Montgomery County
Fire and Rescue Commission

The Effects of Speed Humps and Traffic Circles on Responding Fire-Rescue Apparatus in Montgomery County, Maryland

Tests Conducted Jointly by the
Fire and Rescue Commission and
the Department of Public Works
and Transportation

August 1997

EXECUTIVE SUMMARY

Due to their concern for the alleged adverse effects of speed humps and traffic circles on fire-rescue response, the Montgomery County Fire and Rescue Commission, at its October 10, 1996 meeting, passed two motions concerning this issue: 1) that field tests be conducted to quantify and analyze the effect of speed humps and traffic circles on response times; 2) that the Department of Public Works and Transportation provide these test results to the public when applications for speed humps and traffic circles are submitted to them. These motions came about as the result of concerns of how speed humps and traffic circles adversely affect response times, and they were based upon the results of speed hump and traffic circle tests conducted in Portland, Oregon and Austin, Texas where quantitative data showed significant delays for fire-rescue apparatus.

On April 30, 1997, the Fire and Rescue Commission (FRC) and Department of Public Works and Transportation (DPWT), with assistance from other local fire-rescue and police organizations, conducted field tests of fire-rescue apparatus traversing speed humps and traffic circles of the types typically found throughout Montgomery County. Two courses were utilized for this purpose, one having three[1] 12-ft Watts-type speed humps and the other having a single traffic circle. Twelve test runs were conducted on each course, featuring four types of apparatus (i.e., engine, tiller-style ladder truck, aerial tower, ambulance) and three different drivers per vehicle. The test runs were timed and the results compared to calculated times for courses of similar distances without speed humps and traffic circles in order to determine delays attributed to these devices.

The results of the Montgomery County speed hump and traffic circle tests confirmed that these two types of traffic calming devices cause delays for fire-rescue vehicles en route to incidents. The amount of delay was found to be dependent upon three factors -- vehicle type/size, type of traffic calming device, and driver discretion regarding speed.

On the speed hump course, where the units were attempting to maintain a constant speed of 25 mph, the average impact delay per hump was found to range between a high of 7.3 seconds for the Ladder Truck and a low of 2.8 seconds for the Aerial Tower. The higher delay is equivalent to responding from a station .05 mile per speed hump further away from the incident location along an unimpeded route. More importantly, the four vehicles averaged slightly less than 20 mph across the speed hump test route, about half the response cruising speed of 35-40 mph typically attained by fire-rescue vehicles on unimpeded roads. Should speed hump-impeded routes taken by responding units limit average speed to 20 mph, the amount of area they can serve within 5

[1] Multiple speed humps spaced over short distances are commonplace in the County.

minutes[2] may drop to 1.3 linear miles (equivalent to 6.8 sq. mi. surrounding the station) versus the 2.0 linear miles (16 sq. mi.) served within 5 minutes along unimpeded routes whereby a cruising speed of 35-40 mph is attainable.

On the traffic circle course, where the units were attempting to maintain a constant speed of 35 mph, the average delay ranged between a high of 7.0 seconds for the Ladder Truck and a low of 3.2 seconds for the Ambulance. Similar to the speed hump test results, the higher delay is equivalent to responding from a station about .05 mile per traffic circle further away from the incident location along a route free of traffic circles. Of greater importance, the four test vehicles averaged slightly less than 28 mph on the traffic circle test course, about 7-12 mph less than the response cruising speed of 35-40 mph attained on unimpeded roads.

It is important to emphasize that these TCD tests were conducted at speeds appropriate for the two test courses, but somewhat slower than the typical response cruising speed (i.e., 35-40 mph) of fire-rescue apparatus. If similar tests were conducted in Montgomery County at speeds approaching 40 mph, greater delays would be expected, as indicated by the results of the Portland and Austin tests. The Montgomery County test results could, therefore, be considered as representing minimum delays that one would expect for responding fire-rescue vehicles in the County.

The Montgomery County tests results, in combination with those of the Portland and Austin tests, confirm that speed humps and traffic circles cause considerable delays for responding fire-rescue apparatus, which may adversely impact the outcome of certain life-threatening incidents such as those involving cardiac arrest, uncontrolled bleeding, or persons trapped in burning buildings or vehicles. Delays of this nature must be given serious attention by the public and government officials who determine the employment and specific placement of speed humps and traffic circles in their communities and jurisdictions. Those in favor of these devices must be willing to accept the likely probability of slower fire-rescue service delivery in their community and neighborhoods. While speed humps and traffic circles offer a cost-efficient approach to reducing vehicular speed and reducing the number of traffic accidents in neighborhoods, they present the disadvantage of slowing fire-rescue vehicles.

[2] 5-minutes represents a response time goal, unadopted in Montgomery County, which assumes 1.5 minutes for dispatch, turnout, and acceleration of units up to response cruising speed; and 3.5 minutes for travel time once cruising speed has been attained.

which different type/size fire-rescue vehicles traverse speed humps and traffic circles.

INTERPRETATION OF TEST RESULTS

As expected, the results of the speed hump and traffic circle tests confirm that these two types of traffic calming devices cause delays for fire-rescue vehicles en route to incidents. The amount of delay is dependent upon three factors -- vehicle type/size[12], type of device, and driver discretion regarding speed. For Watts-type speed humps, the most commonly encountered traffic calming device in the County, the average impact delay[13] per hump was found to range between a high of 7.3 seconds for Truck 10 and a low of 2.8 seconds for Aerial Tower 6, over a test course where the units were attempting to maintain a constant speed of 25 mph. For a single traffic circle, the average delay ranged between a high of 7.0 seconds for Truck 10 and a low of 3.2 seconds for Ambulance 248, over a test course where the units were attempting to maintain a constant speed of 35 mph.. The results of each type of test are examined in greater detail below.

Speed Hump Test Results

The results of the speed hump tests (see Appendix I-1), in which the units were attempting to maintain a constant speed of 25 mph, indicate that Truck 10 (T10) experienced an average impact delay of 7.3 seconds per Watts-type hump, the longest delay of any test vehicle. The average delays experienced by Engine 301 (E301), Ambulance 248 (A248), and Aerial Tower 6 (AT6) were 4.2, 3.8 and 2.8 seconds, respectively. In addition, T10 averaged only 6.1 mph while traversing the 12-ft parabolic-shaped humps themselves, about 19 mph below the desirable speed for the test course and about 29-34 mph below a typical response "cruising speed" thought to be in the 35-40 mph range.[14] Likewise, A248, E301, and AT6 averaged only 8.7, 9.1 and 10.8 mph, respectively, while traversing the 12-ft speed humps.

The impact delay of 12-ft Watts speed humps may be more easily understood if equated to distance. The chart in Appendix I-2 contains equivalent distances of this nature. Under the

---

[12] Appendix J presents vehicle specifications (e.g., weight, dimensions, etc.)

[13] Impact delay refers to the full impact delay caused by a hump/circle, including the deceleration time as the unit approaches the device, the time to traverse the device itself, and the time required to accelerate back to the desired response speed.

[14] Results of a widely-accepted response time study conducted in New York City by the Rand Institute indicate that fire department apparatus travel at an average cruising speed of 39.2 mph, following the initial ½ mile of the response route when units are accelerating to that cruising speed. Similar results were replicated in urbanized municipalities elsewhere in the United States.

assumption of a 5-minute response time goal[15], the chart shows that if Truck 10 is responding at a cruising speed of 25 mph, each 12-ft hump that it traverses has the effect of placing the fire station .05 (1/20) mile further from the incident along a response route unimpeded by humps. To further this concept, the chart also reveals that every five humps have the effect of adding approximately 1/4 mile to the equivalent response distance. Stated alternatively, five humps have the effect of needing to move the fire station 1/4 mile closer to the incident in order to maintain a 5-minute response goal. Similar comparisons are presented for the other test vehicles traveling at 25 mph.

More importantly, the four vehicles averaged slightly less than 20 mph across the test route, about half of the 35-40 mph response cruising speed typically attained by fire-rescue vehicles on roads unimpeded by speed humps. Assuming that speed hump spacing along the test course is representative of hump installations county-wide, fire-rescue apparatus will frequently be limited to a 20 mph response cruising speed on hump-impeded routes.

Should speed hump-impeded routes taken by responding units limit average speed to 20 mph, the amount of area they can serve within 5 minutes may drop to the area within 1.3 linear miles[16] from the station versus the area within 2.0 linear miles served within 5 minutes along unimpeded routes upon which a cruising speed of 35-40 mph is attainable. Coverage of 1.3 miles in each direction from a station would be about 6.8 square miles per station for a total of 210 square miles covered by the County's 31 fire-rescue stations[17]. In comparison, coverage of 2.0 miles in each direction would equal 16 square miles per station for a total of 496 square miles[18] covered by the same 31 stations. Assuming the 1.3 mile scenario, station coverage would be 42% of that available from stations unimpeded by speed humps, implying that 58% of the residents/service recipients would wait more than 5 minutes for service after calling 911.

Whether stated in terms of a time delay or an equivalent distance, speed humps along a response route will slow fire-rescue units -- the amount of delay dependent upon the number of humps, type of apparatus, and the discretionary speed of the driver. In the case of a citizen experiencing a life-threatening medical emergency (e.g., cardiac arrest, uncontrolled bleeding, anaphylactic shock,) or entrapment in a burning building or vehicle, these delays may adversely affect timely assistance required of responding fire-rescue units, with serious consequences a possibility. For

---

[15] 5-minutes represents a response time goal, unadopted in Montgomery County, which assumes 1.5 minutes for dispatch, turnout, and acceleration of units up to response cruising speed; and 3.5 minutes for travel time once cruising speed has been attained.

[16] Linear mileage refers to the straight line distance in each direction from the station.

[17] Figure does not include the two rescue stations (equipped with EMS/rescue units but lacking fire suppression units) whose first-due response areas overlap those of the 31 fire and rescue stations which provide fire, rescue and EMS services to the county.

[18] Figure equal to the total area within Montgomery County.

example, when a person goes into cardiac arrest, their best chance for survival is when an automatic external defibrillator is applied, or CPR is initiated, within 6 minutes[19] of the occurrence of cardiac arrest. Their chances for survival decrease steadily beyond the initial 6 minutes.

It is important to emphasize that these speed hump tests were conducted at a speed of 25 mph, an appropriate speed for the Rock Run Drive test course, but considerably slower than the typical cruising speed (35-40 mph) of fire-rescue apparatus. If similar tests were conducted in Montgomery County at speeds closer to this range, greater delays would be expected. Results of the speed hump tests conducted in Portland, Oregon and Austin, Texas (see Appendix K) support this supposition, where, for example, delays exceeded 9 seconds per hump in the Portland tests for larger vehicles traveling at 40 mph. The Montgomery County test results could, therefore, be considered as representing minimum delays that one would expect for fire-rescue vehicles responding along a speed hump-impeded route within the county.

Traffic Circles

The results of the traffic circle tests (see Appendix I-3), where the units were attempting to maintain a constant speed of 35 mph, indicate that T10 experienced an average impact delay of 7.0 seconds regarding the single-circle test, the longest delay of any test vehicle. The impact delays experienced by AT6, E301, and A248 were 5.4, 5.0 and 3.2 seconds, respectively. In addition, T10 and AT6 averaged only 10.3 mph while traversing the circle, about 25 mph below the desirable speed for the test course and about 30 mph below a "cruising speed" 40 mph. Likewise, A248 and E301 averaged only 14.0 mph, respectively, while traversing the circle, also far below both the desired speed and cruising speed.

Of greater importance, the four vehicles averaged slightly less than 28 mph across the test course, about 7-12 mph less than the response cruising speed of 35-40 mph generally attainable on roadways unimpeded by traffic circles. Considering that traffic circles are much less prevalent in Montgomery County than speed humps[20], it is unlikely that fire-rescue apparatus will be frequently limited to a 28 mph response cruising speed due to traffic circles alone; however, for roadways containing a mixture of both circles and humps, response speeds may well be limited to the 20-28 mph range[21].

It is important to emphasize that these traffic circle tests were conducted at a speed of 35 mph, an appropriate speed for the Brickyard Road test course and within the typical 35-40 mph cruising speed range referenced above. Portland also conducted traffic circle tests (see Appendix K), at speeds between 25 and 40 mph. Since Portland's results for 35 mph were comparable (slightly

---

[19] As recommended by the American Heart Association

[20] The present ratio of humps to circles is about 22:1.

[21] The 20-28 mph range incorporates the reduced speeds associated with each type of traffic calming device tested -- Watts humps and traffic circles, respectively.