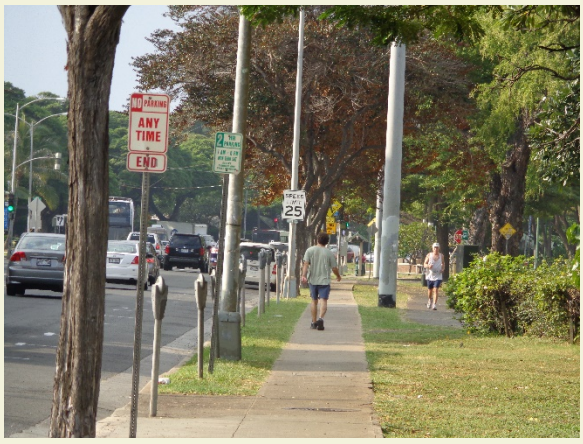
JUNE 2015

HONOLULU COMPLETE STREETS IMPLEMENTATION STUDY LOCATION REPORT

Kapahulu Avenue from Kanaina Avenue to Herbert Street (FINAL)



City & County of Honolulu

Department of Transportation Services

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With
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Summary: Kapahulu Avenue from Kanaina Avenue to Herbert Street

NEED FOR PROJECT

Kapahulu Avenue is a heavily traveled route, with a daily vehicle volume of is 33,900. Kapahulu Avenue acts as a major artery connecting Waikiki and H-1. It also functions as the main street in a high-density neighborhood. There are two major generators of walking and bicycling trips in the immediate project area: the residential areas on the Diamond Head side, and the commercial establishments that line Kapahulu Avenue. Applying Complete Streets to this location will: 1) encourage walking, 2) lower vehicle speeds, 3) create safer street crossings, and 4) strengthen the role of Kapahulu Avenue as a commercial district main street.

SUMMARY OF RECOMMENDATIONS

- Realign Leahi Avenue and reconfigure the channelization and pedestrian island to allow through traffic to Ala Wai Boulevard at a signalized intersection.
- Reconfigure the Herbert Street/Kapahulu Avenue intersection to create a channelization and pedestrian island and square off the intersection.
- Widen the crosswalks to 20 feet and set back advanced stop lines at unsignalized crosswalks.
- Install a traffic light at the Kanaina Street/Kapahulu intersection.
- Create raised pedestrian crossing islands at the intersections of Kanaina Street and Campbell Street.
- Install curb extensions to inset parking, slow turning vehicles, and reduce pedestrian crossing distances.
- Move parking from the west side of Kapahulu to the east side; convert to back-in angled parking.
- Install sharrows on Kapahulu Avenue, and convert Leahi Avenue and Herbert Street into Bike Boulevards. Install a buffered bike lane to connect the Lei of Parks Shared-Use Path with Ala Wai Boulevard bike lanes.

Primary Urban Center Planning

Area, Sub-Area Kapahulu, Council District IV

COST BREAKDOWN

Total: $6,826,182.85

Design: $386,387.71

Construction: $6,439,795.14

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Part One: Introduction, Study Area, & Need for Project

WHAT ARE COMPLETE STREETS?

Complete Streets is a transportation policy and design approach. It aims to create a comprehensive, integrated network of streets that are safe and convenient for all people whether traveling by foot, bicycle, transit, or automobile, and regardless of age or ability. Complete Streets moves away from streets designed with a singular focus on automobiles towards a design approach that is context-sensitive, multi-modal, and integrated with the community's vision and sense of place. The end result is a road network that provides safe travel, promotes public health, and creates stronger communities.

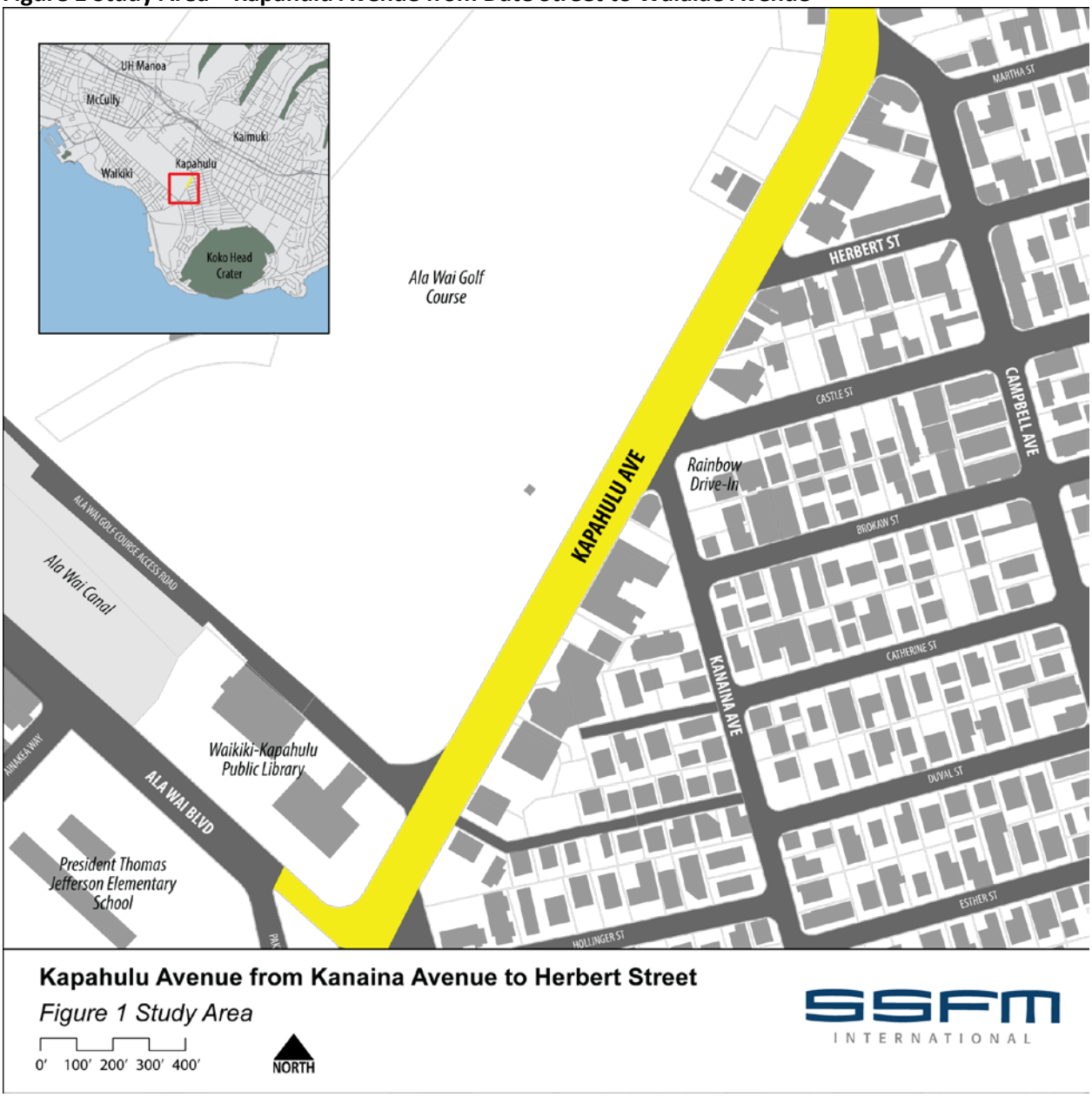
Implementing Complete Streets requires integrating transportation with community planning. Changes are brought about by transforming the built environment. Engineers, planners, architects, landscape architects, and urban design professionals work along with health providers, business leaders, elected officials, community organizations, and residents to promote Complete Streets implementation. Actively engaged community members in Complete Streets are important participants and stakeholders. They help to ensure that efforts are relevant to the community's use, values, and priorities for the neighborhood.

The State of Hawaii adopted Complete Streets in 2009 and required each County to follow suit. In May 2012, the Honolulu City Council adopted a "Complete Streets" policy and passed Ordinance 12-15. The City and County of Honolulu is now taking aggressive steps to implement Complete Streets by updating policies, applying guidelines during maintenance and paving projects, and designing projects in specific locations. The City and County of Honolulu selected fourteen sites across the island of Oahu for in-depth study to illustrate how Complete Streets can be applied in a specific location. This report describes one of the selected sites and presents recommendations to implement Complete Streets at that location.

STUDY AREA

The study area is a span of Kapahulu Avenue from Kanaina Avenue to Herbert Street; the target intersection is Kapahulu Avenue and Herbert Street. It is located in the Primary Urban Center Planning Area, and City Council District IV. It is located directly adjacent to the Ala Wai Golf Course.

Figure 1 Study Area – Kapahulu Avenue from Date Street to Waialae Avenue



NEED FOR PROJECT

Kapahulu Avenue is a heavily traveled route, with a daily traffic volume of 33,900. This, combined with wide lanes and few crossings, creates a barrier for many bicyclists and pedestrians. Kapahulu Avenue acts as a major artery connecting Waikiki and H-1, and also functions as the commercial main street in a high-density neighborhood. With additional streetscaping, lowered vehicle speeds, and consolidated driveways, Kapahulu Avenue has the potential to become an exemplary Complete Street.

There a two potential generators of demand for bicycling in the immediate project area. The first are the neighborhoods loaded and unloaded by Herbert Street and eventually Kilauea Avenue, which connects to Herbert Street at 6th Avenue. Bicyclists of all skill levels use the various facilities in the project area, and in the aforementioned residential areas, there is currently some bike traffic with potential for more. The most important immediate destination for this bicycle traffic is the Lei of Parks shared use path that runs parallel to Kapaulu and connects to key destinations in the Waikiki area.

There is no bicycle infrastructure directly on Kapahulu Avenue, although there are plans in place for adding sharrows as part of a resurfacing project. Improved bicycle facilities can help to realize increased demand for bicycle trips. The commercial establishments and restaurants along Kapahulu are a source of pedestrian trip generation. Kapahulu Avenue has limited on-street parking, which requires many people to park and walk to their destination. There is more on-street parking on the west side of Kapahulu Avenue, due the limited number of driveways. Mauka-bound motorists often have to park on the west side of Kapahulu Avenue, and are forced to walk back across the high-speed four lane cross section.

Best practices suggest that there should be a crosswalk at least every 660 feet in commercial areas such as this. This guideline is not met on Kapahulu Avenue. There is a span of 1,500 feet between signalized crossings on the portion of road from Ala Wai Golf Access Road to Campbell Avenue. As a result, jaywalking is common. The combination of speeding and wide crossing distances across Kapahulu Avenue makes pedestrian crossings unfriendly. Walking along the east side of Kapahulu Avenue is also unfriendly due to the long crossing distances and angled intersections.

The City and County of Honolulu Department of Transportation Services (DTS) has been working on improving the walking environment along and across Kapahulu Avenue for ten years. A curb extension was constructed at the Kanaina Avenue intersection with Kapahulu Avenue. It squares off the intersection, forcing drivers to look directly at pedestrians as they look south for an opening in the traffic. It also shortens crossing distances and makes it difficult for motorists to speed onto Kapahulu Avenue.

Retrofit of the Castle Avenue intersection.

Due to the high daily traffic volume, Kapahulu Avenue is not an ideal candidate for a road diet, but it does have wide lanes and offers an opportunity to readjust the operating speed to the target speed.

A local resident advised that they might actually ride their bike to the commercial establishments along Kapahulu Avenue, however, they feel so uncomfortable with the road environment, that they never do.

A pedestrian and bicyclist cross Kapahulu Avenue at an unsignalized marked crossing.

EXISTING LAND USE, TRANSPORTATION FACILITIES, AND USAGE PATTERNS

Land Use, Transportation Facilities and Traffic Accidents

While the actual study area is limited to the section of Kapahulu Avenue from Kanaina Avenue to Herbert Street, the following description covers the section of Kapahulu Avenue from Ala Wai Golf Access Road to Campbell Avenue. This is because it would be difficult to understand the study area without understanding this larger context.

Kapahulu Avenue is classified as an urban minor arterial. It carries 33,900 vehicles a day and has a 25 mph posted speed limit. It seems to serve more of a collector distributor function, as it collects and distributes traffic from residential neighborhoods to the east to Waikiki via Ala Wai Boulevard and Kalakua Avenue. It also serves to connect those neighborhoods and Waikiki to H-1. Typically, Kapahulu Ave between Leahi Ave and Campbell Ave has two 10-11 foot wide mauka-bound through lanes, two 10-11 foot wide makai-bound through lanes, and 7.5-8 foot wide on-street parking lanes on both sides of the street (on-street

parking ends at intersections, bus stops, fire hydrants, driveways, and cross walks. See parking for more details). The entire roadway width is approximately 64 feet.

At the intersection with Kanaina Ave and Castle St, Kapahulu Ave transitions to one 16 foot wide mauka-bound through lane, one 10.5 foot wide mauka-bound through lane, one 11 foot wide makai-bound left turn/refuge lane, one 11 foot wide makai-bound through lane, and one 16 foot wide makai-bound through lane.

Sidewalks are 8 feet wide concrete in most areas of Kapahulu Ave, but utilities, street trees, newsstands, and bike racks constrict pedestrian space. The lack of buffers along the Diamond Head side of Kapahulu Ave adds to this constriction. There are nine driveways that lead to business parking lots on the Diamond head side, one on the Ewa side.

The accident history is moderate based on the records from 2007 to 2014. The single highest accident location is the intersection of Kapahulu Avenue and Herbert Street. The rest of the accident history is described in Table 1. Almost 20 percent (14 total) of the accidents involved pedestrians; 26 involved car/trucks; 11 involved motorcycles and mopeds. Eight involved bicyclists, five of which occurred between Leahi and Kanaina Avenues.

Figure 2 depicts existing land use, transportation facilities, and traffic accident data within the study area. The land uses immediately adjacent to Kapahulu Avenue on the Diamond Head side are commercial. On the Ewa side is the Ala Wai Golf Course with a small paid public parking lot across from Herbert Street. The Waikiki-Kapahulu Public Library and the President Thomas Jefferson Elementary School are at the makai end of the study area.

Figure 2 Existing Land Use, Transportation Facilities, and Accidents in the Study Area, East End

*Source: City and County of Honolulu, Department of Planning & Permitting, Honolulu Land; *www.walkscore.com*

SSFM INTERNATIONAL

Kapahulu Avenue from Kanaina Avenue to Herbert Street

Bicycle Facilities
Existing=Solid, Proposed=dashed
- Lane
- Path
- Route
- Bicycle Racks

Transit Facilities
- Bus Route
- Bus Stop

Walk Scores
- ## Walk Score
- ## Transit Score
- ## Bike Score

Traffic Accidents
- 1 crash
- 2 crashes
- 3-9 crashes
- 10+ crashes

Red = Car/Truck,
Orange = Motorcycle/Moped,
Blue = Bicyclist,
Green = Pedestrian

Traffic Counts
- ### Average Daily Traffic

Street Trees
- Canopy Diameter

Existing Land Use
- Apartment
- Apartment Mixed Use
- Business Mixed Use
- Institutional
- Park/Open Space
- Resort Mixed Use

Pedestrian Facilities
- No Sidewalk
- Sidewalk
- Crosswalk

Usage Patterns

Table 1 describes existing usage patterns by pedestrians, bicyclists, vehicles, and transit users in the study area. Pedestrian traffic is moderate and bike traffic is minimal.

There are 12 stops in the project area, seven along Kapahulu Avenue and five along Campbell Ave. These stops provide access to 12 routes, with destinations in Waikiki, Ala Moana, the University, the Airport, Hickam Air Force Base, the local beach, Ewa Beach and other locations. The average daily ridership in 2012 was 2,253.

Table 1 Existing Usage Patterns along Kapahulu Avenue

Pedestrian use	High
Bicycle use	Medium to High. 324 bicyclists per day (source: HBL Bike Counts at Ala Wai Blvd and Kapahulu Ave, 2012)
Transit use Average Daily Ridership (Source: *Global Stop Summary by Trip,* TheBus, 2012)	<u>Stops:</u> Kapahulu Ave + Ala Wai Blvd (Stop ID 18) - 413 (ADR) Kapahulu Ave + Campbell Ave (Stop ID 89) - 311 (ADR) Campbell Ave + Castle St (Stop ID 90) - 51 (ADR) Campbell Ave + Catherine St (Stop ID 91) - 37 (ADR) Campbell Ave + Esther St (Stop ID 92) - 40 (ADR) Kapahulu Ave + Paki (Stop ID 183) - 238 (ADR) Kapahulu Ave + Leahi Ave (Stop ID 184) - 205 (ADR) Date St + Kapahulu Ave (Stop ID 3296) - 194 (ADR) Mooheau Ave + Kapahulu Ave (Stop ID 3337) - 200 (ADR) Kapahulu Ave + Opp Campbell Ave (Stop ID 4016) - 214 (ADR) Kapahulu Ave + Opp Leahi Ave (Stop ID 4018) - 143 (ADR) Kapahulu Ave + Mooheau Ave (Stop ID 4127) - 88 (ADR) Campbell Ave + Esther St (Stop ID 4543) - 50 (ADR) Campbell Ave + Herbert St (Stop ID 4544) - 71 (ADR) <u>Boardings and Alightings by Route:</u> Route 2 - Waikiki-School-Middle - 904 (ADR) Route 3 - Kaimuki-Salt Lake - 395 (ADR) Route 8 - Waikiki-Ala Moana - 71 (ADR) Route 13 - Liliha-Waikiki-University - 615 (ADR) Route 14 - St. Louis-Maunalani - 23 (ADR) Route 19 - Waikiki-Airport-Hickam - 43 (ADR) Route 20 - Waikiki-Pearlridge - 27 (ADR) Route 22 - Beach Bus - 24 (ADR) Route 23 - Hawaii Kai-Sea Life Park - 19 (ADR) Route 24 - Kapahulu-Aina Haina - 56 (ADR) Route 42 - Ewa Beach-Waikiki - 30 (ADR) Route 2L - Waikiki-School-Middle Limited - 46 (ADR)

Daily Vehicular Volumes (Source: *Historical Traffic Station Maps,* HDOT, 2009-2013)	6th Ave: Charles St to Olu St (2012) - 12,300 Ala Moana Blvd at Ala Wai Canal Bridge (2009) - 32,000 Ala Wai Blvd between Liliuokalani Ave and Ohua Ave (2008) - 19,200 Ala Wai Blvd: Ohua Ave to Liliuokalani Ave (2011) - 23,100 Alohea Ave: 8th Ave to Francis St (2010) - 6,500 Campbell Ave: George St to Francis St (2013) - 7,800 Date St: Laau St to Olokele Ave (2010) - 17,900 Kaimuki Ave: 3rd Ave to 4th Ave (2012) - 2,900 Kalakaua Ave: Uluniu Ave to Liliuokalani Ave (2011) - 20,200 Kapahulu Ave: Kanaina Ave and Castle St (2008) - 41,100 Kapahulu Ave: Lemon Road to Cartwright Road (2011) - 12,400 Kapahulu Ave: Winam Ave to Paliuli St (2010) - 31,900 Kapahulu Ave: Kuhio Ave to Paki Ave (2013) - 20,000 Kapahulu Ave: Leahi Ave to Kanaina Ave (2013) - 33,900 Kuhio Ave: Paoakalani Ave to Makee Rd (2011) - 13,600 Monsarrat Ave: Kalakaua Ave to Paki Ave (2009) - 10,100 Mooheau Ave: Kapahulu Ave to Winam Ave (2010) - 7,800 Paki Ave: Monsarrat Ave to Kapahulu Ave (2011) - 15,400
Peak periods (Source: *Historical Traffic Station Maps*, HDOT, 2013)	Ala Wai Blvd: Liliuokalani Ave and Ohua Ave - 7:15 AM-8:15 AM, 4:15 PM-5:15 PM Kapahulu Ave: Leahi Ave to Kanaina Ave - 7:15 to 8:15 AM, 3:30 to 4:30 PM Campbell Ave: George St to Francis St - 7:15 to 8:15 AM, 5:30 to 6:30 PM Kapahulu Ave: Kanaina Ave and Castle St - 7:30 AM-8:30 AM, 3:30 PM-4:30 PM Ala Moana Blvd at Ala Wai Canal Bridge - 7:00 to 8:00 AM, 5:15 to 6:15 PM Alohea Ave: 8th Ave to Francis St - 7:00 to 8:00 AM, 7:00 to 8:00 AM Mooheau Ave: Kapahulu Ave to Winam Ave - 7:00 to 8:00 AM, 5:00 to 6:00 PM Ala Wai Blvd: Ohua Ave to Liliuokalani Ave - 7:15 to 8:15 AM, 4:15 to 5:15 PM Kapahulu Ave: Winam Ave to Paliuli St - 7:15 to 8:15 AM, 3:30 to 4:30 PM Paki Ave: Monsarrat Ave to Kapahulu Ave - 7:15 to 8:15 AM, 4:00 to 5:00 PM Kuhio Ave: Paoakalani Ave to Makee Rd - 7:30 to 8:30 AM, 4:30 to 5:30 PM Monsarrat Ave: Kalakaua Ave to Paki Ave - 7:30 to 8:30 AM, 4:00 to 5:00 PM Kapahulu Ave: Kuhio Ave to Paki Ave - 7:30 to 8:30 AM, 4:15 to 5:15 PM Kalakaua Ave: Uluniu Ave to Liliuokalani Ave - 7:45 to 8:45 AM, 5:00 to 6:00 PM Kapahulu Ave: Lemon Rd to Cartwright Rd - 8:00 to 9:00 AM, 4:00 to 5:00 PM 6th Ave: Charles St to Olu St - 7:15 to 8:15 AM, 4:30 to 5:30 PM Date St: Laau St to Olokele Ave - 7:15 to 8:15 AM, 4:45 to 5:45 PM Kaimuki Ave: 3rd Ave to 4th Ave - 6:45 to 7:45 AM, 5:00 to 6:00 PM
Accident History (Sources: *Motor Vehicle Accident Reports,* Honolulu Police Department, 2011-2014	Along Kapahulu Ave between Castle and Herbert St: 2 bicycle accident, 2 car/truck accident. Along Kapahulu Ave between Leahi Ave and Kanaina Ave: 5 bicycle accident, 10 car/truck accident, 5 motorcycle/moped accident, 3 pedestrian accident. At the intersection of Kapahulu Ave and Herbert St: 7 car/truck accident, 3 motorcycle/moped accident, 4 pedestrian accident. At the intersection of Kapahulu Ave and Kanaina Ave/Castle St: 1 bicycle accident, 4 car/truck accident, 2 motorcycle/moped accident, 5 pedestrian accident. At the intersection of Kapahulu Ave and Leahi Ave: 3 car/truck accident, 1 motorcycle/moped accident, 1 pedestrian accident.

Part Two: Field Work and Key Findings

A walking audit brought together 15 participants from the City and County of Honolulu, State agencies, and community stakeholders.

STAKEHOLDER INPUT

The findings of this report are informed by input received from participants in a walking audit along Kapahulu Avenue. SSFM International, Inc., and a team of national consultants, including Dan Burden, national walkability expert, led the walking audit on January 21, 2015. The following stakeholder groups participated in the walking audit:

- City and County of Honolulu Department of Transportation Services (DTS): Mark Garrity, Shawn Butler, Randall Kurashige, Yamato Milner, Chris Sayers, Rika Uechi, and Erron Redoble;
- Hawaii State Department of Health (DOH): Heidi Hansen-Smith;
- Cliff Kaneshiro representing Council Member Ann Kobayashi;
- Hawaii Bicycling League (HBL): Daniel Alexander;
  Consultant Team: Alan Fujimori and Michael Motoki of SSFM, Dan Burden and Samantha Thomas of Blue Zones, and Gary Toth of Gary Toth Consulting.

The walking audit group discussed conditions that affect walkability along Kapahulu Avenue. Subsequent to the audit, Harrison Rue with the City and County of Honolulu Department of Planning and Permitting (DPP), provided input directly to Gary Toth, and his input was incorporated. The consolidated findings are discussed in the following section.





Participants shared barriers and opportunities for Complete Streets along Kapahulu Avenue.
Photo descriptions: *Top row - Members of DTS and walk audit participants; Middle row - walking tour and opportunities; Bottom row- participants and opportunity for Complete Streets*

FINDINGS

This section summarizes key findings based on observations made by the consultant team with input from the Department of Transportation Services staff, and community stakeholders who participated in the walking audit. These inform the recommendations summarized in the next section.

Finding: The wide cross section and straight alignment of Kapahulu Avenue Street encourages speeding.

Kapahulu Avenue is 64 feet wide and has few curves. This design encourages motorists to drive at speeds higher than the posted 25 mph speed limit. Participants in the walking audit noted vehicles traveling at high speeds along the corridor.

The wide and straight cross section of Kapahulu Avenue induces drivers to speed and to focus down the road instead of on crossing pedestrians.

Finding: Parking is in demand on Kapahulu Avenue.

Storeowners within the project corridor mentioned that customers frequently use on-street parking, particularly in the mauka-bound direction, because their private off-street parking lots are inadequate or reserved for business owners. Although makai-bound parking stalls are used less often, business owners felt that removing them would hurt their business. This high perceived demand for parking may discourage the option of removing parking to make room for a bike lane.

Finding: Corner radii along Kapahulu Avenue are large, encouraging higher speed turns and creating long crossing distances for pedestrians.

Residential street crossings along Kapahulu Avenue are very long due to large corner radii. This is made worse at intersections that feature a dedicated lane for turning. For example, the crossing at Herbert Street is 72 feet long, despite the fact that Herbert is residential and a yield street with low volumes. Correcting large corner radii can help to increase pedestrian safety and comfort by reducing crossing distances and lowering vehicle speed.

Long pedestrian crossings (74 feet) exist at Kapahulu Avenue and Herbert Street

Finding: Roundabouts are likely to prove infeasible

Traffic volumes are too high for a single lane roundabout at any point along Kapahulu Avenue and there is not enough room, without a significant right-of-way taking, for a two lane roundabout.

Circulating flow should not exceed 1,800 veh/h at any point in a single-lane roundabout. Exit flows exceeding 1,200 veh/h may indicate the need for a double-lane exit. The existing (2013) bi-directional peak hour volumes on Kapahulu are 2,100 veh/h in the AM and 2,300 veh/h in the PM, which would likely yield a circulating flow higher than the 1,800 veh/h threshold.

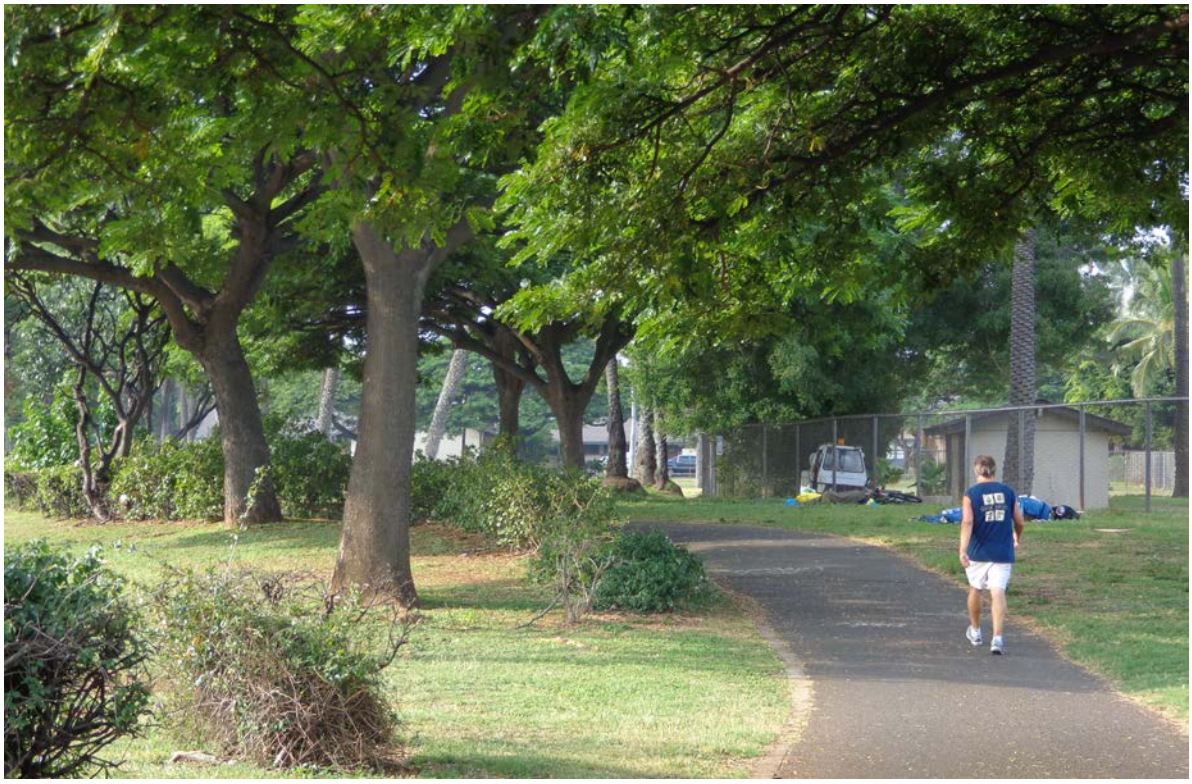
The FHWA's *Roundabouts: An Informational Guide, 2nd Edition* (2010) provides geometrical design for double-lane roundabouts with inscribed diameters of no less than 150 feet. A roundabout of this size would require expanding the ROW along Kapahulu Ave. Although this does not preclude the design of a smaller double lane roundabout, the operations and safety of this roundabout would have to be studied in more detail.

Finding: The crosswalk at Kanaina Avenue and Kapahulu Avenue is uncomfortable for pedestrians.

There are a number of factors that make the unsignalized crosswalk at Kanaina Avenue and Kapahulu Avenue intersection uncomfortable. This crosswalk is long (about 70 feet), unsignalized, and is flanked by two T-intersections. The existing crosswalk configuration does not allow for a protective median or crossing island. These crossing conditions discourage pedestrians from using this crosswalk. Most pedestrians were observed avoiding this crosswalk, and instead jaywalking when there was a gap in traffic.

Finding: Lighting is insufficient along the Lei of Parks trail.

Several DTS employees who live in the area advised that due to the combination of poor lighting and the presence of homeless, many potential users avoid the trail after dark. Path lighting is essential to support pedestrian activity and safety after dark.



The Lei of Parks Trail is poorly lighted at night.

Finding: Motorists exiting Kanaina Avenue onto Kapahulu Avenue find it very difficult to make left turns.

The volumes are so consistently heavy on Kapahulu Avenue, that motorists exiting Kanaina Avenue find it very difficult to find a gap when making a left turn. A recommended counter measure is to create a short turning/refuge lane at this location.

A refuge turning lane is needed to allow vehicles to safely enter and exit Kanaina Street.

Finding: There is a lack of regional network connectivity, which may contribute to longer trips by all travel modes.

Kapahulu Avenue makes up the arterial spine of the Kapahulu community transportation network and connects Waikiki to H-1. Within the project area, Kapahulu Avenue is bordered by a mega block on the Ewa side (Ala Wai Golf Course), and a 45-degree rotated residential grid. The mega block prevents connecting side streets from continuing through. This break in connectivity is exacerbated when motorists coming from side streets are prohibited (legally and physically) or discouraged (by lack of gaps and high conflicting traffic volumes) from making left-turns.

Two roads have the potential for improving multi-modal connectivity. Leahi Avenue currently prevents left-turn movements on to Kapahulu Avenue headed toward Waikiki. However, this street could potentially connect the Kapahulu residential grid to Ala Wai Boulevard. Unlike Paki Avenue, which is the main connection to Ala Wai Boulevard, Leahi Avenue is part of Kapahulu's residential grid. Paki Avenue also provides direct access to Hawaii School for the Deaf and Blind, Paki Community Park, Waikiki Elementary School, and indirect access to Kapiolani Park. Furthermore, historical traffic counts show very low vehicular volumes, which make Leahi Avenue an ideal candidate for a bike boulevard.

Realigning the Leahi Avenue and Kapahulu Avenue intersection with Ala Wai Boulevard could improve network connectivity. Vehicles, bicycles and pedestrians would have more direct access from Kapahulu's lower makai neighborhoods to Ala Wai Boulevard and Waikiki.

A significant improvement for bicycles is the protected bike lane that connects the bike path from Date Street to the existing Ala Wai Boulevard bike lane. Leahi Avenue could also provide a more direct access from Monsaratt Avenue to the Ala Wai Boulevard bike lanes. It could also will act as a bike boulevard for Paki Avenue between Noela Street and Kapahulu Avenue.

Similarly, pedestrian access and safety could be improved by signalizing the intersection and crossing. Each leg of the intersection could have a crosswalk thereby providing Leahi Avenue direct pedestrian access to Ala Wai Boulevard.

Herbert Street, like Leahi Avenue, is a low vehicular volume street, with the potential to greatly improve overall network connectivity. Herbert Street connects directly to Kapahulu Avenue and Kilauea Avenue. Kilauea Avenue is an East-West arterial that provides access to Kapiolani Community College, Kaimuki Middle School, Kahala Mall, and many residences. Herbert Street could improve the bicycle network by making it a bike boulevard.

Part Three: Recommended Application of Complete Streets Concepts

This section describes the recommended application of Complete Streets concepts for Kapahulu Avenue at Herbert Street. It includes a written description of recommendations accompanied by illustrative drawings. The Complete Streets principles incorporated are:

- Encourage multiple modes of transportation, particularly walking and biking
- Promote safety for all modes of transportation
- Adjust the design speed of the road to match and reinforce the posted speed limit of 25 mph
- Promote safer street crossings, and
- Strengthen the sense of arrival

COMPLETE STREETS RECOMMENDATIONS

Conceptual Illustrations of Recommendations

The recommendations for Kapahulu Avenue are described below and shown on Figures 3 through 5. Table 2 is a summary list of all recommendations, the before and after effect. Drawings of the proposed changes are presented for three segments of Kapahulu Avenue:

- From Paki Avenue to Ala Wai Golf Course Access Road (Figure 3)
- From Ala Wai Golf Course Access Road to Castle Street (Figure 4)
- From Castle Street to Campbell Avenue (Figure 5)

Description of Recommendations

The recommendations in Figures 3 through 5 are summarized below.

A) Improve multi-modal connectivity.

- Allow through traffic from Leahi Avenue to Ala Wai Boulevard to improve street network connectivity.
- Convert Leahi Avenue and Herbert Street to bike boulevards.
- Install an additional traffic signal at Kanaina Street to facilitate turning traffic and to help regulate vehicle speeds.

B) Reconfigure intersection alignment for reduced conflicts and placemaking opportunity.

- Realign Leahi Avenue, Ala Wai Boulevard, and Herbert Street so that side streets meet Kapahulu Avenue at a right angle, reducing pedestrian crossing distance and exposure to motor vehicle traffic.
- Create seating areas and landscaped public space in the areas recovered by realigned intersections.
- Add unique elements reflecting area history or famous residents to add an additional placemaking element.
- Encourage local business owners to maintain the spaces.

C) Relocate westside parking to east and convert to reverse-in angled parking.

- Move all parking from the west side of Kapahulu Avenue to the east side; and convert to reverse-in angled parking. This will eliminate a portion of the pedestrians crossing back to the side of the street where there are shops.
- Install 60-degree angled parking to provide the maximum number of spaces (see Table 3).

Table 2 Minimum Dimensions for Head-In Angled On-Street Parking

Angle	Stall Width	Stall Depth (Perpendicular to Curb)	Min. Width of Adjacent Lane	Curb Overhang
45°	8.5-9.0 feet	17 feet 8 inches	12 feet 8 inches	1 feet 9 inches
50°	8.5-9.0 feet	18 feet 3 inches	13 feet 3 inches	1 feet 11 inches
55°	8.5-9.0 feet	18 feet 8 inches	13 feet 8 inches	2 feet 1 inches
60°	8.5-9.0 feet	19 feet 0 inches	14 feet 6 inches	2 feet 2 inches
65°	8.5-9.0 feet	19 feet 2 inches	15 feet 5 inches	2 feet 3 inches
70°	8.5-9.0 feet	19 feet 3 inches	16 feet 6 inches	2 feet 4 inches
90°	8.5-9.0 feet	18 feet 0 inches	24 feet 0 inches	2 feet 6 inches

Source: *Dimensions of Parking*, 4th Edition, Urban Land Institute Notes

- Inset parking using curb extensions to narrow the roadway physically and visually, prompting motorists to slow down.

D) Reduce impact of driveways on walkability.

- When extending the curb to inset parking (see Recommendation C), redesign driveways.
- Consolidate driveways of adjoining properties.

E) Improve bicycle facilities.

- Add sharrow marking in the outside lane of each direction.
- Add a makai-bound buffered bike lane between Ala Wai Boulevard and Ala Wai Golf Course Access Road to connect to existing bike lane on Ala Wai Boulevard.

F) Enhance pedestrian crossings.

- Install a new traffic signal at Kanaina Avenue and Kapahulu Avenue (see recommendation C), allowing for the elimination of the left-turn refuge lane, and the creation of a raised crossing island to protect pedestrians and reduce the effective crossing distance.
- Install a Rectangular Rapid Flashing Beacon at the intersection Herbert Street and Kapahulu Avenue to improve pedestrian safety. Add setback advanced stop lines 40 feet before the crosswalk.
- Install a raised crossing island on the approach of Herbert Street to reduce pedestrian crossing distances and protect pedestrians from turning vehicles.
- Widen the crosswalks to 20 feet at all intersections.

G) Improve the Lei of Parks Trail.

- Install pedestrian scale lighting to encourage nighttime usage and discourage unwanted behavior.
- Install pavement markings and signage (e.g., MUTCD R9-7) to designate proper paths of travel for walkers and bicyclists.
- Install rest areas that include benches and wheelchair spaces to provide users with an opportunity to rest and appreciate the beauty of the path.

Table 3 Proposed Design Changes to Kapahulu Avenue

	CURRENT	AFTER RECOMMENDATIONS ARE IMPLEMENTED
Type of Facility	Urban Minor Arterial	No change.
Posted Speed Limit	25 mph on Kapahulu Avenue	Same.
Crosswalk Length (longest)	Kapahulu Avenue and Herbert Street (west leg): 78’	Kapahulu and Leahi Avenue (north leg): 62’
Street Width and number of lanes.	Typically, Kapahulu Avenue between Leahi Avenue and Campbell Avenue has two 10-11’ mauka-bound through lanes, two 10-11’ makai-bound through lanes, and 7.5-8’ on-street parking lanes on both sides of the street (on-street parking ends at intersections, bus stops, fire hydrants, driveways, and cross walks. See parking for more details). The entire roadway width is ~64’. At the intersection with Kanaina Avenue and Castle Street, Kapahulu Avenue transitions to one 16’ mauka-bound through lane, one 10.5’ mauka-bound through lane, one 11’ makai-bound left turn/refuge lane, one 11’ makai-bound through lane, and one 16’ makai-bound through lane.	Street width and number of lanes remain the same. However, between the Ala Wai Golf Course Access Road and Campbell Avenue, outside parking lanes are removed to allow for a 19’ angled parking bay with 14.5’ travel lane/maneuvering space.
Distance to side streets	~70' from Ala Wai to Leahi Avenue, ~195' from Leahi Avenue to golf course, ~675' from Golf course to Kanaina Avenue, ~95' from Kainaina Avenue to Castle Street, ~310 from Castle Street to Herbert Street, ~460' from Herbert to Campbell Avenue, ~110' from Campbell Avenue to Hoolulu Street	Same spacing, although Leahi now continues through to Ala Wai Boulevard.
Driveways	Driveways lead to business parking lots, 9 driveways Diamond head side, 1 Ewa.	Same, however some driveways are rightsized.
Parking	Mauka-bound: 11 on-street parking stalls between Leahi Avenue and Kanaina Avenue, 6 on-street parking stalls between Kanaina Avenue and Campbell Avenue. Makai-bound: 22 on-street parking stalls between Leahi Avenue and Kanaina Avenue, 14	Makai-bound on-street parking is eliminated. Mauka-bound on-street parking is converted to reverse-in angled parking. This results in 53 stalls total, an increase of 19 stalls.

	on-street parking stalls between Kanaina Avenue and Campbell Avenue. All on-street parking stalls are metered, and are restricted to 2 Hr limits between 7:00 AM to 6:00 PM. Most stall are 7.5’ to 8.0’ in width from curb to pavement striping. Paid public parking lot on Kapahulu Avenue near the intersection with Campbell Avenue. Free public parking lot at Ala Wai Golf Course, 340 stalls.	
Sidewalks	~8' concrete sidewalk in most areas of Kapahulu Avenue, but utilities, street trees, newsstands, and bike racks constrict pedestrian space. Street frontage on the Diamond Head side of Kapahulu Avenue intensifies the perceived constriction of pedestrian space.	Same, except where curb extensions widen the sidewalk.
Transit Routes, Stops, Shelters	14 stops in the project area. Seven along Kapahulu Avenue. Five along Campbell Avenue. These stops provide access to 12 routes.	Same.
Proximity to future rail	Not in close proximity to the rail system.	Same.
Bicycle features	Lei of Parks shared-use path. There are four bicycle racks mauka side between Ala Wai Blvd and Herbert Street.	Additional sharrows on Kapahulu Avenue, Leahi Avenue, and Herbert Street. Makai-bound buffered bike line between Ala Wai Golf Course Access Road and Ala Wai Boulevard.
Nearby Schools	President Thomas Jefferson Elementary School, Hawaii School for the Deaf and Blind (~.35 miles)	Same.
Nearby Institutions	Waikiki-Kapahulu Fire Station Number 7, Paki Community Park and Playground, Waikiki-Kapahulu Public Library, Ala Wai Golf Course	Same.
Other	Curb extensions at the intersection of Kapahulu Avenue and Kanaina Avenue/Castle Street, and a raised channelization island at Campbell Avenue were part of a previous City project.	Same.

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Figure 3 Concepts for Kapahulu Avenue from Paki Avenue to Ala Wai Golf Course Access Road

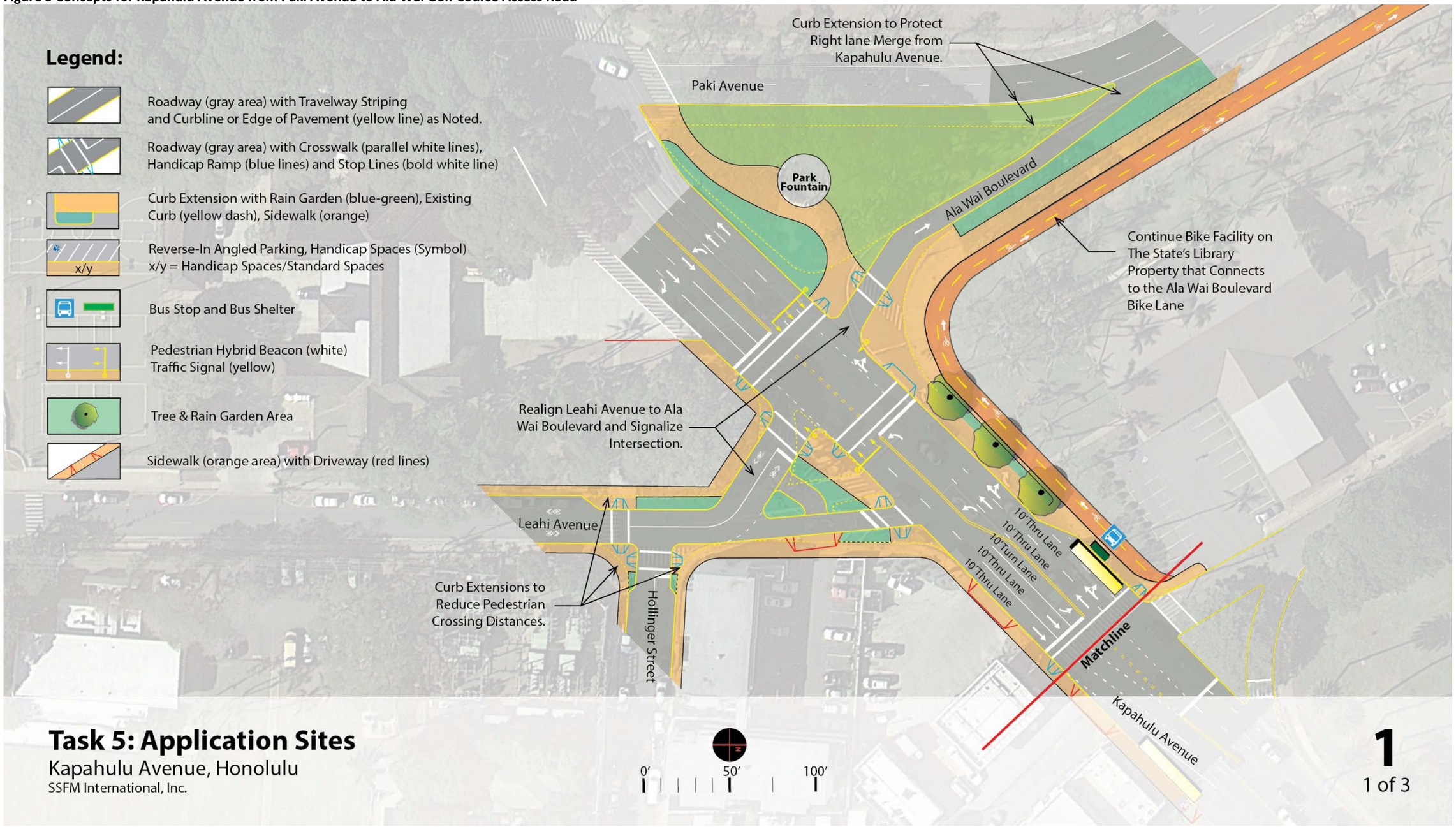

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Figure 4 Concepts for Kapahulu Avenue from Ala Wai Golf Course Access Road to Castle Street

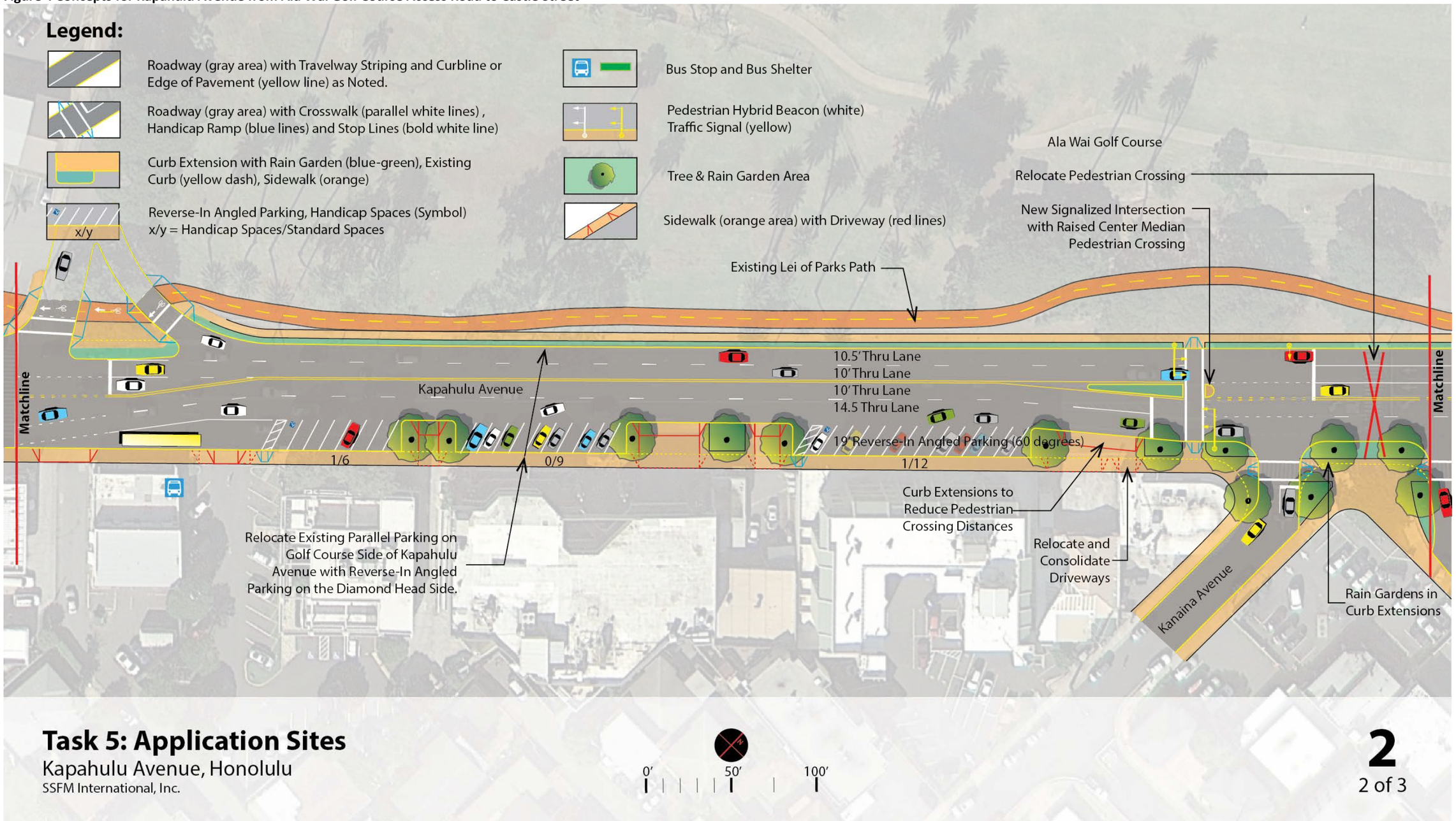

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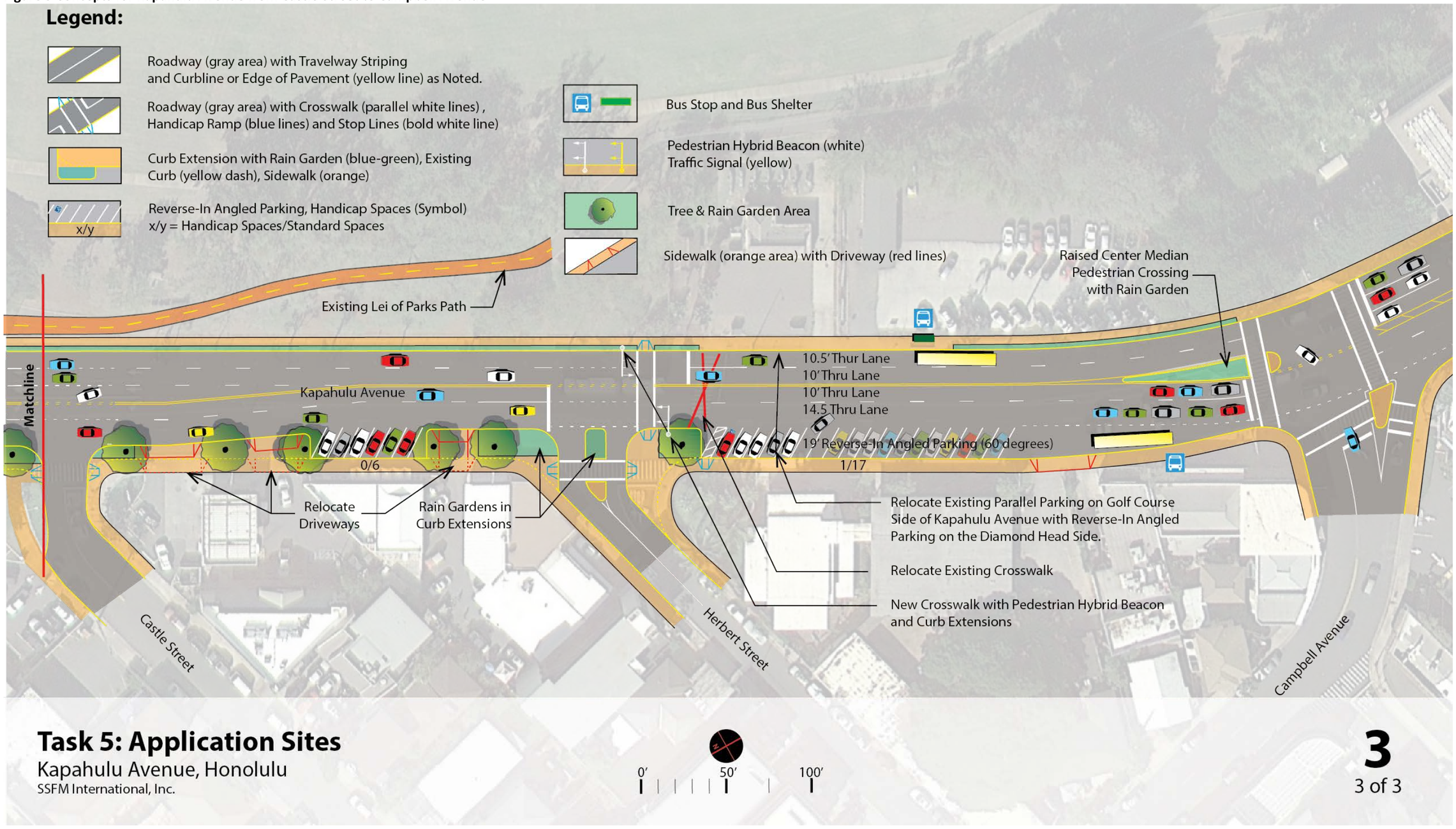
Figure 5 Concepts for Kapahulu Avenue from Castle Street to Campbell Avenue



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Part Four: Implementation

This section looks at the recommendations and sorts them according to how soon they can be implemented. Near-term actions are those that may be implemented immediately through incorporation into existing City paving, marking, or signage projects or maintenance funding. Mid-term actions are those that may require or warrant a longer planning horizon (1 to 5 years) due to logistical, financial, or other considerations. Longer-term actions are those that may require or warrant an even longer planning horizon (5 years and beyond).

Near-Term Actions (0-1 years):

A) Improve multi-modal connectivity.

- Install sharrow markings and bike route signage on Leahi Avenue and Herbert Street.

B) Reconfigure intersection alignment for reduced conflicts and placemaking opportunity.

- Restripe the intersection of Herbert Street and Kapahulu Avenue so that side streets meet at a right angle. Stripe a pedestrian island and line the edges with traffic delineator posts.

C) Relocate west side parking and convert to reverse-in angled parking.

- Restripe the roadway and move all parking from the west side of Kapahulu Avenue to the east side; convert to reverse-in angled parking.
- 60-degree angled stalls should be 19 feet deep (perpendicular to the curb). The adjacent travel lane should be 14.5 feet wide. All other lanes should be 10 feet wide.

Reverse-in angled parking in Portland, OR.

Reverse-in angled parking on Ulune Street, Aiea, Oahu.

D) Reduce impact of driveways on walkability.

- Reduce width of large driveway using bollards or planters.

E) Improve bicycle facilities.

- Install sharrow marking in the outside lane of each direction of Kapahulu Avenue.
- Add a makai-bound buffered bike lane between Ala Wai Boulevard and Ala Wai Golf Course Access Road to connect to existing bike lane on Ala Wai Boulevard. Buffer can be lined with planters, asphalt concrete (A/C) berms (or similar), or traffic delineator posts.

Sharrow markings remind motorists to share the road with bicyclists. An example of a sharrow marking in Kailua, Oahu.

Buffered bike lane in Seattle, WA.

F) Enhance pedestrian crossings.

- Setback advanced stop lines 40 feet before the crosswalk at the intersection Herbert Street and Kapahulu Avenue.
- Install a raised crossing island on the approach of Herbert Street to reduce pedestrian crossing distances and protect pedestrians from turning vehicles.
- Restripe and widen crosswalk to 20 feet at all intersections.

G) Improve the Lei of Parks Trail.

- Install pavement markings and signage (e.g., MUTCD R9-7) to designate proper paths of travel for walkers and bikers.

Mid-Term Actions (1 to 5 years):

A) Improve multi-modal connectivity.

- Use lane striping and A/C berms (or similar) to realign Leahi Avenue and Herbert Street so that they meet Kapahulu Avenue at a right angle.
- Install an additional traffic signal at Kanaina Street.

B) Reconfigure intersection alignment for reduced conflicts and placemaking opportunity.

- Use A/C berms (or similar) to extend curbs, and inset parking. Install planters or public amenities such as seating, wayfinding signage or bike corrals in the new curb extensions.
- Use A/C berms (or similar) to reclaim one lane of Paki Avenue.
- Add placemaking elements to the mini park boardered by Paki Avenue, Ala Wai Boulevard and Kapahulu Avenue.

C) Relocate Ewa side parking and convert to reverse-in angled parking.

- Inset parking (see Recommendation A).

D) Reduce impact of driveways on walkability.

- Provide curb cuts in the new curb extensions for driveways (see Recommendation A). For one-way driveways, ensure width is no greater than 14 feet. For two-way driveways, ensure width is no greater than 24 feet.
- Consolidate driveways of adjoining properties.

E) Improve bicycle facilities.

- None.

F) Enhance pedestrian crossings.

- After installing the traffic signal at Kanaina Avenue and Kapahulu Avenue (see Recommendation C), eliminate left-turn refuge lane. Install a raised crossing island in its place.
- Install a Rectangular Rapid Flashing Beacon at the intersection Herbert Street and Kapahulu Avenue.
- Install a raised crossing island using A/C berms or similar on the approach of Herbert Street and Campbell Avenue.

Rectangular Rapid Flashing Beacon in Seattle, WA.

G) Improve the Lei of Parks Trail.

- Install pedestrian scale lighting on shared-use path.
- Construct rest areas along the path with benches and wheelchair spaces.

Longer-Term Actions (5 years and Beyond):

A) Improve multi-modal connectivity.

- Reconstruct the existing channelization island at the intersection of Leahi Avenue and Kapahulu Avenue to allow through traffic.
- Install a traffic signal at the intersection, and allow through traffic from Leahi Avenue to Ala Wai Boulevard. Adjust signal phasing of other intersections along Kapahulu Avenue accordingly.

B) Reconfigure intersection alignment for reduced conflicts and placemaking opportunity.

- Construct permanent curb extensions that are flush to the existing sidewalk.
- Repave the roadway and redesign stormwater infrastructure so that road runoff drains toward new rain gardens.

C) Relocate Ewa side parking and convert to reverse-in angled parking.

- None.

D) Reduce impact of driveways on walkability.

- Reconstruct driveways in new curb extensions.

E) Improve bicycle facilities.

- None.

F) Enhance pedestrian crossings.

- Reconstruct permanent raised crossing at the intersections with Herbert Street and Campbell Avenue. If conditions allow, install rain gardens.

G) Improve the Lei of Parks Trail.

- None.

Raised crosswalk in Tennessee

Part Five: Cost Sheet

ITEM	*UNIT*	*QUANTITY*	*UNIT COST*	*TOTAL COST*
Removals/Demo				
Demolish existing sidewalk	Sq. Ft.	3345	$ 5.00	$ 16,725.00
Demolish existing Pavement	Sq. Ft.	24110	$ 8.00	$ 192,880.00
Erosion Control	L.S.	1	$ 10,000.00	$ 10,000.00
Site improvements				
Roadway				
Mill and Overlay existing AC pavement	Sq. Ft.	127747	$ 6.00	$ 766,482.00
Curb Gutter and Sidewalk	Sq. Ft.	18262	$ 20.00	$ 365,240.00
Drainage works		53	$ 14,000.00	$ 742,000.00
Raised Median	Sq. Ft.	8633	$ 20.00	$ 172,660.00
4" Stripe (white/Yellow)	Lin. Ft.	9181	$ 6.00	$ 55,086.00
12"stripe (white)	Lin. Ft.	986	$ 9.00	$ 8,874.00
Striping Symbols	each	24	$ 300.00	$ 7,200.00
Intersection				
New Traffic/Pedestrian Signal	each	3	$ 500,000.00	$ 1,500,000.00
Traffic Signal Modification	each	2	$ 350,000.00	$ 700,000.00
Landscaping				
Trees	each	22	$ 1,000.00	$ 22,000.00
Misc.				
Traffic Control	L.S.	1	5%	$ 227,957.35
Mobilization	L.S.	1	10%	$ 455,914.70
Contingency - 25%			25%	$ 1,196,776.09
Design				
Design Cost			6%	$ 386,387.71
TOTAL CONSTRUCTION				**$ 6,439,795.14**
TOTAL COST				**$ 6,826,182.85**