

Tahoe City, Placer County, California

Pedestrian & Bicycle Road Safety Audit



Conducted April 27-29, 2015

Prepared By:
FHWA Resource Center

FINAL REPORT October 2015

Participants:

Craig Allred- FHWA Resource Center, Transportation Specialist

Morgan Beryl- TRPA/TMPO, Associate Planner

Tim Boyer- Placer County/DPW, Transportation Specialist

Jerry Champa- CalTrans HQ, Traffic Engineering Liaison

Cindy Gustafson- TCPUD, District General Manager

Hillary Isebrands- FHWA Resource Center, Safety Engineer

Ron Treabess- North Lake Tahoe Resort Association

Table of Contents

Introduction	1
Purpose/Background	1
Study Area	3
Existing Conditions	4
Site Characteristics and Pedestrian and Bicycle Infrastructure	4
Road User Data	7
Crash Data	7
Public Input from Listening Session	8
Assessment of Findings	9
Safety Benefits of Existing Roadway	9
Identified Study Area Issues and Suggested Improvements	10
Summary of Safety and Operations Improvements	20
Funding Sources for Safety and Operational Improvements.....	23
Conclusions	24
Acknowledgements.....	26
Appendix A	27
Appendix B	28
Appendix C	29
Appendix D.....	35
Fairway Drive Concept	35
“Wye” Intersection and Fanny Bridge Concept	36
Pedestrian Hybrid Beacon Concept – 2 Lane Road.....	37
Grove Street Concept.....	38
Jackpine Street Concept.....	39
Lighthouse/East Gateway Concept.....	40
Appendix E	41

Introduction

Purpose/Background

According to the Federal Highway Administration's (FHWA) *Road Safety Audit Guidelines*, a Road Safety Audit (RSA) is a formal safety examination of a future roadway plan or project or an in-service facility and is conducted by an independent, experienced, and multidisciplinary RSA team. The primary focus of an RSA is safety while working within the context of mobility, access, surrounding land use, and/or aesthetics. RSAs enhance safety by identifying potential safety issues affecting all road users under all conditions and suggesting measures for consideration by the design team or responsible agency.

An RSA is not simply a standards check. Standards checks are part of the design process to ensure adherence to design standards and guidelines. Although the RSA team may identify safety issues by comparing items of concern to standards, the general intention of the RSA is to identify areas where applied standards may interact with road user behaviors to generate a potential safety issue.

In addition to using an RSA as a tool to assess and improve safety performance of facilities in their jurisdiction, public agencies may wish to conduct RSAs oriented to assess or address safety issues related to specific user groups, such as pedestrians and bicyclists. RSA's can be performed as both a proactive and reactive approach to assessing and improving safety on a facility.

The purpose of this pedestrian and bicycle RSA (PBRSA) was to assess the multi-modal safety of Highway 28 through Tahoe City, Placer County, California with the following goals in mind:

- Balance pedestrian safety and vehicular movements in and through Tahoe City
- Provide safe pedestrian and bicycle movements within Tahoe City along SR 28
- Coordinate and leverage current and planned projects within Tahoe City, and
- Enhance pedestrian crossings through implementation of proven strategies and countermeasures.

This roadway was selected because of the high pedestrian and bicycle traffic volume and numerous crosswalk locations along the popular Lake Tahoe loop. Tahoe City is the center of forthcoming transportation mobility and safety improvement projects, namely the CA FLAP SR 89(1) Truckee River Bridge project and the Placer County's TRPA funded On Our Way grant for the Tahoe City

Mobility Plan. Additionally, critics of these projects have concern about the high pedestrian volumes influence on capacity at the Wye intersection and through Tahoe City even with the implementation of the projects.

The PBRSA team was comprised of individuals with a variety of backgrounds including: law enforcement, engineering, planning, and local government and community representatives. There were representatives from Tahoe City Public Utility District, Placer County, California Department of Transportation, Tahoe Regional Planning Agency / Tahoe Metropolitan Planning Organization, North Lake Tahoe Resort Association, and the Federal Highway Administration (FHWA) Resource Center. In addition to input from the PBRSA team, an important aspect of this PBRSA was a public listening session on Tahoe City pedestrian and bicycle issues. A copy of the PBRSA agenda is included in Appendix A.

Tahoe City, CA, shown in Figure 1¹, extends along Highway 28 for approximately one mile, over half of which fronts the western shore of beautiful Lake Tahoe. During peak summer periods, Tahoe City serves over 5,000 pedestrian and bicyclists per day and over 22,000 vehicles per day. The “wye” intersection of Highway 28 and Highway 89, the Fanny Bridge/Highway 89 area and Grove Street experience the highest number of pedestrian concentrations, however there are five additional marked pedestrian crossings along Highway 28 through Tahoe City. It is estimated that Tahoe City has an estimated 3 to 4 million visitors every year serving as the gateway to the west and north shore of Lake Tahoe and the confluence of the Truckee River and Lake Tahoe at the historic Fanny Bridge.

¹ Tahoe City Mobility Plan, February 2015

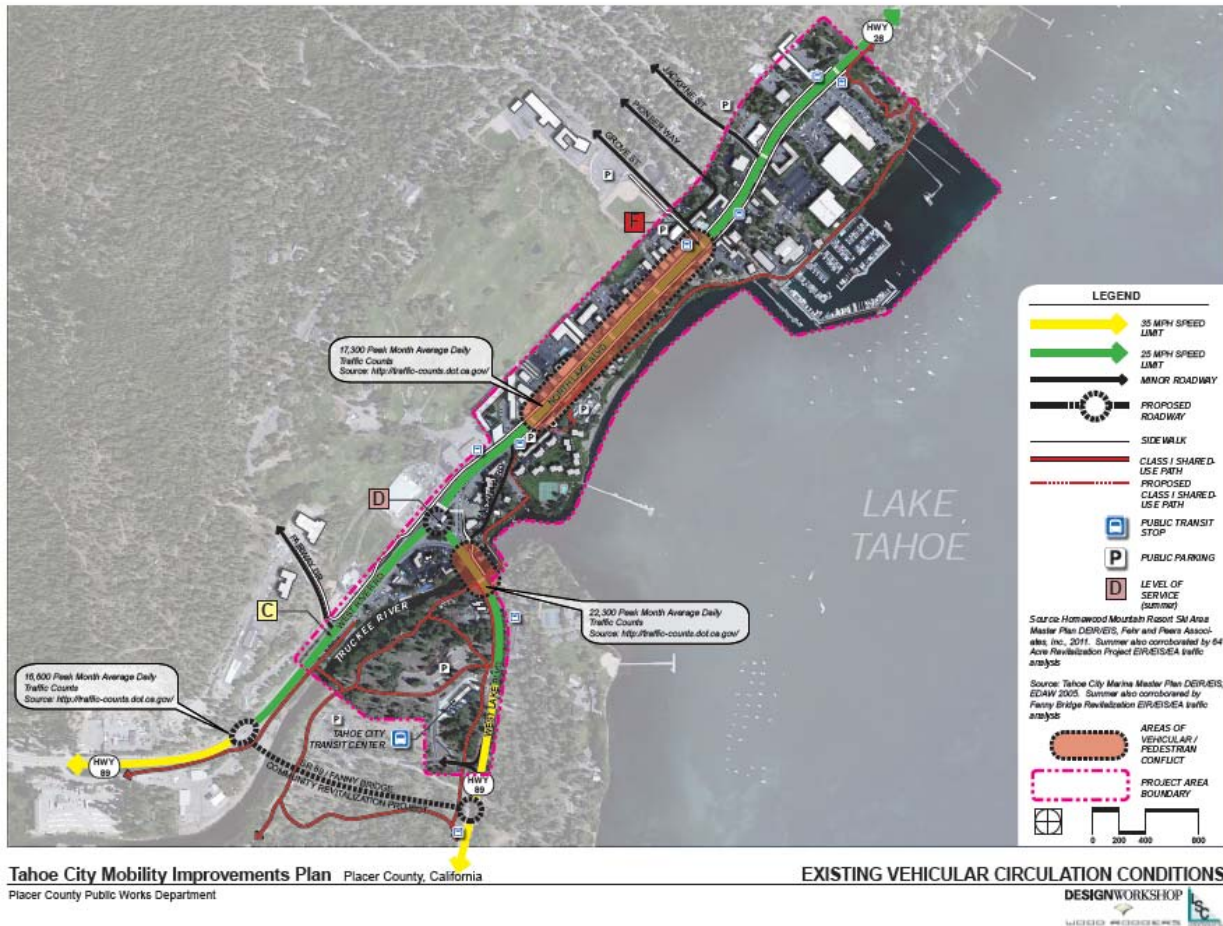


Figure 1: Map of Tahoe City¹

Study Area

The location for this Pedestrian Bicycle Road Safety Audit (PBRSA) extended from Fairway Drive to the Lighthouse development. This segment of Highway 28 is approximately 0.85 miles in length and includes the major intersection with Highway 89 and the local street intersections of Fairway Drive, Mackinaw Road, Commons Beach Road, Grove Street and Jackpine Street. In addition, there are nearly three dozen “defined” driveways and numerous “undefined” business access points along the corridor. Tahoe City experiences significant seasonal variation in pedestrian and bicycle traffic as well as vehicular traffic during the summer and winter ski peaks.

Existing Conditions

Site Characteristics and Pedestrian and Bicycle Infrastructure

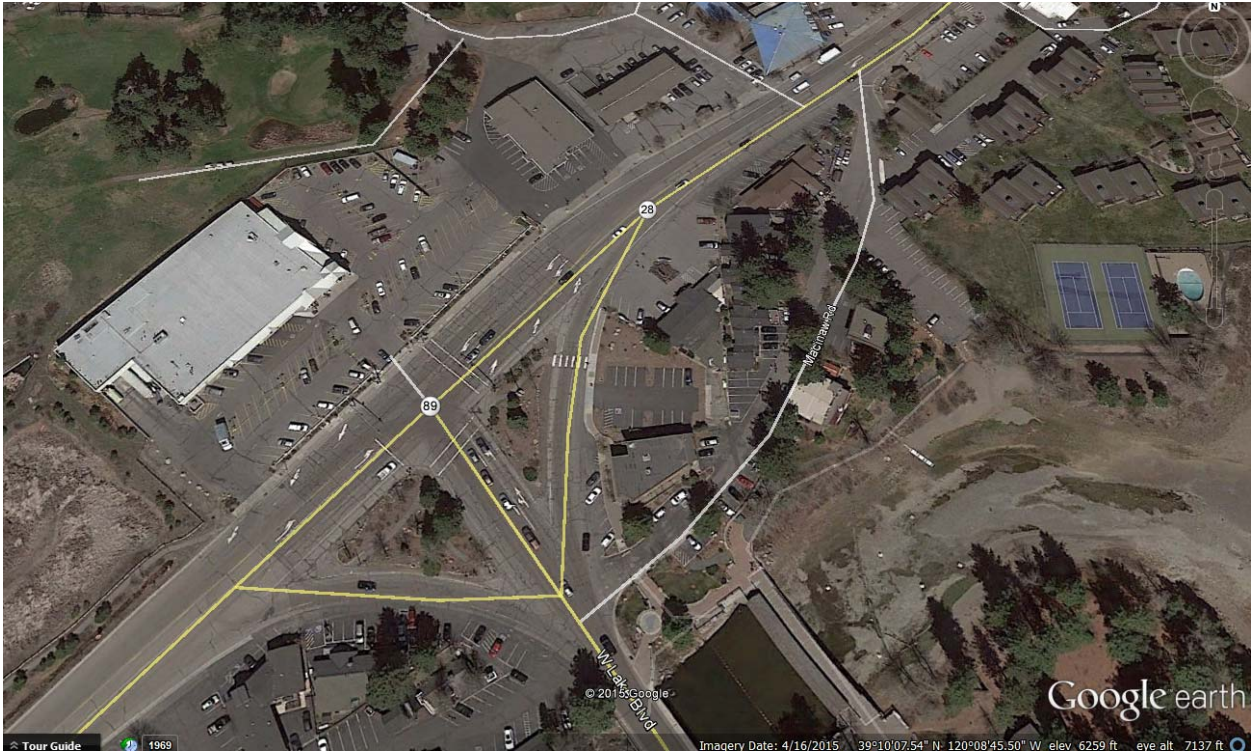
The study area along Highway 28 is predominantly a three lane roadway that includes a two way left turn lane. The roadway width varies from 55 ft to 80 ft. On street, parallel parking is located along most of the study area but the parking widths are not consistent, varying from 10 ft to 13 ft. A portion of the corridor has a marked bike lane but it is not consistent throughout the study area. The minor local street intersections include, Fairway Drive, Mackinaw Road, Commons Beach Road, Grove Street and Jackpine Street which are all stop controlled intersections. The major signalized intersection of Highway 89 and Highway 28 has two sets of dual left turn lanes and two free flow right turning movements. All intersections are shown in Figure 2. Three marked midblock pedestrian crossings were also within the study area, including Cobblestone, Big Tree and the Lighthouse development, shown in Figure 3.



Fairway Drive "T" Intersection



Commons Beach Road "T" Intersection



Hwy 89/Hwy 28 "Wye" Intersection and Mackinaw Road "T" Intersection



Grove Street Intersection



Jackpine Street "T" Intersection

Figure 2: Study area intersections (Aerial Image Source: Google Earth)



Cobblestone Pedestrian Crossing



Big Tree Pedestrian Crossing



Lighthouse Pedestrian Crossing

Figure 3: Midblock Pedestrian Crossings (Aerial Image Source: Google Earth; Photo Source: Isebrands)

Road User Data

In the Tahoe City area, both the Annual Average Daily Traffic (AADT) as well as seasonal traffic counts are important when considering mobility and safety of this corridor. Over the past 10 years, seasonable high traffic volumes have ranged from 22,300 to 27,000 vehicles per day and the AADT varied from 15,200 to 16,700 vehicles per day². In July 2012, CalTrans performed pedestrian and bicyclist counts on Highway 28 from the Big Tree crossing to Grove Street from 10am to 2pm. 226 pedestrians used the Grove Street crosswalk (both directions) and 64 bicyclists were using the bike lanes through this area. Approximately, an additional 115 pedestrians crossed Highway 28 between the Fuller Building and Grove Street. The pedestrian counts from CalTrans are included in Appendix B.

Crash Data

While the RSA is pedestrian and bicycle-focused, to gain a more complete understanding of how the corridor functions, it is important to look at crashes involving both motorized and non-motorized vehicles. It is a known fact that pedestrian and bicyclist are vulnerable road users if they are involved in a crash. If a vehicle is traveling at 20mph, a pedestrian has a 90% chance of surviving; at 30 mph a 50% chance of surviving; and at 40mph a 10% chance of surviving. Figure 4 is from the Seattle DOT Pedestrian Safety Action Plan illustrating the exponential risk associated with vehicular speeds.

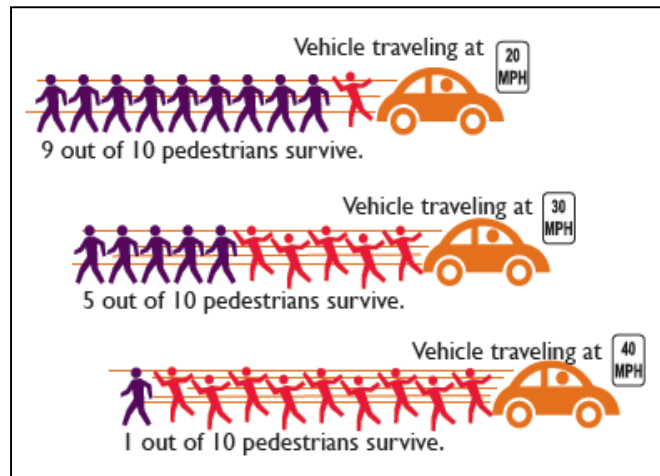


Figure 4: Survivability of Pedestrians (Source: Seattle DOT)

Over a five year period along the study area, from 2009-2013, there were 75 total crashes³, of which 29% were injury crashes. The crashes were concentrated near the Highway 89, Commons Beach Road and Grove Street intersections. Over the same period, five pedestrian crashes and seven bicyclist crashes were reported, all resulting in an injury. (Only one bike crash was outside of the study area.) Fifty-percent of the injury crashes in Tahoe City from 2009-2013 were pedestrian or bicycle crashes within the study area, shown in Figure 5. Over the 5 year period, an average of 1.0

² Tahoe City Mobility Plan, February 2015

³ SWITRS

pedestrian injury crash occurred per year and 1.4 bicyclist injury crash per year occurred within this corridor. Although the numbers are not large, it illustrates that if there is an injury crash, there is a 50/50 chance it will be pedestrians and bicyclist.



Figure 5: Crash Data for Tahoe City from 2009 – 2013

In the 2015-2019 *California Strategic Highway Safety Plan (CA SHSP)*⁴, pedestrian fatalities and severe injuries represented 17.32 percent of the total number of traffic fatalities and severe injuries in California in 2012. Fatal and injury bicyclist crashes are on the rise in California. In 2012, 978 bicyclist were injured in crashes and 147 bicyclist fatalities were reported, both of which are the second highest numbers over the period from 2003-2012.

Public Input from Listening Session

In the listening session prior to the field portion of the PBRSA there was significant input from numerous property owners and community members regarding pedestrian and bicyclist safety in Tahoe City, including:

- Not as much a safety issue as a mobility problem,
- Concern about partnership with State Patrol as it pertains to traffic issues,
- Tahoe City has less flexibility because of the state highway designation,
- Sidewalks too small or do not exist,
- Sight distance issues with parking and lack of parking enforcement are year round issues,

⁴ http://www.dot.ca.gov/hq/traffops/shsp/docs/SHSP15_Update.pdf

- Parking along the roadway can be an issue related to congestion and potential “door dings,” and
- Pavement markings could be improved (i.e. width of edgeline markings, maintenance cycle of re-paving, parking tics).

Assessment of Findings

Safety Benefits of Existing Roadway

While conducting the PBRSA, the Team noted positive features along Highway 28, including the following, also shown in Figure 6.

- **High visibility crosswalk pavement markings:** Most of the marked pedestrian crossings on Highway 28 (between Commons Beach Road and the Lighthouse Shopping Center) had high visibility style crosswalk pavement markings.
- **Crosswalk spacing and locations:** The marked pedestrian crossings along Highway 28 are appropriately spaced (between 350 ft and 660 ft) based on destinations on both sides of the highway.
- **Sidewalk lighting:** Pedestrian level lighting along the sidewalks provided good visibility along the sidewalk.
- **Crosswalk signing:** All marked crossings included supplemental pedestrian crossing signs and temporary in-street crossing signs during late spring, summer and early fall.
- **Multimodal atmosphere:** Most sidewalk widths were desirable based on the number of pedestrians and Class I shared use paths provide options users. Many cyclists were riding with traffic on Highway 28 and complete Street design amenities such as parking, is present.
- **Collaboration:** The community and agencies have a good working relationship with CalTrans Maintenance related to snow removal, sweeping, landscaping and roadside maintenance.



Figure 6: Photos of Existing Safety Features in Tahoe City (Photo Source: Isebrands)

Identified Study Area Issues and Suggested Improvements

Three predominant roadway features were identified as possible improvement areas along the corridor to increase safety and efficiency for all users: Sidewalk/multi-use pathways/Class I bike paths connectivity, intersections/access, and pedestrian crossings. Each of these is described below with detailed explanations and potential improvements for particular locations. The preliminary findings de-brief presentation given after the field work for the PBRSA is included in Appendix C.

Improve Sidewalk/Multi-use Trail Connectivity for Pedestrians

The sidewalks/multi-use trails have several gaps in connectivity within the study area, particularly on the western terminus of the study area. Currently there is not easily identifiable pedestrian access or infrastructure to cross the “wye” intersection. Additionally, there are several pedestrian crossing restrictions (i.e. “No Pedestrian Crossing” signs) near the “wye” intersection and the Fanny Bridge area. These



restrictions are not consistent with the pedestrian and bicycle desire lines, beautiful views, common area and businesses. Examples of these issues are shown in the photos in Figure 7. The following descriptions and corresponding areas in Figure 8 show gaps in sidewalk, multi-use path connectivity and/or crossing restrictions.

1. Between Fairway Drive and the Highway 89/28 “wyé” intersection (south side),
2. Within the Highway 28/89 “wyé” intersection,
3. North end of Fanny Bridge,
4. Between Highway 28/89 “wyé” intersection and Mackinaw Road bus stop,
5. Between the TART Transit Center, along Highway 28, to Fanny Bridge, and
6. Between Commons Beach area and Fanny Bridge.



Figure 7: Examples of Pedestrian Restrictions, Access and Lack of Infrastructure (Photo Source: Isebrands)

General improvements are suggested below to address the over-arching issues described above and specific improvements for segments, intersections, and crossings are included in the subsequent sections.

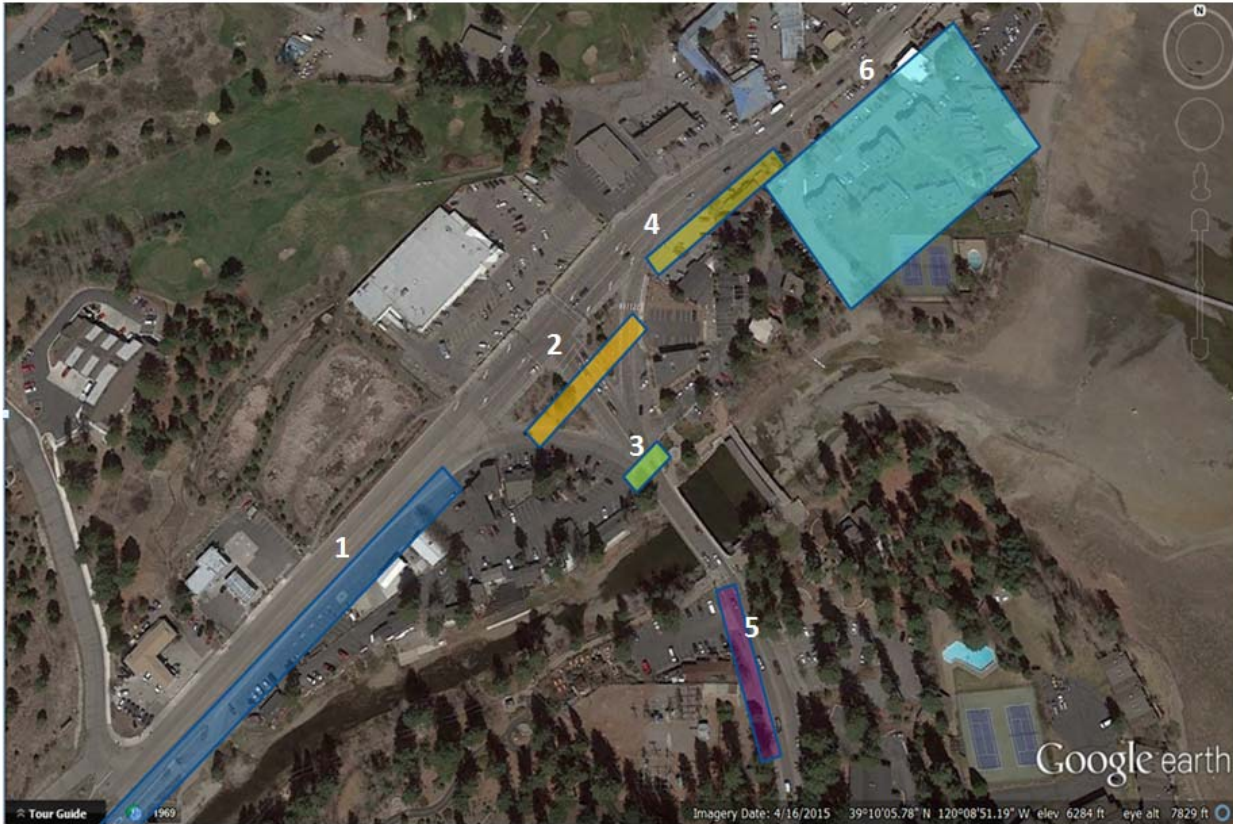


Figure 8: Colored areas indicate gaps in sidewalk, pathway connectivity and/or crossing restrictions (Aerial Image Source: Google Earth)

Suggested Improvements:

- *Provide sidewalk infrastructure where it does not exist.*
- *Provide accessible crossings at logical origins and destinations (i.e. where people already naturally walk).*
- *Eliminate pedestrian crossing restrictions.*
- *Provide defined access (driveways) from Highways 28 and 89 to businesses (Area 1 and Area 4 in Figure 8).*
- *Re-purpose the Highway 89/28 within CalTrans right of way from Fairway Drive to Mackinaw Road to include sidewalk, bike lanes, parking, bulb outs, defined access.*

Improve Bicycle Connectivity

The PBRSA Team observed inconsistency in bike lane markings within the study area as well as inconsistencies between the bike signing and pavement markings. Additionally, bicyclists were observed riding against traffic in several locations - near Mackinaw Road and at the Class I multi-use

trail near the Lighthouse development - where the pathway connections and/or change in type of bicycle facility was not clear. Bicyclists riding against traffic in the roadway put them at higher risk for a crash.

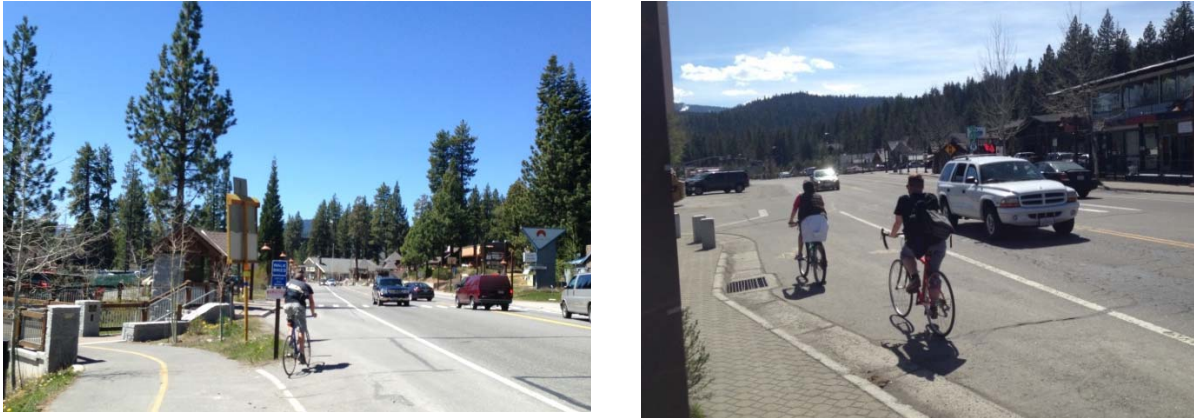


Figure 9: Wrong-way Bicyclist on Highway 28 (Photo Source: Isebrands)

Suggested Improvements:

- *Close the gap between West Shore Bike Trail to the Lakeside Bike Trail*
- *Provide wayfinding for bicyclists where the bicycle facility type changes or ends (Near Fairway Drive and Lighthouse development)*
- *Widen sidewalk where it narrows between Commons Beach Road and Mackinaw Road, and use wayfinding signs to guide bicyclists to bike routes.*
- *Ensure consistent bike lane signing and pavement markings*
- *Re-stripe pavement markings for the travel lanes, bike lanes and parking spots in the Spring rather than the Fall*
- *Install “sharrow markings” where the roadway width does not allow for a full bike lane width*
- *Explore modifications to Mackinaw Road to provide the bicycle connection between Commons Beach and Fanny Bridge (i.e. bike boulevard, one way roadway)*

Fairway Drive Intersection and Roadway Segment from Fairway Drive to the “Wye” Intersection

The PBRSA Team identified the Fairway Drive intersection as the existing Gateway into Tahoe City from Squaw Valley and Truckee; however the wider roadway width of Highway 28 appeared to encourage drivers to increase their speeds heading into the Tahoe City and the signalized intersection. The location is shown in Figure 10. Highway 28 widens from a 2 lane road to a wide three lane cross section, with approximately 55ft of pavement.



Figure 10: Entrance to Tahoe City, CA (Photo Source: Isebrands)

The existing Class I bike trail/multi-use path on the east side of the road ends abruptly at this intersection leaving the pathway user “stranded.”

Suggested Improvements:

- *Provide bump outs to shorten pedestrian crossing distance from multi use trail to Fairway Drive intersection.*
- *Consider bicycle wayfinding signs to direct Class I bike trail users over the existing bridge to the Tahoe Rim Trail. Potential bicycle road riders would be directed to Highway 89 via the pedestrian crossing.*
- *Provide sidewalk infrastructure on the south side of the roadway to connect pedestrians to the “wye” intersection.*
- *Provide defined access (driveways) to the properties on the south side of Highway 89.*

Highway 28/89 “Wye” Intersection and Fanny Bridge Area

The “Wye” intersection of Highway 28/89 and Fanny Bridge provides significant access to attractions for both locals and visitors to Tahoe City and Lake Tahoe year round; yet, the pedestrian infrastructure and connectivity is significantly lacking as mentioned above. The pedestrian movement restrictions in this intersection are not consistent with a community that promotes and thrives on visitors. Desire lines exist between both sides of this intersection; however, countless observations were made of pedestrians running across the road to avoid speeding traffic in the free right turns and walking in the roadway across Fanny Bridge. The existing Pedestrian Signal on the

south end of Fanny Bridge provides for controlled, safe crossing but lacks efficiency. Figure 11 shows examples of pedestrian activity in this area. Improved safety and mobility can be achieved in this area with investments in sidewalks, traffic calming, high visibly crosswalks and efficient traffic and pedestrian traffic control.



Figure 11: Photos of Pedestrian and Bicycle Activities at Fanny Bridge (Photo Source: Isebrands)

Suggested Improvements:

- *Provide pedestrian infrastructure at the “wye” intersection for all movements.*
- *Provide a controlled pedestrian crossing - Pedestrian Hybrid Beacon (PHB)- on the north end of the Fanny Bridge that is coordinated with the south end treatment.*
- *Replace the Pedestrian Signal at the south end of Fanny Bridge with a PHB at Fanny Bridge and coordinate with a second PHB on the north end of Fanny Bridge.*
- *Consider using the extra width on the existing Fanny Bridge for marked bike lane or add a raised sidewalk on the west side⁵*

Improve Sight Distance at Pedestrian Crossings

With parking along much of the Highway 28 corridor - a positive multi-modal and traffic calming feature - the line of sight between pedestrians and drivers at the crosswalks was observed to be consistently blocked along the corridor. Parked vehicles encroached into the pedestrian crosswalk locations which contributed to the visibility issues. Pedestrians are hidden behind vehicles parked too closely to the crosswalks. Additionally, the proximity of driveways to crosswalks also was observed to contribute to sight line issues at the pedestrian crossings.

⁵ The CA FLAP SR 89(1) Truckee River Bridge project includes width for a bike facility and sidewalk on the bridge.

Suggested Improvements:

- *Provide curb bulb outs at all pedestrian crossings where parking is permitted to improve sight distance at the crosswalks. This also reduces pedestrian crossing distances.*
- *Paint “red curbs” to indicate “no parking” areas near crosswalks and driveways*
- *Provide pavement markings for parking spaces (tick)*
- *Provide street lighting adequate for pedestrian crosswalks*
- *Enforce parking restrictions near pedestrian crossings, intersections and driveways*

Grove Street Intersection

During the PBRSA the Grove Street intersection was similar to an average intersection within the study area, however, it is known that this location is a significant pedestrian generator during the Farmers Market and requires assistance from California Highway Patrol during the busy times to keep traffic moving and pedestrians’ safe. Frequent school bus stops are also made at this intersection.

Suggested Improvements:

- *Install a pedestrian activated Pedestrian Hybrid Beacon. Figures 12 and 13 provide locations of PHB installations that are similar in context to Tahoe City. (More information about the PHB can be found in Appendix E.)*
- *Improve the bulb outs by making them larger in order to improve sight distance.*
- *Use high visibility crosswalk markings for the two crosswalks across Grove Street.*



Figure 12: Example of Pedestrian Hybrid Beacon on a Hwy 20 and Wood Street - “T” intersection (Sources: Village of Delta, OH – left; Google Earth Street View - right)

The USFS is installing a Pedestrian Hybrid Beacon at Camp Richardson during the Fall of 2015. Figure 13 shows a mock-up of the Pedestrian Hybrid Beacon.



Figure 13: Mock up of Pedestrian Hybrid Beacon at Camp Richardson (Source: USFS)

Jackpine Street Intersection

The Jackpine Street intersection had more pedestrian activity than was expected and the crossings appeared unpredictable in terms of where pedestrians were crossing at this intersection. Highway 28 traffic speeds were observed to be higher in this area, perhaps due to the wider roadway cross section. The intersection has a slight skew and aligns with one of the driveways to the Tahoe City Marina and shopping area. Because of the skew, the left turn movements for one direction can block the movement from the other direction. An exclusive right turn lane is marked in the southbound direction where it appears parking is still allowed. The pedestrian crosswalk is over 65ft in length. For an average pedestrian, it would take 20 seconds to cross the roadway with higher observed speeds and numerous driveway conflicts. Figure 14 illustrates the skewed nature of the intersection as well as the lengthy crossing distance.



Figure 14: Re-alignment of Jackpine St and Long Pedestrian Crossing Distance (Aerial Image Source: Google Earth; Photo Source: Isebrands)

Suggested Improvements:

- *Re-align Jackpine Street by adding curbing to the south radius. This will square up Jackpine Street to Highway 28.*
- *Provide curb bump outs on both sides of Highway 28 to improve sight distance for pedestrians and vehicles exiting the Marina and to reduce the crossing distance*
- *Eliminate right turn lane from westbound direction.*
- *Optional: Add a second crosswalk at Jackpine Street but consider additional conflict points and impacts to sight distance.*
- *Optional: If ingress and egress of the Marina can be modified, consider the west driveway as an exit only (better sight distance) and the east driveway as right-in-right-out only movements.*

Lighthouse Development Area/East Gateway

The east end of the study area appeared to have the highest speeds as drivers were entering and leaving Tahoe City. There is weak connectivity between the Class I bike pathway and the sidewalk network and roadway bike lanes as shown in Figure 15. Numerous pathway riders rode against traffic to transition either to the sidewalk on the south/west side of the road or to cross over to the east side and ride on the shoulder. Substantial sign clutter exists and potential wayfinding issues were observed where the Class I bike trail, road shoulder, pedestrian crosswalk and transit stop/bus shelter converged. Four driveways leading to the same parking lot also seem to allow unnecessary conflict points for all users.

Suggested Improvements:

- *Provide a raised median in advance of the crosswalk and transit stop to serve as a Gateway to Tahoe City from the North Shore.*
- *Complete a connection from the Class I multi-use trail to the sidewalk, crosswalk, and bus stop*
- *Consolidate driveways at the Lighthouse development.*
- *Provide bike lane markings on both sides of Highway 28 through this area. Roadway width appears to be available.*



Figure 15: Lack of Pathway Connectivity near Lighthouse Development (Photo Source: Isebrands)

Summary of Safety and Operational Improvements

In addition to the discussion in the previous section, Table 1 summarizes the safety and operational improvements suggested as a part of this PBRSA.

Table 1: Pedestrian and Bicycle Improvement Strategies for Tahoe City

Location	Strategy							
	Median Refuge Island	Curb Bump Out(s)	Sidewalk Connection	Driveway Ingress & Egress	Crosswalk Marking Adjustments	Pedestrian Hybrid Beacon	Minor Rd/Access Modification	Bike Connection
Gateway West/Fairway Dr	X ¹	X			X			X
Segment on Hwy 28 b/w Fairway Dr and "Wye"			X	X				X
"Wye" Intersection - Hwys 28/89	X	X	X		X			X
Segment on Hwy 28 b/w "Wye" & Mackinaw Rd			X	X			X ²	
Fanny Bridge area			X	X	X	X	X ²	X
Commons Beach Rd Crosswalk		X						X
Cobblestone Crosswalk		X						
Big Tree Crosswalk		X						
Grove St		X			X	X		
Jackpine St		X		X	X		X	
Gateway East/ Lighthouse development	X	X		X				X

¹ If the Fanny Bridge project moves forward this would not be considered the Gateway to Tahoe City as it would be at the new Western Roundabout.

² Future considerations of Mackinaw Road conversion to a bike boulevard or one way operations.

General strategies and suggestions for improvement that the PBRSA Team recommended for the entire corridor are listed below. Ongoing maintenance and operational costs should be considered along with these suggested improvements.

- Upgrade pedestrian crosswalk and bicycle signing,
- Restriping – bike lanes, parking, travel lanes annually (Spring preferred)
- Complying with the new PROWAG for accessibility improvements,
- Providing adequate sight distance at pedestrian and bicycle crossings, and
- Crosswalk illumination.

The improvements can also be considered in terms of ease of implementation from short-term to mid-term to long term strategies.

Short Term

- Pavement Markings and Warning Signs
 - Re-fresh the pavement markings (crosswalks, bike lanes, centerline, edgeline, parking)
 - Paint the curb in areas for future bump outs with red paint
 - Replace the old pedestrian crossing warning signs with new signs
 - Provide wayfinding signs for bicyclists using Dollar Point bike trail to designate transition into Tahoe City
- Collaboration, Education and Enforcement
 - Share PBRSA findings with Fanny Bridge PDT and On Our Way Grant for Tahoe City Mobility Plan PDT - Consider focusing on potential for pedestrian and bike connectivity as a part of these projects from new roundabouts to Mackinaw Street.
 - Coordinate with CalTrans District 3 maintenance on pavement marking.
 - Enforce parking only in designated spots as it pertains to pedestrian crossing sight distance.
 - Assess the feasibility and funding for a Pedestrian Hybrid Beacon at Grove Street to attempt to reduce decrease delays and spillback through Tahoe City and reduce the reliance on CHP for pedestrian movements during events.

Mid Term

- Improve Pedestrian Infrastructure – Sidewalks, curb and gutter, lighting
 - Install curb bump outs at all pedestrian crossings along Highway 28 (where right of way exists)
 - Improve access points/driveways to businesses and provide pedestrian infrastructure from Fairway Drive to Mackinaw Street.
 - Install median refuge islands to create East and West Gateways to Tahoe City.
 - Pave connection from Class I Bike trail to Lighthouse development pedestrian crossing.
 - Provide crosswalk/pedestrian lighting
 - Roadway lighting (dimming, low profile, pedestrian activated)

Long Term

- Provide a bicycle connection from Commons Beach to Fanny Bridge
- Develop an access management plan for Tahoe City looking at ingress and egress to Highway 89 and 28 as well as considerations for connections through parking lots.

The recommended strategies for the Tahoe City PBRSA are consistent with the 2015 CA SHSP Pedestrian and Bicycle Challenge Area strategies as shown in Table 2.

Table 2: CA Strategic Highway Safety Plan Pedestrian and Bicycle Challenge Area Strategies

Pedestrians

- Improve the safety of pedestrian crossings by using proven effective countermeasures.
- Expand effective enforcement and education of all roadway users to improve pedestrian safety based on known risk factors and data trends.
- Increase funding for pedestrian safety infrastructure and non-infrastructure projects.
- Improve collection, use, and analysis of data needed for pedestrian safety planning and programming.
- Increase pedestrian safety-focused coordination among State, regional, and local agencies including on transportation planning and land use efforts.

Bicycles

- Improve roadway and bikeway planning, design, operations, and connectivity to enhance bicycling safety and mobility to all destinations.
- Improve data collection regarding bicyclist trips, injuries, and fatalities on California roadways and bicycle paths.
- Improve education and enforcement to promote safe multi-modal travel.
- Encourage more bicycle travel by improving public attitudes about bicycling as a safe mode of transportation.
- Develop safe, direct, and connected routes for bicycling.

Funding Sources for Safety and Operational Improvements

Some of the identified projects and funding sources for safety and operational studies and improvements include the following:

Active Projects

- Placer County's TRPA funded On Our Way grant for the Tahoe City Mobility Plan
- CA FLAP SR 89(1) Truckee River Bridge (FHWA Federal Lands)

Potential Funding Sources

- SHOPP – State Hwy Operations Protection Plan (CalTrans)
 - Pedestrian Crossing Enhancement Program
 - Operational Improvements

Request can be made to CalTrans to perform an engineering investigation to develop a project proposal. CalTrans SHOPP funding via the Pedestrian Crossing Enhancement Program for the Pedestrian Hybrid Beacon(s) and other improvements related to pedestrian crossings.

- Active Transportation Program (CalTrans/FHWA)
- Federal Lands Access Program (FLAP)
- Placer County
- North Lake Tahoe Resort Association (NLTRA)
- Property Tax/TCPUD
- PBID (Property Based Improvement District)
- US Forest Service
- Private

Conclusions

RSA's are conducted to address both proactive and reactive safety issues and are not solely based on documented crash data but also take into consideration the perceived risk of the users.⁶ The Tahoe City Pedestrian and Bicycle RSA (PBRSA) used the crash and user count data, information gathered from the community as well as from the field observations of the study area. The study area, from Fairway Drive to the Lighthouse development, included both positive features such as high visibility crosswalks, multi-modal atmosphere, and on-street parking- to name a few - but also disappointing gaps in pedestrian and bicycle infrastructure. It was also evident that there is a perception that limited flexibility exists with this corridor due to its state highway designation.

The goals of this PBRSA were to assess the balance of pedestrian safety and vehicular movements in and through Tahoe City as well as coordinate with and leverage current and planned projects within Tahoe City and lastly, enhance the safety of pedestrian and bicyclists through recommending proven safety countermeasure and strategies.

The most substantial finding from the PBRSA was the lack of pedestrian infrastructure and connectivity from Fairway Drive to Mackinaw Street, particularly at the "wye" intersection of Highways 28/89 and the Fanny Bridge areas. These two locations are not only the gateway to Tahoe City from the West Shore and Squaw Valley but they are also the interface between the community, visitors and beautiful Lake Tahoe.

Some of the improvement strategies include:

- Provide sidewalk infrastructure where it does not exist.
- Provide accessible crossings at logical origins and destinations (i.e. where people already naturally walk).
- Eliminate pedestrian crossing restrictions.
- Provide defined access (driveways) from Highways 28 and 89 to businesses
- Re-purpose the Highway 89/28 within CalTrans right of way from Fairway Drive to Mackinaw Road to include sidewalk, bike lanes, parking, bulb outs, defined access.
- Close the gap in the bicycle trail network
- Improve efficiency and access of pedestrian crossings at Fanny Bridge with installation of two Pedestrian Hybrid Beacons.

⁶ FHWA. Bicycle Road Safety Audit Guidelines and Prompt Lists.

Several of the strategies are likely best suited for particular studies, projects and funding sources while others may be handled through agreements between government agencies. It is hopeful that the recently approved CA FLAP Fanny Bridge project improvements and the On Our Way Grant for the Tahoe City Mobility Study will significantly make strides towards some of these needed improvements.

Incremental safety improvements along this corridor will continue to allow Tahoe City to thrive as a destination for many.



Acknowledgements

The PBRSA Team would like to acknowledge the following agencies and people for assistance during the PBRSA:

- TCPUD for providing meeting space in April and September.
- Business and Property owners for their valuable time and input.
- Jim Brake, CalTrans District 3, for your institutional knowledge (happy retirement!).
- Placer County for sponsoring the coordination of the RSA.
- CA FLAP Fanny Bridge PDT and the On Our Way Grant for the Tahoe City Mobility Study Team for their willingness to coordinate.
- The community of Tahoe City for its passion for continuous improvement in providing a safe environment for both its community members and its visitors.

Appendix A

Pedestrian and Bike Road Safety Audit



AGENDA

Tahoe City, CA Pedestrian and Bicycle Road Safety Audit

Dates: Tuesday April 28 – Thursday April 30, 2015

Location: Tahoe City Public Utility District (TCPUD) Board Room

221 Fairway Drive, Tahoe City, CA

Tuesday, April 28

8:00am – 11:00am Open to Everyone

8:00am-8:15am Welcome/Introductions

8:15am-9:00am Road Safety Audit Introduction

9:00am – 11:00am Open Discussion on Tahoe City Pedestrian and Bicycle Issues

11:00 am – 6:00pm Core RSA Team Only

11:00am-12:00pm RSA Team Briefing and Working Lunch

12:00pm- 6:00pm Field Observations

Wednesday, April 29 – Core RSA Team Only

All day (Approximately 7:00am-6:00pm) - RSA Team Field Observations

5pm – 10pm Preparation of RSA Observations Summary


Thursday, April 30 – Open to Everyone

8:00-9am Tahoe City Ped/Bike RSA Report Out Presentation

9:00-10:00am Q&A

Appendix B

CalTrans Pedestrian Counts

 03 - PLA - 028 PM 0.510 / Grove St. Tahoe City, CA



Notes

Northbound and Southbound volumes represent pedestrian movements at the marked crosswalk at Grove Street.

Ebbike and Wbbike represent bicyclists in the bicycle lanes.

Z1NB, Z1SB, Z2NB, Z2SB, represent pedestrians crossing in the highlighted areas away from the marked crosswalk



Morning Interval		Eric Royer, Patricia Aceves									Clear, Sunny, Mild			Tuesday, 31 July 2012						
Begin	End	SBR	SBT	SBL	Total	WBT	WBbike	EBT	EBbike	Total	NBR	NBT	NBL	Total	Z1NB	Z1SB	Z2NB	Z2SB	Total	Ped Total
10:00 - 10:15		6	3	7	16	162	6	155	1	317	1	5	0	6	1	0	0	5	1	28
10:15 - 10:30		8	3	7	18	191	5	145	2	336	0	2	6	8	4	1	0	2	5	33
10:30 - 10:45		8	21	9	38	184	5	145	13	329	0	5	10	15	2	0	1	0	3	56
10:45 - 11:00		8	0	14	22	198	5	141	10	339	0	1	5	6	3	2	4	0	9	37
Total		30	27	37	94	735	21	586	26	1321	1	13	21	35	10	3	5	7	18	154
11:00 - 11:15		18	3	13	34	178	0	158	1	336	0	6	5	11	0	0	2	1	2	48
11:15 - 11:30		4	4	9	17	196	6	143	2	339	1	3	17	21	4	0	6	2	10	50
11:30 - 11:45		11	1	11	23	207	2	171	6	378	0	14	17	31	0	2	7	3	9	66
11:45 - 12:00		1	0	4	5	197	8	151	5	348	0	0	3	3	1	0	0	0	1	9
Total		34	8	37	79	778	16	623	14	1401	1	23	42	66	5	2	15	6	22	173
12:00 - 12:15		14	9	13	36	190	10	191	7	381	1	11	12	24	1	2	1	0	4	64
12:15 - 12:30		12	2	16	30	199	8	165	3	364	0	8	25	33						63
12:30 - 12:45		9	3	1	13	201	5	134	4	335	4	6	14	24	4	1	1	1	6	44
12:45 - 13:00		9	15	17	41	190	10	168	8	358	1	6	6	13	2	2	0	2	4	60
Total		44	29	47	120	780	33	658	22	1438	6	31	57	94	7	5	2	3	14	231
13:00 - 13:15		10	6	11	27	140	4	159	10	299	0	5	10	15	0	0	5	1	5	48
13:15 - 13:30		9	2	8	19	176	2	149	14	325	0	4	20	24	10	3	5	1	18	62
13:30 - 13:45		8	12	19	39	172	1	150	8	322	2	15	15	32	9	4	1	0	14	85
13:45 - 14:00		16	7	14	37	186	7	142	18	328	1	17	15	33	2	0	4	0	6	76
Total		43	27	52	122	674	14	600	50	1274	3	41	60	104	21	7	15	2	43	271
Peak 15 Min.																				
Peak Hour																				
PHF																				
Truck %																				

Appendix C

Preliminary Report of PBRSA Observations and Findings from April 2015.

Pedestrian/Bicycle Road Safety Audit

April 27-29, 2015
Tahoe City, CA



RESOURCE CENTER



Goals of Pedestrian/Bicycle RSA

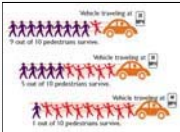
- Balance pedestrian safety and vehicular movements in and through Tahoe City
- Provide safe pedestrian and bicycle movements within Tahoe City along SR 28
- Coordinate and leverage current and planned projects within Tahoe City
- Enhance pedestrian crossings through implementation of proven strategies and countermeasures

-



Quantitative Safety Data – 5yr

- 96 collisions were reported in the area
- Ave of 19.2 per year
- 29 resulted in one or more injury
 - 42 persons were injured
- 83% occurred during daylight conditions (versus 13% during darkness and 3% during dusk/dawn)
- 8 collisions were reported that involved a bicyclist
 - Ave 1.6 bicycle collisions
 - 5 that involved a pedestrian
- Ave 1.0 pedestrians collisions per year



-
- Vehicle traveling at 30 km/h
9 out of 10 pedestrians survive.
- Vehicle traveling at 40 km/h
5 out of 10 pedestrians survive.
- Vehicle traveling at 50 km/h
1 out of 10 pedestrians survive.

Quantitative Safety Data

TABLE 12: Tahoe City Bicycle and Pedestrian Collisions
(2007 through 2011)

Reporting Year	Month/Year	Total Number of Collisions	Bicyclist Number of Collisions	Date	Time	Area of Highway	Collision Type	Lighting	Weather	Pedestrian Status	Road Surface	Pedestrian Status		Bicyclist Status	
												Involved	Not Involved	Involved	Not Involved
2007	05/01	100	10	7/10/07	1:45 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	200	20	7/10/07	5:10 PM	Suburban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	300	30	7/10/07	8:15 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	400	40	7/10/07	11:15 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	500	50	7/10/07	1:15 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	600	60	7/10/07	4:15 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	700	70	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	800	80	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	900	90	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1000	100	7/10/07	4:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1100	110	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1200	120	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1300	130	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1400	140	7/10/07	4:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1500	150	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1600	160	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1700	170	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1800	180	7/10/07	4:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	1900	190	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2000	200	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2100	210	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2200	220	7/10/07	4:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2300	230	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2400	240	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2500	250	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2600	260	7/10/07	4:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2700	270	7/10/07	7:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2800	280	7/10/07	10:10 PM	Urban	Intersection	Daylight	Clear	Not Involved	Asphalt	Involved	Involved		
2007	05/01	2900	290	7/10/07	1:10 AM	Urban	Intersection	Daylight	Clear	Not Involved					

Year	Pedestrian Involved	Bike Involved	Pedal Power	Description of Crash	Date of Crash	Time of Day	Weather	State of Mind of Driver	Location Type	Taxi Company	Pedestrian Location	Road Condition	Lighting	Injuries		Property Damages	
														Fatal	Other	Amount	Other
--CAUTION--	2005	28	25	---	7/10/2010	1:45 PM	Clear	OK	Accident	WOT of Class Road	City	Daylight	0	1	0	0	
	2006	28	34	26	---	10/23/2010	6:35 PM	Clearing	OK	Accident	WOT of Class Road	City	Daylight	0	1	0	0
	2006	28	34	26	---	7/10/2010	6:35 PM	Clear	OK	Accident	WOT of Class Road	City	Daylight	0	1	0	0
	2006	28	34	26	---	7/10/2010	6:35 PM	Clear	OK	Accident	WOT of Class Road	City	Daylight	0	1	0	0
	2006	Commons Road	5	---	7/10/2010	4:15 PM	Clear	OK	Breakdown	City	---	City	Daylight	0	0	0	0
	2006	Commons Road	160	---	8/21/2010	3:10 PM	Clear	OK	Major Breakdown	City	W Road	---	Daylight	0	1	0	0
	2006	Commons Road	1208	---	7/10/2010	10:10 PM	Clear	OK	Stoppage	City	---	City	Daylight	0	0	0	0
	2006	Class 17	539	---	8/22/2010	11:10 AM	Clear	---	Stoppage	City	---	City	Daylight	0	0	0	0
	2006	Class 17	---	---	8/22/2010	8:10 PM	Clear	OK	Accident	City	W Class Road # Bicycle	City	Daylight	0	1	0	0
	2006	Classified	20	---	8/22/2010	5:10 PM	Clear	OK	Breakdown	City	---	City	Daylight	0	0	0	0
2006	Classified	500	---	7/10/2010	10:10 PM	Clear	---	WOT of Class	City	---	City	Daylight	0	1	0	0	
	Classified	500	---	7/10/2010	6:10 PM	Clear	OK	Stoppage	City	W Road	Stoppage	Daylight	0	1	0	0	
	Classified	707	---	8/10/2010	10:10 PM	Clear	OK	Breakdown	City	---	City	Daylight	0	0	0	0	
	2006	28	25	21	---	7/10/2010	6:35 PM	Clear	OK	Accident	City	---	Daylight	0	1	0	0
														Total Coverage: 100%			
													0.00 0.00 0.00 0.00				

Quantitative Safety Data – 5yr

- Locations with highest number of collisions:
- SR 28 / SR 89 Wye intersection where a total of 14 collisions (including 3 that resulted in injuries) were reported in the area without 300 feet to the west or east and 200 feet to the south,
- The section of SR 28 within 200 feet either side of Commons with 14 collisions (4 with injuries)
 - The section of SR 28 within 150 feet of Grove Street with 12 collisions (2 with injuries).

RSA Team

- | | |
|---------------------|-------------------|
| • Morgan Beryl | TRPA/TMPO |
| • Cindy Gustafson | TCPUD |
| • Ron Treabess | North Lake Tahoe |
| • Tim Boyer | Placer County-DPW |
| • Jerry Champa | CalTrans |
| • Craig Allred | FHWA |
| • Hillary Isebrands | FHWA |



Observations

- Area wide cooperative effort
- High visibility crosswalks
- Crosswalk spacing
- Crosswalk locations
- Mixed use Pathway – commitment to biking
- Open space
- Sidewalk lighting
- Multi-modal atmosphere
- Frequency of transit stops
- Relationships with partners
- Signing in crosswalk (post and in street mounting)



Opportunities for Improvement

- Sidewalk and pathway connectivity – Closing the Gap
- Completing active transportation infrastructure
- Wayfinding and signing of uniformity and hierarchy
- Consistent and relevant pavement marking (bike lanes and parking)
- Utilization of CalTrans roadway right of way
- Crosswalk lighting
- Reduce crossing distance at crosswalks
- Inadequate sight distance at driveways and crosswalks

Opportunities for Improvement

- Seasonal traffic operations
- Special Events
- Parking (actual vs. perceived)
- Driveway (ingress and egress, circulation)
- Jurisdictional responsibility and implementation
- Defined “gateways”
- School zones and routes
- Repurposing Mackinaw Road
- Increased aesthetic vales and consistency

Strategies and Solutions

- Entire Corridor
- Crosswalk illumination
- Upgrade signing
- Restriping – bike lanes, parking, travel lanes
- ADA & PROWAG Accommodations
- Providing adequate sight distance

Strategies and Solutions

LOCATION	STRATEGY					
	Median Refuge Island	Curb Bump Out	Driveway Ingress & Egress	Crosswalk Marking Adjustments	Pedestrian Hybrid Beacon	Bike Connectivity
Fairway West/Fairway Dr	X	X	X	X		X
Commons Beach Rd		X	X	X		X
Cobblestone		X	X			
Big Trees		X			X	
Grove St		X		X		
Jackpine St		X	X	X		X
Gateway East/Lighthouse	X	X				X

Fairway Drive Intersection - Gateway



Commons Beach Rd Crosswalk



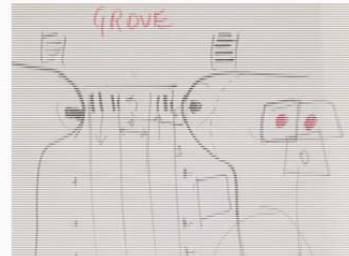
Cobblestone Crosswalk



Big Tree Crosswalk



Grove Street Crosswalk



Jackpine Street Crosswalk

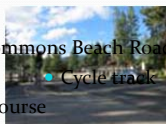


Gateway (Lighthouse) Crosswalk



Wye Intersection & Fanny Bridge

- Mackinaw Road Bike Boulevard
- Pathway connection through Commons Beach Road
- Class I shared use path on golf course
- Safe Route to school planning
- Innovative parking & ride techniques



Other Considerations

Funding Sources & Partners

- Active Transportation Program (CalTrans/FHWA)
- On Our Way Grant (TMPO/TRPA)
- SHOPP – State Hwy Operations Protection Plan (CalTrans)
- Pedestrian Crossing Enhancement Program
- Operational Improvements
- CA Office of Traffic Safety
- FHWA (Federal Lands)
- NLTRA/Placer County
- Property Tax/TCPUD
- PBID (Property Based Improvement District)
- USFS
- Private

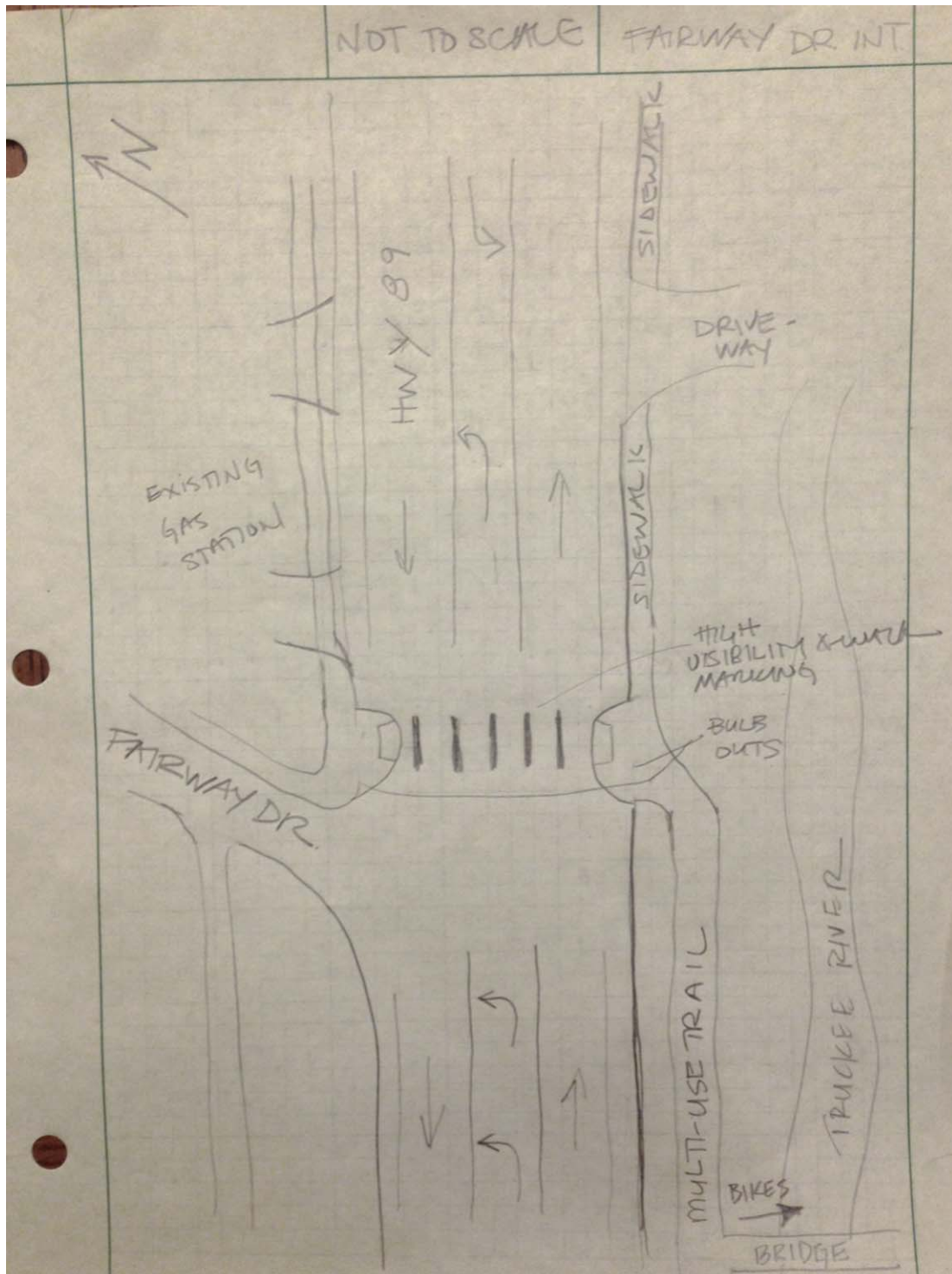
Next Steps

- Pedestrian/Bicycle RSA
- Prepare RSA Report
- Release RSA
- Agency response
- Continued collaboration
- “On Our Way” Mobility Study
- Fanny Bridge Project
- Stakeholders

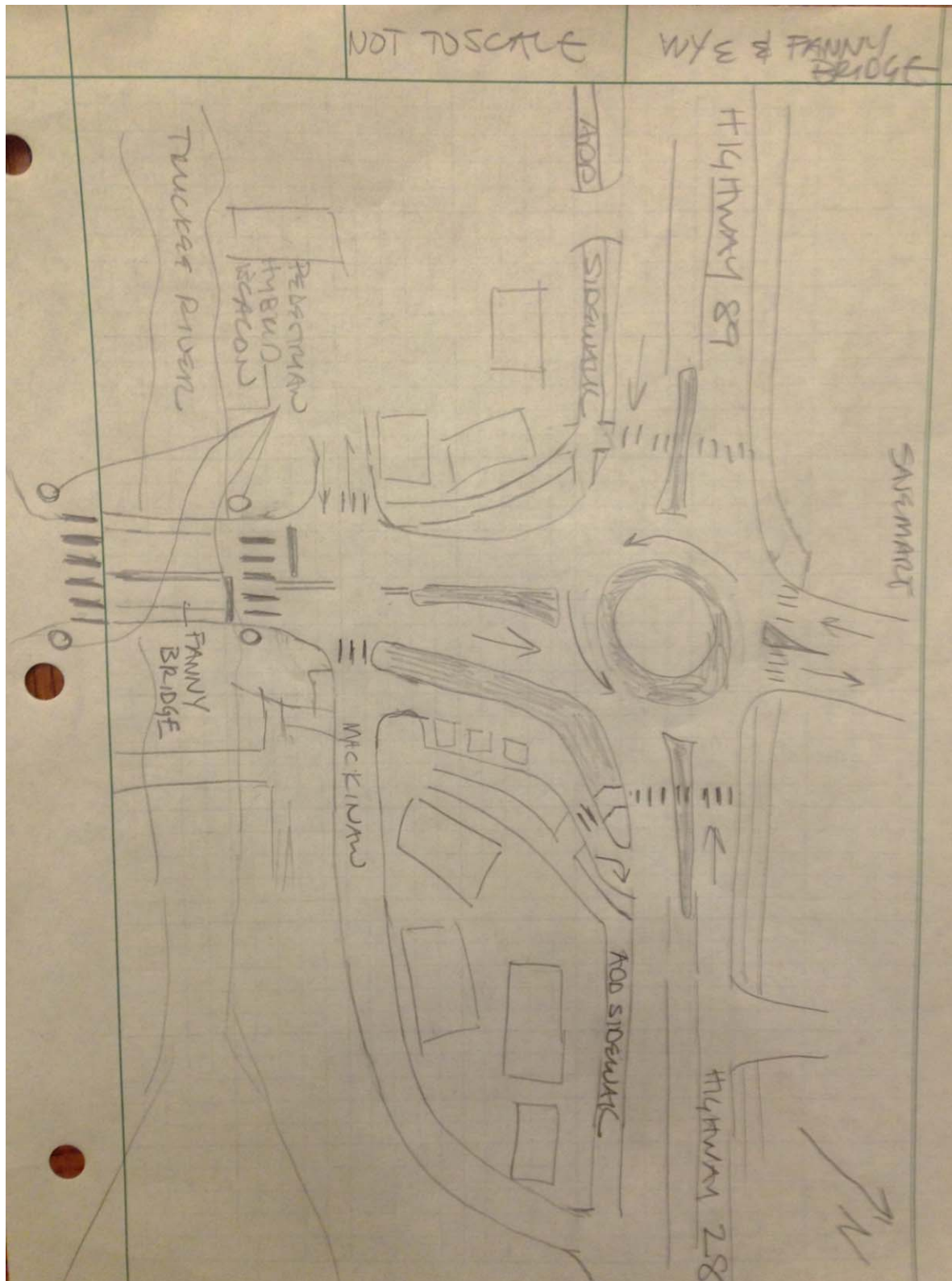


Appendix D

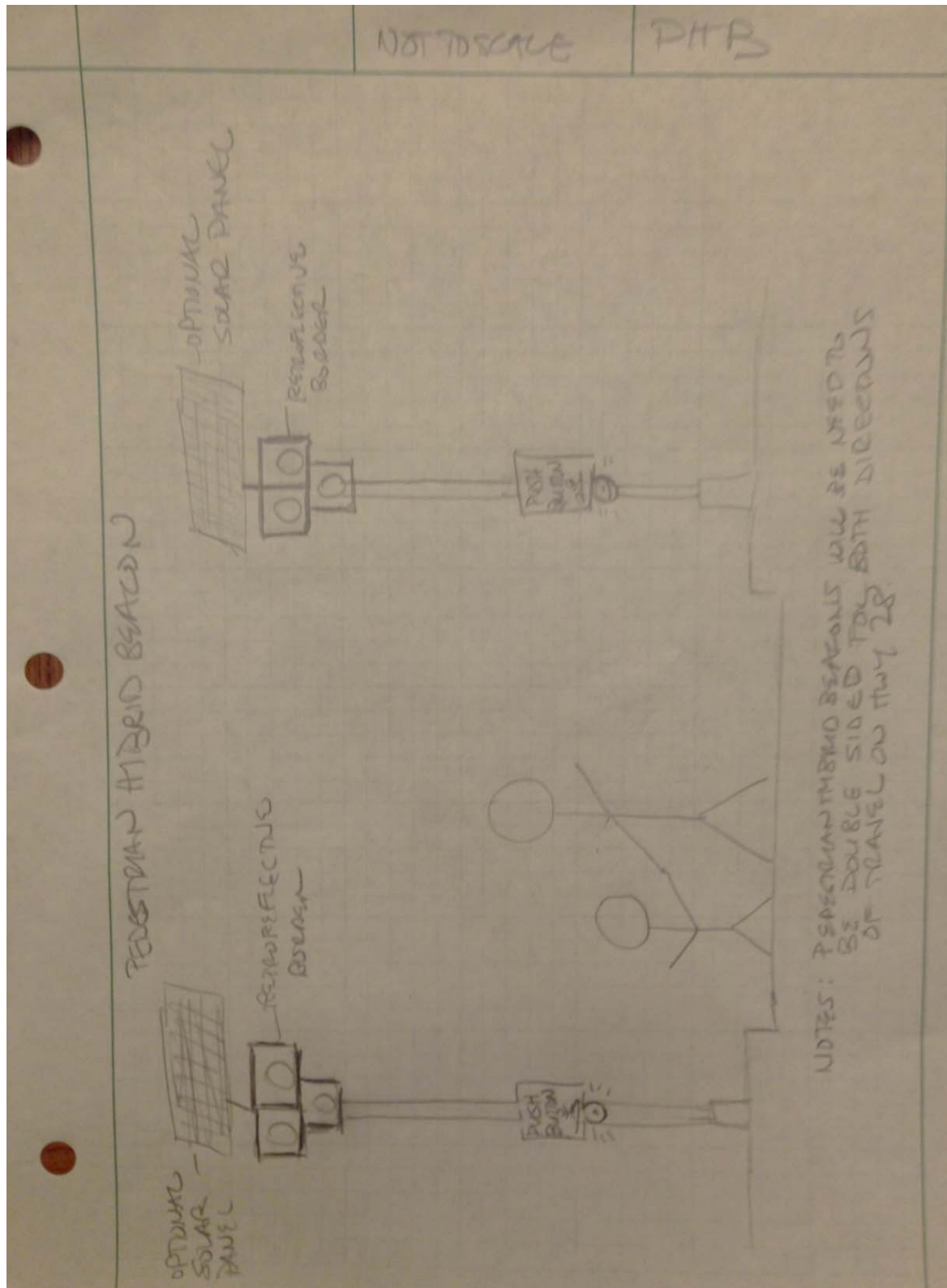
Fairway Drive Concept



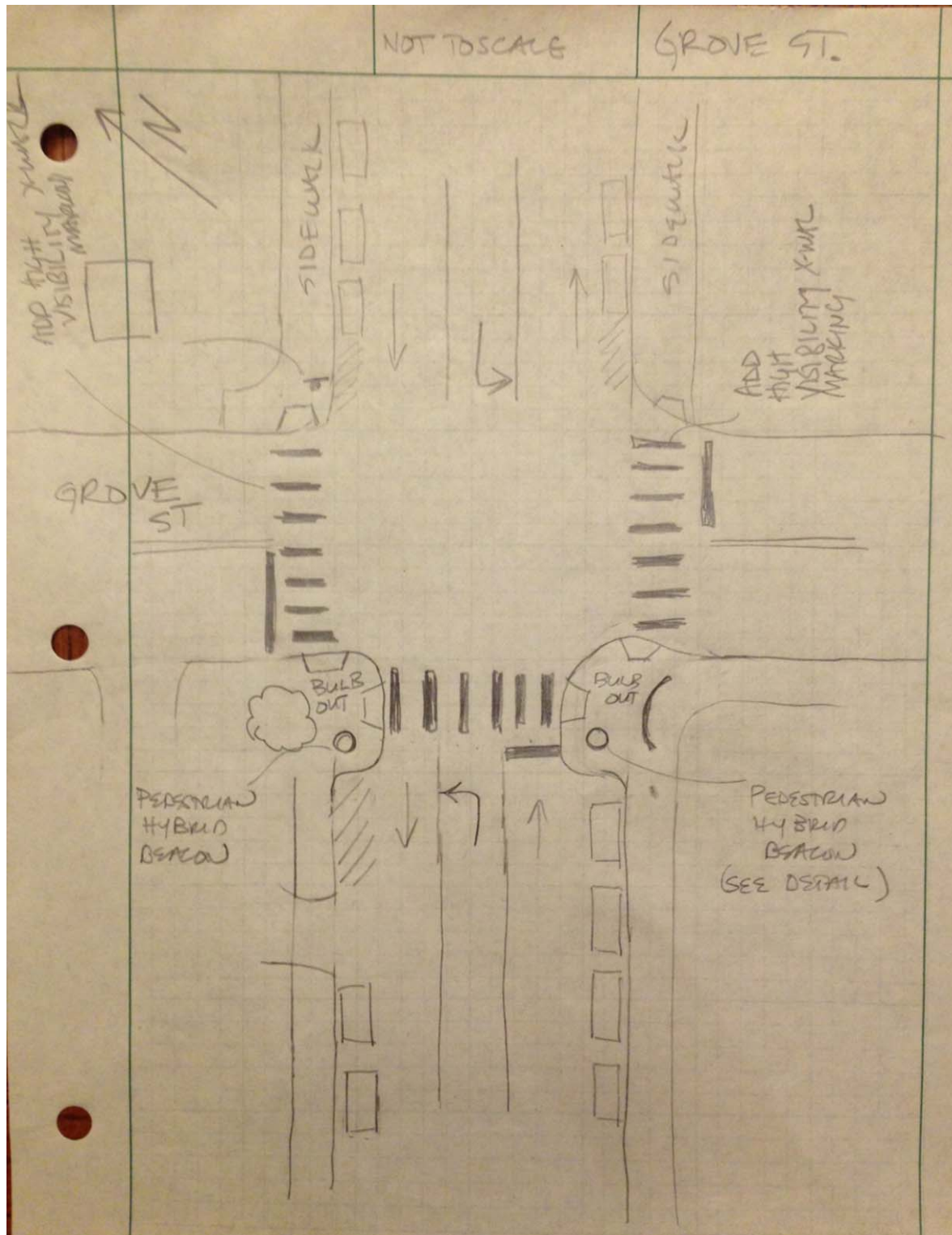
"Wye" Intersection and Fanny Bridge Concept



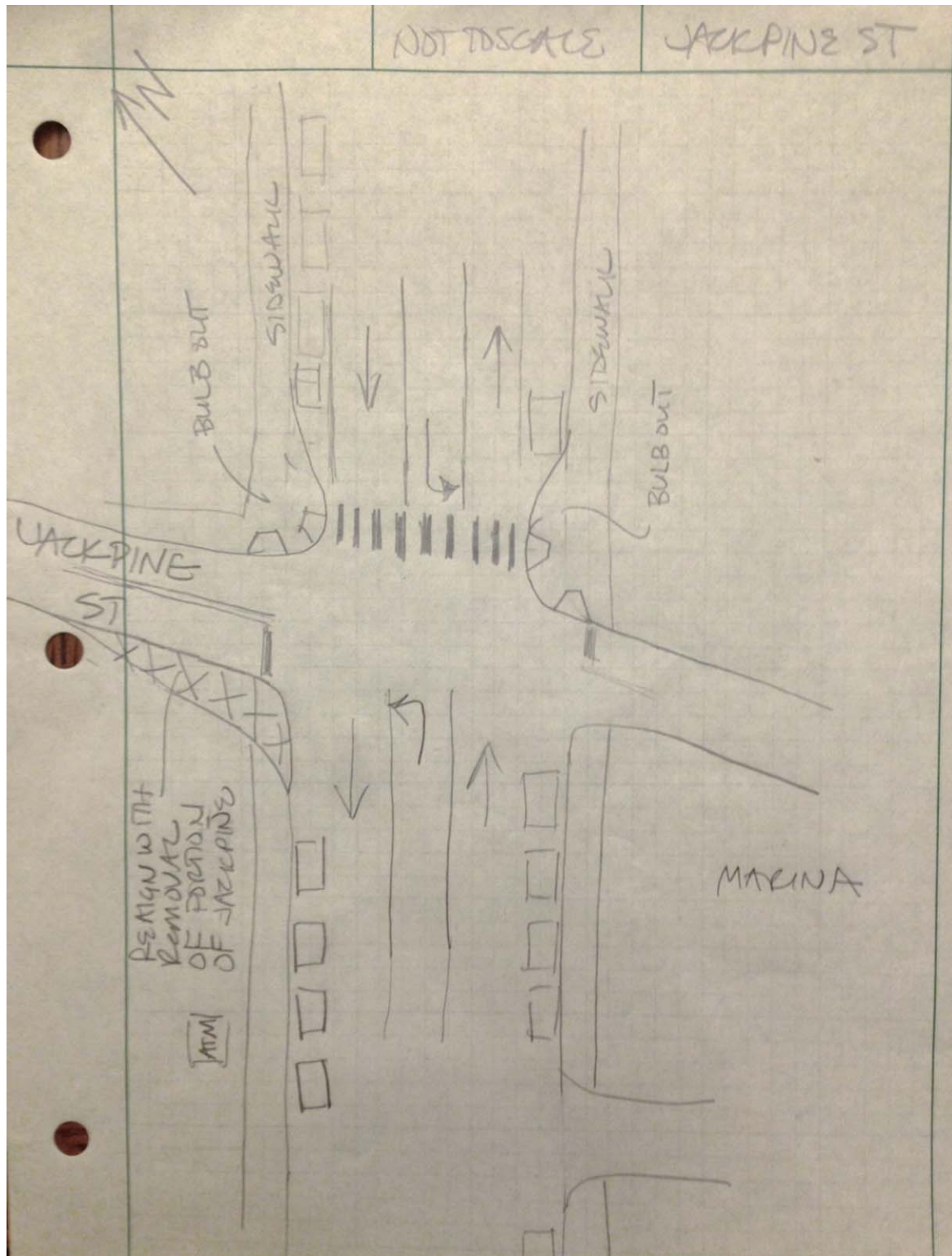
Pedestrian Hybrid Beacon Concept - 2 Lane Road



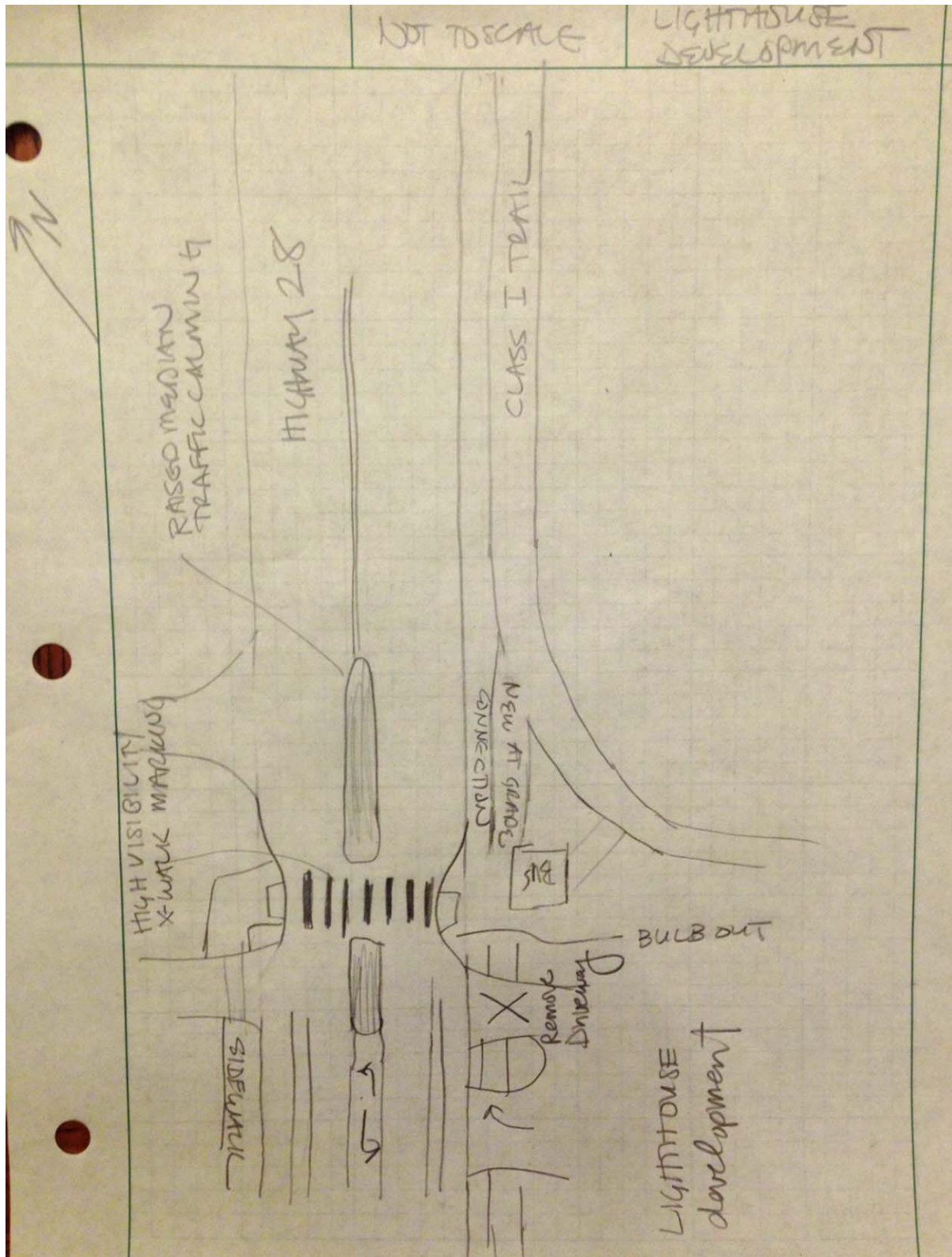
Grove Street Concept



Jackpine Street Concept



Lighthouse/East Gateway Concept



Appendix E

Pedestrian Hybrid Beacon (PHB)













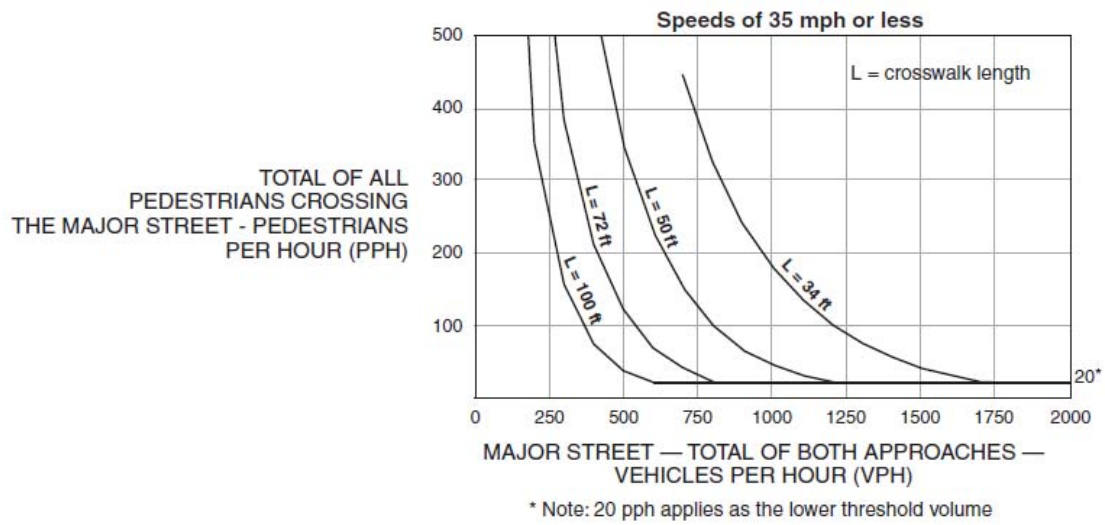
	DRIVERS		PEDESTRIANS	
	Will See ...	Will Do ...	Will See ...	Will Do ...
1		Proceed with caution.		Push the button to activate the system.
2	 FLASHING	Slow down. A pedestrian has activated the system.		Wait.
3		Prepare to stop.		Continue to wait.
4		STOP. A pedestrian is in the crosswalk.		Start crossing when all vehicles are stopped.
5	 FLASHING 	STOP. Proceed with caution if the crosswalk is clear.		Continue crossing; the signal will count down.
6		Proceed if the crosswalk is clear.		Push the button to activate the system.

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways



Proven Safety Countermeasures

Pedestrian Hybrid Beacon

The *pedestrian hybrid beacon* (also known as the *High intensity Activated crossWALK* (or *HAWK*)) is a pedestrian-activated warning device located on the roadside or on mast arms over midblock pedestrian crossings. The beacon head consists of two red lenses above a single yellow lens. The beacon head is "dark" until the pedestrian desires to cross the street. At this point, the pedestrian will push an easy to reach button that activates the beacon. After displaying brief flashing and steady yellow intervals, the device displays a steady red indication to drivers and a "WALK" indication to pedestrians, allowing them to cross a major roadway while traffic is stopped. After the pedestrian phase ends, the "WALK" indication changes to a flashing orange hand to notify pedestrians that their clearance time is ending. The hybrid beacon displays alternating flashing red lights to drivers while pedestrians finish their crossings before once again going dark at the conclusion of the cycle.

Background

Midblock locations account for more than 70 percent of pedestrian fatalities. Vehicle travel speeds are usually higher at midblock locations, contributing to the higher injury and fatality rates at these locations. More than 80 percent of pedestrians die when hit by vehicles traveling at 40 mph or faster while less than 10 percent die when hit at 20 mph.

The pedestrian hybrid beacon is a great intermediate option between the operational requirements and effects of a rectangular rapid flash beacon and a full pedestrian signal because it provides a positive stop control in areas without the high pedestrian traffic volumes that typically warrant the installation of a signal. In addition, the alternating red signal heads allows vehicles to proceed once the pedestrian has cleared their side of the travel lane, thus improving vehicle traffic flow.



U.S. Department of Transportation
Federal Highway Administration

Safe Roads for a Safer Future
Investment in roadway safety pays best
<http://safety.fhwa.dot.gov>

Installation of the pedestrian hybrid beacon has been shown to provide the following safety benefits:

- Up to a 69 percent reduction in pedestrian crashes; and
- Up to a 29 percent reduction in total roadway crashes.

Guidance

Pedestrian hybrid beacons should only be used in conjunction with a marked crosswalk. In general, they should be used if gaps in traffic are not adequate to permit pedestrians to cross, if vehicle speeds on the major street are too high to permit pedestrians to cross, or if pedestrian delay is excessive. Transit and school locations may be good places to consider using the pedestrian hybrid beacon. Chapter 4F of the Manual on Traffic Control Devices (MUTCD) contains a chapter on the pedestrian hybrid beacon and when and where it should be installed. Practitioners should follow the MUTCD guidelines, which are referenced below. Since the pedestrian hybrid beacon is a traffic control device many people are not yet familiar with, effort should be made to perform outreach to the public before implementation so there is no confusion about how the beacon operates and what drivers and pedestrians should do when encountering it.

Key Resources

A Review of Pedestrian Safety Research in the United States and Abroad

<http://www.walkinginfo.org/library/details.cfm?id=13>

Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations

<http://www.walkinginfo.org/library/details.cfm?id=54>

Guide for the Planning, Design, and Operation of Pedestrian Facilities, American Association of State Highway and Transportation Officials, 2004 [Available for purchase from AASHTO]

https://bookstore.transportation.org/item_details.aspx?id=119

Pedestrian Road Safety Audits and Prompt List

<http://www.walkinginfo.org/library/details.cfm?id=3955>

FHWA Office of Safety Bicycle and Pedestrian Safety

http://safety.fhwa.dot.gov/ped_bike/

Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities (NCHRP Report 674)

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_674.pdf

Manual on Uniform Traffic Control Devices, Chapter 4F. Pedestrian Hybrid Beacons

<http://mutcd.fhwa.dot.gov/htm/2009/part4/part4f.htm>

Safety Effectiveness of the HAWK Pedestrian Crossing Treatment

<http://www.fhwa.dot.gov/publications/research/safety/10042/10042.pdf>

Crash Modification Factors (CMF) Clearinghouse [quick search "HAWK"]

<http://www.cmfclearinghouse.org>

FHWA Contacts

Office of Safety: Tamara Redmon, tamara.redmon@dot.gov, 202-366-4077

FHWA Office of Research: Ann Do, ann.do@dot.gov, 202-493-3319

FHWA Resource Center: Peter Eun, peter.eun@dot.gov, 360-753-9551

FHWA Website: http://safety.fhwa.dot.gov/ped_bike/