

The Heavy Route cost database

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Objective

- » To create strongly disaggregated cost functions
- » Add them into a map database
- » Join state-of-the-art economic research on valuation with state-of-the-art engineering research on effect models

Cost categories

- » 1. Air pollution and CO2
- » 2. Noise
- » 3. Accidents

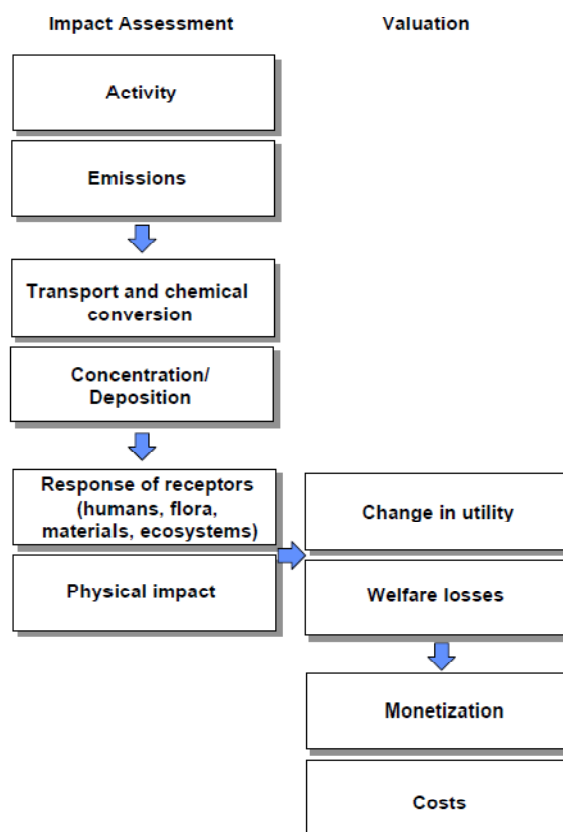
- » 4. Infrastructure cost

- » 5. Vehicle cost and time
- » (6. Comfort)

EU research

- » Numerous EU projects on external cost
 - » UNITE, GRACE, CATRIN
- » Harmonized valuation guidelines
 - » HEATCO
- » Semi-official values
 - » Handbook (Greening transport strategy)

1. Air pollution (NO_x, PM) Impact Pathway Approach



ARTEMIS model

Type of input	Number of classes
Vehicle inclusive trailer	13
Vehicle year model class (emission concept)	7
Load	3
Road: area; road type and speed limit	2, 10, 10-130 in steps of 10
Traffic conditions (level of service).	4
Gradient	-6;-4;-2;0;2;4;6 alt 0;+/-2;+/-4;+/-6

Detailed emission modelling – g/vkm

Economic values - HEATCO



Pollutant emitted	NO _x	NM VOC	SO ₂	PM _{2.5}	
Effective pollutant	O ₃ , Nitrates, Crops	O ₃	Sulphates, Acid deposition, Crops	Primary PM _{2.5}	
Local environment				urban	outside built-up areas
Austria	4,300	600	3,900	450,000	73,000
Belgium	2,700	1,100	5,400	440,000	95,000
Cyprus**	500	1,100	500	230,000	20,000
Czech Republic	3,200	1,100	4,100	170,000	61,000
Denmark	1,800	800	1,900	520,000	54,000
Estonia	1,400	500	1,200	100,000	23,000
Finland	900	200	600	400,000	33,000
France	4,600	800	4,300	430,000	83,000
Germany	3,100	1,100	4,500	430,000	80,000
Greece	2,200	600	1,400	210,000	34,000
Hungary	5,000	800	4,100	150,000	54,000
Ireland	2,000	400	1,600	510,000	50,000
Italy	3,200	1,600	3,500	370,000	70,000
Latvia	1,800	500	1,400	80,000	22,000
Lithuania	2,600	500	1,800	90,000	28,000
Luxemburg	4,800	1,400	4,900	590,000	96,000
Malta (O ₃ estimated)	500	1,100	500	170,000	16,000
Netherlands	2,600	1,000	5,000	470,000	88,000
Poland	3,000	800	3,500	130,000	53,000
Portugal	2,800	1,000	1,900	210,000	37,000
Slovakia	4,600	1,100	3,800	110,000	49,000
Slovenia	4,400	700	4,000	220,000	55,000
Spain	2,700	500	2,100	280,000	41,000
Sweden	1,300	300	1,000	440,000	40,000
Switzerland	4,500	600	3,900	640,000	86,000
United Kingdom	1,600	700	2,900	450,000	67,000

Notes: Cost categories included are: human health, crop losses, material damages.

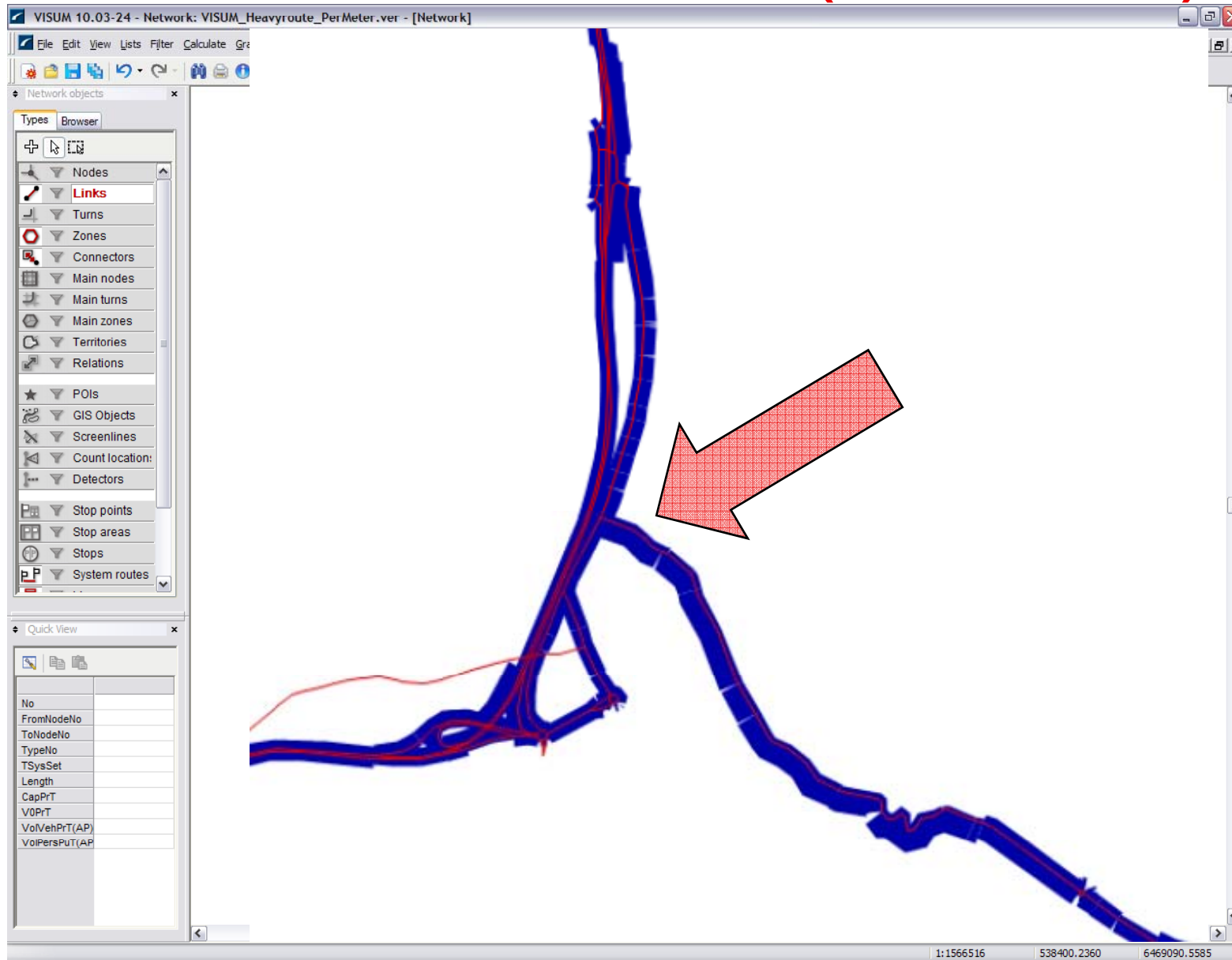
* Values are applicable to all emissions at ground level (e.g. diesel locomotives).

** Estimated values as Cyprus outside of modelling domain.

CO₂

- » Shadow price approach
 - » 22 €/tonne (14 – 56)

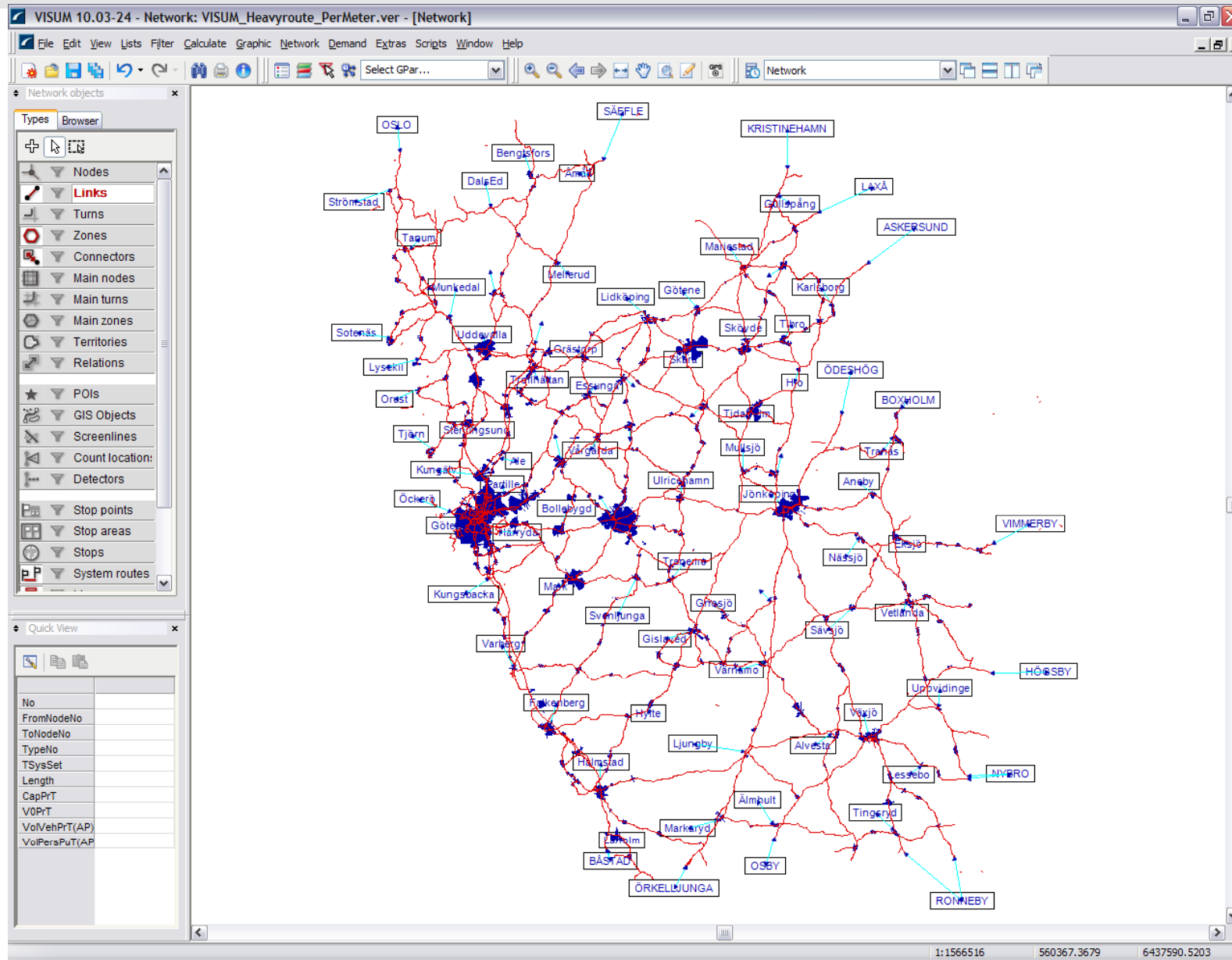
Emission cost (incl Co2) vti



2. Noise

- » Sound source strength of three vehicle types (passenger car + 2 HGV)
- » Estimation of exposure based on urban/non-urban
- » Valuation based on HEATCO
- » Marginal effect

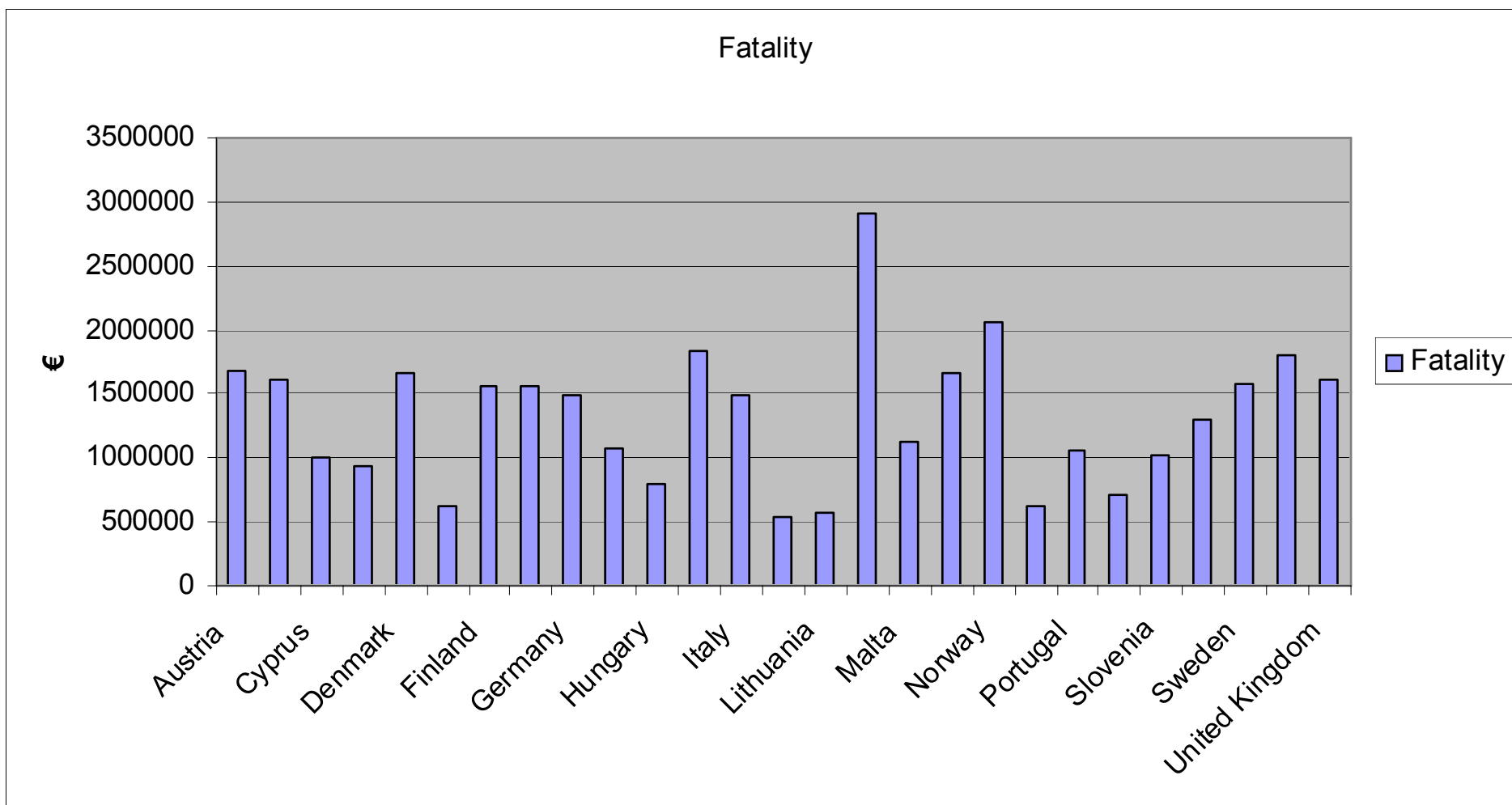
Noise costs



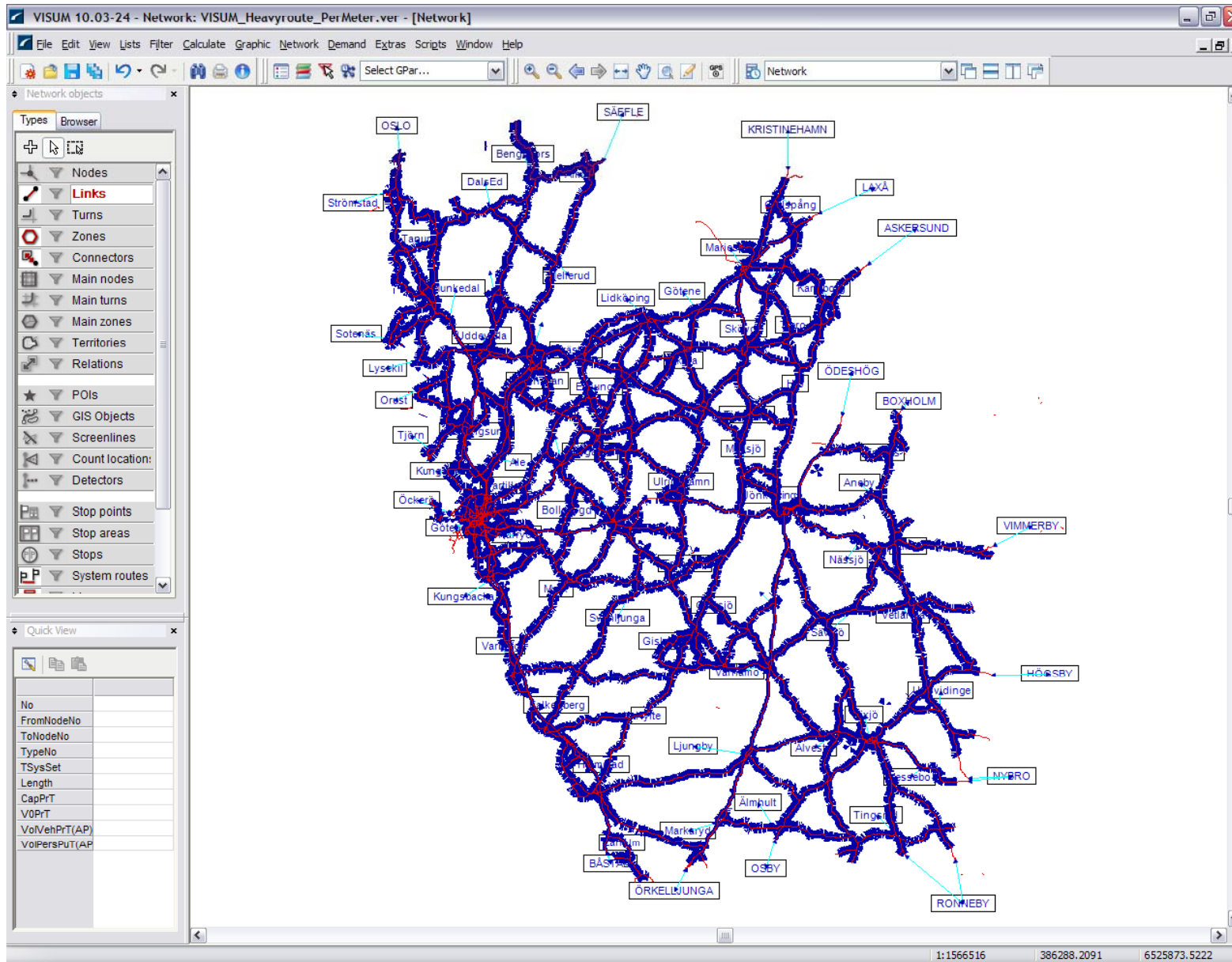
3. Accidents

- » Based on an average accident cost per HGV/km
- » Adjusted for risk dependent on road type
- » Adjusted for accident severity depending on road type and speed

VOSL from UNITE/HEATCO



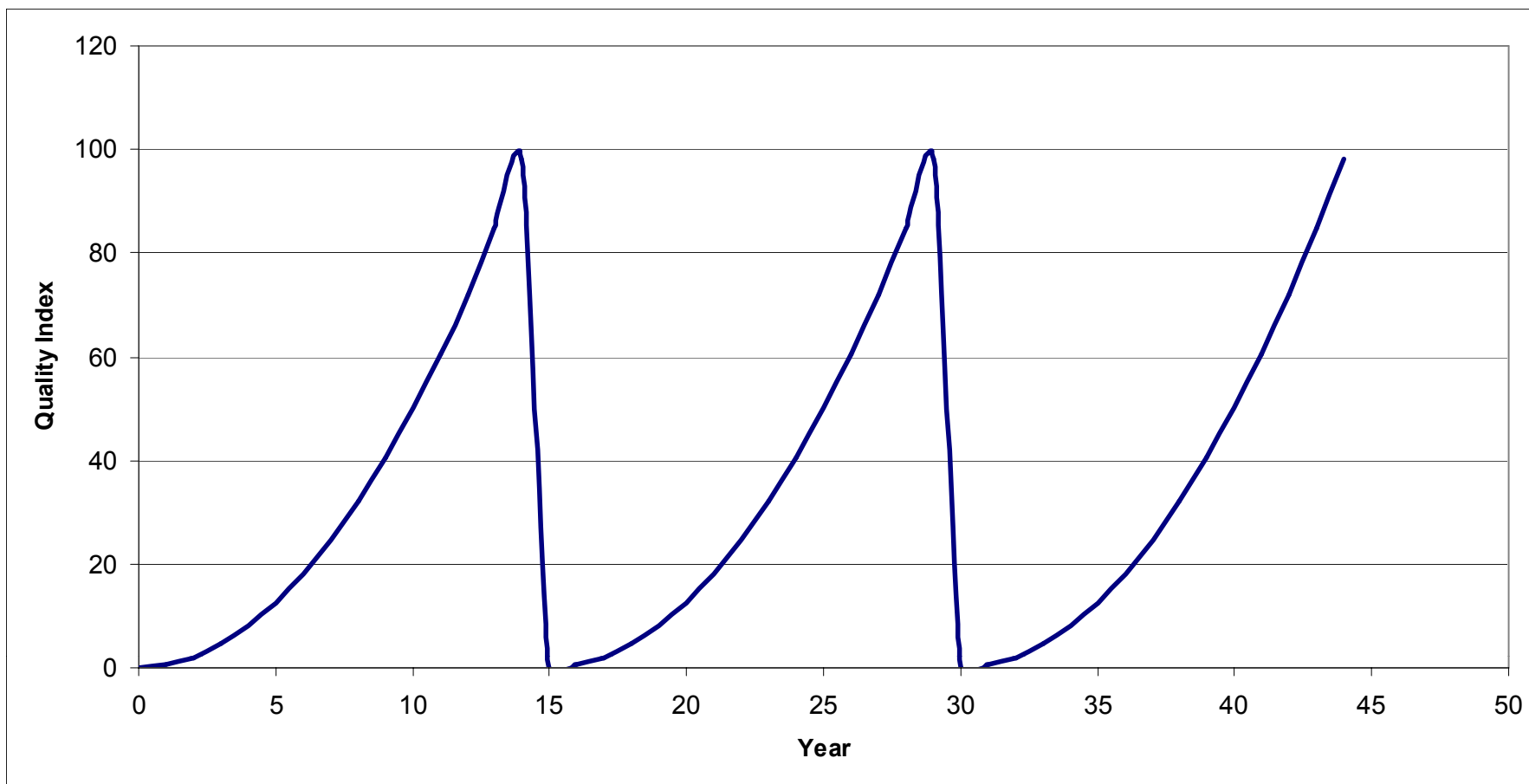
Accident costs

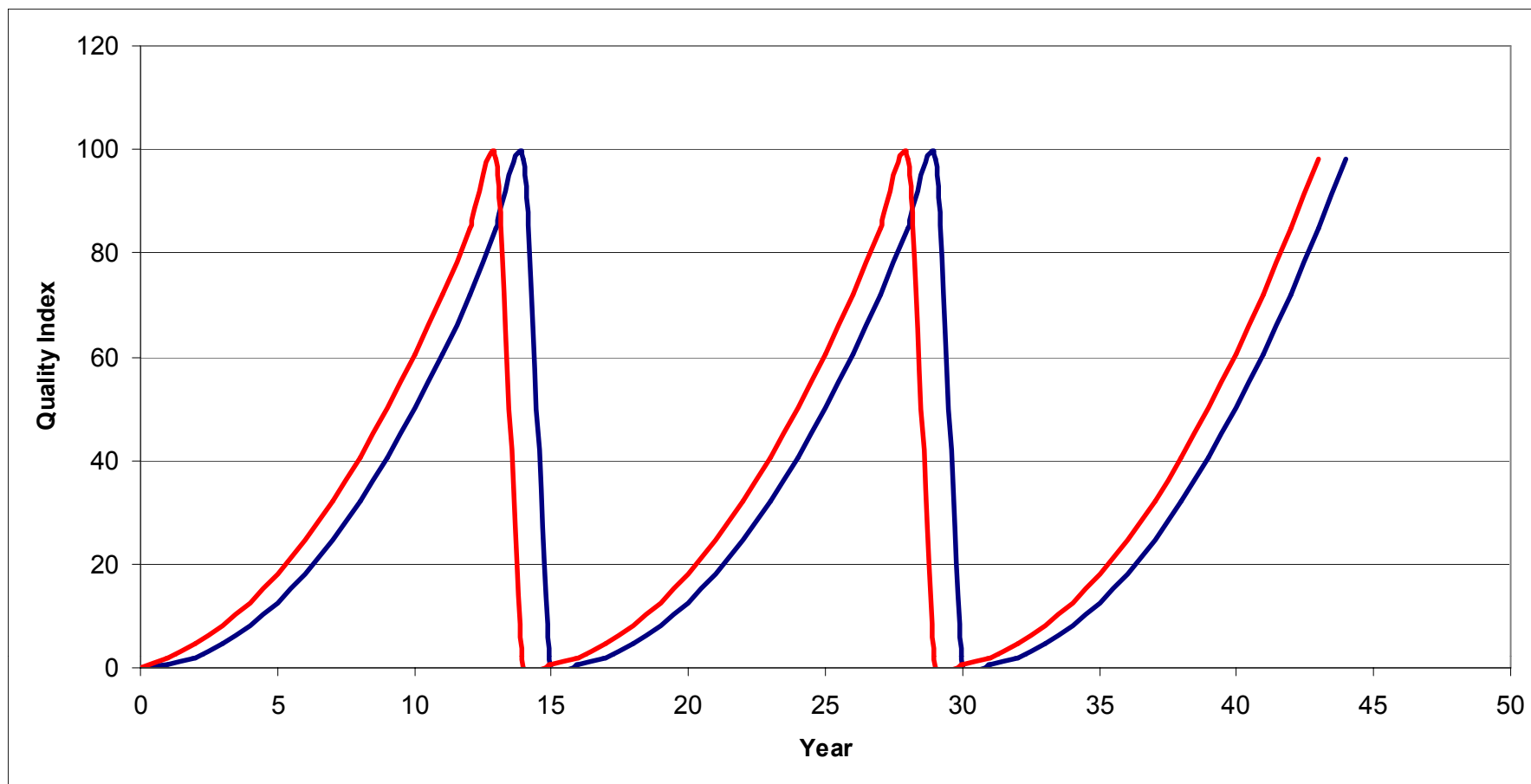


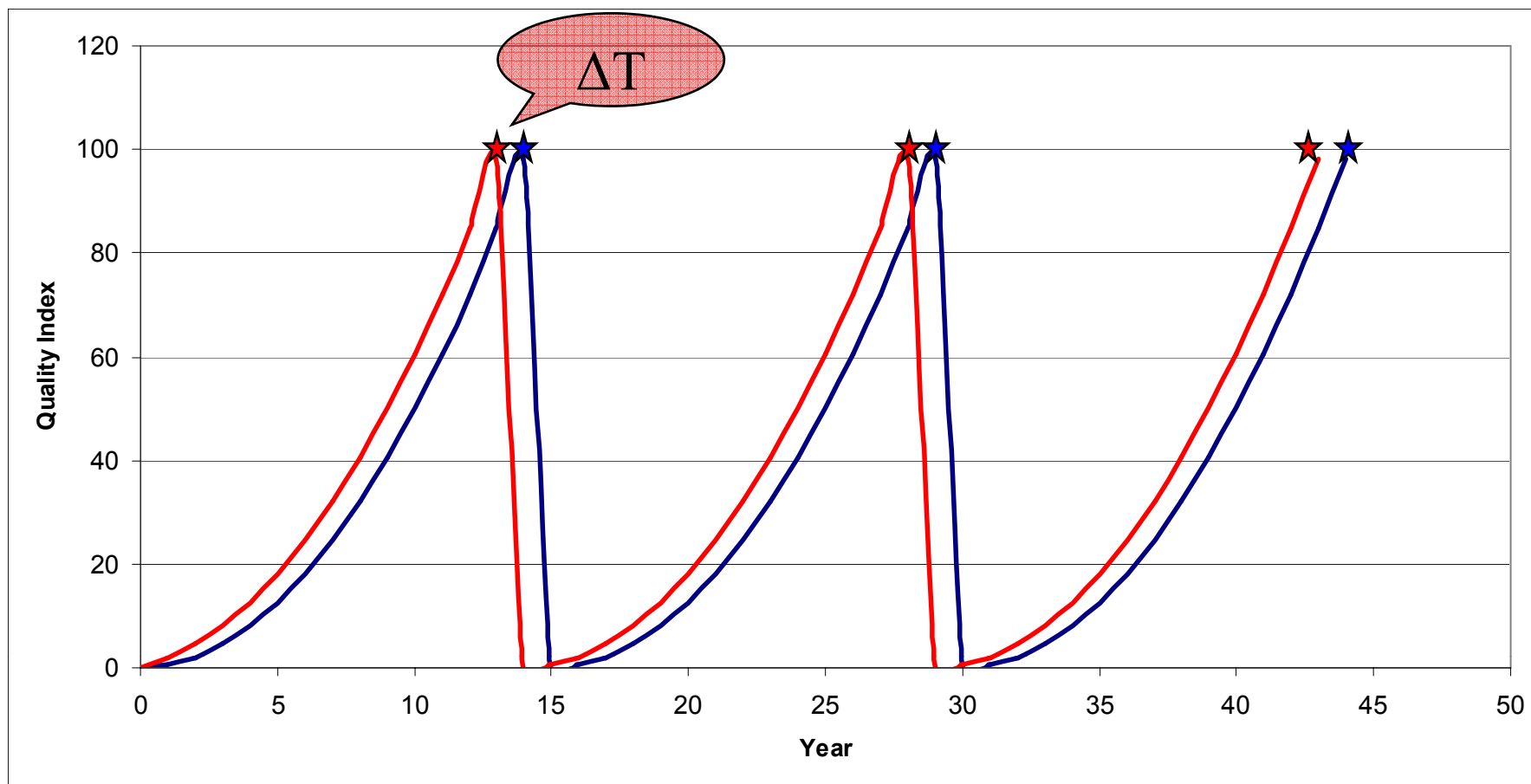
4. Infrastructure cost

- » Econometric method
- » Engineering

- » Lifetime approach
- » Changes in the present value of renewal costs as the traffic changes







Deterioration elasticity

» Marginal cost = Average cost (over the lifetime) of renewal * elasticity

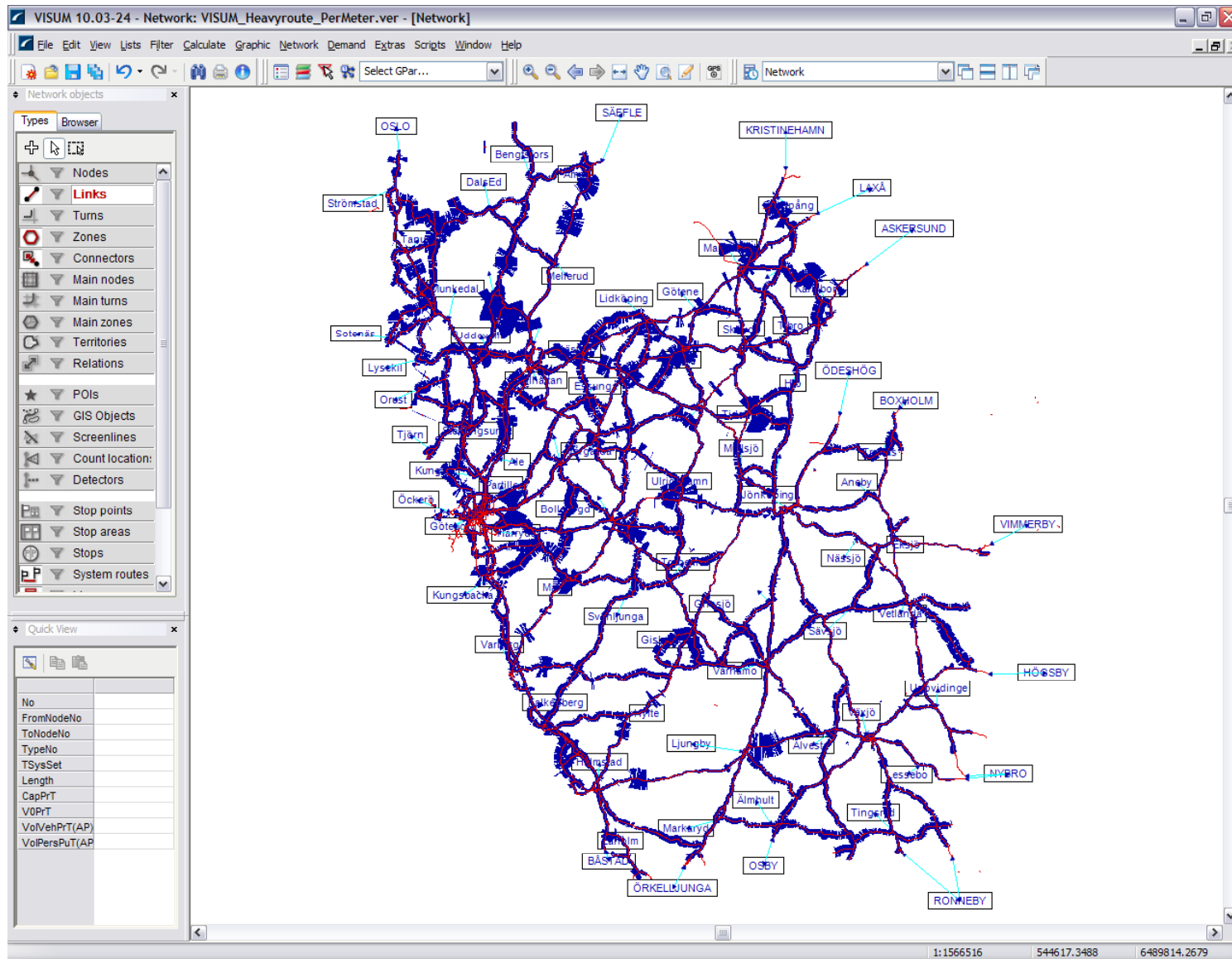
$$\varepsilon = \frac{dT}{dQ} \frac{Q}{T}$$

Standard axles per day and direction (Q/365)	SCI						
	50	75	100	125	150	175	200
200	-	-	-	-	-	-	-0,21
300	-	-	-	-	-0,30	-0,40	-0,47
400	-	-	-0,21	-0,37	-0,47	-0,55	-0,60
500	-	-	-0,37	-0,49	-0,58	-0,64	-0,68
600	-	-0,30	-0,47	-0,58	-0,65	-0,70	-0,74
700	-0,10	-0,40	-0,55	-0,64	-0,70	-0,74	-0,77
800	-0,21	-0,47	-0,60	-0,68	-0,74	-0,77	-0,80
900	-0,30	-0,53	-0,65	-0,72	-0,77	-0,80	-0,82

Differentiation by vehicle type

- » “Forth power rule”
 - » Same for all roads
- » CATRIN project > 1.7 – 10
 - » Differentiated
- » EURODEX – joint European programme

Infrastructure cost

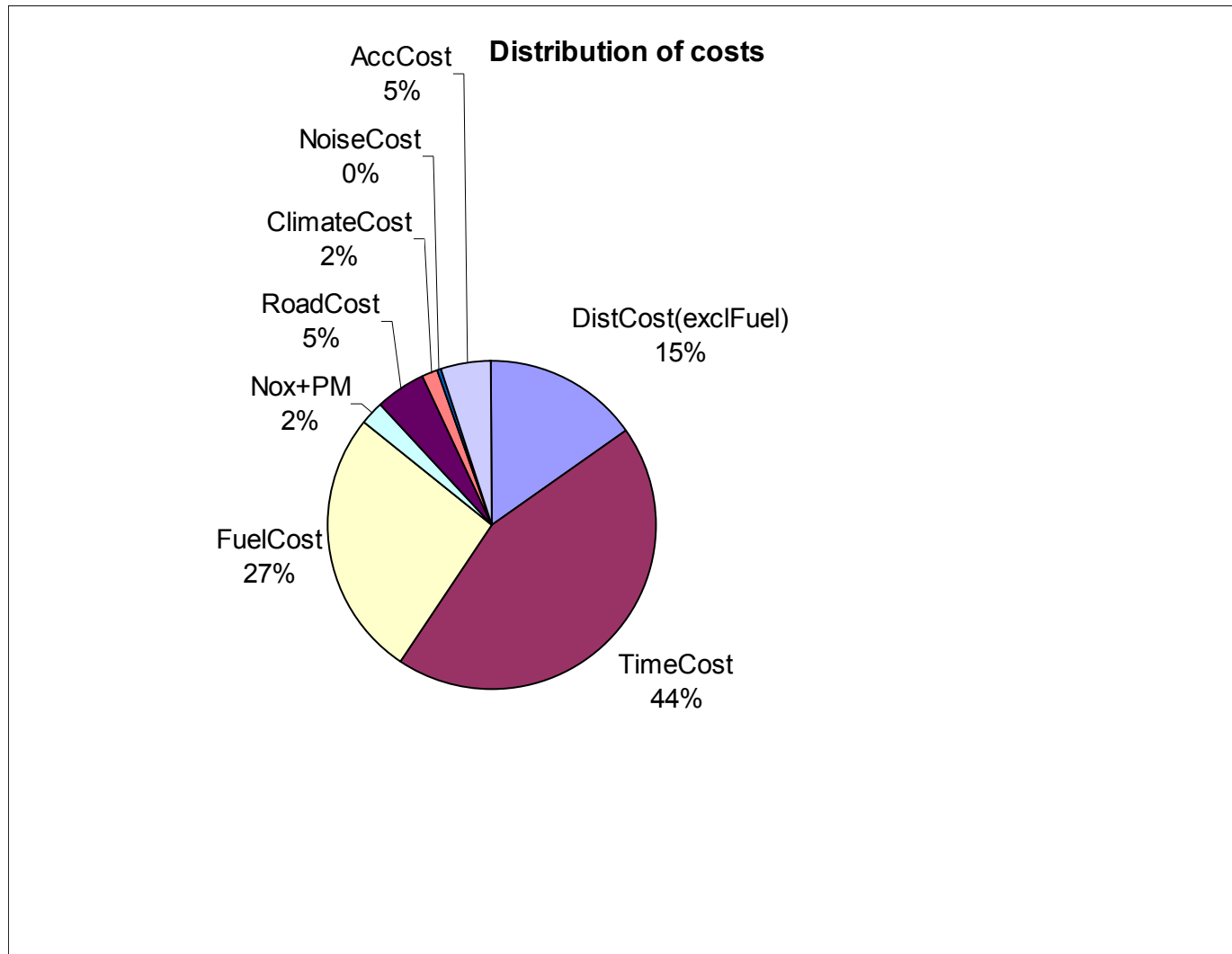


5. Operators cost

	Standard			Heavy Route
	Value of Time €/h	Value of Distance €/km		Value of Distance excl fuel cost. €/km
Lorry light LGV, ≤ 3,5 ton	25.1	0.137		0.045
Lorry medium 3,5-16 ton	27.6	0.236		0.078
Lorry medium 16-24 ton	29.1	0.298		0.098
Lorry HGV 25-60 ton	36.9	0.577		0.190

Summary

Distribution of costs



Conclusion

- » Advanced effect models exist
 - » (ARTEMIS HARMONOISE etc)
- » European wide valuation exist
- » Join economic research and engineering research > plausible cost function

- » Quality of input data?
- » EURODEX proposal