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Slimming the Streets: Best Practices for Designing Road Diet Evaluations

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Slimming the Streets

Best Practices for Designing Road Diet Evaluations

By Hilary Nixon, Ph.D., Asha Weinstein Agrawal, Ph.D., and Cameron Simons

Despite growing interest in road diets among transportation planners and community members, there is limited empirical evidence on the traffic effects of these roadway conversions. Many road diet evaluations are never formally published or archived in a permanent, accessible location, making them difficult to access. And the small number of easily accessible road diet evaluations vary widely in the metrics they evaluate and the quality of data collected. (For helpful summaries of the factors analyzed in other studies, see Huang, et al., 2003 and Lyles, et al., 2012. [1,2]) In short, transportation planners have few high-quality resources to review when they want to understand how road diets perform in practice.

Hilary Nixon

This article analyzes traffic impacts from a 2015 implementation of a road diet along Lincoln Avenue, in the City of San José, CA, USA to answer the following questions:

1. How did the road diet impact all-day counts of traffic volumes and speeders for each street type?
2. How did the road diet impacts vary by street type when looking at all-day counts versus data for peak hours and data by hour of the day?
3. What are recommended best practices for conducting and presenting road diet evaluations that look at speeding and traffic volume impacts?

More detailed study findings are documented in Nixon et al., 2017.[3]

About the Lincoln Avenue Road Diet Project

Lincoln Avenue is a major arterial running through the Willow Glen neighborhood in San José, California. Willow Glen is a relatively affluent, predominantly residential neighborhood with a small neighborhood business district. The street, a four-lane, undivided roadway, has become a popular route for commuters avoiding the more congested nearby freeways and expressways. Close to 20,000 vehicles per day travel along this route, often above posted speed limits.

In response to neighborhood concerns about traffic, city staff designed a one-mile (1.6 km) road diet to reduce through traffic lanes from four to three, using the space freed up from the fourth travel lane to create marked bicycle lanes (Figure 1). Because the project faced considerable controversy, the city implemented the diet as a pilot project and conducted an extensive evaluation. The pilot ran a full year, from February 2015 to February 2016, and the evaluation was the most extensive data collection effort ever undertaken by San
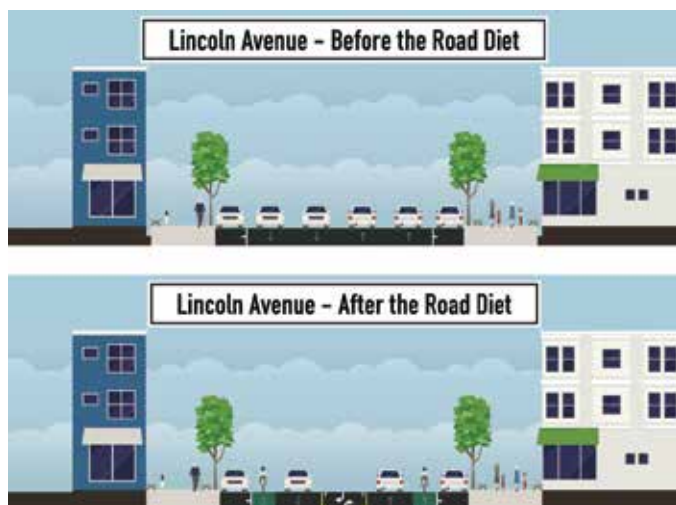
Figure 1. Illustration of a 4-lane to 3-lane road diet.

José's Department of Transportation. In June of 2016 the San José City Council voted unanimously to make the road diet permanent.

Data Collection and Analysis Methods

This study analyzed data obtained from the City of San José's Department of Transportation, which had collected traffic volume and speed data using pneumatic road tubes placed at 45 locations in the Willow Glen neighborhood. The locations were distributed throughout the neighborhood, across four different "street types," as follows:

- Lincoln Avenue road diet: 2 locations within the road diet implementation zone;
- Lincoln Avenue non-road diet: 4 locations along Lincoln Avenue outside the road diet area;
- Major streets: 16 locations along major roads within Willow Glen; and
- Neighborhood streets: 23 locations along neighborhood streets thought most likely to be impacted by the road diet because they were close to Lincoln Avenue or likely to serve as an alternate route.

Data were collected on traffic volumes and speeds over three weekdays before the implementation of the road diet in February 2015 and again one year later in February 2016.

The analytical approach taken here focuses on descriptive changes in traffic volumes and speeds across the four *types* of street location—the Lincoln Avenue road diet segment, Lincoln Avenue non-road diet segment, major streets, and neighborhood streets. (For a detailed analysis of all 45 individual locations and discussion of key localized impacts, see Nixon et al., 2017. [3])

Findings

This section looks first at how the road diet impacted traffic volumes and then at the impact on the number of speeders. Each subsection starts with a look at the most aggregated data—all-day data averaged for all locations in each street type—and then moves to a more nuanced look at the impacts by time of day.

Traffic Volume Impacts

We analyzed volume impacts in two different ways: mean values for each street type, considering both all-day volumes, and also impacts by time of day (peak-hour volumes and volumes for each hour of the day).

All-Day Impacts

Data in the first row of Table 1, showing all-day traffic volumes before and after the road diet, suggest that the road diet did not divert traffic to other streets in the neighborhood. Although volumes fell noticeably at the Lincoln road diet collection points

(-6 percent), traffic volumes for the other street types also fell or, in a few cases, remained essentially flat. Overall, total traffic volume in the Willow Glen area declined by 2 percent after the road diet, suggesting that some vehicles may have diverted completely out of the area to other surrounding neighborhoods or major highways.

Impacts by Time of Day

We analyzed impacts by time of day looking at both peak hourly volumes and volumes for each hour of the day. Traffic fell noticeably more during the peak hours than it did for all-day counts on both types of Lincoln Avenue locations, though not for the major streets and neighborhood streets (Table 1). For example, traffic volumes during the morning peak hours dropped 23 percent at the Lincoln Avenue road diet locations, compared to an all-day drop of 6 percent. By contrast, the major streets saw tiny peak-hour volume changes (1 percent AM increase and 2 percent PM decrease) that were similar to the all-day measure for those locations. Finally, the neighborhood streets saw no change in morning peak-hour volumes but 6-percent fewer vehicles in the afternoon peak hours.

Table 1. Traffic volumes, pre-and post- road diet, by street type and time period.

Time period	Lincoln Avenue – road diet				Lincoln Avenue – no road diet				Major streets				Neighborhood streets			
	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)
Vehicles per day	15,722	14,761	-961	-6%	13,695	13,420	-275	-2%	12,107	12,058	-48	0%	1,939	1,850	-89	-5%
Vehicles per AM peak hour[a]	1,392	1,072	-320	-23%	1,312	1,147	-164	-14%	944	950	6	1%	187	187	0	0%
Vehicles per PM peak hour[a]	1,246	1,111	-134	-12%	1,171	1,053	-118	-10%	1,005	984	-21	-2%	156	147	-9	-6%

Source: Nixon et al., 2017.[3]   Note: Green font indicates a drop in volume.   [a] AM peak = 7 AM – 9 AM; PM peak = 4 PM – 7 PM

Table 2. Speeders traveling 5 or 10 mph above the speed limit, pre-and post- road diet, by street type and time period.

Time period	Lincoln Avenue – road diet				Lincoln Avenue – no road diet				Major streets				Neighborhood streets			
	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)	Pre (#)	Post (#)	Change (#)	Change (%)
Vehicles 5+ mph over																
All day	3683	2058	-1625	-44%	1532	1897	365	24%	1571	1946	375	24%	461	536	75	16%
AM peak hour[a]																
# of vehicles	421	190	-231	-55%	119	143	25	21%	117	157	40	34%	45	60	15	34%
% of vehicles/hour[b]	30%	18%	--c	--c	9%	12%	-c	--c	12%	17%	--b	--b	24%	32%	--c	--c
PM peak hour[a]																
# of vehicles	266	98	-168	-63%	144	182	37	26%	131	171	40	31%	54	60	6	12%
% of all vehicles	21%	9%	--c	--c	12%	17%	--c	--c	13%	17%	--b	--b	35%	41%	--c	--c
Vehicles 10+ mph over																
All day	877	352	-525	-60%	270	371	101	38%	257	367	111	43%	86	117	31	36%
AM peak hour[a]																
# of vehicles	97	29	-68	-70%	16	27	10	63%	17	27	10	59%	8	12	4	53%
% of vehicles/hour[b]	7%	3%	--c	--c	1%	2%	--c	--c	2%	3%	--b	--b	4%	6%	--c	--c
PM peak hour[a]																
# of vehicles	51	10	-42	-82%	24	34	10	42%	17	26	9	53%	9	11	2	28%
% of all vehicles	4%	1%	--c	--c	2%	3%	--c	--c	2%	3%	--b	--b	6%	8%	--c	--c

Source: Nixon et al., 2017.[3]   Note: Green font indicates a drop in volume.   [a] AM peak = 7 AM – 9 AM; PM peak = 4 PM – 7 PM.
[b] This measure is calculated as the percent of all vehicles travelling during the peak hour that are going 5+ mph over. Table 1 shows the number of vehicles per peak hour, used in the calculation here.   [c] Not applicable.

Traffic Speed Impacts

We investigated the road diet's impact on speeding by looking at two measures of "speeders," the number of vehicles traveling 5 mph (8 km/h) or more over the speed limit and the number of vehicles traveling 10 mph (16 km/h) or more over the speed limit. These metrics were chosen to look directly at the number of "problem" drivers per se—the people traveling too fast for safety.

All-Day Impacts

Looking at all-day effects (Table 2), the road diet successfully reduced the number of speeders along the road diet segment, especially the number of 10+ mph speeders, which fell by 525 vehicles, a 60-percent drop.

In contrast to the road diet locations, the three other street types all saw the number of speeders increase, with the increases being fairly large—double digits—in percentage terms. The change was most pronounced on the major streets. The number of 5+ mph speeders went up 24 percent, an increase of 375 vehicles over the day. For the 10+ mph speeders, the percentage increase was even greater (43 percent), though the number of additional speeding vehicles was lower (111 vehicles).

Impacts by Time of Day

For almost every street type, the percentage change in the number of speeders was greater during the peak hours than for the all-day counts, and the change was usually more extreme in the AM peak than the PM peak (Table 2). The only exception to this pattern was for the neighborhood streets, where the percent increase in PM-peak-hour speeders was lower than the all-day increase.

Options for Presenting the Data

A key objective of this study was to identify methods to present the study findings so that readers could easily grasp the meaning and significance of data. In addition to the tables shown above, we developed two different methods to present findings graphically that emphasize the change from pre- to post-diet conditions.

Figure 2 presents the numbers of 10+ mph speeders as a set of three line and bar graphs. One line graph shows the number of speeders pre and post-diet, while the other line graph shows the percentage of all vehicles that were speeding in both time periods. The area between the yellow and blue lines represents the change from one time period to the next. The bar graph makes it easier to understand the *change* from one time period to the next, with increases in speeders above the y-axis (zero line) and decreases below that line.

Although this paper does not discuss detailed findings about impacts at individual counter locations, we include Figure 3 as an example of a method to show in map form the change 10+ mph speeders at each counter. This presentation permits readers to easily identify spatial patterns in data.
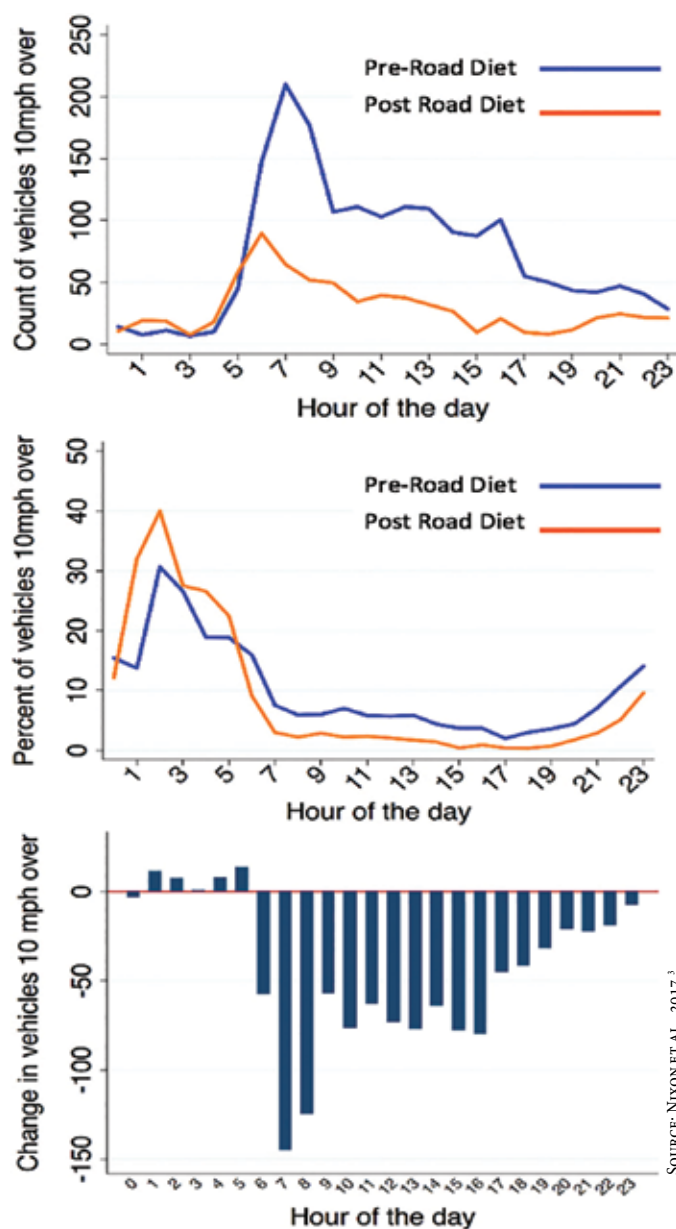

Figure 2. Vehicles traveling 10+ mph above the speed limit, pre- and post-road diet, by hour of the day, Lincoln Avenue Locations. Note: Y-axis scales differ for each graph.

Source: Nixon et al., 2017.[3]

Recommendations for Evaluating Speed and Volume Impacts from Road Diets

This section provides recommendations for how city staff and researchers can design road diet evaluations to effectively assess speed and volume impacts. These recommendations flow from our analysis of City of San José data, as well as from our review of other road diet evaluations. First, suggested approaches to designing the data collection plan are discussed, followed by suggestions for the data analysis approach.
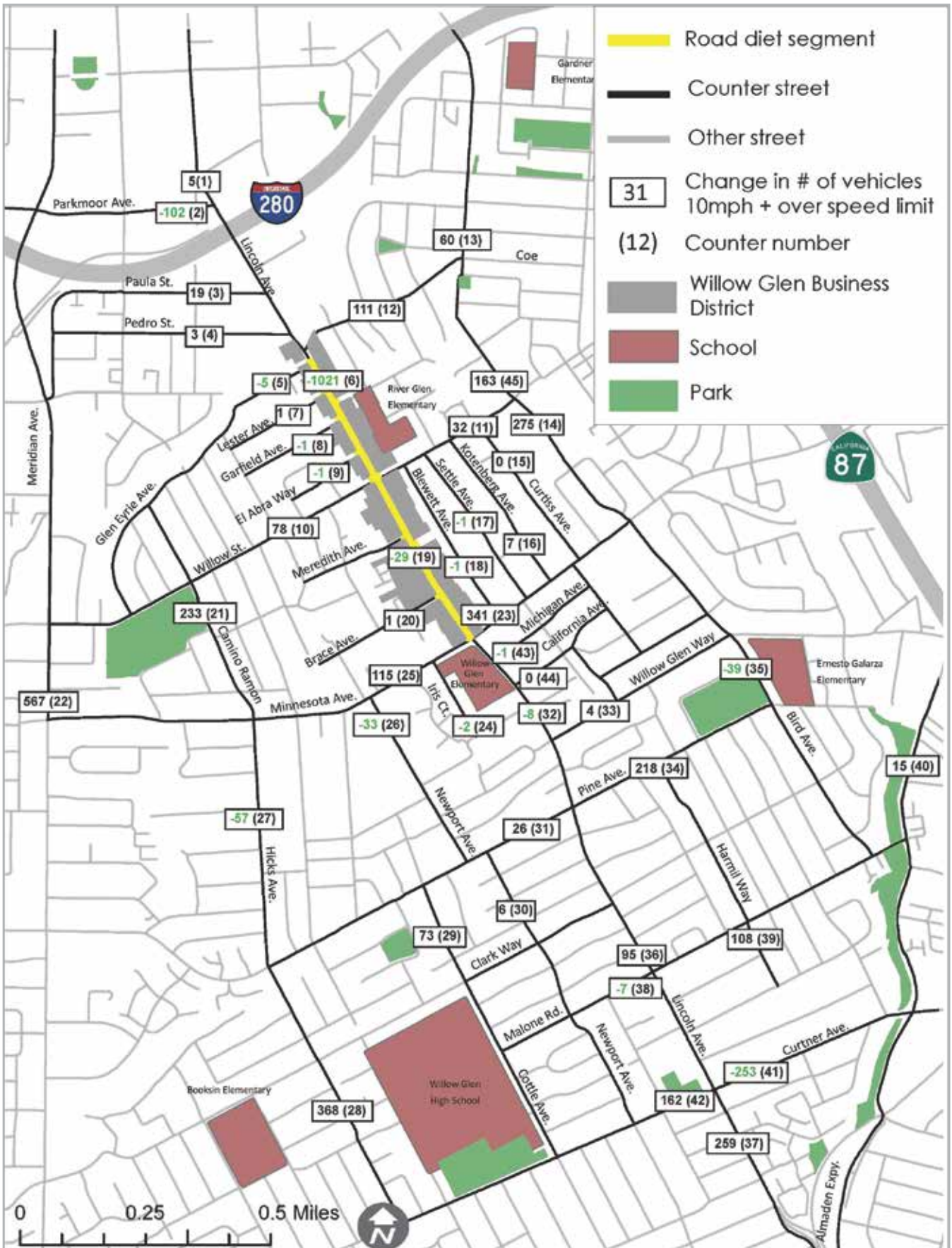
Figure 3. Map-based view of the change in number of vehicles 10+ mph over the speed limit, pre- and post- road diet, by counter location.

Designing the Data Collection Plan

Carefully planning a road diet data collection effort, with an eye to the way the information will later by analyzed, permits high-quality evaluations. By contrast, without careful planning there is risk of spending a great deal of time and money collecting data that ultimately does not allow evaluators to assess the project impacts with any certainly or nuance. In short, if an agency plans to invest the money to evaluate speed and volume impacts at all, it is worth making sure that this investment is carefully designed to get the maximum benefit possible.

Our experience with the strengths and limitations of the Lincoln Avenue data supports the following recommendations for road diet evaluation plans:

- Collect data on enough days to smooth day-to-day variations. A power analysis is useful to determine the minimum amount of data needed to perform statistical analysis.
- Collect and share raw data for every vehicle instead of packaging data into categories (to enable a wider range of analytical approaches).
- Develop a method to compare changes in traffic volumes and speeds in the road diet area with changes outside the road-diet neighborhood itself.
- Select days for evaluation with "regular" traffic patterns.

Data Analysis Approaches

To prepare this paper, we explored numerous options for different speed and volume impact metrics, for statistical testing of the road diet impacts, and for displaying the results graphically. Based on this experience, we recommend conducting the data analysis and communicating the findings as follows:

- Analyze and present the impacts at each data collection location as well as impacts by street types;
- Analyze impacts by time of day as well as by all-day metrics;
- Present findings about changes as both actual counts and percentages;
- Design graphics that emphasize the changes between the pre and post periods; and
- Look at the numbers of "speeders," rather than mean speeds, to identify safety outcomes.

Acknowledgments

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