



Kiawah Island Transportation Services

The Sandcastle and Rhett's Bluff Amenity Planning

Background

Kiawah Island Community Association (KICA) contracted with Toole Design Group (TDG) to perform three transportation service tasks with the goal of evaluating traffic conditions and making recommendations regarding proposed amenity improvements at The Sandcastle and Rhett’s Bluff Boat Launch. The three specific tasks were as follows:

- ▲ Analysis of two critical intersections:
 - Kiawah Island Parkway/Rhetts Bluff Road/Governors Drive
 - Rhetts Bluff Road/River Course Lane/Halona Lane
- ▲ Assessment of proposed amenity improvement on multimodal (pedestrian, bicycle, vehicular) transportation mobility and access.
- ▲ Evaluation and conceptual design development to connect the existing leisure trail across the Rhetts Bluff Road causeway.



Left: The Sandcastle

Reconfiguration of existing facility including:

- The Sandcastle Building
- Reconfiguration of existing Fitness Center as meeting space
- 2 Pools (1 existing, 1 proposed)
- Pool Deck and Outdoor Dining
- Splash Pad
- 152 Parking Spaces

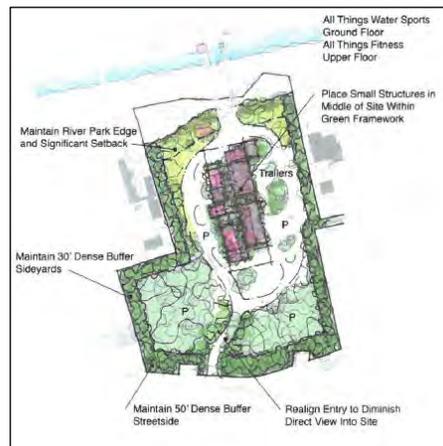
Source: permar, inc.

Right: Rhetts Bluff Boat Landing

Proposed facility including:

- Fitness Center
- Meeting Space
- Coffee Shop
- Ship’s Store
- Existing Boat Launch

Source: permar, inc.



Intersection Analysis

TDG was tasked to evaluate the operation of two intersections: Kiawah Island Parkway/Rhetts Bluff Road/Governors Drive and Rhetts Bluff Road/RiverCourse Lane/Halona Lane. These intersections were evaluated for functionality and recommendations were developed to improve traffic flow and increase pedestrian and bicyclist safety.

Data Collection and Methodology

Gate entrance data was provided by KICA for one week in July 2014 and one week in November 2014. Based on this data, summer traffic volumes are estimated to be more than two times higher than fall/winter volumes (See **Figure 2**). Based on the gate entrance data provided, data collection was scheduled for one weekday afternoon and one weekend afternoon to assess the difference in traffic patterns between weekdays and weekend days. While the traditional AM and PM rush hours do not apply to Kiawah Island, it was found that the early afternoon period was the busiest time of day for vehicle traffic. Therefore, data collection was performed on a Thursday afternoon and a Saturday afternoon in December 2014, and volumes were scaled up 210% for the analysis to reflect summer traffic.



Figure 1: Kiawah Island Parkway/Rhetts Bluff Road/Governors Drive & Rhetts Bluff Road/River Course Lane/Halona Lane Intersections

Based on the scaled turning movement counts, existing conditions models of these study intersections were developed using Synchro/SimTraffic 8.0 and vehicle level of service (LOS) was calculated. Synchro is macroscopic traffic analysis software that supports the 2000 and 2010 Highway Capacity Manual's methodology for signalized intersections, unsignalized intersections, and roundabouts. SimTraffic is a micro-simulation and animation application that can be used to evaluate non-standard intersection configurations as well as obtain additional information such as vehicle travel times and speeds for a study corridor.

Vehicle LOS is a representation of how a roadway is operating, based on average seconds of delay per vehicle. Vehicle LOS is defined in terms of intersection control delay and is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The LOS criteria for unsignalized intersections are provided in the 2010 Highway Capacity Manual and are presented in **Table 1**. For unsignalized intersections, LOS is determined based on the control delay for the stop-controlled legs of the intersection. An LOS of D or better is considered acceptable.

Figure 2: Comparison of Summer and Fall Gate Entrance Data

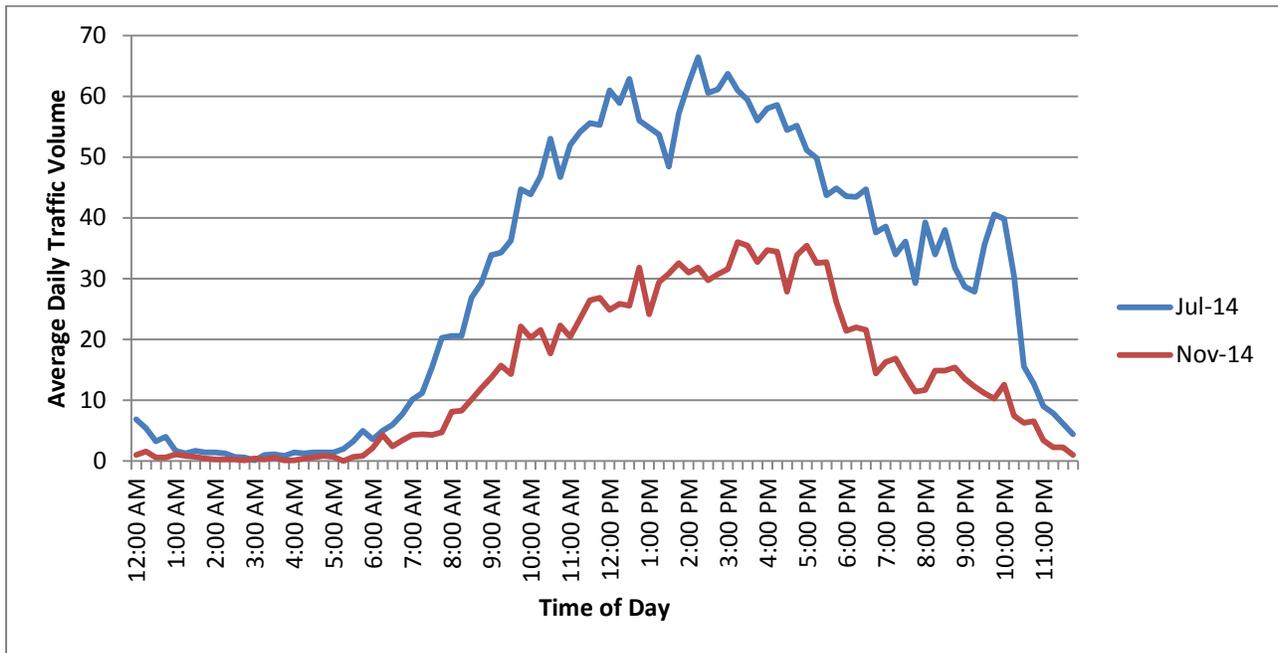


Table 1: Level of Service for Unsignalized Intersections Based on Control Delay

Level of Service	Description	Average Control Delay Per Vehicle (seconds)
A	Little or no delay.	≤ 10.0
B	Short traffic delays.	> 10.0 and ≤ 15.0
C	Average traffic delays.	> 15.0 and ≤ 25.0
D	Long traffic delays.	> 25.0 and ≤ 35.0
E	Very long traffic delays.	> 35.0 and ≤ 50.0
F	Demand exceeds capacity resulting in extreme delays and queuing.	> 50.0

Source: 2010 Highway Capacity Manual

Intersection Operations

The operations at two intersections on the island under existing conditions were evaluated and recommendations to improve traffic flow and safety are provided below. These intersections were Kiawah Island Parkway/Governors Drive/Rhetts Bluff Road and Rhetts Bluff Road/River Course Lane/Halona Lane. In order to include the effects of the gatehouse intersections, and represent the non-standard traffic control at Kiawah Island Parkway/Governors Drive/Rhetts Bluff Road, SimTraffic results were used for this evaluation. With the projected summer traffic volumes (210% of volumes collected), both intersections operate at LOS A or

B during both time periods. Westbound traffic exiting Governors Drive has a slight delay waiting for a gap in the free flow northbound traffic, but this delay is considered more than acceptable by traffic engineering standards. In addition, there is some excess capacity at these intersections. Traffic volumes of up to 250% of those collected would still result in LOS C.

**Table 2: Kiawah Island Parkway/Governors Drive/Rhetts Bluff Road
Existing Level of Service**

Movement	Thursday Peak Hour		Saturday Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
WB left turn	B	12.9	A	6.9
WB right turn	B	11.3	A	5.3
NB through	A	2.4	A	2.3
NB right turn	A	1.0	A	0.9
SB left turn	A	9.0	A	6.9
SB through	A	7.0	A	4.7
Overall	B	11.2	A	6.4

EB = eastbound, WB = westbound, NB = northbound, SB = southbound

**Table 3: Rhetts Bluff Road/River Course Lane/Halona Lane
Existing Level of Service**

Movement	Thursday Peak Hour		Saturday Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
EB left turn	n/a	n/a	A	4.9
EB through	A	6.1	A	7.5
EB right turn	A	3.8	A	2.8
WB left turn	A	5.7	n/a	n/a
NB left turn	A	2.2	A	1.9
NB through	A	0.7	A	0.5
NB right turn	A	0.7	A	0.5
SB left turn	A	1.5	n/a	n/a
SB through	A	0.3	A	0.2
SB right turn	A	0.1	A	0.0
Overall	A	2.6	A	1.6

EB = eastbound, WB = westbound, NB = northbound, SB = southbound

Field Observations

Based on field observation, it was determined that part of the perceived traffic delay at these locations may be due to activity at the gatehouse. Every vehicle entering this portion of the island must stop at the gatehouse. Vehicles having a barcode can pass through the automated gate in the right-hand lane but those who do not have a barcode must stop for a guard to check the vehicle tag. Drivers not having a barcode tend to stay to the left so the guard can see their vehicle tag. After being cleared to proceed, a large volume of the traffic turns right onto Governors Drive. Conflicts between right turning vehicles may be occurring since pavement markings indicate that right turns are allowed from both lanes, but there is only one receiving lane on Governors Drive.



Figure 3: Guard House at Intersection of Kiawah Island Parkway/Governors Drive

Recommendations

The following recommendations will not impact delay or LOS for the study intersections. These recommendations are estimated to cost approximately \$1,000 and are intended to address driver confusion and improve overall safety.

- ▲ Encourage equal lane usage at the gatehouse by keeping both gates down.
- ▲ Install an advanced warning sign indicating that either lane may turn right to access Governors Drive.

In addition, it was requested that recommendations be provided to enhance safety and visibility at the trail crossing on Governors Drive just east of the intersection. These recommendations are estimated to cost approximately \$37,000 and include:

- ▲ Reduce the curb radius on the southeast corner of the intersection to reduce right turning speeds. This recommendation should be checked against the required turning radii of any trucks or large vehicles that are expected to make this turn.
 - ▲ Install advanced warning signage before the turn alerting drivers to the non-motorized crossing.
 - ▲ Upgrade/install trail advanced warning signage on Governors Drive.
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- ▲ Construct a raised crossing with speed table at the crossing location.
- ▲ Add high visibility pavement markings and/or pavement delineators to improve visibility of the crossing, especially in the dark.

For additional clarification of these recommendations, please see the attached plan sheet.

Assessment of Amenity Improvements

Data Collection and Methodology

Automated Traffic Recorders (ATRs) were used to collect vehicle volumes entering and exiting the driveway into The Sandcastle parking lot for a Thursday, Friday, and Saturday in December 2014. In addition, usage statistics were provided by KICA for The Sandcastle facility. Usage statistics indicate how many people entered the facility and for what use (e.g. community meetings, fitness classes, swimming pool); from these it was determined that 37% of people entering the facility during peak season were there to attend fitness classes or use the weight room. During the off-peak season, this portion is approximately 50% of people entering the facility, mostly due to reduced swimming pool usage.

Based on the ATR counts, it was determined that the highest weekday entering volume for the primary driveway to the facility was 33 vehicles per hour. During the Saturday time period, the highest volume was 17 vehicles per hour. Because data was collected during the off-peak season, it can be assumed that 50% of the vehicles entering the primary driveway were there for the fitness classes or weight room. The calculated number of vehicles generated by the fitness center was then scaled up by 210% to represent a worst case peak season value (See **Table 4**).

Table 4: The Sandcastle Fitness Center Traffic Volumes (Existing)

Study Day	Entering Volume*	Off-peak Fitness Center Volume (calculated)*	Peak Fitness Center Volume (calculated)*
Thursday	33	17	36
Saturday	17	9	19

*Vehicles per hour during the peak hour.

Additional traffic to the new 12,000 square foot facility on Rhett's Bluff was calculated. The existing fitness center at The Sandcastle is approximately 3,000 square feet, while the new center at Rhett's Bluff is approximately 5,000 square feet. Assuming a linear increase in vehicle traffic, the additional 2,000 square feet of fitness center space is expected to attract 24 additional vehicles during the peak hour on a weekday and 13 vehicles during the peak hour on a Saturday. The additional 7,000 square feet will contain a coffee shop, ship's store, and meeting spaces. For a conservative estimate of traffic, the trips generated by these uses were estimated based on the ITE Trip Generation Manual land use category of Specialty Retail (LU 826). The estimated trips to the new facility are shown in **Table 5**.

Table 5: Rhett's Bluff Facility Traffic Volumes (Estimated)

Study Day	Existing Fitness Center Volumes (calculated)*	Fitness Center Expansion*	Coffee Shop, Ship Store and Meeting Space*	Total*
Thursday	36	24	35	95
Saturday	19	13	35	67

*Vehicles per hour during the peak hour

These additional vehicles were then added to the two study intersections. For simplicity, it was assumed that all trips to the new facility would make the return trip in the same hour. As a result, in the weekday traffic models, 95 vehicles were added to the northbound **and** southbound traffic through the two study intersections. In addition, under existing conditions, some traffic may already be passing through these intersections to access the fitness center in its current location; however these volumes were not removed or redistributed for this analysis.

Intersection Operations with Amenity Improvements

The two study intersections were analyzed in SimTraffic with the additional traffic volumes and the results are presented in the tables below. On a weekday, the LOS at the Kiawah Island Parkway/Governors Drive/Rhetts Bluff Road intersection is expected to decrease from LOS B to LOS C. This is due to increased delay for the westbound traffic on Governors Drive. Additional northbound and southbound traffic reduces the availability of gaps for the westbound left turn. Because the westbound approach is only one lane, additional delay for the left turn results in additional delay for the right turn as well. Overall, delay at this intersection is considered acceptable by traffic engineering standards and the traffic volume estimates used are considered to be conservative. Traffic operations at the two study intersections are summarized in **Table 6** and **Table 7**.

**Table 6: Kiawah Island Parkway/Governors Drive/Rhetts Bluff Road
Anticipated Level of Service**

Movement	Thursday Peak Hour		Saturday Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
WB left turn	C	24.2	A	7.9
WB right turn	C	18.5	A	6.3
NB through	A	2.3	A	2.4
NB right turn	A	1.0	A	0.9
SB left turn	B	13.8	A	8.5
SB through	B	13.0	A	6.0
Overall	C	12.9	A	4.8

EB = eastbound, WB = westbound, NB = northbound, SB = southbound

**Table 7: Rhetts Bluff Road/River Course Lane/Halona Lane
Anticipated Level of Service**

Movement	Thursday Peak Hour		Saturday Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
EB left turn	n/a	n/a	A	5.0
EB through	A	6.9	A	6.4
EB right turn	A	4.5	A	3.1
WB left turn	A	7.5	n/a	n/a
NB left turn	A	2.7	A	2.3
NB through	A	0.9	A	0.8
NB right turn	A	0.8	A	0.5
SB left turn	A	2.1	n/a	n/a
SB through	A	0.5	A	0.3
SB right turn	A	0.2	A	0.0
Overall	A	2.2	A	1.4

EB = eastbound, WB = westbound, NB = northbound, SB = southbound

Facility Operations

The Sandcastle:

Because Kiawah Island is not open to the public, there is an upper limit on the amount of additional traffic the reconfigured facility can draw. However, estimates were still calculated based on the description of The Sandcastle's reconfiguration and standard trip generation calculation methodology.

The proposed community center renovations will result in an additional 3,000 square feet for use as general meeting/group space. The ITE Trip Generation Manual land use category of Recreational Community Center (LU Code 495) was used to estimate the additional trips to the site based on this increase. This information is based on 7 studies of facilities averaging 72,000 square feet.

There will also be a second pool constructed on the site. The ITE Trip Generation Manual does not have a specific land use category for trips generated by a swimming pool. The closest land use is a Water Slide Park (LU Code 414), for which there have only been two traffic studies. In this instance, the vehicle trips generated by a water park are calculated based on the available parking spaces, rather than the size of the facility itself.

Table 8 shows the anticipated traffic entering The Sandcastle parking lot area during the peak hour on an average weekday afternoon and average Saturday. This calculation does not include special events at the facility, for which traffic would be limited by the size of the facility parking lot. The total anticipated traffic based on the renovations is actually slightly less than the current peak-season traffic estimate.

Table 8: The Sandcastle Fitness Center Traffic Volumes (Anticipated)

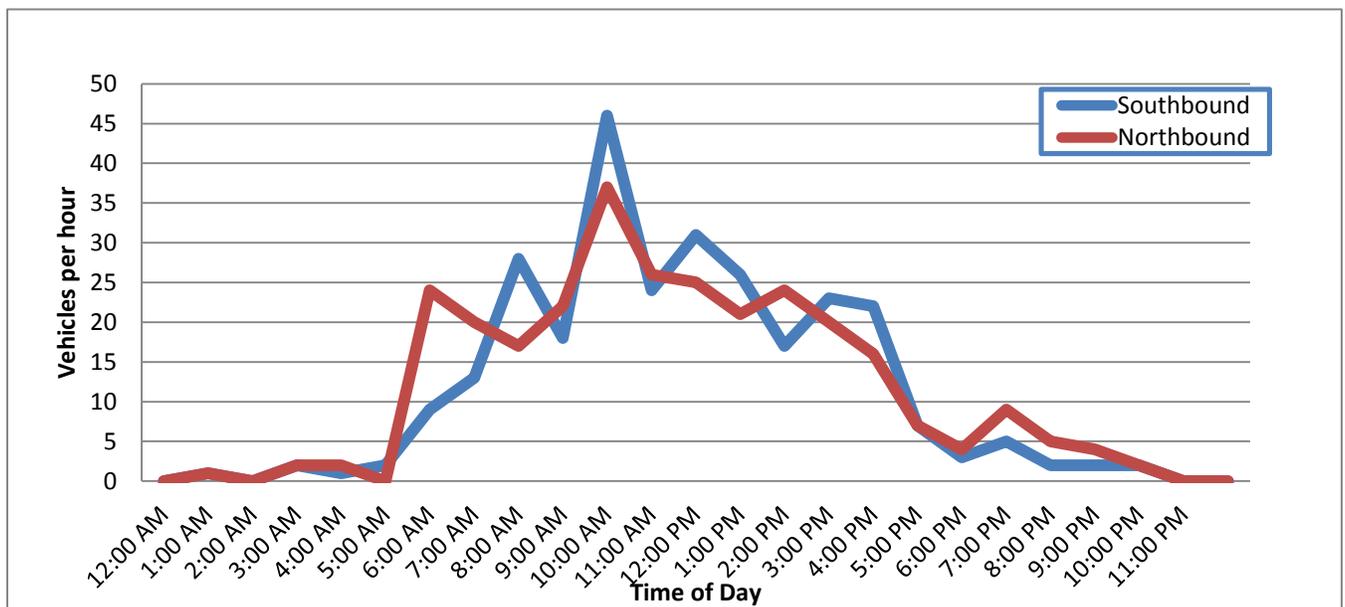
Study day	Entering traffic*	Fitness center traffic removed (calculated)*	Remaining community center and pool traffic*	Additional traffic from pool*	Additional traffic from community center upgrade*	Total anticipated entering traffic*
Thursday	33	-17	16	+11	+4	32
Saturday	17	-9	8	+11	+4	23

*Vehicles per hour during the peak hour.

Rhetts Bluff:

Traffic counts were collected at the Rhetts Bluff causeway. The peak two-way traffic on the causeway occurred during the 9:00-10:00 AM hour, with a total of 84 vehicles during that hour, which scales to 176 vehicles per hour during the peak season.

Figure 4: December 2014 Traffic Across Causeway



Adding the two-way traffic that shifted from the current fitness center location to the new one, as well as potential traffic generated by the larger fitness center and other uses at the new facility results in approximately 366 vehicles per hour on the causeway on a weekday afternoon (See **Table 9**). For comparison, a two-lane residential road can be expected to carry 1,200 vehicles per hour without noticeable congestion. So, while traffic to the area will increase, it is not expected to be a hindrance to the travel patterns of existing residents, nor be out of character for a residential street, as it will only be roughly 30% of the street’s capacity. For consistency, the 210% peak season factor that was used for all other areas of the resort was used for Rhetts Bluff as well; however, because access to and attractions on Rhetts Bluff are limited, this is a conservative factor.

Table 9: Rhett’s Bluff Traffic Volumes (Anticipated)

Study day	December causeway traffic*	Peak season causeway traffic (calculated)*	Shifted two-way traffic from existing fitness center*	Two-way Traffic due to expansion*	Total anticipated traffic across causeway*
Weekday	84	176	+72	+118	366

*Vehicles per hour during the peak hour.

Recommendations

The study intersections are expected to operate at an acceptable LOS during both time periods with the addition of traffic due to the relocation of the fitness center. However, it is possible based on the perceptions of Kiawah Island residents and visitors that this increase in delay may not be considered acceptable.

If the addition of north-south traffic on Kiawah Island Parkway/Rhetts Bluff Road results in delays for westbound Governors Drive that the community considers unacceptable, two traffic control options may address that issue. This location is likely a good candidate for a one-lane roundabout. The relatively high volume of right and left turns from Kiawah Island Parkway onto Governors Drive (when compared to the through movements) would be well served by a roundabout. Evaluation of a roundabout is outside the scope of this study and such should be analyzed fully to determine all potential benefits and impacts.

Another more immediate option would be the addition of a stop sign on the northbound leg of the intersection. This would create a traditional four-way stop, which would allow westbound left turning traffic to turn from Governors Drive without having to assess gaps in northbound traffic. Placement of this stop sign should be studied further, due to its proximity to the gatehouse.

Leisure Trail Connectivity at Rhett's Bluff

KICA desired to evaluate and explore methods, both on road and off road, to close the gap in the existing trail network across the Rhett's Bluff Road Causeway. Findings and recommendations are presented below.

Analysis of Existing Conditions

The existing trail network within the community is comprised of an 8-foot wide asphalt trail. The trail is currently utilized by bicyclists and pedestrians. The trail system exists on both the north and south sides of Bass Pond; however, there is no trail connection across the causeway. The existing Bass Pond Fishing Dock is located on the southwest side of the causeway, but currently has no access routes for pedestrian, bicyclists, and motorists, as there is no legal parking on either side of the causeway. The causeway includes wooden guardrails on both sides of the roadway. The distance between the guardrails varies from 36 feet to 55 feet. There is a 4-foot grass buffer between the guardrail and a 2-foot wide mountable curb. The paved vehicular travel width is 24 feet. Near the northern section of the causeway there are two medians that separate the vehicular travel into two 12-foot travel lanes. The medians are vegetated with trees and shrubs.



Figure 5: Aerial Photo of Rhett's Bluff Road Causeway (Google Earth)

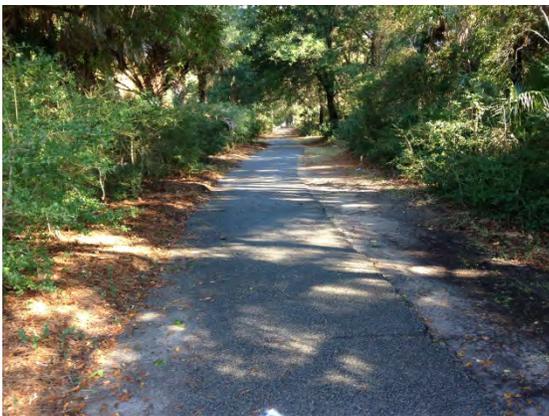


Figure 6: Existing Leisure Trail (Typical)

Currently, south of the causeway, a shared use path terminates at the southeast corner of the Rhett's Bluff Road and Halona Lane intersection. North of the causeway, the existing trail system connects to the Rhett's Bluff Boat Launch, but there is no path connection to the causeway. There is a gap in the vegetation between the intersection of New Settlement Road and the gate at the Rhett's Bluff Boat Launch driveway, providing an opportunity to connect to the existing path with minimal impacts to the existing vegetation.

Recommendations

The overall goal is to provide bicycle and pedestrian access along the causeway. The proposed design will close the gap in the existing trail infrastructure by providing a continuous trail connection and increase the options for all users to access the future fitness center and other amenities within the community north of the causeway.

According to The American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities*, shared use path widths should range from 10-14 feet. While the minimum width can be as narrow as 8 feet, this is not recommended unless other constraints require this width. However, it is understood that KICA owns and maintains all transportation facilities on the island and other standards and considerations may apply in private resort community settings.



Figure 7: Existing Leisure Trail at Rhett's Bluff Boat Launch

To improve path visibility and safety at roadway crossings it is recommended that high visibility (ladder style) crosswalk markings be added at the following key intersections: Rhett's Bluff Road and Halona Lane, east and north crossings, and New Settlement Road and Rhett's Bluff Road, west and south crossings.



Figure 8: Rhett's Bluff Road Causeway Fishing Pier

A proposed path connection is recommended to provide continuous connectivity from the intersection of Rhett's Bluff Road and New Settlement Road to the existing adjacent path. The existing path's alignment currently provides access to the gate at the Rhett's Bluff Boat Launch entrance road. It is further recommended that a new shared use path be constructed along Rhett's Bluff Road northeast, to the existing gap in vegetation and connecting it to the existing 8-foot path.

The universal recommendations outlined above provide the framework to close the gap in the entire community network, as well as incorporating one of the options below. While either of these options would be appropriate, it is important to note that the width of the roadway is sufficient to consider a variety of options, including variations on the concepts presented in this report.

Concept #1 – Shared Road With Proposed Sidewalks:

Concept #1 provides a solution that seeks to connect the trail system while minimizing capital construction costs; it is estimated to cost approximately \$156,000. In Concept #1, signing and marking are recommended to create a shared roadway facility along the causeway. Path users will cross at Halona Lane, with bicyclists

entering the roadway and pedestrians entering a proposed sidewalk. The causeway will be signed and marked with appropriate Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) signage and pavement markings. Pedestrians will be directed to a new 4-foot wide concrete sidewalk, to be installed between the existing curb and gutter and the wooden guardrail on both the west and east side of the causeway. Crosswalks will be striped at the north and south sides of the causeway, as well as installation of wayfinding signage to direct users to the paths at both ends of the causeway. A mid-block crossing with signage is proposed at the Bass Pond Fishing Dock to provide an avenue for path users to cross the causeway and access the dock (see attached plan sheets).

Concept #2 – Two-way Separated Facility:

Concept #2 is a more expensive alternative; however, this option proposes a fully separated shared use path, as well as incorporates a scenic overlook for passive recreation. This design proposes a full reconstruction of the roadway within the existing wooden guardrails to accommodate an 18-foot wide vehicular travel way on the west side of the causeway. Reducing the vehicular travel way to 18 feet for bi-directional travel allows room to propose a 10-foot wide (or 8-foot minimum) shared use path with 5 feet of separation between the path and the road. Should a wider travel way be desired, this separation width could be reduced. The 2-foot wide mountable curb on the east side of the causeway is to be relocated as shown in the concept plans (see attached plan sheets) and will act as the buffer between the vehicular travel way and the shared use path on the east side of the causeway. In order to meet AASHTO guidelines, an extension is proposed to the existing wooden guardrail on the east side of the causeway to incorporate a 42-inch vertical railing. Railings or barriers below this height create a toppling hazard for cyclists. The 18-foot vehicular travel way on the west side of the existing medians will require the median footprint to be reduced. Placing a shared use path along the east side of the causeway keeps the entire trail network off-road. It also provides space on the northeast side of the causeway to accommodate an overlook for respite to enjoy the scenery and explore the wildlife. This overlook could house binoculars for bird watching, environmental identification signage for educational opportunities, and benches for resting. Costs for Concept #2 were estimated at approximately \$265,000 without the scenic overlook and \$350,000 with the overlook.