GUIDELINES FOR ROAD DIET CONVERSIONS

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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.

INTRODUCTION

Rural and urban roadways are becoming increasingly congested throughout the US and other countries, and solutions frequently seek to improve modal options including, bike, pedestrian and transit facilities. A typical approach for solving this problem has been the addition of lanes, but this approach is an expensive and environmentally disruptive practice that frequently offers only short term relief. The need for innovative solutions in addressing mobility and safety concerns in an environment with budgetary constraints is paramount. Such innovative solutions seek to develop multimodal corridors while retaining the original right of way and among them is the concept of road diet, where the number of travel lanes is reduced. Road diets usually involve restriping a four-lane undivided road as a three-lane road with two through lanes and a two-way left-turn lane (TWLTL). This creates surplus roadway width that can be used to to widen existing lanes, create bicycle lanes, supply on street parking, widen sidewalks, or provide opportunities for landscaping and aesthetic improvements.

On roadways with high access density, the inside through lane on a four-lane undivided roadway often acts like a de facto turn-lane. This operation can block through traffic, diminishing operations, as well as introduce crash patterns such as rear end crashes and sideswipe crashes resulting from the stopped left turn traffic. The introduction of a TWLTL can often meet the left-turn demand for both directions of travel in a single lane. This modification can then improve safety and mobility by removing turning traffic from the through lanes. Therefore, road diets are a design tool that can be used within existing right of way at a very low cost to improve mobility, and they frequently have no or few negative impacts.

Past research has focused primarily on case study evaluation of road diets and on safety performance of these treatments. However, there is little literature providing guidance on the details of the designs or information as to when such conversions will work. The need to identify criteria to be considered for establishing road diets is critical and should be addressed so that state and local agencies can expand their use. A review of all State DOT design manuals did not identify any guidance for road diet conversions, which can hinder their adoption. This study provides such guidance in determining the appropriateness of road diet conversions and identifies parameters to be considered during such evaluations.

LITERATURE REVIEW

Road diets have been shown to improve operating efficiency and safety for all users. The operational efficiency is the result of removing left-turning traffic from through traffic and thus eliminating delays and queues behind turning vehicles while at the same time minimizing lane change maneuvers(due to the single through lane). Case study review has shown road diets to be effective on roads with an average daily traffic (ADT) of up to 25,000 vpd, while other studies have indicated that capacity is not affected by the elimination of the lane and often no increase in congestion is observed (1, 2). Improvements in livability conditions and associated benefits are elements to be considered during road diet conversions, as review of past case studies has indicated (3). Road diets make it easier for pedestrians to cross the road at both signalized and unsignalized intersections, increase feeling of a "safer and more comfortable" street, encourage an increase in pedestrian and bicyclist traffic, and encourage economic growth and redevelopment at a quicker pace (3).

A recent study in Iowa evaluated crash data for 30 sites (15 road diets and 15 comparison sites) over a 23 year period (4). The study concluded that, after conversion, there was a 25.2 percent reduction in crash frequency and an 18.8 percent reduction in crash rate. Another study using Minnesota road diet conversions also supported safety gains for such roadways (5). Their study showed reductions of approximately 44 percent in the total number of crashes. In addition, the results showed reductions for injury crashes (45.7 percent) and right angle crashes (37 percent). Reductions were also noted for rear end and left-turn crashes but these reductions were not statistically significant. The study also evaluated before-and-after speeds showing reductions both in mean and 85^{th}-percentile speeds after the roadway conversion.

A study conducted by the FHWA evaluated recent road diet conversions and developed crash modification factors (CMF) for such conversions (6). The study identifies basic benefits of road diets, such as speed reduction, improved safety, and reduced vehicle-pedestrian conflicts. A main goal of the study was to update an earlier study that documented an 18.8 percent reduction in crash rates for road diet conversions (7). The study used a Bayesian approach to compare untreated sites to those where a road diet was implemented. The results clearly indicate that there are safety benefits from these conversions and the magnitude of the benefits depends on the characteristics of the site. Other results include an average reduction of 5 mph in the average speed of motorists and a decrease in percent of drivers driving over 5 mph above the speed limit. The study recommends a CMF of 0.71 for road diet conversions indicating a 29 percent reduction in overall crashes after a road diet installation.

The first attempt in defining operational guidelines for road diet conversions was completed in 2001 (8). This effort relied on evaluating before-after conditions on existing road diet projects completed at that time and documented several of the benefits from such conversions. The case studies reviewed showed that the 85^{th}-percentile speeds were in general reduced by less than five miles per hour and there was a significant decrease for speeds above the posted speed limit. The review also identified safety improvements with total crash reductions between 17 to 62 percent. The 13 roadway conversions reviewed had ADT volumes of 8,400 to 24,000 vehicles per day (vpd). Simulation was also used to identify potential factors that could be used in determining whether a road diet conversion would be appropriate. The study recommended that a road diet conversion could be considered feasible for roads with an ADT between 15,000 and 17,500 vpd. However, the simulation scenarios only evaluated side street volumes at 40 percent of mainline volumes and three left turn percentages. This limited variation of volume distribution does not provide adequate consideration of potential sites where road diets may be beneficial or even feasible. The authors emphasized that individual detailed analysis is required once such conversions are considered feasible in order to evaluate the corridor conditions and details, such as access frequency and left-turn percentages. The study also identified a list of elements that need to be considered during the evaluation process.

A more recent attempt to improve on the prior guidelines for road diets was completed in 2006 (9). The main effort was to assess existing road diets and identify the livability benefits from such roadway conversions considering improved mobility for all users and enhanced street character. The resulting effort developed a step by step process in planning, analysis, and implementation of road diet projects and provided a guide for decision-makers. However, the process developed is general in nature and does not provide specific guidance regarding volumes or left-turn percentages indicating when such a project could result in improved operational and safety conditions.

Based on this review, the literature is inadequate with respect to providing guidance on implementing road diets. The need to identify criteria to be considered for establishing road diets is critical and should be addressed.

METHODOLOGY

Typically, road diet conversions will operate at acceptable levels as long as the signalized intersections do not present any operational problems. Therefore, this analysis focused on evaluating and comparing the operation of three- and four-lane roads at signalized intersections. In order to adequately evaluate signalized intersection operations, a full range of mainline and side street volumes, as well as left turn percentages, needed to be evaluated. Evaluation of a full range of these parameters examines a wide array of the potential operating conditions for road diet roadways. Two methods were used to evaluate signalized intersection operations. The first utilized Critical Lane Analysis (CLA) to determine the capacity of each lane and volume configuration. The second relied on micro simulation studies to compare operational performance of three-lane and four-lane sections through the full range of volume combinations.

Critical Lane Analysis, as developed by Messer and Fambro (10), uses the geometry of the intersection along with intersection traffic volumes as the basis for establishing a measure of potential performance and, by extent, of capacity. The method apportions traffic volumes to each of the available lanes and considers the phasing plans that could be appropriate to accommodate the intersection movements. A critical volume (i.e. heaviest lane volume or combination of lane volumes) for each phase is calculated and the sum of these volumes is the total critical volume for the intersection. This methodology establishes the capacity of the intersection based on the volume of conflicting flows for different phasing options and geometry. In general, a critical sum of 1,400 is assumed to allow for under capacity operation for a signalized intersection.

A series of simulations were undertaken to establish the required guidelines for road diet conversions. A total of 480 combinations were used for the simulations, i.e. 10 volume scenarios for eight left turn percentages and six cross street volumes. These scenarios included:

1. Mainline volumes ranging from 6,000 to 24,000 vpd with 2,000 vpd increments and assuming that 10 percent of the volume will occur during the peak hour. One directional split (50/50) was utilized.
2. Cross street volumes were varied between 3,000 to 13,000 vpd with 2,000 vpd increments. There was only one directional split (50/50) and a 10 percent estimate of left and right turns was used.
3. Left-turn percentages were used ranging between 5 to 40 percent with increments of 5 percent.
4. Right turn percentage was set at 15 percent and not varied as right turn volume has minimal effect on capacity of the through movement.
5. All cross-street scenarios utilized a three-lane cross-section which limited the capacity of the cross street.

Simulations were performed with the CORridor SIMulation (CORSIM) and vehicular delay was calculated for each approach independently. The data obtained from the simulation analysis was then used to develop predictive models of intersection delay that could be used in establishing potential guidelines for the implementation of road diets. The Statistical Package for the Social Sciences (SPSS) was utilized to develop these models.

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RESULTS

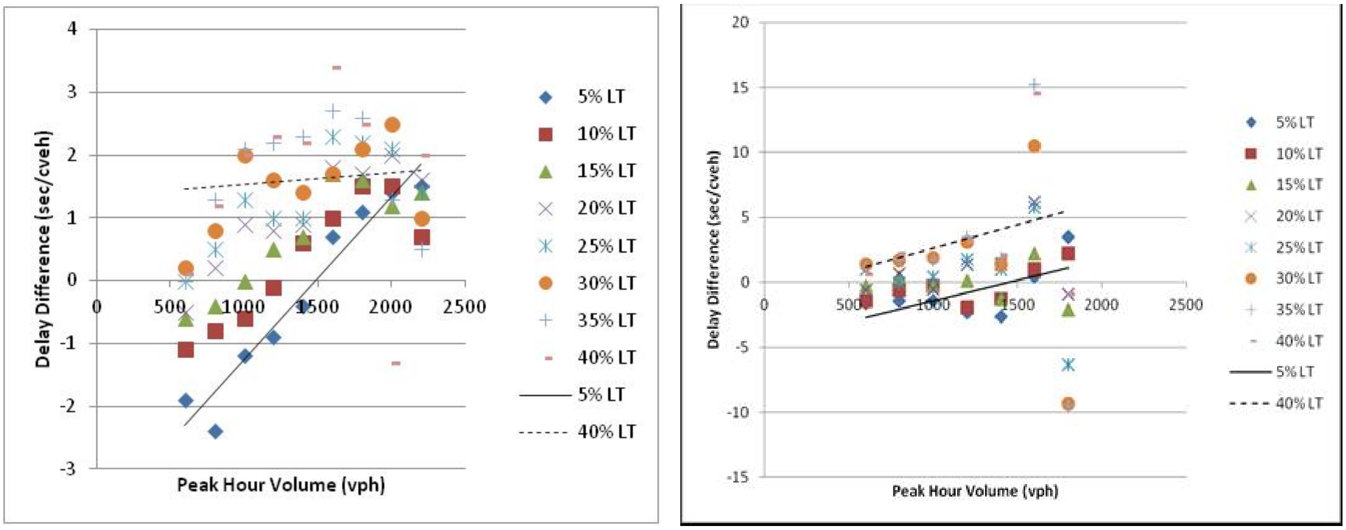
Critical Lane Analysis

While some research and case studies of road diets seem to indicate that road diets can produce increased capacity on roadways, a review of the critical lane analysis does not support this conclusion. CLA provides for the condition where a four-lane roadway may operate as a three-lane road because the inside lanes will be required to accommodate left-turn volumes and act as a dedicated left-turn lanes (aka a de facto left-turn lane). In this case, both the three and four lane roads will produce the same critical volume for the main street. However, when left turn volumes are reduced, additional through capacity can be attained through the use of the shared left-through lane. The left turn volume at which the three and four lane sections are equivalent is dependent on the left turn equivalency factor used in the CLA analysis and generally occurs when left turn volumes are between 25 and 33 percent of the mainline volume. What this analysis demonstrates is that the critical volume of the four-lane road will always be lower than that of the three lanes, since the through traffic is distributed in more than one lane until the inside lane becomes a de facto left-turn at which point the four and three lane alternatives will be equal.

Micro Simulation

The simulation results from CORSIM support the assumption that a four-lane option will have a critical lane volume lower than that of a three-lane alternative. This could indicate an operational advantage of the four-lane option when compared to that of the three-lane. These results are discussed below by examining the delay difference between the three- and four-lane options for a signalized intersection. The difference is calculated as the delay of the three-lane minus that of four-lane option. Therefore, a negative number indicates that the three-lane option has a lower delay than the four-lane option for the specific volume combination. Another issue to be noted in the analysis is that the peak hour volume used is the bidirectional traffic for the street.

The delay differences for the 300 vph side street volume show different trends for each percent of left-turns evaluated (Figure 1.a). For low left-turn percentages, the trend shows that at low volumes the three-lane option is “better” than the four-lane (i.e. negative delay differences) and as the volumes increase the delay differences become smaller. At approximately 1,500 vph on the main street, the four-lane option becomes “better” (i.e. delay differences are positive) indicating that the delay with the three-lane option is greater than that of the four-lane. For the higher percentages of left-turns, delay differences remained practically the same as the volumes on the main street increased and for all combinations the four-lane option was “better” than the three-lane alternative. These data indicate that there is a region for low volumes on the main and side streets that the road diet option will result in an operational advantage, i.e. lower delays, than the four-lane option.



a. 300 vph side street volume b. 1,300 vph side street volume

Figure 1 Signalized intersection delay differences (3-4)

The effect of high side street volumes was evaluated to determine whether the noted trends hold (Figure 1.b). The data shows similar trends for both low and high left-turn percentages as those observed in the other side street volumes. It should be noted that this analysis only includes volumes up to 1,800 vph along the major street as the high side street volumes create lower capacity on the main street thus resulting in oversaturated conditions.

The data in Figure 1 indicates that there are certain conditions where the road diet could be the preferred option over a four-lane alternative. The data also indicates that there is an effect of the side street volume in determining these conditions and that the combination of main and side street volumes needs to be considered in determining whether the road diet is appropriate. Finally, the left-turn percentage has an effect and this should be considered in conjunction with the traffic volumes.

Of interest is also the magnitude of the differences in delays observed in this analysis. Most delay differences were small (less than 5 seconds for the low side street volumes), indicating practically or statistically no significant operational gains or losses between the two options (Table 1). The average values for each side street volume for all left-turn percentages evaluated were less than 1.0 sec/veh indicating again that the delay differences are not statistically significant.

Table 1 Range of delay differences by side street volume

	Delays			Queues		
Side Street (vph)	Min (sec)	Max (sec)	Avg (sec)	Min (veh)	Max (veh)	Avg (veh)
300	-2.4	3.4	0.98	-1	1	0.07
700	-4.5	3.6	0.50	-2	2	0.03
1300	-9.5	15.5	0.94	-3	3	0.30

Another aspect that could be of interest regarding the operational efficiency of road diets is the resulting queue lengths. A queuing evaluation was completed using the same simulation scenarios presented above. The analysis showed that overall the road diet produced similar or smaller queue lengths than the four-lane roads. The effect of the side street volume was considered here as well and the results for the same three volumes used in the delay analysis are shown. A review of the range of values noted here also indicates that overall there are no statistically significant differences between the two options when the average queue lengths are considered (Table 1). The largest differences were noted for the 1,300 vph side street volume scenario, and the averages for each side street volume were less than 0.5 vehicles, again virtually the same.

A similar delay and queuing analysis was undertaken for unsignalized intersections to evaluate the road diet effect. In this case, all delays along the major road were very small (less than 4.5 sec/veh) and the three-lane option had slightly higher delays than the four-lane option. However, these differences were very small and most were less than 2.5 sec/veh, with the majority (56 percent of the cases) of the delay differences being 1 sec/veh or less.

The main differences in the unsignalized intersections were noted for the delays on the side street approaches. For all scenarios tested, the delays on the side street for a road diet conversion were smaller than those observed for the four-lane road. The data was analyzed in a similar manner as that of the signalized intersections to evaluate the effect of left-turn percentages in conjunction with the main street volumes. The results indicated that for all cases examined, the side street delays improved when a road-diet is implemented for any combination of main street volume and left-turn percentages and these differences increased as both volumes and left-turn percentages increased. It is apparent that the gains materialized from road diet conversions for unsignalized intersections could outweigh the minor delay increases along the main street as was discussed above and thus improve the overall intersection operations as compared to the four-lane option.

Operations Models

The analysis completed here was also used to develop prediction models that could allow for establishing guidelines and identifying the conditions under which road diets could improve the operational efficiency of the roadway. The Statistical Package for Social Sciences (SPSS) was utilized to develop these models. Linear regression models were used to model the delay for each condition, i.e. three- and four-lane options, and identify the variables that could predict these differences. The variables considered include the volumes of the main and side streets as well as left-turn percentage.

The model for the three-lane included all three variables of concern and had a good predictive power with an R^2 of 0.48. The model coefficients are summarized in Table 2. The four-lane model also utilized all three variables but the predictive power was lower (R^2=0.28). The variables included in the equations reflect the effect of traffic volumes on delays and their signs indicate that increasing volumes will result in greater delays. The same is true for the left-turn percentage where larger percentages will lead to greater delays.

Table 2 Coefficients for predictive models

Variable	Three-lane		Four-lane	
	Parameter	P value	Parameter	P value

Intercept	-29.113	0.00	-47.968	0.00
Main street volume (vph)	0.013	0.00	0.022	0.00
Side street volume (vph)	0.025	0/00	0.037	0.00
Left-turn percentage (number)	0.313	0/00	0.314	0.00

These models can be used to define the scenarios where the three- and four-lane options produce a delay difference of zero, i.e. both options will perform equally well. This will produce the line of equality which can then be used to establish the regions where road diets are advisable and those where they are not. Figure 2 presents this concept with the blue line identifying when delays are the same for both options. The combinations below the blue line indicate lower delays associated with the implementation of a road diet. The red line in the figure identifies the volume combinations where the roadway will operate under capacity with a road diet and is based on the critical lane volumes between three and four-lanes are equal. Utilizing these concepts, Figure 2 defines three areas with respect to road diet installations. The lower area called “Recommended” identifies the volume combinations where the road-diet will perform below capacity and result in operational gains. The upper area “Not-recommended” identifies the volume combinations where the roadway will operate above capacity, and will have higher delays than the four-lane alternative. A road diet operating in this range will likely result in undesired congestion. The area between the two lines is considered as the area requiring additional investigation to determine the feasibility of a road diet conversion. A road diet in this area will operate under capacity, but may have higher delays than the four-lane section. Thus analysis should be completed to determine the impacts that would result from the road diet.

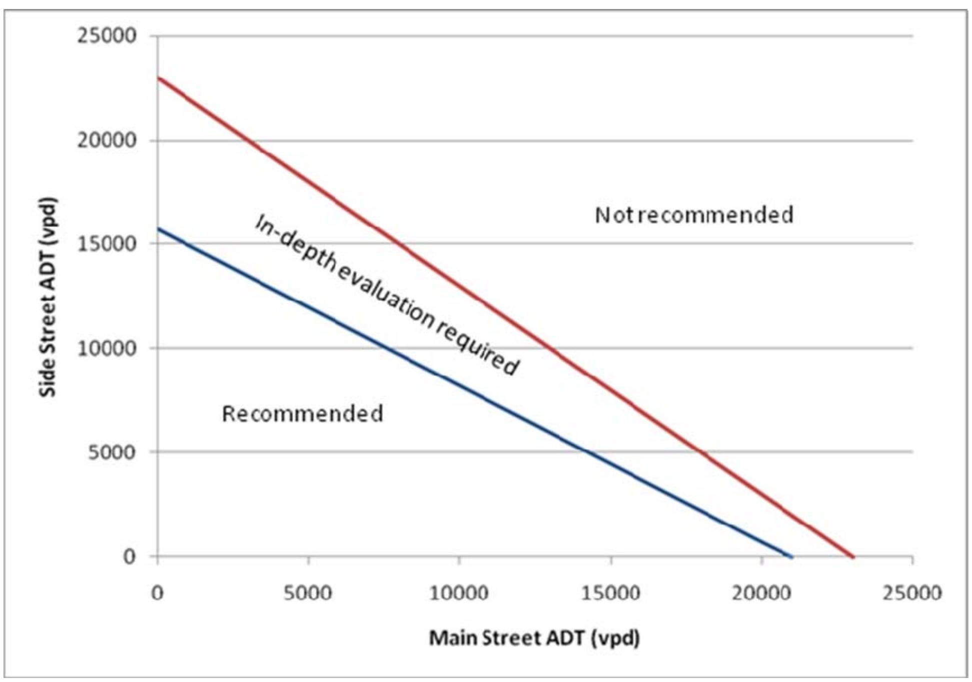


Figure 2 Guideline for operational performance at signalized intersections

The operational guidance developed is based only on main and side street volumes, since it was determined that the operation of the signalized intersection is the critical aspect for a road diet conversion based on the analysis conducted here and since road diets will result in improved conditions at unsignalized intersections. While left turn percentage was shown to be a significant parameter for the capacity and delay of an intersection, it has the same effect for both the four-lane and three-lane sections and therefore provides no differentiation between the alternatives. In other words, once the effect of the main and side street volumes on delays have been accounted for, the left-turn percentage does not contribute any additional delay to the difference between the two options.

The evaluation of the unsignalized intersections indicated that for all scenarios evaluated, the road diet will result in lower delays along the side street, which could outweigh the minor increases along the main street. It was therefore deemed appropriate to not develop a similar guidance as the one shown in Figure 2 for unsignalized intersections. Therefore, unsignalized intersections or access points are not a significant determinant of the success or failure or a road diet project. Even unsignalized access points with high volumes of left turn traffic on the major street will continue to operate at acceptable levels of service while signalized intersections may fail due to the reduced mainline capacity. The primary concern for unsignalized access points is overlapping left turn movements within the two-way left turn lane, which is avoided with the four-lane section. The existing KYTC auxiliary turn lane policy currently addresses this concern by recommending against the use of TWLTLs for access point densities greater than 85 access points per mile (11).

GUIDELINES

The data analyzed here was utilized to develop guidelines for road diet conversions. The guidelines have been developed as a standalone document and they can be used to determine the steps required for a road diet conversion (12). A brief description of the guidelines is provided here.

Road Diet Conversions

The guidelines focus on the determination of whether a road diet application is appropriate considering operational, safety, and other factors that could have a bearing on the decision to implement a road diet conversion. To achieve this, a flow chart was developed that identifies the various steps to be taken when such decision is evaluated (Figure 3).

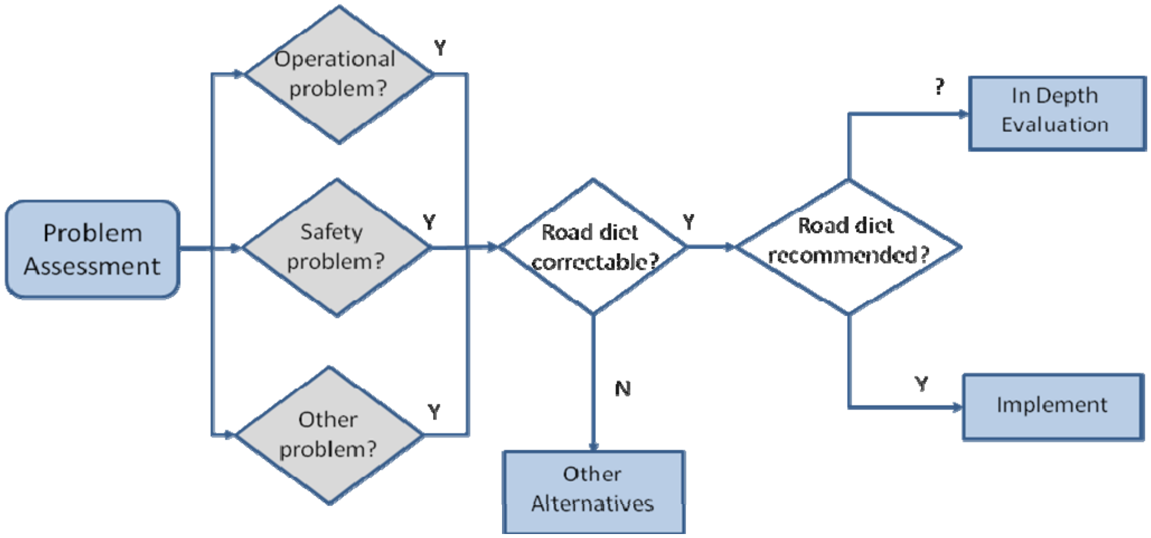


Figure 3 Decision-action flow chart for road diet evaluations

The flow chart allows the user to identify the appropriate action to be undertaken in order to determine whether the road diet will improve the operations, safety or other performance issues associated with the road. To address this, lists of possible problems correctable by a road diet implementation are identified (Table 3). In addition to these lists, the required items for conducting an in-depth evaluation are also identified in order to allow for a complete evaluation of the implications from a road diet implementation.

Table 3 Road diet correctable problems

Category	Problem	Rationale
Operational	Delays associated with left-turning traffic	Separation of left-turning traffic have shown to improve delays at signalized intersections
	High side street delays at unsignalized intersections	Side street traffic requires shorter gaps to complete movements due to the consolidation of left-turns into one lane
	Other operational problems	Potential for including a bike lane could reduce bicycle delays
Safety	Rear end crashes with left-turning traffic	Removal of stopped turning vehicles from the through lane could reduce rear end crashes
	Sideswipe crashes	Elimination of need to change lanes to avoid delays behind a left-turning vehicle in the inside through lane reduces sideswipe crashes
	Left-turn crashes due to offset left turns	Elimination of the negative offset between opposing left-turn vehicles and increase of available sight distance reduces left-turn crashes
	Bicycle and pedestrian crashes	Bicycle lane separates bicycles from traffic; pedestrians have shorter distance to cross and can use a refuge area (if one provided)
Other	Bicycle and pedestrian accommodation due to lack of facilities	Opportunity to provide appropriate or required facilities increasing use by such users
	Aesthetics	Provision for landscaped medians and other treatments as see fit
	Traffic calming	Potential for uniform speeds and consistency; opportunity to encourage pedestrian activity

Road Diet Considerations

Typical considerations for road diet conversions include traffic volumes of the main and side streets and main street left-turn percentages. However, compatibility of the treatment with roadway functional classification, access frequency and land use should also be considered when determining the feasibility of a road.

Road diets may be proposed to address both safety and operational issues on roadways. The guidelines provide criteria to be considered in determining whether a road diet conversion is appropriate. These criteria include operational performance ranges that would support a road diet project as well as safety considerations that need to be evaluated. The operational performance identifies three ranges: 1) Volume combinations where the road diet is recommended because it will improve the operational performance (i.e. delays will be lower with the road diet), 2) Volume combinations where the road diet is not recommended because the operational performance deteriorates (i.e. delays will increase), and 3) Volume combinations where an in-depth evaluation is needed. The last range identifies cases where the road diet will operate under capacity, but may have higher delays than the four-lane section. Thus analysis should be completed to determine the impacts that would result from the road diet.

The crashes that could be affected by a road diet implementation were also identified. These included

- Sideswipe crashes, which can result from vehicles changing lanes to avoid delays behind a left-turning vehicle in the inside through lane. These types of crashes can occur at midblock access points and major intersections. Road diets eliminate these types of crashes by removing the turning vehicle from the through lane. Sideswipes can also occur between vehicles traveling on the two-way left-turn lane and those attempting to enter it but these crashes are not a frequent occurrence as prior research and case studies indicate.
- Rear end crashes, which can be the result of vehicles traveling in the inside through lane behind a stopping or stopped left-turning vehicle. . A road diet reduces these types of crashes by removing the stopped turning vehicle from the through lane. Road diets are anticipated to reduce rear end crashes on roadways with high volumes of left-turn traffic; however, increased congestion resulting from the lane reduction may increase rear end crashes on the main street under other conditions.
- Left-turn crashes, which can result from restricted sight distance caused by opposing turning traffic. Road diets address these types of crashes by providing a dedicated left turn lane and correcting the negative offset between opposing left-turn vehicles.

There are additional elements that should be considered when road diets are evaluated including

- multimodal operations, which can be improved with the implementation of a road diet,
- pedestrian safety, which can be improved with the addition of the refuge within the two-way left-turn lane,
- operational consistency where more uniform speeds along the corridor can be achieved, and
- livability, which can be improved by increasing opportunities for residential and commercial growth with a road diet.

Design Considerations

Various design aspects of the road diet conversion have been identified including recommended cross sections (dimensions of elements and possible components) along with methods to properly transition to and from the road diet to the existing roadway cross section. Transitions are recommended to occur at major change points, such as intersections, since they could allow for a more appropriate accommodation of turning movements. However, if necessary, transitions can occur at midblock sections, where it is recommended to place this away from intersections and/or high volume access points that would place stopped turning traffic in the through lanes of the merging traffic.

If not designed properly, these transitions can increase crashes removing any safety benefit of the road diet. All transitions should follow AASHTO's Policy on Geometric Design for Highways and Streets and MUTCD guidance for the reduction of through lanes.

An additional design issue of concern is the potential of high access densities to increase the likelihood of conflicts between traffic turning into and exiting the access point. This could affect safety along the corridor, since there is the potential for rear end crashes from vehicles slowing down to negotiate entering the access point and overlapping of left-turns between the main street and adjacent access points. According to KTC Auxiliary Turn Lane Policy, a non-traversable median and turn restrictions are recommended when a corridor exceeds 85 access points per mile (based on number of access points on both sides of the street).

Prior to the implementation of a road diet, it is recommended that a capacity analysis be completed for the major signalized intersections on the corridor to ensure that they would operate acceptably with a revised lane configuration. Analysis based on Highway Capacity Manual (HCM) methodologies is sufficient to check intersection capacities. For special cases, such as closely spaced intersections, coordinated signal systems, or corridors with at-grade rail crossings, micro-simulation is recommended to adequately evaluate arrival patterns and queue formation and dissipation.

Road Diet Not Recommended

The guidelines provide a list of conditions when a road diet may not be appropriate. These conditions include corridors where the operational efficiency may degrade as a result of the road diet, corridors where at-grade rail crossings or other conditions exists that may create queues that require a long time to dissipate; and high crash rates resulting from conditions not correctable by road diets. The latter condition reflects cases where crashes such as right angles are a problem. The use of a road diet will not address such crashes. Other scenarios include cases where adequate transitions cannot be developed or if left-turn lanes already exist on the corridor.

CONCLUSIONS

This paper provides the background and process used to develop a set of guidelines to determine when road diet conversions are feasible. A structured approach was followed that considered the operational evaluation of three- and four-lane roads and identified parameters significant to the successful operation of road diets.

An important aspect of the work completed here is the extension of the usable range of volumes where road diets could be beneficial. Past work recommended their application for roads with an ADT up to 17,500 vpd. The current research indicates that such conversions could work for roads with greater volumes, up to 23,000 vpd. Moreover, the findings here identify the effect of the side street volume, indicating that both volumes need to be considered when determining whether such a conversion should be considered.

Typical considerations for road diet conversions include traffic volumes of the minor and main streets, main street left-turn percentages, functional classification, access frequency and land use. Among these factors, functional classification is an important consideration but has limited effect on the decision of a road diet conversion. The roadway classification is meaningful for a variety of aspects, but the traffic volumes along the roadway are more critical than its classification. There is a wide range of volumes for roadways that are classified within a single category practically rendering this factor unusable for consideration in road diet conversions. The effect of access points is also important in determining operational efficiency and performance of a roadway. However, a review of existing cases indicated that there are great differences in access frequencies and this factor has a minor influence on the operational performance of the road diet (although it has been observed that a road diet cross-section can facilitate left-turn egress from access points). Finally, land use along the corridors reviewed was mixed with predominantly residential and commercial uses and had no discernible effect on the road diet performance. Given these considerations, the factors utilized here include traffic volumes and left-turn percentages as predictors for the operational and safety performance of the road diet conversion. However, the other factors noted above need to be considered when determining the overall feasibility of a road diet

Road diets may also improve the operational efficiency of signalized and unsignalized intersections on a corridor. Operational improvements are typically seen when high ADTs and high left-turn percentages are present on the primary and cross-street. Typically road diets are shown to have reduced delays and reduced queues when high left-turn percentages AND high volumes are present.

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