

Testing the Sensitivity of Benefits of Highways Schemes

19th October 2007

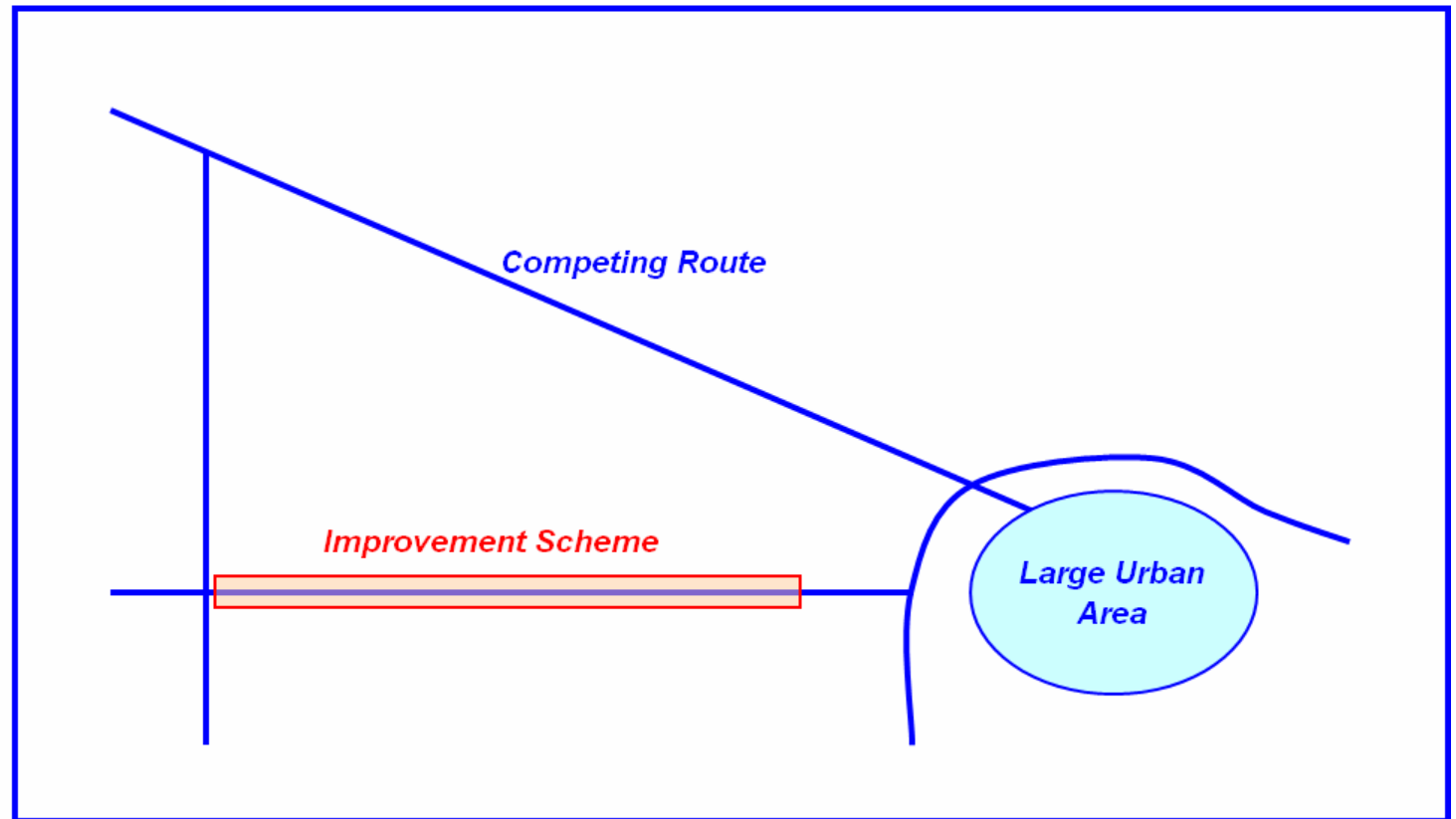
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Sensitivity Issues

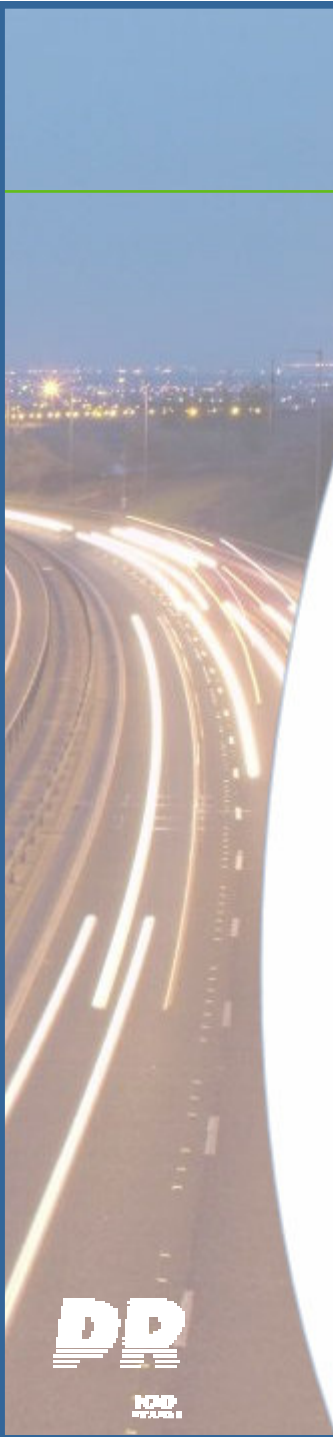
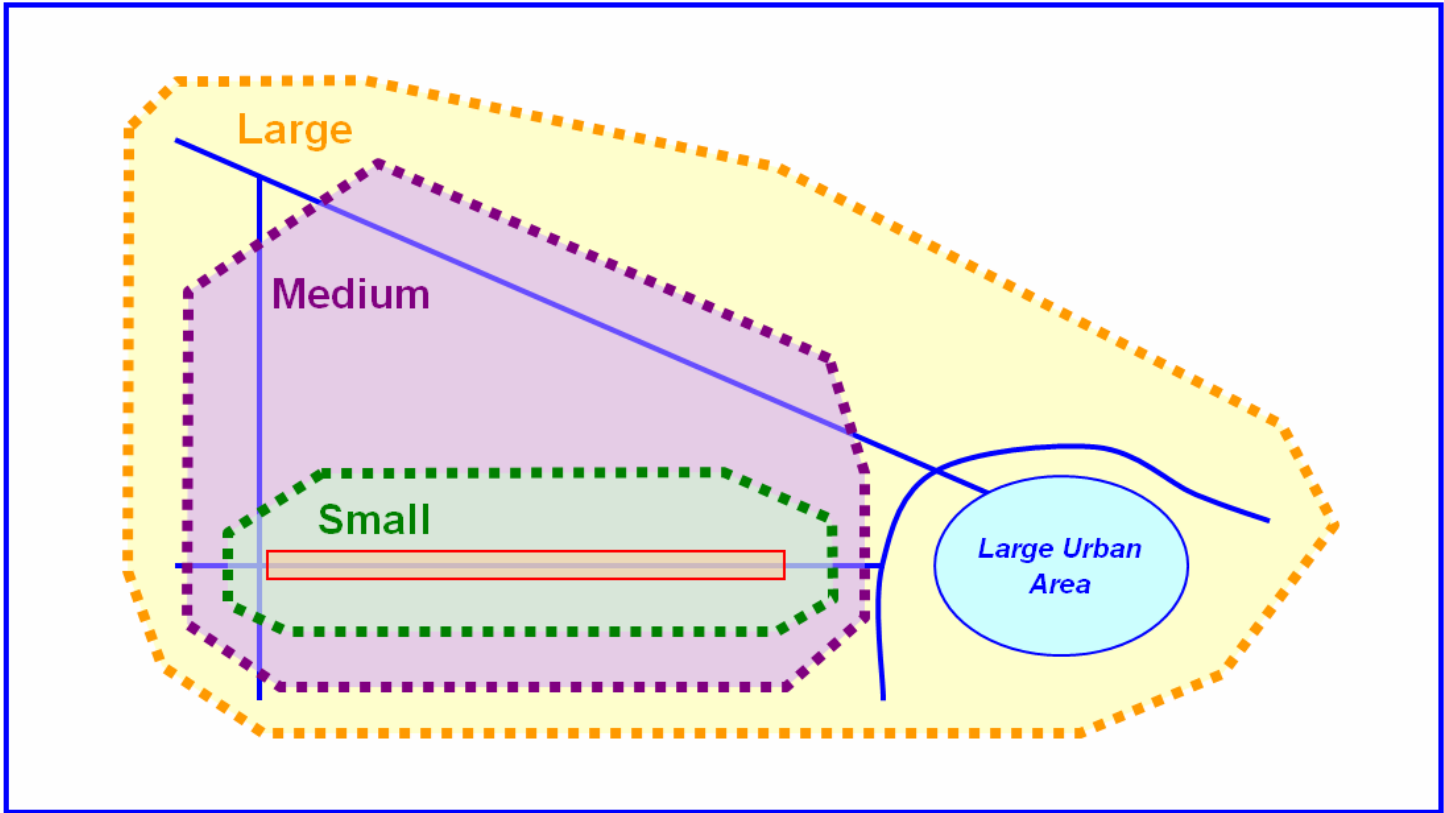
- Study Area
- Route Choice Parameters
- Elasticities
- Version of SATURN?

Case Study



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Study Area



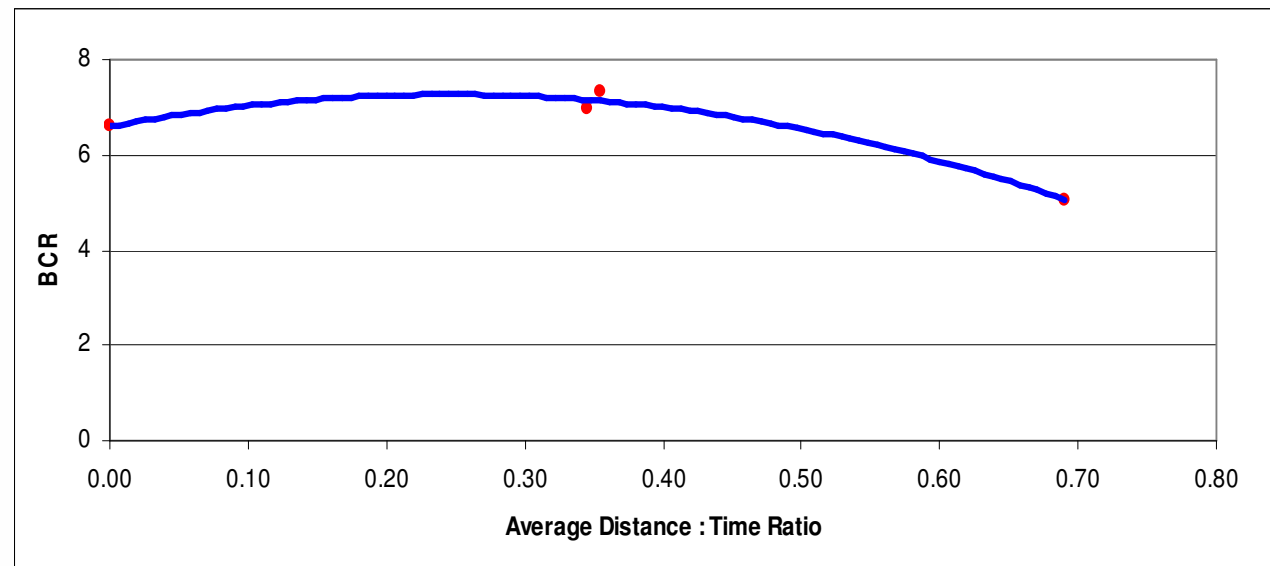
Study Area

	Small	Medium	Large
Includes	<i>Scheme Only</i>	<i>Competing Route</i>	<i>Urban Area</i>
Total Benefits	£210,336	£236,786	£179,187
BCR	8.3	9.3	7.0

- BCRs range from 7.0 to 9.3
- Benefits on Competing Route
- Disbenefits in Urban Area

Route Choice Parameters

	Pure Time	COBA	GIT	Scheme Specific
Dist : Time Ratio	0	0.34	0.39	0.69
Total Benefits	£172,240	£179,140	£188,220	£130,288
BCR	6.6	7.0	7.3	5.1



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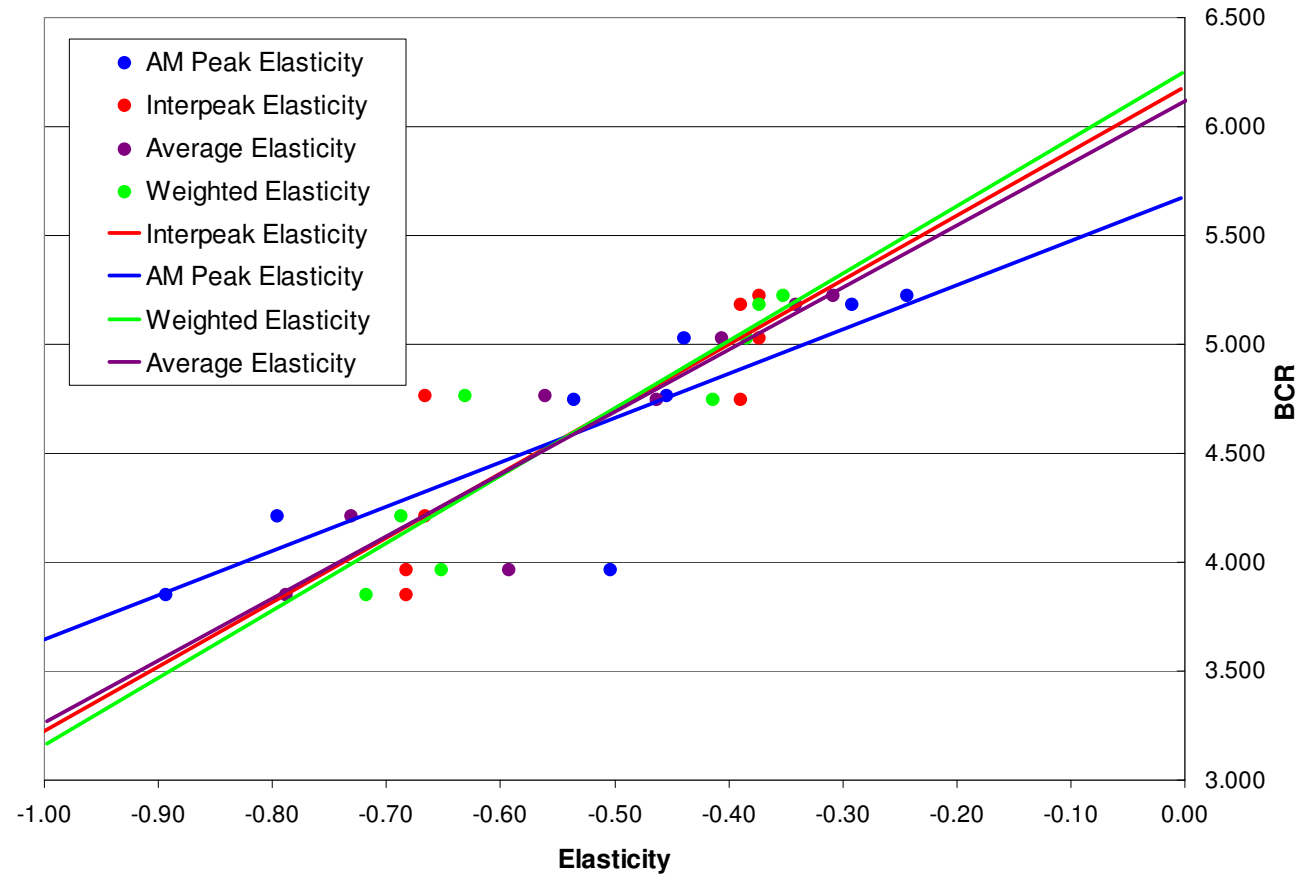
Route Choice Parameters

- BCRs vary from 5.1 to 7.3
- Pure time can lead to long routes
- As assignment becomes strongly distance dependent, drivers less influenced by congestion
- In this case, graph shows peak at 'optimum' BCR

Variable Demand Modelling

- Elasticities calculated using DMRB guidance
- Values depend on whether:
 - Area of high or low modal competition
 - Users are likely to switch time periods outside modelled hour

Variable Demand Modelling



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Variable Demand Modelling

- BCR increases as elasticity $\rightarrow 0$ (inelastic)
- Higher elasticity \rightarrow more induced traffic in Do Something which erodes benefits
- Elasticities need careful consideration
 - E.g. Using high modal instead of low modal elasticities changes BCR from 5.2 to 4.0

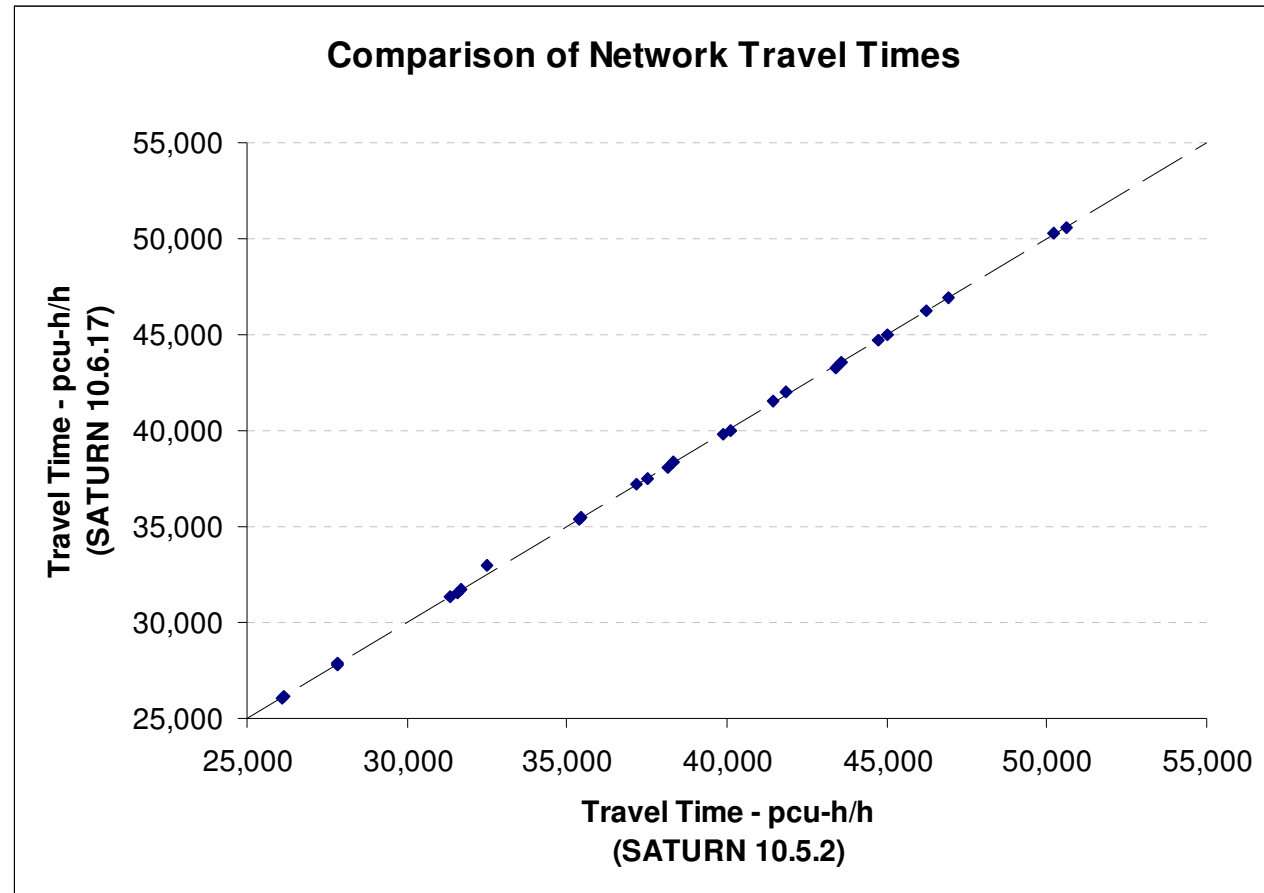
Version of SATURN

- Effect of changes in version of SATURN
- Test is 10.5.2 vs 10.6.17
- Changes?
 - Roundabout capacities
 - Double-phasing at ped. Signals
 - Unspecified changes to prevent crashes
 - Upper limits of NITA and NITA_S

Test Network

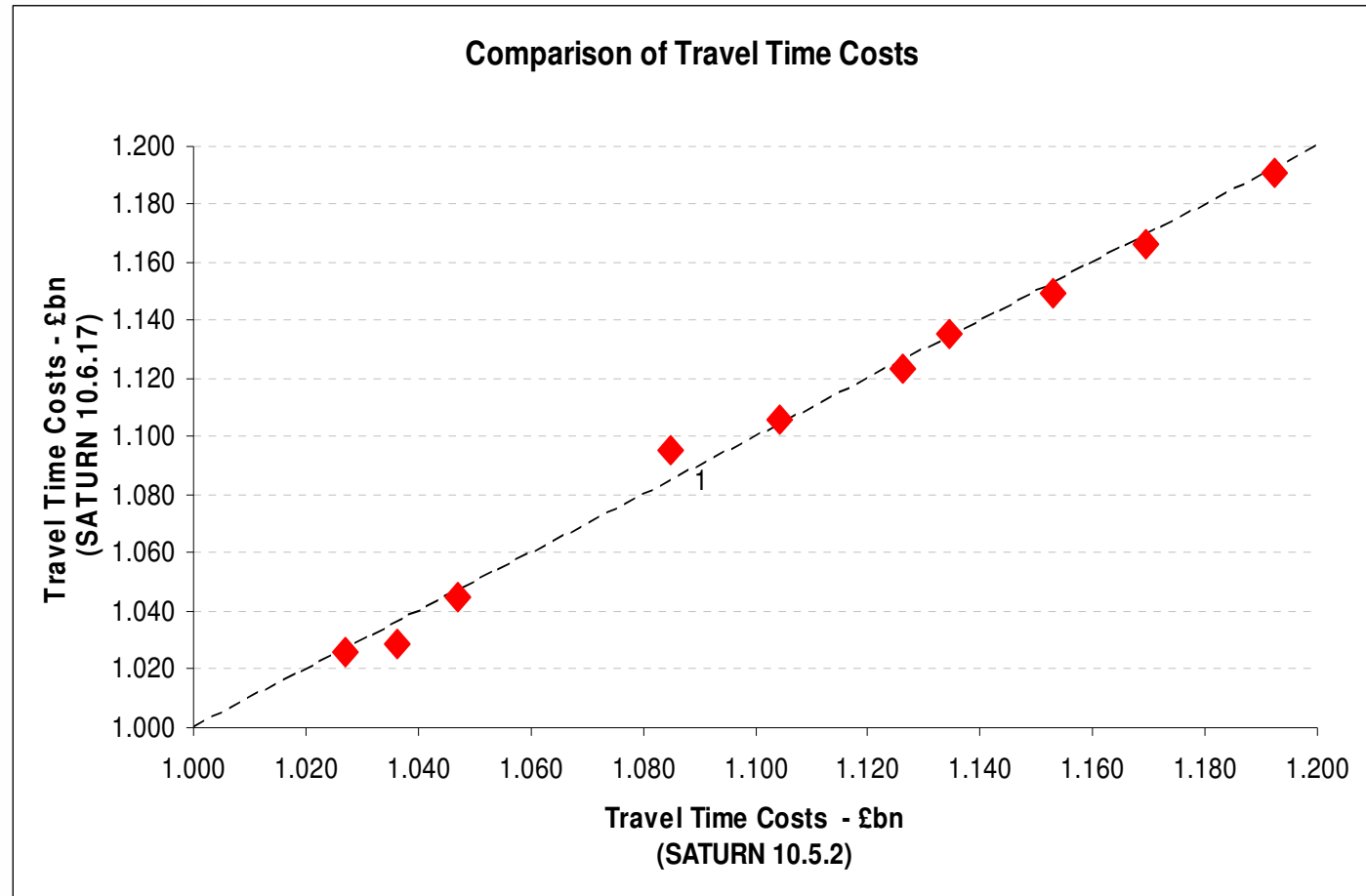
- Large inter-urban traffic model
- 2000+ links
- 750+ simulated junctions
- 122 zones
- 130,000 – 185,000 trips in peak hour
- Motorway widening scheme

Network Assignment Statistics



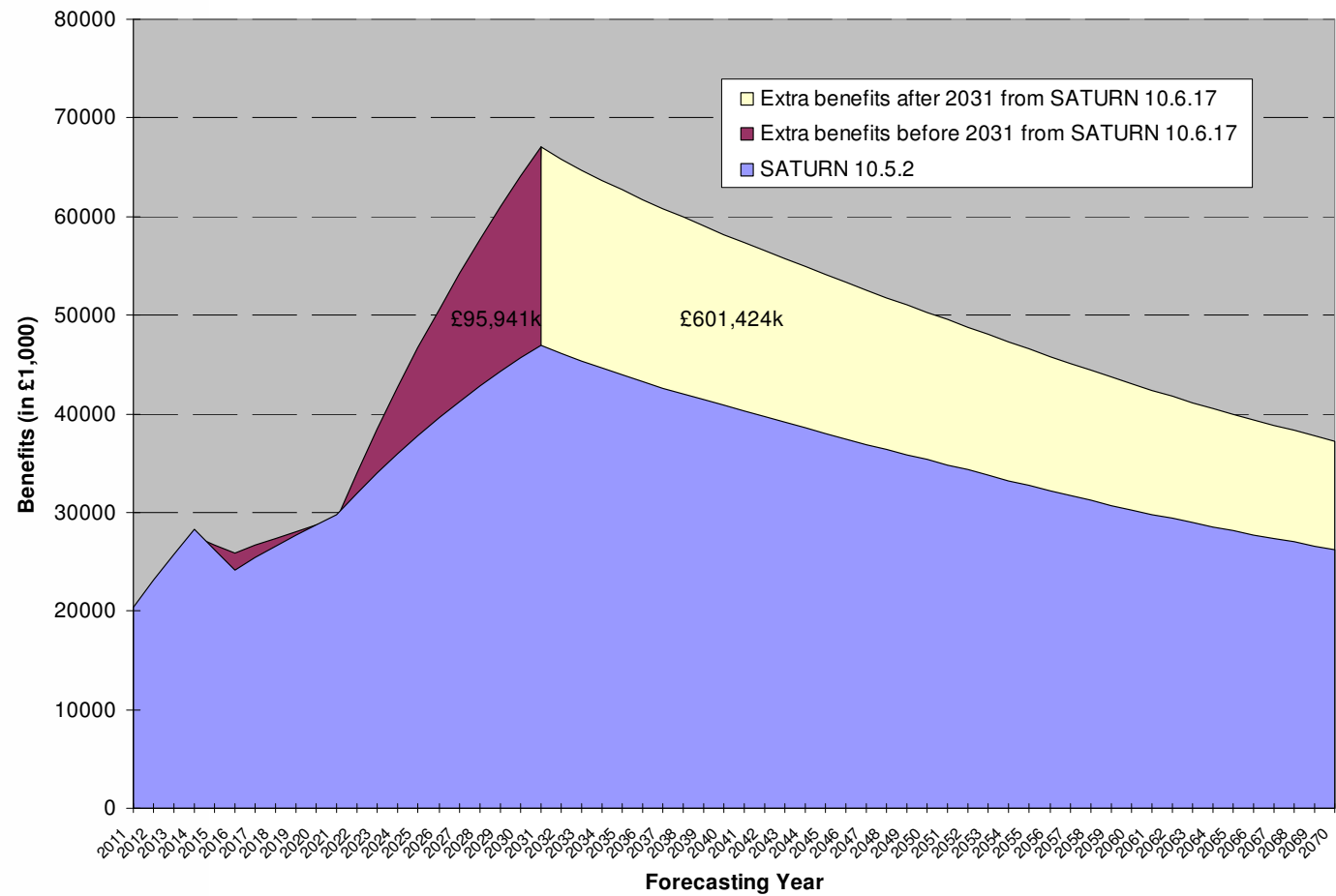
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Total Travel Time Costs



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Scheme Benefits



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Conclusions

- Benefits can be very sensitive to assumptions made in traffic modelling procedures
- Key risk issues should be carefully considered
- Sensitivity tests should be performed

Discussion

- Any suggestions / experiences?

Comments by Ian Wright, Business Manager (SATURN), Atkins Transport Planning:

Following the presentation, there was a discussion about the differences arising from the use of two different versions of SATURN. The presentation highlighted the sensitivity of the TUBA benefits to the SATURN inputs and raised the question as to the likely source of the differences. From the information provided, the most likely cause of the reported variation is the noise inherent within each of the assignments and this component would be greater than the differences arising from the version of SATURN used. We would agree that there will be small differences between different versions of SATURN and we advise, as part of the formal release, that users should assess the differences between them before upgrading to the latest version.

Looking at this issue in more detail, whilst all the assignments were reported to exceed DMRB targets, this does not preclude small variations within the assignment occurring due to imperfect convergence. The %GAP and %FLOW measures provide one set of indications of the “noise” whilst a second comparison may be established by running the assignment for one further SATASS-SATSIM loop (MASL 1 on the SATALL command line) and assessing the variations between the two converged solutions. The approach would be a useful measure of the noise within the assignment and would be particularly important where the differences (eg in total travel time) between the two schemes are comparatively small when compared to overall, network-wide estimates. The presentation highlights the potential impact of convergence on scheme benefits.

It also worth noting that, for scheme testing, the existing DMRB targets state that the *Stability*, as measured by %FLOWS, should be greater than 90% for four consecutive iterations and the *Proximity*, as measured by %GAP for SATURN, should be less than 1%. In our view, these targets are too low and may result in an assignment that it is insufficiently converged for robust scheme evaluation. We would recommend that the convergence in SATURN should comfortably exceed the (current) DMRB targets wherever possible. We would recommend that %FLOWS > 98% (or higher if achievable) for at least four consecutive loops (ISTOP=98% or 99%, NISTOP=4) and %GAP values <0.25% (or lower if achievable). We understand that the existing DMRB targets will be raised in the forthcoming advice from the DfT and we welcome the setting of higher targets.

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Data

Indicator (per hour)	2031 DM/ SATURN 10.5.2			2031 DM/ SATURN 10.6.17			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Total Travel Time (pcu hrs)	43,569.4	32,505.9	50,628.4	43,554.0	32,984.0	50,615.1	-0.04%	1.47%	-0.03%
Total Delay (pcu hrs)	15,150.6	8,845.2	21,061.2	15,124.7	9,301.3	21,043.7	-0.17%	5.16%	-0.08%
Total Travel Distance (pcu km)	2,323,062.3	2,008,798.9	2,434,633.8	2,324,094.0	2,009,307.4	2,434,972.8	0.04%	0.03%	0.01%
Average Speed (km/h)	53.3	61.8	48.1	53.4	60.9	48.1	0.08%	-1.42%	0.04%
Average Distance (km)	13.6	16.1	13.3	13.6	16.1	13.3	0.04%	0.03%	0.01%

Indicator (per hour)	2031 DS/ SATURN 10.5.2			2031 DS/ SATURN 10.6.17			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Total Travel Time (pcu hrs)	43,423.6	31,703.3	50,228.6	43,298.6	31,692.2	50,289.3	-0.29%	-0.04%	0.12%
Total Delay (pcu hrs)	15,022.7	7,775.0	19,948.2	14,876.6	7,760.9	20,082.3	-0.97%	-0.18%	0.67%
Total Travel Distance (pcu km)	2,326,752.0	2,046,426.9	2,506,570.3	2,332,213.5	2,044,716.8	2,501,030.8	0.23%	-0.08%	-0.22%
Average Speed (km/h)	53.6	64.5	49.9	53.9	64.5	49.7	0.52%	-0.05%	-0.34%
Average Distance (km)	13.6	16.5	13.7	13.6	16.4	13.7	0.23%	-0.08%	-0.22%

Indicator (per hour)	2031 (DS - DM) / SATURN 10.5.2			2031 (DS - DM) / SATURN 10.6.17			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Total Travel Time (pcu hrs)	-145.8	-802.6	-399.8	-255.4	-1,291.8	-325.8	75.17%	60.95%	-18.51%
Total Delay (pcu hrs)	-127.9	-1,070.2	-1,113.0	-248.1	-1,540.4	-961.4	93.98%	43.94%	-13.62%
Total Travel Distance (pcu km)	3,689.7	37,628.0	71,936.5	8,119.5	35,409.4	66,058.0	120.06%	-5.90%	-8.17%
Average Speed (km/h)	0.3	2.8	1.8	0.5	3.6	1.6	90.26%	30.86%	-10.45%
Average Distance (km)	0.0	0.4	0.4	0.0	0.3	0.4	112.28%	-4.92%	-8.31%
Corresponding TUBA Benefit (in £1,000)	2,058,039			2,756,139			33.92%		

Variable Demand Modelling

Elasticities:

<i>High Modal Competition</i>			
		AM Peak Period	Interpeak Period
1	Short-term	-0.45	-0.67
2	Long-term	-0.50	-0.68
3	Short-term including time-switching	-0.80	-0.67
4	Long-term including time-switching	-0.89	-0.68
<i>Low Modal Competition</i>			
		AM Peak Period	Interpeak Period
5	Short-term	-0.24	-0.37
6	Long-term	-0.29	-0.39
7	Short-term including time-switching	-0.44	-0.37
8	Long-term including time-switching	-0.54	-0.39

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