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Improving the Environmental Characteristics of Commercial Transportation with More Effective Route Planning

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Why I am here

- 2006 - 2009 – Part of a team. Member of a Swedish-funded IVSS project called **SOLVI** (Safe Operation for Large Vehicles Initiative). Project focuses on safe and fuel efficient driving and routing of large trucks.
- 2008-2009 – Asked by Vägverket to prepare a report on navigation assistance for green driving as part of follow-up to SOLVI.
- This presentation is summary of that report.

Topic of Investigation for Vägverket

- Preconditions for developing a navigation system for heavy trucks that delivers **fuel-efficient routes** avoiding environmentally sensitive areas.
- Role of road authorities and municipalities in supporting and stimulating the market for **environmentally friendly navigation**.

Premise: Road transport is broken in many European countries

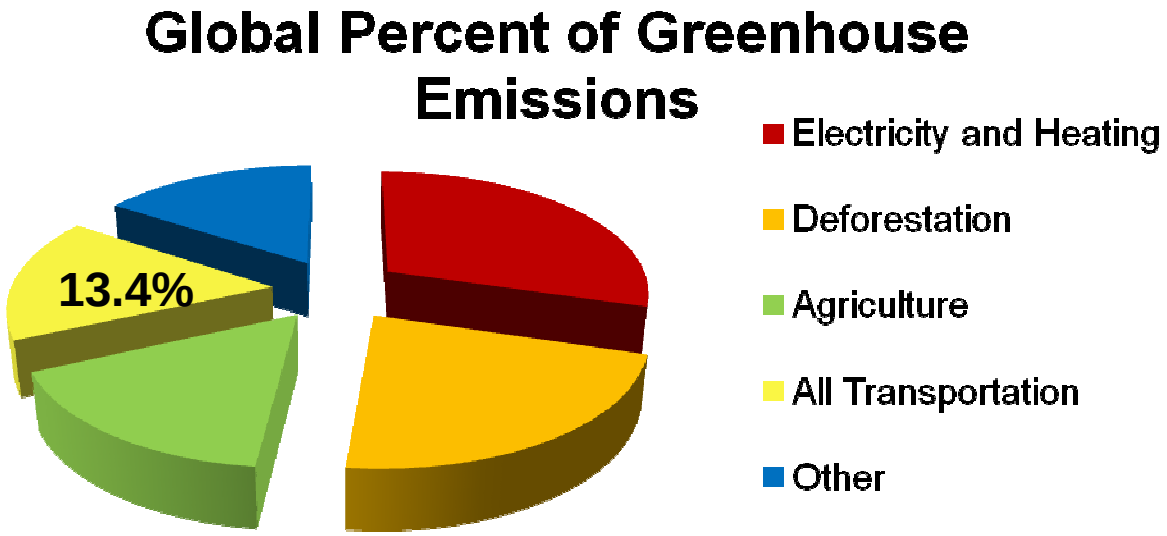
- Traffic congestion and general environmental concerns are making it more difficult and costly for large trucks to operate.
- This is not necessarily good news for trains; it is bad news for the country's competitiveness.
- Truck manufacturers (e.g. Volvo and Scania) realize they must deliver effective mobility, not just trucks, but they cannot do this on their own. Government policies are critical determining factors.

Congestion is bad for business and bad for the environment.

Problem #1 – Transportation-related emissions

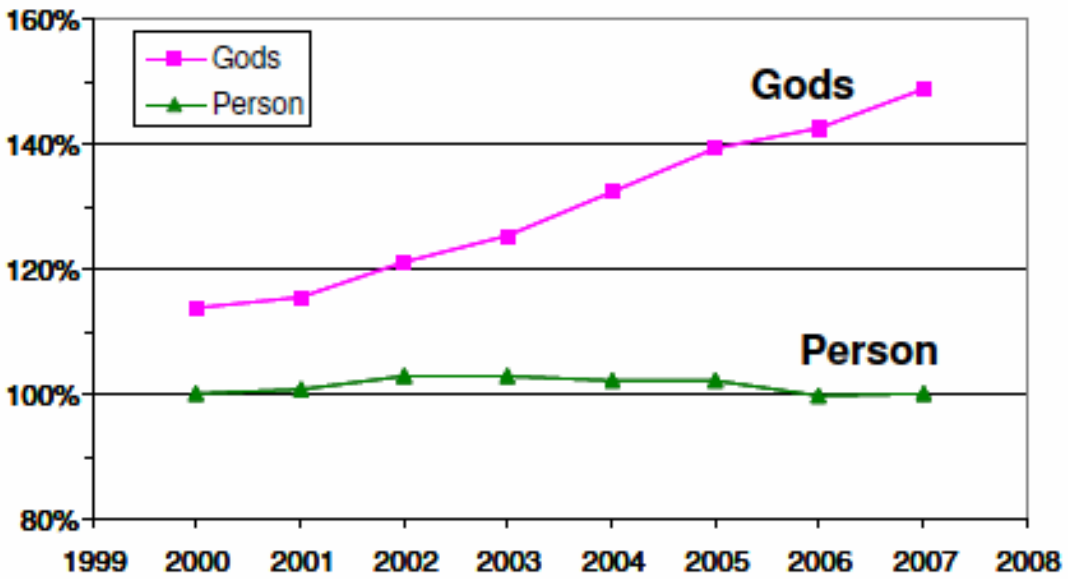
- The transportation sector in Sweden is responsible for approximately 30% of greenhouse gas emissions.
- Globally, transportation is responsible for 13.4% of greenhouse emissions.

(Sweden has no coal-burning electricity plants, and has lower aggregate land area in agriculture, so transportation is proportionaltely higher)



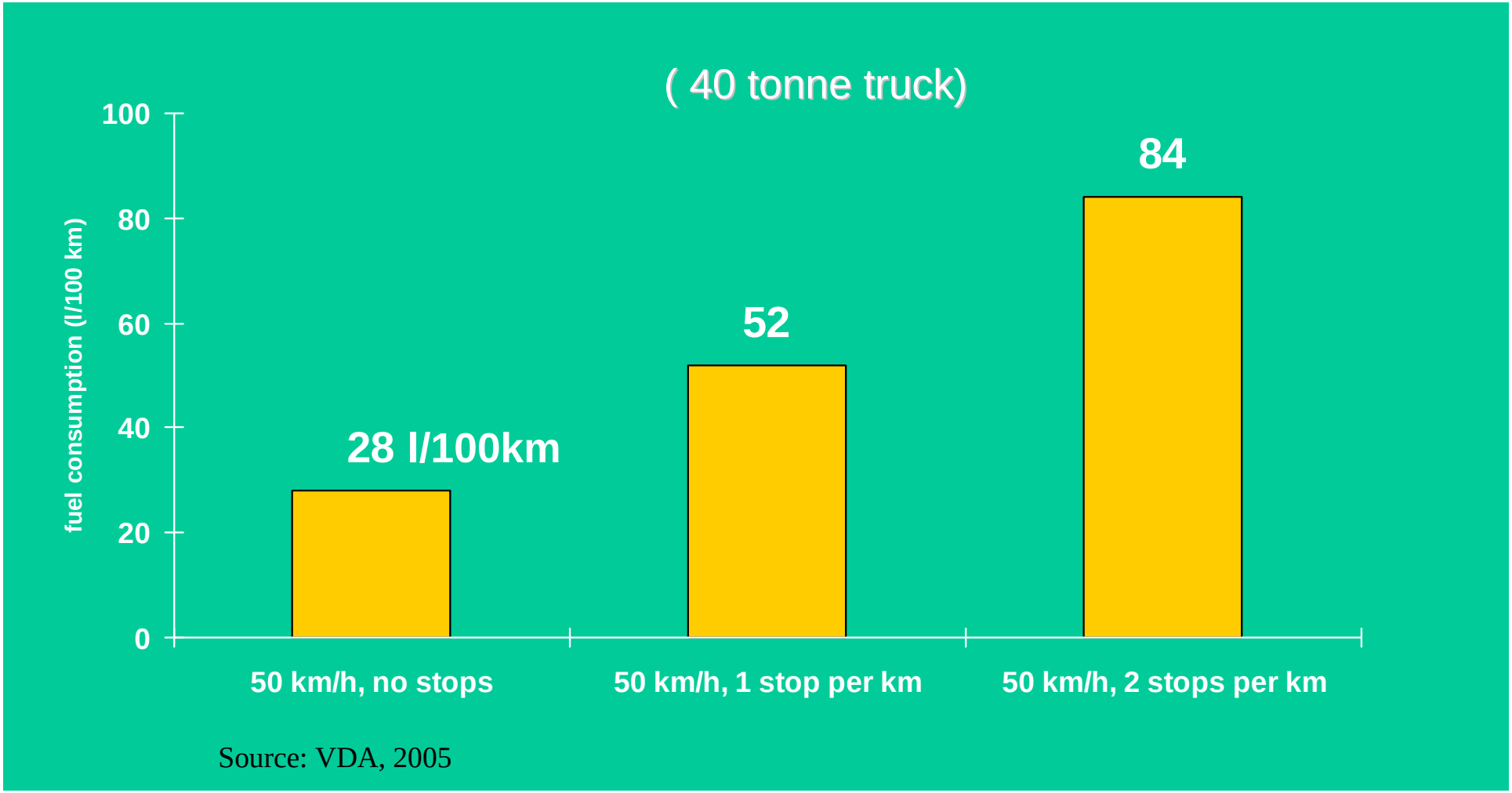
Problem #1 – Transportation-related emissions

- Carbon dioxide emissions from **heavy transport** in Sweden increased around 40% from 1999 to 2006
- During same period emissions from **cars** has been relatively stable ---in spite of the fact that we are driving longer distances. (Laws have had an effect on car engine design)

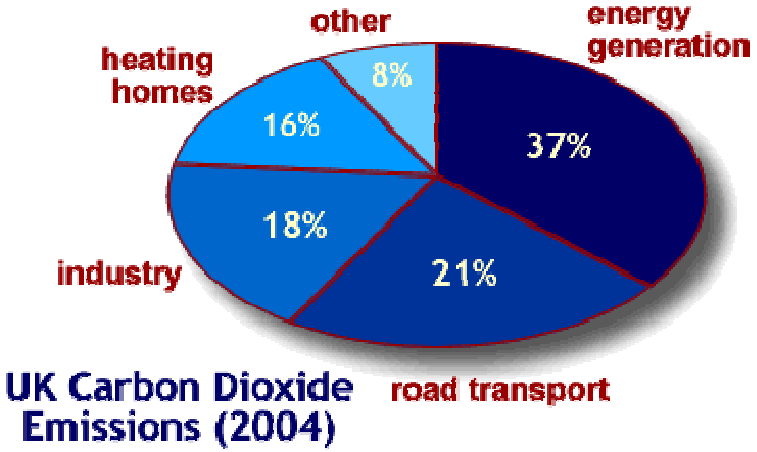


Source: Swedish Institute for Transport and Communications Analysis (SIKA Rapport 2008-10)

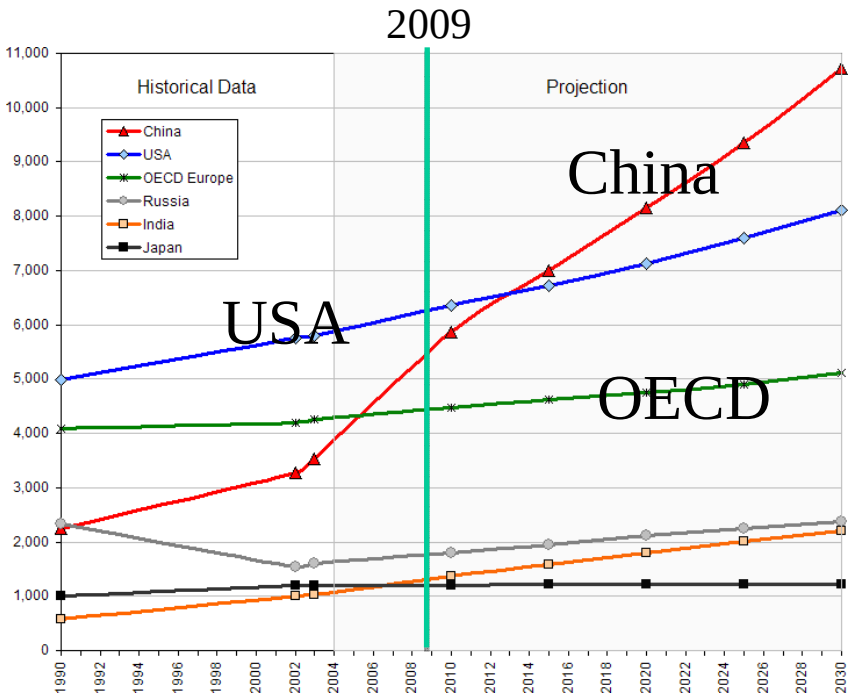
Road congestion increases fuel consumption and emissions



Source: VDA, 2005



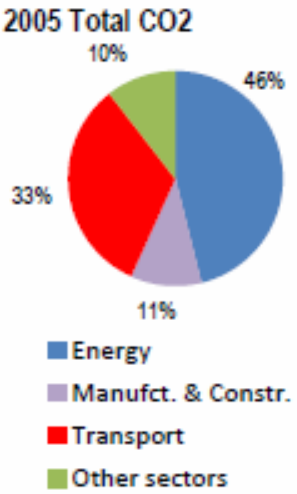
UK Carbon Dioxide Emissions (2004)

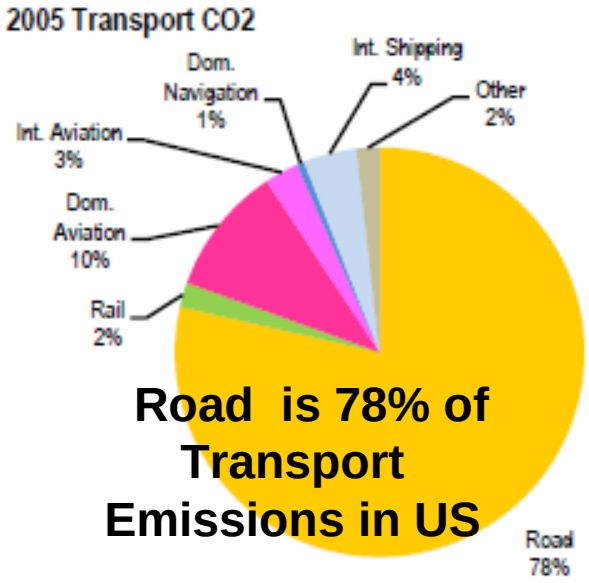


China, India, USA, Europe, Russia, Japan: Carbon Dioxide Emissions, 1990-2030 (in million metric tons)

Fire used to clear forests in Sumatra, Indonesia, for palm oil plantations © Greenpeace/Novis

Most CO2 emissions from deforestation stem from the destruction of tropical forests. While some forests are logged, many are simply burned to make room for industrial agriculture like cattle ranching and palm oil plantations – two leading causes of tropical deforestation. This burning emits massive amounts of CO2 into the atmosphere.





Road is 78% of Transport Emissions in US

United States

Total CO2 from fuel combustion

Transport and the Economy	1990	1995	2000	2001	2002	2003	2004	2005	1990-2005	% per year
Population (millions)	250.18	266.59	282.43	285.37	288.25	291.11	293.93	296.68	19%	1.14%
GDP (billion 2000 US$, PPP)	7055.00	7972.80	9764.80	9838.90	9997.60	10249.80	10651.70	10995.80	56%	3.00%
Road passenger km (million pkm)	3866922	3899426	4353881	4355726	4450661	4483127	4564468	4523955	17%	1.05%
Road freight tonne km (million tkm)	4072935	4757300	5283199	5377719	5446358	5455479	5620498	5655157	39%	2.21%
Road pkm/capita	15457	14627	15416	15263	15440	15400	15529	15249	-1%	-0.09%
Road freight tkm/$ of GDP)	0.58	0.60	0.54	0.55	0.54	0.53	0.53	0.51	-11%	-0.77%
Motorisation (Cars/1000 inhabitants)	744	728	753	777	766	765	..	777	4%	0.29%
CO2 Emissions										
IEA CO2 from fuel combustion (Mt CO2)*	4980.29	5245.68	5846.95	5736.41	5776.48	5822.58	5919.10	5951.13	19%	1.19%
IEA transport CO2 (Mt CO2)*	1553.78	1670.99	1860.25	1829.21	1868.73	1878.51	1918.26	1947.50	25%	1.52%
Transport as a percentage of total	*31.2%*	*31.9%*	*31.8%*	*31.9%*	*32.4%*	*32.3%*	*32.4%*	*32.7%*		
Road	1141.46	1262.67	1427.04	1438.71	1474.18	1506.21	1520.53	1530.30	34%	1.97%
Rail	32.63	32.87	31.06	30.22	31.43	31.58	33.74	37.68	15%	0.96%
Domestic Aviation	187.47	180.31	201.69	193.94	190.06	185.47	192.41	198.83	6%	0.39%
International Aviation	38.78	45.95	57.10	51.73	50.67	49.50	50.38	52.06	34%	1.98%
Domestic Navigation	11.16	9.59	9.77	8.61	9.15	9.52	9.26	11.56	4%	0.24%
International Maritime	91.05	90.84	89.25	61.73	73.23	60.80	77.17	82.11	-10%	-0.69%
Other Transport	51.23	48.76	44.34	44.27	40.01	35.43	34.77	34.96	-32%	-2.52%
GHG Emissions										

Problem #2 – Traffic Safety

- Heavy truck traffic increased by 60% in Sweden during past 20 years, is now 8% of road traffic…
- …but trucks are involved in 22% of traffic-related deaths in Sweden.
- 10% of the 40,000 deaths on Western European roads involve heavy trucks.
- More heavy trucks on the roads is a worldwide phenomenon due to the logistics solutions developed over the past decade.

The top of a truck is given a shaving because of a mismatch between the height of the truck and the clearance of the overpass.

Problem #3 – Data Accuracy

- The goal is to match reality.
- The problem is that reality has a way of changing, sometimes slowly, sometimes quickly,
- …and the reality matchers (i.e. map makers) have a difficult time keeping up with it.
- It is difficult to suggest environmentally-friendly routes when the data is not complete or correct.

Sometimes it is difficult to keep up with reality…even for those who create it.

Map by Google and Tele Atlas

Sometimes it is difficult to keep up with reality.

New Road opened 2006 not shown

Walking and cycle path June 2007 not shown

New Road opened June 2007 not shown

New Intermediate School not shown

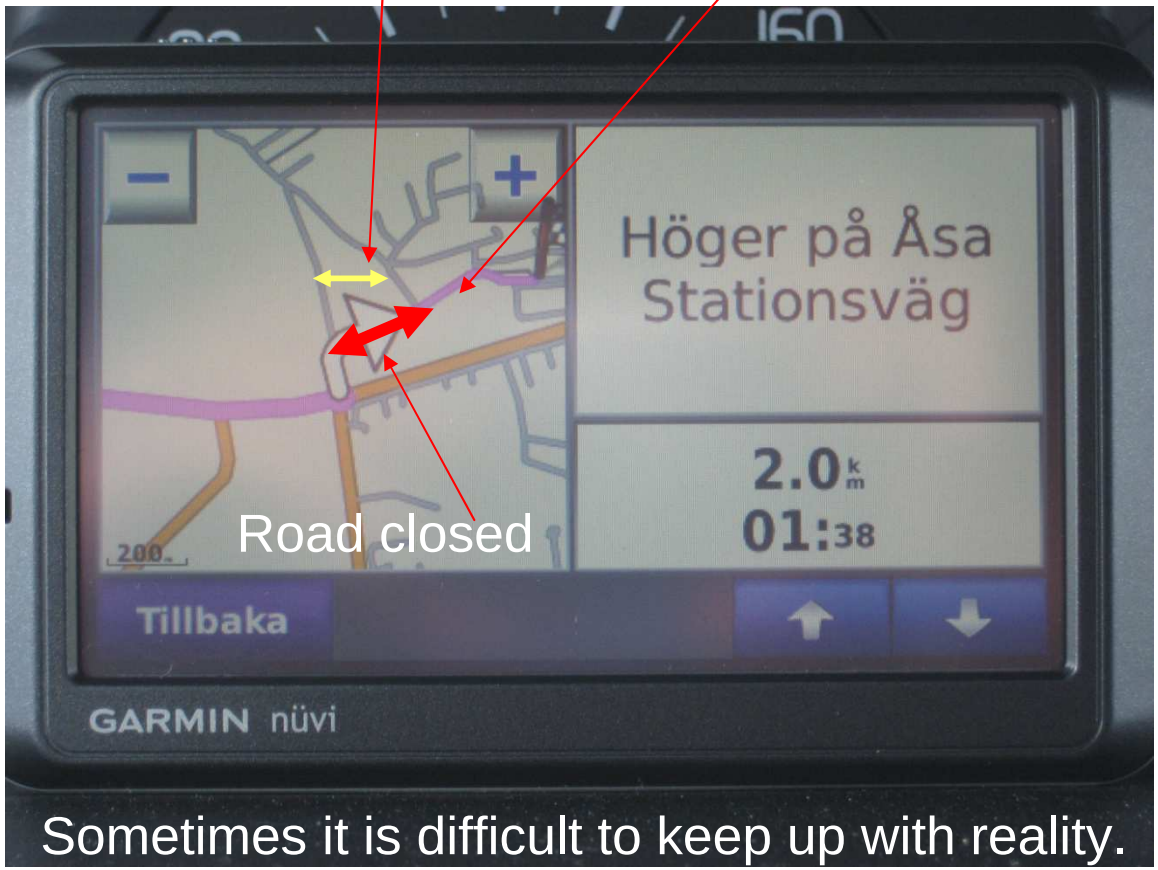
This part of road is legally closed to trucks

Railroad track bed moved 1 km to east November 2005

Map by Navteq; PND by Garmin

New Road opened
June 2007 not shown

Our house

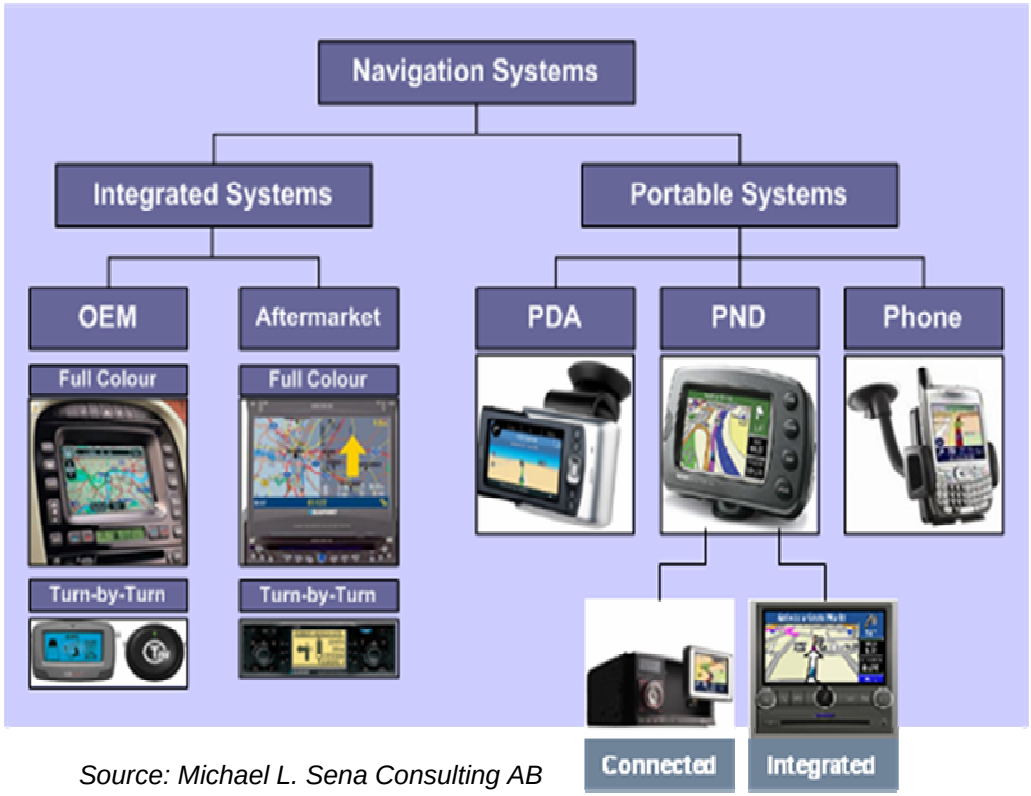


Sometimes it is difficult to keep up with reality.

The Garmin system was purchased July 2008. The correct route is along the yellow arrow on the road that was opened in June 2007. The right turn show by the large arrow, and the voice instructions, lead into a school parking lot that does not have access to a through road.

Can better navigation help to solve these problems?

Classification of Navigation Systems

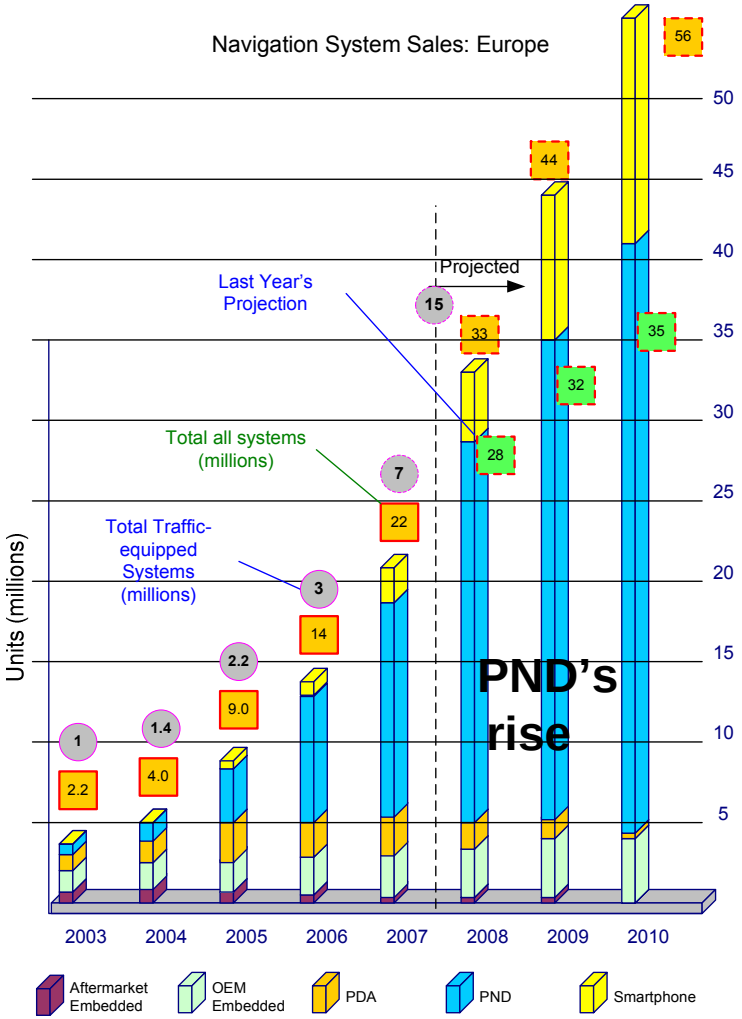


Source: Michael L. Sena Consulting AB

Navigation Systems Sales

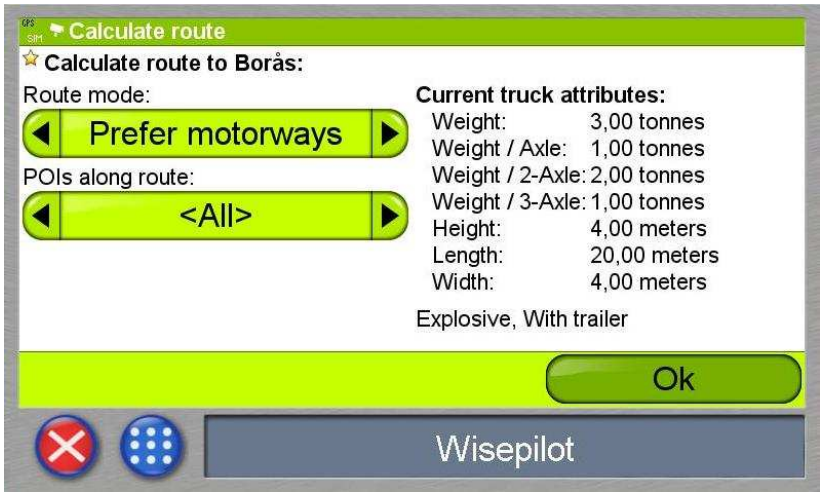
- Projections for total sales for 2008 were revised sharply up following the strong performance of PNDs in 2007 and the expectations for Smartphones.
- Adoption rates of line fit Integrated Systems at the high end have stopped growing.
- All sales projections will probably be revised downward due to lower car sales in 2009.

European Navigation System Market (sales in millions of units)					
	2007	2008	2009	2010	2011
Aftermarket Embedded	0.3	0.1	0.0	0.0	0.0
OEM Embedded	2.1	2.7	2.8	3.4	4.0
PDA	2.0	1.5	0.5	0.0	0.0
PND	16.0	24.0	30.0	37.0	43.0
Smartphone	2.0	5.0	11.0	16.0	22.0

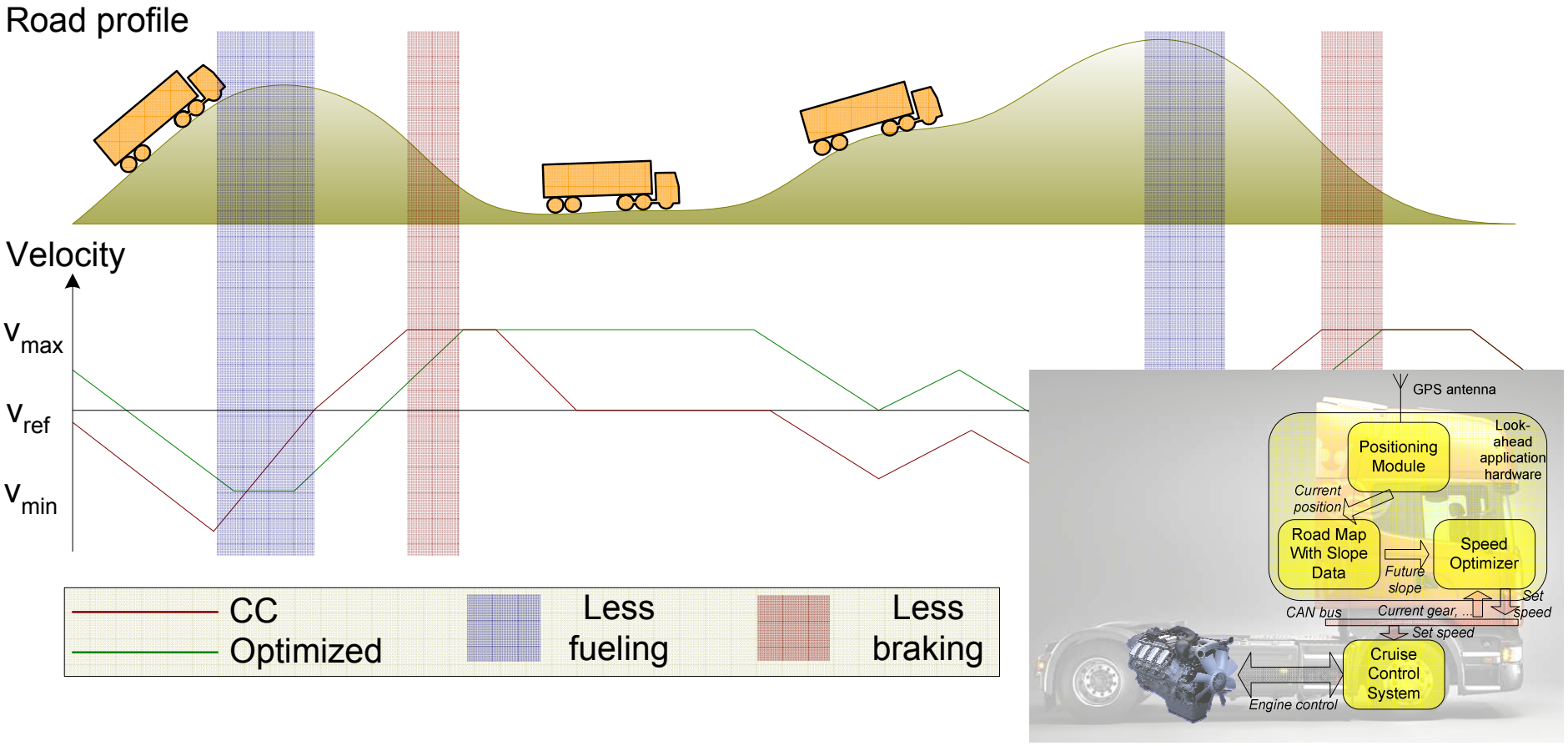


Truck Navigation: What is it?

Routing a large truck



Truck Navigation



Truck Navigation: Status

- The attributes that would enable **green routing**, such as slope, curvature and noise zones, are not yet available from the data suppliers.
- Few systems developed provide routing for large trucks (Siemens VDO, TomTom and Navigon)…
- …are restricted to using only minimum trucking attributes—mainly restrictions and hindrances that prevent through travel by large vehicles.
- Take-up of the truck routing systems is slow due to low availability of the attributes from Navteq and Tele Atlas
- Data collection is piecemeal by country, starting with Germany and expanding VERY SLOWLY to other western European countries.

Feature	Navteq	Road Authorities
Road geometry < 1 metre	√	
Slope < 0,5 accuracy		√
Banking		√
Speed Limits on links		√
Lane count	√	
Lane width	√	
Lane markings	√	
School zones		√
Pedestrian crossings	√	
Stop lights	√	
Accident hot spots		√
Restrictions		

Provide useful data

The SOLVI project has shown that Vägverket's slope data—collected by its modern profilographs to measure road geometry and surface conditions—is of a higher precision than the data collected by Navteq with its D-GPS techniques.

…but data alone will not be enough.

Pre-conditions for **green routing**

If commercially viable, **green route navigation systems** are going to be brought to market, in addition to appropriate data, all three of the following preconditions will have to be addressed simultaneously.

- There will need to be positive incentives for commercial drivers and haulers to select either their routes with reference to environmental impacts, so that market demand for systems that would assist them in doing so can be encouraged;
- There will have to be governmental regulations to require the manufacturers of navigation systems to provide for a green routing alternative; and,
- Our communities will need to revise their planning policies so that facilities are built in places that service access that prioritises safety and environmental concerns over logistic efficiency.

Plan for what will be done, not what should be done

- Low-cost retail chains require more deliveries and generate more traffic.
- Just-in-time manufacturing requires flexible truck routing.
- Large trucks are functioning as rolling warehouses—don't act like small vans can replace then at the snap of a finger.
- Rail transport in today's logistics world is unrealistic—don't ignore this fact of life.
- Truck manufacturers are delivering transportation solutions. Work with them to deliver green routing.

Attack the root cause of the problem, not just the symptoms

What Road Authorities really need to do is to look at truck routing from the business perspective:

- Ten years ago, the trucking business was focused on where a truck was going.
- Gradually, that focus shifted to where the truck is and how it is performing.
- Today it is the logistics process that is driving the placement, size and access requirements of commercial, office, industrial and retail facilities.

Promote sound safety and environmental policies

Laws should be enacted firstly to ensure that people know what society believes is the right thing to do, and secondly to ensure that its citizens do the right thing.

- Educate citizens on **Green Driving** (we have so far failed to do so, both private and commercial drivers).
- Listen to all sides of the debate, not just those who shout the loudest or those who represent the most infuential financial interests. First and foremost, stop sprawling developments that only make the problem worse.
- Pressuring the vehicle manufacturers to improve fuel efficiency is only part of the problem. Truck design needs to change to allow both long-haul movements on roads and rail, and short-haul movement in tight, urban areas.

Future Directions – Think Long-term

- Write new rules to put respect for safety and the environment at the top of the political agenda. (Sweden does not need EU permission to take its future into its own hands.)
- Road Authorities: Use your influence to promote community development that prioritises public transport, bicycling and walking, rather than cars. This will lead to better placement of all facilities.
- Develop realistic policies on truck transport, since trucks will continue to be the only way that businesses will be serviced well into the future.

Jakriborg, Sweden, a new town being built between Malmö and Lund on the principles of multi-use zoning, pedestrian- and bicycle-friendly streets, and an architectural style that harmonizes all of life's daily activities. The idea is not to eliminate private cars, but to put them in their proper place.

The Role of Road Authorities

Road Authorities can support fuel efficient and safer driving in three ways:

Timeframe	Recommendation
Two-to-Five Years	Provide to the navigation map data suppliers all the data that Road Authorities collect and maintain at the lowest possible prices.
Five-to-Fifteen Years	Encourage market demand for Green Routing and Encourage better truck design adapted to urban operation.
Fifteen-to-Thirty Years	Promote the adoption by Swedish society and its institutions of land use development policies that are based on safe and clean use of vehicles.

Questions and Discussion

Thank you.

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