SPEED BUMPS

WHICH DO NOT SLOW RESPONDING FIRE APPARATUS

EXECUTIVE LEADERSHIP COURSE, NFA

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ABSTRACT

This research project analyzed issues surrounding communities that have been installing speed bumps which slow responding fire apparatus.

The problem was that communities in Oregon were installing speed bumps to slow passenger traffic, which also slowed responding fire apparatus.

The purpose of the project was to design a speed control device that slowed passenger traffic in Oregon but did not slow responding fire apparatus.

This research project employed the action research methodology to identify (a) what national designs or standards existed for speed bumps which do not slow responding fire apparatus, (b) what state designs or standards existed for speed bumps which did not slow responding fire apparatus, and (c) what departments of similar size utilized speed-bump designs which did not slow responding fire apparatus.

To affect the action research methodology, a review of the current status was conducted which considered causal and contributing factors supplemented with interviews of key figures.

The results reflected that (a) there are no nationally adopted design standards for speed bumps that do not slow responding fire apparatus, (b) the State of Oregon has not adopted speed-bump standards which do not slow responding fire apparatus, and (c) communities locally have adopted speed-bump designs that don’t slow responding fire apparatus.

The recommendations, as a result of this research, are that (a) a model speed-bump design which does not slow responding fire apparatus should be adopted nationally, (b) the State of Oregon should adopt a speed-bump design by amending Goal 12 which does not slow responding fire apparatus, and (c) a model speed-bump design which does not slow responding fire apparatus should be adopted by Tualatin Valley Fire & Rescue as part of the fire code.

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INTRODUCTION

As planned-community densities increase along with the reliance on the automobile as the primary mode of transportation, transportation routes are under unprecedented traffic pressures. Increasingly, drivers seeking to avoid congestion are taking short cuts through residential areas. Additionally, the simple traffic load created by the suburban commute are clogging previously adequate streets. Increased traffic volumes are leading to increases in traffic speed and volume in residential areas. Neighborhood residents, concerned by speed and cut-through traffic are pressuring local government officials to install traffic calming devices and obstacles in an effort to slow and deter vehicular nuisances. However, while communities are solving the commuter traffic problem by installing mechanical obstacles, these obstacles also slow responding fire apparatus.

In the absence of standards which provide consideration for fire response apparatus, communities are merely trading one set of problems for another. Lengthened response times and increased damage and maintenance costs will also raise the public ire.

The problem is that communities are installing speed bumps to slow passenger traffic which also slows responding fire apparatus.

The purpose of this research paper is to design a speed control device that slows passenger traffic but does not slow responding fire apparatus.

The action research methodology will be employed to answer the following questions:

1. What national designs or standards exist for speed bumps which do not slow responding fire apparatus?

2. What state designs or standards exist for speed bumps which do not slow responding fire apparatus?
3. What departments of similar size utilize speed-bump designs which do not slow responding fire apparatus?

BACKGROUND AND SIGNIFICANCE

In 1973, the Oregon legislature passed Senate Bill 100 (B. Weast, personal communication, January 27, 2001) creating a list of comprehensive land use goals and forming the Land Conservation and Development Commission. In-turn, the Department of Land Conservation and Development (DLCD) was created to administer the policy directions set by the commission. Broadly, DLCD has adopted 19 planning goals that govern all urban development within the state (DLCD, 2000). Collectively, DLCD's goals aim to increase urban densities, discourage vehicular transportation, eliminate urban sprawl and emphasize the logical planning of growth and development.

A manifestation of these planning goals is that construction of additional urban freeways are strongly discouraged. The planning philosophy is that if freeways are clogged enough, commuters will choose mass-transit alternatives and eventually reduce their reliance on the automobile (B. Weast, personal communication, January 27, 2001). However, while this strategy is being implemented, commuters are circumventing normal freeway routes in favor of "cutting-through" neighborhoods on secondary streets in an effort to avoid the freeway gridlock.

This "cut-through" is causing neighborhoods to seek stronger traffic enforcement and the installation of mechanical traffic calming devices or obstacles in an effort to discourage or slow traffic in their neighborhoods.

Traffic calming is a general term for the re-architecture of street spaces in order to reduce the volume and speed of traffic (J. Levin, 1995). While traffic calming strategies have been around for many years, the redesign of streets originally designed for speed and ease of driving is somewhat new. The original purpose of traffic calming devices was to introduce design measures which physically and visually reinforced the residential nature of streets (M. Talbert, 1997).

Current neighborhood street designs appear to be effective as transportation routes; however, residents in the City of Portland, Oregon feel that traffic speed is a major problem. In a 1992 study, 37% of Portland residents felt that neighborhood speeding was the #1 traffic problem in the City (Wilson, 1999). While fire officials recognize the problem of neighborhood speeding, they also recognize the problems created by the installation of traditional traffic calming obstacles such as speed bumps (Wilson, 1999).

The Montgomery County Fire and Rescue Commission found in a 1997 study that the average time lost to a responding fire apparatus was 2.8 to 7.3 seconds per speed bump based on specific design (Montgomery Co., 1997). In another published account, speed humps were found to slow response times substantially and consistently (McGinnis, 1997).

The City of Portland, Oregon conducted a comprehensive study of traffic calming devices, designs and their effect on response times and concluded that fire vehicle response times are negatively affected when traffic-calming devices are installed on response routes (Wilson, 1999).

The fire service builds fire stations and deploys apparatus in a fashion designed to ensure a rapid response when people call for assistance. Any obstacle which impedes a timely response or skews the planned response model by slowing apparatus requires careful analysis. Many traffic calming experts are calling for community education in place of installation of calming devices (Gutschick, 1998). Further, neighborhood traffic issues are seen as symptoms of failed policy, and the installation of calming devices are a misadaptation of a more comprehensive original design concept (M. Talbert, 1997).

This problem has a mechanical-physical component related to the actual traffic calming features and public policy component. The successful public agency must often utilize executive leadership principles in finding creative approaches to policies which hinder your ability to fulfill the mission. Specifically, the creation of a speed-hump design which doesn't slow emergency responders while achieving the broader policy goal will need to be effectively sold within the industry and community. By demonstrating effective leadership behaviors, the public executives should be more successful in implementing the necessary solutions with less opposition and greater community and organizational support. Executive leadership skills will be critical to drawing the various interests together to embrace a new method of managing neighborhood traffic in a fashion that doesn't adversely effect responders.

LITERATURE REVIEW

Oregon's system of land use laws were founded in 1973 with the passage and codification of Senate Bill 100, which created the state-wide planning goals and authorized a branch of government to promulgate and enforce the necessary rules and processes (B. Weast, personal communication, January 27, 2001). Of the nineteen rules currently in effect in Oregon, goal 12 governs transportation and related issues (OAR 660, 2000).

In general, goal 12 states that local government shall establish standards for local streets that minimize pavement width and provide for more efficient use of urban land while providing for emergency vehicle access while discouraging inappropriate traffic volumes and speeds (DLCD, 2000).

These standards discourage the construction of new or larger freeways. Planners and architects of such statutes believe that as freeways become clogged and slow, commuters will select mass transit options and eventually reduce their reliance on the automobile. However, neighborhood associations are painting a very different picture.

Neighborhood leaders are complaining that commuter traffic is now being forced onto neighborhood streets and collectors as they seek alternate route to their destination. A study conducted by the City of Portland, Oregon showed that 37% of city residents felt that neighborhood speeding was the number one traffic problem in the city (Wilson, 2000). While enforcement is the first response most government officials choose to solve such problems, some are turning to design as an alternative.

Street designs that are intended to slow motorists are called traffic calming designs and include such familiar features as speed bumps. Traffic calming design is a general term for the rearchitecture of street spaces in order to reduce the volume and speed of traffic (J. Levin, 1995). The original purpose of traffic calming devices was to introduce measures which physically and visually reinforced the residential nature of streets (M. Talbert, 1997). However well intended as design elements, some believe that the application of traffic calming designs intended for “ground-up” design onto existing streets is misguided. Talbert suggests in his writings that today’s ideas are only parts of a more comprehensive original concept being applied to existing streets in a piecemeal fashion (M. Talbert, 1997). Still others are advocating community and neighborhood education as a more effective solution than redesign of the street via calming obstacles (S. Gutschick, 1998).

While the original intent of traffic calming design features is easily debated, there seems no debate on the effect these obstacles have on responding fire apparatus. A 1997 study conducted by Montgomery County demonstrated an average time loss per speed hump of between 2.8 and 7.3 seconds (Montgomery Co., 1997). Another study cited in the National Fire Protection Journal concluded that speed humps clearly slow responding fire apparatus (McGinnis, 1997). Lastly, in an attempt to quantify the impacts of speed humps on emergency responders, the City of Portland, Oregon conducted a study of speed humps, speed bumps and other traffic calming devices on emergency response apparatus. The Portland study-data confirmed that fire vehicle response times are negatively affected when traffic-calming devices are installed by as much as 10 seconds per hump (Wilson, 1999). A research project conducted by the Austin, Texas Fire Department found that delays of 2.3 to 9 seconds per speed hump could be expected (McGinnis, 1997). Further, the Austin study found no existence of any model or national standard on speed humps, which did not slow responding fire apparatus.

Chief Taylor Robertson of the Eugene, Oregon Fire Department summarized the findings well in his 2000 report by stating that “traffic calming devices have become one of the primary methods by which communities control traffic speed. However, it also slows responding apparatus” (Robertson, 2000).

The sum of these studies indicates that traffic calming devices slow responding fire apparatus. The degree to which they are slowed per device varies by the type of apparatus and design of the calming feature.

In search of a national standard for the design of speed humps, a review of the Uniform Fire Code revealed no standard for such devices (IFC, 1997). The Uniform Fire Code only prescribed that the clear driving surface for fire apparatus shall have an unobstructed width of not less than twenty feet.

The Department of Transportation (DOT) warrants the design and use of recognized traffic control devices but there are no established warrants for traffic calming devices (K. Calongne, 2000). Further, DOT typically references design elements from groups such as the Institute of Transportation Engineers (ITE). Ironically, ITE doesn't apply a prescriptive approach to such devices, rather they note that it is essential that designers develop compromises and consider trade-off's when designing such features (ITE, 1997).

In yet another article published by the Institute of Traffic Engineers, they recommend that "undulations" [traffic humps] should not be placed on primary emergency vehicle access/egress routes nor on important transit routes (Homburger etal., 1989). This conclusion was restated by the Montgomery County study which concluded that speed humps should be created on routes other than primary response routes (Montgomery Co., 1997).

In search of other national standards, a review of the National Fire Protection Association (NFPA) codes and publications revealed no national standard governing such devices. NFPA does prescribe streets to be not less than 28 feet from curb to curb but does not address calming devices (NFPA, 1997). The Building Officials and Code Administrators International (BOCA) code also fails to discuss traffic calming devices. Like the NFPA code, BOCA prescribes that a minimum of 18 feet of unobstructed width be maintained but fails to address obstructions in that same space (BOCA, 1996).

In summary, no national standards were identified for the design of speed humps, which do not slow responding fire apparatus.

In the absence of clearly articulated national standards regarding the design and installation of speed humps which do not slow responding fire apparatus, a review of state designs or standards was conducted.

In Oregon, the Uniform Fire Code is universally adopted and governs street width design (J. Grunewald, personal communication, December 10, 2000). A review of the Uniform Fire Code (UFC) revealed that no state amendment to the UFC existed which addresses speed humps or their design. Further, the UFC in its unamended state, does not address speed humps or their installation or design.

A review of the 19 state planning goals and related administrative rules for the Oregon Department of Land Conservation and Development (DLCD) failed to reveal any prescriptive design criteria for speed humps which do not slow responding fire apparatus (DLCD, 2000). While DLCD's administrative rules are not prescriptive on this matter, they do require that responding emergency apparatus be considered when planning and designing transportation routes (DLCD, 2000). This section, while open to interpretation, provides local fire officials the statutory reference necessary to argue for a response friendly traffic-calming device.

Absent any Oregon standard which regulates the designs of speed humps, a review of neighboring Washington State did reveal a model speed-hump design for a 40-foot roadway which did not slow responding fire apparatus. The Neighborhood Traffic Program in Clark County, Washington established a response-friendly speed-hump design for a 40-foot roadway (Clark County, 1999). Clark County itself, for use in any community later, adopted this standard in the county. While this design doesn't lend itself to the Oregon street standard of 20 feet, it does identify key design features which may be applicable in Oregon.

In the absence of any national or statewide standards which prescribe standards for a speed-hump design which doesn't slow responding fire apparatus, a review of departments of similar size was conducted in an effort to locate any local standards which may prove informative.

A review of the literature found a general consensus to avoid the installation of speed humps on any major response route (Gutschick, 1998). This basis philosophy has been heeded in many communities where comprehensive maps of primary response routes have been distributed as streets where devices will not be allowed. Currently, my employer, Tualatin Valley Fire & Rescue uses this approach. Similarly, the Montgomery County Fire and Rescue Commission has adopted the "drive around" philosophy by prohibiting the installation of speed humps on primary routes (Montgomery Co., 1997).

In Rancho Cucamonga, California, the city faced with neighborhood speeding has concluded that "the control of speeding in residential neighborhoods is a widespread concern which requires law enforcement effort, not speed bumps" (Cucamonga, 2000). Hence, Rancho Cucamonga has intentionally set a policy direction away from speed humps and chosen traffic enforcement. In Oregon, the City of Eugene has adopted a speed-hump standard which does not provide for responding fire apparatus (T. Robertson, 2000). Unlike the City of Eugene, the City of Portland, Oregon has identified but not adopted an alternative speed-hump design which allows fire apparatus to weave between the humps if no opposing traffic is present (Portland,1999). While effective, the requirement to fully use the on-coming lane to weave between the humps presents limitations.

Lastly, a review of the cities served by Tualatin Valley Fire & Rescue found that only one city, Beaverton, has adopted criteria relating to speed humps and responding fire apparatus.

Beaverton prohibits the installation of speed humps on primary response and main transportation routes (Wooley, 2000).

In an effort to identify key data, which may be used in the design of a model speed hump, which doesn't slow responding fire apparatus. An interview was conducted with Kevin Day, Apparatus Maintenance Supervisor for Tualatin Valley Fire & Rescue (K. Day, personal communication, September 10, 2002). Mr. Day advised that no portion of a fire engine may be lower to the ground than 8 inches according to NFPA 1901, section 10-3.2.2. Further he identified the minimum interior wheel to wheel distance as 49 inches for all fire apparatus and the maximum exterior wheel to wheel distance as 100 inches for all apparatus (K. Day, personal communication, September 10, 2002).

The literature review failed to disclose any national, state or similar-sized department standards for the design of a speed hump which doesn't slow responding fire apparatus which could be directly applied within our jurisdiction. Design elements from the Clark County, Washington model could be applied to Oregon roadways if local apparatus specifications are taken into account.

PROCEDURES

Definitions

DLCD: The Oregon Department of Land Conservation and Development, is the administrative arm of LCDC, responsible for the management of and implementation of policy direction.

Fire Code: The adopted code promulgated to enforce fire safe practices in public places, which includes fire department access.

LCDC: Oregon Department of Land Conservation and Development Commission is responsible for the governance of the 19 land-use goals which regulates transportation among other things.

Skinny Street: Any street that is designed to specification less than the requirements identified in the adopted fire code.

Speed Bump: An engineered upward undulation in the road surfaces which is typically 3" to 4" in height and no wider that 18" with tapered approaches and a rounded top. A speed bump is intended to cause passing vehicles to slow in order to negotiate the bump.

Speed Hump: An engineered upward undulation in the road surface which is typically 3" to 4" in height with 6' tapered approach and departure ramps with a 10' to 20' flat top. A speed hump is intended to cause passing vehicles to slow in order to negotiate the hump.

Traffic-Calming Device: Road design measures, which physically and visually reinforce the residential nature of streets and thereby reduce the speed of passing motorists.

Traffic-Table: Same as the definition for speed hump.

Undulation: An engineered roadway feature that resembles a wave or wave-like feature.

For this research paper, the action research methodology was selected because it provides for an effective review of available current information and also yields a standard design for speed humps which do not slow responding fire apparatus. The action research methodology was applied utilizing the APA publication manual, fourth edition.

Currently, there is no nationally or locally adopted standard design for speed humps which do not slow responding fire apparatus.

The research procedure used in preparing this paper began with a literature review of the materials available in the Learning Resource Center at the National Emergency Training Center as of September, 2001. Additional materials were collected from Oregon state agencies and local municipalities of a size and demographic similar to Tualatin Valley Fire & Rescue.

Additionally, interviews were conducted with individuals who had single discipline expertise relating to an element for which no or limited printed material existed.

The research project had limitations related to the amount of printed material available on this specific topic. A majority of the literature found during the literature review was oriented toward related designs but not specifically regarding the topic of this research. Apparently, the topic is narrow and has only emerged as a relevant issue in states experiencing high population growth rates amidst regulatory efforts to contain growth and increase population density. For those reasons, I relied heavily on information from a few states within which those factors exist.

Due to the nonexistence of a model traffic-calming device, which doesn't slow responding fire apparatus, this project entailed collaboration with Ms. Susan Mootry to produce the engineering designs represented in Appendix A.

The problem is that communities are installing speed bumps to slow passenger traffic which also slows responding fire apparatus. Further, the lack of a standardized approach results in a hodge-podge of designs and standards.

The purpose of this research is to design a speed control device that slows passenger traffic but does not slow responding fire apparatus. By creating a model design for speed control devices which does not slow responding fire apparatus, responders will not be unduly delayed in their efforts to interdict the emergent conditions.

RESULTS

1. **What national designs or standards exist for speed bumps which do not slow responding fire apparatus?**

Research and interviews failed to reveal any national design or standard for the design of a speed bump that does not slow responding fire apparatus.

The National Fire Protection Association (NFPA), which promulgates codes and standards for national and international adoption failed to contain a standard governing the speed-bump design or installation (NFPA, 1997).

In the same vein, the Uniform Fire Code, which is the predominant adopted fire code in the 10 western states, also fails to directly or indirectly address speed-bump design or installation (UFC, 1997).

Additionally, the Department of Transportation only references the Institute of Transportation Engineers (ITE) standards which refrain from prescriptive designs in favor of urging trade-off’s and compromises (ITE, 1997). However, in later publications, ITE recommends that “undulations” not be placed in primary emergency vehicle access/egress routes (Homburger etal., 1989).

In addition to the noted references, a comprehensive literature review failed to reveal additional sources on the topic.

In summary, no national standards were identified for the design of speed bumps, which do not slow responding fire apparatus.

2. **What state designs or standards exist for speed bumps which do not slow responding fire apparatus?**

In Oregon, the Uniform Fire Code is adopted and governs fire department access and street width in conjunction with local planning laws (J. Grunewald, personal communication, December 10, 2000). As previously noted, the Uniform Fire code does not address speed bump design or installation, and the document as adopted in Oregon in not amended in this area (UFC, 1997).

The Oregon Department of Land Conservation and Development has jurisdiction on street designs and standards via DLCD-Goal 12 (DLCD, 2000). However, Goal 12 while generally instructive, is not prescriptive and it clearly fails to set standards for speed-bump design (DLCD, 2000).

Like Oregon, Washington, Oregon's neighboring state, failed to possess a statewide standard for the design and installation of speed bumps which do not slow responding fire apparatus.

In summary, no Oregon or Washington standards exist for the design and installation of speed bumps which do not slow responding fire apparatus. Additionally, a comprehensive literature review failed to identify any such speed-bump design standards within the 50 states.

3. What departments of similar size utilize speed-bump designs which do not slow responding apparatus?

A review of the literature revealed that Montgomery County Fire and Rescue Commission, a department of similar size to my employer, Tualatin Valley Fire & Rescue, has adopted a "drive around" philosophy (Montogomery Co., 1997). Montgomery County has prohibited the installation of speed humps/bumps on any primary response route (Montgomery Co., 1997). While this standard does not govern the design features, it does regulate the installation toward the end result of not lengthening response times.

Eugene, Oregon, a similar sized community, addresses speed bumps within their planning code but fails to restrict their installation or create a response-friendly design (T. Robertson, 2000).

Clark County, Washington, a nearby county, has formally adopted a model speed-hump design that does not slow responding fire apparatus, but its design is only for 40' streets and is not transferable to the 20' Oregon standard street (Clark County, 1999). Similarly, neighboring Portland, Oregon, has identified but not adopted a speed-hump design which requires fire apparatus to weave into on-coming traffic to avoid the hump (Portland, 1999).

The final product of this research should be used to establish a nationally adoptable standard for traffic calming devices, which slow civilian traffic, but do not have an adverse impact on responding fire apparatus. This design should utilize the NFPA minimum clearance requirements for apparatus as a key design feature. Design features could force civilian traffic to negotiate traditional speed bumps/humps while high-clearance center barriers could be straddled by responding equipment.

It was an unexpected finding to locate communities which had opted for the enforcement over traffic calming devices. The proliferation of devices with communities in Oregon had led the writer to expect that enforcement had been ruled out by scientific analysis as a logical option.

In summary, some similarly sized jurisdictions have identified or adopted roadway designs which accommodate speed humps/bumps, which do not adversely affect the response times. These standards, while not exactly matching the stated problem, will likely contribute to the final design of a model which will address the stated problem.

DISCUSSION

Increased traffic densities that result from population growth has resulted in planning authorities within states and communities seeking ways to manage the impacts in a cost-effective manner. Urban sprawl or increased urban density in the absence of viable and functional mass-transit will result in higher numbers of vehicle-miles traveled annually. Many communities have accommodated the growth without enhancing the transportation system or providing viable mass-transit alternatives.

Increased growth in population absent the commensurate growth in transportation infrastructure has led to clogged freeways and frustrated motorists seeking secondary routes to their destination. While the term “secondary route” has a technical application, to residents it translates into speeding commuters clogging and speeding through their neighborhoods. These same residents are now pressuring planning and traffic authorities to restore livability to their neighborhoods by creating physical obstacles for passing traffic. These obstacles are commonly referred to as traffic calming devices and are the primary method by which communities control neighborhood traffic speed (T. Robertson, 2000).

Residents do in-fact view traffic in their neighborhoods as a major problem. A Portland, Oregon study found that 37% of city-wide residents found that “neighborhood-speeding” was the number-one traffic problem in Portland (Wilson, 1999).

The research material reflected results that appear to be in conflict with common practice. Specifically, no data was available as a result of the literature search that defines the effectiveness of traffic calming devices when response impacts are considered. To illustrate this point, Rancho Cucamonga, California opted for enforcement instead of traffic calming devices because enforcement didn’t slow emergency responders (Cucamonga, 2000).

Further, traffic industry experts seem to recommend traffic calming practices that differ substantially from current practices. It appears that in most cases, the concepts being utilized today are only parts of a more comprehensive original concept on how to reduce traffic speed in neighborhoods (M.Talbert, 1997). The original intent of traffic calming features was to visually reinforce the residential nature of streets rather than impose barriers that physically control speed (M.Talbert, 1997).

Current utilization of traffic calming features are being implemented at substantial cost and absent neighborhood and driver education (Gutschick, 1998). Further, providing design compromises with developers is recommended by transportation engineering industry groups in a manner that doesn't adversely effect emergency responders (ITE, 1997). Yet another conclusion drawn by the Institute of Traffic Engineers clearly states that undulations not be placed on any primary response route or important transit route (ITE, 1997).

In short, traffic-calming devices slow traffic by imposing physical obstacles and barriers which traffic must slow to negotiate. Those same barriers have an even greater effect on responding apparatus due to the size and weight of those units. But, how great is the impact?

Data gathered in the Portland, Oregon study demonstrated that traffic-calming devices slow responding apparatus by as much as 10 seconds per obstacle (Wilson, 1999). The Austin, Texas study also reflected substantial impact. That study demonstrated that each traffic-calming device created delays of 2.3-9 seconds per device. Following the Montgomery County study, officials concluded that the negative response time impact was so great that they prohibited the installation of the devices on any primary response route (Montgomery Co., 1997). That very conclusion is consistent with the conclusions of the Institute of Traffic Engineers (Gutschick, 1998).

While the need for some traffic-calming devices seems logical given legislative and community mandates (DLCD, 2000), no national standards exist for designs that don't slow emergency responders (K. Calongne, 2000). Of the many fire codes governing street width and design, none address traffic-calming devices or their installation. The Uniform Fire Code, which is the adopted code in Oregon, only addresses street width (J. Grunewald, personal communication, Dec. 10, 2000). The BOCCA code, which is the second most pervasive code, only addresses width and prohibits "obstructions" (BOCCA, 1996). Lastly, the National Fire Protection Association code, only addresses street width (NFPA, 1997).

The collection of codified standards sets forth a pattern of prescribing street widths and outright obstructions but fails to collectively address impediments to effective response. Again, it appears to be an obvious oversight to not address response time impediments. Even NFPA, the world's largest promulgator of such standards, recognizes in its periodical publications that speed humps substantially slow emergency response. However, NFPA's own standards fail to address the matter in any fashion (McGinnis, 1997).

The body of research material offered many potential solutions for addressing the need for traffic calming while not slowing emergency responders. Some communities have ignored potential solutions by bowing to community political demands for physical obstacles (T. Robertson, 2000). Still others have opted to limit the places at which traffic-calming devices are installed or ban them altogether.

Beaverton, Oregon, while not having adopted a model which does not slow responding fire apparatus, does limit installation of traffic-calming devices to neighborhoods, excluding primary routes (Wooley, R., 2000). Just over a small range of hills, Portland, Oregon has taken the opposite approach. Portland installs their traffic calming serpentines, primarily on major transportation routes through neighborhoods (Wilson, 1999). However, Portland's design allows responding apparatus to weave into on-coming traffic to avoid the undulation in their own lane of travel. Traffic permitting, this design has proved quite effective but its effectiveness diminishes with increased 2-way traffic concentrations.

Study results do clearly indicate that in spite of a few creative and isolated successes, no national model exists. Based on the research, it appears that a feature that did not slow responding apparatus while slowing civilian traffic should be based on features unique to fire apparatus. The research indicated that no fire apparatus may have any part of the vehicle closer to the ground than 8 inches (K. Day, personal communication, September 10, 2002). NFPA's language states that "axle housings and any component other than wheels and tires shall clear the road surface by at least 8 inches" (NFPA, 1999). By having a standard that dictates that no portion of an emergency response vehicle be lower to the ground than 8 inches, a calming feature could be designed around that single component of consistency.

Specifically, a traffic-calming upward undulation with clearance of 7 inches, between two traditional speed tables, which stopped short of the undulation, could be an effective solution.

By designing and implementing a model design within a single community or region, responders could rely on a consistent feature while not lengthening response times.

This writer concludes from the research, that a model traffic-calming device should be designed with vehicle clearance as primary component. Further, that upon completion of the design and field testing, the model traffic-calming device be adopted by all jurisdictions within a service area or region.

Within Tualatin Valley Fire & Rescue, adoption of such a model design would require separate adoption by 10 separate municipalities, 3 counties and the fire district. Further, upon adoption by the individual municipalities, the model would need to be codified into local street design ordinances and traffic management ordinances. At the state level, legislation would need to be introduced to make intentional circumvention of a traffic-calming device a traffic infraction. Absent a specific enforceable section of the traffic code, local police may not consistently apply traffic laws to violators. In the absence of clearly applicable laws, law enforcement officers are typically less inclined to cite motorists for perceived violations.

RECOMMENDATIONS

1. The National Fire Protection Association and other fire code promulgating entities should research and develop and adopt a national standard for traffic-calming devices which do not slow responding fire apparatus.

Because the National Fire Protection Association, Building Officials Congress, Uniform Fire Code or any other code promulgating entity have not produced code which addresses the model design of traffic-calming devices which does not slow responding fire apparatus. A committee of informed and interested parties should be convened for the purpose of developing such a standard for national adoption.

In the absence of a clearly articulated national standard, traffic-calming features that are not "response-friendly" will negatively influence times. Further, fire department officials charged with defending infrequent responses to neighborhoods in the face of daily incursions of speeding motorists, will be disadvantaged in the absence of a dual purpose design.

A response-friendly traffic-calming design, with the credibility of a national promulgation and adoption will enhance a local jurisdiction's ability to codify and implement such a standard.

2. **The State of Oregon should amend the Land Conservation and Development Commission's Goal 12, in order to mandate the installation of traffic calming devices consistent with the nationally adopted standard.**

Oregon's Department of Land Conservation and Development promulgates all laws related to growth and its effects in Oregon. Specifically, Goal 12 mandates that urban growth be contained and sprawl reduced by increasing urban population densities. More specifically, Goal 12 mandates narrower street designs and creates disincentives for local governments who expand highway-type systems.

In effect, Goal 12 has intentionally increased gridlock in an effort to create a desire by individual drivers to utilize mass-transit as a less stressful and more timely mode of transportation. This intended consequence has drastically increased cut-through traffic in neighborhoods bringing with it speed and congestion.

Goal 12 should be amended to specifically prescribe the use of a nationally adopted response-friendly traffic-calming device in neighborhoods. Such an adoption would not reduce the intended "consequence" of driving a private vehicle but would also not erode response times. Because local communities' transportation rules are reviewed by DLCD to verify compliance with Goal 12, amendment of Goal 12 would ensure local compliance.

3. **Tualatin Valley Fire & Rescue should adopt the national standard for traffic-calming devices during its fire code adoption process and communicate the impact of said change to the neighborhoods and planning jurisdictions.**

Tualatin Valley Fire & Rescue is a legal entity of the State of Oregon and thereby obligated to adopt standards that are adopted by the State of Oregon. Local adoption of a nationally adopted traffic-calming standard would take the form of an ordinance giving the standard the effect of law at the local level. Once the standard becomes law, the fire marshal and local planning officials must design streets in accordance with that statute.

From the date the ordinance is adopted forward, all modifications to streets and all new streets must be designed in accordance with the statutes.

Future readers should review the cited codes and standards-making organizations in order to evaluate if progress has be achieved toward the adoption of a national traffic-calming design standard.

Additionally, future readers should take the steps necessary to cause the local adoption of a response-friendly traffic-calming standard in advance of political and community pressures.

Lastly, future readers should conduct comparative research of the traffic-speed impacts in communities with traffic-calming undulations with Rancho Cucamonga, California. Such a study should provide insight into the effectiveness of enforcement when compared to traffic calming.

REFERENCES

Building Officials and Code Administrators International. (1996) Fire Prevention Code (10th Ed.), Section F-315. Country Club Hills, IL

Calongne, Kathleen (1999). Problems Associated with Traffic Calming Devices. Boulder, CO. Unpublished manuscript. Kcalongne@compuserve.com (15 October, 2000).

City of Portland Department of Transportation: Slowing Traffic in Neighborhoods. [On-Line]. Available: www.trans.ci.portland.or.us/trafficcalming (1999).

Gutschick, S. (1998, March). Traffic-Calming Devices: Coming to A Roadway Near You. Firehouse, 23, 122-125.

Homburger, Wolfgang S., Deakin, Elizabeth A., Bosselmann, Peter C., Smith, Daniel T., Beukers, Bert (1989). Residential Street. Design and Traffic Control, (pp.106). Washington, DC: Institute of Transportation Engineers.

Institute of Transportation Engineers (1997). Copy Editor. Guidelines for the Design and Application of Speed Humps, (pp21. Washington, DC: Institute of Transportation Engineers "Street Design Handbook".

International Fire Code Institute. (1997) International Fire Code, Section 902.2.2.1. Fallbrook, CA.

Levin, John (1995). Neighborhood Transportation Planning Issues and Strategies. City of Minneapolis, MN. Strategies in the Linden Hills Neighborhood.

McGinnis, L. (1997). Things That Go Bump in the Night. NFPA Journal, 91, 78-82.

Montgomery County Fire and Rescue Commission. (1997). The Effects of Speed Humps and Traffic Circles on Responding Fire-Rescue Apparatus (pp. 1-4) Montgomery County, MD:

National Fire Protection Association. (1997). Fire Protection Handbook (18th. Ed.), (p. 1-12). Quincy, MA:

National Fire Protection Association. (1999). Standard for Automotive Fire Apparatus (NFPA 1901, 10-3.2.2, pp. 23). Quincy, MA:

Neighborhood Traffic Program Resolution, 1999-12-12. Clark County Washington, (1999).

Oregon Administrative Rules, sec. 660-012-0045 (7), (2000)

Oregon Department of Land Conservation and Development. (2000, October 10). Oregon's Planning Goals and Guidelines [On-Line]. Available: www.lcd.state.or.us/hoalhtml/hoals.html

Rancho Cucamonga, City of (2000). Won't Speed Bumps Slow Traffic on our Streets? (pp.1), City of Rancho Cucamonga, CA. [On-Line}. Avaliable: www.ranch-cucamonga.ca.us/engr_pubworks/speedbumps.htm (15 October, 2000).

Robertson, Taylor (2000). Speed Hump Impacts on Emergency Response Times Eugene Fire and Emergency Medical Services, (pp.7-12). (Executive Fire Officer research Paper) Emmitsburg, MD: National Fire Academy

Talbert, Michael (1997). Impact of Traffic Calming Devices on Emergency Apparatus Response Times, (pp.5-6). (Executive Fire Officer Research Paper) Emmistsburg, MD: National Fire Academy.

Wilson, Ed (1999). The Influences of Traffic Calming Devices on Fire Vehicle Travel Times, (pp.3-23). (Executive Fire Officer Research Paper) Emmitsburg, MD: National Fire Academy.

Wooley, R. (2000). Beaverton Traffic Calming Proceedures. Transportation Division Proceedures. Beaverton, OR:

Appendix A

Figure 1

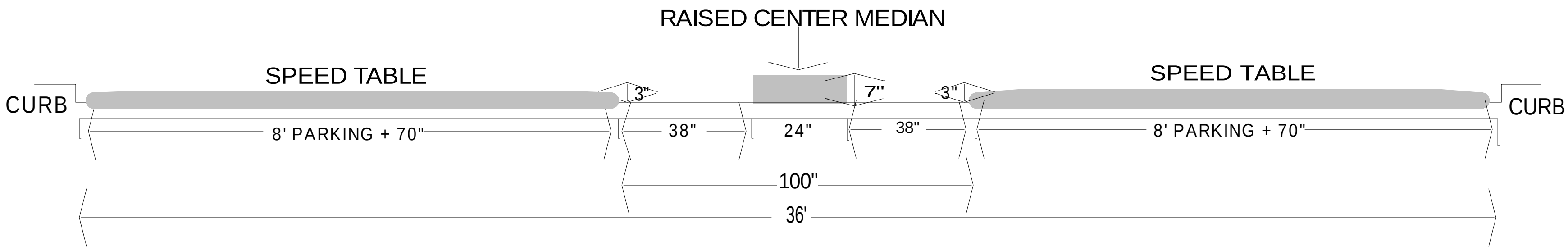

Figure 2

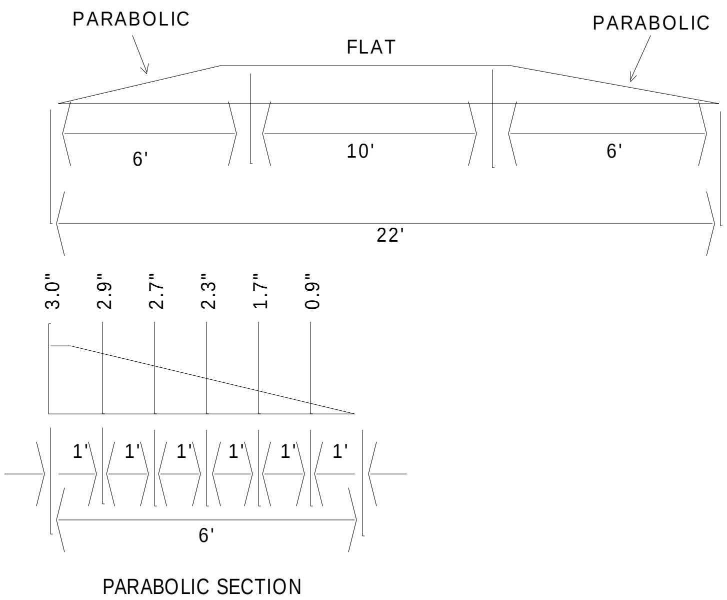

Figure 3