INTERNATIONAL FURNITURE RETAIL STORE COMING TO FRESNO

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The City of Fresno will welcome the newest IKEA store building in the State. The international home furnishing retailer is expected to cover a footprint of 160,000 square feet and be located near the intersection of Herndon Ave and Riverside Drive. With immediate access to Highway 99, the store is expected to allow accessibility for customers seeking to purchase easy to assemble furniture, home appliances and a number of additional home goods.

The approximate 18- acre site will house the main steel designed structure and the additional services as required for a project of its nature. The currently undeveloped site for the proposed development project will require a comprehensive geotechnical analysis, structural, urban stormwater, wastewater, potable water, off-site and on-site transportation design system to achieve a successful project.

GEOTECHNICAL DESIGN

The development requires a strong foundation that can support the proposed two-story steel structure. A number of foundations were considered for this project however a shallow foundation was selected because shallow foundations distribute the loads of the building throughnumerous footing. Also, the soil properties were determined in a bid to classify the soil at the construction site. The soil tests done on the soil obtained from the site showed that the building will be set up on silty sand.

Dry density is the weight of the soil which tells the designer of the footing how much the soil weighs per cubic foot. Dry density of the soil was found to be 122 pounds per cubic foot. Another important property of soil is the angle of internal friction, it tells the engineer how much friction there is between the different particles of the soil, which tells the designer the strength of the soil. For this soil,

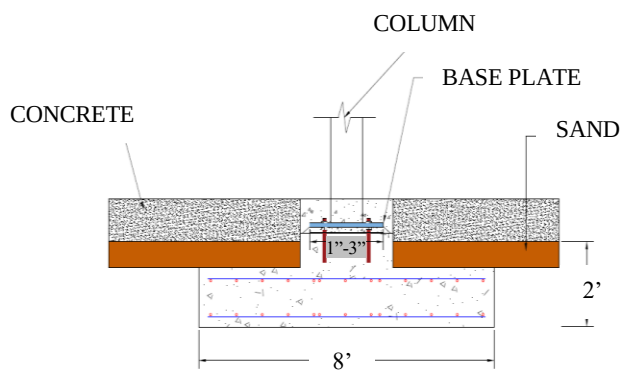

Figure 1 Foundation Schematic

an angle of friction of 37 degrees was calculated. On the other hand, the maximum load of the building was calculated as

201,400 pounds or 201.4 kips. Multiple 8 by 8-feet footings were deigned to support all columns with the largest load of 201.4 kips. 6 by 6-feet footings were designed to support the columns with a load of 135.75 kips. 4 by 4 feet footing were designed to support all columns with a load of 68.88 kips. All footings are placed at the same depth of two feet below the surface.

STRUCTURAL DESIGN

The proposed structure will have a 160,000 square foot footprint and will be constructed of steel. The height of the building is 30 feet around the perimeter of the building with a 2% pitch up the middle of the building. Reaching a total of 34 feet and running down from the store front to the back of the building. The showroom of the IKEA will consist of two stories, with both floors being 15 feet. The warehouse for storage of larger IKEA furnishings will be one story and run the full height of the building. The location of the warehouse will be in the North-West corner of the building with a square footprint of 200 feet by 200 feet.

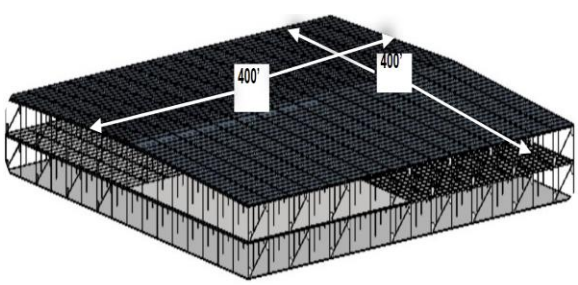

Figure 2 Structural Framework

The building was uniquely designed with a green roof and with seismic governing loads. The building is composed of ordinarily braced moment frames. The building braces will span the height of the floor stories. There are four braces on each side of the building along with two in the middle of structure between the showroom and warehouse. The braces of the structure were designed from the governing seismic loads.

STORMWATER MANAGEMENT

The proposed IKEA development project will require a comprehensive stormwater design system to achieve a complete stormwater management strategy. Design complies with the city of Fresno and the Fresno Metropolitan Flood Control District (FMFCD) and will not contribute to the overall City existing stormwater system. Stormwater management strategies for the IKEA development project will incorporate best management practices (BMPs) and low impact development (LID) strategies.

This project incorporates a number of practices, including bioretention areas, roof runoff controls, an onsite detention pond, a green roof and permeable pavement. Bioretention is a best management practice that serves a physical process of capturing stormwater and storing the runoff before entering the main stormwater system. Typical bioretention areas consist of a vegetated cover often made of shrubs or trees, a 3-inch layer of mulch, permeable soil or gravel layer and an installed underdrain at a depth of 4 feet. The City of Fresno Public Works Department list of approved shrubs and groundcover list the names of medium shrubs and trees.

Trees will be planted per 50 square feet of bioretention area. Trees and medium shrubs not only enhance the aesthetics of a parking lot but also provide shade for customers once tree reach maturity. In Fresno, where summer temperatures normally exceed the triple digits

tree shade in exposed parking lots is desirable.

Bioretention areas are expected to occupy an approximate 14% of the developed site. Areas are expected to become the entrance points to the bigger underdrain downstream conveyance system. An overflow device is placed at the ponding depth and captured flow is carried in to the proposed detention pond. The network shall be made of an 8-inch slotted Poly Vinyl Chloride (PVC) pipe. The detention pond is designed to capture the peak runoff of a 100-yr storm and serves as a groundwater recharge facility.

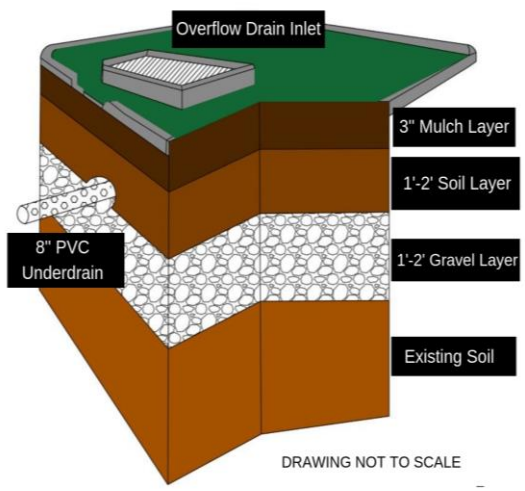

Figure 3 Bioretention Profile

The proposed project calls for the construction of a green or vegetated roof. The vegetation and soil layer on the roof is expected to control roof runoff, however an overflow technique must be utilized.

Runoff shall be collected by the gutter and delivered to the base of the building through a roof downspout. The downspout is emptied on to a stormwater planter with a concrete pad to dissipate the water to prevent erosion. The width of the planter has a minimum width of 30-inches and is equipped with an

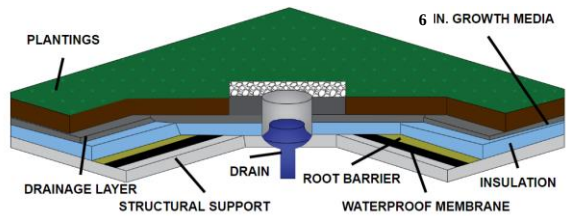

Figure 4 Green Roof Profile

overflow underdrain with a diameter of 8 inches of slotted PVC pipe.

Permeable pavement, such as porous asphalt, provides a surface that lowers the level of impact with the addition of a parking lot. The corresponding runoff number that is generated from the porous asphalt yields a lower peak runoff rate that directly impacts the sizing of inlets, piping and reduces the size of other best management practices. Runoff is still intercepted by bioretention areas and enter the conveyance system to the onsite detention pond. It is expected that runoff pre to post development will flow from 1.2 cubic feet per second to 9.4 cubic feet per second.

It was determined that the best way to manage excess runoff is by installing a detention pond on site that can detain the excess runoff. The detention pond has been designed to meet the FMFCD's requirements for a 24-hour 100-year storm. The design philosophy for this detention pond involved calculating the runoff volume generated by a 24-hour 100-year storm, then determining the necessary dimensions of a detention pond to ensure that this runoff volume could be adequately detained.

For the Fresno area, a 24-hour storm with a recurrence interval of 100-years will have an average rainfall intensity of 0.104 inches per

hour for the duration of the storm. The total amount of runoff that such a storm produces can be calculated using the rational method.

The total area of the site was proportioned by land type (pavement, grass, etc.). Each of these land types has an associated runoff coefficient. Using this information with the rational method equation above, it was determined that a theoretical 24-hour, 100-year storm would produce a total of 63,624 cubic feet of water, or approximately 476,000 gallons.

The detention pond was designed based on this value for the total volume of runoff. An 18-inch reinforced concrete pipe shall serve as an outlet culvert for this detention pond. This outflow culvert shall connect to the nearest inlet for the FMFCD's municipal stormwater pipe.

The detention pond shall be shaped as follows: A rectangular base at a depth of 8 feet below grade, with surrounding side slopes of 2 Horizontal: 1 Vertical until the slopes meet the grade of the project grading plan. For efficiency's sake, it was decided that the footprint of the detention pond should not exceed 15000 square feet. A total footprint of 160 feet by 80 feet was settled based on the exoected runoff.

WASTEWATER DESIGN

The IKEA store must have a system in place to transport and dispose of all wastewater that is generated in the store. Any wastewater that is generated at the IKEA store must be handled by the wastewater system that Key Consulting designs. Bathrooms are not the only source of wastewater generation; generally, any potable water fixture shall generate some wastewater. These sources include sinks, drinking fountains, and food preparation. All wastewater must be directed into the City of Fresno's sewer system. The city's Department of Public Utilities maintains a 12-inch PVC sewer main underneath North Riverside Drive. A private lateral pipe will be used to direct all wastewater into this sewer main.

This lateral pipe has been designed based upon the expected volume of wastewater that it will be required to handle. The International Plumbing Code can be used to estimate the amount of wastewater that the store will generate per day. For large retail stores such as IKEA, it is assumed that 0.05 gallons per day will be generated per square foot of floorspace Therefore, it is estimated that the IKEA store will generate a daily load of 16,000 gallons per day.

For a daily load of 16,000 gallons per day, the City of Fresno recommends that a 4-inch PVC pipe be used as a lateral. The city will install a connection between this lateral and their sewer main. The 4-inch lateral must maintain a 1.5% slope to ensure that solids within the wastewater are adequately flushed and do not get stuck in the pipe. The lateral must be buried at a minimum depth of three feet, starting at a distance of 5 feet from the storefront. The distance from the storefront to the City's sewer main is approximately 330 feet. This requires an elevation drop of 5 feet to maintain the 1.5% slope, meaning that the lateral ceases at a depth of 8 feet. The city's sewer main is buried at a depth of approximately 8.5 feet at the location of the proposed connection.

Because the store's lateral pipe ceases at a depth higher than the city's sewer main, no

pump lift station shall be required. Manning's equation is used to calculate the velocity and volumetric flow rate of wastewater within the lateral. The equation is used to ensure that the ratio between the depth of water in the lateral pipe and the diameter of the pipe itself stays in the range of 0.5 for average use to 0.8 for peak use.

POTABLE WATER DEMAND

The proposed building will connect to the existing water main in two different locations to maximize efficiency and performance, while keeping cost at a minimum. Multiple methods can be used to estimate total water demand, but the fixture method tends to be safest and most conservative method.

The fixture method accounts for every possible fixture in the building. Fixtures accounted for include bathroom closets, urinals, and water fountains.

Estimated water demand will be 75 gallons per minute for non- emergency water needs, and approximately 4,500 gallons per minute for fire demand, or emergency water demand needs. To meet non-emergency water needs two connections will be connected to Fresno water main connection. One of the connections to the water main is located in the northeast of the building, with an approximate length of 90 feet and 5-inch diameter of PVC C900 pipe.

While the other connection will be located in the north west part of the building with approximately 300 feet length and also 5-inch diameter made of PVC C900 pipe. Fire

demand will be with multiple techniques Installing fire sprinklers with a minimum pressure of 20 pounds per square inch to meet City standards. While also setting up an emergency water tank that is capable to hold up to 200,000 gallons and can meet fire needs while for approximately two hours. Multiple fire hydrants will also surround the building to meet the necessary fire demand. Multiple connections to the main will be installed for redundancy and to meet higher future water demands that are expected with population growth.

Figure 5 Parking Site Plan

ONSITE ACCESS

When designing on-site transportation features it is important to consider off-site factors, like right of ways, traffic volumes, and easements. On-site factors may include: structures, piping, traffic circulation, and many more. On-site design was designed to City of Fresno Parking Manual Standards, City of Fresno Standard Drawings, City of Fresno Municipal Codes, and American with Disabilities Act. These were the main guidelines to the reach the proposed design.

City of Fresno required a parking lot capacity of 534 spaces in accordance to SEC. 15-2408.

City of Fresno Parking Manual requires 9 feet by 19 feet standard stalls, 9 feet by 18 feet standard with continues curb and 27 feet minimum aisle width. The on-site overhead powerline tower was a design constraint. Four loading bays for commercial truck shall be 12 feet by 67 feet. ADA compliant stalls account for 2% of total stalls and include 3 van accessible spaces.

OFFSITE ACCESS

Potential customers will use Riverside Drive to access the IKEA store. With the new design, Riverside Drive contains four intersections that give access to the proposed project. Herndon Avenue will be the main road that services the customers. The new volumes that the IKEA will bring were applied to each lane at the intersections. The resulting intersections stay above a Level of Service D, the minimum required in the City of Fresno urban areas.

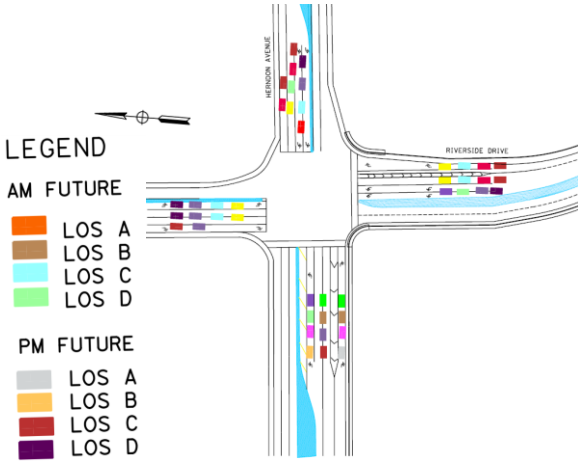

Figure 6 LOS at Hendon Avenue and Riverside Drive

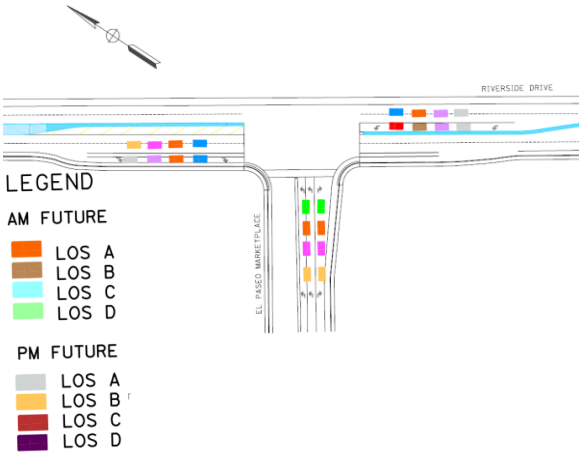

Figure 7 LOS at El Paseo Marketplce and Riverside Drive

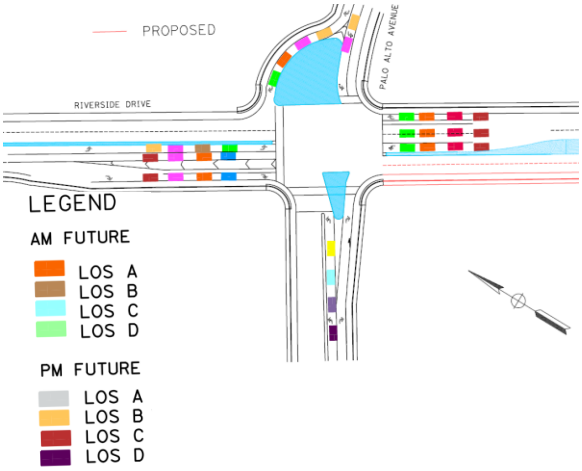

Figure 8 LOS at Palo Alto Avenue and Riverside Drive

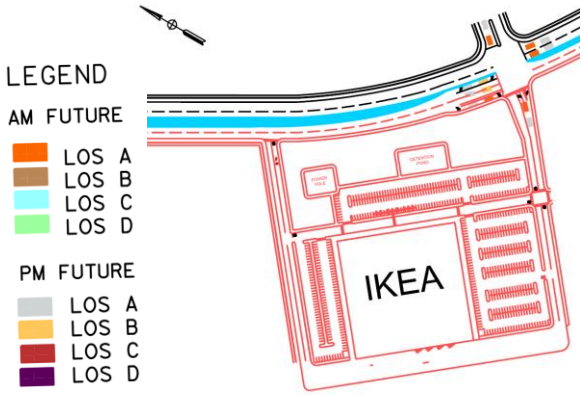

Figure 9 LOS at Cresta Avenue and Riverside Drive

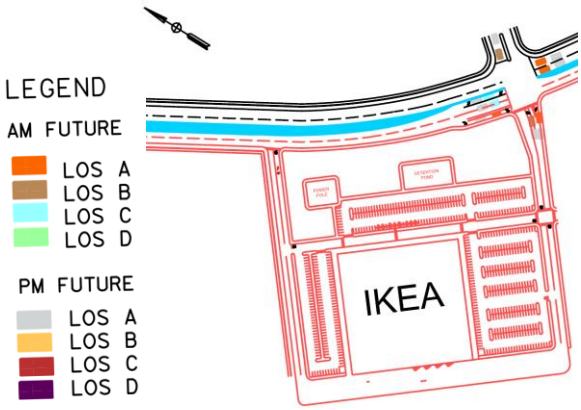

Figure 10 LOS Future at Cresta Avenue and Riverside Drive

A lane was added going southbound on Riverside Drive to better service the customers along with pedestrian and bicycle accommodations. This new lane will extend pass the new intersection and merge back into one lane as it gets closer to Veterans Boulevard. The new intersection at Riverside Drive and Cresta Avenue did not qualify for a traffic signal warrant when considering the volumes for existing with project and for 20 years in the future.

Since the intersection did not meet the signal warrant, stop signs will be implemented at this intersection. Another access point was added alongside Riverside Drive to alleviate congestion at the new intersection. All roadway improvements are in the right of way.

Key Consulting Inc. would like to acknowledge the following mentors and advisors. The work performed would have not been possible without their guidance and contributions.

Dr. Lubo Liu, CSU, Fresno

Dr. Aly Tawfik, CSU, Fresno

Dr. Fariborz Tehrani, CSU, Fresno

Dr. Lalita Oka, CSU, Fresno

Dr. William Wright, CSU, Fresno

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