Low Speed Design Criteria for Residential Streets

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Background

The City of San Antonio receives many complaints regarding speeding in residential areas. Citizens perceive speeding on residential streets as a safety issue and as a quality of life issue. As a result, there has been significant demand to retrofit traffic calming features on existing residential streets. Although the City's Speed Hump Program has effectively addressed speeding on many existing residential streets, new neighborhoods continue to be developed in a way that subsequent installation of traffic calming devices is requested. Residential streets in San Antonio and its extraterritorial jurisdiction historically have not been designed to dissuade speeding.

According to State law and City ordinance, the *prima facie* speed limit on residential streets is 30 mph. In an effort to reduce the need to retrofit new streets with traffic calming features, the City of San Antonio initiated a study to determine street characteristics that discourage speeding. The goal was to establish and codify street geometric criteria for the development of streets in new neighborhoods that would produce operating speeds that do not exceed the 30 mph speed limit.

Ordinance Development Oversight Committee

To increase the likelihood of support for, and approval of, a new City ordinance governing design criteria for residential streets, City staff invited representatives of neighborhood groups and land developers to participate on the oversight committee. The committee members who were most engaged in the process were those who develop single-family residential subdivisions for the lower end of the San Antonio housing market, where land development profit margins are presumably thinner.

During its half-dozen meetings, spanning as many months, the oversight committee discussed the need for the ordinance, the legitimacy of the City's speed data, "what if" cases, etc. The use of an oversight committee was somewhat rocky, but definitely beneficial. The group effort resulted in the ordinance gaining support from the land development community, the necessary City committees and commissions and ultimately, approval from the City Council.

Data Collection/Study Methodology

The data that was the focus of the study came from 66 residential streets in the San Antonio area where the posted speed limit is 30 mph. The data collected included unimpeded street length, street width, condition at the endpoints, 85^{th} percentile speed, and traffic volume. For the purpose of this study, the following definitions were used:

1. Unimpeded street length – the length of the street segment between speed impediments, e.g., stop signs, traffic signals, sharp turns, cul-de-sacs, etc.
2. Street width – the width of the street as measured from face-of-curb to face-of-curb or from the edge of pavement on each side of an uncurbed street.

3. Condition at endpoints – those features that require significant deceleration or a stop to negotiate.
4. 85^{th} percentile speed – that speed at or below which 85 percent of all traffic is moving. For the purpose of this study, the 85^{th} percentile speed was determined by the placement of traffic counters at the midpoint of the unimpeded street length. The 85^{th} percentile speed used for the study was the average 85^{th} percentile speed for the two directions of travel.
5. Traffic volume – the 24-hour traffic volume for both directions collected at the midpoint of the street.

Although many factors are thought to influence a driver's speed, the study was based on the premise that long streets, particularly unimpeded street lengths, tend to have higher operating speeds.

To evaluate the effect of unimpeded street length on operating speeds, existing streets of varying lengths were selected for study. The general range of unimpeded street lengths was between 400 and 2000 feet. Since vehicle speeds were to be evaluated near the midpoint of the unimpeded street length, it was also deemed important to include only streets where the majority of vehicles would travel the entire length of the street, i. e., streets without major traffic generators along the unimpeded street length. Streets with major generators would have lower measured speeds, since a significant portion of the traffic would decelerate near the count location.

Unimpeded street lengths were determined using the City's basemaps. Once the streets had been identified for study, speed and volume data were collected at the midpoint of the unimpeded street length. Field investigations were performed to collect additional data including street width and condition at the endpoints. Figure 1 illustrates a plot of unimpeded street length *vs.* 85^{th} percentile speed for the 66 data points in the study.

Upon inspection of Figure 1, it is evident that there is a clear relationship between vehicle speed and unimpeded street length. Typically, as unimpeded street length increases, so do vehicle speeds. The blue line on the graph represents the desired operating speed of 30 mph, the legal speed limit.

Further inspection of the graph suggests that for every unimpeded street length, there is a corresponding range of operating speeds. The variation in operating speeds for any given unimpeded street length is undoubtedly a result of other factors that are known to influence operating speeds, e. g., street width, on-street parking, etc. Of particular interest are those data points that represent the higher operating speeds for any given unimpeded street length. If these streets exhibit common characteristics, then those factors could be addressed in new land developments. Therefore, the next step in the process involved a qualitative analysis of each of the data points where operating speeds were high.

The qualitative evaluation of each of the higher-speed data points revealed certain common characteristics of these streets. It was noted that most of these streets were entrance streets for the neighborhood, often intersecting a major arterial, and typically carrying a greater volume of traffic than the lower-speed streets. Some of these streets were subject to non-neighborhood

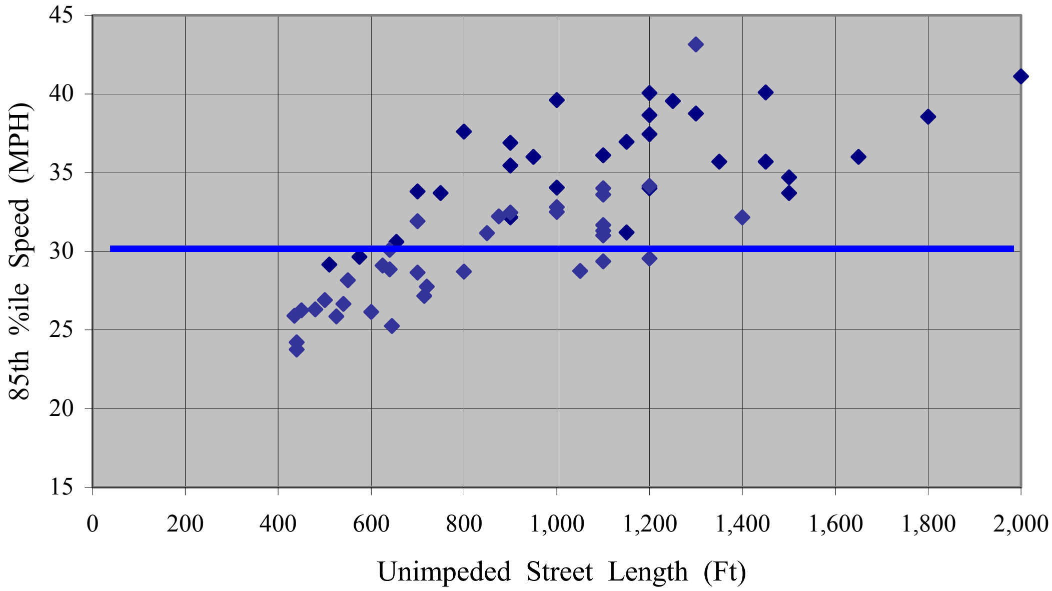

Figure 1. Unimpeded Street Length *vs.* 85th Percentile Speed

type, cut-through, traffic but all of them served as major collector streets for their subdivision. Traffic speeds on streets with these characteristics are typically the subject of complaints by residents regarding the need for traffic calming features. Therefore, disallowing construction of new streets with these undesirable characteristics could yield significant benefit in terms of reducing the number of future unhappy residents.

Due to the identification of common characteristics among those streets with higher operating speeds, the data set of 66 streets was then separated into two distinct groups. Figure 2 illustrates the two data sets as categorized by either high-volume entrance/collector streets or low-volume interior neighborhood streets.

With the understanding that vehicle speeds and unimpeded street lengths tend to be proportional to one another, designing streets with lower vehicle speeds requires shorter unimpeded street lengths. To gain a better understanding of the value for the unimpeded street length that yields the desired operating speeds, best-fit curves were determined for each data set, as shown in Figure 3.

Of particular interest is the unimpeded street length that corresponds to the intersection of the best-fit curve with the horizontal line at the 30 mph speed. This unimpeded street length was the basis for the criteria that were developed which are aimed at producing streets with operating speeds that do not exceed the legal speed limit.

New Ordinance

As a result of the findings in the preceding figures and through discussions within the oversight committee, the following design criteria were established. New streets projected to carry less

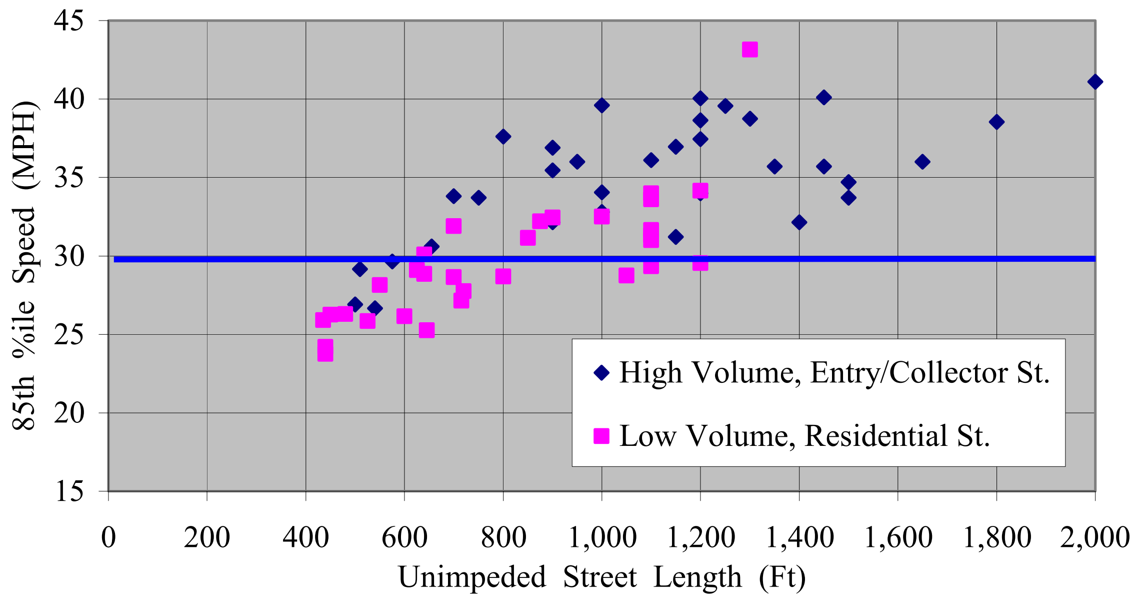

Figure 2. Data Differentiated by Traffic Volume

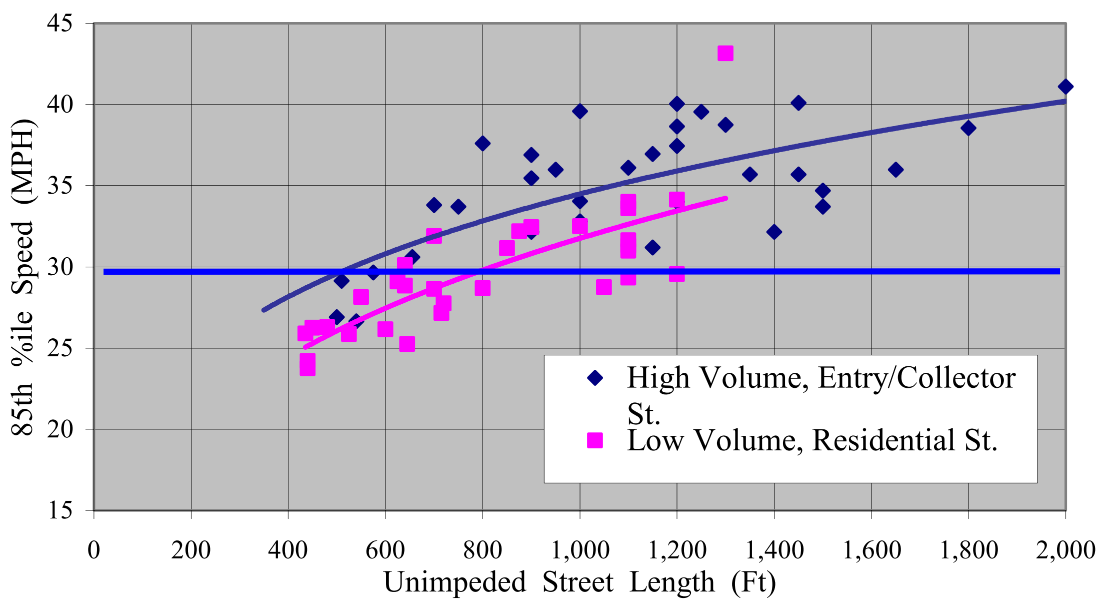

Figure 3. Best-Fit Curves for Each Data Set

than 500 vehicles per day (vpd) are limited to a maximum unimpeded street length of 1200 feet. New streets projected to carry more than 500 vpd will be limited to a maximum unimpeded street length of 900 feet. However, a maximum length of 700 feet is applied to new streets which are projected to carry more than 1000 vpd and have one or more of the following additional characteristics:

- intersect an arterial street
- function as neighborhood entrance streets
- are likely cut-through streets
- have widths of 40 feet.

In addition, the ordinance prohibits single-family residential lots from fronting onto *collector* streets. This requirement supplements a pre-existing ordinance that prohibited such lots from fronting onto *arterial* streets. The value of this new requirement is in reducing the likelihood of future residents' moving into a home and then discovering that the street which their house faces carries more traffic than they desire.

Traffic Calming Alternatives

Some proposed land developments are located on difficult terrain or on sites with shapes that make it difficult to adhere to the maximum unimpeded street lengths required by the ordinance described above. Consequently, the ordinance also allows the land developer to achieve the desired operating speeds by incorporating traffic calming features into longer streets. Traffic calming features allowed by this ordinance are traffic circles, median islands, speed humps, and T-intersections. In addition, for streets with less than 500 vpd, one-lane slow points are allowed as traffic calming features.

Summary

The new ordinance does not ensure all traffic operating speeds on new residential streets will not exceed the 30 mph speed limit. However, it does mandate design criteria that will greatly reduce the number of new streets that would have otherwise resulted in operating speeds which the occupants of abutting properties would have found objectionable. In addition, it prohibits residential frontage on collector streets; this will also lead to fewer new problems with residents' concerns of speeding traffic.

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