



# Traffic Engineering & Highway Safety Bulletin



April 2003

Military Traffic Management Command Transportation Engineering Agency  
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## Traffic Calming

### Did You Know...

Traffic calming is the use of physical measures to address speeding and high-volume cut-through traffic on neighborhood streets.

Speeding and cut-through traffic can create an atmosphere in which nonmotorists are intimidated, or even endangered, by motor vehicle traffic. By addressing high speeds and cut-through volumes, traffic calming can improve both the real and perceived safety of pedestrians and bicyclists, and improve the quality of life within a neighborhood.

Generally, traffic calming measures are not appropriate on higher speed and higher volume streets such as arterial roadways. Traffic calming measures may be appropriate on the following roadway types:

- ❖ Local residential streets

### Traffic Calming Objectives Include:

- ❖ Achieving lower speeds for motor vehicles
- ❖ Reducing collision frequency and severity
- ❖ Increasing the safety and the perception of safety for nonmotorized users of the street(s)
- ❖ Reducing the need for police enforcement
- ❖ Enhancing the street environment (e.g., street scaping)
- ❖ Increasing access for all modes of transportation (motor vehicles, bicycles, pedestrians, etc.)
- ❖ Reducing cut-through motor vehicle traffic

- ❖ Collector streets with predominantly residential land uses
- ❖ Arterial roads within downtown districts or commercial areas (with posted speeds of 40 mph or less). ●

### In This Issue:

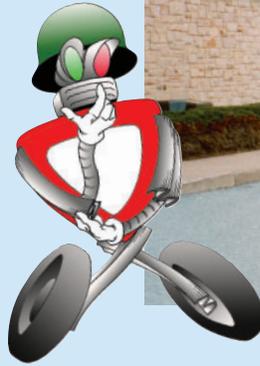
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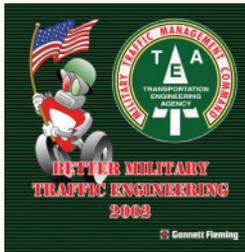
## Top Five Recommended Traffic Calming Devices:

1. **Speed humps** are low cost and effective at reducing vehicle speeds.
2. **Roundabouts** are used to reduce vehicle conflicts at intersections with balanced approach volumes that satisfy multiway stop warrants or traffic signal warrants. They can be aesthetically pleasing, but are costly.
3. **Raised crosswalks** are elevated crosswalks that bring added attention to mid-block pedestrian crossings. They are also effective at

## What's Wrong with this Photograph?



**Answer on Page 7**



## THE BETTER MILITARY TRAFFIC ENGINEERING 2002 CD-ROM Now Available from MTMCTEA

The CD is designed to function as an instructional tool to train personnel on the proper installation and use of traffic control and safety devices. It is divided into six traffic engineering topics:

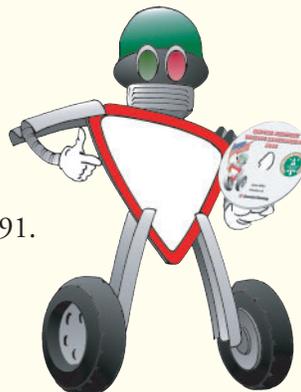
- ❖ Signs and pavement markings
- ❖ Traffic signals
- ❖ Gates
- ❖ Parking
- ❖ Roadside safety
- ❖ Intersections

The CD is extremely easy to use and provides animation, graphics, and illustrations to inform the user. It includes 17 calculators that use graphic displays that provide answers to many traffic engineering calculations. The calculators, as well as the CD can even be downloaded and installed on your computer for improved accessibility. Go to

<http://www.tea.army.mil/cdrom/default.htm>

to obtain further information about the CD. Copies of the CD can be obtained free

of charge by calling Janie Campbell at (757) 599-1591.



reducing vehicle speeds. Often these devices are combined with bulb-outs to enhance pedestrian crossings.

4. **On-street parking (in housing areas)** is often effective at reducing vehicle speeds in residential areas by psychologically narrowing the roadway. When used for traffic calming, it is important that roadway width and intersection sight distance requirements are satisfied. On-street parking on high-volume, high-speed roadways can have a negative effect.

5. **Diverters** are devices that partially or completely prohibit traffic movements. They are excellent for eliminating residential "cut-through" movements. However, diverters also adversely impact emergency vehicle access and the access needs of local residents. ●

## Why Not Just Use Multiway Stop Control?

A common request made by the general public is to use multiway stop control as a means of reducing vehicle speeds. The *Manual on Uniform Traffic Control Devices (MUTCD)* states that STOP signs should not be used for speed control. The decision to install multiway stop controls should be based on an engineering study.

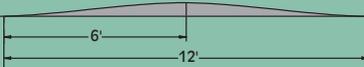
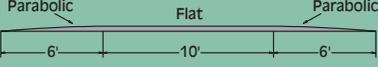
The following problems may occur if a multiway stop control is used where not warranted:

- ❖ Traffic will rarely come to a full stop.
- ❖ Motorists will increase their speed between STOP signs to make up for lost time.
- ❖ Residents will gain a false sense of security. The unwarranted control will breed disrespect for other multiway

stop-controlled intersections that are warranted.

When implemented after a proper engineering study, a multiway stop control is an excellent tool to reduce right-angle crashes, but is not an effective tool at reducing vehicle speeds along a corridor. ●

**More on traffic calming at:**  
[www.ite.org/traffic/index.html](http://www.ite.org/traffic/index.html)

<b>Why Install Speed Humps and NOT Speed Bumps</b>			
<b>Type of Device</b>	<b>Speed Bumps</b>	<b>Speed Hump (Watts Profile)</b>	<b>Speed Hump (Seminole Profile)</b>
			
<b>Size</b>	1- to 3-feet long 3- to 6-inches high	12-foot long 3- to 4-inches high	22-foot long 3- to 4-inches high Commonly referred to as a speed table.
<b>Application</b>	<b>NOT RECOMMENDED</b> <b>AR 420-72 Section 2-17</b> designates transverse ridges and speed bumps as safety hazards and states: <i>"Speed bumps will not be installed as a means of controlling or reducing the speed of traffic."</i>	Recommended only for local streets having average daily traffic (ADT) volumes of less than 3,500 vehicles, and a posted speed limit of 30 mph or less.  Not recommended for major emergency service routes.	Appropriate for streets with ADT volumes of up to 6,500 vehicles.  Many jurisdictions also permit the use of Seminole speed humps on emergency response routes.
<b>Design Speeds</b>	<b>NOT RECOMMENDED</b> At low speeds, vehicle occupants experience a jolt. At high speeds some vehicles can traverse speed bumps easily since the vehicle's suspension quickly absorbs the impact.	Designed to slow vehicles to 15 to 20 mph at each hump and 25 to 30 mph in between properly spaced humps. Smoother to transverse when traveling at lower speeds than at higher speeds.	Because of its gentler profile, the Seminole speed hump has a design speed of 25 to 30 mph at the hump, and approximately 35 mph in between humps. Smoother to transverse when traveling at lower speeds than at higher speeds.
<b>Speed Reduction</b>	Dependent upon vehicle type and speed.	Reduces vehicle speeds by about 8 mph in the vicinity of humps.	Reduces vehicle speeds by about 6.5 mph. Studies show that vehicle speeds at the hump and in-between the humps are not significantly different.
<b>Volume Reduction</b>	Unknown	Volumes are reduced, on average, by about 18 percent.	Volumes are reduced, on average, by about 12 percent.

## Traffic Calming Techniques

The following table describes the attributes associated with various traffic calming techniques and provides cost information.

Source: *Pennsylvania Traffic Calming Handbook, Pub 383*, January 2001.



**Legend:** ■ Significant Effect    ▣ Moderate Effect    □ Minimal or No Effect

**Horizontal Deflection** - Refers to two types of traffic calming measures. The first type hinders the driver's ability to drive in a straight line. The second type of horizontal deflection measure is designed to narrow the width of the travel lane. Doing so reduces speed.

- 1 **Bulb-out/Curb Extension** - Areas of expanded curbing that extend across a parking lane and may narrow a travel lane.
- 2 **Chicane** - Series of three bulb-outs, staggered at mid-block locations on alternating sides of the street.
- 3 **Gateway** - Entrance treatment, typically using physical and textural changes, which provides identity to an area.
- 4 **On-Street Parking** - Provisions of on-street parking that reduce roadway width.
- 5 **Raised Median Island/Pedestrian Refuge** - Narrow islands, at mid-block or intersections, located between travel lanes with boulevard landscaping and curbing for pedestrians.
- 6 **Traffic Circle/Roundabout** - Raised island in the center of an intersection that requires vehicles to travel counterclockwise around the island.

**Vertical Deflection** - Refers to traffic calming measures that create a change in the height of the roadway. When designed properly, vertical deflection measures reduce speed.

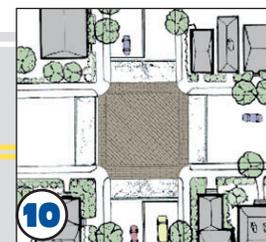
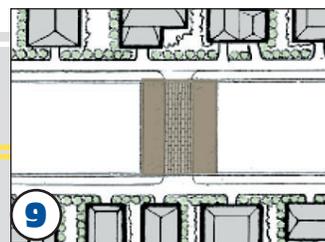
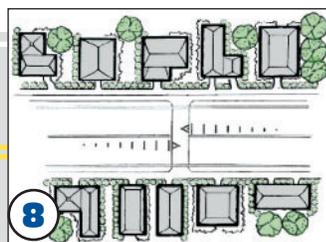
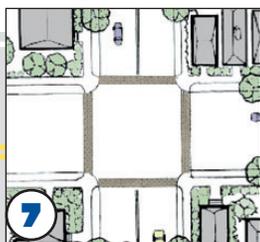
- 7 **Textured Crosswalk** - Use of pavers or other materials to define crosswalks and alert motorists that they are entering a pedestrian crossing.
- 8 **Speed Humps** - Raised humps in the roadway, typically 3-inches high with a 12- or 22-foot travel length.
- 9 **Raised Crosswalk** - Marked pedestrian crossing elevated 3- to 6-inches above street grade at intersections or mid-block.
- 10 **Raised Intersection** - Intersections, including crosswalks, raised 3- to 6-inches above street grade.

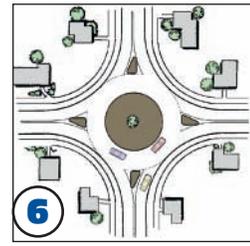
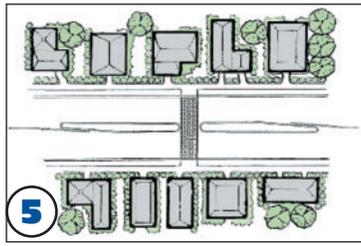
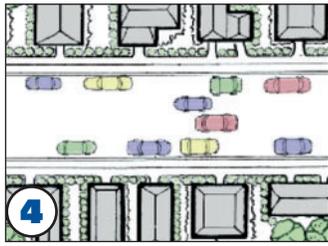
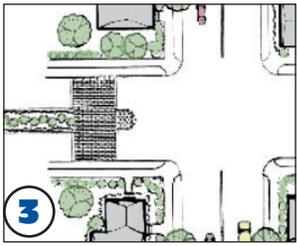
**Physical Obstruction** - Refers to measures that prevent specific vehicle movements, thereby discouraging or eliminating cut-through traffic.

- 11 **Semi-Diverter** - Directional closure created by physically blocking half the street.
- 12 **Diagonal Diverter** - Physical barrier placed diagonally across a four-way intersection to create two unconnected intersections.
- 13 **Right-in/Right-out Island** - Use of raised islands to prevent left turns and through movements, to and from side streets, at intersections.
- 14 **Raised Median Through Intersection** - Median barrier through an intersection that discourages through traffic in a residential neighborhood.
- 15 **Street Closure** - The use of a cul-de-sac to close a roadway by extending a physical barrier across the entire width, obstructing through traffic.

**Signing and Pavement Markings** - Can be used as traffic calming measures that regulate traffic movements in lieu of physical changes. However, police enforcement is often required to ensure motorist compliance.

- 16 **Speed Limit Signing** - Field investigations of citizen complaints of speeding on residential streets often reveal that very few, if any, speed limit signs are in place. In most states, only a 55-mph speed limit is enforceable without the posting of speed limit signs. For this reason, residential streets should include speed limit signing if a speed limit other than 55-mph is to be enforceable; however, a speed study must be conducted to determine the appropriate speed limit.
- 17 **Turn Prohibitions** - Turn prohibitions are an excellent "quick fix" that can be used for both 24-hour or part-time applications. Curbing cut-through traffic by living in the area must also abide by the posted restriction. If the cut-through occurs only during certain peak hours, part-time turn prohibitions may be appropriate.
- 18 **Roadway Narrowing With Edge Lines** - A low-cost way of reducing speeds is to narrow the roadway lane through the use of edge lines. A number of jurisdictions across the country have installed this type of pavement marking application to create 10-foot-wide lanes. This application is appropriate on local streets and low-volume minor collectors, but should not be used on major collector or arterial roads.
- 19 **Transverse Markings** - Double-thick thermoplastic transverse pavement markings have been successful in slowing traffic in driveways, hospitals, approaches to severe curves, and stop signs.





	Volume Reduction	Speed Reduction	Conflict Reduction	Emergency Response	Estimated Cost
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line by creating a horizontal shift in the roadway. This shift forces drivers to slow their vehicles in order to safely navigate the measure. The forces the usable surface of the roadway causing drivers to slow the vehicles to maintain an acceptable comfort level.

	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	\$7K - 10K
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	\$6K - 14K
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	\$5K - 20K
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Varies
breaks in	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	\$5K - 15K
round the circle.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$20K - 120K

vehicles must slow down over these measures in order to avoid unpleasant bumping sensations.

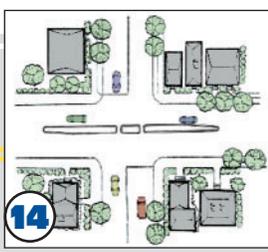
trian-friendly area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	\$50-150/sq. yd.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$1.5K - 3.5K
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$2K - 10K
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$15K - 60K

The overall traffic volume reduction depends upon the nature of the traffic calming measure and the number of movements obstructed.

	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$1K - 20K
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$7K - 20K
intersections with major streets.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$3.5K - 7.5K
al area by restricting movements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$1.5K - 20K
g all traffic movements.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	\$1.5K - 25K

s to the roadway. In certain applications, these measures may produce the same effect as the physical traffic calming measures.

f any, speed limit signs are idential streets must d to establish the speed limits.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	\$250-400/sign
ne drawback is that the residents e applications should be used.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	\$250-400/sign
edge lines and centerlines. A nes. This pavement marking ial streets.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	\$0.30/linear foot
verse areas such as school zones,	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	\$2.00/linear foot



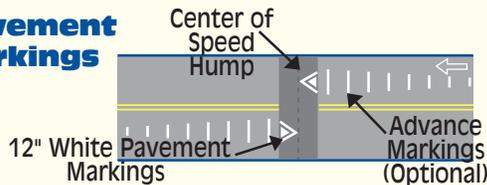
# Special Considerations for Speed Hump Applications

## Signing



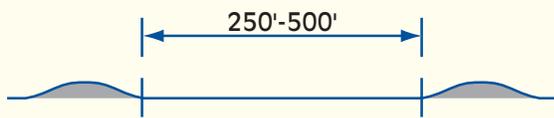
The SPEED HUMP (W17-1) sign should be used to give warning of a vertical deflection in the roadway that is designed to limit the speed of traffic. If used, the SPEED HUMP sign should be supplemented by an Advisory Speed plaque (W13-1). If a series of speed humps exists in close proximity, an Advisory Speed plaque may be eliminated on all but the first SPEED HUMP sign in the series.

## Pavement Markings



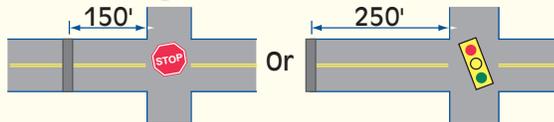
Speed hump markings consist of 12-inch white markings as illustrated. Two other allowable configurations exist as shown in the *MUTCD*. Advanced speed hump markings, which shall be white, may be used in advance of a speed hump where added visibility is desired or where deflection is not expected.

## Number and Spacing

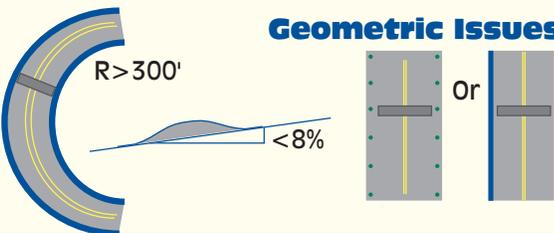


A single hump will act as point speed control. To reduce speeds along an extended section of street, a series of humps is usually needed. Humps should be placed 250 to 600 feet apart. One study shows that placing speed humps at intervals of 275 feet resulted in 85th percentile speeds of 25 mph; intervals of 550 feet resulted in 85th percentile speeds of 30 mph.

## Proximity to Intersections



Normally, humps should not be placed within 150 feet of an unsignalized intersection, or 250 feet of a signalized intersection.



## Geometric Issues

Curves - Speed humps should be used only on curves if the radius is greater than 300 feet.  
Grade - Humps should be installed on streets with a grade less than 8 percent.  
Curbing - Humps should be installed only on streets with curbing unless obstructions such as signing or flexible delineator posts prevent drivers from driving around the hump.

## Bicycles and Drainage



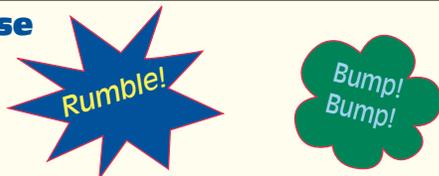
Ideally, speed humps should extend across the roadway from curb to curb. Bicyclists generally prefer this design, and it prevents motorists from driving with one wheel in the gutter. However, if drainage cannot be accommodated in the preferred design, the hump can be altered to allow drainage around the hump and to the nearest inlet.

## Emergency Vehicle



Watts humps delay emergency vehicles anywhere from 1 to 10 seconds, with most delays in the range of 3 to 7 seconds. Seminole humps delay emergency vehicles by approximately 1 second.

## Noise



Although speed humps may create noise from vehicles passing over them, the overall noise levels on the street may be reduced because of reduced vehicle speeds.

## Traffic Calming Planning and Design Considerations

Traffic calming measures should typically be considered only after:

- ❖ Education and enforcement efforts have failed to produce the desired results.
- ❖ Existing traffic conditions have been thoroughly analyzed.
- ❖ Projected traffic conditions (which will be created after the measures have been implemented) are studied.
- ❖ The necessary approvals have been received by installation authorities and/or by outside agencies if the roadway is not owned by the installation.

A qualified engineer should gather the appropriate traffic data, analyze the data, and identify what (if any) traffic calming devices are appropriate.

Throughout the study and design process, the community should be engaged as much as possible to identify areas of concern, gather feedback on potential solutions, and provide feedback on the success of traffic calming improvements.

## Contact Us

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## Legal Issues

Hundreds of local governments across the country have implemented traffic calming programs. Few have encountered liability issues. Almost all lawsuits that have arisen have been dismissed, denied, or withdrawn. Where lawsuits have succeeded, they have done so not because a traffic calming measure was found inherently unsafe, but because signs or pavement markings were poorly maintained. In order to minimize liability, installations should maintain documentation

illustrating that their traffic calming programs are appropriate, and that the installation of traffic calming measures are based upon the recommendation of a qualified engineer. ●

## MTMCTEA Can Help!

MTMCTEA highway engineers stand ready to help installations with their traffic engineering concerns—especially those involving high crash locations or access control. We perform many types of studies with an emphasis on low-cost improvements that are immediate or short-term and yield high benefits to their implementation costs. Generally, the studies conducted include:

- ❖ Access control
- ❖ Access roads
- ❖ Fatal crash analysis
- ❖ Force protection
- ❖ High crash locations
- ❖ Safety audits
- ❖ Signal operations
- ❖ Traffic calming evaluations
- ❖ Traffic engineering
- ❖ Traffic impact (such as BRAC)

### Answer from Page 2

1. A speed bump is shown. Speed bumps should not be used and are prohibited by AR 420-72.
2. There is no advance signing for the device and the pavement markings are not in accordance with the *MUTCD* as illustrated on page 6.
3. The device is too close to the unsignalized intersection. Speed humps, if used, should be at least 150 feet from unsignalized intersections.
4. It is difficult to see in the photo, but the hump is starting to break apart as a result of being struck by snowplows. If speed humps are used, flexible delineator posts should be used in colder climates to alert plow operators of speed hump locations.



## Reference List

- ❖ Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. Washington, D.C. 2000.
- ❖ Institute of Transportation Engineers. *Traffic Calming, State of the Practice*. Washington, D.C.
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- ❖ Lockwood, Ian. *ITE Traffic Calming Definition*. ITE Journal. July 1997
- ❖ <http://www.ite.org/traffic/index.html>
- ❖ [www.fhwa.dot.gov](http://www.fhwa.dot.gov)
- ❖ [www.tea.army.mil](http://www.tea.army.mil)
- ❖ [www.ite.org](http://www.ite.org)



## Training

Continuing Education	Phone	Web Site
<b>Penn State University;</b> The Penn Transportation Institute	(814) 865-4700	www.pti.psu.edu
<b>University of Maryland;</b> Md. Transportation Technology Transfer Center	(301) 403-4623	www.encc.umd.edu/tttc
<b>Georgia Institute of Technology</b>	(404) 385-3501	www.gatech.edu
<b>Northwestern University Center for Public Safety</b>	(800) 323-4011	www.northwestern.edu/nucps/index.htm
<b>Texas A&amp;M University</b>	(979) 845-3211	www.tamu.edu
<b>University of Washington; College of Engineering</b>	(206) 543-2100	www.engr.washington.edu/epp

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