

# Capacity issues in Sweden - applications and research

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## Abstract

This paper gives an overview of the Swedish trunk road system and present objectives, guidelines concerning capacity and level of service. Procedures to assess these issues in the feasibility and design procedure are also described. An important goal in Sweden is investments and speed limit changes over a 10 year time scale to decrease the CO<sub>2</sub>-exposure.

The long term speed limit overview with the objective to require median barriers at speed limits over 80 kph with results so far is presented. By now over 50 % of the former traffic load over 80 kph is decreased to 80 kph. Some 2,700 km have been retrofitted to 2+1 median barrier roads with speed limit mainly 100 kph.

An overview is also given of the updated Swedish Highway Capacity Manual with new chapters especially on jam densities, entry lanes, weaving areas and traffic signals. Some interesting research projects are also briefly covered. These are 2+1 median barrier roads, capacities at motorway work zones, speed harmonisation with variable speed limits on motorways to increase capacity, ramp metering and Drive Me (autonomous driving full scale tests).

*Keywords: capacity, level-of-service, state of the art, manual*

## 1 Introduction

The purpose of this country report is to give an overview of

- the present situation on Swedish trunk roads
- present Swedish policies on capacity related issues
- procedures and methods for highway capacity and traffic performance analysis and design.
- the ongoing speed limit review
- the new Swedish Highway Capacity Manual (SHCM) and the new Swedish Guideline for simulations

- Swedish experience of variable speed limits and ramp metering on motorways.

Country reports for Sweden are also available from previous ISEP conferences (Bergh et al 2011). Some projects are also reported in more details at the conference.

## 2 Overview Swedish Trunk Roads

The Swedish Transport Administration (STA) is responsible for rural roads and major urban through roads, all together some 100 000 km. The highest traffic volume in Sweden is found on the E4 through Stockholm with sometimes 10 lanes and short interchange spacing with a peak AADT around 140 000 veh/day. At the other end there are almost 20 000 km gravel roads with AADT's below 200 veh/day. The average traffic growth is around 2 % during the last years with a long term forecast varying geographically between 0 and 2 %.

30 % of the yearly mileage is produced on some 2 000 km motorways and 14 % on some 2 700 km median barrier roads with overtaking lanes. Motorway AADT's vary from 65 000 at 50 kph to 17 000 at 120 kph and on median barrier roads from 12 000 at 70 kph to 7 000 at 110 kph with maximum flows around 20 000. There are only 1 500 km rural roads with AADT's over 4000 veh/day, see figure below.

Speed limit	Motorway			2+1 with median barrier			2 lane		
	km	Mfkm	AADT v	km	Mfkm	AADT v	km	Mfkm	AADT v
<=60	2	45		27	130		8888	4656	
70	58	1384	65042	136	587	11787	58799	10696	498
80	39	737	51586	70	232	8988	13844	7200	1425
90	132	1804	37536	148	543	9806	9895	7770	2151
100	153	1617	28960	1833	5280	7623	2194	825	1030
110	1279	9614	20592	453	1122	6620	16	43	
120	341	2069	16628	0	0	0	0	0	
Total	2006	17315		2668	7896		93639	31206	
%	2	30		3	14		95	54	
Over 80 kph %	12	49		15	22		73	28	

**Figure 1:** Main Swedish road types by speed limit, length (km), traffic load (Million vehicle km) and average AADT (source NVDB 131231).

The main current capacity and level-of-service issues on state roads relate to the design and operation of urban motorway sections with close interchange spacing including ITS-measures such as incident detection systems, variable speeds, ramp metering and also lane closures at road works. There are also a few median barrier roads at high traffic volumes creating some capacity problems. This is an obvious problem on a few sections with terminations from two lanes to one lane creating bottlenecks in between multilane roads.

## 3 Swedish Policies

The overall objective for the Swedish transport system is to produce sustainable, safe efficient accessibility for the whole country. STA report results (Trafikverket 2015), hopefully progress on a yearly basis to the government expressed for accessibility in four "qualities" for five road or transport types. These are punctuality, capacity, robustness and usefulness. The 2014 result by quality and transport/road type with definitions of the qualities is given in the figure below.

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