VERTICAL CONTROL DEVICES

Vertical controls reduce traffic speeds, may assist in managing volume, and reinforce safe, pedestrian-friendly streets by using forces of vertical acceleration to discourage speeding.

Speed humps, speed tables, raised crossings, speed cushions, and textured pavements are common vertical speed control measures. Vertical control measures may be a temporary or short-term method for reducing speeds. Over the longer term, self-regulating designs are more desirable to manage travel volumes and reduce cut-through traffic. Vital Streets projects should generally not require these measures, as they will be designed to promote self-regulating design.

USE

- Vertical speed control elements are most appropriate on streets with speeds limits less than 30 mph, and where there is higher than desired operating speeds. They will be most common on lower order streets (Neighborhood Residential, Link Residential, and Neighborhood Business) as well as alleys.
- They may also be used on streets where traffic volumes are higher than desired and frequently used by cut-through traffic.
- Vertical speed control elements may be accompanied by operational strategies to reduce vehicular speeds such as targeted enforcement efforts or speed display signs. They also may be installed in tandem with horizontal speed control measures such as bulb-outs or chicanes, or applied individually on streets with a constrained right-of-way.

DESIGN

SPEED HUMPS AND TABLES

Speed humps are parabolic vertical traffic calming devices intended to slow traffic speeds on low-volume, low-speed roads. Speed humps are three to four inches high and 12–14 feet wide, with a ramp length of three to six feet, depending on target speed. Speed humps are often referred to as “bumps” on signage and by the public.

- Vertical speed control elements shall be accompanied by the appropriate signage and pavement markings warning drivers of the upcoming device.
- Speed humps should not be placed in front of driveways or other significant access areas. They should be located where there is sufficient visibility and available lighting.
- Speed humps should be designed to the following criteria:

  - Slopes should not exceed 1:10 or be less steep than 1:25.
  - Side slopes on tapers should be no greater than 1:6.
  - The vertical lip should be no more than a quarter-inch high.
  - They are not constructed into the gutter pan to not impede drainage.
- Spacing for vertical speed controls should be determined based on the target speed of the roadway. Typically, speeds humps are placed 200–250 feet apart; humps should be spaced no more than 500 feet apart. To achieve greater speed reductions, space speed humps closer together.
- Speed humps may be applied on one-way or two-way roads, a minimum 50 feet from the nearest intersection.

SPEED TABLE

Speed tables are midblock traffic calming devices that raise the entire wheelbase of a vehicle to reduce its traffic speed. Speed tables are longer than speed humps and flat-topped, with a height of 3-3.5 inches and a length of 22 feet. Vehicle operating speeds for streets with speed tables range from 25-45 mph, depending on the spacing. Where applied, speed tables may be designed as raised midblock crossings, often in conjunction with bulb-outs.

- Speed tables shall be accompanied by the appropriate signage and pavement markings to warn drivers.
- Speed tables should be designed to the following criteria:
  - Slopes should not exceed 1:10 or be less steep than 1:25.
  - Side slopes on tapers should be no greater than 1:6.
  - The vertical lip should be no more than a quarter-inch high.
- Where a speed table coincides with a crossing or crosswalk, it should be designed as a raised crosswalk with appropriate signage and pavement markings
- Locate vertical speed control elements where there is sufficient visibility and available lighting, a minimum 50’ distance from intersections

TEXTURED PAVEMENTS

Roadway materials can have significant impacts on traffic safety and vehicle speeds, user comfort, vehicle maintenance costs, stormwater management, and street noise. Paving treatments and textured pavements can help reduce speeds and are more commonly used on streets with high volumes of pedestrians and lower volumes of motor vehicle traffic.

- Historic cobblestone streets and alleys are an example of the effects of textured pavements on vehicle speeds. Modern textured pavements, such as brick pavers, are smoother than cobblestones, which helps accommodate bicyclists.
- The use of paving treatments in parking lanes can visually reduce the width of the roadway.
- Regardless of the material used on the roadway, an accessible, smooth travel path must be provided at crosswalks in order to accommodate people with disabilities.
- Pedestrian crossings must meet accessibility requirements by providing a smooth, stable, and slip-resistant accessible path, and should include the necessary reflective markings as required in the MUTCD.
- Pavers should not be used in crosswalks.
- Surfaces such as smooth granite or tile should not be used as they create slippery conditions for bicyclists and pedestrians in wet weather. Consider the reflective characteristics of the pavement, or porous asphalt that provides a unique texture and color.
- Pavements that resist heaving and rutting should be used for locations where heavy vehicles stand or park, or locations that are less durable, such as high-volume intersections or steep grades.

RAISED INTERSECTION

Raised intersections are created by raising the level of the roadway at an intersection to the same level as the sidewalk. Raised intersections are a similar concept to speed tables but are applied to the entire intersection. Raised intersections make it physically more difficult for drivers to go through intersections at higher speeds, improve drivers’ awareness of pedestrian crossings, and help define locations where pedestrians are expected. Use of these

approaches should be only in appropriate locations based on engineering judgement, keeping in mind maintenance, operations, and effectiveness.

- Raised intersections are appropriate in areas of high pedestrian demand, in school zones, and locations where pedestrian visibility and motorist yielding have been identified as concerns.
- Raised intersections and crossings can be used as gateway treatments to signal to drivers when there are transitions to a slower speed environment that is more pedestrian-oriented.
- Raised crossings and intersections require detectable warnings at the curb line for persons with visual impairments.
- Signage to indicate the raised intersection must be provided.
- Design speeds, transit routes, and emergency vehicle routes must be considered when designing approach ramps.

SPECIAL CONSIDERATIONS

- Vertical speed control elements are most effectively implemented at a neighborhood level, rather than by request on a single street. While they may deter cut-through traffic on one street, traffic conditions on surrounding streets may worsen as a result.

OPERATIONS AND MAINTENANCE

- Designs should ensure proper drainage. Raised intersections can simplify drainage inlet placement by directing water away from the intersection. If the intersecting streets are sloped, catch basins should be placed on the high side of the intersection at the base of the ramps.
- Vertical traffic calming must be designed to permit snow removal and accommodate street sweeping vehicles that do not damage the vertical speed control elements. Snow plow operators should be adequately warned and trained.
- The impact of traffic calming treatments at the network or neighborhood level should be monitored prior to and after installation to ensure there are no adverse impacts. Vertical control measures can be installed on a pilot basis to assess potential impacts before permanent treatments are deployed.
- Vertical traffic calming must maintain signage and markings.

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  - Part 3 Markings: Chapter 3B. Pavement and Curb Markings
  - Section 3B.25 Speed Hump Markings
  - Section 3B.26 Advance Speed Hump Markings http://mdotcf.state.mi.us/public/tands/Details_Web/mmutcdpart3_2011.pdf

DETAILS

- City of Grand Rapids Frequently Used Detail
  - City Standard Speed Table
- MDOT Standard Highway Signs
  - SHS-E02-WARN "W" Warning Signs http://mdotcf.state.mi.us/public/tands/Details_Web/mdot_signs_e02_warning.pdf