Transport Innovation Fund (TIF) Status Report

Report by the Director of Planning and Transportation

Summary

Work on the TIF feasibility study has reached a key stage. Analysis to date suggests it would be possible to define a scheme with a positive economic appraisal. However, operating surpluses would be modest. Although stakeholder engagement with the study has been constructive, the idea of charging has received little positive support. The analysis also suggests implementation of the NDR and an associated package of complementary measures would be more effective in tackling congestion (it also avoids the potential risk to the local economy which charging carries). Continuing the study would require a further funding bid to DfT and additional match funding of around £200k from the County Council. It is therefore proposed to bring the study to a close, although the complementary measures will continue to be investigated and other opportunities for funding transport (such as the proposed Community Infrastructure Levy) explored.

1. Background

1.1. Norfolk County Council has a strong track record of delivering transport improvements. Our 2nd Local Transport Plan (LTP) was assessed as "excellent" by Government, as was our delivery of the Council's 1st LTP. The Government in particular highlighted our record of delivering public transport improvements in the Norwich area, commenting that we had delivered a "step-change" in public transport alternatives. This achievement resulted in extra funding of over £10 million for the current LTP period.

1.2. Bus use continues to grow strongly in the Norwich area, bucking the national trend. Public satisfaction with buses is also increasing and late last year we signed a ground-breaking Joint Investment Plan with First and Norwich City Council to deliver over £30m of investment in Norwich area bus services over the next 3 years. These improvements in public transport will help to further constrain the amount of traffic entering the city centre.

1.3. Despite this success, traffic has continued to grow across the wider conurbation. Congestion is expected to worsen in future, not least because of significant growth in houses and jobs which must be accommodated. The key to tackling congestion, and removing through traffic from the city centre, will be continued successful implementation of the Norwich Area Transportation Strategy, including the Northern Distributor Road, enhanced bus infrastructure, walking and cycling networks.

1.4. In order to fully fund the NATS strategy, keep pace with the demand for travel and support the continued prosperity of the Norwich area, it is important that we investigated any new funding opportunities that may arise. These potential opportunities include the examination of a local road pricing scheme and the potentially significant funding on offer from Government.

1.5. To this end Norfolk County Council was successful in obtaining a TIF pump-priming grant from Government to investigate whether road pricing is an appropriate demand management measure for the Norwich area to tackle congestion and improve the overall transport system by facilitating a step change in transport investment. The Government funding was available for the financial year 2007/08.

1.6. The bid was endorsed by Norfolk County Council Review Panel on 19 July 2006 and Cabinet on 10 July 2006, and by the Norwich City Council Executive Committee. Letters of support were also received from a variety of stakeholders who also felt it was appropriate to investigate this issue.

2. Introduction

2.1. Work on the Transport Innovation Fund (TIF) feasibility study into road pricing for the Norwich area has progressed over the last year. This was funded in 2007/08 by a £250,000 grant award from the DfT and £250,000 from our own revenue budget. Our contribution represents money we would have spent anyway in progressing work on the Norwich Area Transportation Strategy (NATS), the Northern Distributor Road (NDR) and in considering the transport implications of the Joint Core Strategy (JCS) for Greater Norwich.

3. The feasibility study

3.1. The main workstreams within the study looked at the following aspects.

- WP0 Situation Analysis
- WP1 Scenario Planning
- WP2 Data Collection and Modelling
- WP3 Road User Charging Technology Assessment
- WP4 Communications and Engagement
- WP5 Social, Business and Environmental Impacts
- WP6 Governance, Finance, Procurement and Delivery Mechanisms
- WP7 Appraisal and Business Case

3.2. During the study we have engaged with key stakeholders to hear their views and to highlight what is potentially on offer if we were to submit a TIF congestion package bid to government. Road pricing would only be implemented with an up front funded package of transport investment. We would also need to ensure that overall the package makes Norwich a better place to live, work, do business in or visit. We have also undertaken focus group work with the general public to gauge their views on congestion and its solutions.

3.3. Analysis of road pricing scenarios, in conjunction with improved bus frequencies, was carried out using the existing NATS model. In parallel with this, much work has been carried out to update the Norwich traffic and public transport models to enable more sophisticated analysis. These new models will also be used to provide more robust data to feed in to the business case for the Northern Distributor Road (NDR).

3.4. A number of tests are underway using the enhanced model. Further tests will inform all the land use and transport issues currently being considered in the Norwich area (JCS, Growth Point and the NDR) as well as in finalising this investigation into road pricing. The results are not expected to change any of the main conclusions contained in this report.

3.5. Finally, building on NATS, we have considered the sort of additional public transport and other measures that could be implemented as part of the overall TIF package. Details of these complementary measures are described in section 5 below, and in Annex A.

4. Indicative road user charging scheme

4.1. The initial modelling work has considered road user charges that are incurred when a vehicle crosses a cordon in the morning peak period only. For practical reasons the inner and outer ring roads have been used as cordons.

4.2. Economic appraisal of this initial modelling indicates that modest charges of around £2 to £3 on such cordons, would reduce vehicle kilometres and journey times and produce a small operating surplus. Based on this technical work and feedback from stakeholders, in particular the retail sector, and evidence from other TIF studies, it is likely that any charge would only be applied during the morning peak period.

A full report on the modelling work is shown in Annex B.

4.3. **Road User Charging options tested**

The following schemes were also included in the model tests:

- The Norwich Northern Distributor Road (NDR) was assumed to be included as part of the congestion charging scenario – two tests were also performed on congestion charging without the NDR in place;
- A network-wide increase in bus frequency, to varying degrees, was included as part of each congestion charging scenario, to represent significant improvement in public transport alternatives.

Seven options were thus tested as shown in Table 1. The Do Minimum (DM) scenario against which each option is compared is also shown.

Table 1	DM	1	2	3	4	5	6	7
Congestion Charge:								
Inner Ring Road	×	£2	£3	×	£2	£3	£2	×
Outer Ring Road	×	×	×	£2	£1	£2	×	£2
NDR included	×	✓	✓	✓	✓	✓	×	×
Bus Frequency Factor	1.00	1.25	1.50	1.50	2.00	2.00	1.25	1.50

We also have model results for the NDR and complementary measures with no charging for comparative purpose (see Table 5).

4.4. **Summary of Economic Benefits and Costs**

Table 2	1	2	3	4	5	6	7
Time Savings	503	525	217	503	169	-20	-301
Net Revenue	9	-1	24	28	11	12	31
Carbon Benefits	0	0	-3	-1	-4	0	-3
Operating Costs	215	276	458	698	698	215	458
Capital Costs	132	132	142	151	151	9	20
Other Costs	28	37	39	51	63	25	42
Net Benefits	**138**	**79**	**-401**	**-370**	**-736**	**-258**	**-793**

All values are £m at 2002 prices, discounted over a 60-year appraisal period

Only the options with the Inner Cordon and NDR (Options 1 and 2) provide a positive net benefit, and as such are the only schemes which are likely to be of interest to the DfT. Typically for transport projects Benefit to Cost Ratios (BCR) are used as a measure of economic performance and anything above 2.0 would normally be classed as good value for money. However, DfT do not recommend using the BCR for comparing road user charging options. This is because the BCR formula breaks down where high levels of public sector revenues outweigh public sector costs.

The main factors contributing to the positive benefits of Options 1 and 2 are the

small cordon size with relatively low operating costs and the high level of time savings.

The carbon benefits shown in Table 2 provide an indication of the effectiveness of each option in reducing carbon emissions. Only Option 1 provides a net reduction in carbon emissions, although when rounded this shows as zero in the table. The options that show increases in carbon emissions (the negative figures in the table) reflect the greater level of rerouteing involved in avoiding a cordon charge.

4.5. It is notable that the RUC options without the NDR (6 and 7) actually increase travel time (negative time savings), as motorists take longer routes to avoid paying the charge. This suggests that RUC alone would not deliver a more efficient transport network, although it may reduce traffic within the cordon. (RUC alone would do nothing for the traffic problems in the northern suburbs).The NDR delivers a significant level of time saving benefit to each option, which contributes to improving the benefits of the package as a whole.

4.6. **Financial Appraisal Packages**

Table 3 summarises the revenues and indicative costs relating to the packages

Table 3	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Revenues							
RUC	206	274	449	432	651	208	466
Public Transport	0	2	1	2	5	2	3
Total	206	276	450	434	656	210	469
Operating Costs							
RUC	157	157	339	496	496	157	339
Public Transport	58	119	119	202	202	58	119
Total	215	276	458	698	698	215	458
Operating Surplus	**-9**	**0**	**-8**	**-264**	**-42**	**-5**	**11**
Capital Costs	132	132	142	151	151	9	20
Net Scheme Cost	**141**	**132**	**150**	**415**	**193**	**14**	**9**

All values are £m at 2002 prices, discounted over a 60-year appraisal period

Generally revenues from RUC exceed the operating costs and provide a net revenue stream. The table also shows that the increased bus frequency generates limited additional revenues, suggesting that little modal shift to public transport is encouraged by introducing an RUC scheme. It is possible that the more extensive package of public transport measures currently being tested will show a greater modal shift, but we do not expect this to change our fundamental conclusions. This is because it will still be a relatively small proportion of trips where public transport represents a reasonable public transport alternative to the car.

4.7. Financial Appraisal of RUC Element

Table 4 shows the degree to which the RUC scheme is self-financing in terms of revenues covering the capital and operating costs of charging scheme itself.

Table 4	1	2	3	4	5	6	7
Charge Revenues	206	274	449	432	651	208	466
Operating Costs	157	157	339	496	496	157	339
Capital Costs	9	9	20	29	29	9	20
Net Revenue	40	108	90	-93	126	42	107
Revenue/ Cost	1.24	1.65	1.25	0.82	1.24	1.25	1.30

All values are £m at 2002 prices, discounted over a 60-year appraisal period

Most options generate sufficient revenues to cover the costs of delivering the charging scheme and those with a single £2 charge have a revenue/cost ratio of around 1.25. Generally the differences in net revenue are a function of the size and therefore cost of operating the RUC cordon as well as the level of charge.

A higher charge leads to a lower level of increase in revenue as a result of more drivers avoiding paying the higher charge (and driving more miles). Thus although the higher charges are better in terms of revenue generation, their impacts on congestion relief are less.

4.8. Summary of Economic and Financial Appraisal

A package of measures comprising a road user cordon charge at the Inner Ring Road, plus implementation of the Northern Distributor Road (options 1 and 2) provide the greatest benefits and the only positive economic outcomes (See Table 2). Although these options provide lower revenues, costs are lower and more time saving benefits are delivered.

There is a higher cost burden to local government with the £2 charge and the £3 charge goes further towards fully funding the rest of the package. However, there is little difference in time savings, which may make the £3 charge potentially less acceptable as its chief benefit over the £2 charge is in raising revenue.

With a charging cordon on the Outer Ring Road more revenue is collected but there are less time saving benefits and more charge paid by users, leading to negative benefit overall. Time savings are eroded because avoidance of the charge involves longer re-roueting movements. This shows an inefficient charging scheme which is unlikely to be publicly acceptable and would not attract DfT funding.

Without the NDR, RUC does not generate sufficient benefits, and in particular highlights the disbenefit to transport users of the charge, leading to longer journeys to avoid payment or increased financial cost.

4.9. **Summary of Model Outputs**

Table 5 shows a summary of the key modelling runs in terms of operational impact on the road network.

Table 5	**Change compared to Do Minimum**		
	NDR	*RUC(option 1 - IRR)*	*NDR,RUC(option 1)*
Total Travel Time	-16%	-19%	-20%
Total Travel Distance	-13%	-15%	-16%
Total Average Speed	3%	5%	5%

Summary modelling data for the NDR alone, a £2 charge on the inner ring road alone (Option 1) and the two combined has been analysed. This is in terms of changes in total travel time, distance and speed within (but not including) the IRR.

Although total travel time is reduced in all cases, the impact on congestion relief from charging appears limited given that average speeds have not changed significantly. It may be the case that insufficient numbers of vehicles have been removed by charging from the city centre to enable speeds to fall significantly.

The results indicate that implementing RUC in isolation reduces overall travel time by 19% and distance by 15%; the NDR in isolation delivers almost the same level of change. The combined scheme provides little additional improvement over either of the schemes in isolation, suggesting that both the NDR and RUC schemes are impacting on the same trips within the city centre.

4.10. **Modelling conclusions**

Road user charging for Norwich appears to be potentially self-financing and generally charge revenues would cover the costs of running the scheme and a modest revenue stream for investment in other transport measures. However, in isolation it would not provide congestion relief across the network, and adds to overall travel time. Although significant vehicle movements are removed from within the Inner Ring Road, the impact on journey speeds is relatively modest.

The analysis suggests that a large-scale investment in additional bus frequencies across the entire network may not be appropriate and that any additional investment would need to be targeted at the areas where additional patronage and load factors could be maximised.

The NDR is a powerful complementary measure to a RUC as it generates significant benefits sufficient to produce a favourable economic case. However, the cost of the NDR would not, in any significant degree, be met by RUC revenues and the amount of charge revenue generated with the NDR in place is only marginally greater than that without it.

The work to date suggests that if a charging scheme were to be progressed, the preferred option is likely to be a package comprising a morning peak charge on the Inner Ring Road cordon, the NDR and a significant programme

of targeted public transport improvements.

The modelling suggests that the NDR and its complementary measures delivers the majority of the traffic relief in the city centre that would be generated by the RUC scheme. (The NDR also provides relief to the residential roads in the northern suburbs). Implementing RUC on a network which has the NDR already in place would deliver limited additional benefit to the city centre.

5. Indicative package of transport measures

5.1. The supporting measures for a Norwich road user charging scheme would be designed to ease congestion, reduce journey times and provide viable alternatives to the car for more journeys. The study focused on three strategic geographical areas – rural, urban and market towns, each of which has varying travel patterns and needs. Cutting across each of these market groups, the package would contain measures in the three key areas of:

1. Integrated Transport – connectivity between key towns, integrated real-time information and signing at interchanges and on the network, ease of access/transfer/payment;
2. Network Enhancements – increasing the effectiveness of the existing network by improved services, bus priority on key radial corridors, improved bus links within Norwich, integrated network ticketing and branding;
3. Infrastructure Enhancements – improvements to infrastructure to assist with efficient and effective transport operation, including improvements to large and small interchanges, shelter improvements, Bus Rapid Transit on key growth corridors, Smartcard ticketing and enhancements to the rail network.

5.2. Further detail is provided in Annex B. The proposals were generally well received by elected members.

5.3. It is anticipated that this total package would cost around **£400m**. This figure includes the cost of the Norwich Northern Distributor Road, estimated at about £116m. (Many of the public transport measures in the package would also require significant revenue support).

5.4. Existing funding streams such as the Local Transport Plan (LTP), the Regional Funding Allocation (RFA) and potentially other streams such as developer contributions, prudential borrowing and Growth Point bidding could contribute to this total. It is estimated that TIF would need to bridge a **£250m** gap. Informal indications from DfT officials suggested that Government funding of this order of magnitude could be available. However, the recent allocation of Growth Point funding to Norwich perhaps challenges the credibility of this. The proposed Community Infrastructure Levy could be a more likely source of significant additional transport funding.

6. Stakeholder views

6.1. The following engagement activities were undertaken

6.2.
- Internal workshop on 4 January 2007 to apprise key staff of project and introduce the idea of a “package” of transport measures and what we

might include as complementary measures to a road pricing scheme

- Informal meetings held between the Director of Planning and Transportation and key business/stakeholders to explain what we hope to get from the feasibility study (February 2007)
- Second stakeholder workshop held in 27 March 2007. To enable us to explain the TIF process, the idea of up-front funded packages of complementary measures
- Scenario planning workshop held on 22 May 2007. This involved both County and City Council staff. The various work packages that make up the project were outlined and people expressed their views on possible charging scenarios to be tested.
- Five focus groups held with members of the public in July 2007. This was qualitative research to investigate public perceptions of congestion and means of addressing it
- Stakeholder workshop on perceptions of congestion and means of addressing it
- Workshop/presentation to County Councillors on the package approach to TIF – presentation material circulated to all 78 councillors (11 September 2007)
- Presentation to and discussion with the Norwich Cycling Campaign on the package approach to TIF (20 September 2007)
- Presentation to and discussion with the Norwich City Councillors on the package approach to TIF (2 October 2007)
- Presentation to and discussion with the Norwich Highways Agency Joint Committee (City and County Councillors) on the package approach to TIF (10 January 2008)
- Presentation to and discussion with the Costessey Parish Council on the package approach to TIF (29 January 2008)
- Business workshop on perceptions of congestion and means of addressing it (27 February 2008)
- Views on a draft of this report were sought from Review Panel and the GNDP and it was considered by Cabinet on 19 May 2008.

6.3. A wide range of views were expressed. Some elected members are strongly opposed on principle, some strongly support the principle. Most stakeholders engaged constructively with the study, but remained to be convinced that a workable scheme could be defined.

6.4. On 27 November 2007 Norwich City Council, passed a formal resolution as follows:

This Council requests that before any decision on a congestion charge for Norwich is made, the following matters are addressed satisfactorily:

(1) that a full public consultation has taken place;
(2) that Norwich jobs are not put at risk or the city's economy put at a

competitive disadvantage to the rest of the region;
(3) that improvement to public transport is in place as a viable alternative to private cars before any congestion charge is established;
(4) that a congestion charge be proved to be effective at reducing congestion where there is currently a problem;
(5) that any money raised be spent on improving sustainable transport in Norwich;
(6) that those living within the congestion charge zone are exempt from payment;
(7) that, regardless of the outcome of the unitary debate Park & Ride and its subsidy will be an integral part of the congestion charge policy';
(8) that the proposal for a 20mph speed limit in residential streets be considered as part of the package.

It is worth noting that given the modest revenues generated in the scenarios tested, an exemption for residents within any charging area is likely to undermine the financial viability of a charging scheme.

6.5. Consultation with the general public (through focus groups) and stakeholders have highlighted that while currently, there is no evidence of widespread opposition to the principle of congestion charging, there is, more importantly, no strong support for such a scheme either.

6.6. Both groups agreed that congestion was a critical issue and had real life impacts on individuals. However, they felt that additional investment and improvement in public transport infrastructure was the main mechanism necessary to reduce congestion, albeit unsure about where this money would come from. It is clear nonetheless in the case of the public that they would need to see real and visible changes to the public transport landscape before agreeing to any charges.

6.7. Pursuing charging at this stage would appear to be risky as a significant number of individuals in the focus groups stated they would not consider leaving the car behind. This was even more prevalent among low income groups. There was also a concern that a congestion charge might increase social exclusion as more people struggle to get the money to pay the charge or decide not to undertake trips they see as not vital.

6.8. Stakeholders were keen to stress that congestion is a result of economic success and that a congestion charge without a coordinated and integrated public transport infrastructure runs the risk of adversely impacting on the economy of Norfolk.

6.9. While many people agreed that a congestion charge is an option that could potentially work, the overwhelming view was that this was not a viable option now. There was a lot of work still to be done on the public transport infrastructure and other avenues to be explored for alleviating congestion such as Park & Ride before a charge is brought in.

6.10. Individuals in the focus groups agreed that London is a success only because it had the public infrastructure network and population to support a charging scheme.

7. Possible further work

7.1. Our original proposal envisaged the study continuing until the end of 2008. However, DfT were only able to commit funding for 2007/08 – pending the outcome of the Comprehensive Spending Review (CSR 2007). In order to complete our original proposal it is estimated that some £400,000 would need to be spent in 2008/09. Further match funding from the DfT is not guaranteed. Although we can now submit a supplementary bid for 2008/09, this may not be successful unless we can demonstrate to DfT a reasonable commitment that we will actually submit a bid for a package including a road pricing scheme ih due course.

7.2. If the feasibility study continued, a wider public consultation of possible road pricing scenarios and complementary measures would be undertaken. This would build upon the work carried out already with stakeholders and extend to the wider general public. More detailed analysis would also be carried out to help stimulate a wider public debate.

7.3. Given the lack of positive stakeholder support for charging and limited effectiveness of charging, based on the modelling work to date, there may not be the justification to put further resources into examining charging at this time and prompting an ultimately unnecessary public debate.

7.4. We have discussed the options with officials at DfT. They have indicated they would not object to us halting the study at this stage. The work to date has provided them with useful analysis of the issues associated with charging in a medium-sized city.

7.5. The TIF study in Shrewsbury has produced some similar findings and been brought to a halt as a result. In view of this Shropshire County Council has resolved not to submit a business case for road pricing and complementary measures under the Transport Innovation Fund. Their work has shown that a package of transport measures including road pricing, a new North West Relief Road (NWRR similar to an NDR) and large scale improvements to public transport could produce significant benefits for Shrewsbury by reducing the amount of traffic entering the town centre. However, their study confirmed that even with a toll on their new NWRR as well as a town centre charge of up to £1.50, the package would be difficult to balance in cash-flow terms. Additionally, councillors in Shropshire made it clear that they did not support town centre road pricing or a toll on the NWRR.

7.6. In order to conclude the study, a final report will be prepared which includes the results of the current modelling work, taking account of the Joint Core Strategy growth scenarios. This will also include the results of a business workshop on 27 February which aims to understand the business view of congestion and the sort of measures that they would like to see being taken forward.

8. Discussion

8.1. From the technical work undertaken, it appears that it would be possible to formulate a TIF package that has a positive economic appraisal, albeit modest, which comprises a ring road cordon road pricing scheme, the NDR and significant public transport improvements. However, the revenues that would be collected using a modest ring road cordon scheme are unlikely to be sufficient, for example, to enable prudential borrowing to implement some of the necessary complementary capital measures.

8.2. On the other hand, modelling suggests that implementation of the NDR, in conjunction with complementary measures, is likely to have a similar impact by way of time savings and journey time reliability as cordon pricing. The reductions in overall travel time of 19% and distance of 15% brought about by RUC (Option 1), compare with figures of 16% and 13% for the NDR. The key difference being the NDR and other measures attract the trips away from the city centre whereas the RUC “prices” the trips out. Overall the modelling suggests that the two effects are not cumulative and the impact of the two schemes is less than the sum of the individual schemes.

8.3. Based on these conclusions, it appears that for the time being, road pricing does not have a part to play in helping to solve transport problems, in particular congestion, in the Norwich area.

8.4. In view of this it is recommended that a wider public consultation of possible road pricing scenarios and complementary measures is not carried out. This is because we do not feel that we could put together a sufficiently attractive package capable of securing sufficient public support for successful implementation. It is unlikely that we could prepare a satisfactory bid to Government for substantive funding from the TIF congestion fund. We should focus on implementation of the existing NATS, including the NDR, which is likely to be more effective in tackling congestion and increasing travel choice.

8.5. Nevertheless, we believe that this study has been extremely useful in finding out how applicable road pricing is to places like Norwich at this time. It has also helped us raise the profile of transport issues with DfT and demonstrated the critical significance of the NDR as part of the NATS package.

8.6. Additional benefits of the study have been the investigation into complementary measures for a TIF package. Many of these measures are still likely to be applicable to enhancing the existing NATS strategy to help accommodate the additional growth in the Joint Core Strategy (JCS) area. These complementary measures will continue to be investigated. There are likely to be opportunities to fund at least some of them through Growth Point funding, the proposed Community Infrastructure Levy (CIL) or other forms of developer contributions.

9. Resources

9.1. **Finance :** Small sums from the Strategy and Performance, Transport Strategy revenue budget will be used to complete the work on the final report.

9.2. Completing all the work in our original proposal is now estimated to cost another £400k. We could bid for 50% of this from DfT, but are not assured of success.

9.3. **Staff :** Existing staff resources from Strategy and Performance will be used.

9.4. **Property :** None

9.5. **IT :** None

10. Other Implications

10.1. **Legal Implications :** None

10.2. **Human Rights :** None

10.3. **Equality Impact Assessment (EqIA) :**

This report concludes that road user charging should not being taken forward at this time so it will not form part of current transport policy. However, transport policy has undergone an EqIA and measures are being put into place to ensure that transport policies equally serve all diverse groups and in particular are checked for the needs of the disabled.

10.4. **Communications :** None

11. Section 17 – Crime and Disorder Act

11.1. No issues are anticipated as no particular schemes or measures are being proposed at this time.

12. Risk Implications/Assessment

12.1. The risk of the County Council is the relationship with DfT being damaged by closing down this feasibility project at this time is regarded as low. The issue has been discussed with DfT and they recognise that not all of their 10 pump-priming feasibility studies will culminate in submitting a substantive bid to the TIF congestion fund. They are satisfied the work to date has been worthwhile in widening their evidence base on charging.

13. Alternative Options

13.1. The alternative is to continue the feasibility study. This would enable us to refine the modelling work, test additional scenarios and optimise the package of investment/charging scheme. We would also seek further input form stakeholders and engage the public in wider consultation. This is not recommended for the reasons given in sections 7 and 8.

14. Conclusion

14.1. It is concluded that:

- A package of transport measures for the Norwich area including road pricing could have a positive economic appraisal – but revenues raised will not be sufficient to fund alternative measures (operational as well as capital costs)
- Modelling suggests that NATS/NDR is likely to have a similar impact on

the performance of the road network and journey reliability as a road pricing scheme within the charged area, but that combining the two does not double the impact

- Road pricing would not obviate the need for the NATS/NDR package, which is what actually generates the benefits for road users (nor would it deal with the congestion problems in the suburban areas outside of the road pricing cordon).
- Stakeholders have engaged constructively with the study, but there has been little positive support for charging
- Analysis to date does not justify bidding to DfT for additional funding to continue the study, or finding match funding of £200k
- The work undertaken should be written-up in a report to DfT and to share with stakeholders

Action Required

The committee is invited to:

(i) note this report and the decision made by Cabinet on 19 May 2008.

Background Papers

- Presentation to this committee on 10 January 2008

Officer Contact

If you have any questions about matters contained in this paper please get in touch with:

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Annex A - Transport Innovation Fund (TIF) Status Report

1. Indicative package of transport measures

1.1. Measures proposed to support **rural areas** include an integrated delivery of Demand Responsive Transport – semi-fixed bus routes operating to a flexible frequency – and taxi services centred on, and fully integrated with Park and Ride sites and services, to provide improved linkages from rural areas to Norwich. Park and Ride provision would be enhanced including a new site at Trowse, and improved waiting facilities, cycling provision and "Shop-n-Go" facilities at all sites.

1.2. Provision for **market towns** focuses on strategic links into Norwich and is being developed in tandem with the market towns strategies. The package would include the development of market town hubs providing connectivity between local transport serving the market towns and surrounding rural areas, and enhanced bus services along the key radial corridors into Norwich. Improved traffic management is a key measure, with improved car parking provision at market towns located on key transport corridors, with improved parking signage linked via car park guidance systems and Urban Traffic Management Control.

1.3. For the **urban area of Norwich**, a raft of public transport measures is proposed including:

- The creation of a number of strategic interchanges at key locations in the transport network (such as the rail station, university, Castle Meadow, Anglia Square), strongly branded and with high quality waiting facilities, real-time information, ticket machines and high levels of security;
- An extensive number of mini-interchanges with high quality shelters and lighting, information/help points, real time information and improved signage and pedestrian links between stops;
- A high-frequency (7/8 minutes) city centre bus link to connect the rail station and bus station with key strategic interchanges at Castle Meadow and St Stephens Street;
- Greater certainty for users of the quality, reliability and frequency of services on bus network within Greater Norwich by partnership working or possibly Quality Contracts.
- Development of an integrated transport brand and integrated multi-modal ticketing scheme covering the Greater Norwich area.
- Major improvements to the quality and frequency of existing radial bus services to provide a 'turn up and go' service operated by fully accessible, low emission vehicles on all routes forming the NATS core bus network. Services on each route would operate at intervals of at least 7-8 minutes during peak periods with higher levels of service available where two or more routes converge as they approach the city. Evening and Sunday services would also be enhanced to meet the

target service levels set out in the Norwich Bus Strategy.

- A frequent orbital bus service linking the northern suburbs of Norwich with key employment areas and the Norfolk & Norwich University Hospital. This service would take account of lessons learnt from the experimental orbital service supported by Urban Bus Challenge, with fully integrated ticketing between orbital and radial services.
- The development of a 'Bus Rapid Transit' (BRT) service with enhanced segregation and priority, high quality infrastructure at stops, distinctive vehicles and off-bus ticketing on a limited number of corridors linking key locations for future growth with the city centre.
- Shelter improvements on main corridors including improved security and easy access.
- Implementation of intelligent bus priority linked to the BusNet system at all signal controlled junctions on the NATS core bus network.
- Additional physical bus priority measures (e.g. bus lanes, bus gates, bus advance areas) at congestion hotspots on the core bus network, taking advantage of opportunities arising from traffic reduction delivered by the NDR.

1.4. Public transport measures which are being considered for county-wide application include:

- Improvements to ticketing utilising technology such as Smartcards and mobile phones, to improve integration of payment for transport and potentially link to other Council payment systems;
- Real time passenger information

1.5. The package will also include a number of measures to encourage walking and cycling:

- Integrated and improved walkways, walking schemes and upgrades of key crossing points to assist pedestrians;
- A cycle hire scheme, comprehensive cycle network and improved facilities, particularly at key interchanges to benefit cycling;
- Local Safety Schemes, promotion of Travel Plans and a city centre signing strategy, to encourage more non-motorised travel.

ANNEX B – Note on Modelling

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March 2008

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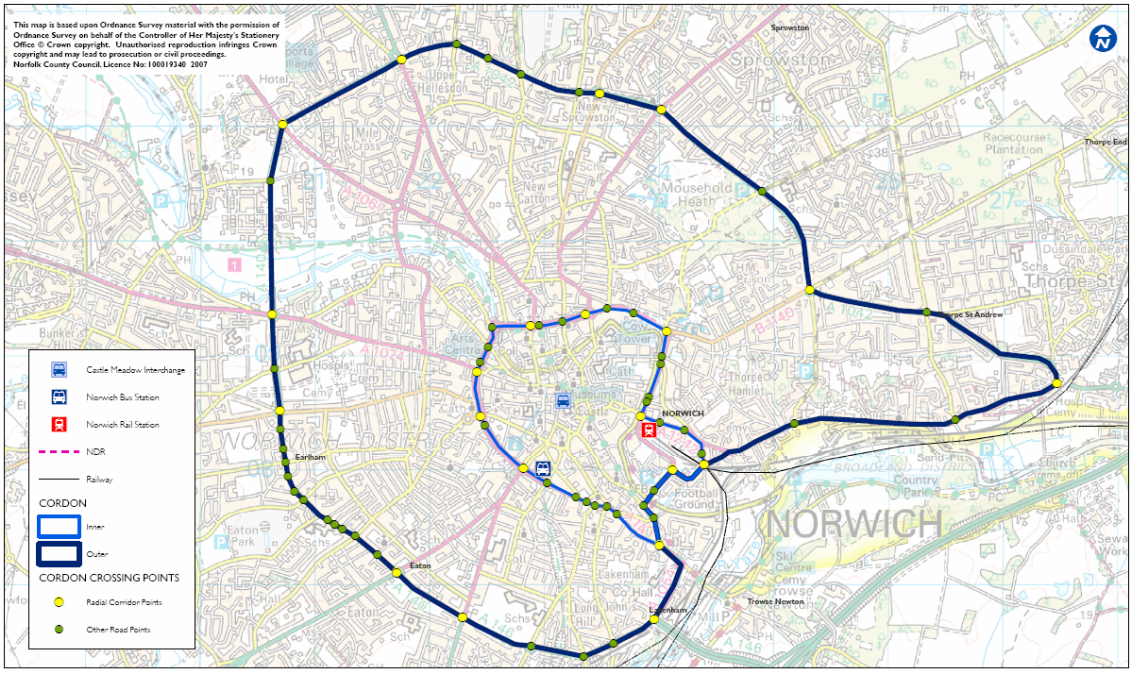
1. Modelling Inputs and Assumptions

1.1 Conceptual Scheme

A conceptual congestion charging scheme is being developed based on ANPR technology, applied as a continuous cordon ring at either the Inner Ring Road or the Outer Ring Road. Under this scheme vehicles crossing the cordon point towards the city centre are charged, but trips made wholly within the cordon are not charged. A combined option comprising both cordons, with charges increasing towards the city centre, is also possible. An approximate total of 150 cordon crossing points have been identified for the conceptual scenarios.

Figure 1: Location of Conceptual Congestion Charge Schemes



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DRAWING TITLE
NORFOLK TIF: TRANSPORT ASSESSMENT
Road User Charging Scheme
Inner & Outer Cordons

REV.	DESCRIPTION	CH'K'D	DATE
A	Draft For Evaluation	....	....
B	....	....	....
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1.2 Charging Options

Options for congestion charging have been subject to a preliminary assessment of likely benefits and costs, using forecasting models for highways (SATURN) and public transport (VISUM). The conceptual scheme options have been tested with a variety of levels of charge ranging from £1 to £3. These charges are applied in the morning peak only.

The following schemes were also included in the model tests:

- The Norwich Northern Distributor Road (NDR) was assumed to be included as part of the congestion charging scenario – two tests were also performed on congestion charging without the NDR in place;

- A network-wide increase in bus frequency, to varying degrees, was included as part of each congestion charging scenario, to represent significant improvement in public transport alternatives.

Seven options were thus tested as shown in Table 1. The Do Minimum (DM) scenario against which each option is compared is also shown.

Table 1: RUC Options Tested

	DM	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Congestion Charge:								
Inner Ring Road	×	£2	£3	×	£2	£3	£2	×
Outer Ring Road	×	×	×	£2	£1	£2	×	£2
NDR included	×	✓	✓	✓	✓	✓	×	×
Bus Frequency Factor	1.00	1.25	1.50	1.50	2.00	2.00	1.25	1.50

In the following sections, all costs and benefits are presented as £m at 2002 prices, over a 60-year appraisal period, in line with DfT appraisal guidance.

2. Economic Appraisal of Options

Table 2 summarises the costs and benefits of each option, which are as follows:

- Time Savings – benefits to transport users in terms of travel time savings;
- Net Revenue – the balance between road user charges paid and the revenue collected, plus the additional revenues to bus operators;
- Carbon Benefits – changes in carbon emissions through changes in traffic levels;
- Operating Costs –the operating costs of RUC and additional bus services;
- Capital Costs – the cost of delivering infrastructure for RUC and NDR;
- Other Costs – loss of indirect tax through reduced fuel use.
- Net Benefits - the difference between the benefits and costs (equates to the NPV figure in the Transport Economic Efficiency table in a standard DfT appraisal).

Table 2: Summary of Economic Benefits and Costs

	1	**2**	**3**	**4**	**5**	**6**	**7**
Time Savings	503	525	217	503	169	-20	-301
Net Revenue	9	-1	24	28	11	12	31
Carbon Benefits	0	0	-3	-1	-4	0	-3
Operating Costs	215	276	458	698	698	215	458
Capital Costs	132	132	142	151	151	9	20
Other Costs	28	37	39	51	63	25	42
Net Benefits	**138**	**79**	**-401**	**-370**	**-736**	**-258**	**-793**

All values are £m at 2002 prices, discounted over a 60-year appraisal period

Only the options with the Inner Cordon and NDR (Options 1 and 2) provide a positive net benefit, and as such are the only schemes which are likely to be of interest to the DfT. Under appraisal rules these two schemes would be classed as good value for money as they would have a Benefit Cost Ratio (BCR) above 2.0. Note that the BCR is not used to compare options in this instance. TAG Unit 3.5.4, Cost Benefit Analysis, states that "the BCR is of limited value where projects (road user charging, for example) result in significant revenues accruing to public accounts." The BCR formula breaks down where high levels of public sector revenues outweigh public sector costs.

Two key factors contribute to the positive net benefit for Options 1 and 2. The first is the relatively low operating costs, which is a function of the size of the RUC scheme; the Inner Ring Road cordon involves fewer cordon points than other options. The second is the high level of time savings for options including the Inner Cordon, which are more than double the level of time savings generated by options with either the Outer Cordon alone or the dual cordon. These options have high operating costs and do not deliver sufficient time savings.

It is notable that the options without the NDR actually increase travel time (negative savings). This suggests that RUC alone would not deliver a more efficient transport network, although it may reduce traffic within the cordon area. The NDR delivers a significant level of time saving benefits which provides a major contribution to the viability of the package as a whole. The impacts of the NDR and RUC schemes on city centre traffic are discussed in Section 6.

3. Financial Appraisal of Options

Section 2 presented the full range of economic costs and benefits that are taken into account of in the economic appraisal of schemes. It is also appropriate to look at the financial performance of the options, i.e. costs involved in delivering each package as against the revenues generated, to understand the extent to which options provide revenue streams that can be used to fund the costs of schemes.

3.1 Financial Appraisal of Full Package

Table 3 summarises the revenues and costs relating to the package as a whole. This includes costs to both local government (costs and revenues relating to RUC and the NDR) and public transport operators (costs and revenues relating to enhanced public transport provision).

Table 3: Summary of Scheme Revenues and Costs

	1	**2**	**3**	**4**	**5**	**6**	**7**
Revenues							
RUC	206	274	449	432	651	208	466
Public Transport	0	2	1	2	5	2	3
Total	206	276	450	434	656	210	469
Operating Costs							
RUC	157	157	339	496	496	157	339
Public Transport	58	119	119	202	202	58	119
Total	215	276	458	698	698	215	458
Operating Surplus	**-9**	**0**	**-8**	**-264**	**-42**	**-5**	**11**
Capital Costs	132	132	142	151	151	9	20
Net Scheme Cost	**141**	**132**	**150**	**415**	**193**	**14**	**9**

All values are £m at 2002 prices, discounted over a 60-year appraisal period

In most cases, revenues from RUC exceed its operating costs, thus providing a net revenue stream. It is clear also from this table that the increased bus frequency generates limited additional revenues, suggesting that little modal shift to public transport is encouraged by introducing an RUC scheme.

The high level of additional service provision incurs significant operating costs, and would therefore require significant subsidy. The mostly negative operating surpluses indicate that the RUC revenue surplus would not be sufficient to fully cover the cost of increased bus service provision, thus requiring additional subsidy to be found from other sources. There would also be no revenue surplus to contribute to the capital cost of the package.

3.2 Financial Appraisal of RUC Element

A further financial analysis considers the revenues and costs accruing to the RUC alone within each option. This assesses the degree to which the RUC scheme is self-financing, i.e. charge revenues cover the capital and operating costs of RUC. This is shown in Table 4.

Table 4: Summary of Revenues and Costs for RUC Only

	1	2	3	4	5	6	7
Charge Revenues	206	274	449	432	651	208	466
Operating Costs	157	157	339	496	496	157	339
Capital Costs	9	9	20	29	29	9	20
Net Revenue	40	108	90	-93	126	42	107
Revenue/ Cost	1.24	1.65	1.25	0.82	1.24	1.25	1.30

All values are £m at 2002 prices, discounted over a 60-year appraisal period

All options other than Option 4 (which has high costs and a low per trip charge) generate sufficient revenues to cover the costs of delivering the charging scheme. All of the schemes with a single £2 per trip charge have a revenue/cost ratio of around 1.25, reflecting the fact that the difference in revenue between options is commensurate with the difference in costs. Thus there is little appreciable difference in revenue generation potential between these options, the differences in net revenue being a function of the size of the cordon scheme.

A higher per trip charge leads to a lower level of increase in revenue, for example, the change in charge on the Inner Ring Road from £2 to £3, which is a 50% increase, leads to only a 33% increase in revenues (Option 1 to Option 2), which is a result of more drivers avoiding paying the higher charge. However, because there is no difference in costs, the change in net revenue is significantly greater, and the revenue/cost ratio is better. Thus the higher charges are better in terms of revenue generation, although their impacts on congestion relief may be less.

Another point of note is that the options without the NDR (6 and 7) generate little additional revenue compared to equivalent options with the NDR (1 and 3). For example, only an additional 4% of revenue is generated for the Outer Cordon without the NDR than with it. This suggests the possibility that the RUC scheme is affecting the same trips as the NDR; this is discussed further in Section 6.

3.3 Costs to Government

The cost to government is an important indicator of the affordability of schemes and packages. Table 5 summarises these costs, compared to the revenues generated by RUC.

Table 5: Costs to Government

	1	2	3	4	5	6	7
Operating Costs	157	157	339	496	496	157	339
Capital Costs	132	132	142	151	151	9	20
Indirect Taxation	28	37	39	51	63	25	42
Total Cost	**317**	**326**	**520**	**698**	**710**	**191**	**401**
Charge Revenues	206	274	449	432	651	208	466
Net Cost to Govt	**111**	**52**	**71**	**266**	**59**	**-17**	**-65**

All values are £m at 2002 prices, discounted over a 60-year appraisal period

RUC in isolation is the only scenario in which there is a government surplus (negative net cost), as RUC revenues alone would not be sufficient to cover the capital costs of the NDR. Option 4 in particular has a significant funding gap of over £200m, resulting from high scheme operating costs relating to the dual cordon operation and low revenues from the low per trip charge.

4. Other Indicators

Within the economic appraisal there are a number of indicators that demonstrate the impacts of the different options. Chief among these are the user benefits and carbon benefits.

4.1 User Time Savings and Charges

Table 6 presents the net user benefits in terms of time savings to transport users, compared with the charges paid, to identify which options provide an overall benefit to users of the transport network. A time/charge ratio is shown to show the degree of difference between time savings and charges.

Table 6: User Time Savings and Charges

	1	2	3	4	5	6	7
Time Savings	503	525	217	503	169	-20	-301
User Charges	-197	-277	-426	-406	-645	-198	-438
Net User Benefits	306	248	-209	97	-476	-218	-739
Time/Charge Ratio	2.6	1.9	0.5	1.2	0.3	-0.1	-0.7

All values are £m at 2002 prices, discounted over a 60-year appraisal period

Only the Inner Ring Road cordon combined with the NDR, and the lower level of charge on the dual cordon with NDR, produce positive benefits to users. Increasing the Inner Cordon charge from £2 to £3 (Option 1 to 2) generates only a small increase in time benefits, while significantly increasing charges paid, thus reducing the time/charge ratio. The increase in charge on the combined cordon scheme (Option 4 to 5) leads to a reduction in benefits while still increasing charges. These results suggest that the higher charge levels are adding little to relief of congestion in the network and are thus predominantly revenue generators.

The results for Options 6 and 7 indicate that there are no time saving benefits for an RUC scheme if the NDR is not in place. Section 6 of this report further attempts to consider the traffic modelling implications of the RUC and NDR schemes in terms of the impact on city centre journey times, vehicle average speeds and delay.

4.2 Carbon Benefits

Carbon Benefits were presented in Table 2 and this provides a further indication of the effectiveness of each option in reducing carbon emissions. Only one option provides a net reduction in carbon emissions, this being Option 1. The most significant increases in carbon emissions occur in the options involving the Outer Cordon (3, 5 and 7). This reflects the greater level of rerouting involved in avoiding the Outer Cordon charge.

5. Summary of Economic and Financial Appraisal

Table 7 summarises the key economic and financial indicators, as a positive/negative score. Note that positive cost scores denote a revenue surplus which is a benefit to the scheme.

Table 7: Summary of Economic and Financial Results

	1	2	3	4	5	6	7
Net Scheme Benefits (NPV)	++	+	--	--	---	--	---
Net Scheme Cost	--	--	--	---	--	-	-
Operating Surplus	-	-	-	---	--	-	+
RUC Revenues	++	++	+++	+++	+++	++	+++
RUC Revenue Surplus	+	++	++	-	+++	+	++
Net Cost to Government	---	--	--	---	--	+	++
Time Saving Benefits	+++	+++	++	+++	++	-	---
Net User Benefits	++	++	--	+	---	--	---
Carbon Benefits	+	-	--	-	--	-	-

The summary analysis shows that a package of measures comprising a road user cordon charge at the Inner Ring Road with the NDR (options 1 and 2) provides the widest range of positive outcomes, and crucially the only positive economic outcome. While these options provide lower revenues due to the smaller cordon which intercepts fewer journeys, costs are lower and more time saving benefits are delivered.

The relative merits of charging £2 or £3 on the Inner Cordon vary; while charging £2 produces greater levels of benefit, mostly due to lower charge payments, there is a higher cost burden to local government. While both charge levels give a positive return on investment in RUC, the £3 charge goes further towards fully funding the rest of the package. However, there is little difference in time savings, which may make the £3 charge more politically difficult as its chief benefit over the £2 charge is in raising revenue.

By moving the charging cordon further out to the Outer Ring Road more revenue is collected. However, there is less time saving benefit and more charge paid by users, leading to negative benefit overall. Time savings are eroded because avoidance of the charge involves longer rerouting movements than with the IRR. The fact that user charges outweigh time savings suggests this is an inefficient charge scheme and would make public acceptability difficult. This option, having negative benefits and a negative NPV, would not attract DfT funding.

A dual charging cordon at both ring roads gives negative benefits and a negative NPV, which would not be attractive to DfT. These schemes have high costs and low time saving benefits which are outweighed by charges paid, therefore there is little evidence of a transport benefit for this scheme. The lower level of charging tested for this RUC configuration is the only option for which revenues are insufficient to cover the cost of operation of the RUC scheme.

Without the NDR, RUC does not generate sufficient benefits, and in particular highlights the disbenefit to transport users of the imposition of charging, leading to longer journeys to avoid the charge or increased financial cost. While the absence of the NDR means that revenues from charging outweigh the costs to government, resulting in a financial surplus, the overall result is a negative NPV.

6. Summary of Model Outputs

The following tables provide a summary of journey statistics extracted from the SATURN model assignments associated with the following modelled scenarios presented in Table 1:

1. Do Minimum (2010 AM peak);
2. NDR without road user charging;
3. £2 charge for entering the inner ring road (IRR), without the NDR (Option 6)
4. £2 charge for entering the inner ring road (IRR), with the NDR; (Option 1).

All outputs are for the AM peak (08:00-09:00) period, for the 2010 assessment year.

6.1 Overall Impacts Within Inner Ring Road Cordon

Table 8 provides a summary of changes in total travel time, distance and speed within (but not including) the IRR as a result of the intervention measures outlined above. The table highlights the impact compared to the do minimum of implementing the NDR and RUC in isolation, and the impact of the combined package.

Table 8: Summary of Modelled Output – Within Inner Ring Road

	1	**2**	**3**	**4**	**Change cf Do Minimum**		
	DM	*NDR*	*RUC*	*NDR,RUC*	*NDR*	*RUC*	*NDR,RUC*
Total Travel Time *(pcu.hrs)*	504.0	423.5	406.6	401.5	-16%	-19%	-20%
Total Travel Distance *(pcu.kms)*	8710.4	7537.1	7376.9	7314.0	-13%	-15%	-16%
Total Average Speed *(km/h)*	17.3	17.8	18.1	18.2	3%	5%	5%

The results indicate that implementing RUC in isolation reduces overall travel time by 19% and distance by 15%; the NDR in isolation delivers almost the same level of change. The combined scheme provides little additional improvement over either of the schemes in isolation, suggesting that both the NDR and RUC schemes are impacting on the same trips within the city centre.

Although total travel time is reduced in all cases, the impact on congestion relief appears limited given that average speeds have not changed significantly. It may be the case that insufficient numbers of vehicles have been removed from the city centre to enable speeds to fall significantly.

The modelling suggests that the NDR delivers the majority of the traffic relief in the city centre that would be generated by the RUC scheme. Implementing RUC on a network which has the NDR already in place would deliver limited additional benefit to the city centre.

6.2 Impacts on Routes Within the Inner Ring Road Cordon

Further detailed analysis has been undertaken in an attempt to ascertain the effects of the RUC and NDR schemes on specific routes within the IRR. Accordingly, four routes have been selected and assessed in terms of journey time, vehicle delay, and average speed. The routes assessed are as follows:

- Route 1 – from the IRR at St Benedicts Street, via Charing Cross, St Andrews Street and Bank Lane, to the train station at the end of Prince of Wales Road (1.491km).
- Route 2 –from the IRR at St Stephens Street to the train station via Cattle Market and Prince of Wales Road (1.535km).
- Route 3 – from Whitefriars junction with the IRR, to the train station via Prince of Wales Road (11.77km).
- Route 4 – Inner Ring Road (6.356km in each direction).

Table 9 summarises the changes for each route under the four scenarios.

Table 9: Summary Route Statistics

	1	2	3	4	Change cf Do Minimum		
	DM	*NDR*	*RUC*	*NDR,RUC*	*NDR*	*DM*	*NDR,RUC*
Route 1							
Journey Time *(s)*	277	234	258	257	-16%	-7%	-7%
Ave Delay *(s)*	40	24	21	19	-40%	-48%	-53%
Ave Speed *(km/h)*	19.38	21.77	20.78	20.86	12%	7%	8%
Route 2							
Journey Time *(s)*	379	349	393	383	-8%	4%	1%
Ave Delay *(s)*	34	35	46	37	3%	35%	9%
Ave Speed *(km/h)*	14.58	15.66	14.10	14.42	7%	-3%	-1%
Route 3							
Journey Time *(s)*	181	150	162	163	-17%	-10%	-10%
Ave Delay *(s)*	28	11	10	11	-61%	-64%	-61%
Ave Speed *(km/h)*	23.40	28.20	26.10	26.00	21%	12%	11%
Route 4 (Clockwise)							
Journey Time *(s)*	1016	985	1024	997	-3%	1%	-2%
Ave Delay *(s)*	277	248	288	261	-10%	4%	-6%
Ave Speed *(km/h*	22.51	23.20	22.35	22.95	3%	-1%	2%
Route 4 (Anticlockwise)							
Journey Time *(s)*	1036	982	1016	1003	-5%	-2%	-3%
Ave Delay *(s)*	329	273	309	295	-17%	-6%	-10%
Ave Speed *(km/h*	22.10	23.33	22.52	22.81	6%	2%	3%

The key results for each route are:

- Route 1 – implementing the NDR provides a significant reduction in journey time and delays on this route. Time savings are more modest with RUC alone, although average delays have decreased to a greater degree. The cumulative impact of both schemes on speeds and delays is minimal.
- Route 2 – the NDR reduces journey times on this corridor, though to a lesser degree than on route 1. Journey times increase significantly with RUC in place, such that, both in isolation and with the NDR, the situation is worse than in the do minimum.

- Route 3 – all scenarios produce an improvement, although the improvement with the NDR is marginally greater.
- Route 4 – the NDR reduces delays in both directions, while the RUC scheme increases clockwise delays and marginally reduces anticlockwise delays. Adding RUC onto a network with the NDR in place would reduce the level of time savings generated by the NDR, but would still be an improvement on the do minimum.

Overall the NDR in isolation delivers more time savings on each route than RUC in isolation, although some delay times are reduced more with RUC. The combined impact of both schemes is however marginal. Some of the improvements in traffic speeds in the city centre resulting from traffic being attracted out of the centre by the NDR are lost when the RUC forces trips out of the centre onto the ring road. While only one route (route 2) is worse off in the combined scheme than in the do minimum, most routes are worse off in the combined scheme than with either scheme in isolation.

7. Revised Model Runs

In 2008 a new set of model runs were undertaken on the updated NATS model (needs some brief description of what has been updated). The RUC scenario tested in the revised model runs was what? The revised model results are shown in Table 10.

Table 10: Revised RUC Model Run Results

*****table to be determined*****

8. Conclusions

Road user charging for Norwich appears to be potentially self-financing. In all but one option tested, charge revenues more than cover the costs of running the RUC scheme, thus providing a revenue stream for investment in other transport measures. However, in isolation it does not provide congestion relief across the network, as it adds more travel time as a whole. The modelling suggests that while significant vehicle kilometres are removed from within the Inner Ring Road, the impact on journey speeds within the IRR is relatively modest.

Congestion charging rarely generates positive economic benefits in its own right, as on the whole it introduces additional time or monetary costs to journeys. The level of congestion relief generated is highly sensitive to the pricing structure and availability and quality of alternative routes and modes. Alternative journey destinations can be chosen in the short term for some journey purposes such as shopping and leisure, while others such as work require longer term changes. Therefore a successful congestion charge economic business case will be heavily dependent on a package of complementary measures to provide attractive alternatives.

The analysis suggests that a large-scale investment in additional bus frequencies across the network may not be appropriate, as such levels of bus service would not be commercially sustainable; additional investment would need to be targeted at the areas where additional patronage and load factors could be maximised.

The NDR generates significant time saving benefits which make a major contribution to the economic viability of the package of schemes. The modelling demonstrates that the NDR delivers a significant proportion of the traffic relief in the city centre that could be delivered through road user charging. While the NDR in isolation would not generate a revenue stream, the time savings generated outweigh the capital costs of delivery, thus making it good value for money under DfT appraisal criteria.

The model output suggests that the NDR in isolation delivers more time savings on each route than RUC in isolation, although some delay times are reduced more with RUC. The combined impact of both schemes is however marginal, as the additional traffic forced onto the edge of the city centre by the charge scheme often counteracts the benefit of traffic attracted away from the centre by the NDR.

Notwithstanding the caveats relating to the assumptions used in the modelling tests, on a like-for-like basis the preferred option for congestion charging appears to be a package comprising the Inner Ring Road cordon, the NDR and some degree of public transport improvement, although the optimum level of charge and public transport provision is not clear from the results presented here.