Lakefront Park Project Abstract

2024 NCEES Education Award Submittal: Community Enhancement Category

Project Description

The project evaluates and designs improvements for Lakefront Park near the City's downtown.

Project Objectives

A team of five senior engineering design students created three design alternatives to revitalize the park, with each design fulfilling the project objectives in a unique way. The design process was guided by four main project objectives stemming from the values and goals shared by the Client, City, and County, and informed by public input. Project objectives include:

1) Improved water quality and swim-ability
2) Improved park sustainability
3) Enhanced accessibility for all potential users
4) Increased lakefront use and placemaking

Design Constraints and Considerations

Environmental and hydrologic constraints include rip rap that heavily armors the shore. Although it reduces erosion, rip rap significantly reduces lake access, does not reduce the City's nutrient and particulate load to the lake, and is unsightly.

Because the site is small and narrow, spatial constraints limit the design flexibility and constructability. The site is adjacent to a six-lane U.S. highway, a set of parallel railroad tracks, a paved walking and biking path, and the municipal center. The highway speed limit is 35 MPH, which cannot be changed. The project budget is approximately $20 million.

Three Design Alternatives Developed

The student team developed and presented three design alternatives to explore the range, cost, and applicability of the project goals. Essential to each of the three designs are environmental/water quality improvements, modifications to the park shoreline, and accessibility considerations.

The alternatives were compared using Multiple Criteria Decision Analysis (MCDA) in a decision matrix. Alternative 2 was selected, as it offers the highest-scoring balance of improving accessibility, sustainability, water quality, and placemaking, while remaining within budget.

- **Hydrologic/stormwater design** - stormwater design for Alternative 2 routes runoff through a rain garden and four stormwater screening devices, reducing suspended solids concentrations entering the lake by nearly 30%.
- **Environmental design** - includes a beach enclosure system**,** reducing beach closures and providing a reliable swimming area for park visitors. Additionally, to improve stability, aesthetics, and environmental quality, the design includes a series of floating wetlands and vegetation planted above and below rip rap in the boardwalk shoreline area.
- **Coastal design** - coastal analysis finds a significant wave height of 2.5 feet, requiring material that is no less than 225 pounds each and not less than 9 inches in its smallest dimension.
- **Structural design** - focuses on four main structures: the underpass, park pavilion, boardwalk, and stepped shoreline seating.
- **Transportation design** - includes an underpass for a U.S. Highway, redesign of local street intersections, and bike trail modifications.
- **Geotechnical design** - a pavilion constructed over the lake will be supported by 18 piles driven approximately 50 feet into the underlying lakebed. The design contemplates an estimated load of about 262,000 pounds per column with a settlement of less than one inch using a safety factor of 2.5.
- **Project schedule** - the estimated schedule for the selected alternative is 3 ½ years.
- **Opinion of estimated project cost** - estimates for the alternatives range from $9M to $26M.

This unique project provides students with hands-on, real-world project experience that supports health, safety, and welfare to the public; multi-disciplinary collaboration of faculty, students, and licensed professional engineers; and learning through collaboration that are not possible in traditional classroom settings.