TOPIC: Criteria and Design Guidelines for Three-lane Roads:
Literature Search
IdeaScale 96

July 6, 2017

Prepared for: Mitch Bartelt
Prepared by: Sheila Hatchell

Resources searched: TRID, RIP, ASCE Engineering Database, Internet, Library Catalog

Summary: I was able to locate no resources directly related to this topic. I have included resources that may be of use to the researcher. Several of the resources listed in the Less Relevant Results section are dated and/or from other countries. The abstract is in English but the final report might not be.

Most Relevant Results

A Summary of Experiences With 3-Lane Roadway Conversions
By: Hennepin County, MN and City of Saint Paul, MN
Undated; No Abstract Available

Arterial Street Traffic Calming With Three-Lane Roads (Contact the library for the full text article)
Authors: TA Sohrweide, B. Buck, R. Wronski.
Publisher: Paper presented at the ITE 2000 Annual Meeting.

Abstract:
Two cities, Burnsville, Minnesota and River Falls, Wisconsin, both had 4-lane arterial roadways that were having problems with excessive vehicle speeds, pedestrian crossing safety, and left-turning vehicle safety. The implemented solution in both cities was a conversion to a 3-lane roadway with a center 2-way left-turn lane. This article discusses the decision in these 2 cases to switch to a 3-lane roadway, and also addresses the additional concern of roadway traffic carrying capacity. Evaluation of the change found a decrease in accidents and in traffic volume. Vehicle delays have remained essentially the same, although initial public reaction has not been positive.

Two-Way Left-Turn Lane Design Guide
Mike on Traffic, Musings of a Professional Engineer
A New Set of Guidelines for Road Diet Conversions
Authors: Nikiforos Stamatiadis and Adam Kirk
Publication date: 2013; Paper sponsored by TRB Committee AFB10 Geometric Design

Abstract:
Road diets, which convert four-lane highways to three-lane cross sections, are an innovative solution to address mobility and safety concerns under budgetary constraints. These improvements can assist in the development of multimodal corridors with minimal impact on automobile mobility, while retaining the original right of way. Past research has focused on evaluating road diet safety, but minimal guidance exists on determining when such conversions are appropriate from an operational perspective. The proposed guidelines focused on evaluating and comparing the operation of three- and four-lane roads at signalized intersections to provide basic guidance as to when the road diet conversion is appropriate. One of the important findings of this research is the expansion of the usable range for road diets. Prior experience has limited road diet application to roadways with ADTs less than 17,000 vehicles per day. This research identifies the importance of side street volumes and supports the utilization of road diets on roadways with volumes up to 23,000 vehicles per day. This paper provides comprehensive guidance for road diet evaluation including operational performance, correctable safety problems and identifies a list of evaluation elements that should be examined when in-depth analysis of alternatives is required.

The Effects of “Road Diets” on Traffic Crashes and Injuries. (Contact the Library for the full text)
Authors: HF Huang, CV Zegeer

Abstract:
"Road diets" are often conversions of four-lane undivided roads into three lanes (two through lanes plus a center turn lane) (Figure 1). The fourth lane may be converted to bicycle lanes, sidewalks, and/or on-street parking. In other words, the existing cross-section is re-allocated. Road diets can potentially offer benefits to both vehicles and pedestrians. On a four-lane street, drivers change lanes to pass slower vehicles (e.g., vehicles stopped in the left lane waiting to make a left turn). In contrast, on a road diet, driver speeds in each through lane are limited by the speed of the lead vehicle. Thus, road diets may reduce vehicle speeds and vehicle interactions during lane changes, which could potentially reduce the number and severity of vehicle-to-vehicle crashes. Road diets may also benefit pedestrians, because they will have fewer lanes of traffic to cross and motor vehicle speeds are likely to be lower. Zegeer et al. found a reduction in pedestrian crash risk when crossing two- and three-lane roads, compared to roads with four or more lanes. Under most average daily traffic (ADT) conditions tested, road diets have minimal effects on vehicle capacity, because left-turning vehicles are moved into a common two-way left-turn lane. However, for road diets with ADT's above approximately 20,000 vehicles, there is an increased likelihood that traffic congestion will increase to the point of diverting traffic to alternate routes. Simulation analyses by Knapp and Giese indicated that conversions from four to three lanes would reduce level of service when peak-hour volumes exceed 1,750 vehicles per hour. While these potential crash-related benefits are cited by road-diet advocates, there has been only limited research concerning such benefits. (States and cities where the effects of road diets on crashes have been evaluated include Iowa, San Francisco, and Seattle.) This study was designed to help fill this gap.
Research in Progress: Road Diets in Nebraska
Sponsor Organization: Nebraska Department of Roads
Performing Organization: University of Nebraska, Lincoln
PI: John Sangster
Project Dates: July 1, 2016 – December 31, 2017

Abstract:

Examining municipalities with fewer than 12,000 residents, there are currently 14 communities throughout Nebraska in which the major roadway passing through town expands from a two lane roadway to a four-lane roadway. The benefit of this design is an oversized roadway capacity allowing for further growth of the community, at a cost to safety, as these roads increase the risk for rear-end crashes when left-turning vehicles are stopped in a lane with through traffic. The prevailing design choice for rural communities has shifted since the construction of these roadways to prefer a three-lane section, providing one lane of through traffic in each direction with a left-turning refuge in the center lane, increasing safety while giving up capacity. A roadway reconfiguration reducing the existing number of lanes on a corridor is referred to as a road diet. The Nebraska Department of Roads (NDOR) has been participating in this practice for around twenty years, with some communities wholeheartedly embracing the concept, and others being more reluctant to adopt a road diet. Recently, the Federal Highway Administration (FHWA) identified road diets as a strategic initiative within their Every Day Counts innovation program.

Less Relevant Results

Three-Lane Roadways with Two-Way Left-Turn Lanes
No authors listed; undated.
CTRE, Iowa State University

Road Diets: Athens-Clarke County’s Experience in Converting 4-Lane Roadways into 3-Lane Roadways
(Contact the library for the full text article)
Authors: DE Clark;
Publication date: August 2001; ITE 2001 Annual Meeting and Exhibit.

Abstract:

Like many communities throughout North America, residents of Athens-Clarke County, Georgia have recently been stressing the need to better accommodate all modes of transportation on local streets. One way of accomplishing this is to convert existing ravel lanes into turn lanes and/or bicycle lanes. In October 1999, Athens-Clarke County decided to convert Baxter Street from 4-lanes to 3-lanes. The conversion was viewed as a demonstration project to see what impacts such a conversion would have on the safety and crash frequency in the corridor, in addition to the traffic volumes both on the street and within the surrounding area. The paper summarizes Athens-Clarke County experience in converting roadways from 4-lane to 3-lane roadways with an emphasis on changes in traffic volume and crash frequency on both the converted roadway and the surrounding transportation network. The paper also discusses how the public has received the conversion including surrounding business owners, residents, and transportation advocates.
Risk of Accident on Three-Laned Roads  (48 page study in Dutch)
Author: KB Andersen; Danish Council of Road Safety Research, Lyngby, Denmark
Date: September 1974

Abstract:
A Danish investigation for the period 1962-66 shows that three-lane roads in rural areas for ADT below 8-10,000 are safer than corresponding two-lane roads but in contrast they are more dangerous for ADT above 8-10,000. A later Danish investigation for the period 1967-71 of roads in rural areas shows that the three-lane sections for all observed traffic volumes are safer than ordinary two-lane sections with a width of the carriageway of 6-8M. This investigation is based on considerably more accident observations on sections with ADT above 8-10,000 than the American investigations and the first Danish investigation for which reason its results may be regarded as a more reliable basis for the judgment of the risk of accidents on three-lane roads. A special Danish investigation of the effect of the restriping of three-lane roads into two-lane roads with the same width of the carriageway concludes that no significant effect of the restriping can be proved, neither as regards the number, the seriousness of the accidents nor the distribution of the accidents by type. /TRRL/

Design and Operation of Three-Lane Roads  (43 page study in French)
Author: JL Biermann; VSS Zuerich, Switzerland
Date: December 1971

Abstract:

Road-diet Conversions: Where and When.  (The paper is in English; contact the library if you would like to read the full text)
Author: N Stamatiadis
Publication date: April 2014; Transport Research Arena (TRA) 5th Conference. Paris, France

Abstract:
Road diets, which convert four-lane highways to three-lane cross sections, are an innovative solution to address mobility and safety concerns under budgetary constraints. Past research has focused on evaluating road diet safety, but minimal guidance exists on determining when such conversions are appropriate. The proposed guidelines focused on evaluating and comparing the operation of three- and four-lane roads at signalized intersections to provide basic guidance as to when the road diet conversion is appropriate. This research identifies the importance of side street volumes and supports the utilization of road diets on roadways
with volumes up to 23,000 vehicles per day; both important advances of current knowledge. This paper provides comprehensive guidance for road diet evaluation including operational performance, correctable safety problems and identifies a list of evaluation elements that should be examined when in-depth analysis of alternatives is required.

Simulation-Based Guidelines for Road “Diets.” (Contact the library for the full text)

Authors: N Stamatiadis, A Kirk.
Publication date: 2014; Advances in Transportation Studies, Volume 2, pp.5-16. University of Roma Tre.

Abstract:
Road diets, which convert four-lane highways to three-lane cross sections, are an innovative solution to address mobility and safety concerns under budgetary constraints. These improvements can assist in the development of multimodal corridors with minimal impact on automobile mobility, while retaining the original right of way. Past research has focused on evaluating road diet safety, but minimal guidance exists on determining when such conversions are appropriate from an operational perspective. The proposed guidelines focused on evaluating and comparing the operation of three- and four-lane roads at signalized intersections to provide basic guidance as to when the road diet conversion is appropriate. One of the important findings of this research is the expansion of the usable range for road diets. Prior experience has limited road diet application to roadways with ADTs less than 17,000 vehicles per day. This research identifies the importance of side street volumes and supports the utilization of road diets on roadways with volumes up to 23,000 vehicles per day. This paper provides comprehensive guidance for road diet evaluation including operational performance, correctable safety problems and identifies a list of evaluation elements that should be examined when in-depth analysis of alternatives is required.