

Testing the Sensitivity of Benefits of Highways Schemes

30th October 2007

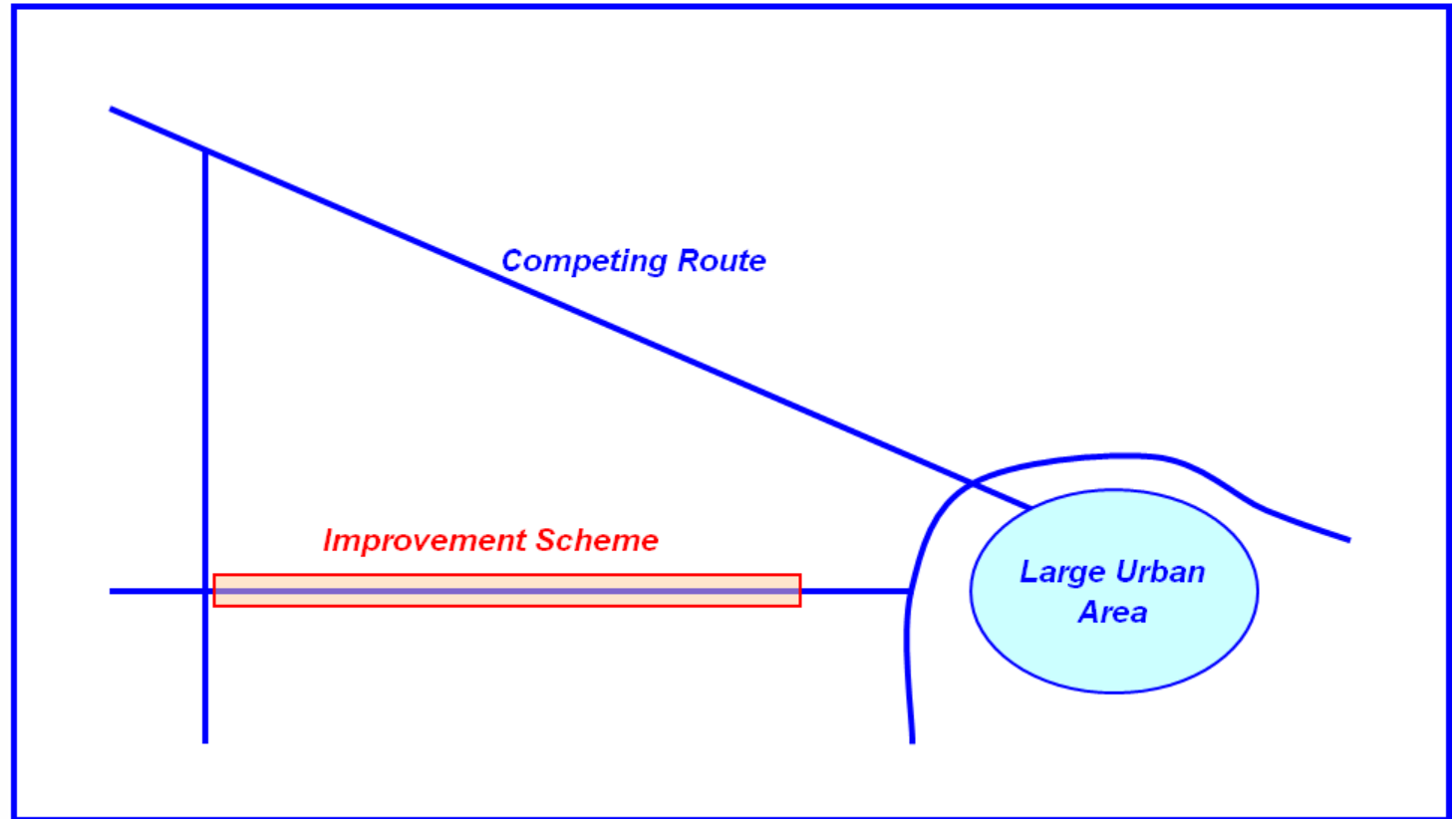
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Sensitivity Issues

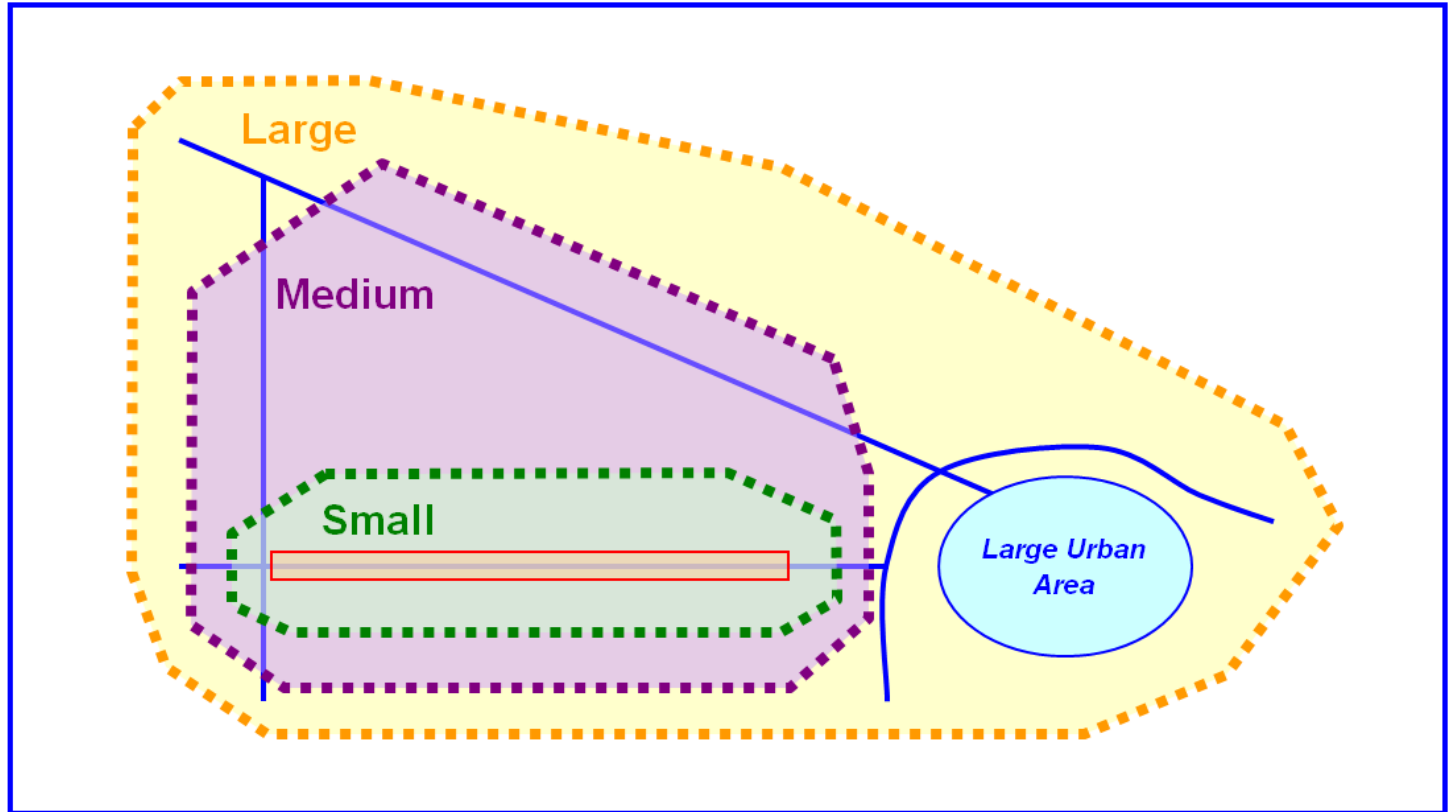
- Study Area
- Route Choice Parameters
- Elasticities
- Convergence

Case Study



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Study Area



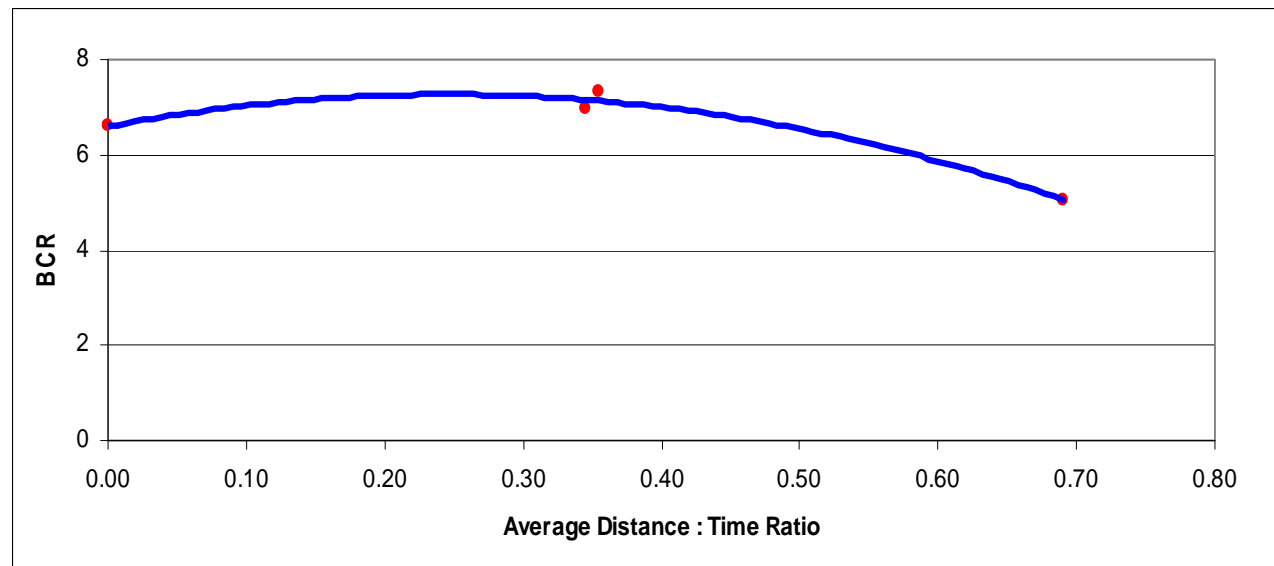
Study Area

| | 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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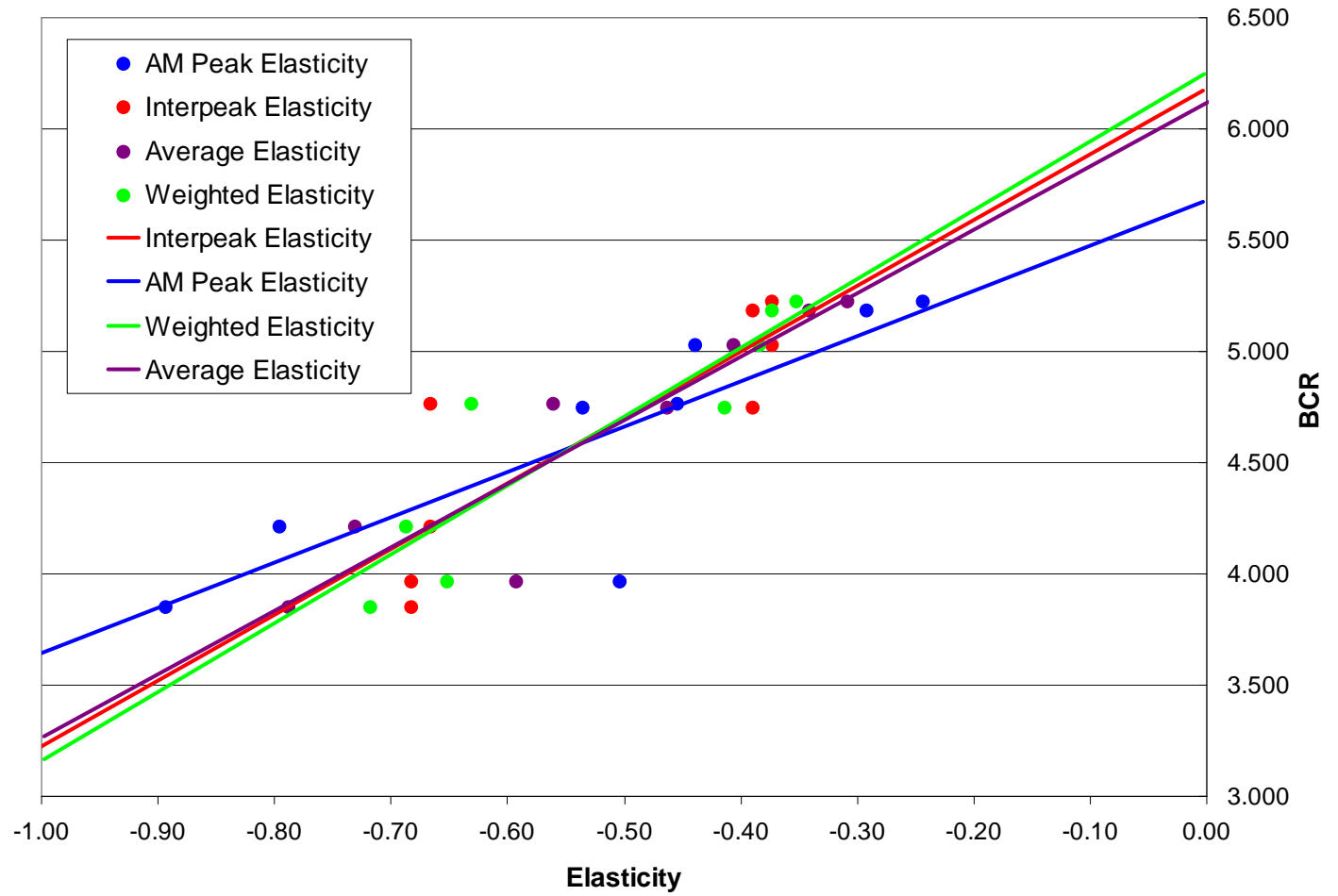
Route Choice Parameters

- Benefits range from £130m - £190m (BCRs → 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

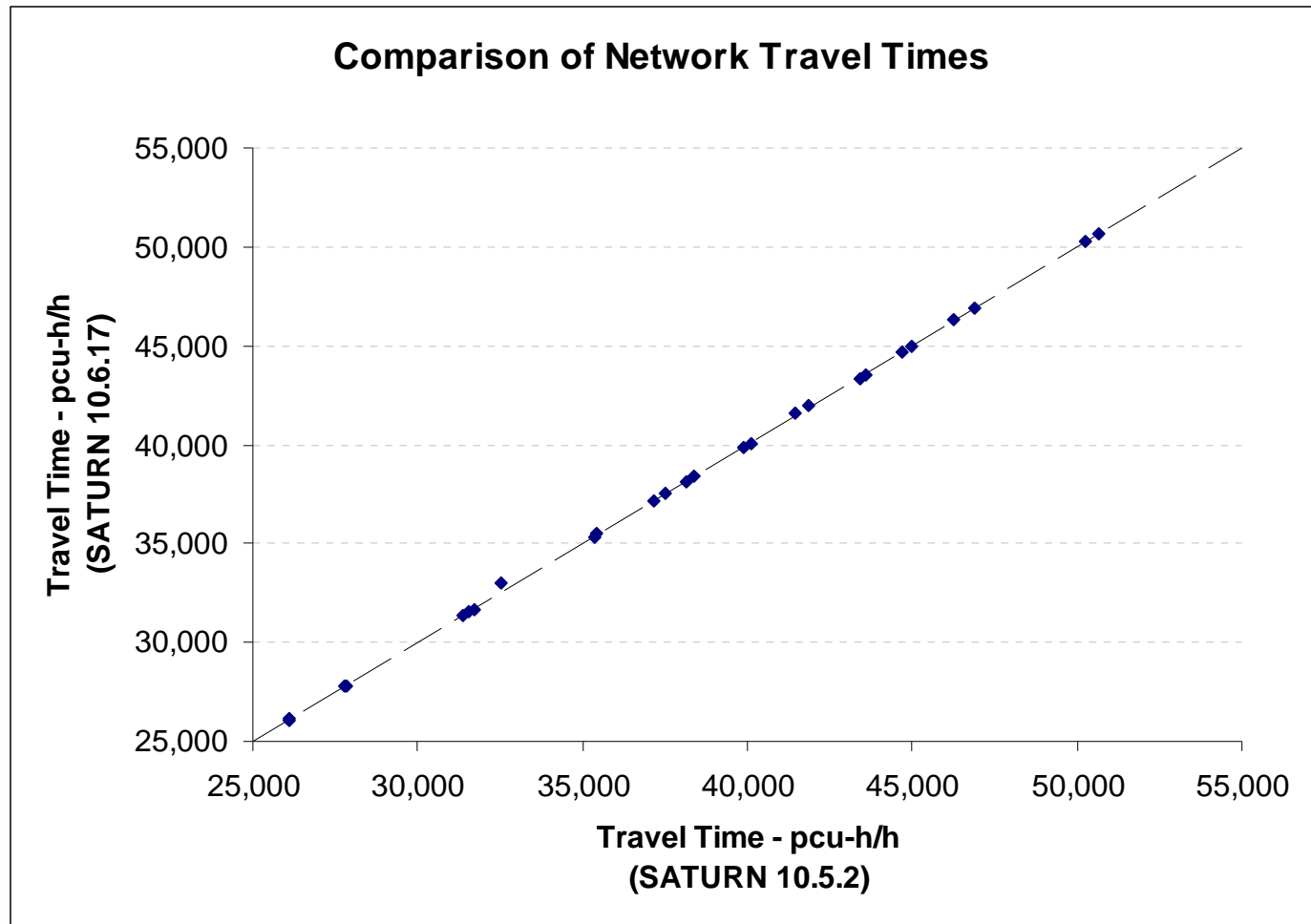
Convergence

- Effect of differing levels of convergence from model runs in different versions of SATURN
- Test is 10.5.2 vs 10.6.17
- Minor changes to assignment / simulation calculations

Test Network

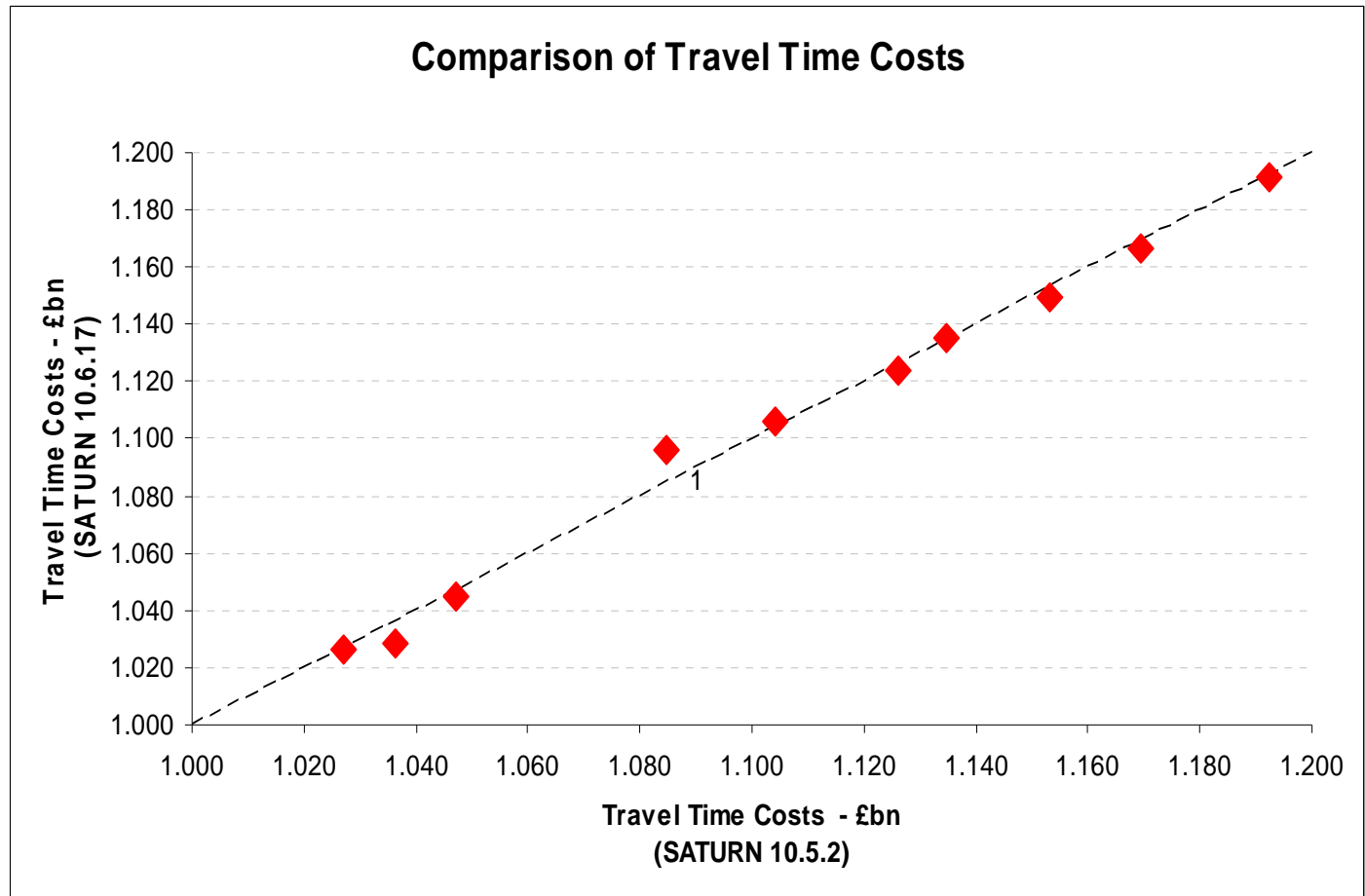
- Large inter-urban traffic model
- 2000+ links
- 750+ simulated junctions
- 122 zones
- 130,000 – 185,000 trips in peak hour
- Motorway widening scheme
- Convergence to DMRB standards
(4 iterations > 90%, %Gap < 1%)

Network Assignment Statistics

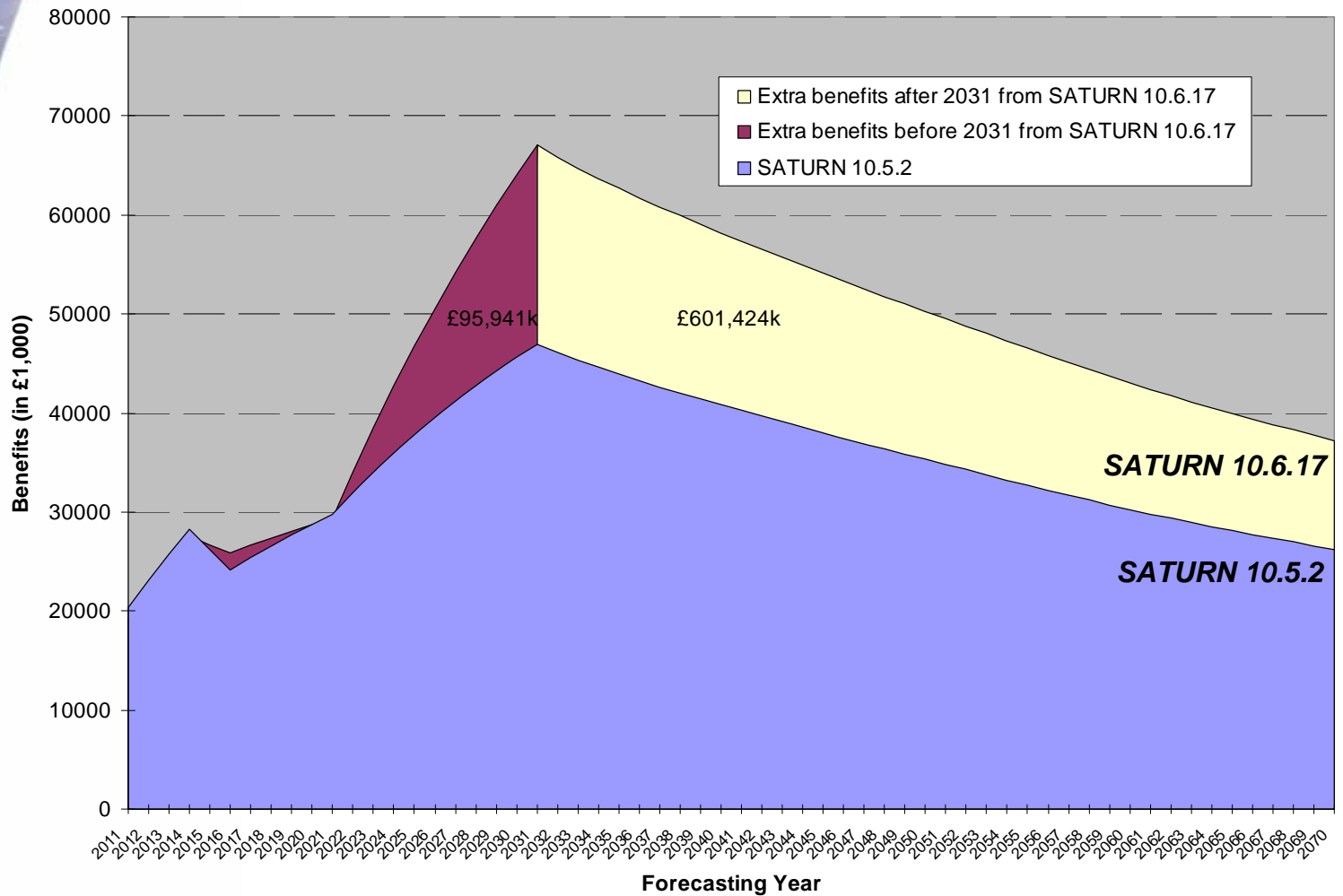


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Total Travel Time Costs



Scheme Benefits



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| 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% | | |

Conclusions

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