Appendix F

Example Case Studies from Other Communities of Implementations of Some of the Possible Treatments for Airport Road

source: Harkey, D L, and C V Zegeer. *PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System.* Federal Highway Administration, Office of Safety Programs: Washington, DC, 2004 (in press).

Bridgeport Way Corridor Improvement

PROBLEM

A 1.6 km (1 mi) stretch of Bridgeport Way, a central arterial road in this small community, was the site of hundreds of traffic accidents between 1995 and 1998, many involving pedestrians. Pedestrian travel through the corridor was made difficult and dangerous by narrow gravel shoulders.

BACKGROUND

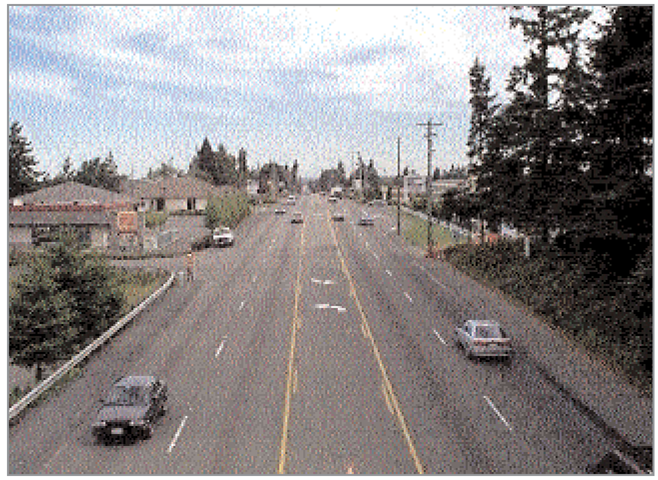
In the summer of 1996, the City of University Place decided to design and construct safety improvements along a portion of Bridgeport Way, a major arterial roadway running through the heart of the city. Bridgeport Way provides access to City Hall, a library, senior housing, a medical facility, and multiple retail centers.

Bridgeport Way carries the largest daily traffic volumes in the city, ranging from 18,800 vehicles per day at the south end of the city to 24,100 vehicles per day near the city center. This 1.6 km (1 mi) stretch of Bridgeport Way was the site of 301 accidents resulting in one fatality and 91 injuries between 1995 and 1998. Ten crashes involved pedestrians. Prior to construction of the improvements, pedestrian travel through the corridor was made difficult by narrow, 0.6 m (2 ft) wide gravel shoulders that placed pedestrians dangerously close to vehicular traffic.

SOLUTION

With a desire to pursue the goals outlined in the City's adopted Vision Statement, the City of University Place saw an opportunity to rebuild and transform Bridgeport Way into an inviting main street that would allow pedestrians and bicyclists to move about comfortably and safely while still accommodating vehicular movement through the corridor.

Prepared by Ben Yazici, City Manager, City of Sammamish, WA; Former Assistant City Manager/ Director of Public Works for City of University Place, WA and Steve Sugg, University Place, WA.



Brigeport Way before the redesign.

The proposed roadway design included the following:

- Replacement of the existing two-way-left-turn-lane with a raised, landscaped median, which would prevent left turns out of driveways.
- Construction of wide sidewalks on both sides of the roadway.
- Construction of bicycle lanes on both sides of the roadway.
- Placement of planter strips on both sides of the road, between the sidewalk and bicycle lane.
- Street lighting.
- Permission of U-turns at the signalized intersections.
- Placement of utility lines underground.

Although access to local businesses was severely affected by construction of raised median islands, the local Chamber of Commerce worked with the City to convince business owners that the new roadway would provide a much better business climate than the existing

Bridgeport Way after the redesign.

road. With this collaborative approach between the City and the Chamber of Commerce, most business owners donated the needed right-of-way to construct this project. The City spent less than $30,000 on right-of-way acquisition to obtain an average 3.1 m (10 ft) strip of the front edge of each commercial property along the roadway. Without cooperation from the businesses, it would have cost the City $500,000 to obtain the right-of-way at fair market value.

University Place also worked with the local utility company to place utility lines underground. The utility company agreed to pay half of the cost, if the City could provide a utility trench as part of the City's construction project. This lowered the City's cost of burying the utility lines by as much as $1 million.

The project was completed in 1999 at a total cost of $2.5 million, including design, right-of-way and construction.

RESULTS

The City has analyzed speed, accident, and economic development data collected before and after the construction of the Bridgeport Way improvements between 35th and 40th Streets. The project's traffic calming features reduced speeds and crashes while increasing business activity. Average speed decreased by 13 percent and traffic accidents were reduced by 60 percent (see table below).

Prior to the project's implementation, very few pedestrians walked along or crossed the roadway because there were no sidewalks, crosswalks, or paved shoulders. Increased pedestrian activity is evidenced by the over 3200 pedestrians per month usage levels found at the two new mid-block crosswalks. The south crosswalk has 100 pedestrians per day, which is enough activity to warrant a pedestrian signal. The City is considering upgrading the south crosswalk warning sign flasher to a fully signalized crosswalk to improve safety at that location. Yet, despite a dramatic increase in the level of pedestrian activity on the street and the increased exposure to motor vehicle traffic, the frequency of pedestrian crashes has remained constant at about 2.5 crashes per year.

The Bridgeport Way project has also contributed to economic development. Citywide sales tax data indicate that sales revenues increased by 5 percent citywide. Yet, the businesses around the project corridor experienced an increase of approximately 7 percent.

When the Bridgeport Way project was first presented to the public it included a number of roundabouts at key intersections. Public reaction to these bold new facilities was mixed, and to achieve public consensus, the design was modified to include standard intersections with left-turn pockets and a median. Making this design modification and creating a stronger community consensus before construction helped the project gain positive community support. Moreover, the project has been a great success for the City of University Place based on the fulfillment of its key goals:

- To help reduce vehicle crashes.
- To contribute to the economic vitality of the Bridgeport Way Corridor.
- To provide improved safety and convenience for pedestrians.

Safety Measures	Before	After	Change
Posted Speed Limit	56 km/h (35 mi/h)	56 km/h (35 mi/h)	Same
Average Actual Speed	61 km/h (37.6 mi/h)	52 km/h (32.6 mi/h)	–13 %
Average Annual Crashes	19	8 (first year)	–60 %

Table 1. Data from before and after the Bridgeport Way redesign.

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ADA Curb Ramps

PROBLEM

The City wanted to build curb ramps that were compliant with the Americans with Disabilities Act while guidelines were not yet finalized.

BACKGROUND

Austin, Texas has an extensive curb ramp program that takes a systematic approach to creating ADA-compliant street crossings. The City's Americans with Disabilities Office has a full time Public Works and ADA Compliance coordinator, and a multi-million dollar program guided by a citywide ADA Task Force, as well as an ADA Work Group within the Public Works Department.

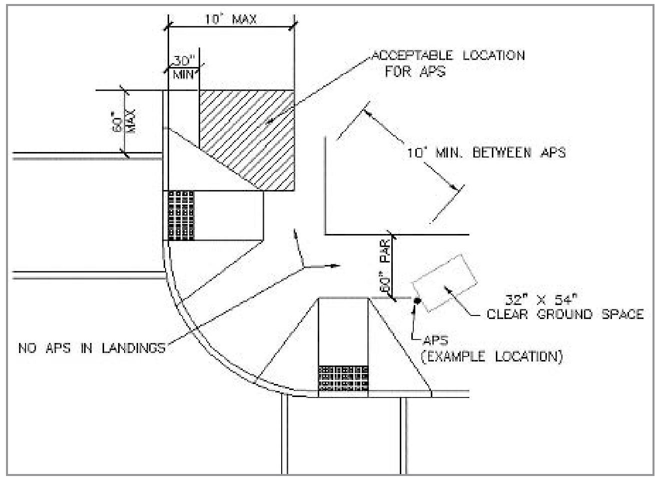
The "state of the art" in designing curb ramps can be understood by a comparison of Austin's program with current guidelines and regulations. As many communities actively work towards ADA compliance, new design guidelines, standards, and regulatory processes continue to evolve.

The City of Austin has worked closely as the guidelines have evolved, and the City is continually adapting its designs, not only achieve ADA compliance, but to create the best possible street designs for all modes of transportation.

This case study provides useful background on both Austin's program and the current "state of the practice" to inform professionals, agencies, and citizens about the available resources and models which can lead to the development of new best practices.

Prepared by Jeff Olson, R.A., Trailblazer.

Information provided by Barbara McMillen, FHWA Office of Civil Rights and Dolores Gonzalez, ADA Coordinator, Austin, TX.



Curb ramps at an intersection with Accessible Pedestrian Signal (APS) zones indicated in plan.
Source: Building a True Community: Final Report, Public Rights-of-Way Access Advisory Committee.

SOLUTION

Austin, Texas has had a proactive curb ramp program since the passage of the ADA. This program was featured in the U.S. Conference of Mayors 1995 report, *Implementing the ADA: Case Studies of Exemplary Local Programs*. Austin has a population of 500,000, of which 15% are people with disabilities. The city appointed an ADA program manager in 1991 and has 23 additional coordinators in each of the city's departments, along with a Mayor's Committee for People with Disabilities. More than 4,000 curb ramps have been installed as part of a multi-year, multi-million dollar program. The program was developed with the following process:

- Held public hearing to solicit input from persons with disabilities.
- Met with transition plan review group to evaluate data and set priorities.
- Scheduled development based on personnel and funds available.
- Developed a map showing highest priority facilities services by walkways.

- Prioritized areas based on map, in descending order radiating from the downtown area.
- Divided the city into 12 sections.
- Gave the highest priority to the downtown areas with the most government buildings and pedestrian activity.
- Determined that the older part of city had higher pedestrian activity than newer areas.
- Identified the need for access along major roadways, especially along major bus routes.
- Assigned the highest priority ramps and routes to facilities to be handled through the building modification program.
- Established a citizen request program to handle specific identified needs.
- Set an initial goal through the Plan to provide ramps at intersections with sidewalks.

While Austin was creating its initial ADA Compliance program, new federal regulations and guidelines were under development. Public rights-of-way are covered by the ADA under Title II, subpart A. The U.S. Access Board initiated a rulemaking process in 1992, which is still in process towards establishing a final version of Section 14: Public Rights of Way. The Access Board initially issued the Americans With Disabilities Act Accessibility Guidelines (ADAAG) in 1991 (36 CFR 1191, Appendix A). In 1994, the Access Board published an interim final rule in the Federal Register that added several sections to the ADA, including Section 14. The response to the interim final rule clearly indicated a need for substantial education and outreach regarding the application of guidelines in this area. A Public Rights-of-Way Access Advisory Committee (PROWAAC) was established in 1999, as a step towards resolving these issues.

Throughout this process, the City of Austin Curb Ramp program worked with the evolving guidelines. Important changes, such as requirements for separate curb ramps for each direction of pedestrian travel, and the provision of detectable warning surfaces required adjustments to both designs and budgets. A recent City of Austin evaluation of the Curb Ramp program identified the following challenges based on their experience in developing ADA compliant street crossings:

- The number of ramps required was updated from 1,500 to more than 6,000 based on an on-the ground survey of the city's roads.
- Driveways cutting across walkways are included under ADA, but needs for these have not been estimated.
- Existing utilities in the right-of-way create potential costs due to relocation and removal.
- Curb ramp installations can conflict with traditional placements for storm drains.
- Existing sidewalks are in need of maintenance and repair.
- Lack of sidewalks.
- Coordination with other agencies, including Texas DOT, and public transit provider CMTA (Capital Metropolitan Transportation Authority).
- Lack of funding resources and an increasing scope of work.
- Meeting compliance deadlines under ADA.
- Very complex logistical coordination of curb ramp work.
- Initial lack of product availability to achieve detectable warnings.
- Agency resistance to change.
- Obtaining high visual contrast between ramps and adjacent surfaces.

Austin's experience shows that a coordinated, pro-active approach can result in significant public benefits, even if important guidelines are part of an evolving process. The city successfully involved teams of individuals and organizations across institutional boundaries. To its credit, the City proceeded with the installation of thousands of curb ramps based on the best information available at the time. While early designs may not have included every feature of a "perfect" curb ramp (such as detectable warning surfaces), they provided important benefits to the public.

It is important to note that curb ramps, even if they are not absolutely "state of the art," are a major positive step towards creating accessible communities. Parents pushing strollers, postal carriers, children riding bicycles, seniors, and many other citizens benefit from curb ramps. Most curb ramp installations can be characterized as "good" design; even if they are less than perfect, they are a significant improvement over the prior condition of not having ramps at all.

RESULTS

Federal policy is often best evaluated in terms of its implementation at the local level. Austin's experience shows that the seemingly simple task of providing curb ramps requires a detailed understanding of legal requirements, intergovernmental coordination, and technical best practices. Coordinating slopes, drainage, traffic signal operations, utilities, concrete, asphalt, and pavement markings demands a considerable amount of coordination, often involving multiple agencies and interests.

The community has been supportive of the curb ramp program. In a 1999 report, the City of Austin quantified its ramp construction program as follows:

Estimated Number of Curb Ramps Built by Various Entities or Programs	
Citizen Requests	150
City Crews	700
General Contractors under contract to the City	850
Roadway infrastructure alteration / improvements	450
Building Modification program	35
New construction by private developers	2,000
Estimated Total	4,185

Table 1. Estimated Number of Curb Ramps Built by Various Entities or Programs.

Actual construction costs have averaged $972 per ramp, with a total program cost of $2.25 million, funded by City bonds. A 1999 budget request called for an additional $4 million in program funding.

Ongoing activities of the Austin Curb Ramp program include meetings of the ADA Work Group, disseminating information about Construction Standards for public rights-of-way and the ADA, continuing a Citizen Request Program for curb ramps in the public rights-of-way, and curb ramp construction in compliance with the approved Transition Plan.

One of Austin's challenges was the implementation of curb ramps while the national ADA regulatory process was still evolving. The difficulty in developing and implementing complete ADA guidelines comes from the intent of accommodating people of all abilities throughout a nation of varied climates and construction conditions. This is part of the process initiated with passage of the Americans With Disabilities Act of 1990, which is a civil rights statute. The United States Access Board, the U.S. Department of Transportation and other organizations have cooperatively developed a series of vital new documents that address curb ramps as an integral part of street design. Austin's experience and these new tools help define the continually evolving state of the practice in curb ramp design. The most recent versions of these documents are:

1. *Building a True Community: Final Report*, Public Rights-of-Way Access Advisory Committee, January 10, 2001, U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, NW, Suite 1000, Washington, DC 20004-1111, www.access-board.gov.
2. *Designing Sidewalks and Trails for Access, Part I of II: Review of Existing Guidelines and Practices*, U.S. Department of Transportation Publication No.: FHWA-HEP-99-006, July 1999.
3. *Designing Sidewalks and Trails for Access, Part II of II: Best Practices Design Guide*, U.S. Department of Transportation, Publication No.: FHWA-EP-01-027, September 2001.

Document 3, The Best Practices Design Guide, provides an excellent overview of the state of the practice in curb ramp design with Table 7-1, which includes the following BEST PRACTICE/Rationale:

1. PROVIDE A LEVEL MANEUVERING AREA OR LANDING AT THE TOP OF THE RAMP. Landings are critical to allow wheelchair users space to maneuver on or off of the ramp. Furthermore, people who are continuing along the sidewalk will not have to negotiate a surface with a changing grade or cross slope.
2. CLEARLY IDENTIFY THE BOUNDARY BETWEEN THE BOTTOM OF THE CURB RAMP AND THE STREET WITH A DETECTABLE WARNING. Without a detectable warning, people with vision impairments may not be able to identify the boundary between the sidewalk and the street.
3. DESIGN RAMP GRADES THAT ARE PERPENDICULAR TO THE CURB. Assistive devices for mobility are unstable if one side of the device is lower than the other or if the full base of support (e.g. all four wheels on a wheelchair) are not in contact with the surface. This commonly occurs when the bottom of a curb ramp is not perpendicular to the curb.
4. PLACE THE CURB RAMP WITHIN THE MARKED CROSSWALK AREA. Pedestrians outside of the marked crosswalk are less likely to be seen by drivers because they are not in the expected location.
5. AVOID CHANGES OF GRADE THAT EXCEED 11 PERCENT OVER A 610mm (24 in) INTERVAL. Severe or sudden grade changes may not provide sufficient clearance for the frame of a wheelchair, causing the user to tip forward or backward.

6. DESIGN RAMPS THAT DON'T REQUIRE TURNING OR MANEUVERING ON THE RAMP SURFACE. Maneuvering on a steep grade can be very hazardous for people with mobility impairments.

7. PROVIDE A CURB RAMP GRADE THAT CAN BE EASILY DISTINGUISHED FROM SURROUNDING TERRAIN: OTHERWISE, USE DETECTABLE WARNINGS. Gradual slopes make it difficult for people with vision impairments to detect the presence of a curb ramp.

8. DESIGN THE RAMP WITH A GRADE OF 7.1 +/- 1.2 PERCENT. (DO NOT EXCEED 8.33 PERCENT OR 1:12) Shallow grades are difficult for people with vision impairments to detect but steep grades are difficult for those using adaptive devices for mobility.

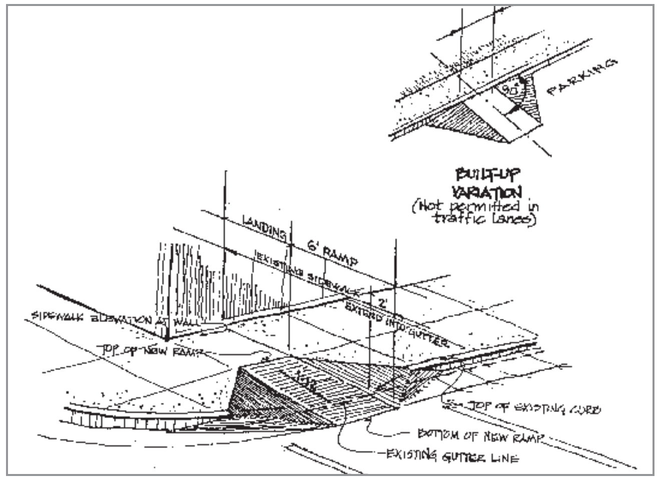
9. DESIGN THE RAMP AND GUTTER WTH A CROSS SLOPE OF 2.0 PERCENT. Ramps should have minimal cross slope so users do not have to negotiate a steep grade and cross slope simultaneously.

10. PROVIDE ADEQUATE DRAINAGE TO PREVENT THE ACCUMULATION OF WATER OR DEBRIS ON OR AT THE BOTTOM OF THE RAMP. Water, ice or debris accumulation will decrease the slip resistance of the curb ramp surface.

11. TRANSITIONS FROM RAMPS TO GUTTER AND STREETS SHOULD BE FLUSH AND FREE OF LEVEL CHANGES. Maneuvering over any vertical rise such as lips and defects can cause wheelchair users to propel forward when wheels hit this barrier.

12. ALIGN THE CURB RAMP WITH THE CROSSWALK, SO THERE IS A STRAIGHT PATH OF TRAVEL FROM THE TOP OF THE RAMP TO THE CENTER OF THE ROADWAY TO THE CURB RAMP ON THE OTHER SIDE. People using wheelchairs often build up momentum in the crosswalk to get up the curb ramp. This alignment may also be useful for people with vision impairments.

13. PROVIDE CLEARLY DEFINED AND EASILY IDENTIFIED EDGES OR TRANSITION ON BOTH SIDES OF THE RAMP TO CONTRAST WITH SIDEWALK. Clearly defined edges assist users with vision impairments to identify the presence of the ramp when it is approached from the side.



Source: Building a True Community: Final Report, Public Rights-of-Way Access Advisory Committee. This illustration shows many of the features that should be incorporated a curb ramp. However, it does not show detectable warnings, which are an important component.

These concepts are consistent with the experience many communities have in developing successful curb ramp programs. In the Summary to her 1999 Urban Symposium presentation, Dolores Gonzales summarized both Austin's perspective on these issues (and a point of view likely to be representative of similar efforts nationwide), as follows:

- Much work remains before our roadways will be fully accessible.
- Technological solutions specifically targeted for persons with disabilities could help defray costly and complicated concrete solutions.
- Continuing education of the public and building professionals are needed for effective implementation of the ADA.

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REFERENCES

Implementing the Americans with Disabilities Act: Case Studies of Local Programs, The United States Conference of Mayors, April 1995.

Public Works and ADA Compliance, presentation at the Urban Symposium, Dallas Texas, June 29, 1999, Dolores Gonzales, City of Austin Americans With Disabilities Office.

U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, NW, Suite 1000, Washington, DC 20004-1111, www.access-board.gov.

Large Intersection Solutions

PROBLEM

As roads are made wider, the crossing distances for pedestrians increase, creating a significant exposure of pedestrians to the high volumes of motor vehicles. With a typical pedestrian crossing speed of approximately 1 m (3.2 ft) per second, streets with four or more lanes in each direction can result in crossing times that require more than 30 seconds. In addition, lengthy crossings can make it impossible for pedestrians to see signal indicators on the far side of the crossing. Confusing multiple turning movements (often with protected signal phases) increase the potential for pedestrian crashes.

BACKGROUND

In St. Petersburg, Florida, the intersection of Highway 98 at 74th Avenue North presented an extreme version of these conditions in the early 1990's. Widened to nine lanes in each leg of the intersection, this intersection created a serious challenge for engineers to design a solution which could accommodate both pedestrians and motorists. The adjacent land included St. Petersburg Community College, a convenience store, an auto parts store, and a training center for the disabled. Some communities would have tried to build expensive solutions (such as overhead pedestrian bridges, for example) or simply ignored the problem, however, the designers of this project applied a combination of common sense, innovation, and creativity to create a solution that works within the available resources.

Prepared by Jeff Olson, R.A., Trailblazer.
Information provided by Michael Wallwork, Alternative Street Design.

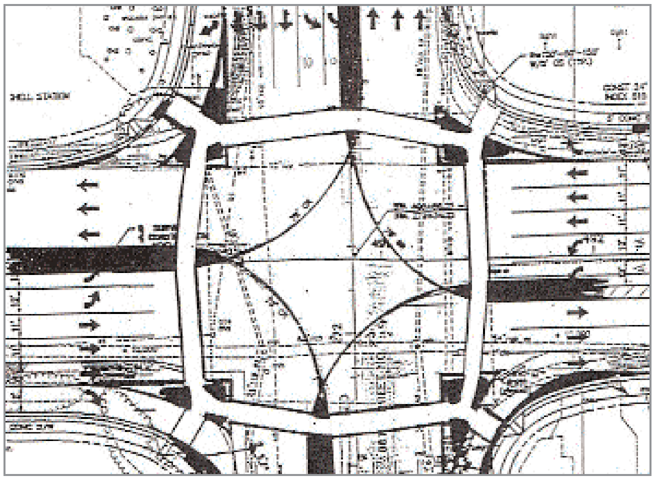
Provided by Dan Burden of Walkable Communities, Inc. and Jeff Olson, R.A.
Initial Conditions, Highway 98 at 74th Avenue, St. Petersburg, Florida.

SOLUTION

Michael Wallwork, the street's designer, was asked by several community representatives to look at the intersection and explore alternatives to make it more pedestrian friendly. Accessibility was an important issue because a training center for wheelchair users was in the area. Since the designer was Australian, many of the design features came from Australia's best practices.

The important issues included the following:

- Provide median noses that extend beyond the crosswalk to provide refuges for pedestrians.
- Narrow the lanes to minimize speeds, to shorten pedestrian crossing distances, and to widen the median.
- Add Australian standard right turn slip lanes, which are designed to keep pedestrians in the drivers' line-of-sight, slow right turn vehicles to around 29 km/h (18 mi/h), and minimize the angle between turning vehicles and approaching vehicles to increase capacity and to reduce the angle drivers must to turn their heads.



Provided by Dan Burden of Walkable Communities, Inc. and Jeff Olson, R.A.
Design Solution for Highway 98, St. Petersburg, Florida.

- Add a bend in the middle of the crosswalk to meet the above requirements.
- Meet ADA standards with cut-throughs and ramps.

RESULTS

For a retrofit of existing conditions, the pedestrian features of the Highway 98 intersection provide an excellent balance between pedestrian and motor vehicle needs. By reducing the pedestrian crossing time, providing right turn slip lanes, and reducing the all-red signal phase slightly, the 'green' time made available to motorists was actually increased and pedestrian safety was improved. With reduced lane widths, refuge islands at each corner and median refuges in the middle of each intersection leg, the maximum distance that a pedestrian has to cross is now only five lanes, or approximately 15 m (50 ft). This is a significant improvement over the prior conditions of crossing nine` lanes of traffic in one signal phase. Overall crossing distances were reduced from over 55 m (180 ft) to approximately 40 m (130 ft).

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REFERENCES

Background provided through e-mail interview with Michael Wallwork of Alternative Street Design. Original graphics provided by Dan Burden of Walkable Communities, Inc. and Jeff Olson, R.A.

Pedestrian-Friendly Redesign

PROBLEM

A high rate of pedestrian and vehicle conflicts were occurring along a section of Highway 111 through downtown Cathedral City, CA.

BACKGROUND

Highway 111 is the major state highway linking the desert cities of the Coachella Valley from Palms Springs to Indio and beyond to the Imperial Valley. Many of the cities in the desert have developed around this highway, including Cathedral City, which lies to the east of Palm Springs. Most of Highway 111 has been configured with two travel lanes in each direction, and in accordance with California Department of Transportation (Caltrans) plans, most cities along the 111 corridor have plans that show it eventually widened to three lanes in each direction.

The City of Cathedral wanted to redevelop its downtown area, through which Highway 111 passes. As part of this redevelopment, the City wanted to narrow Highway 111, also known as East Palm Canyon Drive through the city, and provide for a more pedestrian-friendly street through the downtown area. This section of Highway 111 had also had one of the highest rates of pedestrian conflicts and accidents in the corridor.

SOLUTION

In order to plan for a design that would make Highway 111 safer and more pedestrian friendly, the city needed to coordinate with Caltrans to determine who owned the road. The process for starting the design of the downtown area began in 1991 when the City crafted a

Prepared by Jerry Jack, City of Cathedral City.

Looking west toward the San Jacinto Mountains after the installation of landscaped medians and enhanced parkways.

broad vision for the new pedestrian-friendly environment, which included measures to slow traffic along the highway. This vision included plans to keep Highway 111 at two lanes in each direction and narrow the roadway to increase pedestrian accessibility across the traffic lanes and shorten crossing distances. With its plans to eventually widen the highway to three lanes in each direction, Caltrans vetoed the City's plans.

Faced with a firm rejection of their plans by Caltrans, Cathedral City successfully sought to have the section of Highway 111 that ran through Cathedral City relinquished to the City. With East Palm Canyon Drive (no longer Highway 111 after the relinquishment) owned by the municipality, the City was able to go forward with its vision of a pedestrian-friendly redesign of its downtown area. Throughout the process, the city worked with a resident/business design committee and a consultant.

The final step in the process of moving forward with the City's plans for its downtown area included securing funding from the Riverside County Transportation Commission for the redesign of East Palm Canyon Drive (formerly Highway 111). The entire project cost approximately $3.2 million (of which storm drain and right-of-way acquisition were a large share). This was funded through the City's RDA, city bonds, and regional transportation funds.

The new design for the roadway included a landscaped center median, two travel lanes in each direction 3.7 and 4.0 m (12 and 13 ft) wide, a side landscaped median separating a new parking aisle with angled parking, and the elimination of numerous angular driveways and streets, which had previously compromised the smooth traffic operation of the street. New bus shelters were provided and new traffic signals with pedestrian crossings were installed to better connect the businesses on the south side of the roadway with the north side, which would eventually include a new shopping complex, movie theater, and community park. The speed limit on East Palm Canyon Drive was reduced from 72 km/h (45 mi/h) to 56 km/h (35 mi/h) in order to emphasize the traffic calmed nature of the new redesigned roadway and promote the pedestrian-friendliness of the new downtown area.

Looking east showing the use of protected/separated right turn and bus lanes.

RESULTS

While many commuters who regularly traveled through the downtown area were not pleased with the roadway's new design and traffic calmed characteristics, pedestrians and city officials were very pleased with the end result. A study of pedestrian accidents was conducted after the redesign of the roadway was completed. From 1993-95, there were nine pedestrian accidents, and since the new roadway opened in 1998, no accidents have been reported. In terms of pedestrian safety, the redesign of the street has been an overwhelming success. The redesign has improved the aesthetic character of the downtown area, and it has also served as the first step toward remaking the downtown area into a pedestrian-friendly, culturally vibrant commercial and civic district.

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Trail Intersection Improvements

PROBLEM

Safe intersection crossings were needed for a trail that intersects with several roads.

A typical major intersection treatment.

A typical minor intersection treatment.

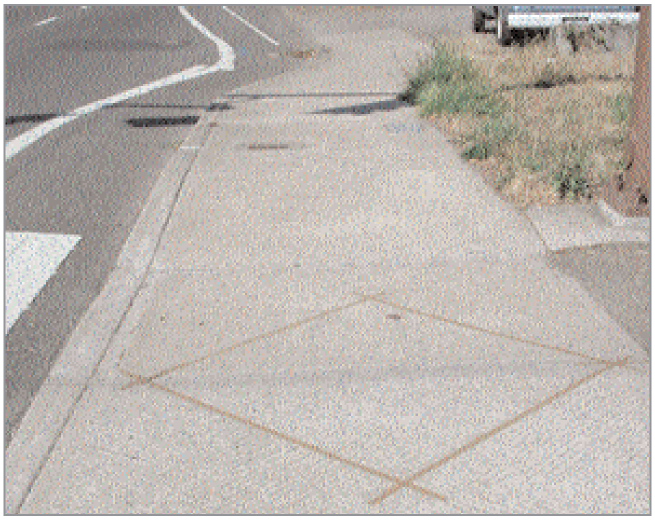
BACKGROUND

The Springwater Corridor is a 16.8 mi former rail corridor converted into a recreational non-motorized commuter trail in 1996. Located in southeast Portland, Oregon, the corridor extends eastward to the City of Gresham and links to the small, unincorporated community of Boring. The route it travels features a variety of landscapes and includes industrial, commercial, and residential areas.

Master planning for the project began in 1992 after the introduction of the Intermodal Surface Transportation Act (ISTEA) in the early 1990s. Based upon 1990 census data, surrounding population densities, and a recent City of Portland Parks & Recreation Department park user survey, use levels were projected for the corridor at an annual rate of approximately 400,000 people per year. Anticipated uses included bicycling (56%), walking (36%), jogging (9%), and equestrian (3%). The trail would be multiuse, and include a 3.7 m (12 ft) wide paved surface with 0.6 m (2 ft) wide soft shoulders and a separated equestrian trail wherever feasible.

The Springwater Corridor is unusual because it does not fall into a road right-of-way. This eliminates the conflicts between trail users and automobiles found on most roadway bicycle lanes. The corridor, however, does intersect with several roads. Addressing these intersections was essential to ensure trail user safety and to minimize automobile and trail user conflicts. With growth in the Portland metropolitan region projected to increase automobile traffic, the situation would only become more aggravated.

Information provided by George M. Hudson, Landscape Architect, former City of Portland Park Planner, Trail Program Manager.



A bicycle-activated Signal Loop Detector.

A pedestrian-activated signal button in a refuge island.

SOLUTION

The intersections were broken into three categories—major intersections, minor intersections, and private driveway crossings—based upon type of use, roadway width, traffic gaps available for pedestrian crossings, automobile volume, and automobile speed.

Minimal improvements at all intersections included:

- Vehicle control bollards to prevent vehicles from accessing the trail.
- Center removal bollard to allow for maintenance and emergency service vehicle access to the trail.
- Removal or thinning of vegetation to increase visibility at the intersection.
- Use of natural stone basalt boulders as needed to prohibit vehicle access into the trail right-of-way.
- Stop signs.
- Striping.
- Crossing warning signs.

MAJOR INTERSECTIONS

Due to high automobile traffic volume resulting in a high degree of crossing difficulty, six major intersections were identified along the Springwater Corridor at Johnson Creek Boulevard—SE 45th, 82nd Avenue, 92nd Avenue, Foster Road, 122nd Avenue, and Eastman Parkway in the City of Gresham. Eighty-second Avenue is a State-owned route. The Oregon Department of Transportation required meeting traffic signal warrants to justify the installation of a signal at the trail and roadway intersection at 82nd Avenue. User counts of a minimum of 100 trail users per hour for any 4 hours within a day had to be met. Trail user counts were carried out on an existing improved segment of the trail within the City of Gresham. Warrants were met and the state approved a signal installation.

Improvements installed at major intersections included pedestrian- and bicyclist-activated signals, median refuge islands with a signal-activating button, signage forewarning both the trail users and motorists of the approaching intersection, and crosswalk striping. In addition, curb extensions and a realignment of the trail to minimize crossing distance were incorporated into the intersection design.

MINOR INTERSECTIONS

Defined as crossings at public roadways that present a low to moderate degree of difficulty in crossing, 28 minor intersections along the Springwater Corridor were identified due to their low traffic volume and minimal width. Minor intersections were treated similar to major intersections with the deletion of the pedestrian-activated signals. A few intersections deemed challenging to cross received overhead flashing yellow pedestrian warning signs.

PRIVATE DRIVEWAYS

Private driveways were defined as vehicle crossings providing access to private property and businesses adjacent to the trail, which serve a private citizen or a group of citizens. Improvements installed to prevent a private property from being land locked included fixed and removal bollards, stop signs for automobile traffic, a raised trail surface with warning striping to act as a speed table for motorists, and placement of locally found basalt boulders to restrict vehicle access to the corridor. The City decided to restrict future additions of private driveway crossings and to combine private driveway crossings wherever feasible.

RESULTS

The installation of trail improvements was completed in 1996. Since that time, there has been only one reported accident at an intersection resulting in an injury. This single accident was between an equestrian and a car. The horse became startled, bucked off its rider, and bolted into an intersection. The accident clearly was not due to a faulty design, but perhaps an inexperienced rider.

Based on the interim user counts to establish warrants at the 82nd Avenue intersection, use levels of the Springwater Corridor are now exceeding the use level projections made during the master planning effort. Plans currently underway to link the Springwater Corridor from southeast Portland to downtown Portland with a Class I bikeway are anticipated to be in place by early 2003. User projections at that time are expected to exceed one million users per year.

In conclusion, the intersection designs along the Springwater Corridor adequately addressed public safety and reduced potential conflicts between trail users and automobiles.

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Grade-Separated Trail Crossing

PROBLEM

An at-grade crossing of a busy arterial road exposed users on one of the most heavily used recreational trails in West Virginia to potentially dangerous motor vehicle traffic.

BACKGROUND

Residents, visitors, and students from Marshall University enjoy the mature shade trees and beautiful views of nearby hills from the flatlands of Ritter Park on the southern edge of Huntington, West Virginia. One of the most popular attractions of the park is a pathway that circles the lower portion of the flatlands along Four Pole Creek. In its application for a Recreational Trails Program grant, the Greater Huntington Park and Recreation District stated, "The pathway circling Ritter Park and extending westward to Harveytown Road constitutes 4.8 km (3.0 mi) of argumentatively the most heavily used walking/jogging trail in West Virginia."

However, the trail crossed Eighth Street, the main traffic artery leading south of Huntington to the city's hilltop residential neighborhood and the Huntington Museum of Art. When the Greater Huntington Park and Recreation District was confronted with the issue of pedestrian and vehicle conflicts at this crossing, creative solutions were needed.

SOLUTION

Challenges facing this approach included mitigating the potential flooding of Four Pole Creek and providing long approach ramps to keep the angle of descent reasonable for disabled individuals. Brast Thomas, design engineer for this project, supplied a creative solution to both the flooding problem and access challenge by designing the trail structure to rest on the bridge's arched concrete supports. This allowed the pathway underpass to be at an elevation only inches below the 100-year flood height.

The pedestrian trail bridge utilizes the space beneath the Eighth Street roadway bridge at Four Pole Creek.

Work began in September 1999 and was financed by a Recreational Trails Program grant totaling $24,360 from the West Virginia Division of Highways with $12,180 from federal grant funds, and $12,180 provided

Prepared by William Robinson, West Virginia Department of Transportation.

by a local sponsor match. A work crew from the local park district, under the supervision of Thomas Company and Ankrom Associates (now Environmental Design Group, Inc.), constructed the trail structure.

From an engineering standpoint, no unusual methods or materials were employed, but the economy of design was evidenced in linking the two structures.

To resolve the safety issue presented by trail users crossing Eighth Street at-grade, James McClelland, Director/Secretary of the Greater Huntington Park and Recreation District and a regular jogger on the pathway, suggested building a bridge to take the pedestrian traffic under Eighth Street, using the space beneath the Eighth Street roadway bridge at Four Pole Creek.

The extensive use of wood made the structure strong, practical, inexpensive, and aesthetically pleasing.

RESULTS

Public response to the new bridge has been very positive. The trail itself enjoys strong public support as a grass roots project originally born from the efforts of local trail users and advocates.

The design was severely tested when, just weeks after completion, floodwaters assaulted the new structure. Even though the flood nearly reached one hundred-year levels, washing and clearing a small amount of flood debris was all that was required to return the bridge to service, and interference with stream flow was minimal.

When the people of Huntington come to Ritter Park to see the rose garden, the stone bridge, and the artist-designed playground, they also discover a new secret—the Pedestrian Bridge beneath Eighth Street over Four Pole Creek.

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Leading Pedestrian Interval (1 OF 2)

PROBLEM

The intersection of South Street and Orange Avenue in Downtown Orlando experienced a relatively high incidence of pedestrian/motorist conflicts.

BACKGROUND

Right-turn-on-red maneuvers made by motorists were particularly dangerous for pedestrians crossing an intersection. The intersection of South Street and Orange Avenue in Downtown Orlando experienced a relatively high incidence of pedestrian/motorist conflicts, especially after a municipal parking facility was relocated away from municipal buildings. A new office tower being constructed on the old parking lot site, and many municipal workers parked at a parking facility 0.4 km (0.25 mi) away. The walk to municipal offices required the crossing of the intersection of South and Orange.

A leading pedestrian interval at the intersection of South Street and Orange Avenue gives pedestrians a 4 second head start in crossing.

Information provided and contributions made by Ken Stygerwal, Tommy Holland, and Bob Faris, City of Orlando.

The increase of pedestrian traffic through this intersection and the occurrence of a pedestrian accident in the crosswalk in 1997 prompted the City to examine the operation of the traffic signal to improve pedestrian safety.

SOLUTION

The intersection of South Street and Orange Avenue in Downtown Orlando was the site for what is called a leading pedestrian interval. At a cost of only hundreds of dollars and taking only 2 hrs to install, the leading pedestrian interval was simply a change in signal phasing that allowed for a pedestrian phase to begin 4 s before the green phase for motor vehicle traffic. This allowed pedestrians a head start to cross in the crosswalk of the intersection. It provided significant visibility to those crossing, gave extra time for pedestrians to cross, and alerted motorists to the existence of pedestrians in the crosswalk. An illuminated sign was installed on the overhead signal post reminding motorists to "yield to peds" in the crosswalk while the signal was green. When the signal was red, the sign changed to read "no turn on red" to prevent pedestrian collisions from this action.

With the 4 second lead time given by the leading pedestrian interval, pedestrians are able to cross part of the intersection before vehicles begin turning.

The extra time for the pedestrian phase was gained from the introduction of a third signal phase at that particular intersection. The intersection was operating on two phases, and a third 6-second phase was added in order to accommodate the additional pedestrian walk time while all other approaches were red. The walk signal is maintained as the green phase begins for motorists.

RESULTS

Although the primary impetus for the introduction of the leading pedestrian interval was due to a highly publicized accident involving a municipal employee, a review of pedestrian accidents reveals no decrease since the new signal phase began operating in 1998. Accident rates remain unchanged at this intersection.

The new signal phase enhances the visibility of pedestrians crossing in the crosswalk and alerts motorists to the existence of pedestrians in their right-of-way as they cross the busy intersection. City staff note that, because of the reduction in pedestrian/auto conflicts, the leading pedestrian interval has also improved the vehicular level of service despite the decrease in green time for vehicles. Both motorists and pedestrians alike became accustomed to the new situation rather quickly, and both groups seem to be undisturbed by the new signal operation. Pedestrians benefit from the increased safety and visibility the new signal phase provides.

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Leading Pedestrian Interval (2 OF 2)

PROBLEM

At signalized intersections, right and left turning vehicles present a danger to pedestrians crossing during the WALK interval, and crash statistics show that pedestrians are especially vulnerable to left turning vehicles (left turning vehicles are over represented in pedestrian crashes).

BACKGROUND

One practical solution to this problem is to program the traffic signals to allow the pedestrian to begin crossing before the vehicle traffic on the parallel street is given the green light. This is commonly referred to as a leading pedestrian interval (LPI). One of the most effective ways to decrease crashes that involve motor vehicles and pedestrians is to separate them in time. Pedestrians and motor vehicles can be separated in time by providing a leading pedestrian interval, which permits pedestrians to gain a head start before turning vehicles are released.

Research has shown that this treatment is associated with a decrease in pedestrian/motor vehicle conflicts and an increase in the percentage of motorists that yield right of way to pedestrians. This study examined the influence of a three-second LPI on pedestrian behavior and conflicts with turning vehicles (Van Houten, Retting, Farmer, Van Houten, & Malenfant, 2000).

SOLUTION

A leading pedestrian interval was created for study at three signalized intersections in downtown St. Petersburg, Florida where pedestrian crossings occurred at the average rate of 60 per hour. To insure unbiased results no public outreach or awareness was conducted prior to execution of the study. The Insurance Institute for Highway Safety funded the study at cost of $30,000.

In order to collect baseline data, prior to the installation of the LPI, each intersection was configured to provide simultaneous onset of the WALK signal and GREEN phase for turning vehicles. During the experiment the LPI was installed to release pedestrians 3 seconds ahead of turning vehicles by extending the duration of the all red signal phase by three seconds. Sites 1 and 2 were each at intersections where one street carried four lanes of one-way traffic and the other two-way traffic (two lanes in each direction), while site 3 was an intersection where both streets carried two-way traffic (each street had a total of 4 lanes). These streets had 30 mph (48 kph) posted speed limits and carried high volumes of traffic.

Observers collected data on three items: a) pedestrian/motor vehicle conflicts, b) pedestrians beginning to cross during the five second period at the start of the WALK interval, and c) pedestrians starting to cross during the remainder of the WALK interval. They also noted the percentage of pedestrians yielding right of

Prepared by Ron Van Houten, Ph.D., Center for Education and Research in Safety, Dartmouth, Nova Scotia.

Pedestrians are given a WALK signal three seconds before parallel traffic is given a green light.

way to turning vehicles and the number of half-lanes traversed by the lead pedestrian during the 3 seconds the LPI was in effect. Data were collected separately for pedestrians 65 and older at all three sites.

RESULTS

Following the introduction of the LPI, conflicts were virtually eliminated for pedestrians departing during the start of the WALK interval. There were 44 total pre-treatment observation periods at all three sites. During each of these sessions, the sites averaged between 2 and 3 conflicts per 100 pedestrians, with some periods having up to 5 conflicts per 100 pedestrians. After the LPI was installed, 34 of the 41 sessions had no conflicts, and no session had more than 2 conflicts per 100 pedestrians.

This effect held up for senior citizens and non-seniors alike. There was also a smaller reduction in conflicts during the remainder of the WALK interval. This reduction was likely the result of pedestrians claiming the right away during the earlier portion of the WALK interval. The percentage of pedestrians yielding to vehicles also declined following the introduction of the LPI, and data showed that pedestrians tended to cross more lanes during the 3 second LPI the longer the intervention was in effect. This was likely the result of regular users discerning the presence of the LPI and modifying their behavior to utilize it to the fullest extent possible.

Over a period of four months at these three sites, no reduction in intersection effectiveness for motor vehicles was detected. Moreover, local authorities opted to retain the LPI in places where the range of permitted turning movements governed by the signal cycles allows safe use of the LPI. This intervention was shown to increase pedestrian safety and improve pedestrian comfort and perceived safety levels as well.

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