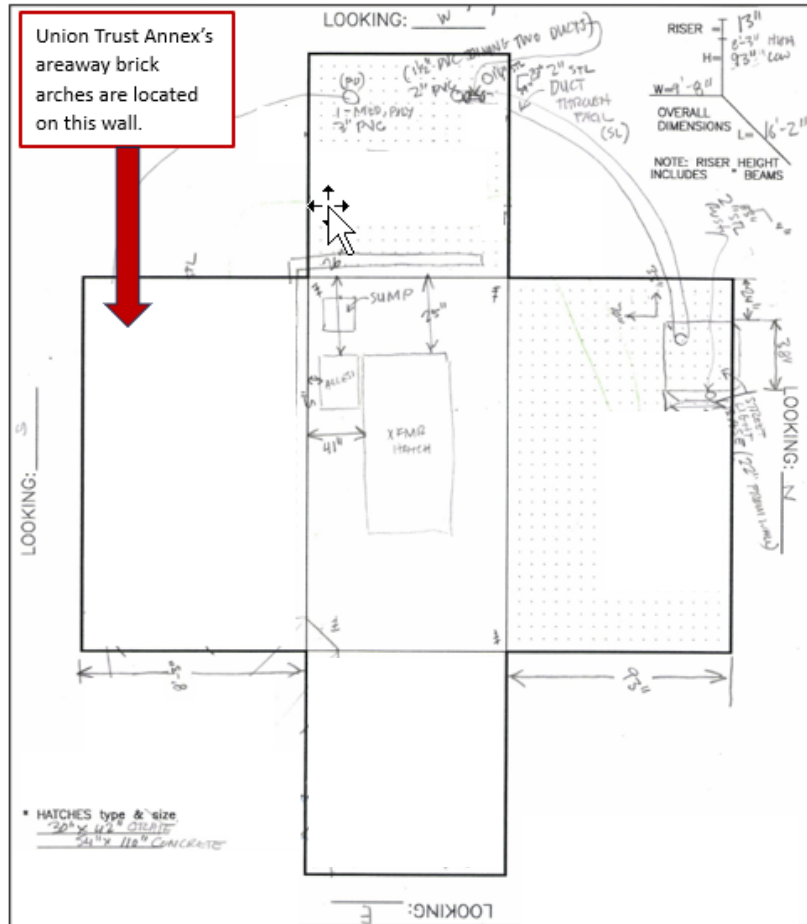


Figure 8 – A survey of the vault done in 2001 by City Light noting hatch and vault dimensions.

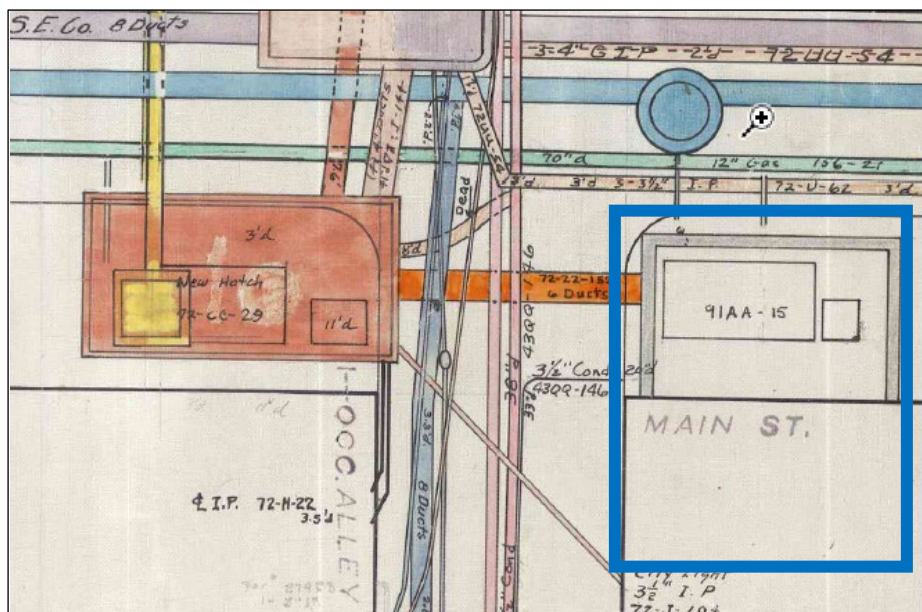


Figure 9 – Excerpt from City Light’s Franchise Map for Vault 22V-4 which has a different name, date unknown, though there is a c. 2004 update elsewhere on the map. Areaways in this general location created after the Great Seattle Fire of 1889. City Light’s vault was installed in 1977 (see also figure 7).

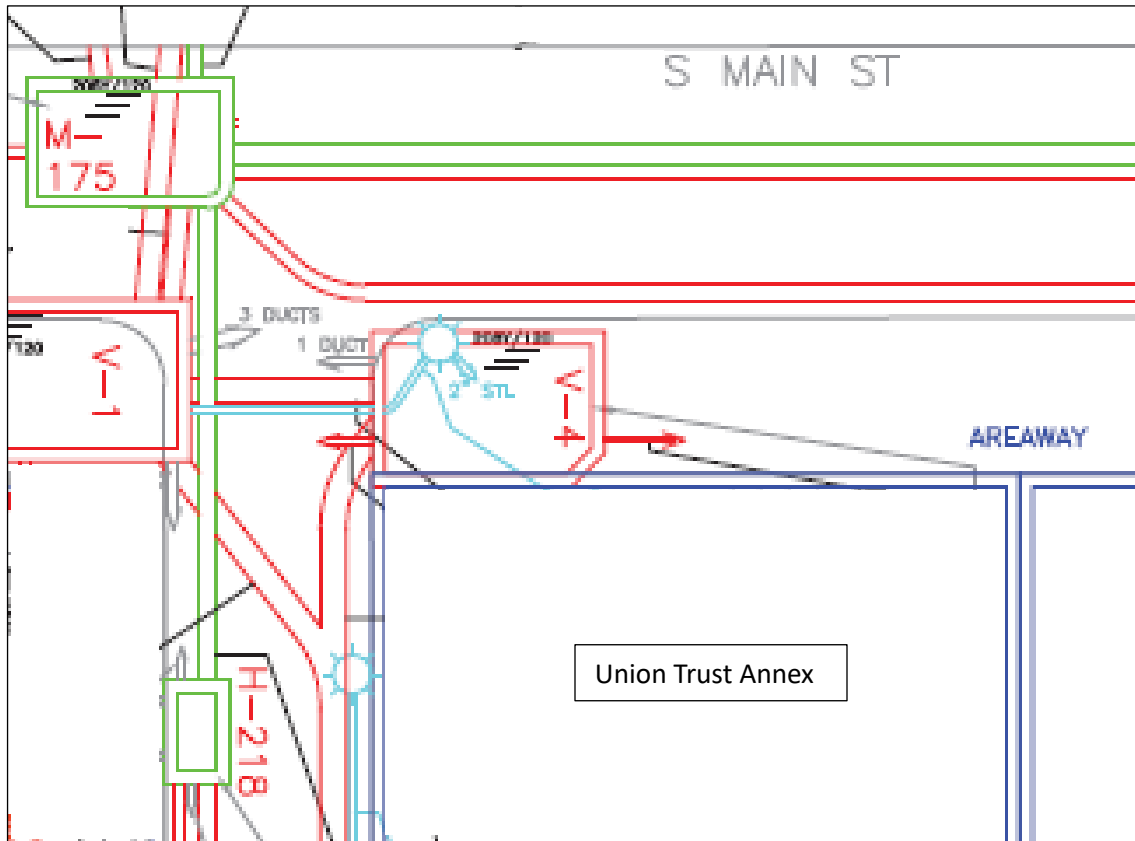


Figure 10 – Vault 22V-4 part of a larger network to supply electricity to the buildings within Pioneer Square. North is to the top. (Source: Seattle City Light, 2022.)

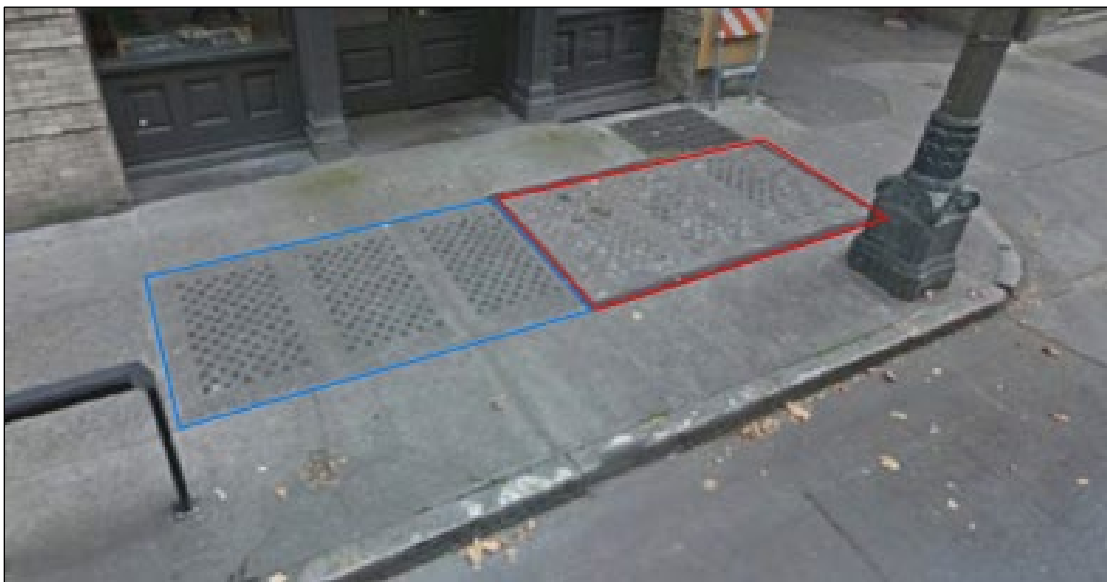


Figure 11 – Vault at 117 S. Main St. The blue outlined area shows the portion that will remain in place and will not be altered. The red outlined area shows the area we are proposing to change. (*) Note: The glass pavers here are not true prisms that allow light into the underground space. They are embedded in the upper portion of the concrete panel and do not extend through the depth (thickness) of the concrete panel. (Source: Seattle City Light, 2023.)

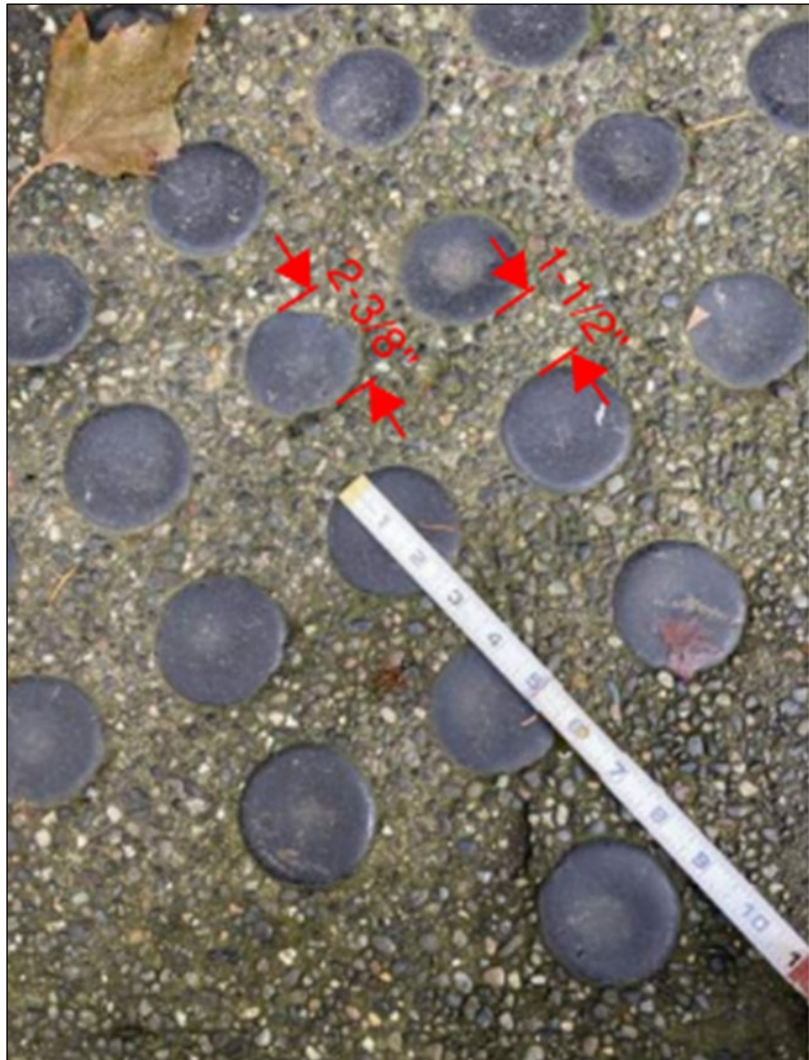


Figure 12 – Zoomed in view of the existing round glass pavers within the blue outlined area as seen in figure 11. The diameter is 2-3/8 inches. (Source: Seattle City Light, 2023.)



Figure 13 – Zoomed in view of the existing and deteriorated round glass pavers within the red outlined area in figure 11. The diameter is 2 inches. (Source: Seattle City Light, 2023.)

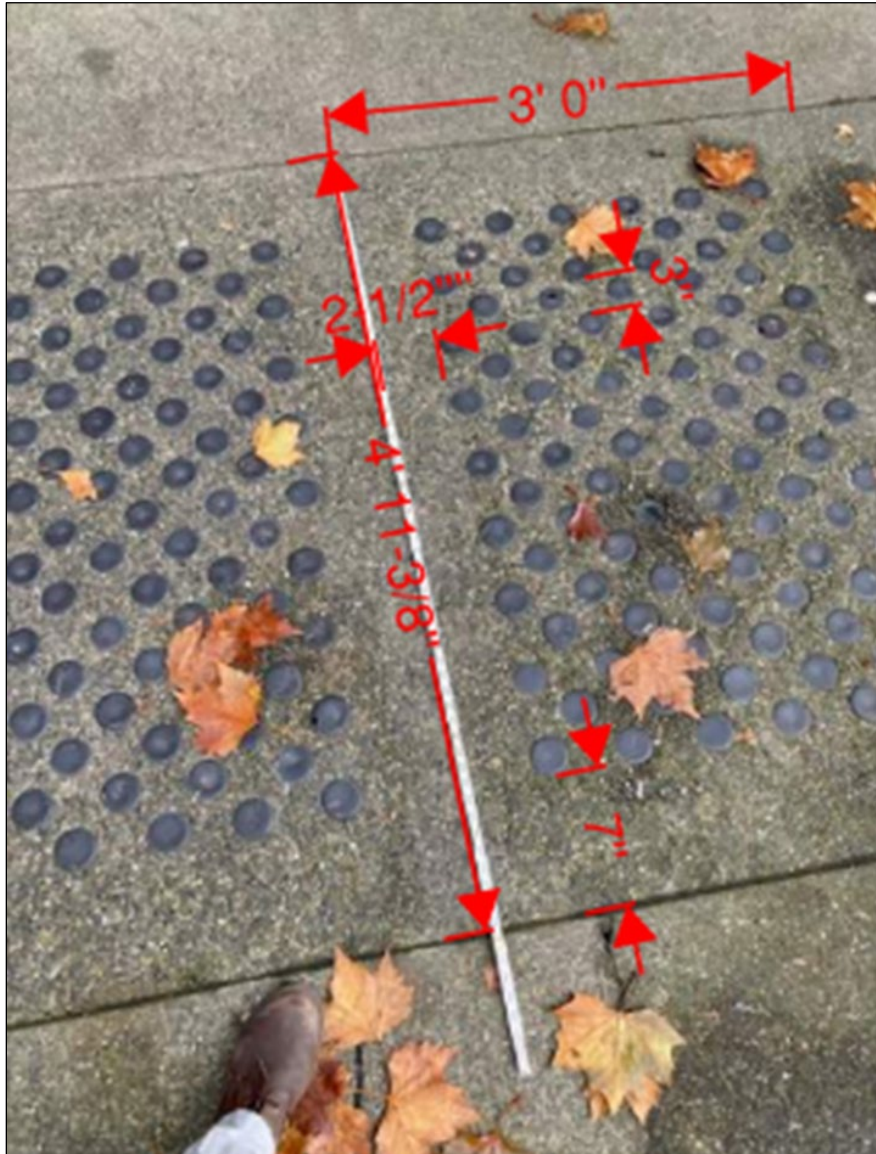


Figure 14 – Zoomed out view of figure 12 (within the blue outline in figure 11) showing dimensions of concrete panel and spacing between the round glass pavers (e.g., 3"). Glass paver is 2-3/8 inches in diameter. (Source: Seattle City Light, 2023.)



Figure 15 – Photo showing typical steel grates used by City Light for vault covers requiring ventilation. (Note: Three are shown in this image stacked on top of each other as delivered from our manufacturer. The 117 S. Main St. Vault installation will include two grates installed side by side.) (Source: Seattle City Light, 2023.)

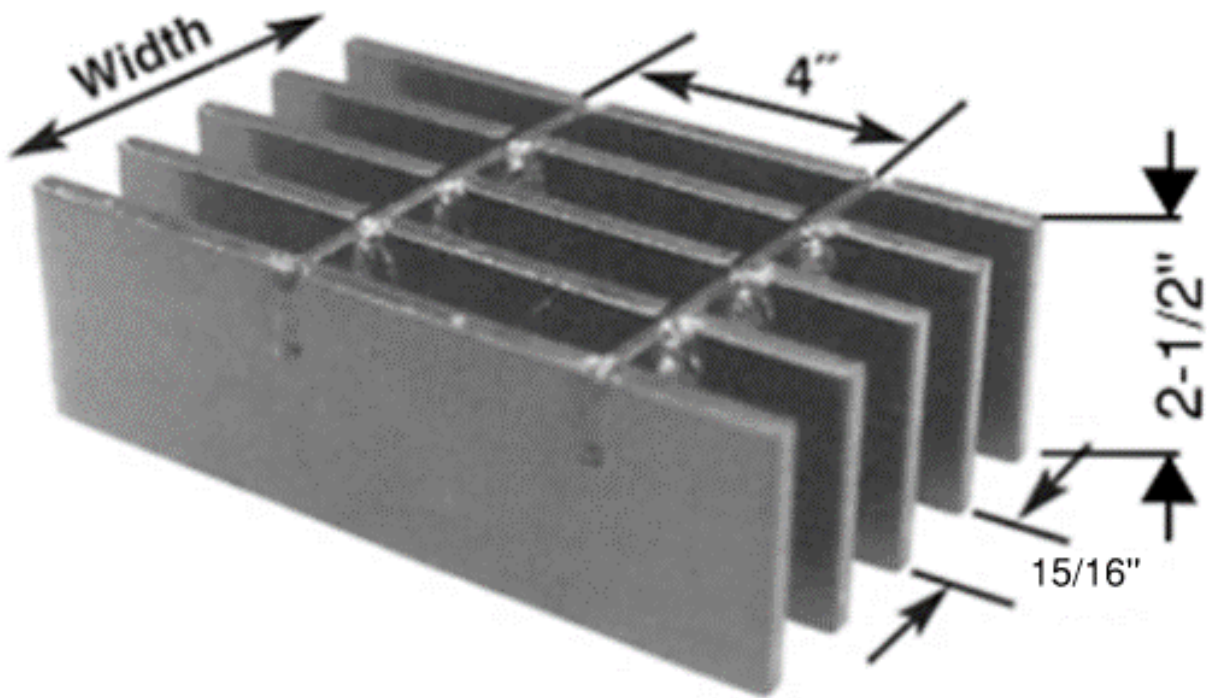


Figure 16 – Dimensions of steel grating. (Source: Seattle City Light, 2023.)

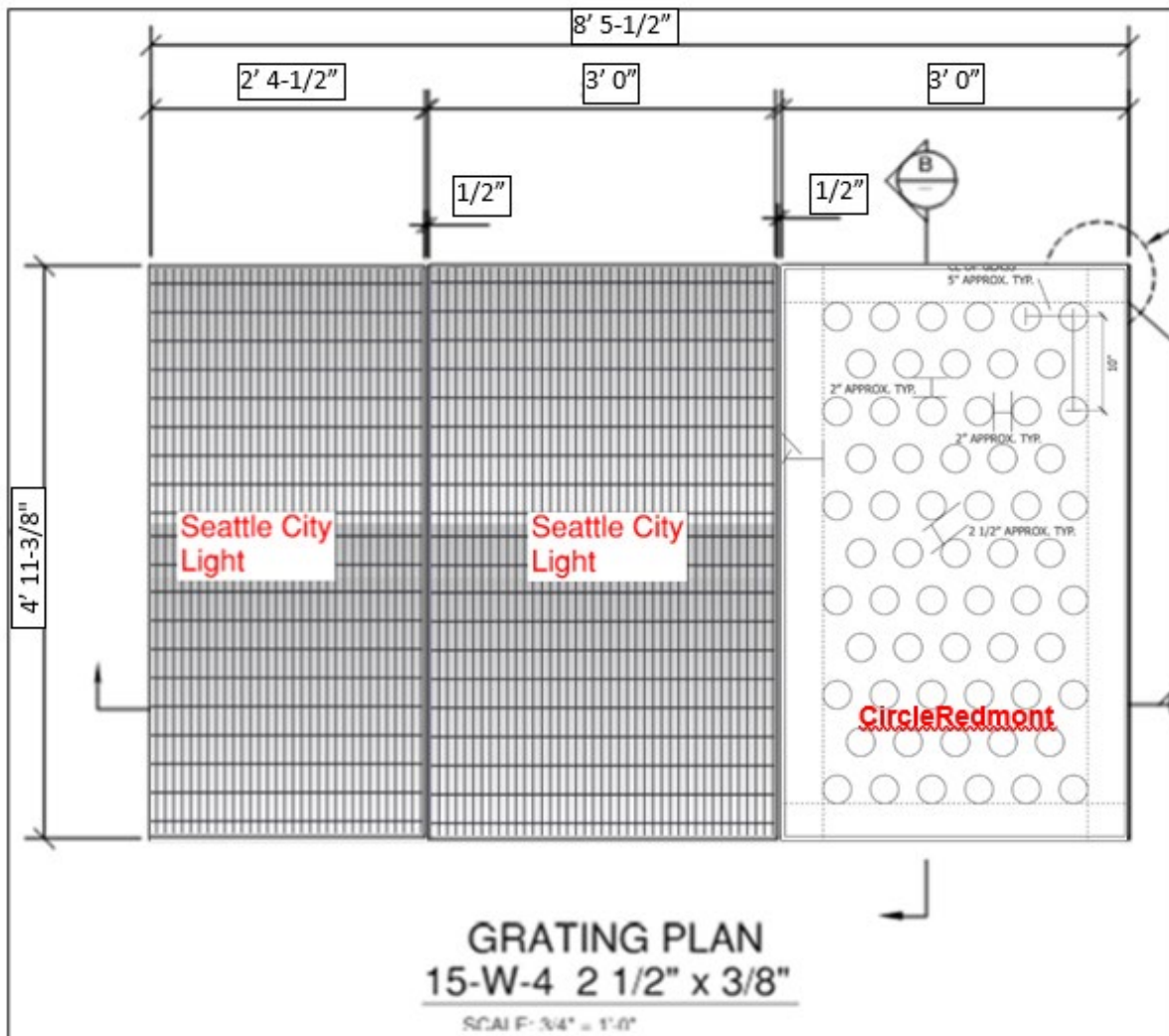


Figure 17 – Locations of the steel grates and CircleRedmont’s concrete panel with round glass pavers. In this figure, the 3-inch diameter round glass paver is shown. Steel grates and concrete panel to be installed by City Light. (Source: Seattle City Light, 2023.)



PRODUCTS & PAVERS GUIDE

Need the strength of a driveable paver surface?
Ask your Circle Redmont design associate which paver options would be right for you!

Nominal Size	Actual Size	Catalog #	Pieces / Case	Options	71R concrete	81R cast iron	91R steel	Picture
8"	7-5/8" x 7-5/8" x 1-1/2"	CR8R™ radius corner	5	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●			
	7-5/8" x 7-5/8" x 1-1/2"	CR8S™ square corner	5	Clear, Sandblasted top, Bottom, both surfaces or custom patterns			●	
6"	5-5/8" x 5-5/8" x 1-1/2"	CR6R™ radius corner	10	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●			
	5-5/8" x 5-5/8" x 1-1/2"	CR6S™ square corner	10	Clear, Sandblasted top, Bottom, both surfaces or custom patterns			●	
4.5"	4-1/2" x 2-3/8"	CR4.5R™ round paver	12	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●			
4"	3-5/8" x 3-5/8" x 3/4	CR13A™ historic paver	60	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●		●	
1.5"	1-1/2" x 7/8	CR11™ historic paver	288	Clear, Sandblasted top, Bottom or both surfaces		●		
2.75"	2-3/4 x 2-3/4 x 1-7/8	CR14™ historic paver	20	Clear or Sandblasted top	●			
	6-1/4 x 9-5/8 x 1-1/2	SW2™ rectangle paver	5	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●		●	
	6-1/4 x 7-3/4 x 1-1/2	SW3™ rectangle paver	6	Clear, Sandblasted top, Bottom, both surfaces or custom patterns	●		●	

Figure 18 – Excerpt from CircleRedmont’s 2023 product brochure showing paver options.
(Note: This catalog page does not include the 3" round glass paver option that became available in late 2023.)

Typical 71R™ End Section Detail

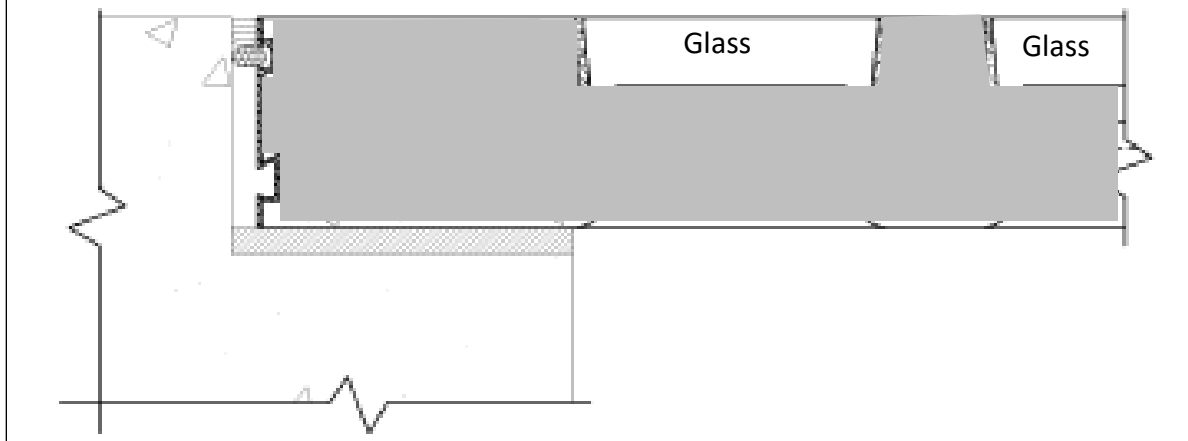


Figure 19 – Approximation of glass paver placement on surface of the concrete hatch cover with concrete material underneath (gray shading) using the CircleRedmont 71R detail.

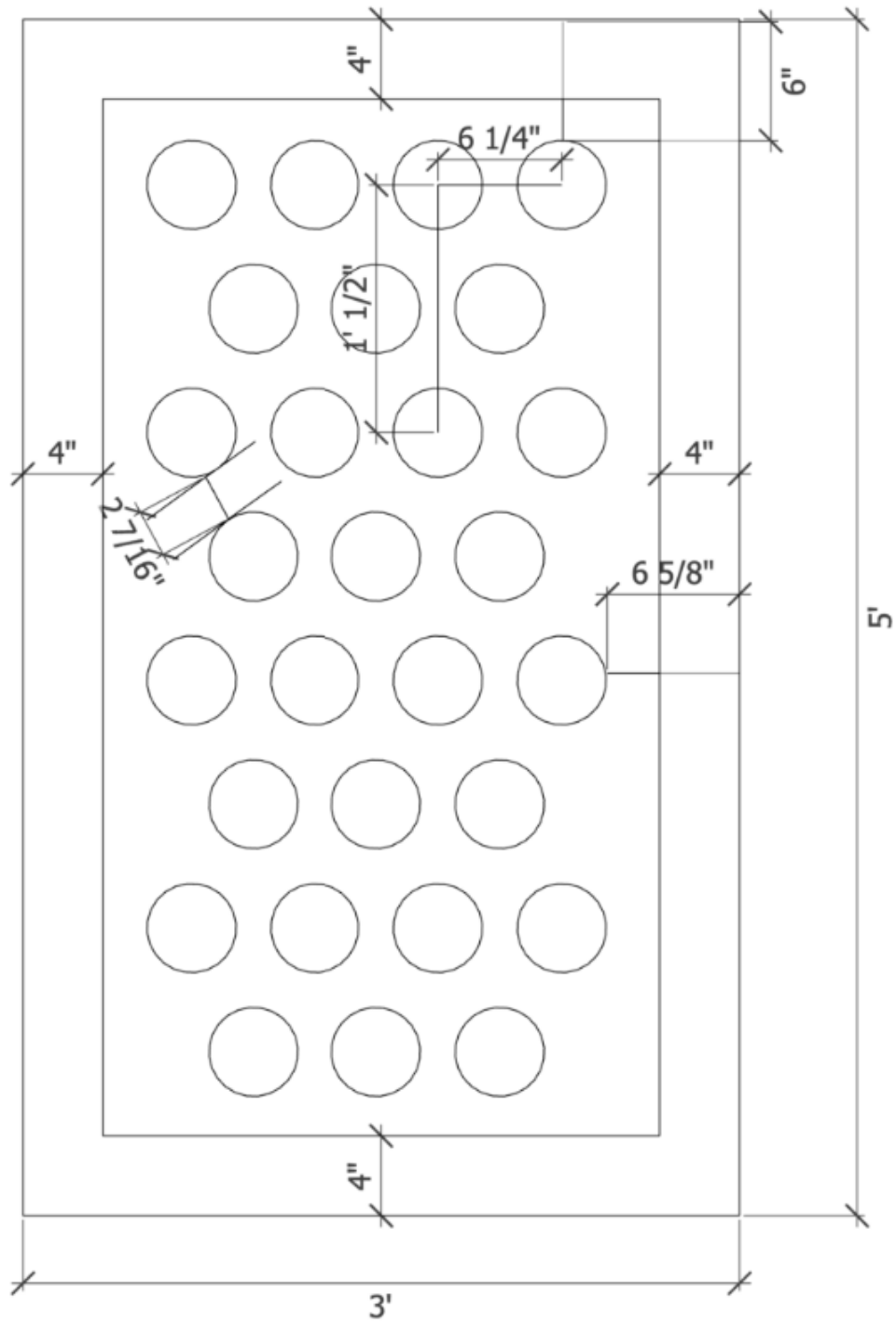


Figure 20 – Option 1: A 4.5-inch diameter round glass paver. Total glass pavers: 28.

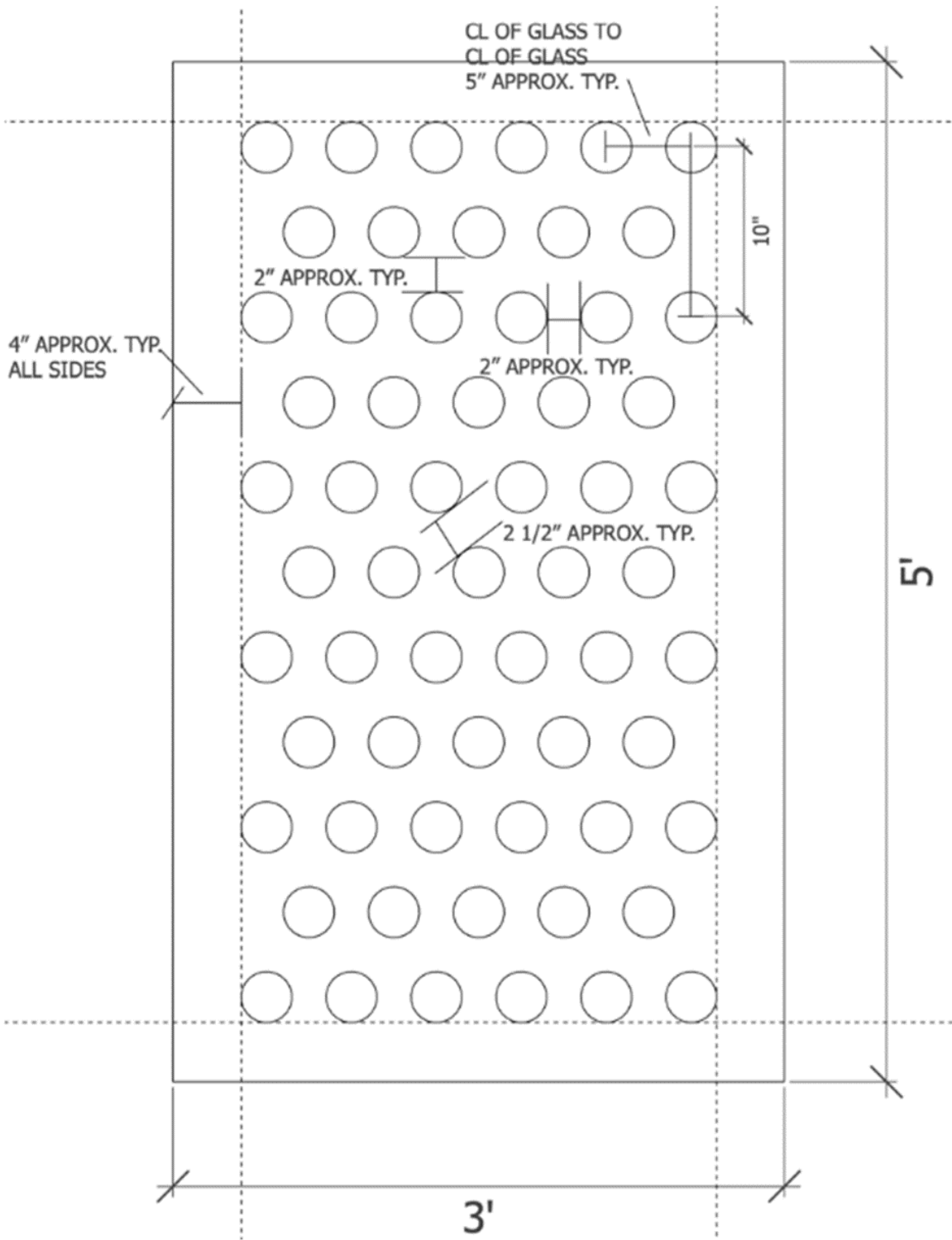


Figure 21 – Option 2: A 3-inch diameter round glass paver. Total glass pavers: 61.

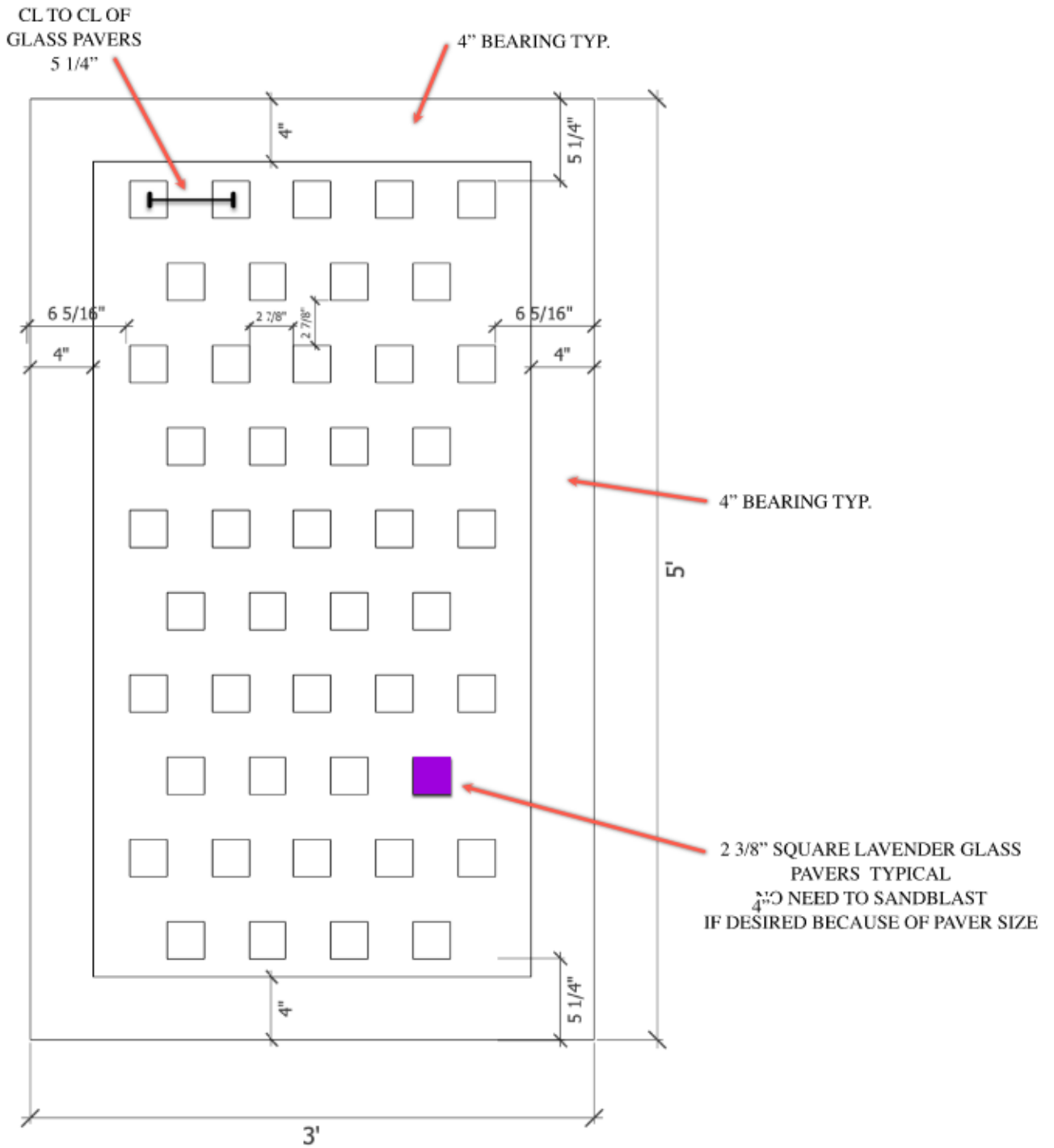
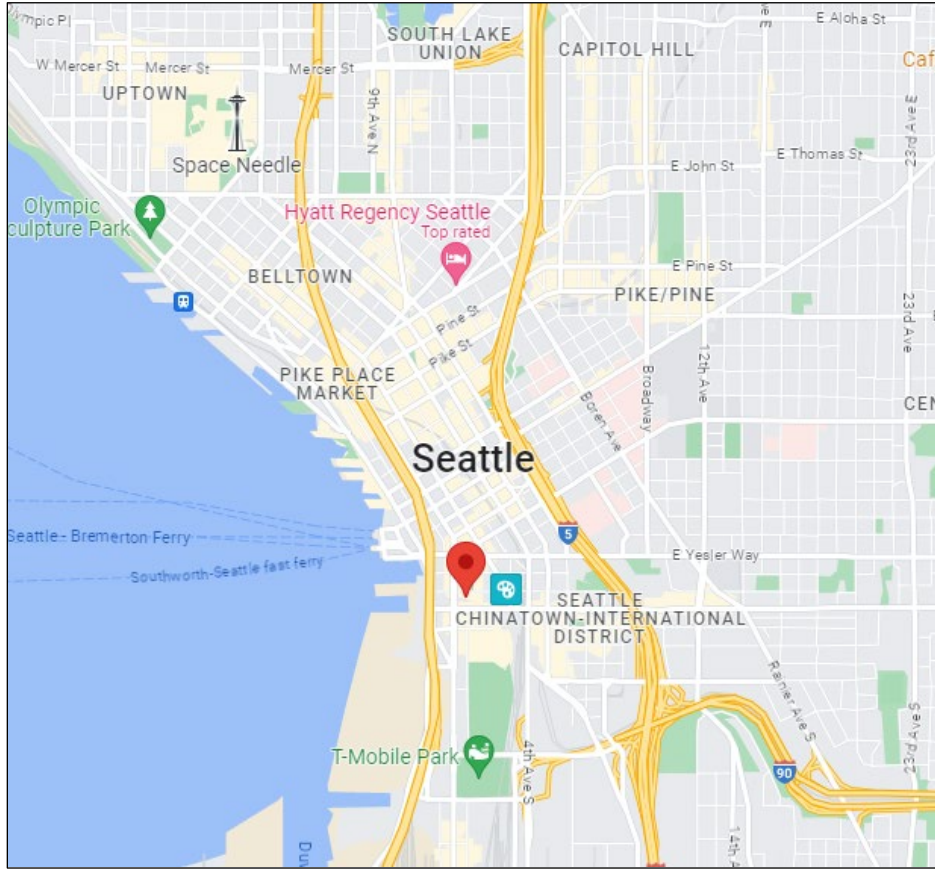
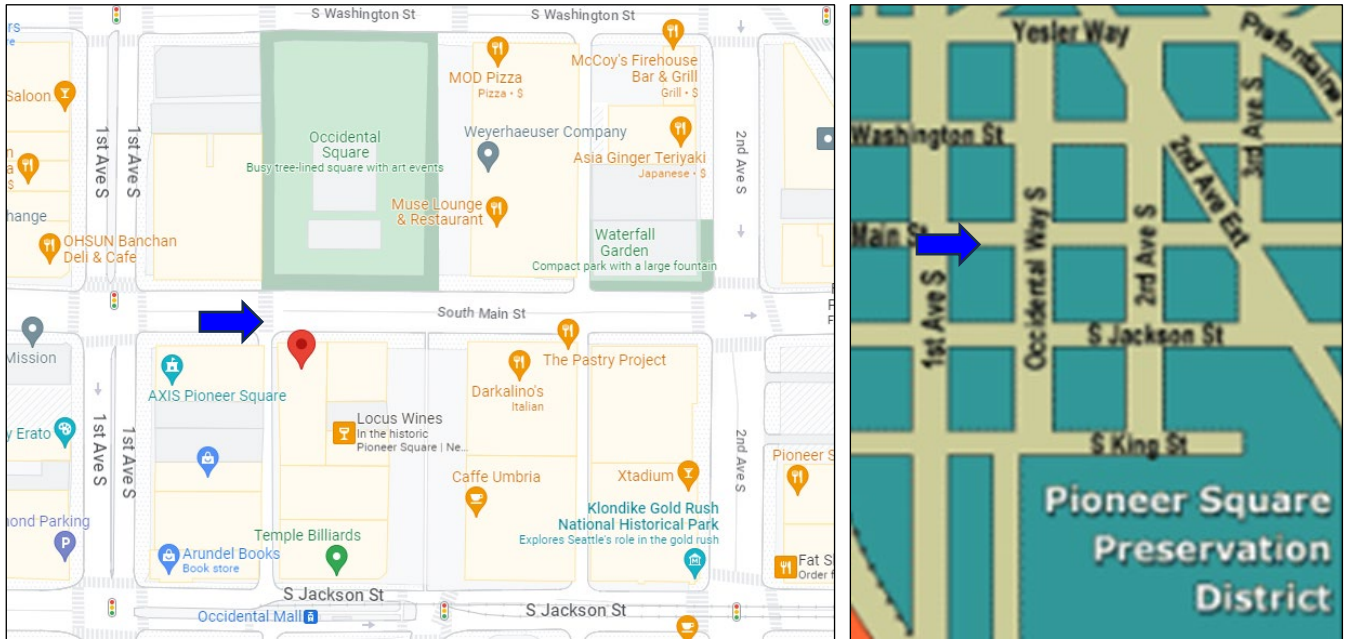


Figure 22 – Option 3: A 2-3/8 inch (aka 2.75-inch) square glass paver. Total glass pavers: 45. Lavender color available.

Maps



Map 1 – Vault location within the City of Seattle. (Source: Google Maps, 2023.)



Map 2 – Vault location within the Pioneer Square Preservation District. (Source: Google Maps, 2023 (left) and Seattle Dept. of Neighborhoods, 2023 (right).)

Photographs



Photo 1 – Overall project context, view to the east on South Main Street. Occidental Square to the left, Union Trust Annex on the right (by the 3-globed streetlight). (Source: Google Maps, street view, 2023.)



Photo 2 – View to the southeast showing Vault 22V-4 on the corner of South Main St. (on the left) Nord Alley (on the right), and in front of the Union Trust Annex. (Source: Google Maps, street view, 2021.)



Photo 3 – A view of the same location as seen in Photo #2, taken in 2008.
(Source: Google Maps, street view, 2008.)



Photo 4 – A view of the same location, taken in 2001, with ladder access in use.
(Source: Seattle City Light, 2001.)



Photo 5 – Vault interior, view to the west showing existing conditions. Union Trust Annex brick arch to the left. (Source: SCL, 2022.)



Photo 6 – Vault ceiling interior, west view showing rusted steel beams. Panel on right is sidewalk surface with glass pavers. (Source: SCL, 2022.)



Photo 7 – Detail view showing general conditions of the steel beams and ceiling decking in the vault. (Source: SCL, 2022.)



Photo 8 – Northwest corner detail. The ceiling concrete panel has on the exterior surface the small round glass pavers. (Source: SCL, 2022.)



Photo 9 – Existing conditions on the exterior or sidewalk surface of the vault’s concrete hatch cover. Circular imprints are visible where glass pavers were once located in the concrete. (Source: Seattle City Light, 2022.)

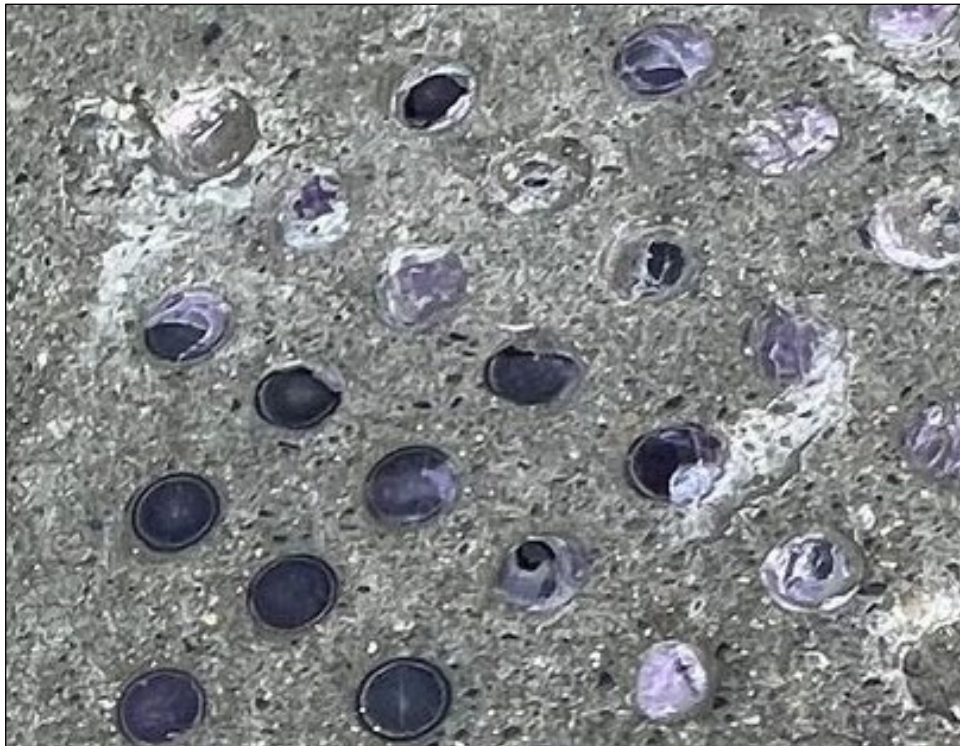


Photo 10 – Detail of upper right corner of photo #9. Glass pavers are embedded on the surface with many that are chipped, cracked, or missing. (Source: Seattle City Light, 2022.)