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CAL STATE LA
COLLEGE OF ENGINEERING,
COMPUTER SCIENCE,
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Cal State LA College of ECST Capstone Senior Design
CIVIL ENGINEERING PROGRAM 2023-2024
PROJECT DESCRIPTIONS

Costa Mesa Park-and-Ride: A Sustainable Solution to Promoting Urban Commuting

Client: Aztec Engineering Group Inc.
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Build an environmentally friendly park-and-ride facility to incentivize carpooling. Located in Orange County, California, Costa Mesa is a vibrant city known for its rich history, diverse culture, and bustling urban environment. It consists of a dynamic mix of residential, commercial, and recreational areas. The city is renowned for its commitment to sustainability initiatives, with a focus on reducing carbon emissions and promoting eco-friendly practices. Costa Mesa also faces challenges related to traffic congestion, especially during peak hours, due to its proximity to several major highways and popular destinations.

The City of Costa Mesa has enlisted the help of the California State University of Los Angeles (Cal State LA) Senior Design class of 2024 to develop a 149,000-square-foot plot of land located in their city into a park-and-ride facility. The site is conveniently located directly off the 405 freeway, less than 5 miles from the CA-55 and CA-73 freeways, and between two transit center locations. The proposed facility runs along Bristol Avenue, which, on average, is subject to over 113,000 cars daily. The final design will allow Costa Mesa residents to safely and efficiently enter, exit, and park inside the lot while addressing all other client and local community concerns.

California needs efficient, safe, and reliable transportation for all its inhabitants. The park-and-ride's main goal is to improve the efficiency and effectiveness of existing transportation systems and the quality of life of the city's inhabitants. Some of these considerations include keeping the freeway from reaching capacity, reducing time spent in congestion, lowering stress related to traffic, reducing emissions, improving local air quality, reducing commuter-associated expenses, safety and accessibility compliances. This project strives to create an inviting, safe, and environmentally conscious park-and-ride location from which the City of Costa Mesa community can benefit.

This project's scope includes altering the existing intersection to include a paved entryway into the parking lot flush with the existing grade and elevation. In preparation for our design, we considered technical and

nontechnical constraints, formulated questions for the client, identified design criteria, reviewed topographical maps, and produced design alternatives. We considered existing structures, pipelines, and traffic in the area to address potential hazards and ensure continuity with the local area. In addition to regular parking spots, the constructed facility will include spots exclusively for accessibility and electric vehicle (EV) charging. We will further emphasize accessibility by creating a safe transversal path to carpool pick-up and drop-off zones for all commuter's levels of movement ability. Lastly, we have considerations for traffic and ease of entering/exiting the facility, emergency service response, aesthetic value, and sustainability.

Costa Mesa Park and Ride

Client: Aztec Engineering Group Inc.
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The City of Costa Mesa has identified the need for a park-and-ride facility south of the 405-Freeway off-ramp and Bristol Street. The purpose of this is to alleviate a transportation deficiency in the area that impacts the traffic corridors of the 405, 75, and 55 highways, in addition to lowering the emitted greenhouse gasses by vehicles to allow for an overall positive impact on the community. The proposed project envisions a park-and-ride facility at 3156 Bristol Street, Costa Mesa, to tackle the pressing transportation challenges in the area while integrating sustainability, constructability, and accessibility.

The primary goal is to adhere to the client's requirements and specifications for the facility by including a minimum of 140 parking spaces with accommodation of a minimum of 7 ADA-compliant spaces and 33 stalls with access to electric vehicle chargers. Additional requirements are amenities such as concrete benches, trash receptacles, bike lockers, and an on-site storage shed.

The project consists of environmentally conscious and sustainable solutions considered, including a low-impact development strategy for stormwater management, recycled and renewable materials, and solar panels for renewable energy. It also incorporates possible new and emerging technologies and construction methods that can help attain said goals. All while navigating the construction processes to ensure proper constructability is accounted for.

The overall design needs to take into account local properties and existing utilities to prevent encroachment on the property lines or infringement on owners' recommendations of existing infrastructure on the proposed site location. The project also involves modifications to the intersection of Bristol Street and the South-Bound Bristol Street on/off ramps to ensure smooth traffic flow with redesigned traffic stripes, signage, and signal timings. The design of the park-and-ride is structurally sound with considerations for foundation, liquefaction, seismic, and continued loading, and addresses all issues and concerns brought to us by the sponsor.

Aside from the design aspects, consideration of the construction methods is also taken into account to minimize light, sound, and environmental pollution while also minimizing traffic impact during the construction of the park-and-ride to minimize detrimental effects on the community.

Costa Mesa Triangle Park & Ride

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With traffic congestion worsening in Orange County, California as people continue to move to suburban communities and commute to their destinations, the need for ride sharing increases. Thus to reduce traffic congestion, especially during peak hours a park and ride lot is needed in the area.The current park and ride lots in Orange County within the vicinity of Bristol St. and Interstate 405 are not sufficient for the demand needed by Costa Mesa due to the commercialized area of South Coast Plaza, highly trafficked freeways: Interstate 405, California State 55, and California State 73, and the existing nearby lots are mostly shared use.

After researching what is entailed in designing a park and ride facility and identifying constraints, we brainstormed solutions. We then narrowed the brainstormed ideas to three alternatives: a minimally designed lot, a maximum land use park and ride, and a parking structure. Analysis of the alternatives and then comparing and contrasting them against one another yielded the maximum land use lot as the best alternative. In agreement with our recommended alternative, we designed the maximum land use park and ride lot.

The Costa Mesa Triangle Park & Ride is a stand-alone park and ride facility at Bristol Street and Interstate 405 Freeway. The purpose of the facility is to provide the residents of Costa Mesa a convenient transition point to ride share. The design maximizes land use and has approximately 170 parking stalls including: ADA accessibility and electric vehicle charging. In addition, the design will entail: concrete benches, bike lockers, bike racks, and a solar canopy within the loading zone for a comfortable ease in transition to ride sharing. To ensure the facility is maintained, a 500 square foot shed will be constructed on site for storage of tools.

Development of a Sustainable Park-and-Ride Facility in Costa Mesa

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Located in Orange County, the city of Costa Mesa is known for its diverse culture, rich history, and, most importantly, an ever-growing urban environment. Known for its dedication to sustainability, the city comprises residential, commercial, and recreational areas. As part of its commitment to sustainability and addressing transportation challenges, Costa Mesa has initiated a collaboration with the senior design team at California

State University, Los Angeles (CSULA) in designing a park-and-ride facility located at the intersection of Bristol Street and the 405 Interstate, in Costa Mesa, California.

The primary goal of this project is to develop a park-and-ride facility that addresses the pressing need for sustainable transportation solutions in Costa Mesa. A comprehensive analysis required the utilization of several engineering factors including, but not limited to, surveying the site, designing the parking facility, implementing efficient traffic flow management, and assessing potential environmental impacts. The recommended design comprises 57,000 square feet and incorporates 144 parking spaces (including 7 for ADA compliance and 33 for electric vehicles). With a gradient ranging from 2 to 5%, the layout ensures efficient traffic flow and accessibility. The facility's features include bike lockers, electric vehicle charging stations, solar panels, storage facilities, and two designated seating areas. Some project deliverables include engineering design drawings, permit requirements, and cost estimation.

By working closely with the client, the objective is to create a facility that provides convenient parking for commuters and encourages carpooling and public transportation. The facility aims to enhance the area's transportation infrastructure, reduce traffic congestion, and improve air quality, thereby enhancing the overall quality of life for residents.