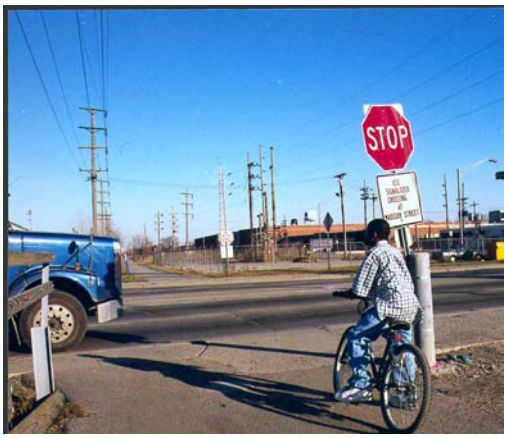
Soles and Spokes Design Workshop

Over, Under and Across: Bicycle-Friendly Grade Separation and At-Grade Crossings

A street or path can be quite safe and pleasant to bike along until it reaches a major barrier, such as a highway, river or railroad corridor. Cyclists dread these parts of their journey: the dark, muddy underpass where the trail veers perilously close to the river. . . the steep bridge ramp that overwhelms even the lowest gear and hardiest legs. . . the river that requires a half mile detour to get across. . . the intersection where motorists rarely yield. These barriers create "islands of bicycling" and reduce the likelihood that people will use bikes to get around.



A young cyclist looking for a break in traffic instead of detouring to the signalized crossing down the block. Like most people, cyclists prefer direct, continous routes.

To spread the word about design strategies for providing cyclists direct, safe and pleasant access across barriers, the Chicago Area Transportation Study (CATS)[1] organized a workshop in mid-December, 2001 entitled, *Over, Under and Across: Grade Separation and At-Grade Crossings.* It was the first in a series of workshops CATS hopes to offer to address specific issues in bicycle and pedestrian facility design. The 100 participants included representatives from federal, state and local government, consulting agencies and advocacy and public interest groups.

James Mackay, PE, Bicycle Planner for the city of Denver, conducted the workshop. Mr. Mackay is a nationally recognized expert in designing safe and comfortable bicycle facilities. He has also developed vandal resistant underpasses and lighting. Bicycling Magazine recognized Denver as one of the "Top Ten Cities for Cycling" in North America for the last three consecutive years.

Main points from this presentation are within this report. For a packet of Mr. Mackay's handouts (which include specifications and signage examples), contact Ms. Gin Kilgore at 312.793.0451 or gkilgore@catsmpo.com.

Workshop participants mingling and discussing local examples of cycling barriers.

Mr. James Mackay, PE providing on the spot design guidance.

[1] CATS, as the metropolitan planning organization for northeastern Illinois, is responsible for developing the region's long-range transportation plan and five-year program of federally funded transportation projects. See www.catsmpo.com and www.catsmpo.com/bikeped for more information.

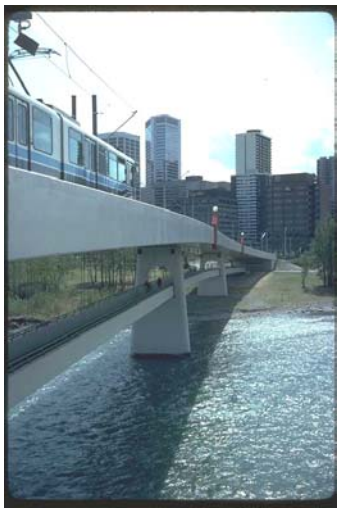
Workshop Overview

Mr. Mackay urges the use of grade separation to provide access across barriers such as high-speed, high-volume roads, rivers, and railroad corridors. His facilities accommodate not just the traffic confident cyclist who rides in any condition, but also children, families, novice riders and even traffic-confident cyclists who sometimes want a respite from motorized traffic.

Many of the facilities Mr. Mackay highlighted were costly to construct. However, he urged comparing up-front and long-term costs. A more expensive design may save on future maintenance expenditures. Also, a poorly designed facility that no one uses--or that creates liability--is not cost effective in the long run.

One way to keep costs down is to coordinate with roadway, bridge and transit projects. It is more economical and convenient to add bicycle accommodations to a major project during the scoping and initial design phases than to retrofit. For an overview of regional funding sources and strategies, visit www.catsmpo.com/bikeped.

Through examples of a wide range of facilities, Mr. Mackay illustrated features to consider (and avoid) when building overpasses and underpasses.



A multi-use path was built as part of this light rail project in Calgary. The path is on the lower level.

Grade Separation--Designing for Intended Users and Uses

Most of Mr. Mackay's presentation focused on bicycle and pedestrian over and underpasses. These structures are used by pedestrians, cyclists, people in wheelchairs, skaters, joggers, families, amblers, talkers and people watchers. Some traffic moves quickly, some slowly and some not at all (for example, some bridges act as "scenic overlooks" and fishing spots.) All users should be able to mix safely and comfortably. Some general design advice follows.

***Approaches/Sightlines*:** Design bridge and underpass approaches so that users can anticipate possible conflicts. For example, a cyclist turning onto a bridge should be able to see if someone is exiting it in the on-coming direction. Provide ample room for these turning and passing movements. Providing good visibility also increases the perceived feeling of safety; people prefer to have a sense of who or what is on an enclosed structure before entering it. Design underpasses so that the far side exit is visible from the entrance.

ADA Compliance and Maintenance Access: One major theme of the workshop is that a facility will likely meet the needs of all intended users if it is designed to comply with the Americans with Disabilities Act (ADA) and accommodate emergency and maintenance vehicles.

ADA requirements include:

- Handrails.
- Rest plateaus every 30 vertical inches (when the slope exceeds 5%).
- Grade cannot not exceed 8.33%.
- Cross slope cannot exceed 2%.

Other guidelines:

- Provide 10' minimum vertical clearance for emergency and maintenance vehicles.
- Use a 20' minimum turning radius. This will accommodate cycling speeds, wheelchairs and sweepers. If deflections must be used instead of curves, a 45 degree deflection is easier to negotiate than a 90 degree deflection. It also provides better sightlines.
- Minimum railing height should be 42", according to the AASHTO Guide to the Development of Bicycle Facilities. AASHTO's bridge guidelines call for a minimum railing height of 54", which is the standard used by IDOT. In Illinois, federally and state funded projects must follow AASHTO guidelines. Following AASHTO also helps with liability.

The sidewalks on either side of this Portland, OR metal-decked bridge were widened to become multi-use facilities. There are separate curb-cuts (not shown) for cyclists transitioning from an on-street bike lane and pedestrians continuing from the sidewalk network.

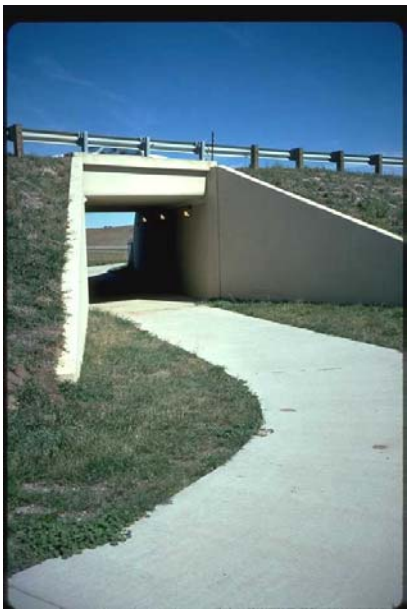
***Drainage**:* Pooling water creates maintenance and safety problems, especially when it freezes or creates algae. Where possible, leave an open space at the bottom of bridge railings to prevent accumulation of water and debris. Where underpasses are adjacent to a waterway, use one-way valves to let water out without letting it in from below.

Expansion Joints: Even a small gap can create a hazard for a cyclist or skater. Use expansion joints that will not create tripping problems or "wheel trap" crashes for skaters. An expansion joint that functions via thin sliding plates is preferable to one with longitudinal gaps.

***Bridge Decks*:** Use concrete instead of wood, because wood decks are very slippery when wet or icy. Wood also rots, warps and is a fire hazard.

***Buffer Zones**:* In some cases, an underpass will be bounded by a drop-off into a stream or other hazard. Mr. Mackay uses bicycle friendly rumble strips as a buffer or "recovery zone" to warn cyclists when they have strayed too close to the edge. Recommended width is 3 feet (2 feet minimum).

***Aesthetics*:** People are more likely to use and appreciate a facility that is visually appealing. Good design and public art can turn under and over passes into community assets.

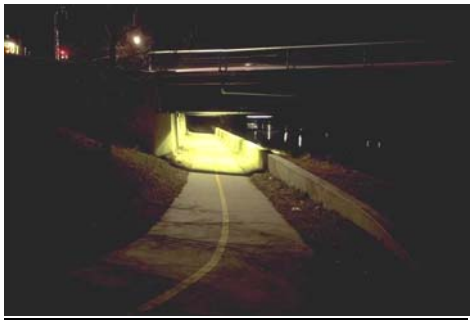


This underpass has good sightlines and approaches: cyclists can see through to the other side and the path curves gently. A mural could enhance its appeal.

DISCOURAGING CERTAIN USES AND ACTIVITIES BY DESIGN

Bicycle and pedestrian bridges should be welcoming to intended users, but not to motorists or people with criminal intent. However, strategies for discouraging some kinds of activity should not degrade the experience of the intended users.

***Lighting and Visibility**:* Open, airy structures with good sightlines allow for easy, casual monitoring; you can see what or who is on the structure before entering it and activity is more visible. Maximize exposure to sunlight (this will also help prevent water from freezing). Transportation corridors should also be planned for 24 hour use. Mr. Mackay advocates the use of vandal-proof, Lexan enclosed lights. The expense of the supplemental Lexan enclosures is high (about $700), but will be recouped in maintenance costs.



Lighting helps facilities function 24 hours a day--accommodating people working the late shift, or coming home after a show.

***Barriers**:* In an attempt to keep out motorists (but still provide emergency and maintenance vehicle access), removable barriers are often placed at trail intersections--even when the likelihood of a motorist turning onto a trail or bike/ped bridge is slim. This can create a situation where the solution is worse than the problem. For example, bollards (removable or hinged posts) can be difficult to see or predict, especially at night, which creates a crashing hazard. Recumbents and bikes with trailers have a difficult time negotiating them. Mr. Mackay suggests installing barriers when there has been a demonstrated need (such as frequent motor vehicle incursion). If a barrier is deemed necessary, make sure it is visible in daylight and at night and provides enough clearance for cyclists who might be hauling trailers or riding a tandem. Ideally, cyclists should not have to dramatically change course to navigate the barrier.

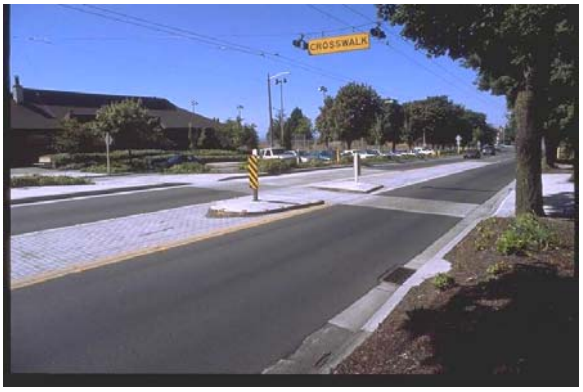
***Graffiti**:* Incorporate public art to avoid having "blank canvasses" that invite graffiti. Corrugated and textured surfaces are also passive deterrents to graffiti.

This bollard hinges down to allow a maintenance vehicle to access the bridge. Its placement in the middle of the path allows enough room for cyclists to pass it single file. Reflective paint and a warning sign could help improve its visibility, especially at night. However, if it is unlikely that a motorist would try to access the trail at this location, the bollard could be removed.

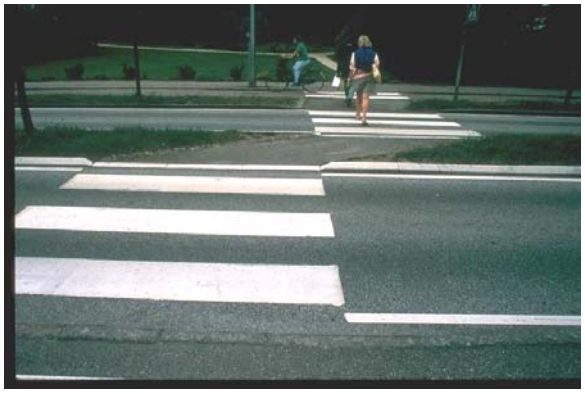
At-Grade Crossing Treatments

Often grade-separation is not financially or logistically feasible. Delineate mid-block crossings with pavement markings and signs. Pushbutton actuated in-pavement beacons can be used to increase the crosswalk's visibility. Center refuge islands allow cyclists and pedestrians to cross traffic one direction at a time.

Consider using yield instead of stop signs for trail traffic approaching a low volume road. When trail traffic is heavier than the intersecting motorized traffic, consider having the motorized traffic yield.

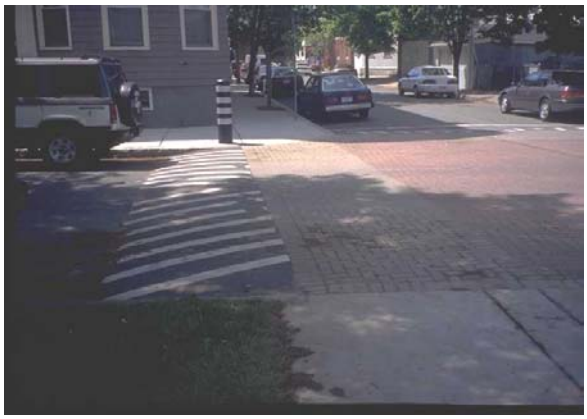


Signage, a center refuge area and push button activated overhead lights increase the visibility of the above mid-block crossing.



This off-set crosswalk slyly directs cyclists and pedestrians to look in the correct direction before crossing the next section of roadway. This also provides a larger refuge area, which is particularly helpful for cyclists.

When a heavily used trail crosses a lower volume road, consider designing the intersection so that the trail traffic has the right of way. For example speed tables (right) can be used to increase an intersection's visibility and calm motorized traffic. By elevating the intersection to the sidewalk (or trail) level, you also help smooth out the ride for people in wheelchairs, on bikes or pushing strollers.



A raised intersection in Cambridge, MA.

Additional Resources:

- Oregon DOT Planning and Design Manual: www.odot.state.or.us/techserv/bikewalk
- Florida DOT Policies and Standards: www11.myflorida.com/safety/ped_bike/ped_bike_standards.htm
- Institute of Transportation Engineers Guide to Traffic Calming: www.ite.org/traffic
- AASHTO Guide to the Development of Bicycle Facilities: www.aashto.com

Designing Sidewalks and Trails for Access--Best Practices Guide: Fax 301.577.1421 and request FHWA Publication #FHWA-EP-01-027

For more information on CATS' bicycle and pedestrian planning activities and resources, visit www.catsmpo.com/bikeped or call 312.793.0451.