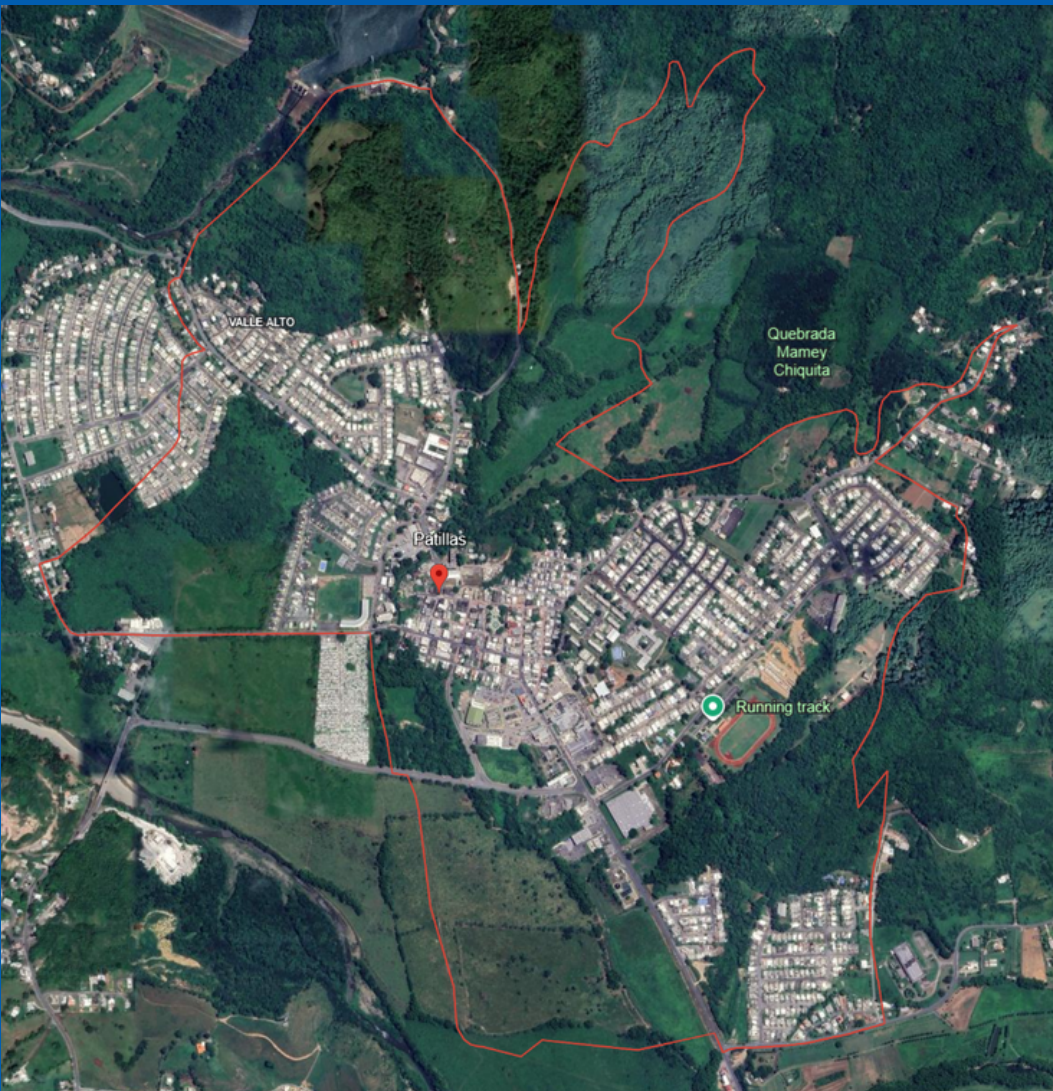




Development of a Methodology to Apply Complete Streets Procedures in the Urban Core of Patillas, Puerto Rico



Polytechnic University of Puerto Rico
Department of Civil Engineering, Environmental Engineering and Land Surveying
CE 4920 - 09 Engineering Senior Design Project II, WI-25

Authors

Jean C. Calderón Rodríguez - Amaury A. Delgado Miranda - Andrés Martínez Camacho - Omar G. Muñiz Baranda - Andy L. Muñiz Montañez - Nyrma O. Ortiz Torres - Josean Y. Pagán Reyes - Yandel E. Prieto López - Paulo G. Quintana Ríos - José L. Sanabria Santiago
Prof. Ginger M. Rossy Robles

What is Complete Street?

A Complete Street is an urban corridor designed for safety, accessibility, and efficiency for pedestrians, public transportation, and vehicles. In Puerto Rico, this approach is established by Law No. 201 of December 16, 2010 (Complete Streets Law).

In the urban center of Patillas, its implementation is realized through continuous and accessible pedestrian routes (ADA), orderly management of the street edge (parking, loading/unloading, and pick-up/drop-off zones), and the functional integration of public transportation stops with the pedestrian network, strengthening multimodal connectivity and equitable mobility.

Existing Conditions

The current condition of the urban area of Patillas, particularly along PR-3 (Luis Muñoz Rivera) and its immediate surroundings, presents operational and safety challenges due to the restricted road width and curbside management (parking and bus stops) that reduces the effective width of the roadway.

Furthermore, accessibility deficiencies are observed, with sidewalks and ramps that do not consistently meet ADA standards. Visibility at intersections is also limited, and there is a need for improved signage and road markings to better regulate traffic flow and reduce conflicts between pedestrians and vehicles.



Figure 1: Existing Conditions Bus Stop

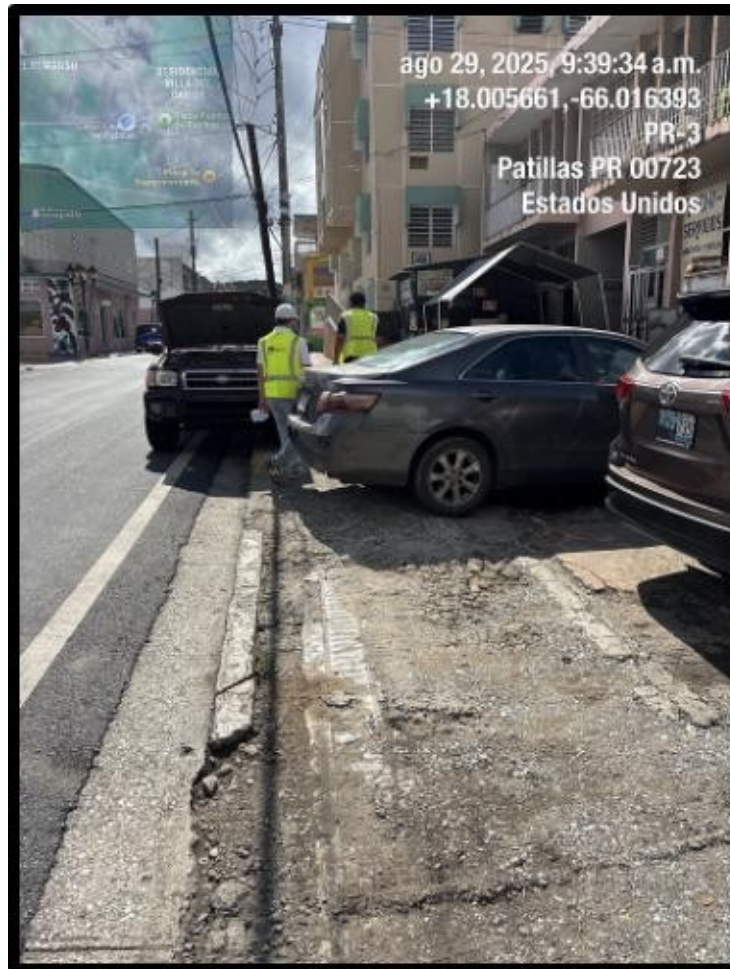


Figure 2: Existing Conditions Sidewalk



Figure 3: Existing Conditions Parking Lot

Proposed Plan

Sidewalk/ADA

- Define a preliminary concept for corridors and sidewalks to guide detailed design.
- Ensure pedestrian continuity and ADA accessibility (functional routes and connections).
- Enhance the alignment of crosswalks and geometric conditions at critical points.
- Strengthen signage and marking according to MUTCD standards to reduce conflicts.

Multi-Level Parking

- Propose a multi-level parking structure made of reinforced concrete with internal ramps.
- Establish controlled entry and exit points to minimize conflicts and queues.
- Include accessible parking spaces and an ADA-compliant route connected to the right-of-way.
- Support the strategy to alleviate parking pressure on the street and free up curb space.

Public Transit Stop

- Propose two standardized models made of precast concrete.
- Address current deficiencies: seating, lighting, and signage.
- Model A: a fully prefabricated module (roof, bench, slab, and walls) for high durability and quick installation.
- Model B: a more cost-effective alternative featuring steel columns (partially prefabricated) for secondary routes.

Abstract

A methodology and conceptual-level preliminary design package was developed to implement Complete Streets in downtown Patillas, focusing on the PR-3 corridor and its surrounding street network. Existing conditions reflect recurring operational and safety constraints driven by limited roadway width, curbside activity (parking and transit operations), restricted visibility, and inconsistent ADA accessibility. The proposed plan integrates implementable actions for curbside organization, continuous ADA compliant sidewalks and curb ramps, transit stops connected to the pedestrian network, and targeted operational improvements to reduce conflicts and optimize multimodal circulation. A key element is the concept of a multi-level parking facility to shift parking demand away from the curb, freeing space for a safer right of way allocation.



Figure 4: Patillas Downtown Aerial View

Public Bus Stops Design



Figure 5: Public Bus Stop Render

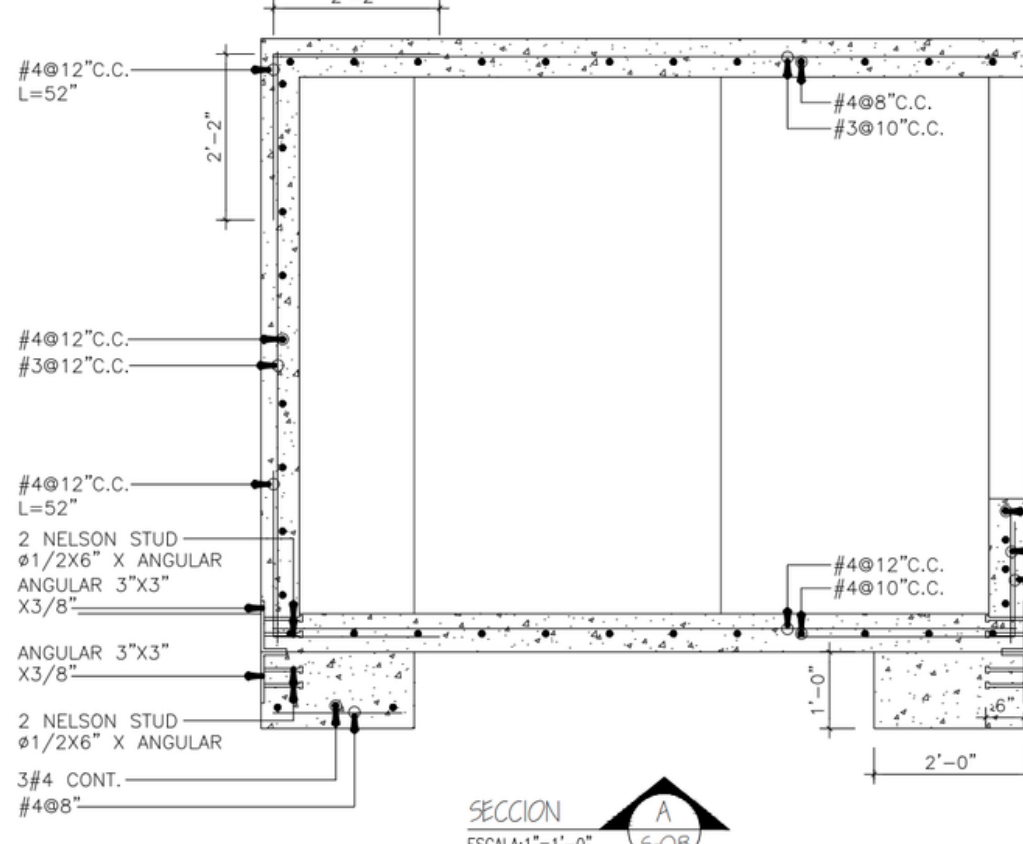


Figure 6: Bus Stop Structural Details

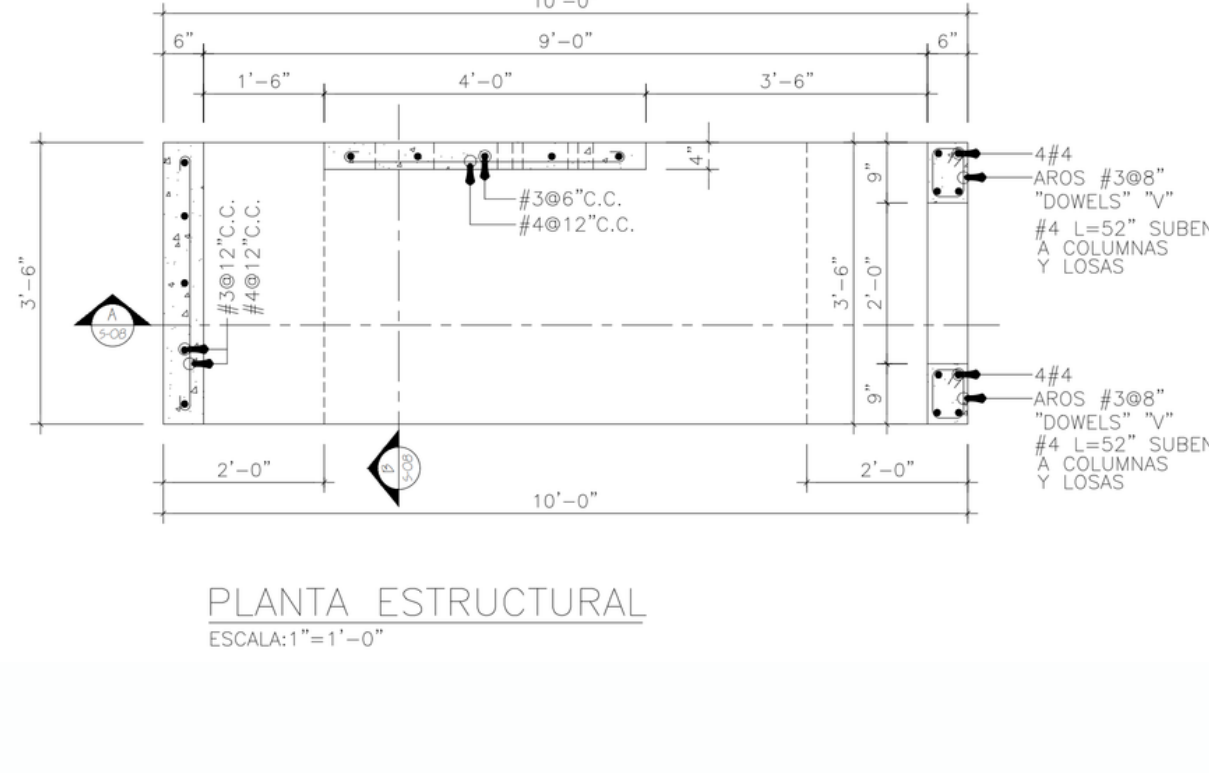


Figure 7: Bus Stop Structural Details

Multi-Level Parking Structure Design



Figure 8: Multi-Level Parking Structure Render Front View



Figure 9: Multi-Level Parking Structure Side View



Figure 10: Multi-Level Structure Parking Elevation Section

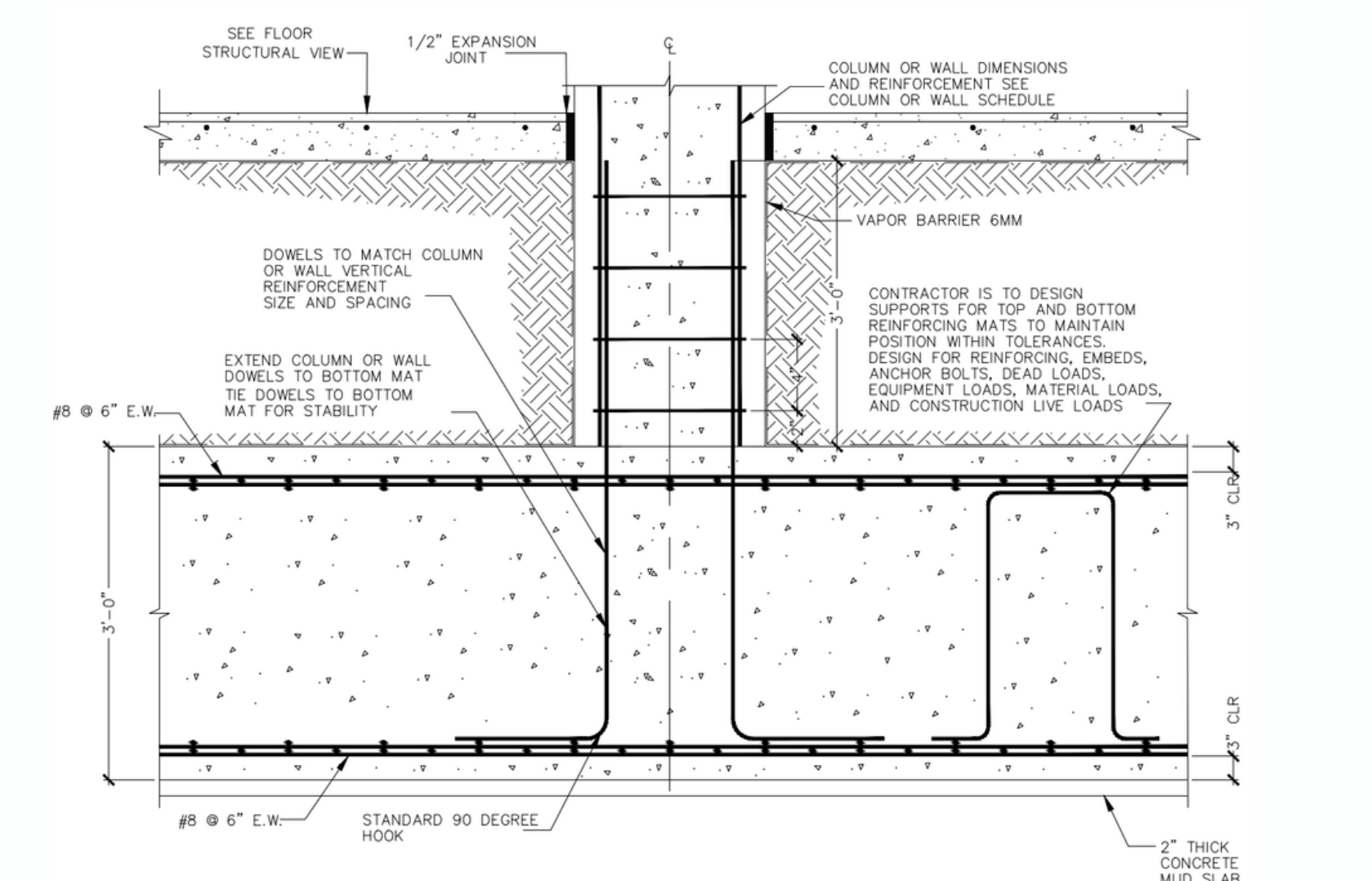


Figure 12: Multi-Level Parking Structure Foundation Reinforcement

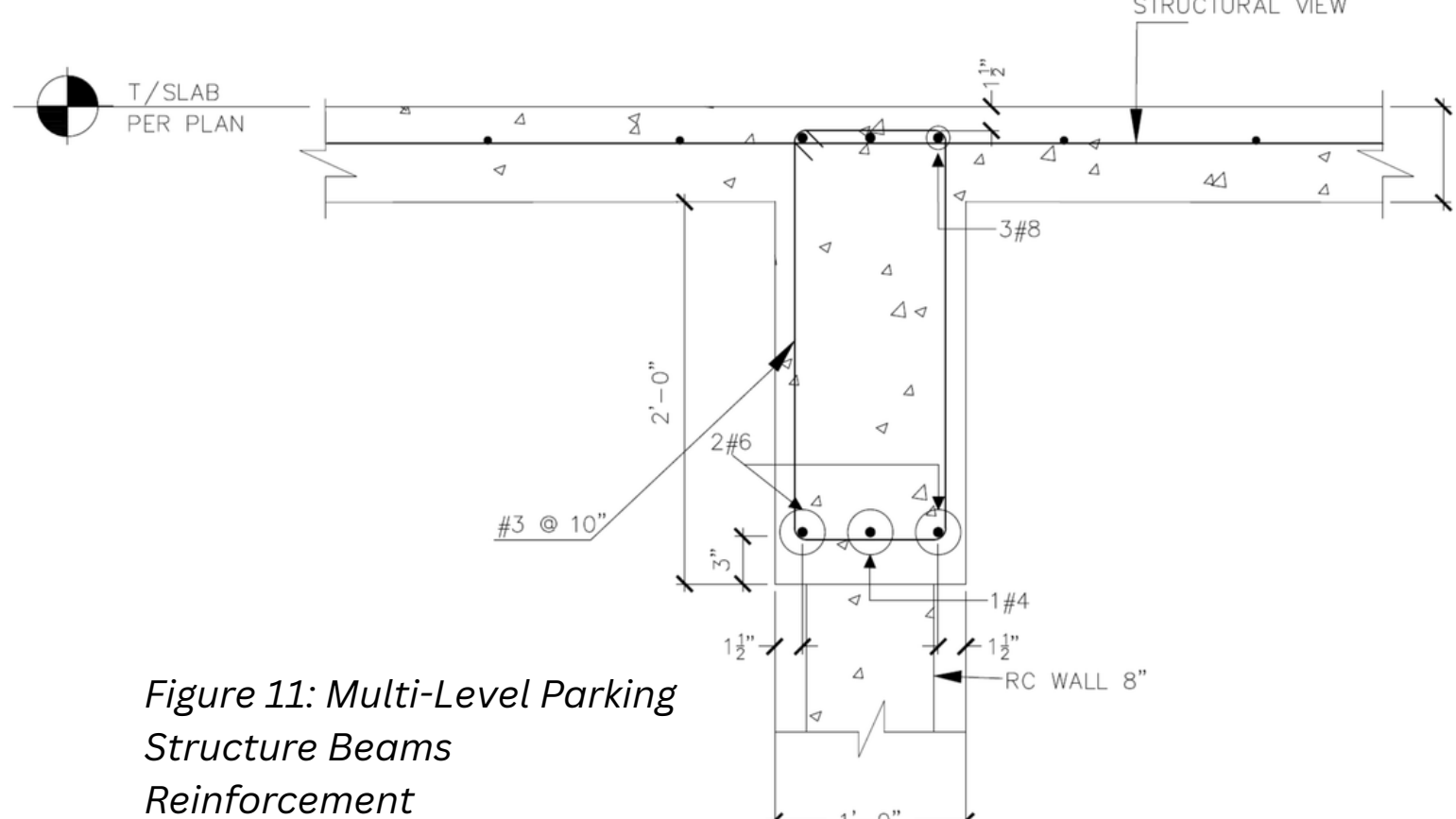


Figure 11: Multi-Level Parking Structure Beams Reinforcement

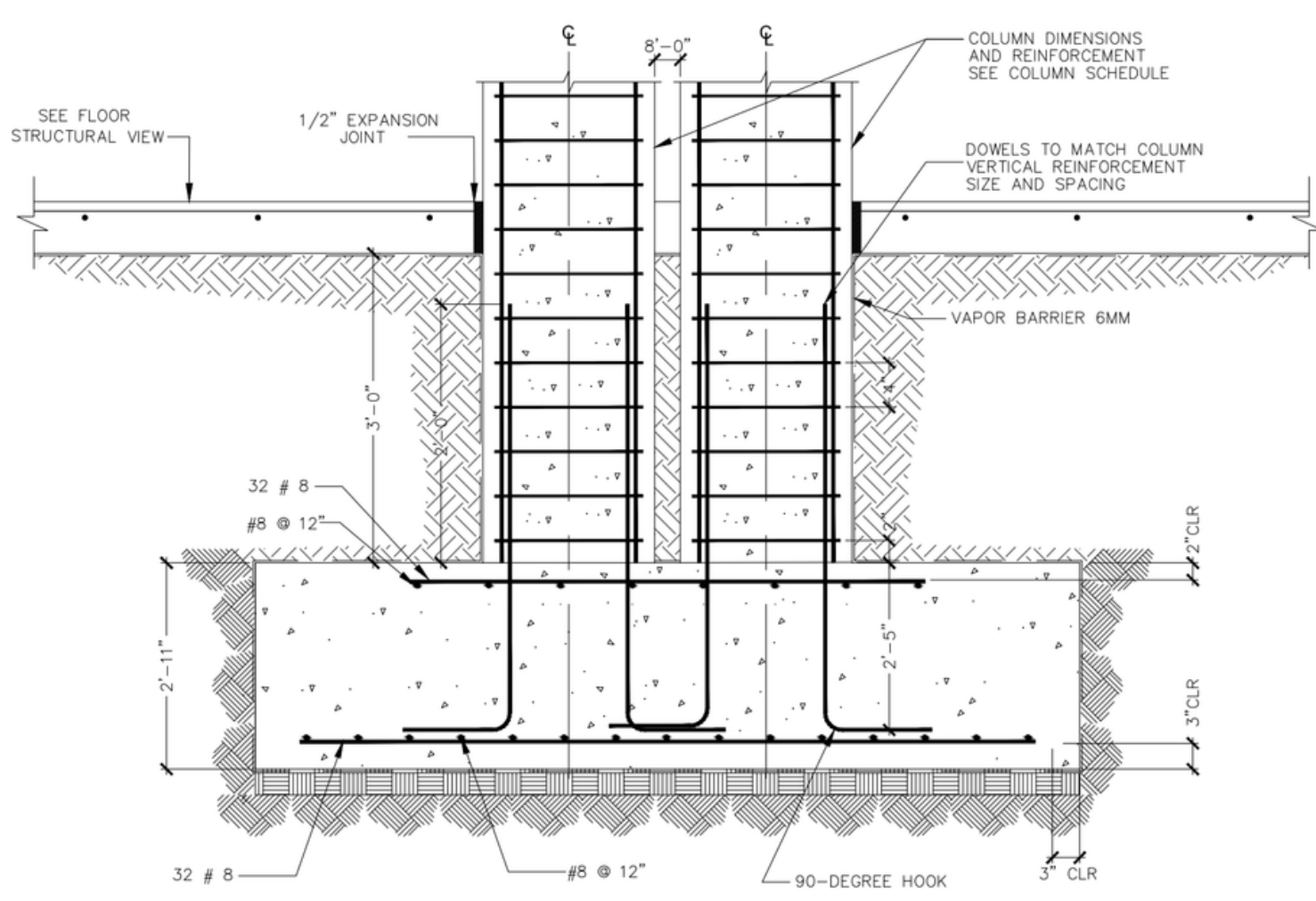


Figure 13: Multi-Level Parking Structure Foundation Reinforcement

New Sidewalks Design Details



Figure 14: Existing Sidewalk Cross section

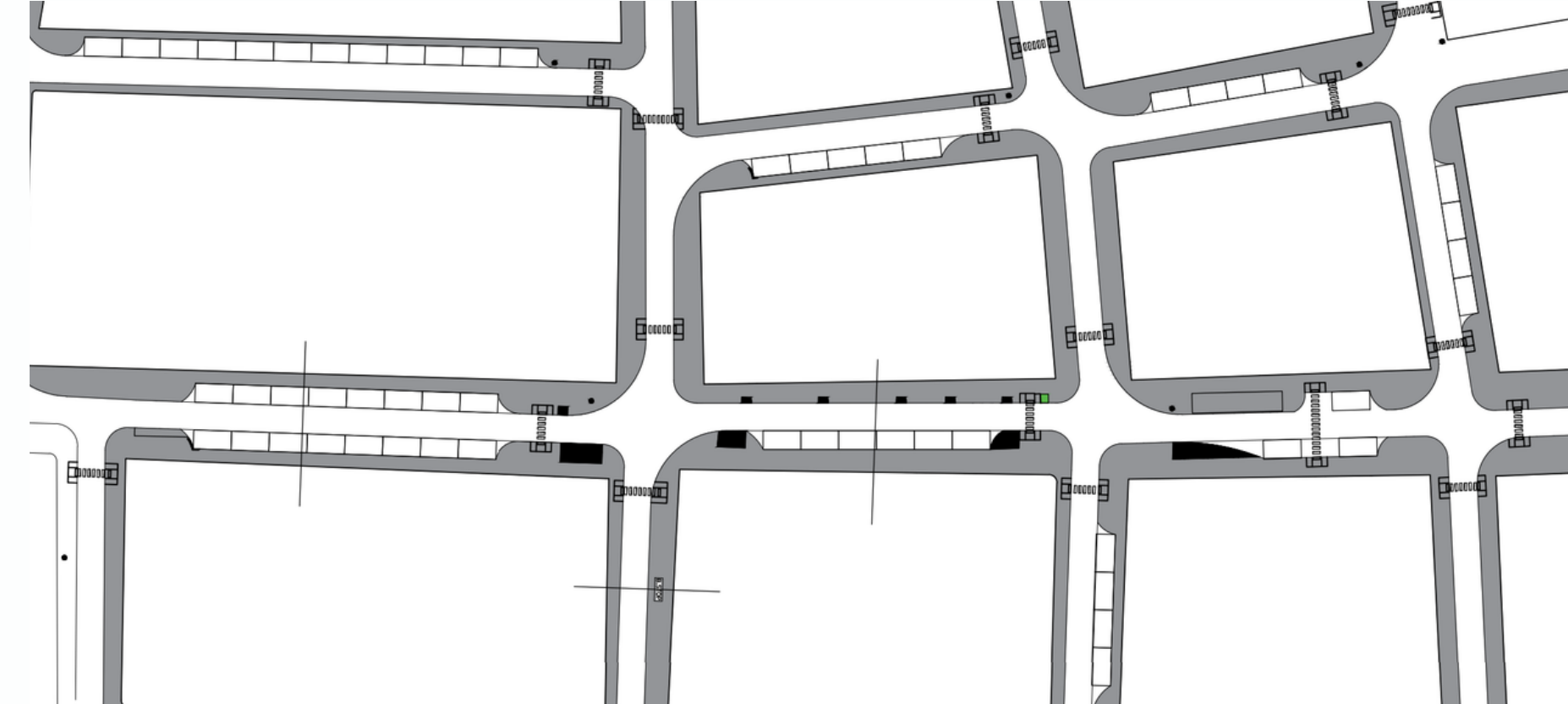


Figure 15: New Sidewalk Design

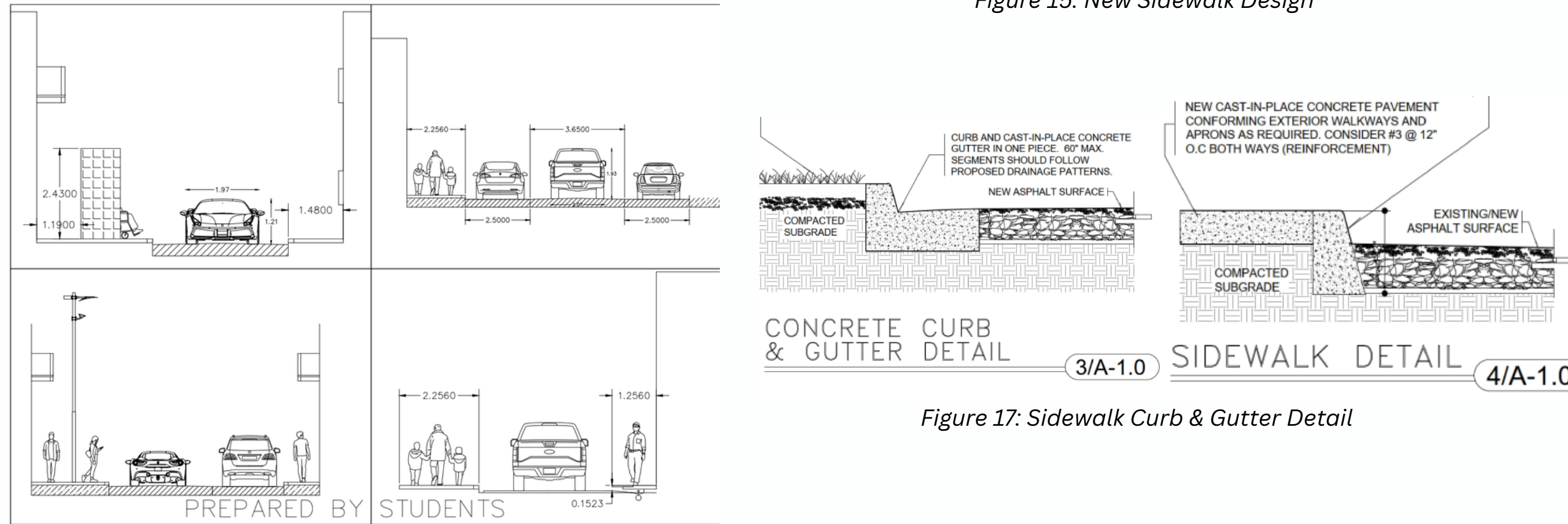


Figure 16: Proposed Sidewalk Cross section

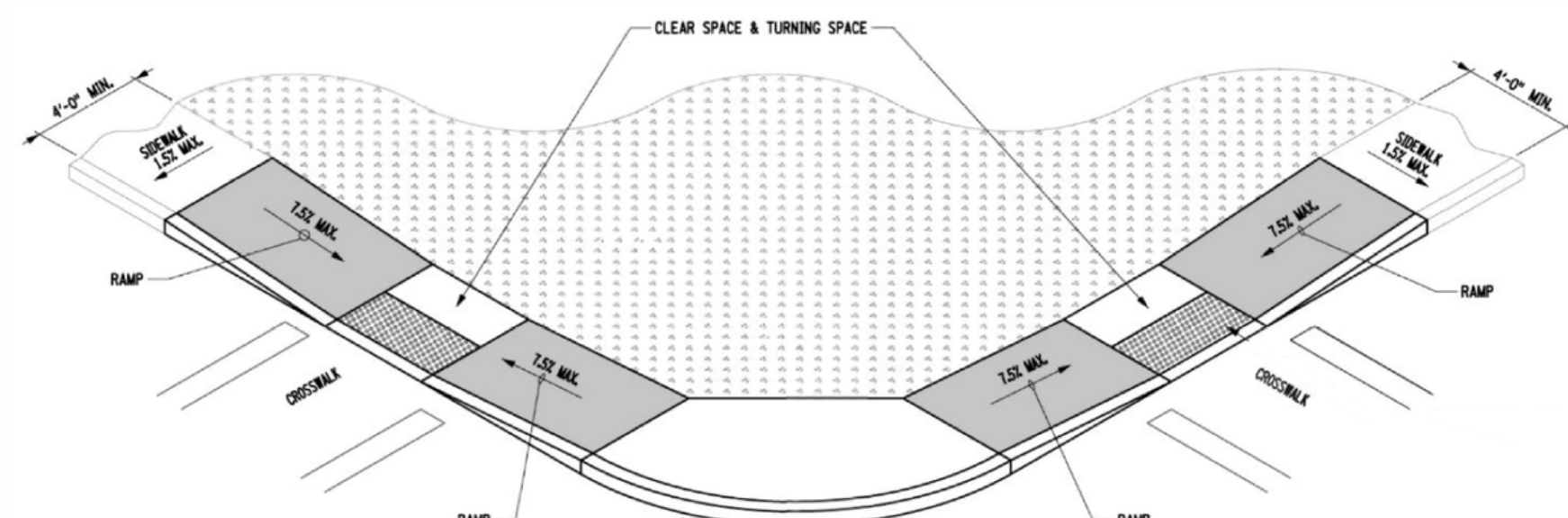


Figure 17: Sidewalk Curb & Gutter Detail



Figure 18: Sidewalk Details

Estimated Costs

Multi-Story Parking Facility Price	\$15,099,576.32
Sidewalks in the town of Patillas Price	\$5,566,781.16
Public Bus Stop Price	\$31,245.00
Total Price Est.	\$20,697,602.49
Time Est. (Days)	1286

Figure 19: Total Project Cost Estimate

Conclusion

Implementing a Complete Streets approach in downtown Patillas is viable when approached as an integrated strategy, combining operational and geometric improvements rather than isolated interventions. The existing situation relies heavily on street-side parking, and its informal management contributes to capacity loss, uncontrolled stops, visibility restrictions at crossings, and conflicts with pedestrian mobility and accessibility.

To address these deficiencies, the proposed methodology prioritizes a more predictable and enforceable system through signage, road markings, and functional allocation of curb space, supported by ADA-compliant sidewalk and ramp concepts, standardized public transportation stops, and a conceptual multi-level design to manage demand outside the corridor. This framework establishes a clear path toward detailed design and phased implementation, focused on safety, accessibility, and urban performance.

Affiliates

"We're also proud of the institutions we partner with that support our project: Advantage Business Consulting, Inc. (ABC), ShareTech, CivilTek, and Professional Engineers, P.S.C."

