Rubber Speed Humps: The City of Peoria Experience

K. Kelly LaRosa

ABSTRACT

The City of Peoria’s Neighborhood Traffic Management Program (NTMP) was developed in 2000 and adopted by the City Council, with an annual budget of $100,000. Rubber speed humps and tables are among the many traffic calming options available through the program. In 2002, the City of Peoria ordered and installed materials for rubber speed humps and tables on local residential roadways that qualified for traffic calming measures through the NTMP. The rubber speed humps and tables were installed as a temporary traffic calming measure and evaluated over a 90-day test period.

This paper describes the City of Peoria experience in ordering the equipment and materials needed for installation, the time and cost of installation, and lessons learned from several unforeseen problems that occurred during the process. During the experience, City of Peoria Traffic Engineering Division staff evaluated the advantages and disadvantages to using rubber speed humps and tables, the costs and benefits, the effectiveness in using them as a traffic calming measure for residential citizens, and other challenges associated with the installation of the features.

INTRODUCTION

Founded in 1886, Peoria is located in the semi-arid desert region of Maricopa County, northwest of Phoenix, Arizona, at an elevation of 1,100 feet. Peoria experiences approximately 300 sunny days each year. The annual average temperature is a high of 87 and a low of 55 degrees. It is not uncommon for summer temperatures to consistently reach a high in the triple-digits. The metropolitan Phoenix area in Maricopa County is home to over 55 percent of the state’s population with an estimated 2.9 million people. Since 1980, Peoria has grown from a small town of 12,000 to a dynamic community of more than 120,000, with half of this increase occurring in the 1990s. The Maricopa County’s July 1, 2002 estimates show the population of Peoria to be 122,655 residents. For the past ten years, the City of Peoria has been one of the fastest growing cities not only in the state, but also in the nation.

The City of Peoria’s Neighborhood Traffic Management Program (NTMP) has been in effect for over two years. The goal of the program is to improve the quality of life for Peoria citizens by reducing excessive traffic volumes and speeding in residential neighborhoods. On September 5, 2000, Council adopted an ordinance implementing the NTMP, and subsequently adopted an ordinance on April 2, 2002 approving revisions to the policy. The City Council has consistently approved an annual budget of $100,000 for the program. An additional $75,000 was also approved during fiscal year 2003 to supplement the NTMP. Another supplement is anticipated to be approved in
addition to the annual budget allocated for fiscal year 2004.

As of March 31, 2003, information packets and request forms regarding the NTMP have been sent to over 300 residents. Over 70 completed request forms have been received by the Traffic Engineering Division. There are 36 neighborhood areas that have been designated as “residential traffic control areas”, as approved through resolutions by City Council, that allow residents and Traffic Engineering Division staff to work together on the development of potential traffic calming projects to improve the quality of life in their neighborhoods.

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM (NTMP) PROCESS

The City of Peoria’s NTMP policy follows six steps:

1. **Inquiry.** Upon receiving an inquiry from a resident, an information packet and request form are mailed to the resident.

2. **Traffic Studies.** If the request form is returned completed to the City, traffic studies to measure average daily traffic volumes and average speeds are conducted on residential roadways throughout the neighborhood.

3. **Plan Development.** If the results of the traffic studies show the neighborhood meets the NTMP criteria, a public meeting is scheduled with residents and property owners in the neighborhood to discuss potential alternatives for a traffic calming project. Also at this time, a resolution is prepared for City Council approval designating the neighborhood as a “residential traffic control area” which allows staff to work with residents on the selection and implementation of appropriate traffic calming measures.

4. **Consensus Building.** When residents decide what traffic calming features they would like to pursue in their neighborhood and the locations of the proposed features are determined, petitions are prepared by City staff and provided to a neighborhood coordinator. A minimum of 70% of signatures from homeowners within the petition boundary, as determined by City staff, are required in order for the petition to be approved.

5. **Implementation.** If the petitions are approved, the project is scheduled for construction.

6. **Evaluation.** Another set of traffic studies is conducted after the project has been constructed to determine the effectiveness. The results are provided to the neighborhood coordinator. If residents desire to remove traffic calming measures or try additional features, the City continues to work with them through the NTMP.

The following table shows the minimum criteria for traffic volumes and average speeds that must be exceeded in order to be eligible for traffic calming measures through the NTMP.
### Minimum NTMP Criteria

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Average Daily Traffic Volume (veh/day)</th>
<th>Average Volume in Peak Hour (veh/hour)</th>
<th>Average Vehicular Speeds (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site is Eligible for All Traffic Calming Measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>750</td>
<td>75</td>
<td>n/a</td>
</tr>
<tr>
<td>Collector</td>
<td>6000</td>
<td>600</td>
<td>n/a</td>
</tr>
<tr>
<td>If the Above Criteria is Not Met, but the Criteria Below is Satisfied, the Site is Eligible for Speed Humps or Speed Tables Only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>375</td>
<td>38</td>
<td>27.5</td>
</tr>
<tr>
<td>Collector</td>
<td>3000</td>
<td>300</td>
<td>32.5* or 37.5**</td>
</tr>
</tbody>
</table>

* If the posted speed limit is 30 MPH
** If the posted speed limit is 35 MPH

### RUBBER SPEED HUMPS

Two of the first neighborhoods to inquire about the NTMP and meet the program’s criteria requested temporary rubber speed humps and tables. The first neighborhood, Pivotal Peoria Center, requested four temporary speed tables on Emile Zola Avenue, a street that directly connects the neighborhood to an arterial roadway, and provides access to a fire station and a post office. The City Fire Department only agreed to the installation of speed tables on Emile Zola Avenue, as opposed speed humps. The roadway is 37 feet wide, with an 11-foot travel lane in each direction and parking lanes on both sides. It experienced an average daily traffic volume of over 1,400 vehicles per day prior to the installation of the rubber speed humps. It is striped with a double yellow centerline and has a posted speed limit of 25 MPH.

The second area, Terramar, requested five rubber speed humps on three roadways in the neighborhood. Three of the requested rubber speed humps were on a 37-foot wide roadway that directly connects to the collector street providing access to the neighborhood. Approximately 68%, or 2,600 vehicles per day, of the total daily traffic entering and exiting the neighborhood uses this access point. The other two requested rubber speed humps were on side streets that are 29-feet wide. All three roadways receiving the speed humps in Terramar have a posted speed limit of 25 MPH.

The City’s original intent was to order rubber materials for these two projects, and after testing the effectiveness of the speed humps and tables, remove and relocate the materials to another neighborhood interested in traffic calming measures. The rubber materials are manufactured in 2-foot wide units so that they can be arranged according to the road width of the street receiving the rubber speed humps.

The City used a sole-source justification to order the rubber materials from the vendor, Recycled Technologies, located in Oregon. The vendor offered three sizes of speed humps: 14-foot, 18-foot and 22-foot. Each are three inches in height. The 14-foot speed hump is created with two 7-foot pieces that have a profile in the shape of a
parabolic curve. The 18-foot and 22-foot speed humps are created by placing one or two 4-foot flat pieces, three inches high, in between the 7-foot pieces, respectively. The City of Peoria ordered the 14-foot speed humps for Terramar as they most closely resembled the City’s standard 12-foot asphalt concrete speed hump, and the 22-foot rubber speed humps for Emile Zola Avenue as they most closely met the City’s standard for 22-foot long asphalt concrete tables (consisting of a 6-foot sloped approach taper, a 10-foot flat top, and a 6-foot sloped departure taper). The costs are summarized below, and included all installation hardware and materials. Vendor prices were based on the size of the rubber speed hump ordered, the quantity of each size, and the linear feet of roadway on which the speed humps were to be installed.

<table>
<thead>
<tr>
<th>Road Width (ft)</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emile Zola Avenue</td>
<td>22' Table</td>
<td>36</td>
<td>$328</td>
</tr>
<tr>
<td></td>
<td>14' Hump</td>
<td>36</td>
<td>$186</td>
</tr>
<tr>
<td>Terramar</td>
<td>14' Hump</td>
<td>28</td>
<td>$186</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vendor discount for freight weight greater than 75,000 lbs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Cost =</td>
</tr>
</tbody>
</table>

22-foot Rubber Speed Table on Emile Zola Avenue
INSTALLATION

City of Peoria staff installed the rubber speed humps and tables in May, 2002. The installation of the four rubber speed tables on Emile Zola Avenue took four days (one per day) to install. In Terramar, two speed humps were installed on one day and three the next. Each day, the City used a crew of 5 employees, one to serve as a flagman for traffic control and four for the installation. Also, one truck driver and two additional employees were used one hour each day to load and deliver the materials to the job site.

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Labor Costs</th>
<th>Qty.</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-foot Speed Table</td>
<td>4.5 each</td>
<td>$2,063 each</td>
<td>4</td>
<td>$8,252</td>
</tr>
<tr>
<td>14-foot Speed Hump</td>
<td>2 each</td>
<td>$832 each</td>
<td>5</td>
<td>$4,160</td>
</tr>
</tbody>
</table>

$12,412

* After materials were delivered to the job site

The average cost for the City to install the rubber speed humps and tables does not include the time lost from other regularly scheduled duties, employee travel to and from the job site, and other preparation tasks. For comparison purposes, the City contacted three other companies for cost estimates to install the rubber speed humps. Quotes received ranged from $1,380 to $2,400 to install the 14-foot rubber speed humps, and $1,630 to $3,725 for the 22-foot rubber speed tables. Additional costs would be expected to remove and relocate the materials to another neighborhood location.

The rubber speed humps were installed by anchoring a steel plate to the pavement and then bolting the rubber units to the steel plate. The 14-foot rubber speed humps required one steel plate along the longitudinal centerline of the speed hump. Due to the
extra 4-foot units required for the 22-foot rubber speed table, three steel plates were used along the longitudinal joints of the speed table. Because of the additional pieces needed for the 22-foot rubber speed tables, they took much longer to install than the 14-foot rubber speed humps. The rubber material was placed six inches from the curb and gutter so as not to inhibit drainage.

Traffic studies were conducted prior to the installation of the rubber speed humps and tables. The traffic studies measured both average daily traffic and average vehicular speeds. The projects were tested again after 90-days. The results of the traffic studies, shown below, show the rubber speed humps and tables were very effective. The traffic studies were conducted during a typical work-week day while Peoria Unified School District was in session. The results of the traffic studies were provided to the neighborhood coordinator for each area, and residents were then given the option of requesting a petition for permanent asphalt concrete speed humps or tables, trying another traffic calming measure, or removing the speed humps and tables altogether.

<table>
<thead>
<tr>
<th>Emile Zola Avenue Traffic Study Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Traffic Volume</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>May, 2002</td>
</tr>
<tr>
<td>August, 2002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Terramar Traffic Study Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Traffic Volume</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>68th Avenue</td>
</tr>
<tr>
<td>May, 2002</td>
</tr>
<tr>
<td>August, 2002</td>
</tr>
<tr>
<td>68th Drive</td>
</tr>
<tr>
<td>May, 2002</td>
</tr>
<tr>
<td>August, 2002</td>
</tr>
</tbody>
</table>

**CHALLENGES**

**Equipment**

Staff purchased additional equipment in order to complete the installation of the rubber speed humps and tables, including a hammer drill, drill bits, electric impact wrench, sockets, safety equipment, and other tools, totaling approximately $2,000.00. Safety equipment including back restraints and knee pads were needed for all employees, as the rubber materials were very heavy. Each rubber unit required two employees to lift
and drag it to its location on the roadway. In addition, arrangements were made to
borrow a fork lift and “roll-off” truck to transport the materials to the job site. Due the
weight of the materials, only one speed hump or speed table could be transported at a
time. The 22-foot rubber speed tables weighed 13,320 lbs. each, and the 14-foot
rubber speed humps weighed 7,740 lbs. and 6,020 lbs each for a 36-foot and 28-foot
wide roadway, respectively. Barricades were also required for traffic control during
installation.

Pavement Markings

Two different pavement marking patterns were tested. On Emile Zola Avenue,
markings similar to the standard found in Figure 3B-29, Option A, of the Manual on
Uniform Traffic Control Devices were used. In Terramar, the rubber speed humps were
marked in a chevron pattern across the length and width of the hump. A unique
problem that arose after the rubber materials were installed occurred when staff
attempted to apply the pavement markings on the rubber speed humps and tables. The
rubber materials appeared to absorb heat in the warm summer weather, making it
difficult for cold-rolled white plastic tape to stick.

In addition, staff attempted to determine the best pavement marking applications that
would allow the rubber units to be reused when moved to another location. One option
included applying permanent pavement markings that would require the marked pieces
to be tracked when removed and relocated, in order to reconfigured them in the correct
pattern at the new location. Another option included attempting to find a temporary
pavement marking that could be peeled off the rubber materials when the speed hump
or table was removed and reinstalled at a new location. The latter option would require
additional pavement marking materials to be ordered and applied each time.

One rubber speed table location on Emile Zola Avenue was marked with paint on a
permanent basis. The paint started to wear off the rubber materials, especially in the
vehicle wheel path, within one week of installation and would require continuous striping
maintenance.

The remaining rubber speed tables on Emile Zola Avenue and the rubber speed humps
in Terramar were marked with cold-rolled white plastic tape. For standard pavement
marking applications on roadways, the City uses 3M Staymark Series 5730 white
reflective tape or equivalent. After consultation with a specialist in the Materials Division
of 3M, a 150-yard roll of six-inch Staymark Removable Wet Reflective Tape, Series 750,
was ordered at an approximate cost of $700.00. The Series 750 “Wet” tape adhered to
the rubber material, yet was able to be removed when the rubber units were relocated
to the next neighborhood project. Although the Series 750 tape did adhere to the
rubber material, it experienced cracking along the joints between rubber units.
Deterioration

The rubber speed humps in Terramar deteriorated within several months. In the first two months, the rubber material warped and buckled at joints between the rubber units. Toward the center of the roadway, the rubber units began to separate and create gaps that could be a potential safety concern for pedestrians and bicyclists. Pieces broke off some of the rubber units. After 90 days, the rubber humps experienced pronounced shifting in the direction of the vehicular travel. After 120 days, the rubber speed humps in Terramar had to be removed as they became completely dislodged from the asphalt roadway pavement, shifting approximately 45 degrees within the roadway. Similar deterioration of the rubber speed tables occurred on Emile Zola Avenue, although over a greater time frame. The three sets of anchored steel plates used for the 22-foot rubber speed tables allowed them to remain attached to the roadway pavement and appeared to be more stable than the 14-foot rubber speed humps.

Pavement Damage

After the rubber speed humps and tables were removed, pavement cracking and water stains were discovered. The holes resulting from where the steel plates were attached
to the pavement had to be filled with crack-sealant or repaved. The deterioration of the rubber materials and resulting pavement damage was most likely due to the extreme weather temperatures typical of the Phoenix region softening the asphalt roadway pavement. Water collection under the rubber material also contributed.

ADVANTAGES

To residents within the City of Peoria, the most important advantage provided by the use of rubber speed humps and tables was the clear perception that they were temporary traffic calming measures. The rubber materials afforded the opportunity to try traffic calming measures on a temporary basis. The temporary appearance of the rubber materials was a way to assure residents who were undecided of whether or not they wanted speed humps on their residential roadways that the features were temporary and could be removed when needed, as opposed to the permanent appearance of asphalt concrete speed humps and tables.

SUMMARY

In summary, the total cost of the project was approximately $89,848.00.

<table>
<thead>
<tr>
<th>Project Cost Summary</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>$74,736</td>
</tr>
<tr>
<td>Labor Costs</td>
<td>$12,412</td>
</tr>
<tr>
<td>Extra Equipment</td>
<td>$2,000</td>
</tr>
<tr>
<td>Pavement Marking Tape</td>
<td>$700</td>
</tr>
<tr>
<td><strong>Project Cost Total</strong> =</td>
<td><strong>$89,848.00</strong></td>
</tr>
</tbody>
</table>

The advantage of using the rubber materials in a traffic calming program is that it allows residents a clear perception of the use of rubber speed humps as a temporary measure. Disadvantages of using rubber materials for speed humps include challenges in applying pavement markings, deterioration, cost, installation time, labor requirements, and the need to purchase additional materials to reuse and reinstall them in other locations. After a comparison of the advantages and disadvantages, in most instances it will be more cost effective and efficient to use asphalt concrete instead of rubber materials for the construction of speed humps and speed tables. Additional public education and flexibility regarding municipal traffic calming programs and relocation possibilities of speed humps can be used to increase public acceptance.

Due to the cost of installing and removing the rubber materials, the deterioration of the rubber materials experienced during the hot summer months, resulting pavement damage and other problems, the City of Peoria has decided not to use the rubber materials for temporary speed humps or speed tables in the future. It is anticipated that...
there will be few occurrences in which residents desire the location of a speed hump to be moved or relocated after it is installed. In those instances, the City is willing to grind out and reinstall the asphalt concrete speed hump.

EPILOGUE

The five temporary rubber speed humps were removed from the Terramar neighborhood in October, 2003. The four temporary rubber speed tables were removed from Emile Zola Avenue in April, 2003. The rubber materials are unable to be reused at this time. They are currently being stored in a City maintenance yard, and the City of Peoria plans to dispose of the materials after one year if no other use can be determined.

The Terramar neighborhood has since had five 12-foot asphalt concrete speed humps installed in the same locations as where the rubber speed humps were located. This has covered the pavement damage that occurred as a result of the rubber speed humps. Residents along Emile Zola Avenue are currently working on a petition to have permanent asphalt concrete speed tables installed. The petition has not yet been completed, but City staff is working with residents on revising three of the speed table locations. As a result, the holes that remain after the rubber speed tables were removed have been filled with crack-sealant, and the roadway has been re-striped. No other repairs to the pavement where the rubber speed tables were located is scheduled at this time.

AUTHOR INFORMATION

K. Kelly LaRosa is the Assistant City Traffic Engineer with the City of Peoria, Arizona, and manages the Neighborhood Traffic Management Program (NTMP) program. She has been a member of ITE since 1996. For further information regarding the City of Peoria NTMP, please contact:

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