Need Statement 715 – Literature Search

Title: Comparative analysis of grade-separated pedestrian infrastructure and at-grade treatments

Date: June 16, 2023

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Resources searched: TRID, ASCE, Web, Transport, MnDOT Library Catalog, EBSCO

Summary

Results are compiled from the databases named above. Links are provided for full text, if applicable, or to the full record citation. I completed my searches using the following terminology: "Grade-separated pedestrian infrastructure, Grade-separated pedestrian crossings, bridge vs underpass AND pedestrian; grade-separated AND at-grade.; pedestrian infrastructure and underpasses. Results are organized by more and less relevant below.

There are not many recent studies on this topic from the United States. I included a few older ones in the Less Relevant Results section. As always, if you want me to do more research, let me know.

More Relevant Results

Title: Australasian pedestrian facility selection tool [V2.2.1]: user guide

Authors: Abley, S., Smith, D. and Rendall, S.

Source: TRID/AustroRoads, 2021

Link: https://austroads.com.au/publications/active-travel/ap-r652-21

Abstract: This user guide describes the operation and outputs of the *Australasian Pedestrian Crossing Facility Selection Web Tool* located at http://www.austroads.com.au/road-operations/network-operations/pedestrian-facility-selection-tool

This guide describes the user interface of the tool, including:

- how to access the tool
- the types of facilities that can and cannot be assessed
- computer requirements
- a quick-start guide to using the tool
- a description of the usability features
- inputs and outputs relating to each section of the tool
- known issues and troubleshooting.

Appendix E documents updates made to the tool in April 2021.

Title: Crossing Selection Process

Source: Waka Kotahi-New Zealand Transport Agency

Link: https://www.nzta.govt.nz/walking-cycling-and-public-transport/walking/walking-standards-and-guidelines/pedestrian-network-guidance/design/crossings/crossing-selection/crossing-selection-process/

Description: Selecting an appropriate crossing facility type including supporting aids requires a comprehensive and context sensitive approach. This page outlines a recommended crossing selection process. Firstly understand the street environment and context, then use the crossing selection flowchart to identify potentially suitable crossing options, finally use the crossing context table to find out more about the recommended parameters for each crossing type and other important considerations to identify a safe and appropriate crossing type along with supporting aids.

Title: Development of Pedestrian Level of Service (PLOS) for Foot Over Bridges and Skywalks.

Authors: Banerjee Arunabha; Maurya Akhilesh Kumar

Source: Sixth International Conference of Transportation Research Group of India (CTRG2021). 2022.

Link: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=tspt&NEWS=N&AN=01876942

Abstract: The performance evaluation and expansion/redesigning of a pedestrian facility depend on the Pedestrian Level of Service (PLOS). Indo-HCM (2017) has recently developed LOS for foot over bridges (FOBs) considering five locations across different Indian cities. However, no study has been conducted over elevated walkways such as skywalks. Hence, the current study tries to develop PLOS standards for overpass facilities (FOBs and skywalks). To achieve the above objective, videography data was collected over seventeen FOB and seven skywalk locations across six different Indian cities. Subsequently, the collected data was processed in the lab to extract the most significant parameters (flow rate, speed, density, and area module) along with microscopic factors (age, gender, luggage condition, use of hand-held devices, and group size). The t-test confirmed that the data for both the facilities should be kept segregated. Microscopic analysis revealed that majority of the users were male and young adults (21-40 years). The walking speed over skywalks was 6.5 m/min greater than that over FOBs. To develop the LOS ranges, equal data binning technique was applied. Thereafter, actual ground conditions were considered to define the LOS ranges. Finally, two separate LOS standards were developed which could replicate the actual condition of the existing overpass facilities. The outcome of the study would be beneficial to planners and government authorities in developing standards for **grade-separated** facilities such as FOBs and skywalks. This would help in developing improved and comfortable facilities for pedestrians.

Title: Are Facilities to Support Alternative Modes Effective in Reducing Congestion?: Modeling the Effect of Heterogeneous Traffic Conditions on Vehicle Delay at Intersections.

Authors: Kodupuganti Swapneel, R., Pulugurtha Srinivas, S.

Source: Multimodal Transportation. 2023.

Link: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=tspt&NEWS=N&AN=01867225

Abstract: Multimodal facilities are being built in a majority of urban areas to accommodate both motorized and non-motorized traffic. The resulting transportation system is susceptible to complex interactions between different modes and users. These complex interactions are hard to quantify and capture on a regular basis. There is a need to rely on a microsimulation platform to replicate such real-world scenarios and forecast future conditions. This study focuses on assessing the effect of heterogeneous traffic conditions involving multiple modes like light rail transit (LRT), walking, bicycling, and motorized traffic on vehicle delay at intersections using Vissim traffic simulation software. A 2.5-mile urban arterial corridor comprising of seven **at-grade** and two **grade-separated** signalized intersections along US-29 route in the city of Charlotte, NC, USA was chosen for analysis and modeling. Base simulation model was developed by replicating the traffic scenario for the year 2018 (without LRT and non-motorized traffic). External controllers like VisVAP and Viswalk were used to assign signal priority and model heterogenous traffic conditions. The vehicle operational performance of the corridor

improved along the major street after the addition of the LRT. An increase in vehicle delay on the major street was observed with an increase in the non-motorized traffic. Contrarily, the operational performance of the cross-streets at **at-grade** intersections did not see any significant change due to the addition of non-motorized traffic. The proposed framework assists planners to assess the impact of adding a new transit system like LRT and associated non-motorized traffic on the urban corridor.

Less Relevant Results

Title: A Critical Review of Grade-Separated Pedestrian Crossing Facilities

Authors: Manthirikul, Sandeep; Jain, Udit; Amshala, Vijay Teja
Source: Journal of Transportation Engineering Part A: Systems
Link: https://doi.org/10.1061/JTEPBS.0000711
Abstract: Vehicle–pedestrian crashes are one of the common road accident types. Pedestrian crossing warrants are guidelines that recommend a particular type of pedestrian crossing facility to be provided at a crossing location. Various countries around the world have their crossing warrant guidelines, but most of them are focused toward at-grade facilities. Even with existing warrant criteria, the number of pedestrian–vehicle crashes is alarming. This indicates that the warrant criteria and their threshold values may need reexamination. Several of the existing warrant guidelines do not provide the required clarity for the provision of grade-separated pedestrian crossing facilities (GSPCFs). GSPCFs include overpasses (or foot overbridges), underpasses (or subways), and partial underpasses (or hump subways). The existing warrant guidelines consider GSPCFs as a single unit and do not identify which type of GSPCF should be provided at a crossing location. Appropriate GSPCFs not only minimize the accident rate but also eliminate delays for both vehicles and pedestrians. This paper conducts an in-depth analysis of the existing literature on urban midblock GSPCF warrants around the world. The discussion highlights the limitations associated with existing warrant guidelines and the need to formulate improved GSPCF warrants.

Title: Development of the Australasian Pedestrian Facility Selection Tool

Authors: Abley, S., Smith, D. and Rendall, S.
Source: TRID
Link: https://trid.trb.org/view/1346165
Abstract: This report documents the research undertaken to develop a standardised tool to help practitioners select the most appropriate pedestrian crossing facility for a particular site. The project identified a number of gaps in existing walkability and pedestrian level of service research which lacks suitable models for assessing the relative benefits of different types of facilities for midblock and intersection crossings. The analysis identified that the walkability of crossings could be evaluated by isolating the individual elements of perceived delay, perceived safety and comfort. Community Street Review responses collected in a previous New Zealand research and the results of focus group surveys informed the development of additional walkability models. The tool developed from the research assesses both midblock and intersection applications of raised platforms, kerb extensions, median refuges, zebra crossings, signals, grade separation and a combination of facilities. The initial assessment considers which types of pedestrian crossing facilities are appropriate for the traffic environment. Feasible facilities can then be evaluated in relation to pedestrian and vehicle delay, safe sight distances, pedestrian level of service and economic evaluation. The facility selection tool can be accessed via the Austroads website.

Note: This discusses the development of the guide. An updated version was released in 2021 and is linked above.

Title: Small Town and Rural Multimodal Networks

Author: FHWA

Source: Federal Highway Administration, 2016

Link: https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_towns/

Abstract: This document is intended to be a resource for transportation practitioners in small towns and rural communities. It applies existing national design guidelines in a rural setting and highlights small town and rural case studies. It addresses challenges specific to rural areas, recognizes how many rural roadways are operating today, and focuses on opportunities to make incremental improvements despite the geographic, fiscal, and other challenges that many rural communities face.

It provides information on maintaining accessibility and MUTCD compliance, while at the same time encouraging innovation. For example, this document highlights two innovative facility types: Yield Roadways and Advisory Shoulders. Regarding Yield Roadways, this document references AASHTO resources such as the Guidelines for Very Low-volume Local Roads 2001, which includes discussion of Two- Way Single-Lane Roads, and the A Policy on Geometric Design of Highways and Streets, which notes that "on residential streets the level of user inconvenience occasioned by the lack of two moving lanes is remarkably low". It also notes that when faced with two-way traffic in a single lane "opposing conflicting traffic will yield and pause on the parking lane area until there is sufficient width to pass" (2011, p. 5-13). This document notes that Yield Roadways are a common form for low-volume local rural and urban roads, but recognizes that additional research on this facility type will be helpful. It will also be helpful to learn from the experience of states such as Oregon that recommend similar street types in their Oregon Neighborhood Street Design Guidelines.

Similarly, the document notes that as of 2016, an approved Request to Experiment is required to implement Advisory Shoulders. Called "dashed bicycle lanes" in the FHWA experimentation process, at least five such experiments are currently ongoing. Beyond local experimentation, the guidance in this document incorporates lessons learned from installations in the UK, where speed and crash reduction benefits were noted after facility implementation. Refer to FHWA's Bicycle and Pedestrian Program website for the current approval status of these and other treatments before implementation.

By including these facilities in this document, FHWA is fostering innovation and encouraging participation in the formal experimentation process. This will help to ensure that conversations about design flexibility and multimodal networks also address rural conditions and meet the needs of everyone. In doing so, this document is intended to foster an ongoing dialogue about multimodal transportation infrastructure needs in small towns and rural areas.

Note: See this: https://ruraldesignguide.com/