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Reducing Speed and Improving Safety in Residential Areas

Currently, there is a 30 mph posted speed limit in residential areas in Rutland, which the municipality would like to reduce to 25 mph without conducting an engineering and traffic investigation in order to improve safety. This report will discuss the varying characteristics that define a residential area, steps for changing local speed limits in Vermont, methods for reducing through traffic and driver speed, and correlations between street design and crime reduction.

Defining Residential Areas

In the words of the Institute of Transportation Engineers “[r]esidential neighborhoods exist in every context, from rural to the highest-intensity urban core,” and because people reside in these neighborhoods, it is important that residential street design is approached with livability in mind.¹ Additionally, residential areas are defined by a variety of characteristics, which specifics differ depending on the state or municipality defining the area. Some factors defining residential areas are predominant building type, population size, prevailing use of space, speed limit, and space between dwellings.

A residential area must consist of primarily residential buildings. The U.S. Census Bureau defines a residential building as “a building consisting primarily of housing units,” even if the building as a whole functions primarily for nonresidential purposes.²

Population is also used as a qualifier for determining “urban” or “rural” areas: To qualify as an urban area, the territory identified according to criteria must encompass at least 2,500 people, at least 1,500 of which reside outside institutional group quarters. The Census Bureau identifies two types of urban areas:

¹ Institute of Transportation Engineers, *Designing Avenues and Streets in Residential Areas*, January 1, 2011, accessed February 5, 2015, <http://library.ite.org/pub/e1cfdc96-2354-d714-5167-79f3d6719128>.

² United States Census Bureau, *New Residential Construction Definitions*, June 28, 2012, accessed February 12, 2015, <http://www.census.gov/construction/nrc/definitions/#r>.

- Urbanized Areas (UAs) of 50,000 or more people;
- Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.

“Rural” encompasses all population, housing, and territory not included within an urban area.³

The US Census Bureau defines institutional group quarters as “places where people live or stay, in a group living arrangement, which is owned or managed by an entity or organization providing housing and/or services for the residents”.⁴

Maine statute defines a “business or residential district” as “the part of a municipality, contiguous to a way, that is built up with structures that are situated less than 150 feet apart for a distance of at least ¼ of a mile.”⁵

New Hampshire statute defines a "rural residence district" as “the territory contiguous to a way not comprising a business or urban residence district when the frontage on such way for a distance of 1/2 mile or more is mainly occupied by dwellings or by dwellings and buildings in use for business on any one side” and an “urban residence district” as “the territory contiguous to a highway not comprising a business district when the frontage on such highway for a distance of 300 feet or more is mainly occupied by dwellings or by dwellings and buildings in use for business.”⁶

While no statewide definition of residential area or district exists in Vermont, many cities and towns have their own definitions. In South Burlington, a residential street is defined as “a street, between two intersecting streets, upon which a residential district abuts, or where 50% or more of the abutting street frontage is in predominantly residential use.” Additionally, South Burlington defines a residential district as, “a zoning district established in these land development regulations which permits primarily residential uses.”⁷

Local residential streets are defined, by the Institution of Traffic Engineers (ITE), as those with a “25 mph posted speed limit, two-lane roadway, do not serve primary access to commercial or industrial areas, [and a] minimum of 12 dwellings fronting the street per 1000ft of roadway including both sides.⁸ Additionally, ITE, under the sponsorship of the

³ United States Census Bureau, "2010 Urban and Rural Classification," February 9, 2015, accessed February 12, 2015. <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>.

⁴ United States Census Bureau U.S., "Census Bureau: FAQs," accessed February 12, 2015, <https://ask.census.gov/faq.php?id=5000&faqId=1681>.

⁵ Maine State Legislature, "Title 29-A: Motor Vehicles Heading," last modified 05 January 2015, accessed February 4, 2015, <http://legislature.maine.gov/statutes/29-A/title29-Asec101.html>.

⁶ New Hampshire Legislature, "Title XXI Motor Vehicles: 259:93" accessed February 4, 2015, <http://www.gencourt.state.nh.us/rsa/html/XXI/259/259-93.htm>

⁷ South Burlington Planning and Zoning, "City of South Burlington Land Development Regulations," 2003, accessed on February 4, 2015, <http://accd.vermont.gov/sites/accd/files/Documents/strongcommunities/cd/tif/sburlington/Zoning-Bylaws.pdf>

⁸ Virginia Department of Transportation, "Residential Traffic Calming Guide Pilot Program January 1998 - December 1999," December 1, 1997, accessed February 16, 2015, <http://library.ite.org/pub/e271644c-2354-d714-51c1-506d69177055>.

U.S. Department of Transportation, has developed “context intensity gradations—called context zones—to distinguish the urban built environment adjacent to and surrounding thoroughfares.”

According to a Vermont Department of Health report, “Complete Streets: A guide for Vermont communities,” the Vermont Department of Transportation describes a variety of place types with different design considerations: city, village, suburban and rural.⁹ Thus, the Complete Streets Guide has developed using context zones to match transportation design with the context of a project location (see Table 1 and Figure 1). The context zones C-3 and C-4 can be considered residential areas in Vermont, for the purposes of this report.

Conclusively, a residential area is one that consists primarily residential buildings and activities. However, since a statewide definition of residential area or district does not exist in Vermont, the municipality can determine specific defining “residential” qualities individually.

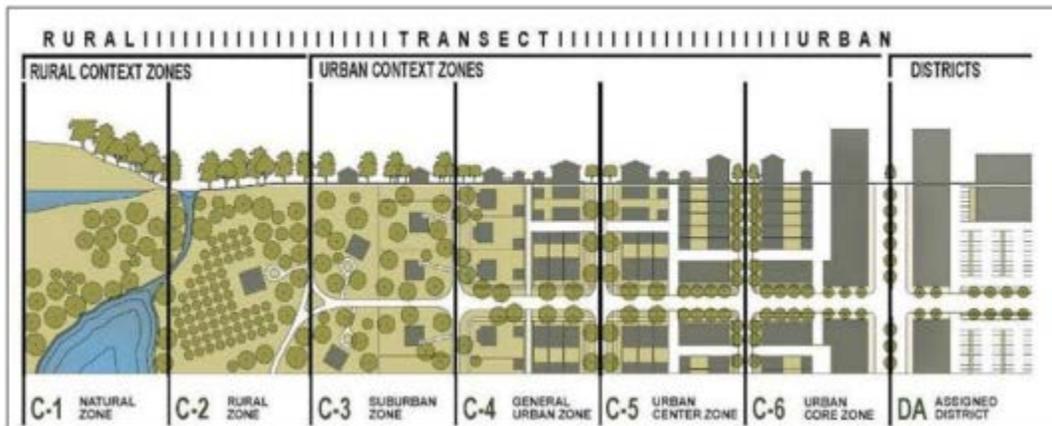


Figure 1: Urban to Rural Transect according to the Institute of Transportation Engineers

Source: Institute of Transportation Engineers, "Designing Avenues and Streets in Residential Areas," January 1, 2011, accessed February 11, 2015.

<http://library.ite.org/pub/e1cfdc96-2354-d714-5167-79f3d6719128>.

⁹ Vermont Department of Health, “Complete Streets: A guide for Vermont Towns,” September 2012, accessed Feb 11 2015,

http://healthvermont.gov/family/fit/documents/Complete_streets_guide_for_VT_communities.pdf.

Table 4.1 Context Zone Characteristics

Context Zone	Distinguishing Characteristics	General Character	Building Placement	Frontage Types	Typical Building Height	Type of Public Open Space	Transit (Where Provided)
C-1 Natural	Natural landscape	Natural features	Not applicable	Not applicable	Not applicable	Natural open space	None
C-2 Rural	Agricultural with scattered development	Agricultural activity and natural features	Large setbacks	Not applicable	Not applicable	Agricultural and natural	Rural
C-3 Suburban	Primarily single family residential with walkable development pattern and pedestrian facilities, dominant landscape character. Includes scattered commercial uses that support the residential uses, and connected in walkable fashion.	Detached buildings with landscaped yards, normally adjacent to C-4 zone. Commercial uses may consist of neighborhood or community shopping centers, service or office uses with side or rear parking.	Varying front and side yard setbacks	Residential uses include lawns, porches, fences and naturalistic tree planting. Commercial uses front onto thoroughfare.	1 to 2 story with some 3 story	Parks, greenbelts	Local, express bus
C-4 General Urban	Mix of housing types including attached units, with a range of commercial and civic activity at the neighborhood and community scale	Predominantly detached buildings, balance between landscape and buildings, presence of pedestrians	Shallow to medium front and side yard setback	Porches, fences	2 to 3 story with some variation and few taller workplace buildings	Parks, greenbelts	Local, limited stop bus rapid transit, express bus; fixed guideway
C-5 Urban Center	Attached housing types such as townhouses and apartments mixed with retail, workplace and civic activities at the community or sub-regional scale.	Predominantly attached buildings, landscaping within the public right of way, substantial pedestrian activity	Small or no setbacks, buildings oriented to street with placement and character defining a street wall	Stoops, dooryards, storefronts and arcaded walkways	3 to 5 story with some variation	Parks, plazas and squares, boulevard median landscaping	Local bus; limited stop rapid transit or bus rapid transit; fixed-guideway transit
C-6 Urban Core	Highest-intensity areas in sub-region or region, with high-density residential and workplace uses, entertainment, civic and cultural uses	Attached buildings forming sense of enclosure and continuous street wall landscaping within the public right of way, highest pedestrian and transit activity	Small or no setbacks, building oriented to street, placed at front property line	Stoops, dooryards, forecourts, storefronts and arcaded walkways	4+ story with a few shorter buildings	Parks, plazas and squares, boulevard median landscaping	Local bus; limited stop rapid transit or bus rapid transit; fixed-guideway transit
Districts	To be designated and described locally, districts are areas that are single-use or multi-use with low-density development pattern and vehicle mobility priority thoroughfares. These may be large facilities such as airports, business parks and industrial areas.						As applicable

(Based on transect zone descriptions in SmartCode Version 9.2, 2008. Source: Duany Plater-Zyberk & Company.)
 Shaded cells represent Context Zones that are not addressed in this report.

Table 1: Context Zone Characteristics

Source: Institute of Transportation Engineers, “Designing Walkable Urban Thoroughfares: A Context Sensitive Approach,” 2010, accessed February 11, 2015
<http://library.ite.org/pub/e1cff43c-2354-d714-51d9-d82b39d4dbad>

How to Change the Speed Limit in Vermont

According to Title 23 V.S.A. Section 1007, a municipality has the authority to change speed limits after conducting an engineering and traffic investigation. The only exception listed in which the municipality does not have to conduct an investigation is if the road is unpaved.¹⁰

Conducting an Engineering and Traffic Investigation

“Setting Speed Limits – A Guide for Vermont Towns” provides guidelines for Vermont officials to adjust speed limits in their municipalities, and includes the steps for conducting a traffic investigation.¹¹ The guide stresses that the speed limit must be “reasonable and safe.” There are a few central considerations when setting speed limits: protecting the public, reducing unreasonable behavior, and creating a law that will be effective and enforceable. The recommended practice for determining speed limits is to conduct an engineering and traffic investigation. A professional engineer is not required—anyone may collect the information. In order to conduct an engineering and traffic investigation, one will need to have a vehicle, be able to donate their time, print the documentation provided in the guide, and acquire a speedometer and a slope meter (although both are optional).

Steps for conducting an engineering and traffic investigation:

1. Consider the characteristics of the road, such as travel surface number of lanes, width of lanes and shoulders, presence of passing zones, steepness, and curvature of the road. Record all data on the “Traffic Engineering Report” form provided by the guide.
2. Monitor the speeds of at least 100 vehicles traveling on the road, and record all speeds on the “Spot Speed Study Field Data Sheet,” provided in the manual. Indicate the speed that 85% of vehicles are traveling. On low volume roads the Vermont Agency of Transportation suggests that instead of collecting a sample, which may be too time consuming, the researcher should conduct several time runs and estimate the speed.
3. Consider all characteristics of the road itself and the surrounding area. For instance, is the area residential or urban? Is the surrounding area farmland or a school zone?
4. Determine a safe speed for curves and other hazardous areas by driving along the curve in a conventional car for multiple passes, increasing speed by 5mph with each pass. If the driver leans in his seat while going around the curve, he is going too fast. A slope meter can also be used to determine safe speeds around curves, which costs \$200.
5. Record parking practices and residential/pedestrian activity.

¹⁰ Vermont state Legislature, “1007: Local Speed Limits,” accessed February 4, 2015, <http://legislature.vermont.gov/statutes/section/23/013/01007>.

¹¹ Vermont Local Roads, St. Michaels College, “Setting Speed Limits – A Guide for Vermont Towns,” May 2012, accessed March 4, 2015, http://54.172.27.91/transportation/speed/VTlocalRoads_SpeedLimits_Guide_2012.pdf.

6. Record accident activity for the past 12 months, including accidents that are weather related, DUI associated, and primarily caused by intersections.
7. Once data has been collected, the official can then determine an appropriate speed limit for the area. After a speed limit has been determined, an ordinance is then proposed to the municipality.¹²

The key to setting a new speed limit is determining the 85th percentile, which is the 10mph band of speed within which most drivers travel.¹³ If speed limits are set lower than the 85th percentile, what most drivers feel to be safe, the municipality runs the risk of reducing driver respect for the speed limit in question and possibly other posted speed limits.¹⁴ Similarly, the Main Road Speed Limit Study conducted in Huntington Vermont references the study “Effects of Raising and Lowering Speed Limits on Selected Roadway Sections,” stating that “drivers do not generally comply with changes (lowered or raised) in posted speed limits on non-freeways in rural or urban areas, especially in speed zones posted at 40 mph or lower.”¹⁵

Cut Through Traffic in Relation to Speed Reduction

The 2015 Governor’s Highway Safety Plan revealed that speed remains a contributing factor in approximately 30% of crashes that occur in Vermont. The period of 2007-2011 revealed “speeding and aggressive driving account for 35% of the fatal crashes in Vermont.” The goal of Vermont’s speed management strategies is to “reduce the number of major crashes involving speed and/or aggressive driving by 20% between the years of 2012-2016”.¹⁶

Lowering the posted speed limit is one method of reducing speed. A 2013 study done in the City of Edmonton in Alberta, Canada looked at the behavioral response of drivers to lowered posted speed limits (from 50 km/h (31 mph) to 40 km/h (25 mph) in six residential areas. After 3 months the mean free-flow speed decreased by 7.7% and after 6 months it decreased by a total of 9.7%. The study further concluded that posted speed

¹² All the information in the “Setting Speed Limits- A Guide for Vermont Towns” section comes from: Saint Michael’s College, “Setting Speed Limits- A Guide for Vermont Towns,” 2012, accessed January 31, 2015. http://54.172.27.91/transportation/speed/VTlocalRoads_SpeedLimits_Guide_2012.pdf

¹³ Saint Michael’s College, “Setting Speed Limits- A Guide for Vermont Towns”

¹⁴ Michael S Scott & David K Maddox, “Speeding in Residential Areas: 2nd Edition,” Center for Problem Oriented Policing, US Department of Justice- Office of Community Oriented Policing Services, State University of New York at Albany, January 2010, accessed February 16 2015
http://www.popcenter.org/problems/pdfs/Speeding_Residential_Areas.pdf

¹⁵ Chittenden County Metropolitan Planning Organization, “Main Road Speed Limit Study- Huntington Vermont,” December 21 2009, accessed February 16 2015,
http://www.ccrpcvt.org/library/studies/20091221_Huntington_Speed_Limit_Study.pdf

¹⁶ This paragraph refers to: State of Vermont “Governor’s Highway Safety Program 2015: Highway Safety Plan “Toward Zero Deaths,” accessed February 25, 2015,
<http://ghsp.vermont.gov/sites/ghsp/files/2015%20Vermont%20Highway%20Safety%20Plan%20WEBSITE%201.21.15.pdf>

limited reduction is most effective when used in conjunction with education and enforcement.¹⁷

According to the Institute for Transportation Engineers' "Residential Traffic Calming Guide," a local residential street is one "that provides direct access to abutting residences and serves only to provide mobility within the neighborhood." Additionally the traffic on local residential streets is "expected to be entering or exiting from the residences."¹⁸ An increase in through traffic in residential areas becomes problematic when motorists who are not entering or exiting the neighborhood choose to use the street as a way of passage, ultimately increasing the volume of traffic and often the speed of the overall flow of traffic.¹⁹

The Metropolitan Area Planning Council's "Health Impact Assessment" of Massachusetts's Speed Limit Bill found that reducing the speed limit by 5 mph would result in a 1.8 mph decrease in speed on local roads.²⁰ According to Massachusetts Department of Transportation a local road is a road that "provide[s] access to abutting land with little or no emphasis on mobility."²¹ The Assessment found lowering the speed limit "would prompt drivers to reduce cut-through traffic by seeking faster, though often longer, routes on higher capacity roads, resulting in additional 55.3 million VMT (vehicle miles travelled) per year" Additionally, there would be "slower travel speeds on local roads and higher traffic volumes on newly preferred, higher capacity roads" which would result in 5.8 million additional vehicle hours travelled per year. These additional 5.8 million vehicle hours travelled per year would cost approximately \$127 million per year, and the increase in fuel burned would cost \$21 million a year.²²

A case study carried out in South Australia reduced speed from 60 km/h (37 mph) to 40 km/h (25 mph) on three residential roads. The streets were selected due to their characteristics that result in prompting an increase in through traffic during rush hour. The reduction in posted speed limit was shown to be successful in slowing the travel speeds of drivers; "mean travel speed close to 40 km/h and 85th percentile speed below 50 km/h."

¹⁷ The information in this paragraph comes from Md. Tazul Islama, Karim El-Basyouny, and Shewkar E. Ibrahim, "The Impact of Lowered Residential Speed Limits on Vehicle Speed Behavior," *Safety Science*, Vol. 62, February 2014, 483-94, accessed March 4, 2015,

<http://www.sciencedirect.com/science/article/pii/S0925753513002312#>.

¹⁸Institute of Transportation Engineers, "Residential Traffic Calming Guide," 1997, accessed February 11 2015,

<http://library.ite.org/pub/e271644c-2354-d714-51c1-506d69177055>.

¹⁹ Eran Ben-Joseph, "Residential Street Standards & Neighborhood Traffic Control: A Survey of Cities' Practices and Public Officials' Attitudes," University of California Berkeley, 1995, accessed February 16 2015, http://nacto.org/docs/usdg/residential_street_standards_benjoseph.pdf

²⁰ Peter James, Kate Ito, and Mariana Arcaya, "Health Impact Assessment: Speed Limit Bill," Massachusetts Metropolitan Area Planning Council, November 13, 2013, accessed February 4, 2015,

<http://www.mapc.org/sites/default/files/Speed%20Limit%20HIA.pdf>.

²¹ Massachusetts Department of Transportation, "Functional Classification," 2014, accessed February 11, 2015.

<http://www.massdot.state.ma.us/planning/Main/MapsDataandReports/Maps/FunctionalClassification.aspx>.

²² James, Peter, Kate Ito, and Mariana Arcaya, "Health Impact Assessment: Speed Limit Bill."

Although, the change in posted speed limit was not successful at reducing the volume of through traffic the residential areas experienced during rush hour.²³

Alternative Methods for Reducing Through Traffic and Driver Speed

Currently, there is not a consensus on methods that have been proven to effectively reduce through traffic, improve driver compliance with posted speed limits, or improve the safety of a neighborhood as a whole. One alternative a municipality can consider is implementing traffic calming mechanisms.

Traffic calming is defined as “the combination of physical controls and community support to reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized users.” Additionally, traffic calming objectives include: “reducing speeds for motor vehicles, reducing crash frequency and severity, increasing safety, reducing the need for police enforcement, and reducing cut-through motor vehicle traffic.” In order to implement any traffic calming mechanisms on a local street a 25mph speed limit must already be in place.²⁴

Some traffic calming mechanisms are: blinking speed limit signs, 2-way and 4-way stop signs, and turn prohibitions. Signage is usually not effective on its own, but when combined with other traffic calming mechanisms can be effective tools for traffic management.²⁵ Other traffic calming methods are speed humps, speed bumps, rumble strips, road narrowing, installing traffic islands, adding painted or paved crosswalks, and the like. The latter methods all require significant structural change of the road itself.

Crime Reduction in Street Design

According to the Institute of Transportation Engineers, there have been multiple studies on traffic calming.²⁶ It has been noted in a study conducted in West Palm Beach Florida that a lowered speed limit, 25mph, in conjunction with other traffic calming mechanisms, such as the addition of sidewalks, have contributed to a reduction in through traffic and crime. Speed reduction along with traffic calming techniques “physically altered driver behavior, leading to slower, more respectful motorists and reduced the amount of cut-through or non-neighborhood traffic.” The increased safety of the West Palm neighborhood has been

²³ Taweesak Banawiroon and Wen Long Yue, "A Further Investigation of 40 Km/h Speed Zone Case Study of the Unley of South Australia," Eastern Asia Society for Transportation Studies, 2003, 965-78, accessed February 16, 2015, <http://www.easts.info/2003proceedings/papers/0965.pdf>.

²⁴ Institute of Transportation Engineers, "Residential Traffic Calming Guide."

²⁵ Institute of Transportation Engineers Michigan Section's Technical Project Committee, "Speed Control in Residential Areas," 1998, , accessed February 16 2015, <http://library.ite.org/pub/e271b7f3-2354-d714-518b-58ef17953fd3>.

²⁶ Institute of Transportation Engineers, "Traffic Calming Library," 2015, accessed February 22, 2015. <http://www.ite.org/traffic/search.asp?=&keywords=&terms=13>.

primarily attributed to an improved sense of community and increased “natural surveillance,” because more pedestrians were out and about in the neighborhood.²⁷

Beyond reduction in speed limit, alternative treatment plans do exist to decrease crime rate in a given area. The National Crime Prevention Council (NCPC), on behalf of the U.S. Department of Justice’s Community Capacity Development Office, has developed a treatment plan with the goal to reduce the number of crimes and improve the overall quality of life in communities. Thus far the NCPC has served ten communities with this action plan. The NCPC treatment plan is known as “Crime Prevention through Environmental Design” (CPTED). This comprehensive treatment plan encompasses four main principles; access control, territorial reinforcement, maintenance and surveillance. Both access control and territorial reinforcement highlight the importance of sidewalks being present in the area.²⁸

This report was completed on February 16, 2015 by Olivia Taylor, Erin Dickinson, and Quin Mann under the supervision of Professors Jack Gierzynski, Robert Bartlett and Eileen Burgin in response to a request from Representative Fagan.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Anthony Jack Gierzynski, Professor Robert Bartlett and Professor Eileen Burgin. The material contained in the report does not reflect the official policy of the University of Vermont.

²⁷ Ian Lockwood and Timothy Stillings, “Traffic Calming for Crime Reduction & Neighborhood Revitalization,” 1998, accessed February 16 2015.

http://www.cityofnewhaven.com/TrafficParking/pdfs/West_Palm_Beach.pdf.

²⁸ National Crime Prevention Council, “Best Practices For Using Crime Prevention Through Environmental Design in Weed and Seed Sites,” January 1 2009, accessed February 12, 2015,

http://www.ncpc.org/resources/files/pdf/training/Best_Practices_in_CPTED_-2.pdf.