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MEMO

To:	Bill Hansell
Company Name:	**KENSINGTON FIRE PROTECTION DISTRICT**
From:	Matt Frantz, Steven Patton
Date:	December 15, 2021
Regarding:	Schematic Structural Design Narrative
Project:	21479

STRUCTURAL SYSTEM DESCRIPTIONS:

Overview

The Kensington Public Safety building has served as a fire station and police office to provide emergency services for the past 52 years. It is located adjacent to a fault on a hillside and has experienced settlement and cracking since its initial construction. The building requires an interior renovation, seismic strengthening and foundation strengthening to mitigate settlement and crack propagation. The renovation of the existing Kensington Public Safety building will occur on the site located at 217 Arlington Ave, in Kensington, CA 94707.

The structure will be designed in accordance with the 2019 California Existing Building Code (CEBC). The structure will be designed for 100% of current building code gravity loading requirements and 75% of current building code seismic loading requirements according to section 503.5 of the 2019 CEBC for Seismic Design Category F, where the work area exceeds 50% of the building area. The existing and proposed renovated building is operating as an essential service facility, occupancy category IV, so the importance factor is 1.5, which requires the building be designed for higher seismic and wind criteria.

History

The Kensington Public Safety building was initially constructed in 1969. The building was renovated, and moment frames supported by drilled piers were installed over the apparatus bay for seismic strengthening in 1998. The moment frames were strengthened, and the building was renovated again in 2004. An entry ramp was constructed, and drilled piers were installed along the western side of the building to mitigate crack propagation in 2009. Settlement and cracking persisted, so a report for a structural mitigation plan was written in 2016.

Building Program

The ground floor of the building contains a public entry/lobby, two drive-in apparatus bays, PPE cleaning area, turnout room, workshop, multiple offices, a restroom, a large collaboration space and stairs to the 2nd floor. The existing building is a wood framed building originally constructed in 1969, with structural foundation renovations in 1998 and 2009. The first floor has a plate height of approximately 12 feet and steps up approx. 3 feet, where the second-floor level is offset.

The 2nd floor contains the station living quarters, captain's office, exercise and day rooms, kitchen, bath, and laundry rooms. The second floor has varying ceiling heights due to a step in the floor diaphragm. A new lift will be provided to allow ADA access to the entire second

floor area. The existing second floor roof deck area is also proposed to be enclosed as part of the proposed renovation to increase the enclosed floor area at the second floor. The renovation work proposed assumes the eastern half of the existing building framing above the ground floor will be demolished and rebuilt to accommodate the new space plan.

Existing Structural Systems
The existing framing system is 15/32" roof plywood over existing sawn lumber framing spaced at 24 inches on center at the roof and, and ¾" T&G plywood over existing sawn lumber framing spaced at 16 inches on center at the second floor. The joists are spanning between bearing walls at the southern portion of the building and steel girders at the northern portion. The existing lateral system is composed of plywood diaphragms and wood shear walls with the exception of the moment frames along the entrance of the apparatus bay. The existing 1st floor perimeter walls are 2x6 sawn lumber studs at 16 inches on center. Continuous concrete footings support walls and shallow spread footing support highly loaded posts. There are drilled piers supporting the western exterior wall line.

Geologic Hazard Approach
ZFA has reviewed the following geotechnical investigations for the site:

- 1969 Woodward Clyde
- 1990 Seidelman Associates
- 1997 Geomatrix
- 2009 Kleinfelder
- 2018 Rockridge Geotechnical

The site has the potential for slope creep / seismic induced landslide instabilities as reported in the multiple geotechnical reports and investigations performed for the initial construction and previous renovations of the existing building. The 1997 Geomatrix report indicates that seismically induced downslope displacement is also possible. There has also been significant settlement observed in the building. The original foundations were designed as shallow spread footings, which were likely not extended to competent bearing materials. The western edge of the building has been underpinned with deep foundation elements (northern half in 1997, southern half in 2009). The strengthening of the existing foundations will be designed to extend a portion of the new and existing continuous footings to competent bedrock (shale) that exists at varying elevations on the site. At locations where this is not feasible due to increased depth to competent bedrock, new and existing continuous footings will be supported on deep foundation elements and will be tied together at grade with a structural slab.

Geotechnical Approach
The 1969 Woodward Clyde and 1997 Geomatrix reports both state that the site is not crossed by a fault trace. The 2018 Rockridge investigation concludes that a geologic discontinuity at the rear site retaining wall has a strong possibility of being a fault splay and should be considered as an active fault or fault splay. Based on the previous geotechnical investigations there is no apparent evidence of a fault trace within the building footprint. Therefore, design for surface fault rupture through the building is not considered. The use of drilled piers is proposed to mitigate slope instability, both creep and earthquake induced, though the post-earthquake condition from a major earthquake may require many months for repairs prior to basic recovery of operations. The building will not collapse and with fire personnel skill, firefighting equipment can be removed and utilized for emergency response services.

Structural Scope

Gravity

To accommodate the renovation plan, the existing bearing walls will be removed at the first and second floor at the southern portion of the building. Plywood sheathing will be installed to match the existing plywood thickness at the roof and second floor. Roof plywood will be blocked at all unsupported edges. The roof will be designed to support roof top mechanical units as well as accommodate a small future solar panel array. The framing system will be sawn lumber joist framing at 24 inches at the roof and 16 inches on center at the second floor spanning typically between bearing walls. Existing W-shape steel beams with existing sawn lumber joists over the apparatus bays will remain.

New and renovated interior 1st floor walls will be 2x6 studs at 16 inches on center. The 2nd floor perimeter and interior bearing/shear walls will be 2x6 at 16" on center while the interior non-bearing walls will be 2x4 studs at 16 inches on center. Typical 6x8 to 6x12 sawn or machined lumber headers are expected over openings. Bearing walls have been coordinated to stack to the foundation where possible. The existing interior stair is proposed to be relocated with a new elevator to be placed in the existing stair location. A new stair will be provided to the north of the existing stair location adjacent to the existing concrete retaining wall on the north side of the building.

Exterior and interior bearing walls will consist of 3x sill plates with 5/8" diameter anchor bolts at 48 inches on center minimum anchorage to the foundation system. Anchor bolt spacing will be reduced at shear walls. Conduits and pipes will require coordination with framing particularly at shear walls. Exterior finishes will be a combination of stucco and siding materials as specified in the architect's design documents.

Seismic

The strengthening of the lateral force (seismic and wind) resisting system will consist of additional shear walls with holdowns each end and increased nail spacing at existing shear walls to remain.

Foundation

To accommodate the installation of new deep foundation elements to underpin and reinforce the existing foundations, portions of the apparatus bay slab will be replaced with a 9" thick structural slab with two layers of #5 reinforcing at 12" on center over a 15-mil vapor retarder over 6" compacted rock base. The remaining replacement slab areas will be 8" thick with two layers of #5 reinforcing at 16" on center over 15 mil vapor retarder over 6" compacted rock base. Continuous footings and tie beams will be provided at approximately 10'-0" to 15'-0" on center. The footings are expected to be a minimum of 24" wide and 24" deep with (4) to (8) #6 bars top and bottom and #4 stirrups at 9" on center. Deep foundation elements will be provided at grouped locations where underpinning existing isolated pad footings or at 6'-0" on center along continuous footings and will consist of drilled cast-in-place piers. Cast-in-place piers are to be a minimum of 24" diameter with a minimum of 16 foot embedment into bedrock and should be assumed to require casing due to a high-water table. Concrete is to be installed via the tremie method. Assume all piers will use closely spaced spiral ties with 150Lb/CY of reinforcing steel. It should be noted that the piers at low headroom conditions (apparatus bay) may require spliced cages and specialized low headroom drilling equipment.

Electrical and plumbing conduits/pipes shall have flexible connections where they penetrate the exterior foundation to accommodate the potential for seismic induced settlement and building displacements. Additionally, conduits and pipes will need to be coordinated with foundations. Apparatus bay concrete aprons are to be designed by the civil engineer. Concrete aprons must be designed to tolerate differential settlement between the building

and the sidewalk which may require pile foundations. Nonstructural exterior walks and apron slabs may need to be replaced in a post seismic event to meet ADA requirements.

Long Term and Seismic Performance
Creep and cracking of the building will be limited due to the relevelling and underpinning that will be performed. The building will not collapse after a major earthquake, assuming the fault line is not crossing the structure as stated in the geotechnical reports, however, repairs should be expected.

OUTLINE STRUCTURAL MATERIAL SPECIFICATIONS:

Concrete:	5000psi at 28 days at piers, foundations and walls 4000psi at 56 days for slabs 25-35% Fly Ash cement replacement
Concrete Reinforcing:	ASTM A615 Grade 60 ASTM A706 Grade 60 when welded or at special concrete shear walls or special concrete moment frames
Under-slab Vapor Retarder:	ASTM E1745 Class A, 15mil
Structural Shapes (AISC):	WF – ASTM A992 Grade 50 C, L, and Plates – ASTM A36 or A572 Grade 50 HSS – ASTM A500 Grade C Pipes – ASTM A53, Grade B All exposed exterior steel to be hot dipped galvanized All exposed exterior hardware to be hot dip galvanized or stainless steel High Strength Grout – ASTM C1107 7000psi at 28 days
Welding Electrodes:	E70
Bolts:	Machine bolts - ASTM A307 High strength bolts - ASTM F3125 Grade A325 bolts Anchor Bolts/Rods: ASTM F1554 Gr. 36 or 55
Wood (WCLIB/WWPA):	2x material – DF #1 (FSC option) 4x and thicker – DF #1 (FSC option)
Wood Connectors:	Simpson C-2021
Plywood (APA):	CD Exp 1 and Structural 1 per PS-1 and PS-2
Machined Lumber:	Redbuilt PSL, LVL, and LSL