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Costs and benefits of a road diet conversion

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ABSTRACT

The analysis presented here is of a cost benefit evaluation of a road diet conversion, reducing an urban arterial street from two-lanes in each direction to one-lane in each direction with a middle turning lane. Livingston Avenue is located in New Brunswick, New Jersey, and is an oversized arterial corridor accessing the center of the city. The costs include increases in travel time from the capacity reduction. These are modeled with a VISSIM micro-simulation of the street. Safety benefits of road diets are one of the main reasons that these are pursued. Evidence on the safety effect suggests that road diet conversions of arterial streets in urban areas will achieve about a 19% reduction in crashes. The benefits of crash reductions and the costs of increased delay are evaluated based on the value of statistical lives saved versus the cost of travel time. This is done for various different scenarios and includes robustness checks. Results overwhelmingly find benefits exceed costs over a 20 year period.

1. Introduction

Complete Streets policies are aimed at balancing the needs of all roadway users, encouraging and allowing safe travel by bicyclists, pedestrians, transit users, and freight, in addition to existing car traffic. This is made possible through the transformation of the built environment and may include the installation of bicycle lanes, crosswalks, sidewalks, pedestrian signals, and transit stops. It may also include the addition of median islands, curb extensions, or the occasional road diet. The latter is the focus of this analysis for Livingston Avenue in New Brunswick, New Jersey, a major arterial road that cuts through a residential area and feeds the center of the city. There is substantial pedestrian traffic that crosses the street at both signalized and unsignalized crosswalks. This study was a collaboration funded by a Rutgers University Community–University partnership grant. The focus was on determining the costs and benefits of implementing a road diet along Livingston Avenue.

The City of New Brunswick adopted a Complete Streets policy in May 2009. The policy reinforced the city's commitment to "creating a comprehensive, integrated, connected street network that safely accommodates all road users of all abilities and for all trips." (City of New Brunswick, 2013a) The city has since made plans to increase investment in bicycle and pedestrian infrastructure(Barna, 2013; Bradshaw, 2013a,b) and has also passed legislation and increased traffic enforcement in an attempt to eradicate preventable vehicular-pedestrian crashes. (Bradshaw, 2013a,b) This study, thus, is an instrumental part of this plan. However, at initial stages of this work, it was clear that the City was concerned about public opposition to any reductions in road capacity that might slow traffic entering the City.[1]

This analysis is intended to evaluate the feasibility of a road diet on Livingston Avenue to understand how this may affect traffic flow and also to evaluate the benefits and costs of the conversion. There is evidence that road diets are effective at reducing crashes and reducing speeds (Gates et al., 2007; Pawlovich et al., 2006; Thomas, 2013) and some evidence that there is no effect (Huang et al., 2002). A synthesis of the literature concluded that road diets are effective at reducing crashes (Thomas, 2013). Specifically, the costs are primarily associated with any traffic delay that might occur, while the benefits are based on potential reductions in traffic crashes, including those with pedestrians.

The approach taken here is to investigate the feasibility of a road diet by analyzing the results of a micro-simulation of the traffic network using VISSIM software. VISSIM is a microscopic, time step and behavior-based simulation model developed to model urban traffic and public transport operations (Planung Transport Verkehr

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[1] This was expressed in an early meeting with city staff. There was a desire to complete the work prior to the start of a mayoral election campaign, since the plan was seen as controversial and would likely be opposed by voters.

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(PTV), 2012). VISSIM is particularly useful for examining different scenarios with altered lane configurations and signal timings. The key output provided by the model is the total travel time within the network as well as the time each vehicle is delayed. This provides a means of assessing how the relative level of service of Livingston Avenue and the key intersections are affected by various road diet configurations. Estimates of crash and injury reduction are based on recent research suggesting that road diets can reduce crashes by 19% (Thomas, 2013), and additional scenario analysis is conducted to investigate the robustness of the cost/benefit analysis.

2. Background

New Brunswick is located in central New Jersey and sits along the Raritan River. It is the county seat of Middlesex County. The population is about 50% Hispanic, 16% African–American and totals about 55,000 residents. Over one-third of the population is foreign born. About 25% of the population is below the poverty line and median household income is $40,280 based on the American Community Survey 5-year estimate, and average household income is $53,854. New Brunswick is home to the main campus of Rutgers University with an enrollment of over 40,000 students. The city is relatively densely populated at about 10,500 residents per square mile (4075 per sq km) (City of New Brunswick, 2013b). Employment in the city has grown to about 27,000 jobs from 20,000 in 1990. Rutgers University and Johnson & Johnson (which is headquartered in New Brunswick) are the two major employers in the city.

The northeast corridor offers direct train service to New York City, which has led to major redevelopment of the city as a transit-oriented development. About 10% of the population commutes to work by public transportation and slightly over 3% walk to work. Much of the city is very walkable, with adequate sidewalks along almost all major and minor streets.

Livingston Avenue (also known as county route 691), the subject of this study, is a major local street corridor that connects downtown New Brunswick with US route 1 in the south. It stretches about 3.5 miles (5.6 km) and provides access to the many neighborhoods within the city. Livingston Avenue has two lanes in each direction with a 25 mph speed limit for almost its entire length in New Brunswick. The roadway has an AM peak traffic volume of about 14,000 vehicles and a PM peak volume of about 17,500–18,000 vehicles, over three hours for each peak. Most vehicles exceed the speed limit of 25 mph (40 km/h). Land uses along the street are a mix of residential, retail, and small offices. A number of uses fronting on Livingston Avenue attract vulnerable road users, including three elementary schools, a rehabilitation center for the blind, the public library, a 50-unit senior citizen apartment building, multiple churches and a Rutgers University academic building. Total pedestrian activity tabulated during this study amounted to over 9000 street crossings for both the morning and evening peak periods (over three hours in each peak), for counts at nine intersections along Livingston Avenue.

The street enters North Brunswick to the south where it reduces to three lanes, one of which is a central turn lane and has an increased speed limit of 35 mph (56 km/h). Along this final stretch in North Brunswick the environment becomes more suburban in character and the sidewalks disappear.

Livingston Avenue has been identified as having on over-representation of pedestrian crashes among county roads in Middlesex county (Kaplan et al., 2012). Classified as an urban minor arterial, it is meant to interconnect with and augment the principal highway system. According to a road safety audit conducted in 2011 there were a total of 113 vehicle crashes between 2007 and 2009. Of these, 17% involved a pedestrian and 6% involved a bicyclist (Kaplan et al., 2012). Over two-thirds of the pedestrian crashes occurred at night and most were at major intersections along Livingston Avenue. According to the safety audit, 49 of the 113 crashes (43%) resulted in an injury, with 54 people having injuries; there were no fatal crashes during this time period. One issue noted in the audit is that the police department reported that many pedestrian crashes occur when vehicles that

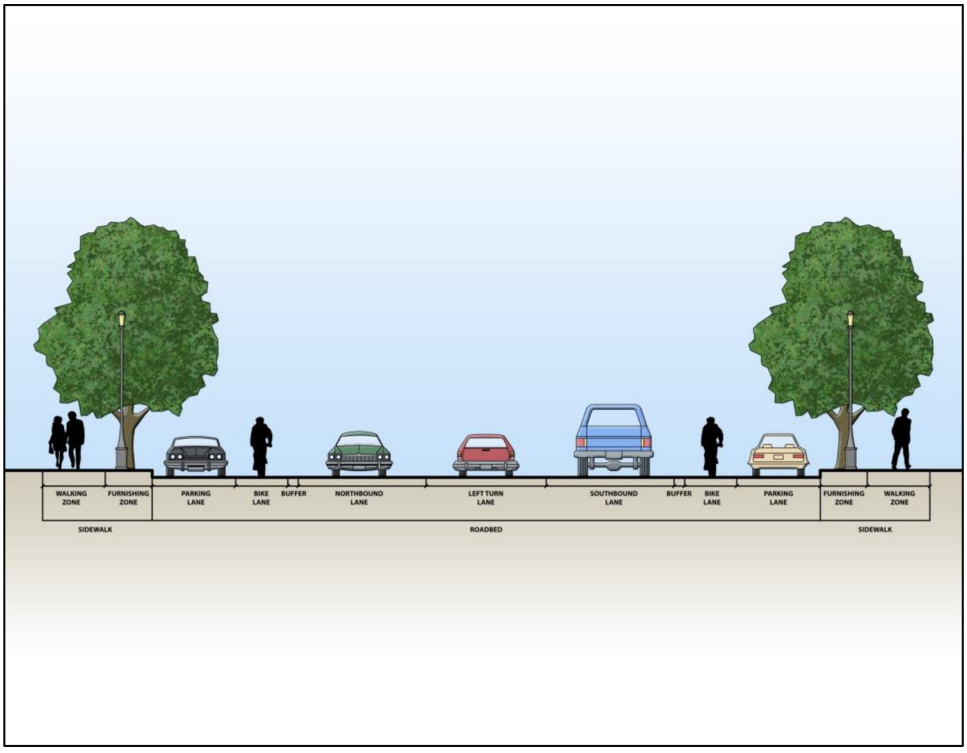

Fig. 1. Road diet cross-section showing a typical configuration.