Institute for Transportation Research and Education – N.C. State University

Accessibility of Modern Roundabouts and NCHRP Report 674

Bastian Schroeder, Ph.D.

Transportation Research Board and Easter Seals Project Action

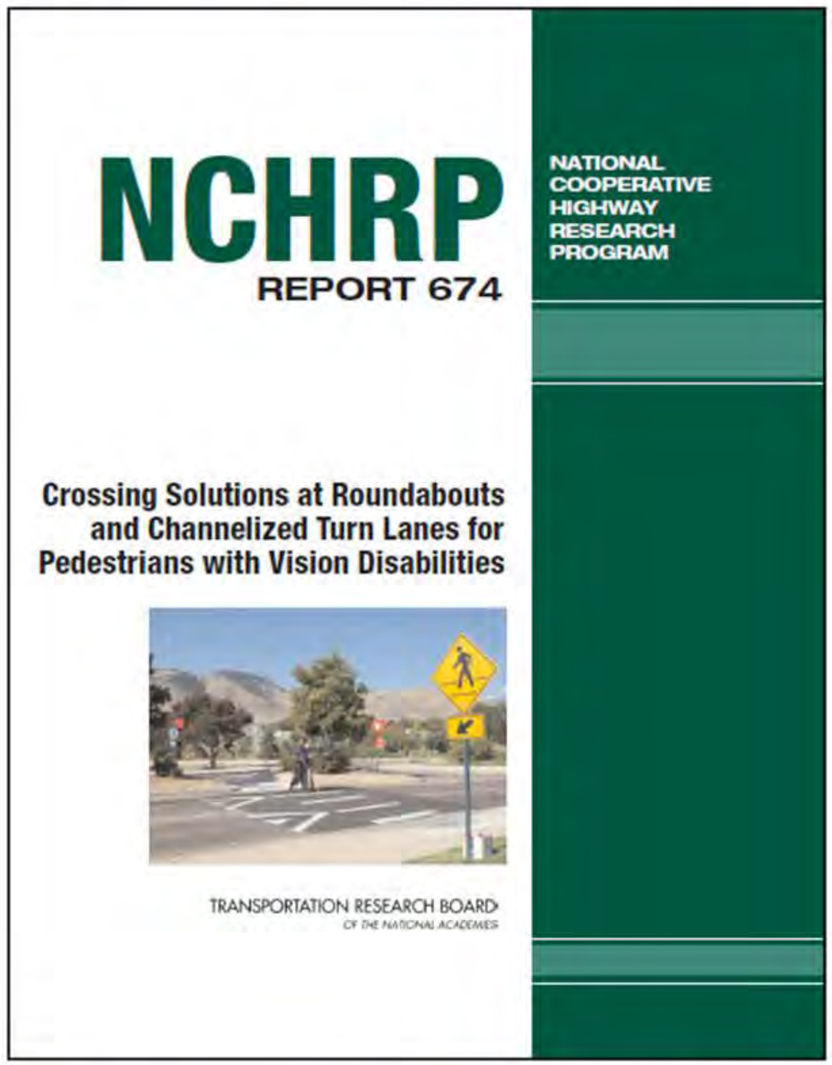
November 9, 2011

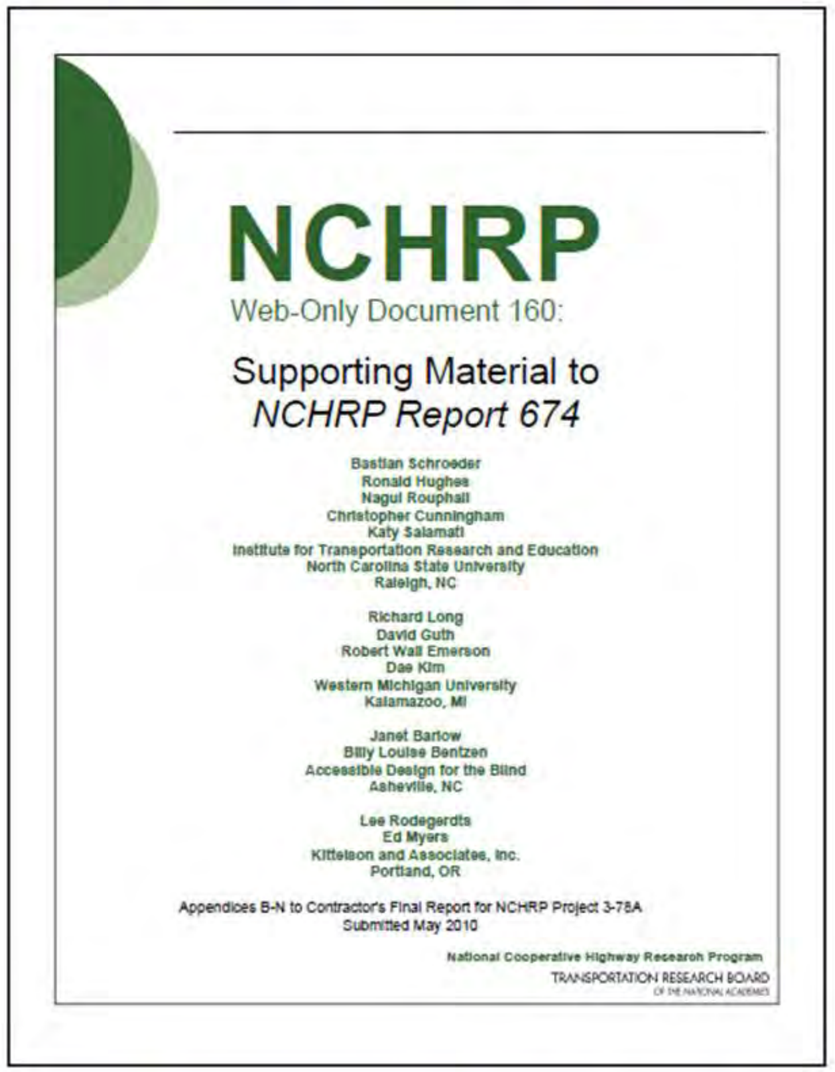
ITRE

http://www.itre.ncsu.edu

Report Available Online

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





- http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w160.pdf

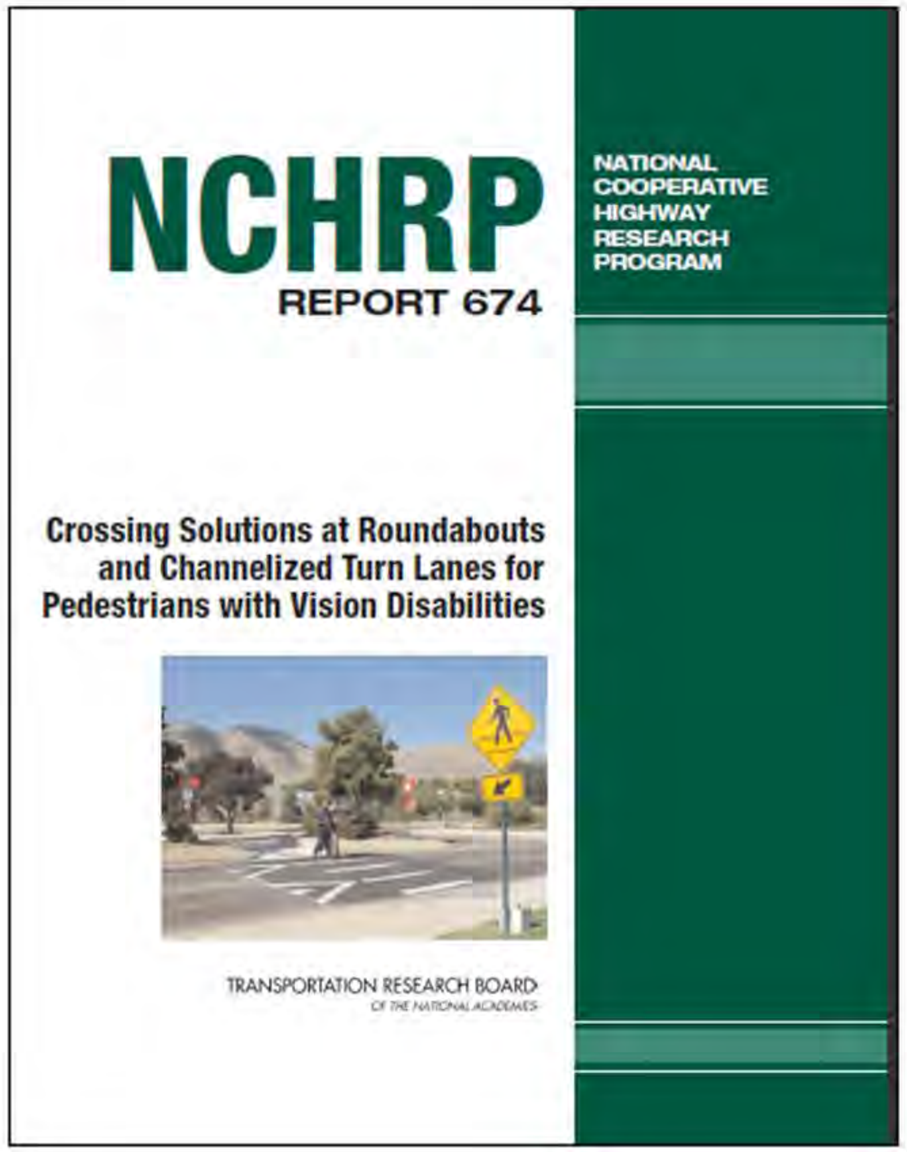
Overview

- NCHRP Report 674
  - … establishes common "language" and performance measures for ongoing accessibility debate
  - … contains field data for twelve studies at five intersections, 56 blind participants, and 3,300 crossing attempts
  - … presents an initial assessment of new crossing treatments, particularly for two-lane roundabouts
  - … provides ways to extend the research results through statistical modeling and simulation
  - … establishes a baseline for future research in this area to assure compatibility of results.

- The report does not give warrants or requirements for treatment installation

Report Outline

1. Introduction
2. Synthesis of Literature
3. Methodology
4. Analysis Framework
5. Results
   - Performance Measures
   - Participant Feedback
6. Study Extensions
   - Mixed-Priority Delay Models
   - Simulation Approach
7. Interpretation and Application
8. Detailed Appendices



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

Roundabout Accessibility Challenges

- **The crossing task for blind pedestrians**
  - Finding the crosswalk
  - Aligning to cross
  - **Deciding when it is safe to cross**
  - Maintaining alignment during crossing

- **Confounding challenges**
  - Uninterrupted flow (no signal)
  - Potentially high speeds
  - Ambient noise at crosswalk
  - Non-straight geometry
  - Low driver yield compliance

- **Treatments available**

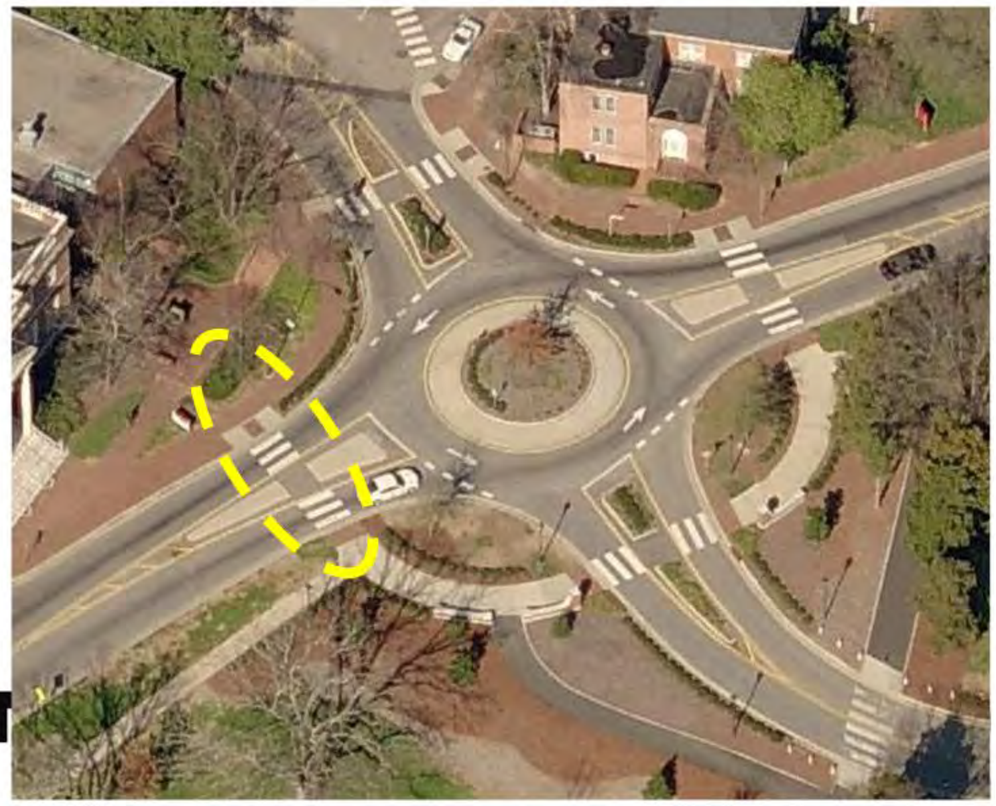
NCHRP 674 Study Results

- Channelized Turn Lane
  - Two approaches pre and post treatments
  - Sound Strips with and without flashing beacon

- Single-Lane Roundabout
  - Three sites – no treatments tested
  - Two in pre condition only
  - One pre and post without treatment

- Two-Lane Roundabout
  - Two approaches pre and post treatments
  - Pedestrian Hybrid Signal or HAWK
  - Raised Crosswalk

Evaluation of Single-Lane RBTs.



- Three sites tested
- Three different cities
- No treatments installed
- Varying geometries
- Range of volumes
- Different participants and driving culture

Single-Lane RBT Results

- Tested **Single-Lane Roundabouts** appear to not pose unreasonable crossing difficulties to most blind travelers, provided that
  - Speeds are low through good roundabout design
  - Drivers are courteous and yield the right-of-way
  - Appropriate detectable warnings are installed
  - Blind travelers received O&M instruction specific to roundabout crossings
- Some participants did have difficulties
  - One site had high intervention rate (3.9%)
  - Another site had high delay (85th percentile delay 35.4 seconds per lane)

Two-Lane Roundabout

Golden Rd. @ Johnson Rd., Golden, CO

http://www.itre.ncsu.edu

Raised Crosswalk

Pedestrian Hybrid Beacon (HAWK Signal)

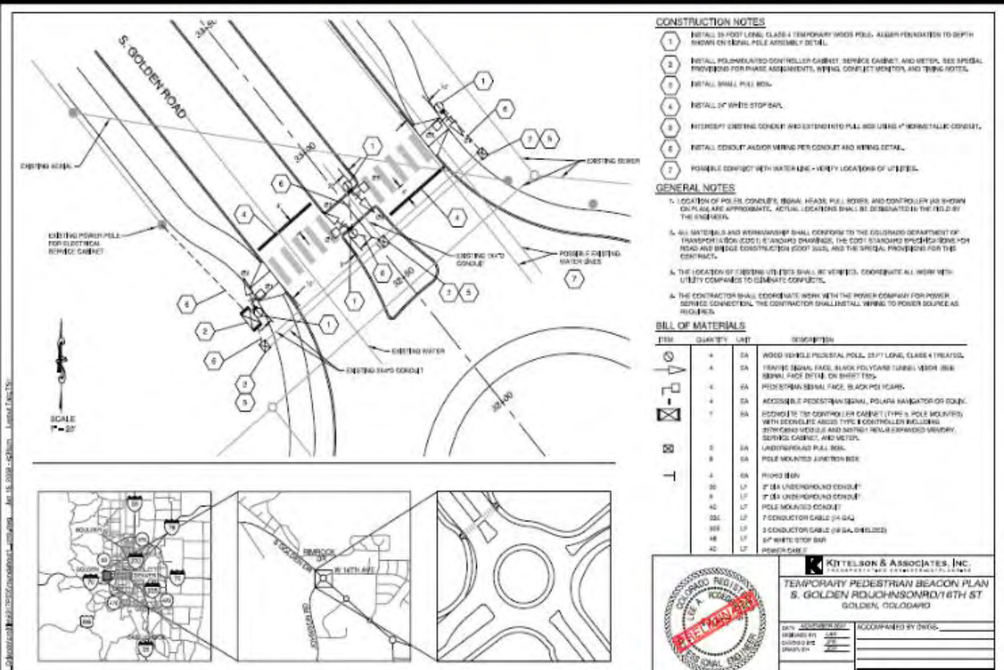
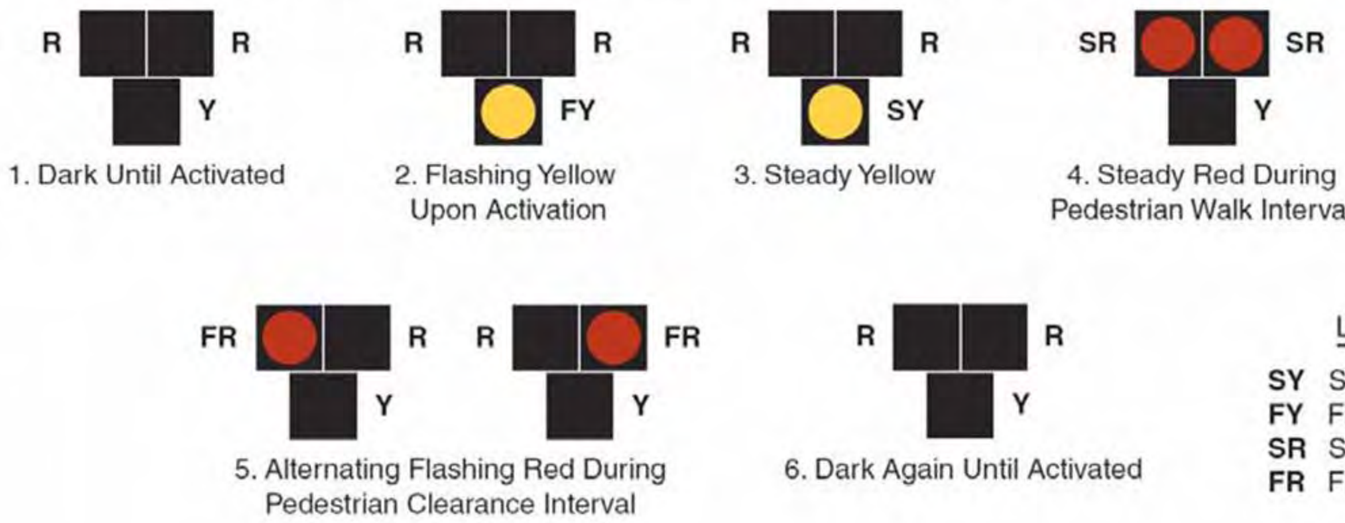


Figure 4F-3. Sequence for a Pedestrian Hybrid Signal



Two-Lane Roundabout Results

- Raised Crosswalk
  - Average delay decreased (17 sec to 8 sec)
  - 85th percentile delay decreased (30 sec to 13 sec)
  - O&M interventions decreased (2.8% to 0%)
  - … but some “risky” events observed

- Pedestrian Hybrid Beacon
  - Average delay decreased (16 sec to 6 sec)
  - 85th percentile delay decreased (30 sec to 8 sec)
  - O&M interventions decrease (2.4% to 0%)
  - **…but high vehicle red-light violations (12.6%)**

Two-Lane RBT Findings

- **Two-lane roundabouts** are challenging without additional treatments
  - Speed and volumes are higher
  - Multiple-threat situations are biggest risk
  - Treatments proved effective in reducing speeds, increasing yields, and creating crossing opportunities
  - Treatments reduced delay and interventions (risk)
  - Raised crosswalk exhibited more multiple threat and (perceived) risk than PHB
  - PHB had concerning rate of vehicle red-light violations

US Access Board Position

- Proposed Guidelines for Public Rights-of-Way
  - Pedestrian crossing easily located for wayfinding
  - Signalization Requirement for Two-Lane Approaches
  - http://www.access-board.gov/prowac/

Related Research Efforts

- Oakland County, Michigan
  - Two 2x3lane roundabouts
  - Rectangular Rapid-Flashing Beacons (RRFB)
  - Pedestrian Hybrid Beacons (PHB)
  - Study Completed, Release of Results Pending
- FHWA Evaluation of RRFBs at Multi-Lane RBTs
  - Investigate eight RRFB approaches
  - Explore alternatives to PHB and Signalization
  - Expected Completion in 2014

Closing Thoughts

- Access Board Notice of Proposed Rulemaking (NPR) still open for comments and looking for more data
- Treatment alternatives (non-signalized) need more research to solidify results
- Capitalizing on momentum of national accessibility debate and existing treatment installations
- More research is forthcoming and should emphasize compatibility with the 674 framework
- *FHWA is looking for municipalities willing to assist with RRFB accessibility evaluation.*

ITRE Website Resources

NC STATE UNIVERSITY | FIND PEOPLE | LIBRARIES | MYPACK PORTAL | CAMPUS MAP | Search NC State

ITRE
Institute for Transportation Research and Education
at North Carolina State University

Exploring and advancing transportation systems through research, education and technical assistance.

About ITRE
Contact Us
Location and Directions
Site Index
Search ITRE
Staff Directory

ITRE Home | Research | Training & Education | Technical Assistance | Centers & Programs | News & Events

Research

ITRE Home » Research » Blind Pedestrians Access to Roundabouts

Blind Pedestrians Access to Roundabouts and Other Complex Intersections

The Institute for Transportation Research and Education (ITRE) is centrally involved in research addressing questions and concerns of pedestrian accessibility to roundabouts and complex intersections. The focus of this ITRE research branch is on **accessibility concerns at modern roundabouts and signalized intersections with channelized right turn lanes**. Both types of facilities pose challenges to pedestrians who are blind, including:

- Presence of free-flowing traffic (typically) not controlled by a signal
- Elevated levels of background noise generated by other movements at the intersection
- Curved vehicle trajectories that make it difficult to discern traffic patterns
- Lack of reliably auditory cues that can be used to identify crossing opportunities
- Mixed-priority crossing challenges, where pedestrians can cross either in a large gap between vehicles, or in front of a stopped (yielding vehicle)
- Unreliable driver behavior, where only some proportion of traffic yields to pedestrians
- Inconsistent use of wayfinding cues that can help the pedestrian to find the intended crossing location

Additional Information

» Research Roadmap (PDF:128KB)

» Publications and Presentations

» Press Releases

› ITRE Research Improving Safety for Sight-Impaired Pedestrians (PDF: 214KB)

› ITRE's Roundabout Research Presented at National Conference (PDF:45KB)

Thank You for Your Time!

Bastian Schroeder
+1-919.515.8565
Bastian_Schroeder@ncsu.edu

Institute of Transportation Research & Education (ITRE)
North Carolina State University, Centennial Campus, Box 8601
Raleigh, NC 27695-8601, Fax: (919) 515-8898