Evaluation of Speed Hump Program in the City of Omaha

BY MICHAEL N. GORMAN, MASSOUM MOUSSAVI, AND PATRICK T. McCOY

For the past 5 years, the City of Omaha has been installing speed humps on residential streets to reduce speed and volume of vehicular traffic on those streets. The speed humps are constructed across the full width of the roadway and are 4 in. high and 12 ft. long.

The City of Omaha has developed stringent guidelines governing the conditions that must exist before speed humps will be installed. Although the guidelines might appear too strict to a neighborhood requesting speed humps, the guidelines might appear too lax should an accident occur or other problem develop that indicates the speed hump should not have been installed. This incongruity puts the traffic engineer in an uncomfortable position when trying to determine what is appropriate for the motoring public while preserving the residential character of a neighborhood.

In 1986, the City of Omaha began to receive many complaints from citizens opposed to the construction of speed humps. In addition, the Fire and Police divisions of the Public Safety Department had raised very unsettling questions about the affect of speed humps on emergency response vehicles. Similar problems in other cities caused Omaha to reevaluate its entire speed hump program.

In October 1986, the Mayor's Traffic Safety Advisory Committee (MTSAC) requested the city traffic engineer to place a six-month moratorium on the installation of any new speed humps and to take that time to study the ones already in place. This report summarizes the results of the study.

Existing Policies

For a speed hump to be installed in Omaha, the following conditions, or warrants, must be met:

1. The proposed speed hump must be located on a residential street functionally classified as local.
2. The 85th percentile speed of traffic must be greater than 35 mph.
3. No Stop sign or traffic signal is located within 300 ft of the proposed speed hump location.
4. Seventy-five percent of the property owners living on the segment of street in question concur with the installation of speed humps and have signed a petition to accept warning signs, pavement markings, and restricted parking directly in front of their homes.
5. The street segment where the proposed speed humps are being considered has no adverse characteristics, such as steep grades or severe curves, that would contribute to or cause a safety hazard.

Using these guidelines, the city has denied 90% of the requests for speed hump installation. These guidelines are consistent with recommendations from the Institute of Transporation Engineers[1] and the California Traffic Control Devices Committee.[2] Problems occur when one or more of the requirements is compromised as a result of overwhelming neighborhood pressure. The most important of the requirements are the street classification, 85th percentile speed, and street geometrics. The street classification and geometrics relate directly to safety. The 85th percentile speed is a measure of the relative need for the device.

The only additional guideline that may be needed involves the type of curb that exists on streets under study. At locations where there are roll-over or nonexistent curbs, problems occur when motorists drive off the roadway to avoid the speed humps. This is a concern because of the potential for destruction of property and the obvious safety hazard if vehicles drive on shoulders and sidewalks.

Speed humps may be removed using similar guidelines. A neighborhood wishing to remove a speed hump needs to obtain 75% support on a formal petition, and the Public Works Department will remove the device.

Existing Locations

Since the speed hump program began in 1982, the city has installed over 60 speed humps. Many times this has involved installing more than one on a particular street segment. The following is an evaluation of existing speed humps based on input from residents, accident history, and vehicular speed data.

Postcard Survey

To find out how the residents who live on street segments felt about the speed humps after they were installed, 216 let-

ters were mailed with self-addressed, stamped postcards inside that asked residents if they were in favor of or against the installation of speed humps. Out of 147 responses, 82% were in favor of the speed humps, and 18% were against. Those who were in favor of speed humps indicated that the devices are doing the job that they were intended to do. The most common complaints about speed humps were:

- Speeding still exists.
- Stop signs should be used instead of speed humps.
- Increased enforcement should be used to slow traffic, not speed humps.
- People drive on lawns to avoid speed humps.
- Increased noise level on street.
- Speed humps cause vehicle damage.
- Less on-street parking.
- Speed humps are not effective at speeds greater than 50 mph.
- Concerns about emergency vehicle operation.

Some interesting conclusions can be drawn from the survey. Speed humps are a very polarizing issue. Residents are either very much in favor of the devices or very much against them. Those that are in favor want more, and those who are against want fewer. However, the majority of people who live on streets with speed humps think they are doing the job they were intended to do. As a result of the survey, it can be concluded that speed humps are at least perceived to be successful by the residents.

Accident Statistics

One of the main reasons residents believe that they need speed humps is to reduce accident potential. The city was concerned that accidents may actually increase because of the devices. To determine what was actually happening, accident statistics were studied for 19 locations that represented street segments with two or more speed humps. All these locations were two-lane, residential streets with similar geometric characteristics (e.g., 25-ft. paved road, grades less than 5%, straight sections) and traffic conditions (e.g., local traffic only, average daily traffic between 200 and 1500 vehicles, speed limit of 25 mph).

Because speed humps were installed at different times during the past five years, the same period could not be used for every evaluation. To get a true representation of the accidents experienced before and after the devices were installed, we determined the number of months that elapsed since speed humps were installed at each location. Once determined, the accident experience was compared with the same number of months before the devices were installed. The results are summarized in Table 1.

Before installation, 17% of the accidents involved personal injuries and the remainder involved property damage only. After installation, only 5% of the accidents involved personal injuries and the rest were accidents involving property damage only. The types of accidents reported include collision with fixed objects, such as parked vehicles, traffic signs, trees, buildings, and guardrails: sideswipes; head-on collisions; rear-end collisions; and turning-vehicle collisions.

Table 1. Accident Summary, Before and After Installing of Speed Humps

	Property Damage Only			Personal Injury			Total		
Location	After	Before	Difference	After	Before	Difference	After	Before	Difference
1	6	3	+3	0	0	0	6	3	+3
2	10	2	+8	1	4	−3	11	6	+5
3	4	7	−3	0	0	0	4	7	−3
4	1	8	−7	0	0	0	1	8	−7
5	3	0	+3	0	0	0	3	0	+3
6	3	1	+2	0	0	0	3	1	+2
7	3	1	+2	0	0	0	3	1	+2
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	1	0	+1	0	0	0	1	0	+1
13	0	0	0	0	0	0	0	0	0
14	1	0	+1	0	0	0	1	0	+1
15	1	2	−1	1	1	0	2	3	−1
16	1	0	+1	0	0	0	1	0	+1
17	0	0	0	0	0	0	0	0	0
18	1	1	0	0	0	0	1	1	0
19	3	0	+3	0	0	0	3	0	+3
TOTAL	38	25		2	5		40	30	
N		19			19			19	
Diff. Mean		0.684			−0.158			0.526	
Std. Dev.		2.907			0.688			2.547	
t stat		1.026			−1.000			0.901	

$t_{05,18} = \pm 1.734$

Therefore, none of the differences are statistically significant at the .05 level.

Collisions with parked vehicles accounted for more than 23% of the total accidents before the installation of speed humps. This percentage increased to 43% after the installation. The percentage of sideswipes also increased from 6% to 20%. None of these accidents were related to speed humps, but there was a 50% drop in the number of accidents that involved other fixed objects, which may have been attributed to speed hump installation.

Table 1 shows that 9 out of the 19 locations had an increase in total number of accidents after installation, 3 locations had lower accidents, and 7 locations had no change. However, the results of the statistical analysis using a paired *t*-test, at the 5% level of significance, showed that the number of accidents after installation does not differ from the number of accidents before installation. Therefore, it can be concluded that there is no correlation at the 5% level of significance between speed humps and accident expectancy.

Speed Studies

Perhaps the most common reason residents request speed humps is to reduce the speed of traffic through their neighborhood. As the name *speed hump* implies, this is the primary purpose of the device. To determine the effectiveness of speed humps at existing locations, the results of "before" speed studies were compared with "after" speed studies. As closely as possible, the after studies were taken in the same location as the before study. The same speed-measuring techniques were to be used in both studies. There was no effort to set up radar units an established distance away from speed humps in the after study. Previous studies have shown that speed humps do reduce the speed of traffic within 200 to 100 ft of the devices.[1] In this study, an attempt was made to determine the effect of speed humps on speeds throughout the street segment, regardless of the speed hump locations. The results are summarized in Table 2.

The results of a paired *t*-test, at the 5% level of significance, showed that the 85th percentile speed after installation of speed humps was less than the 85th percentile speed before installation. The results also showed that there is a significant reduction in the upper limit of a 10-mph pace after installation. At the 5%

Table 2. Before-and-After Speed Study Summaries

	85th Percentile Speed (mph)		
Site	Before	After	Difference
1	35.8	32.3	3.5
2	35.5	35.6	−0.1
3	34.4	31.5	2.9
4	35.8	34.4	1.4
5	35.0	32.6	2.4
6	39.3	33.3	6.0
7	36.1	33.0	3.1
8	37.4	35.7	1.7
9	35.9	36.0	−0.1
10	38.6	36.5	2.1
N	10		
Diff. Mean	2.291		
Std. Dev.	1.699		
t stat	4.264		

$t_{05,9} = 1.833$
Therefore, significant reduction.

	Upper Limit of 10-mph Pace		
Site	Before	After	Difference
1	40.0	35.0	5.0
2	35.0	35.0	0.0
3	35.0	35.0	0.0
4	35.0	35.0	0.0
5	35.0	35.0	0.0
6	40.0	35.0	5.0
7	35.0	35.0	0.0
8	40.0	35.0	5.0
9	35.0	35.0	0.0
10	40.0	35.0	5.0
N	10		
Diff. Mean	2		
Std. Dev.	2.449		
t stat	4.582		

Therefore, significant reduction.

	Percent Within 10-mph Pace		
Site	Before	After	Difference
1	78.3	64.7	13.6
2	75.8	64.5	11.3
3	82.0	79.1	2.9
4	43.1	82.0	−38.9
5	72.1	72.8	−0.7
6	52.6	76.6	−24.0
7	73.7	75.7	−2.0
8	64.5	74.7	−10.2
9	72.6	66.6	6.0
10	67.0	70.9	−3.9
N	10		
Diff. Mean	−4.590		
Std. Dev.	15.360		
t stat	−0.945		

Therefore, not significant reduction.

level of significance, it was found that there is no change in the percentage of vehicles within the 10-mph pace in the before-and-after study.

Because of the relatively minor change in speeds at the majority of locations, the conclusion is that speed humps affect the overall speed of traffic on a street segment. At those locations where the most dramatic reductions were received, the after study was taken very near the speed hump. At distances between 200 and 300 ft away from the hump, traffic appears to substantially regain the speed it was previously traveling. Therefore, in order to actually control speed, speed humps need to be spaced approximately 400 to 600 ft apart. This is extremely difficult in most residential areas because of curves and steep grades.

City of Omaha Officials

The city's Traffic Engineering Division is most directly involved with approving the installation of speed humps and is required to maintain all the associated records, signing, and pavement markings. Other divisions of city government, such as the Police, Fire, and Street Maintenance divisions, must also deal with speed humps daily. The Law Department is also involved because city attorneys must defend the city in case of a lawsuit, and they have a duty to point out potential problems that may increase the likelihood of litigation to other city government divisions.

To study speed humps from differing perspectives, we decided to gather opinions of officials from each of the affected departments and divisions. We attempted to obtain more objective information; however, most of what follows is subjective. Hard-and-fast statistics, whether for or against speed humps, simply do not exist. Nonetheless, the opinions of these experts must be considered extremely valuable. Each person has many years of experience and is reflecting on problems or conditions that actually exist.

Fire Division

The fire chief requested that other methods be used to reduce speeds in neighborhoods and that all existing speed humps be removed. The chief cited the following problems: patients complaining of pain while passing over a speed hump, hampered patient care during transport, failure to control vehicle during inclement weather when passing over speed humps, lack of sufficient notification to safely reduce speed before approaching the device, difficulty in controlling the vehicle while passing over the speed hump during normal conditions, equipment being dislodged from compartments, and increased response time.

Police Division

The Police Division also recommended that speed humps not be installed on city streets. The division said that such devices impede the travel of emergency response vehicles and suggested that other measures, including additional Stop signs, be used instead. The division suggested that with good enforcement, education, and engineering, speed humps are not necessary. The division is particularly concerned about the possibility of small vehicles and motorcycles encountering the device and possibly losing control.

Street Maintenance Division

Contrary to what many believe, the Street Maintenance Division indicated that speed humps have not caused a problem from a maintenance standpoint. Snow removal and other aspects of street maintenance are not hampered to a measurable extent.

The division also indicated that the construction of speed humps is not a problem. Although there were some problems at first, it has standardized on a method of installation that seems to work.

The division did, however, state, "Considering that our crews spend much of their working life trying to eliminate bumps in the street, which cause problems for drivers and residents, we do have some problems understanding why we are out creating bumps in some streets."

Law Department

The Law Department brought up the following points:

1. The city's potential liability for failure to effect measures to slow drivers down is less than that which exists after installing a speed hump.
2. The city has no specific duty to slow traffic down on residential streets.
3. If the city is going to continue installing speed humps, the criteria used to select appropriate locations must be very rigid and uncompromised. In addition, the city has a duty to monitor the signing and pavement markings at these locations on a regular basis with short time spans in between.

Summary

To summarize the points made by the various city officials, the most important concerns regarding speed humps appear to center around potential liability and emergency vehicle access. All officials had an intuitive feeling about the poten-

Michael N. Gorman, *P.E., is the city traffic engineer of Omaha, Nebraska. He received a B.S. degree in civil engineering from Iowa State University and is currently pursuing an M.S. degree at the University of Nebraska-Lincoln. He is a Member of ITE.*

Massoum Moussavi, *P.E., is an assistant professor of civil engineering at the University of Nebraska-Lincoln. He received his B.S. degree in civil engineering from West Virginia Institute of Technology and M.S. and Ph.D. degrees from Virginia Polytechnic Institute and State University. He is an Associate Member of ITE.*

Patrick T. McCoy, *P.E., is a professor of civil engineering at the University of Nebraska-Lincoln. He received B.S. and M.S. degrees in civil engineering from Iowa State University and a Ph.D. from Texas A&M University. He is a Member of ITE.*

tial liability of a street that has speed humps. The track record of several cities with hundreds of speed humps seems to negate that concern, however. Both in Europe and in the United States, litigation resulting from speed humps has been minimal, much less than that resulting from other traffic control devices, such as traffic signals or signing.[1] At the time of this report, there were no reported accidents attributable to speed humps in the City of Omaha.

Emergency vehicle access is a very serious concern. The points brought out by the Fire and Police divisions are important. As a minimum, no additional speed humps should be installed without Fire division and Police division review. As long as speed humps are not placed on collector and major streets, the problem should remain minimal. In addition, it would not be advisable to locate the devices on streets adjacent to police or fire stations.

The actual increase in response time because of a typical speed hump is in the range of a few seconds and is not life threatening in most cases. Studies done in California support this observation.[2] The actual delay because of speed humps on a 1,000-ft street segment was 16 sec. for an ambulance with a patient. On a 5,000-ft segment the delay increased to 80 sec. Police vehicles and ambulances without patients had significantly less delay time.

Conclusions

Based on the experience in Omaha and the information gathered from other agencies and organizations, the following conclusions can be drawn:

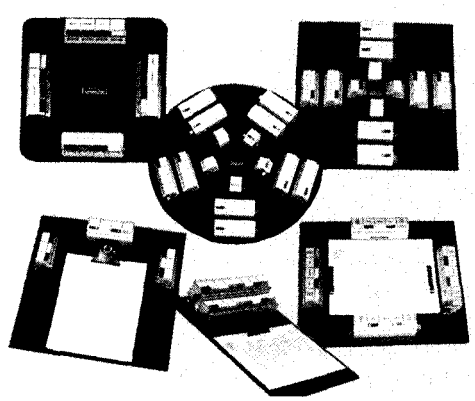
- The residents who live along streets with speed humps are generally in favor of their installation.
- Accident statistics both in Omaha and in other cities do not indicate conclusively that the number of accidents has increased or decreased because of speed humps. The common perception that lawsuits will be more common on streets with speed humps is simply not supported by Omaha's experience or the experience of many cities in California.
- Speed studies on streets before and after the installation of speed humps indicate the devices have a statistically significant effect on the 85% speed.
- Omaha's existing policies with respect to speed hump installation are effective and consistent with policies and recommendations of other agencies. Additional consideration should be given to allowing the Public Safety Department to review proposed speed hump locations and check the type of curb section on a street on which a speed hump is being considered.
- A more frequent check of signing and pavement marking around speed humps should be instituted to ensure that the appropriate warning devices are in place. This would reduce liability and increase safety.
- The criteria set forth by the Traffic Engineering Division for the installation of speed humps should not be compromised. Each item directly affects the potential safety of the vehicle occupants as well as the need and the overall acceptance by the residents.

References

1. ITE Technical Council Committee 5B-15. "Road Bumps—Appropriate for Use on Public Streets?" *ITE Journal* 56 (November 1986): 18-21.

2. California Traffic Control Devices Committee. *Subcommittee Report on Pavement Undulations (Road Bumps)*. November 1983.

3. City of Wichita. *Speed Hump/Bump Study*. Wichita, Kansas: Department of Operations and Maintenance, 1986.



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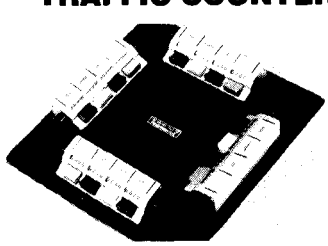

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