Integration of Resilience and Context Sensitivity

Integration of Resilience and Context Sensitivity in a Coastal Environment

State Road A1A in Fort Lauderdale, Florida

Background

The following case study examines a transportation project that builds resilience to climate hazards into project design, while also demonstrating the Context Sensitive Solutions (CSS) and Design (CSD) processes.

CSS/CSD distinguishes itself as a transportation planning and design process that prioritizes the broader physical, environmental, as well as societal context within which a project is conceptualized, planned, designed, constructed, operated, and maintained. CSS/CSD promotes collaboration among a diverse range of stakeholders to ensure long-term project resilience and success. CSS/CSD principles are often used interchangeably. They can also be achieved through processes referred to as Value Sensitive Design or Flexible Design. The case study identifies key benefits of incorporating CSS/CSD into resilient, or adaptive, transportation improvement projects. [1]

Context Sensitive Solutions/Design

The **Context Sensitive Solutions (CSS)** process is a collaborative, interdisciplinary, and holistic approach to the development of transportation projects. The CSS process involves all stakeholders, including community members, elected officials, interest groups, and affected local, state, and federal agencies. The CSS process values equally the needs of agency and community, considering all trade-offs in decision-making.

Context Sensitive Design (CSD) is design process that not only considers physical aspects or standard specifications of a transportation facility, but also the economic, social, and environmental resources in the community being served by that facility.

Resilience is defined by AASHTO as "the ability to prepare and plan for, absorb, recover from, or more successfully adapt to adverse events." In the context of climate change, resilient projects are often referred to as climate change adaptation strategies, where a change in project characteristics and design is made to lessen the impacts of current and future climate change hazards on the project itself. Adaptation strategies can also be used to reduce project risk to other hazards, such as terrorism, earthquakes, and landslides and mitigate or avoid associated consequences of hazards, such as traffic bottlenecks in an evacuation.

By using CSS/CSD, project teams can ensure that climate adaptation and resilience projects are not only prepared for the future but reflect current site contexts. Preserving site context includes maintaining consistency with community values, responding to community needs, blending into the surrounding built and natural environment, and serving the functional purpose of the project itself. Several adaptation strategies and CSS/CSD concepts are illustrated in the State Road (SR) A1A project case study in Fort Lauderdale, Florida. The use of CSS/CSD on this case study project was successful in several ways, by incorporating a Complete Streets design with a focus on pedestrian safety, effectively collaborating with the community and partners to identify context specific needs, reducing travel lanes to create space for bike lanes and a central median, avoiding environmentally sensitive areas, and developing adaptive responses to storm surges and sea level rise.

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Center for Environmental Excellence

Impacts from Hurricane Sandy

SR A1A in Fort Lauderdale, Florida is a critical asset to the community given its central location and access to key businesses, residential sites, and public beaches. In 2012, outer bands of Hurricane Sandy (also called SuperStorm Sandy) passed by the area but did not make a direct hit. The four-lane state highway and adjacent sidewalks, weakened by Hurricane Sandy, were further damaged one month later when another storm passed by the city (Figure 1 shows the damaged area of SR A1A).

Response Efforts

The City of Fort Lauderdale, Florida DOT (FDOT), and the Broward Metropolitan Planning Organization (BMPO) coordinated the immediate recovery efforts to bring the inundated and damaged road back to some level of functionality, as well as the development of a longer-term adaptation strategy to protect the roadway from future flooding. The immediate recovery efforts included installing a sheet pile wall next to the beach to protect the road and re-establishing two temporary lanes of traffic on the functional remains of the existing roadway. Because the road had to be completely rebuilt, the partners also had a unique opportunity to rebuild it using CSS/CSD principles and adaptation strategies. Initial project construction occurred at a rapid pace so as not to lose valuable project development time while designs for both two-lane and four-lane alternatives were refined with public input.

Figure 1: Project Boundaries

CSS/CSD Process

Project design involved extensive public discussion, a key component of CSS/CSD, to facilitate community engagement with recovery efforts. The City, FDOT, and BMPO met with the public and launched a website to collect input on what they thought the new road should look like and the functionality it should provide. This feedback was instrumental in leading to a reconfigured cross section that included a two-lane roadway (reduced from four) with bike lanes and improved pedestrian access to the beach. Although the two-lane design had a lower vehicle capacity from the previous design, the City was willing to accept this lower level of capacity in order to provide a Complete Streets-oriented design that met the needs of all roadway users. The new two-lane design addressed previous pedestrian safety concerns by supplementing an existing, non-Americans with Disabilities Act (ADA)-compliant pedestrian tunnel under the roadway with a new, at-grade crosswalk. Design and construction limitations were also addressed through CSS/CSD collaboration. For example, the footprint of the new design could not be expanded given possible encroachment on a sea turtle nesting area (which was emphasized throughout the collaborative project planning process). The partners held open communication with the permitting agencies (Florida Department. of Environmental Protection and the Florida Fish and Wildlife Conservation) and other environmental groups to ensure the new road met all environmental needs in addition to community needs.

Figure 2: Flooded SR A1A (2012), *Photo by Art Seitz*

Highway Improvements and Project Resiliency

Protection from future storm surge and sea level rise was another key concern in project design. The new design added flood protection by adjusting its slope. The original road sloped toward adjacent homes. The new road is slightly elevated in the middle of the road. The new design now redirects stormwater runoff to storm drains on either side of the highway. The seaward side of the road was raised the maximum extent feasible while still maintaining access and harmonization with adjacent properties (this was not based on sea level rise projection or modeling). Traffic control boxes were raised onto concrete slabs to prevent water damage from flooding.

The City pushed for the incorporation of Complete Streets design elements, which was consistent with the City's Complete Streets Policy.1 Rebuilding the road gave the City an opportunity to make major changes that would have been difficult to achieve otherwise. There was strong community support for these changes, in part because the aesthetic improvements also changed the roadway from a through-put facility into a "nice place to be." To account for concerns with turtle nesting, back walls were put in place behind wall beach openings to prevent sea turtles from entering the roadway. These walls also serve to break up storm surges that might advance up the beach. The project sponsors also took steps to enhance the aesthetics of the roadway by adding a median with landscaping including coconut palms, which the City requested for continuity of the landscape theme in the A1A corridor. Other aesthetic additions included stamped asphalt crosswalks, decorative brick paver sidewalks, installing the back walls in swirling design pattern with embedded lighting, and improving pedestrian lighting.

Figure 3: Hurricane-related Damages and Emergency Repairs, *Photos Provided by FDOT*

In total, the entire project process spanned just under 3 years from the onset of the hurricane to the opening of the final road. Framing the project around CSS/CSD and resiliency for SR A1A project the new road design to respond to community and environmental needs while adapting the road to current and future storm surges and sea level rise. The FDOT team identified both CSS/CSD and resiliency efforts as essential to the design process. As noted by an FDOT official, "it is much simpler and less costly to implement CSS/CSD and resiliency from a project's outset rather than in the face of disaster and under the challenging constraints that come along with it." The same official also acknowledged that it often takes a disaster to motivate political, agency, and stakeholder action to implement CSS/CSD and resiliency concepts into project designs.

Benefits of Incorporating CSS/CSD into Resilience Projects

The SR A1A project demonstrates how CSS/CSD principles and concepts can be incorporated seamlessly to improve projects focused on adaptation. Those interviewed for this case study noted the successes of the SR A1A CSS/CSD process, which included: incorporation of a Complete Streets design with a focus on pedestrian safety, effectively collaborating with the community and partners to identify context specific needs, reduction of lanes from four to two to create space for bike lanes and a central median, avoidance of environmentally sensitive areas (sea turtle habitat), and adaptive responses to storm surges and sea level rise. By taking in the full picture of the project location, including community needs, environmental concerns, and existing/projected hazards, the project partners were able to create a successful design that accounts for all these needs.

A unique aspect of applying CSS/CSD principles to resilience projects is that it allows for consideration of both existing and future site context. While CSS/CSD is typically focused on understanding the existing site conditions and needs, incorporating CSS/CSD into resilience projects, especially those oriented around adapting to climate change, creates an opportunity to think about what the future site context may be. Project teams will need to think about how risks may change over time and how community needs will evolve and can evaluate these changing needs through scenario-based planning. As an example, users of a roadway may identify the need for more sidewalks and bike lanes. While considering this need, project teams may also evaluate how rising temperatures could affect pedestrians and bicyclists. An adaptation strategy could be designed to provide shading in the form of structural overhangs or tree canopy to ensure that the sidewalks and bike lanes are useable and safe well into the future.

Applying CSS/CSD principles to achieve greater resilience presents an area rich for exploration where there is significant opportunity to address project challenges for the present and future.

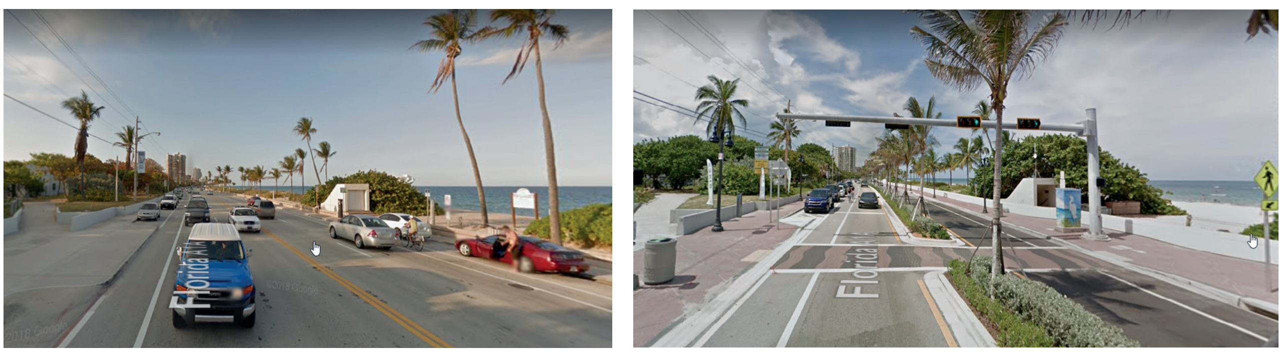

Figure 4: Before and After Route A1A Improvements, *Photos Provided by FDOT*

Figure 5: Sidewalk and Wall Improvements, *Photos Provided by FDOT*

1 "Complete Streets Policy," City of Fort Lauderdale, Florida, accessed on November 16, 2021 from https://www.fortlauderdale.gov/government/departments-i-z/transportation-and-mobility/transportation-division/programs-policies-and-initiatives/complete-streets-policy