The Effects on Road Safety of 30 Kilometer-Per-Hour Zone Signposting in Residential Districts

IN SWITZERLAND, REDUCED SPEED LIMITS OF 30 KM/H ARE IMPOSED ON A LOCAL RATHER THAN A GENERAL BASIS, ABOVE ALL ON NEIGHBORHOOD STREETS AND COLLECTOR STREETS IN RESIDENTIAL DISTRICTS. AN INVESTIGATION INTO 30 KM/H ZONES IN SWITZERLAND INDICATED A SIGNIFICANT DECLINE IN ACCIDENT FREQUENCY AND SEVERITY.

BY HANS PETER LINDENMANN

INTRODUCTION

Background

In Switzerland, reduced speed limits of 30 kilometers per hour (km/h) are imposed on a local rather than a general basis, above all on neighborhood streets and collector streets in residential districts. These 30 km/h zones can be set up only in areas up to 1 square kilometer in size and without any main highways.

In addition to the signposting of the 30 km/h zone on all streets leading into a relevant area, traffic engineering and structural measures are employed within the area itself to reduce motor vehicle speeds.

A nationwide investigation into 30 km/h zones in Switzerland indicated a significant decline in accident frequency and severity. Because of the positive cost-benefit ratio, it is recommended that 30 km/h zone signposting for residential districts be introduced rapidly in Switzerland.

Since the introduction of 30 km/h zone signposting in residential areas, more than 700 districts and areas in Swiss municipalities and cities have implemented 30 km/h zone signposting accompanied by appropriate traffic engineering and structural measures.

According to Swiss road traffic law, a 30 km/h zone ("Tempo 30–Zonen" in German-speaking Switzerland) with corresponding signposting and other measures can be legally created only if a technical report has confirmed that its implementation is appropriate in a specific district.[1] Many such reports, varying widely in form, have been prepared for individual areas over several years. This means that a certain amount of experience has been accumulated with respect to suitability and relevant preconditions.

However, apart from a few findings from individual studies in the context of trial projects, the actual effects of 30 km/h zone signposting on road safety are not yet known.[2–4] Foreign sources, particularly from Germany, provide a wealth of experience with 30 km/h zones.[5] Most experiences have been positive, but results from abroad cannot be applied directly to the situation in Switzerland.

Figure 1 shows the basic concept for traffic management in an urban area. The fundamental expectation is that 30 km/h zone signposting, together with structural measures for traffic calming, should produce a lower speed level, which should enable an increase in road safety.[6–7]

Two questions arise more frequently in connection with this expectation. The first concerns the extent of the changes to accident frequency and severity; the second concerns the cost-benefit ratio of the measure. A nationwide study carried out in Switzerland, of which results and findings are described below, answered these questions.[8]

Aims

The nature of the basic questions meant that the following aims were central to the research project:

- Quantification of changes to traffic behavior and to the number of accidents and accident victims achieved by the implementation of 30 km/h zones;
- Clarification of cost-benefit ratios; and
- Criteria and standard scales for the selection of areas with 30 km/h zones.

RESEARCH METHODOLOGY

Selection of Objects To Be Researched

The selection of 30 km/h zones for inclusion in the research, all of which had been in existence for several years, was made on a demographic basis by reference

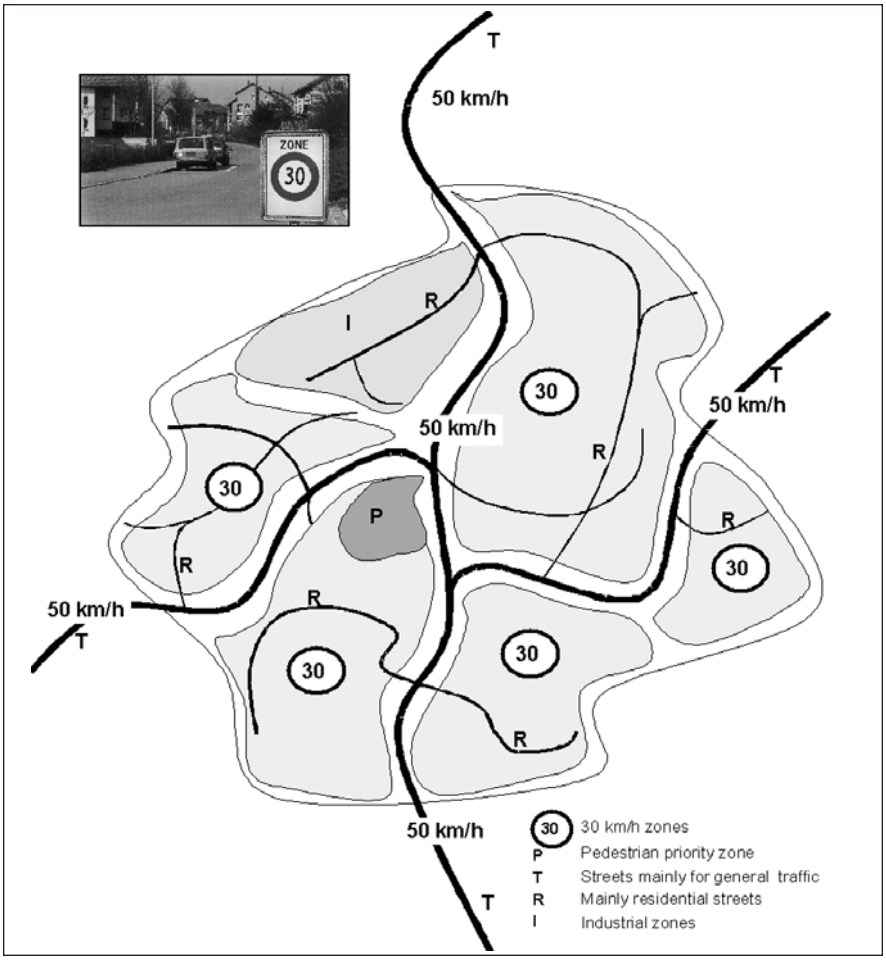

Figure 1. Basic concept for traffic management in an urban area.

to the distribution of the Swiss population in sectors of urban areas (municipalities with more than 10,000 inhabitants) and rural areas (municipalities with less than 10,000 inhabitants).

This produced a selection of 11 zones in large- and medium-sized towns and cities and 20 zones in small towns and villages. Only those towns and villages that had carried out research into speed behavior in the periods before the implementation of the relevant 30 km/h zones could be taken into account.

The 30 km/h zones are created by installing the necessary signals at the start of all mainly residential streets leading into the zone (see Figure 1). Because all streets within the zone have the same speed limit, priority for traffic from the right is introduced everywhere, at all intersections and turnoffs. There is no signposting to indicate this.

On sections where traffic tends to travel particularly fast, targeted steps are taken at specific sites to reduce speeds by means of structural traffic calming measures, such as such as lateral and vertical offsets (speed bumps), central islands, street narrowing and parking lanes on alternate sides. Figure 2 shows examples of traffic calming measures.

Methodology

To determine the changes in speed behavior and accident occurrence, clarify the cost-benefit ratio and enable assessment of the effects, investigations were carried out into the following:

- Before/after changes in accident occurrence;
- Local distribution of accidents (pre 30 km/h) in the zone;
- Before/after changes in speed behavior;
- Costs of the measures and cost-benefit ratio; and
- Criteria and standard scales for assessing the suitability of an area as a potential 30 km/h zone.

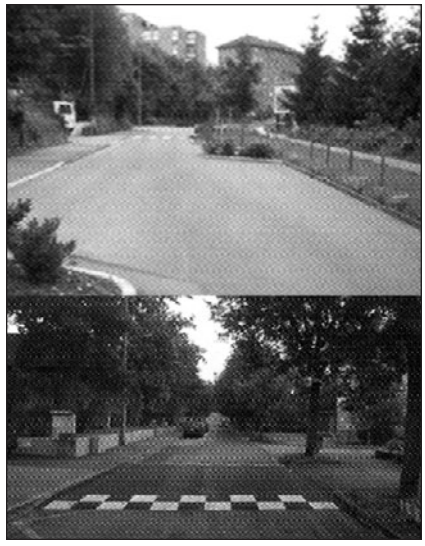

Figure 2. Examples of traffic calming measures.

RESULTS

Accident Occurrence

The detailed analyses showed decreases in accident numbers in both urban and rural areas. The total before/after reduction over all zones was considerable, at about 15 percent. Accident severity also declined markedly, by about 27 percent. The number of accident victims decreased by about 15 percent in urban areas and by 45 percent in rural areas. For each zone with an average size of 0.2 square kilometers averaging about six accidents and two injured persons over 3 years, a reduction of about one accident and 0.5 accident victim could be expected over the same period. Table 1 shows the results in detail.

Along with the changes in accident occurrence, the local situation and distribution of accidents before the introduction of the 30 km/h zones also were analyzed in detail. From the distribution of accidents before the introduction of the zones in the 30 investigated areas, three fundamentally different types of accident occurrence (accident schemes) emerged, similar to those produced by previous individual studies (see Table 2).[9]

The accident distributions clearly illustrate that the area-based 30 km/h measure often is not uniquely suitable as the sole measure for achieving a reduction in accident occurrence. Particularly in the case of local accident black spots at intersections, for example, appropriate local accident analyses need to be carried out to reveal accident causes. These generally indicate

Table 1. Changes in accident occurrence.

30 km/h zone	Accidents per year			Accident victims per year		
	Before speed limit (50 km/h)	After speed limit (30 km/h)	Change (percent)	Before speed limit (50 km/h)	After speed limit (30 km/h)	Change (percent)
In large/medium-sized towns/cities	3.42	3.29	-3.8	0.84	0.71	-14.5
In small towns/villages	1.57	1.12	-28.7	0.31	0.17	-45.4
Total	2.23	1.90	-14.8	0.48	0.35	-27.5

Table 2. Classification of accident occurrence.

All 30 km/h zones		Accidents					Accident victims		
		V speed limit (50 km/h)		N speed limit (30 km/h)		X^2-test	V speed limit (50 km/h)	N speed limit (30 km/h)	X^2-test
Case III	22 zones	193	65 percent	139	67 percent	s	33	26	r
Case II	5 zones	70	21 percent	43	21 percent	s	16	8	s
Case I	3 zones	37	12 percent	22	12 percent	r	5	0	-

Note: s = significant (95 percent); r = random.

deficiencies and shortcomings relating to traffic engineering (operation) in the area immediately around the intersection, which can be only partially influenced by means of 30 km/h zone signposting.

In the case of dispersed accident distributions, the introduction of a 30 km/h zone is particularly expedient because the random local occurrence of accidents often is related to vehicle speeds and, in the absence of raised accident frequencies, no local measures can be taken. In about 22 of the 30 residential districts studied, there was a dispersed accident distribution both before and after, with similar shares of the total accident occurrence—65 percent before and 67 percent after.

Speeds

The reductions in accident frequency and severity were the consequence of lower speed levels after the implementation of 30 km/h zone signposting. The decrease in the 85th and 50th percentile speeds was about 6 to 7 km/h, on average. This indicates a considerable deterioration in the degree of adherence to the signposted maximum speed of 30 km/h.

In addition to the before/after changes in speed behavior, research was carried out to determine whether there were differences in the changes in speed level if zones contained a variety of traffic engineering and structural measures for traffic calming or practically none.

Table 3 shows the results in detail, both for the changes (referred to above) in speed behavior in the relevant areas and for the speed reduction in 30 km/h areas with and without structural measures.

The analysis of the relationships between changes in speed behavior and the traffic engineering and structural measures for traffic calming clearly revealed the positive effect of the structural measures. In zones with a variety of structural traffic calming measures, such as lateral and vertical offsets (speed bumps), central islands and street narrowing, an average reduction between 7 and 8 km/h in the medium ($V_{50\%}$) and higher ($V_{85\%}$) speeds was achieved. By contrast, there was practically no reduction or only a minimal reduction in zones without structural traffic calming measures.

This analysis also shows that the measures have only a limited effect, depending directly on drivers' acceptance of the 30 km/h speed limit. If a 50-percent degree of adherence to the speed limit is tolerated as the lowest extreme, an assessment scale for the suitability and extent of the necessary traffic calming measures can be specified, as in Figure 3.

Table 3. Changes in speed behavior.

All 30 km/h zones	Speed											
	Before speed limit (50 km/h)				After speed limit (30 km/h)				Change			
	v 50% km/h	n	v 85% km/h	n	v 50% km/h	n	v 85% km/h	n	v 50% km/h	T-test	v 85% km/h	T-test
Urban areas	37.06	16	45.11	18	30.39	18	37.70	23	-6.67	s	-7.41	s
Rural and village areas	40.46	50	47.08	52	34.59	37	41.16	37	-5.87	s	-5.92	s
Total	39.7	66	46.6	70	33.2	55	39.9	60	-6.5	s	-6.7	s
With structural measures	39.85	48	46.85	47	32.07	43	39.17	50	-7.78	s	-7.68	s
Without structural measures	39.06	18	43.94	18	39.11	9	45.42	7	0.05	r	1.48	r

Note: s = significant; r = random; α = 5 percent; n = number of measurement sites.

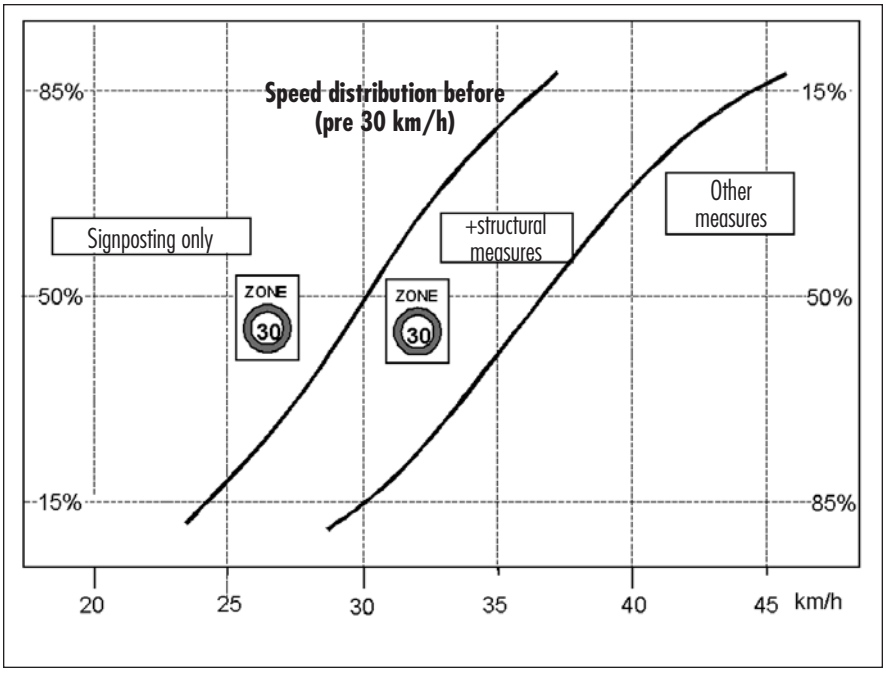

Figure 3. Assessment scale for speed behavior.

In general, police speed checks are not favored as an additional measure to enforce lower speeds when 30 km/h zones are introduced. The large number of such zones also means that it would be impossible to enforce adherence to the 30 km/h limit in all of them.

This scale makes it possible to assess, on the basis of the speed behavior identified before the introduction of a 30 km/h zone, whether the measure would be suitable and whether additional traffic calming measures would need to be commissioned.

Speed surveys need to be carried out at different sites in the neighborhood, and the speed distributions (cumulative frequencies) need to be extended and compared with the sector of the speed distribution appropriate for the introduction of a 30 km/h zone.

Costs of Zones and Cost-Benefit Ratio

In addition to the basic costs for signposting a 30 km/h zone on all streets entering the zone, further traffic engineering and/or structural measures aimed at achieving a lower speed level were commissioned or built at selected sites in two-thirds of all zones. These included familiar structural measures, such as road narrowing, lateral and vertical offsets in the roadway, central islands and speed bumps in the roadway and around intersections, as well as the frequent use of parking lots and parking lanes on alternate sides.[10]

For average zone sizes of 0.3 square kilometers, each 30 km/h zone has an average street network of 2.27 km. The average costs resulting per kilometer of street in a single zone for the traffic engineering and structural measures required to implement the 30 km/h zone amount to about 33,000 Swiss francs.

The correlation between financial outlay and kilometers of street network applies exclusively to smaller zones up to about 0.3 square kilometers. If the size of the zones (area) and the total expenditure for the technical installations also are taken into account, no correlation can be derived. It is, however, possible to determine that the outlay in most 30 km/h zones with an area of up to 0.3 square kilometers amounts to approximately 30,000 to 100,000 Swiss francs.

In addition, almost double the outlay is necessary, on average, in urban areas compared to rural ones. This is principally a consequence of the need for significantly more robust (structural) measures to achieve the desired effect and of the larger number of signposting measures often required in urban 30 km/h zones.

These findings make it clear that the outlay involved in establishing effective 30 km/h zones is modest. If the costs are set against the reduced accident costs achieved, the measures are tremendously cost efficient. On average, one fewer accident occurs per zone in three years. In the same period, there are 0.5 fewer accident victims. On the basis of an average cost per accident of 37,000 Swiss francs (1998) and per accident victim of 80,000 Swiss francs (1998), the outlay involved in establishing a 30 km/h zone becomes economically efficient within three years due to the reduced accident occurrence.[11, 12]

FINDINGS

The research project led to clear results with respect to the effects of 30 km/h zones in towns and municipalities. It also produced criteria for assessing the expediency of initiating 30 km/h zones in a specific district or area. These led to the following findings:

- On the basis of a positive cost-benefit ratio only two to three years after the implementation of a 30 km/h zone in districts within the residential area of towns and municipalities, this measure enables a sustained increase in road safety in the area. It was recommended that it be implemented rapidly and extensively in Switzerland.[13]
- A substantial and lasting reduction in the speed level of motor vehicles in 30 km/h zones can be achieved only by installing individual, carefully selected and properly located structural measures. Compared to the reduction in the speed limit of 20 km/h, the obtainable reduction in the speed level between 5 and 6 km/h, on average, may appear slight. This reduction, however, manifests itself in the form of about 15 percent fewer accidents and 27 percent fewer accident victims.
- The assessment of the advisability of introducing a 30 km/h zone in a specific, individual area needs to be undertaken carefully, on the basis of an analysis of current accident occurrence and speed level on the area's major streets. If the distribution of accidents is dispersed, the establishment of a 30 km/h zone is particularly advisable. By reference to the

evaluation of the existing speed levels for the major streets in the area, it is possible to verify which measures need to be implemented when the 30 km/h zone is established. ■

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HANS PETER LINDENMANN

is a senior scientist and lecturer at the Institute for Transport Planning and Systems (IVT), Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. He holds a degree in civil engineering from ETH in Zurich.