

Trolleybus Landskrona

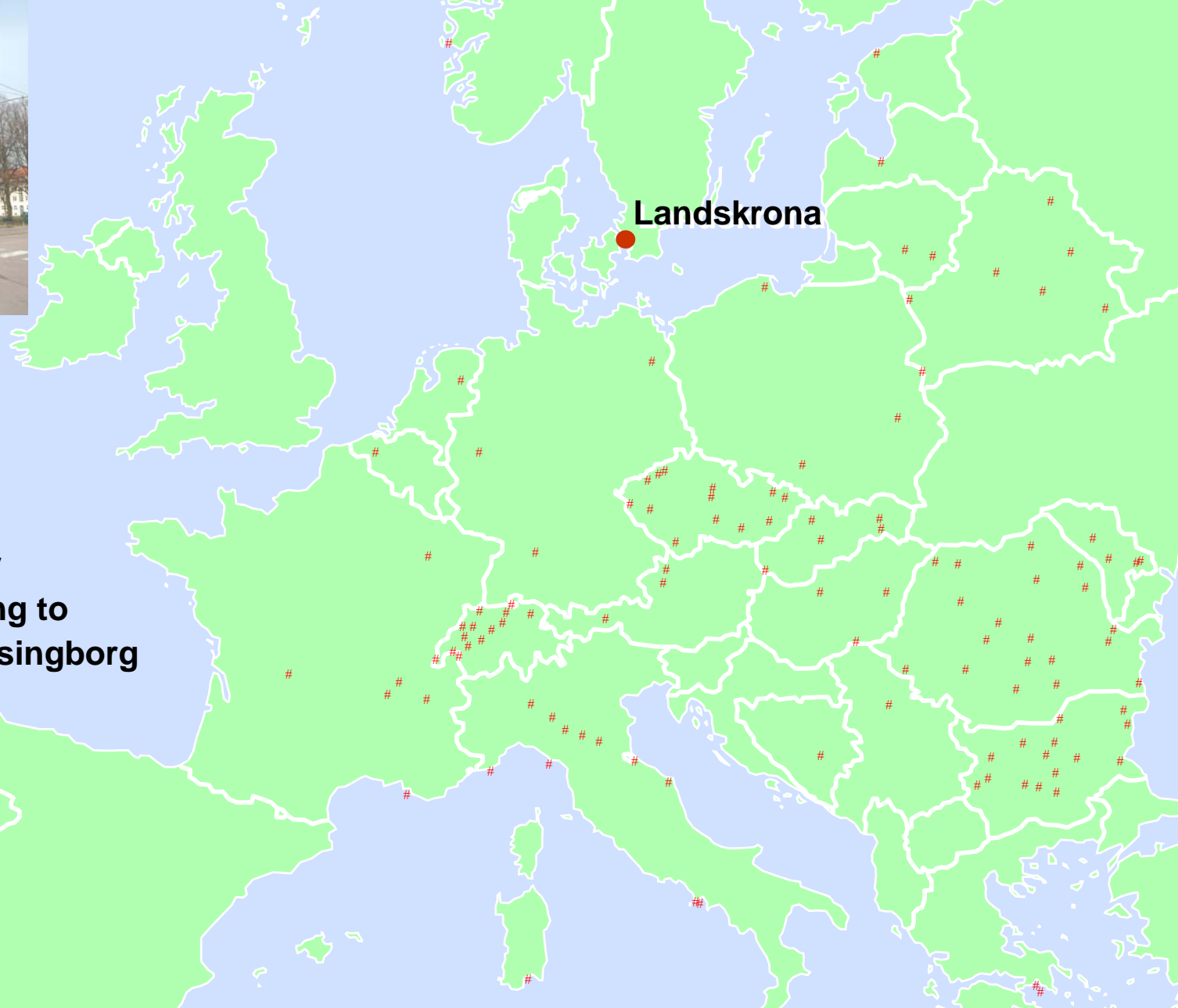
The world's smallest trolleybus "system"

Salzburg, 20 April 2006

PG Andersson, Trivector, Lund, Sweden



1st International Workshop to Push Forward Your Trolleybus System



Landskrona

- 27000 inhabitants
- Harbour
- Former industrial city
- Inhabitants commuting to Malmö, Lund and Helsingborg
- Trolleybus operation opened in 2003



Landskrona med miljön i tanken

Centrum Stationen

LANDSKRONA STATION



3

Arriva

GANZ

SOLARIS
TROLBUSO II
6993

TXI 4763



3 Centrum

Elvira

SOLARIS
GANZ

6992

TXT 754

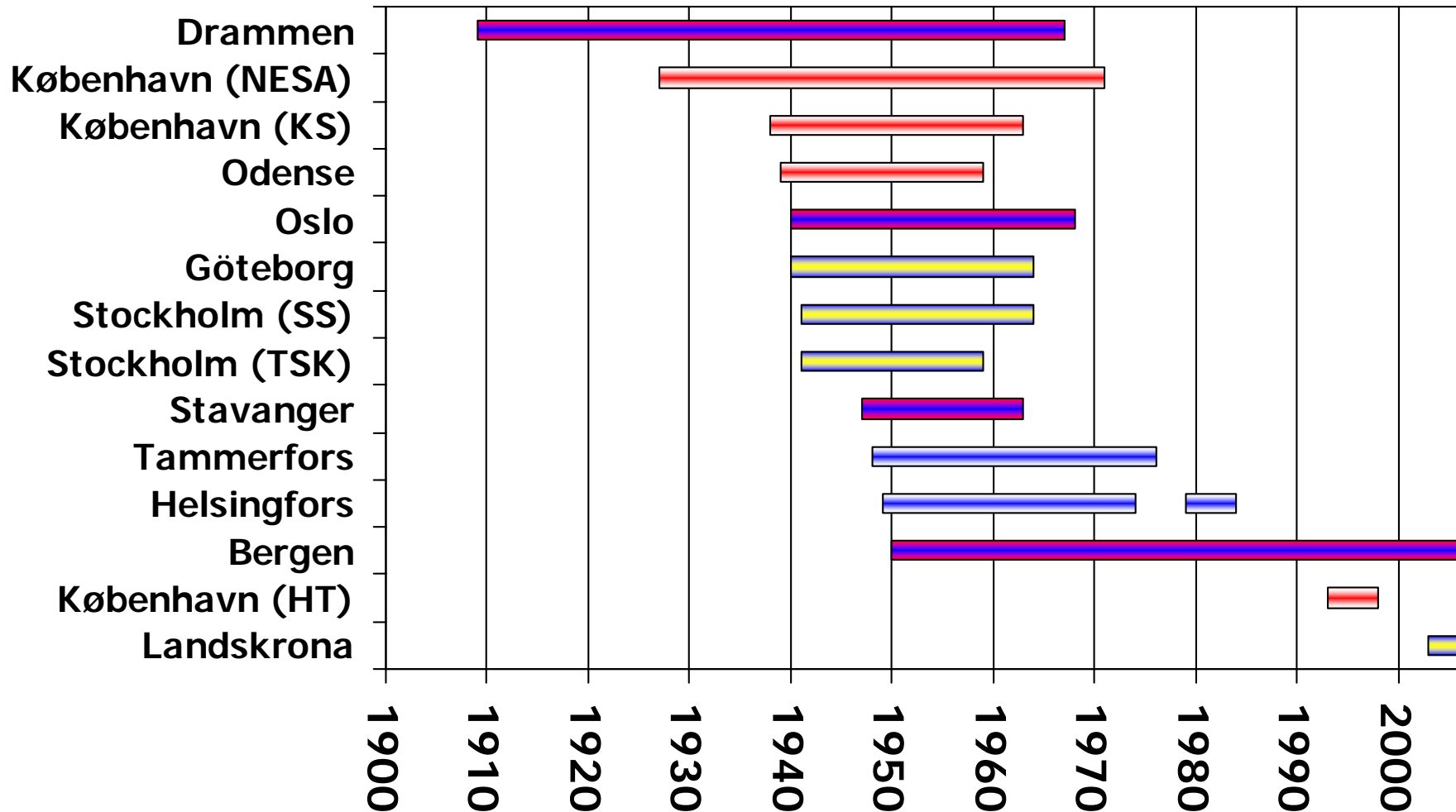
FKH 491

Leksaker



V Centrum Stationen
Landskrona- bussig mot miljön
Ellen
SOLARIS GANZ
6993
TXT 763

Trolleybuses in the Nordic countries

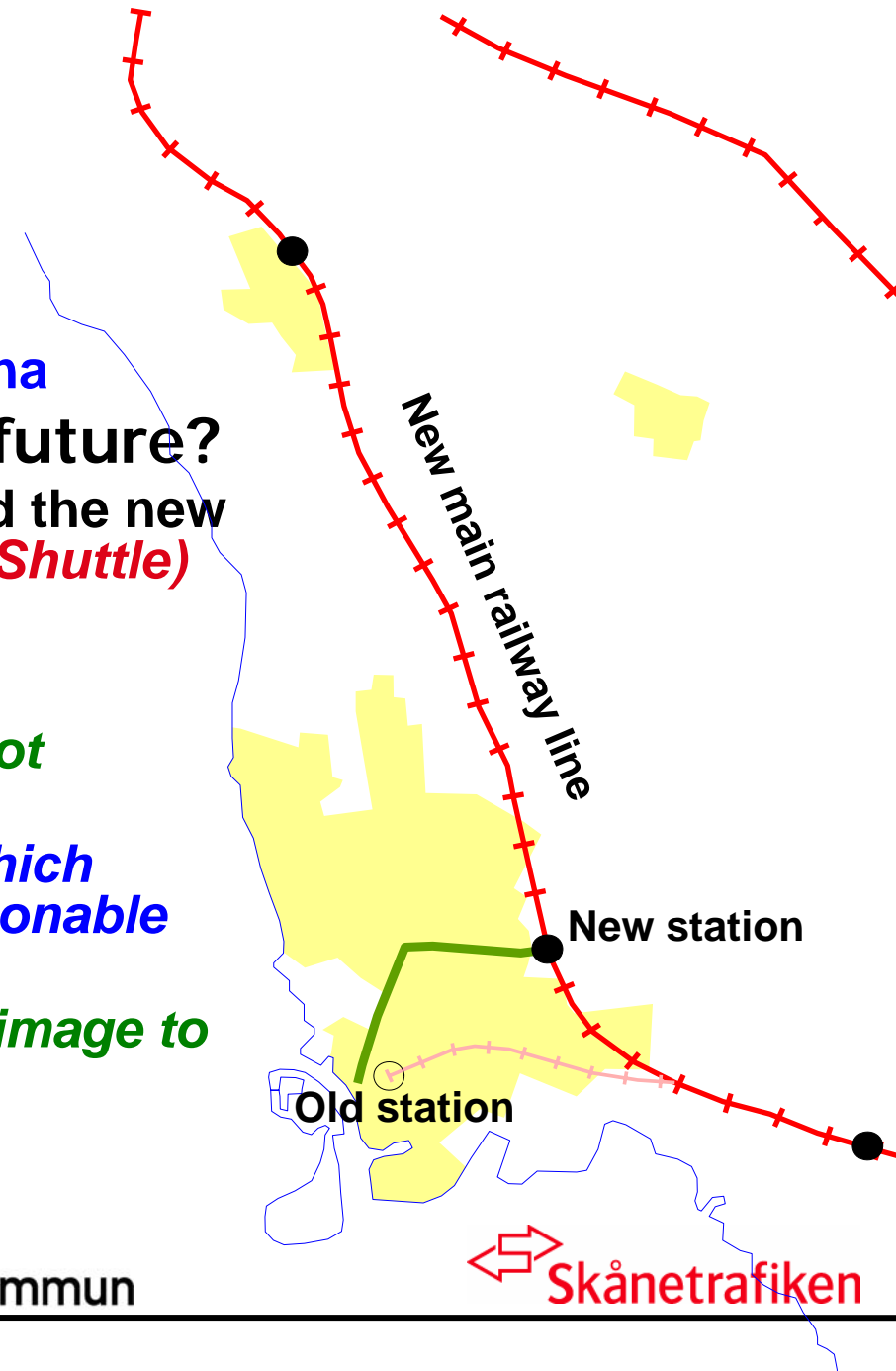


Landskrona 1997

- There was a decision to build:
 - A new railway outside Landskrona
 - A new railway station east of Landskrona
- How to operate City buses in the future?
 - New shuttle between the city centre and the new station – *Stationspendeln (The Station Shuttle)*

The report stated:

- *The Station Shuttle could be a good pilot project for trolleybuses in Sweden.*
- *It is a short route with tight headway which could be built for trolleybuses at a reasonable cost.*
- *The trolleybus will also strengthen the image to be the local continuation of the electric commuter train into the city centre.*



1998 application for governmental support (LIP – Local Investment Programmes)

Improve environment and create new jobs

- Zero emissions

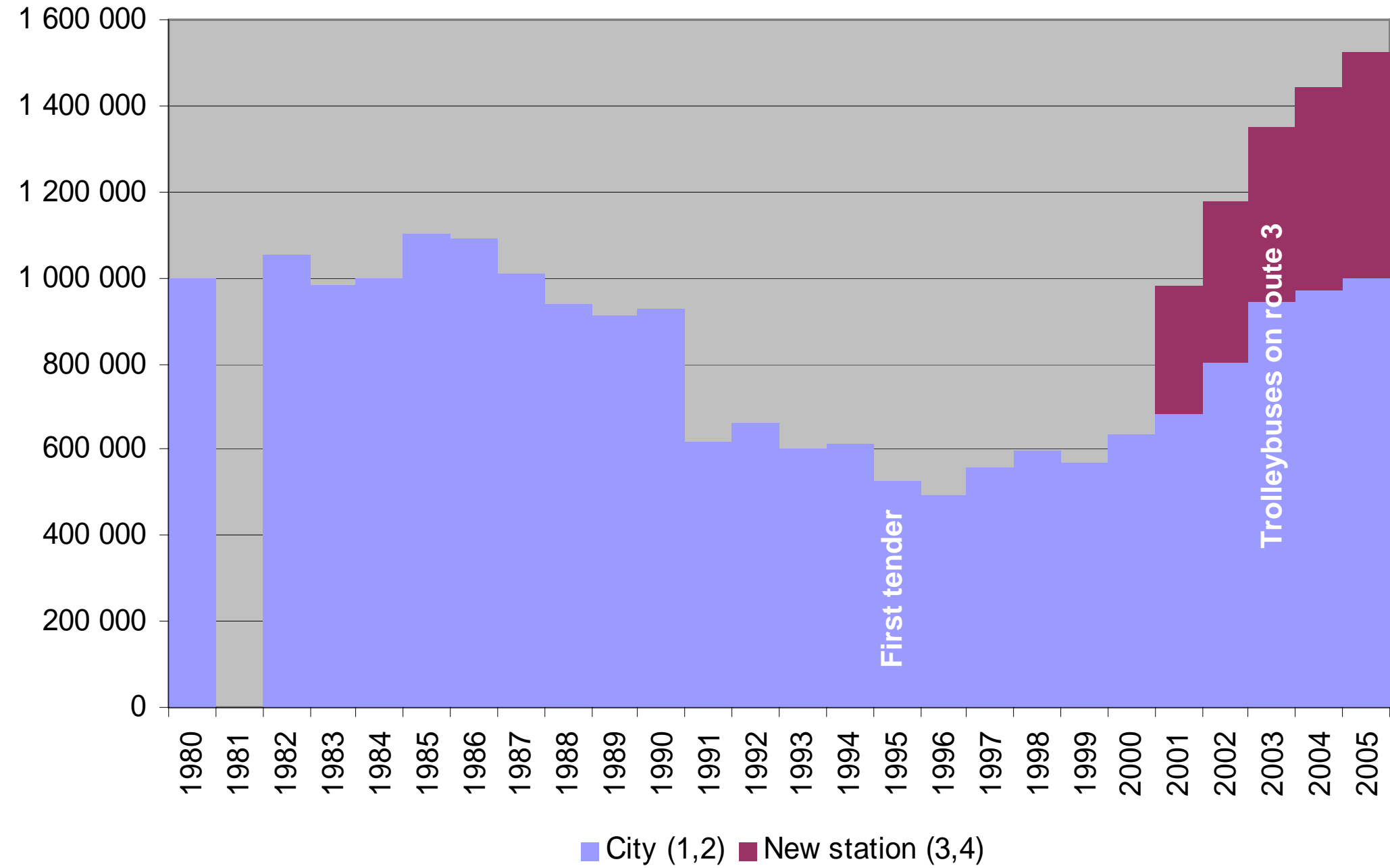
	Calculated	Result 2004
• NO _x	-1.300 kg/year	-1.309 kg/year
• Particles	-18 kg/year	-21,3 kg/year
• CO ₂	-180.000 kg/year	-219.200 kg/year

- Silent

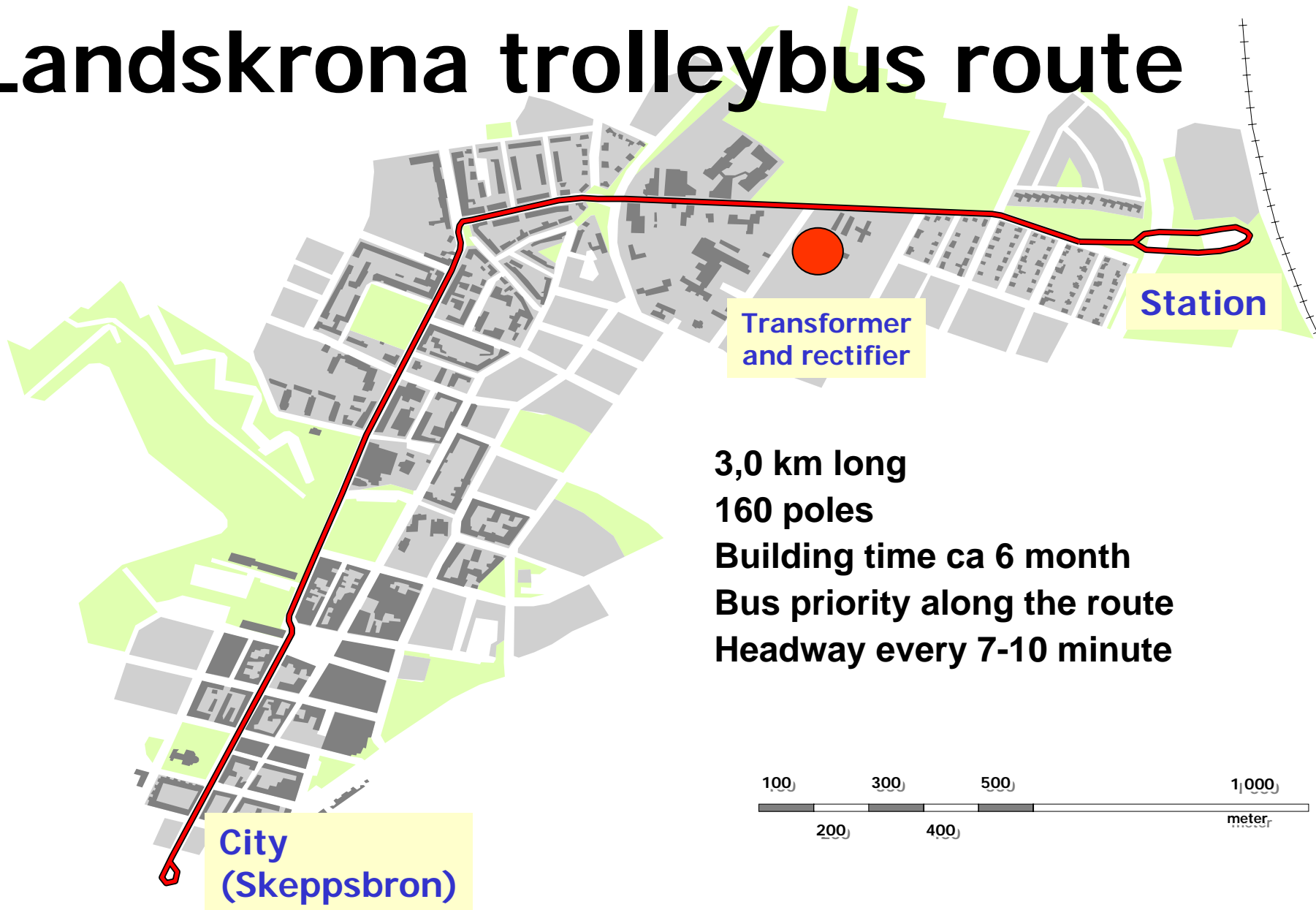
- Stable and Reliable bus route

- 1999 the City get 12,4 MSEK (1,3 M€) in support

Landskrona PT trips 1980-2005



Landskrona trolleybus route



Vehicles

- 3 peaces:
 - 2-axle low floor trolleybus
- Trollino 12
- Solaris/Ganz Transelektro
- Length 12,15 meter
- Width 2,60 meter
- Doors 2+2+1
- Passengers seated 29 (total 70)
- Auxiliary power – Battery
 - 4 km operation in 30 km/h (without passengers)
- Power input 750 V DC
- Traction engine (400 V AC, asynchrone)



Energy consumption

first year (2004)

	Trolleybus	Diesel bus
Energy consumption	1,8 kWh/km	0,45 l/km
		4,5 kWh/km
Energy price (ex VAT)	0,64 SEK/kWh	5,70 SEK/l
Operation cost	1,12 SEK/km	2,56 SEK/km
reduction trolleybus 56 % of cost, 60% on energy		
Including 16% regeneration of break power		
Diesel 0,57 SEK/kWh, Electricity 0,64 SEK/kWh (due to taxes)		

Overhead wires and poles

- Special design for Landskrona based on standard poles
- 100% poles
- 750 volt DC
- Maximum speed 70 km/h

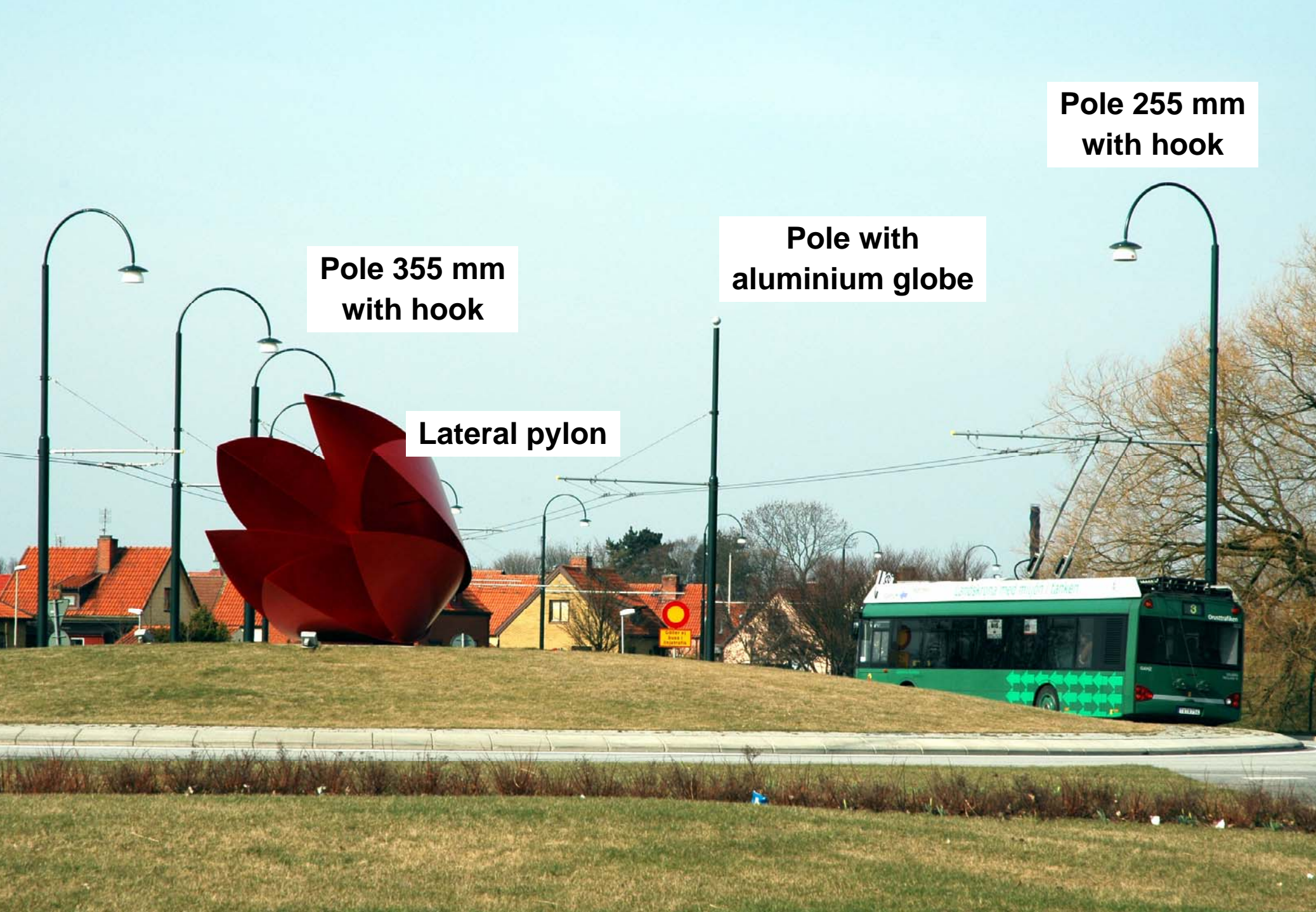


**Pole 255 mm
with hook**

**Pole with
aluminium globe**

**Pole 355 mm
with hook**

Lateral pylon



Pole foundation – an innovation!

Step 1, steel tube in ground



Pole foundation – an innovation!

Step 2, pole fixed



Pole foundation – an innovation!

Step 3, pole work finished



De-icing

- First winter problem with ice on wires
- Changes in substation
- De-icing car
- No problems in winters 2004 and 2005



Electric substation

- Input 10 kV AC
- 1 Transformer
 - 800kVA
- 2 Rectifiers
 - (Secheron) 800kW
- Output 750 V DC to overhead wire



Budget trolleybus Landskrona

Project cost (MSEK)

1. Vehicles	15,2
2. Poles and wires	16,8
3. Substation	3,6
4. Other	3,1

Total **38,7**

Result 2004 **40,8**

Financing (MSEK)

1. LIP-contribution 1	12,4
2. LIP-contribution 2	3,0
<u>3. RTI-contribution</u>	<u>4,2</u>
Governmental contr.	19,6
4. City of Landskrona	19,1

Total **38,7**

Cost comparison

Diesel bus-Trolleybus

Tax diesel bus: 20400 kr/år

Tax trolleybus: 930 kr/år

Diesel bus			Trolleybus			
			Totalt		ex 50% gov support	
Investment MSEK	yearly cost MSEK/y		Investment MSEK	yearly cost MSEK/y	Investment MSEK	yearly cost MSEK/y
Wires and poles			16,8	0,97	8,3	0,48
Substation			3,6	0,18	1,8	0,09
Vehicles	6,3	0,67	15,2	1,11	7,5	0,55
Other			3,1	0,23	2,8	0,21
Recond, veh			0,8	0,06	0,8	0,06
Oper. Wire				0,10		0,10
Oper. Km		0,81		0,53		0,53
Oper. Hour		2,15		2,15		2,15
Sum	6,3	3,63	39,5	5,33 (+47%)	20,4	4,17 (+15%)

Milstones in the project

Jun 98	Decision ta ask for LIP-contribution for trolleybuses
Mar 99	LIP-contribution was awarded, 12,3 MSEK
Oct 01	City executive board decide to tender the trolleybus line
Apr 02	Opening of tenders
Aug 02	tenders was accepted from Ganz/Solaris and SRS (now Carillion Rail Sverige)

- 16/12-02 First works in Vattenverksallén
- 30/1-03 cut the first sod for the trolleybusfirst pole in the ground
- 7/3-03 First lateral pylon mounted
- 6/5-03 First wires mounted
- 2/7-03 First run by trolleybus in Sweden since 1964
- 28/8-03 Test runs with Landskrona's own trolleybuses
- 4/9-03 Full power test
- 15/9-03 First run with passengers
- 27/9-03 **INAUGURATION**
- 27/9-03 From 18.00 (6 pm) full trolleybus operation on route



Trivector



Landskrona kommun

 Skånetrafiken