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Analysis and Comparison of Traffic Calming Methods, Traffic Calming Strategies and Tools

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ABSTRACT

Traffic calming programs, as the name suggests, are attempts to reduce vehicle speeds and reduce traffic volume. Therefore, there are several goals that are usually specified for programs. These include: Slow traffic speeds; Reduce interrupted traffic; Increase pedestrian, cyclist, and vehicle safety and reduce traffic noise pollution; Improve the beautification of the residential area and generally promote traffic safety and environmental goals. Although the accuracy of the results is often controversial. However, the results are usually good. With the access to electronic information in today's society, public policy for better analysis and evaluation of traffic calming is envisioned in this article. In this study, various calming methods and tools were examined around the world and how they are used, the disadvantages and advantages of each are explained. After traffic calming, the speed is reduced by eight percent. Compared to the eight percent reduction, the speed was reduced by only 3 km/h. However, reducing the speed from 37.5 km/h to 34.5 km/h on a street with a speed limit of 45 km/h cannot be considered a constructive method considering the costs incurred.

Keywords: Traffic calming, safe speed, traffic modeling, traffic straw speed.

1. INTRODUCTION

TRaffic calming is the process of encouraging people to find alternative modes of transport to drive more slowly and to drive respectfully towards residents when passing through their homes [1-3]. Traffic calming began in Europe about 40 to 50 years ago. The first roots of traffic calming were in the Netherlands. In the late 1960s, this was done by converting a street to prevent motor vehicles from entering and expanding the area of entrances to houses for residents. [4-6]

The Netherlands has used diversionary schemes, such as street closures, one-way streets, and other methods of traffic calming using physical measures such as speed bumps. These methods quickly spread to other countries such as Germany, Sweden, Denmark, England, France, Japan, and Austria. The Germans quickly realized that single-lane road calming would divert traffic [6-8]. They began planning to extend this scheme to major roads. Although traffic calming had been a preferred traffic management tool in Great Britain for the past decade and a few years, its development was overshadowed by the 1963 government paper Traffic in Cities, which was initially welcomed, which transformed traffic calming into a transport scheme and made the place livable. [9-12] Colin Buchanan, the author of this paper, is known as the father of traffic calming. Although Omaha, Nebraska, experimented with speed bumps on a few selected streets in the 1960s, their proposal did not fully incorporate traffic calming. Seattle, Washington, spent $12 million on residential street improvements, and thus had both the resources and public support for the development of traffic calming. Later in 1975, Berkeley, California adopted a citywide traffic management plan that specifically included traffic calming. [13-15] Although residential streets were the most studied and considered, the prospect of traffic calming methods for a wider range of streets was discussed. Initially, traffic calming programs in the United States proceeded without any administrative or governmental authorization, which was sometimes legally vulnerable [16]. However, their scale was less than that of the Europeans. “The American programs were characterized by the speed before and after, the volume, and the conflicting information created” but nothing comparable to the opportunities and difficulties of European studies. Some European societies have long since concluded that traffic calming should be confined to high-class roads. [17, 18] If traffic safety is to be livable and walkable, it should be moved to a separate area outside the road. [19] The lack of proper publicity and growing opposition to traffic calming make it impossible to move high-class roads in the United States. This may be indicated by the feeling that everyone wants traffic calming where they live, but will not accept that their path is on someone else’s [20].

2. METHODOLOGY

2.1. Types of Traffic Calming Devices

Traffic calming devices can be divided into one of two general categories, which mainly focus on one of the two items: traffic volume or speed. Volume control devices are those that transfer traffic to another route, or severely limit it, or act by eliminating traffic in an area. Examples of this type of device are: completely closed streets, semi-closed, diagonally transferred and semi-transferred.

Another category is speed control devices. This group includes three subgroups: vertical, horizontal and the type of width reducing devices. Vertical devices are devices that are installed vertically on the road and are used to force control of incremental accelerations and appropriate conversion to a reasonable speed. Speed bumps are the most extreme type of these devices. Horizontal devices are focused on changing lateral positions to divert vehicles from a direct and fast route to reduce their speed. Traffic squares and decoy devices are common examples of this type of device. Rather than using physical forces and width-reducing devices, it is appropriate to use “visual psycho-emotional perception” to limit the speed to a reasonable level. Limiting tables or width reducers are such devices. [21-24] There are a wide variety of traffic calming devices available. Each device has its pros and cons. Each is better suited to different types of street conditions and applications [25].

2.2. Types of Volume Control Methods and Devices

As mentioned earlier, the purpose of volume control devices is to reduce and attenuate the number of vehicles passing through a residential area. In general, this involves diverting traffic to another route that is more suitable for the flow of traffic. The following are some common examples of traffic control devices [26].

2.2.1. Closed or dead-end streets

This is probably the most fundamental traffic calming device that significantly limits the use of the street by citizens. Although it eliminates intermittent traffic, it may be perceived as a nuisance and an unnecessary restriction by the public. The use of vegetation, barriers, bollards, or landscaping to completely block traffic is illustrated in Figure (1) for the effect mentioned [26].

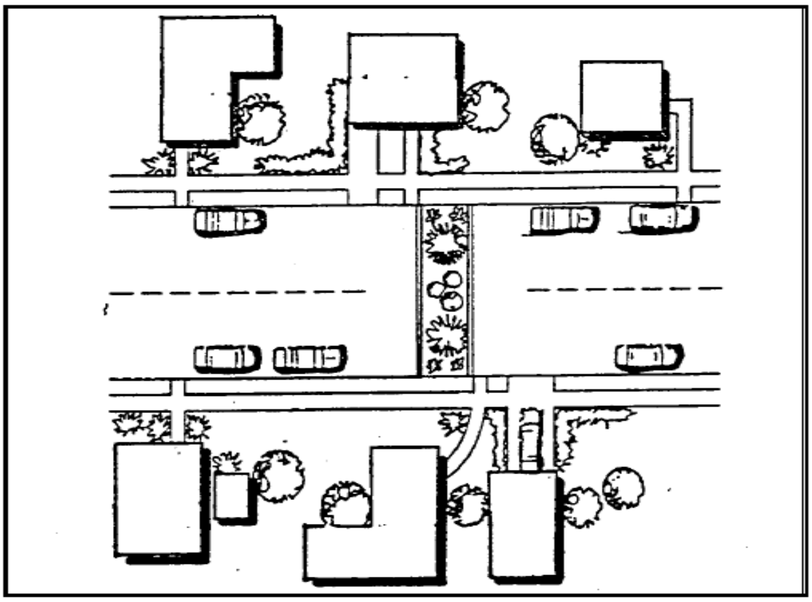

Figure 1. Linear regression Analysis of EC and TDS for Household Basin Water

2.2.2. Diagonal diverter

This particular device is placed diagonally at the intersection and is designed to interrupt the flow of traffic from one side of the intersection to the other. As a result, this type of device installation is very effective for intermittent traffic and maintains the continuity of vehicle routing. However, because there is no oncoming traffic flow, an increase in the turning speed of vehicles can actually occur. As shown in Figure (2), this can increase the length of the trip and cause inconvenience to residents [26].

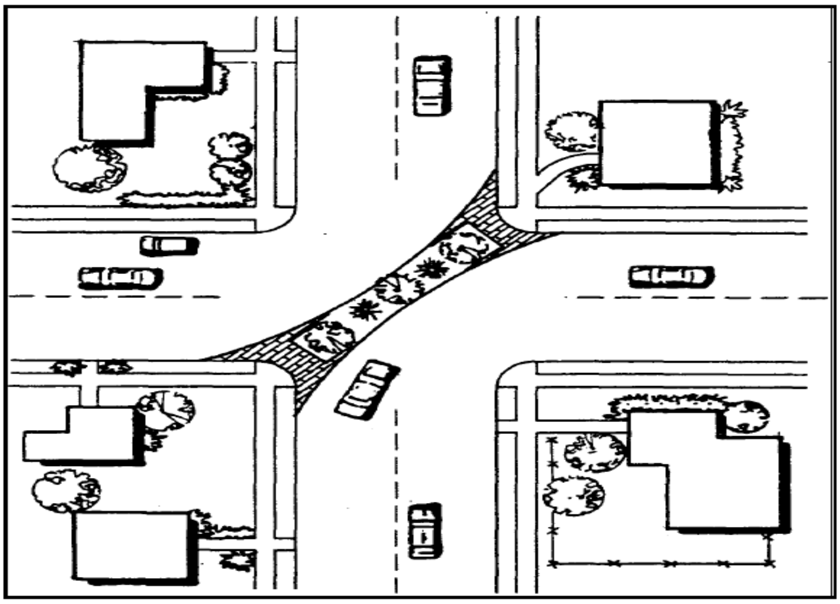

Figure 2. Diagonal transmitter [12]

2.2.3. Semi-Transfers

When the goal is to physically prevent one direction of traffic at a specific point on a two-way street, a semi-transfer traffic calming device is chosen, similar to that shown in Figure (3). In effect, this device prevents vehicles from circulating, or forces them to circulate, depending on the designer's preference. Intermittent traffic is reduced, but this is not 100% true for all drivers, especially when traffic flows in the future. Again, the travel time may increase for some residents of the neighborhood [27].

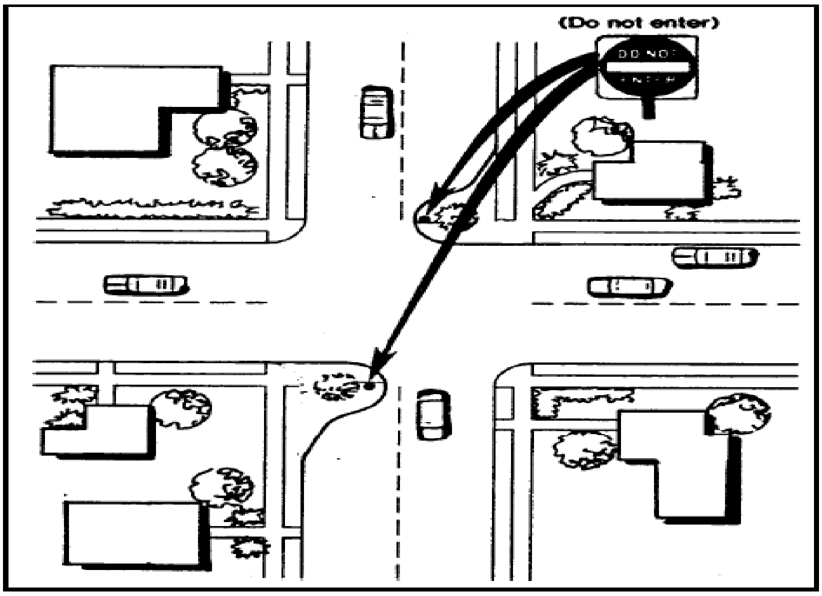

Figure 3. Semiconductors

2.2.4. Turn Prohibition

In principle similar to the semi-transmission, the turn prohibition device is used when a specific turn on a particular street is to be prohibited. This design is shown in Figure (4), and is very effective when one street at an intersection has more traffic than the other streets, or when we want to eliminate collisions and confrontations in two-way traffic. This device can also have detrimental effects on neighbors and residents in terms of access [27].

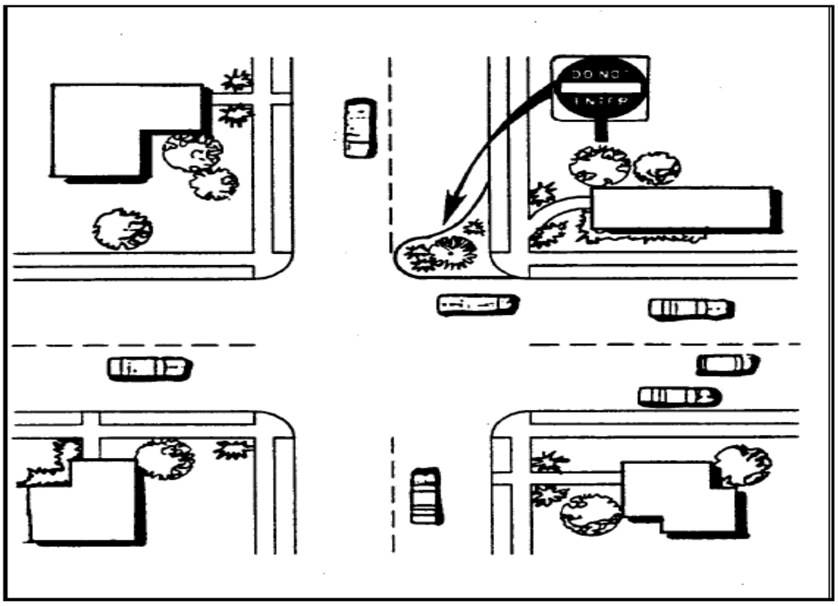

Figure 4. Movement ban.

2.2.5. Traffic Squares

Of the types of horizontal traffic calming devices, the square is probably the most discussed. It is a raised median that is placed in the middle of an intersection and forces drivers to choose their route to any street from the intersection they wish by going counterclockwise around the square. When a square is constructed, no vehicle can travel a straight line through the intersection, as shown in Figure (5). In general, cars are forced to "operate after entering the square," so the square's function is to show and create the right path for cars. Traffic squares increase confusion and danger for pedestrians and cyclists who want to cross the street [28].

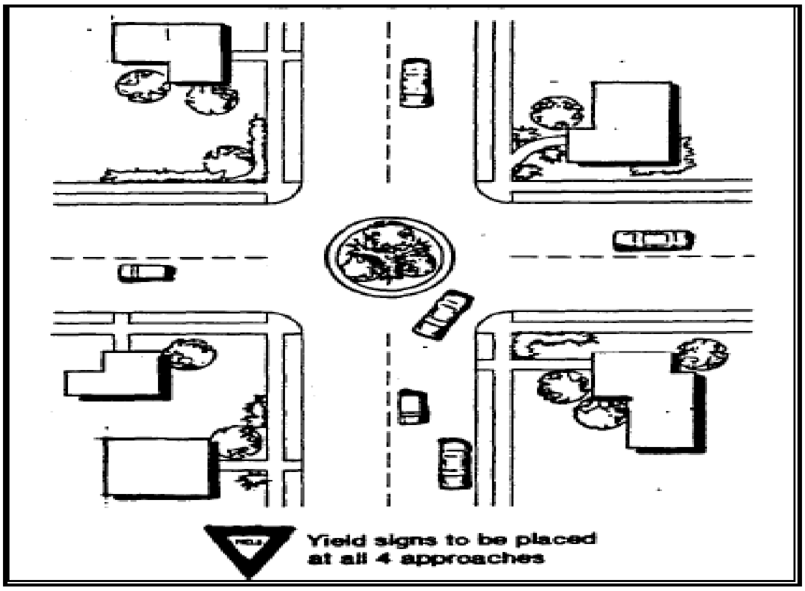

Figure 5. Traffic squares.

2.2.6. Deceptive Detours and Spirals

A deceptive design alters the path of vehicle travel on a street in a way that would not be as long if the street were straight. This is accomplished by installing curbs between intersections. As shown in Figure (6), these horizontal detours and twists force drivers to drive more slowly to maneuver to the left or right. Some residents will have more right-of-way than the property owner, and some will have less right-of-way. Therefore, this method is very difficult to implement unless the street provides a sufficiently wide right-of-way. Most residents within this design will lose out on street parking opportunities [28].

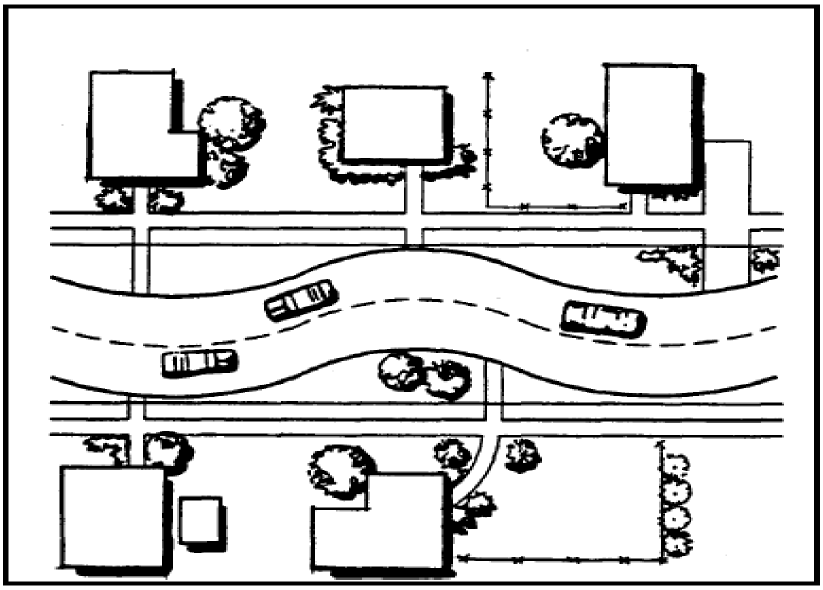

Figure 6. Deceptive and Spiral Deviations

2.2.7. Warning signs (Stop)

As you know, the red hexagonal sign containing the word "stop" as shown in Figure (7) is a traffic order created by the laws and regulations of driving. The purpose of the stop sign is to design the right of way for traffic flow at intersections. This sign is very suitable and effective for the intersection of a street with low traffic with a street with heavy traffic or the intersection of streets with equal traffic volume. It is also used in places where the traffic volume at the intersection has not reached sufficient capacity. Many transportation authorities argue that traffic signs do not reduce speed, so they do not recognize the signs as a speed control tool [28].

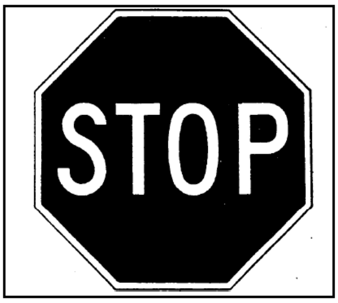

Figure 7. Warning signs (stop).

2.2.8. Rumbles

These devices are patterned after rough pavement textures that suddenly warn drivers that they are approaching a dangerous situation. This sudden noise that drivers encounter is effective and useful for unmarked areas and mid-block pedestrian crossings. In general, these devices are ineffective in reducing overall speed and have a negative impact on cyclists. The raised stripes are very noisy and are generally not pleasant for residents of the area. Examples of raised noise stripes are shown in Figure (8) [29].

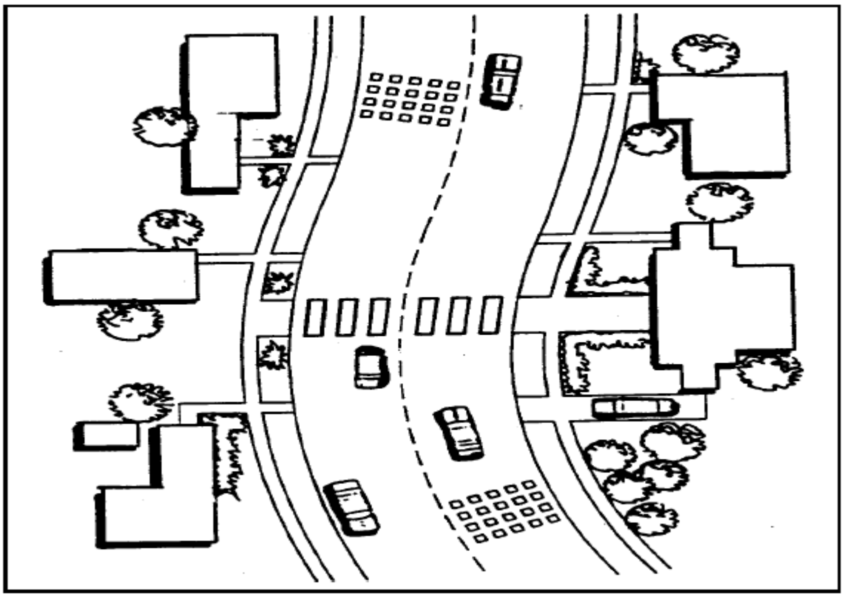

Figure 8. Rumble grooves.

3. RESULTS AND DISCUSSION

3.1. Vertical speed control devices

This device is one of the most common sources of dissatisfaction among citizens who frequently use that road. Accelerating and braking to pass vertical obstacles causes interruptions in the speed of travel on those roads. This acceleration and deceleration due to this device causes discomfort to passengers and also makes it unsafe to maintain control of the vehicle unless they pass at a lower speed. Speed bumps, speed bumps, and raised intersections are common vertical speed control devices for traffic calming. In most cases, speed bumps are the most common and economical type of vertical speed control device. As a result, this device is most often used to calm traffic flow. Emergency services in particular object to this type of device, which causes delays in response to accidents and causes frequent mechanical problems and suspensions in emergency service vehicles. They also increase noise and air pollution.

3.2. Speed bumps

Speed bumps are wavy pavements installed on the street, as shown in Figure (9). The height of the speed bumps varies depending on how fast the passing vehicles can pass the speed bump without causing discomfort to the driver and causing damage to the vehicle. The feeling of discomfort and the feeling of being out of control of the vehicle will be greater when the attempt to speed increases. Without a doubt, the speed bump is the most controversial traffic calming device. Usually, the maximum height of the speed bump is approximately 10 cm. They are usually 4 to 7 meters

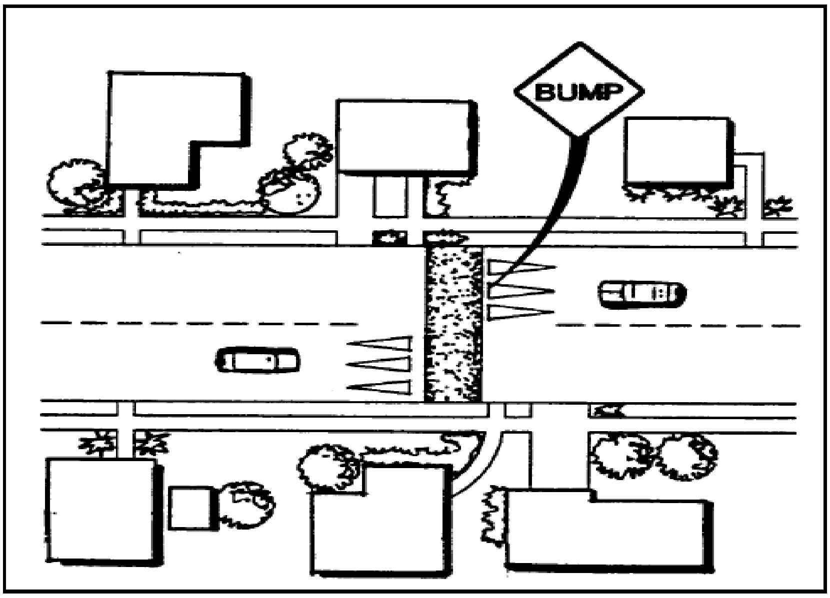

Figure 9. Straw speed

3.4. Straw Speed Cushions

Similar to straw speed cushions, straw speed cushions are designed to have minimal impact on emergency vehicles. Instead of extending across the entire width of the road, a straw speed cushion covers a portion of the road. This device is shown in Figure (10), which is made of recycled plastic or asphalt, is raised to a height of 7 cm, and the cushion is approximately 3.5 m long. The space between the cushions allows emergency vehicles to pass through the device with some freedom. Therefore, emergency vehicles pass through the device more quickly and easily than straw speed cushions.

Figure 10. Straw speed cushions

3.5. Raised Intersection

A raised intersection is designed like a speed bump except that it covers the entire intersection area. The raised level of this device is 4 inches higher than the surrounding streets. This forces vehicles to slow down and maintain this speed reduction within the intersection. This device is shown in Figure (11), it provides excellent relief for pedestrians and those using the intersection under speed control. Like speed bumps, these devices have a negative impact on the passage of emergency service vehicles.

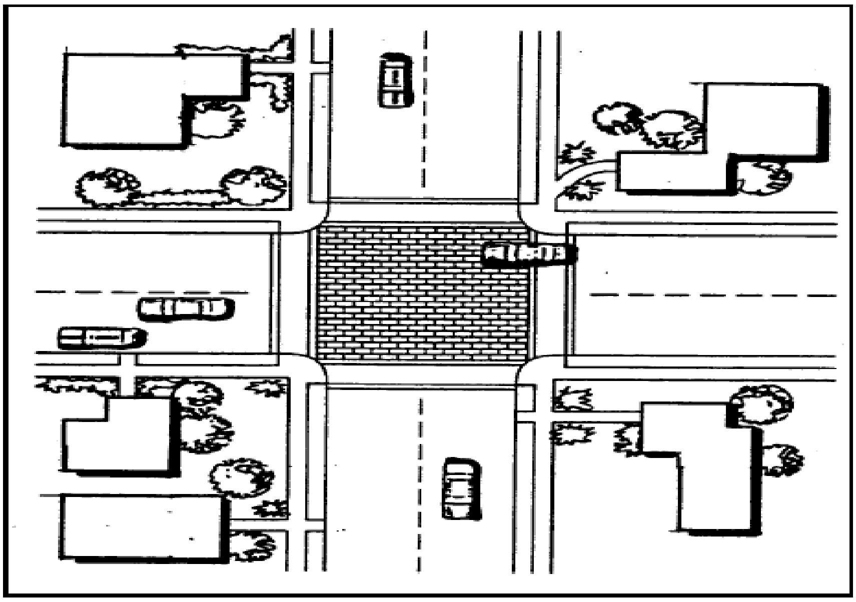

Figure 11. Elevated intersection

3.5. Width Reduction Devices

Wider roads usually encourage motor vehicles to travel at higher speeds. To counteract this, changes in the road can create a "visual illusion" of approaching and narrowing the road. Many effective traffic calming devices capitalize on this method.

A wide variety of width reduction methods can be used in connection with traffic calming programs. These types of methods are much more expensive than other speed control devices. Due to the increased costs, the less width reduction method is preferred for traffic calming programs. These types of methods can be implemented at intersections, in the middle of a block to reduce the width or to divide the street in the middle. The following are the more common methods of width reduction for speed control.

3.5.1. Bottlenecks

The purpose of this method is to reduce the width of the road at intersections. This method is done by limiting the table radially at each corner of the intersection. As the road begins to narrow, vehicles are forced to slow down to create a proper distance from the bumper of the vehicle in front as they enter the intersection. Figure (12) shows how the design below does not consider and accommodate cyclists.

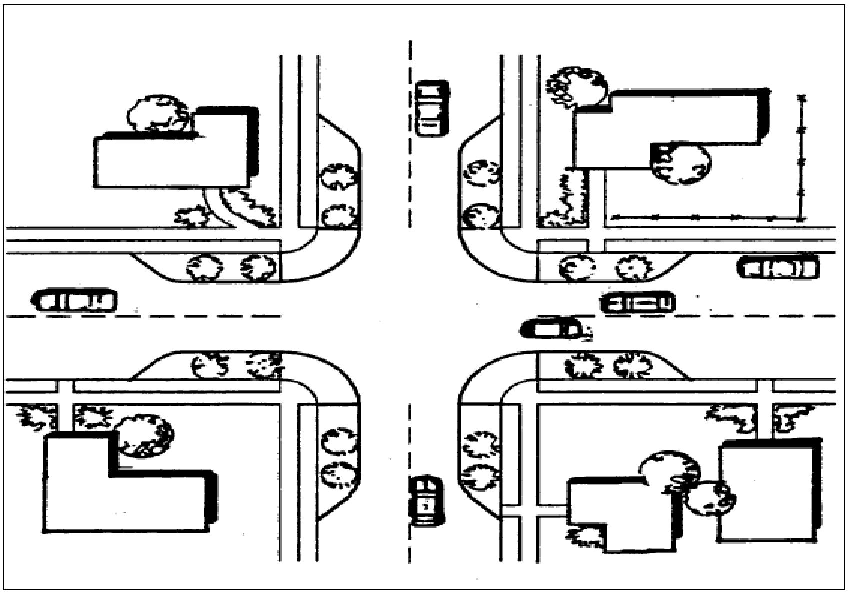

Figure 12. Bottlenecks

3.5.2. Reducing the width of the passing lane

Like a bottleneck, reducing the width of the passing lane in the middle of the road is more effective than at the intersection. This method is especially effective where it is along the long stretch of road between intersections. Most residents object to this method because they lose parking space in front of their house. These methods can be dangerous for cyclists. Figure (13) shows the reduction of the width of the middle lane of the block.

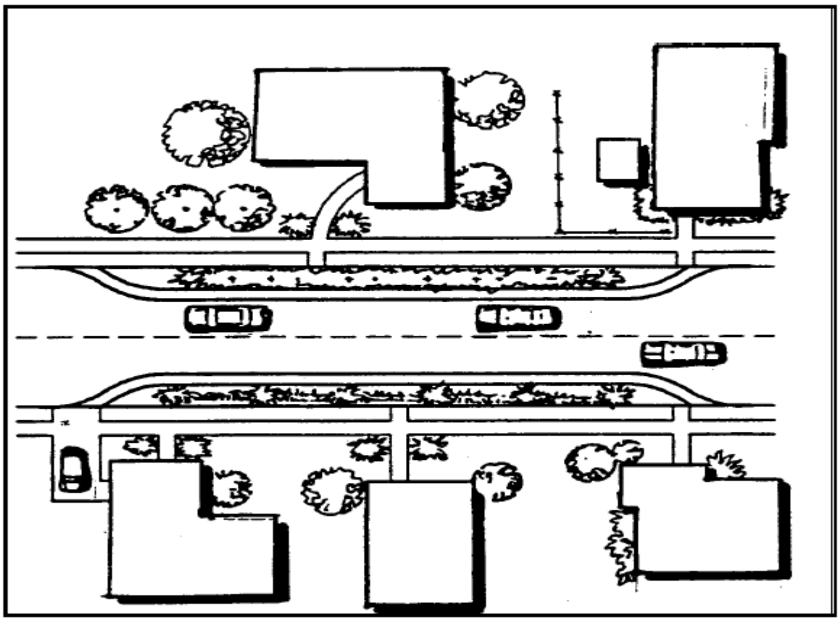

Figure 13. Reducing the width of the passing lane

3.5.3. Middle divider

The width of the street is reduced when the divider is placed longitudinally along the street and in the middle of it. This method can reduce the future lines of the street, as shown in Figure (14). In addition to landscaping, a narrow sidewalk should also be added. Often, parking areas are located where the divider is located.

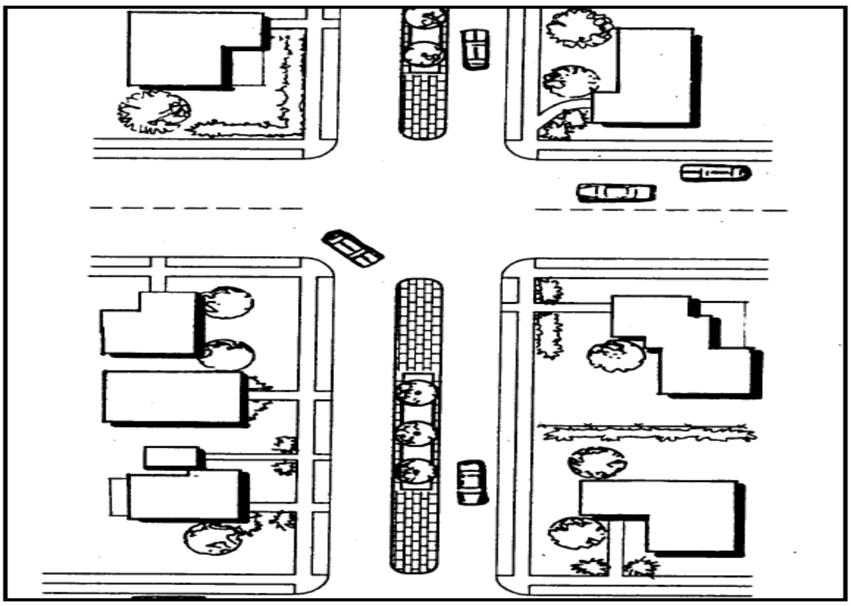

Figure 14. Middle separator

4. COCNLUSION

It is very difficult to conduct an analysis of reduced speed and interrupted traffic due to variable factors. The best approach is to have "before and after traffic calming" data collected over the same period of time, day, season, etc., which is often very difficult to obtain consistently. Also, the early or lateness of the study after the device is installed is a major factor in the validity of the data. Most importantly, through traffic control, the area is surveyed by traffic movement. In this study, all traffic calming devices were examined in order and their advantages and disadvantages were identified in order to obtain the best choice for the authorities. Caution and precision should always be used in interpreting the effect of traffic calming with speed reduction and volume statistics. What may appear to be a positive effect rather than a negative effect when compared overall. Since the speed for many streets around residential areas is less than 45 km/h, the speed reductions created may seem attractive, but they are actually significant reductions. As shown in Table (1), Davis Street is a neighborhood where traffic calming has been implemented.

Table 1. Data Analysis of EC and TDS in Drain Water from June to August.

Calming method		Volume (vehicles per day)			Venue		
Semi-closed square	Davis Street	Changes (%)	next	before	Change (%)	Next	**before**
Speed reducing cushion	Raini Street-Block 60	-75	568	2233	-8	34.5	**37.5**
	Raini Street-Block 70&80	-31	269	389	6	52.5	**49.5**
Speed reducing cushion and square as a bottleneck	Raini Street-Block 90	-30	2321	2323	-20	42	**52.5**
square	River Street-Block 600	-124	1869	835	-21	33	**42**
	River Street-Block 700	-3	5900	610	N/A	N/A	**N/A**
		-36	2033	3152	4	40.5	**39**

After traffic calms, the speed is reduced by eight percent. Compared to the eight percent reduction, the speed was reduced by only 3 km/h. However, reducing the speed from 37.5 km/h to 34.5 km/h on a street with a speed limit of 45 km/h cannot be considered a constructive approach considering the costs incurred.

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CONFLICT OF INTEREST
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