

Appraisal in the Context of Housing Development

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1 Introduction

1.1 Introduction

1.1.1 In the July 2007 Housing Green Paper **Homes for the future - more affordable, more sustainable** (CLG, 2007), the Government outlined plans to deliver 3 million new homes by 2020. As part of these plans, the Department for Communities and Local Government (CLG) and the Department for Transport (DfT) set out a joint commitment to develop a methodology to better capture the economic benefits generated by new housing developments, for inclusion in the New Approach to Appraisal (NATA).

1.1.2 This TAG Unit provides that methodology. It outlines the analyses required to reflect the impacts of new housing in the appraisal of transport schemes, and the circumstances where those analyses are likely to be appropriate.

1.2 Background

1.2.1 Demand for transport is determined by the location of housing, employment, shopping, leisure and other land uses. New housing and other developments can, therefore, have a significant impact on the demand for transport in the surrounding area. This TAG Unit discusses the appraisal of transport interventions in circumstances where significant housing development is planned. Its focus is on the analysis and evidence required to inform decisions on whether to proceed with the transport intervention, rather than the housing development. However, a brief overview of the way land is designated for housing or other purposes provides useful background to the issues discussed here.

1.2.2 There are two key stages in the land use planning process: the development of a Regional Spatial Strategy (RSS); and the development of a Local Development Framework (LDF). The RSS provides an overview of the need for, and broad location of, new housing and other development to meet economic, environmental and social objectives in the region. The LDF takes the RSS as its starting point and identifies locations and sites within the planning authority where new development may take place, specifying what kind of development (housing, retail, industrial and so on) will be permitted at each location.

1.2.3 RSSs and LDFs are required to consider the implications for transport (and other utilities) of possible new development ¹. The aim is to ensure that, as far as possible, development is located where existing transport infrastructure can accommodate the increases in demand. However, in some cases the need for new development in a specific location will mean that new development will require some form of transport intervention to support it.

1.2.4 Developers work within the framework provided by RSSs and LDFs – but planning permission is not always restricted to sites designated in the LDF (see **Planning Policy Statement 3: Housing** (CLG, 2006),

¹ Guidance for planning authorities on assessing transport implications of new development, in the context of preparing development plans and making decisions on planning applications, is contained within **Planning Policy Guidance Note 13: Transport** (CLG, 2001). Further detailed guidance on preparing Transport Assessments to accompany the submission of planning applications, in cases where a new development is likely to have significant transport implications, is set out in **Guidance on Transport Assessment** (CLG/DfT2007).

paragraph 71). Where some form of transport intervention is needed, planning permission may sometimes be granted conditional on the developer providing or funding the transport intervention in full.

- 1.2.5 However, in some cases, development may be needed to satisfy national, regional or local requirements, but the developer is unwilling or unable to fund the transport intervention in full. This may be because:
- (a) there is a lack of funding available from the uplift in the value of land arising from planning permission, or;
 - (b) the transport intervention significantly benefits existing travellers, as well as residents of the new development
 - (c) a transport intervention that is needed to address transport-related goals will also address the needs of residents of new development.
- 1.2.6 In these circumstances, the transport authority must consider whether providing the transport intervention from public funds would represent good value for money. Appraisal in circumstances where land use development is dependent on the transport intervention being appraised is difficult and is the main topic for discussion in this TAG Unit.

1.3 Overview

- 1.3.1 The DfT recommends that, when appraising transport interventions, forecasts are based on the planning projections (population, households, employment, workers) and trip ends provided in the TEMPRO database. TEMPRO combines official projections of population growth from the Office for National Statistics, CLG household forecasts and plans established by the regions in the RSSs to provide an internally consistent and geographically detailed database. Note, however, that TEMPRO does not take account of the detailed geographical information included in LDFs. Analysts are expected to gather this information themselves. Since the inputs to the TEMPRO database take account of projected new housing, the TEMPRO database itself also reflects housing growth projections. For more information concerning the derivation of the TEMPRO forecasts, see the **TEMPRO Planning Data Guidance Note**.
- 1.3.2 Areas with planned housing growth will have increased trip generation forecast in TEMPRO. Thus, existing appraisal methods, using the TEMPRO database, will deliver evidence to reflect the transport impacts of new housing developments. The increased trip generation, arising from planned housing growth, will usually improve business case benefits of a transport intervention.
- 1.3.3 For many transport interventions, land use developments can be assumed to be independent of the transport intervention and thus should be included in both the with- and without-intervention scenarios. In these circumstances, we believe that **the impacts of new housing will be integrated into transport appraisals through existing methods**. There is no need to make allowance for the benefits that flow from the new housing per se.
- 1.3.4 However, we recognise that it will often be useful to identify an additional element in appraisal: the proportion of transport user benefits from an intervention that are attributable to the residents of new housing. This would provide an indication of the extent to which a transport intervention supports an area of new housing development. Section 2 discusses the methods we recommend to provide this additional information for these 'standard' schemes.
- 1.3.5 There are, however, some transport interventions which 'unlock' housing development. That is, the housing development directly depends upon implementing the proposed transport investment. This might be due

either to a lack of access to the planned area of development, or to planning constraints arising from an expectation that the surrounding transport network would be rendered over capacity during peak periods were the new development to proceed. We propose that in these cases the transport intervention and the housing development be treated as a combined project, with the assessment of impacts combining the impacts of the housing development, including the benefits flowing from additional housing services, with those of the transport intervention. The methods we recommend for use in these circumstances are discussed in Section 3 below.

2 Transport User Benefits Attributable to Residents of New Housing, in Standard Transport Appraisal

2.1 Introduction

- 2.1.1 The first issue to consider here is what we mean by the phrase 'new housing'. The purpose of the analysis is to demonstrate the extent to which a transport project being appraised contributes to the 'Support the delivery of housing' challenge in the Appraisal Summary Table (AST). Though there may be some anticipation, a transport project is unlikely to support the delivery of new dwellings much before it is open. Therefore, we recommend that 'new housing' is taken to mean those new dwellings provided in or after the project opening year.
- 2.1.2 The TEMPRO database constrains new households to the expected numbers of new dwellings provided. Thus, the additional households projected in TEMPRO may act as a proxy for new housing. TEMPRO provides household projections for 2006 and every fifth year up to 2041. By taking the TEMPRO forecast year closest to the project opening year as the base, TEMPRO can be used to estimate, in broad terms, the amount of new housing quickly and easily.
- 2.1.3 TEMPRO provides projections at a zonal level, where zones are coarse subdivisions of local authority districts. Transport models usually subdivide TEMPRO zones in the vicinity of the planned intervention, but combine them further away. Because new households may emerge in any TEMPRO zone, the approach recommended is based on an analysis of the proportion of new households emerging in every modelled zone.
- 2.1.4 Transport user benefits are usually estimated using either TUBA or, less commonly, COBA. Our recommended approach to estimating the proportion of transport benefits attributable to residents of new housing differs slightly depending on which program is used.
- 2.1.5 TUBA estimates transport user benefits on a zone by zone basis. We recommend that the transport user benefits for home based trips, for each model zone be split between new and existing households in line with the proportion of new and existing households in the relevant TEMPRO zone.
- 2.1.6 It is not possible to disaggregate the benefits estimated by COBA in the same way. We recommend, therefore, that an aggregate proportion of new households within the model study area should be applied to the overall user benefits estimates generated by COBA.

2.2 Reporting

- 2.2.1 The results of this analysis should be reported under the 'support the delivery of housing' challenge on the Appraisal Summary Table. The entry under 'Key Points' should note that no housing is dependent on the scheme. The percentage of total transport user benefits that is attributable to new housing should be reported under 'Metrics'. The entry under the 'Assessment' column MUST be 'not applicable'.

3 Estimating Benefits for Transport Interventions that 'Unlock' New Housing

3.1 Applicability and preliminary analysis

- 3.1.1 The guidance in this section should only be used when a transport authority is faced with the prospect of providing a transport intervention from public funds and one or more housing developments is dependent on that transport intervention. In these circumstances, the transport authority must consider whether the combination of the transport intervention and the dependent housing development would represent good value for money.
- 3.1.2 As discussed above, these circumstances may arise when housing development is needed to satisfy national, regional or local requirements, but the developer is unwilling or unable to fund the transport intervention in full. They may also arise when a transport intervention that is needed to address transport-related goals will also address the needs of residents of new development.
- 3.1.3 The housing development for consideration may include:
- Strategic sites set out in the relevant RSS;
 - Sites allocated in relevant LDFs; and
 - Planning permissions – both outline and full.
- 3.1.4 The transport authority should seek evidence that the housing development is needed, in the location specified, to satisfy national, regional or local requirements.
- 3.1.5 The analysis recommended in **Guidance on Transport Assessment** (CLG/DfT, 2007) should be carried out. This will ensure that thought has been given to reducing the need to travel and promoting sustainable accessibility. It will also provide a good understanding of the scope for measures to be delivered (or funded) by the developer and residual problems to be resolved by the transport authority. Where a Transport Assessment has been carried out by a developer, this should provide a good starting point for this work.

3.2 Steps in the process

- 3.2.1 To assess the value for money of transport interventions that unlock a housing development, a four step procedure is recommended:

Step 1: Determine the quantum of housing development that should be regarded as dependent on a transport intervention;

Step 2: Identify appropriate transport interventions;

Step 3: Assess the transport user benefits of the transport interventions in isolation (that is, in the absence of the dependent housing development);

Step 4: Assess the benefits of the dependent housing development assuming the transport intervention is provided.

3.2.2 Steps two, three and four should only be taken if the analysis in Step one confirms that some housing development is dependent on a transport intervention.

3.2.3 The analysis requires four scenarios to be developed, as outlined in the table below:

- Scenario A - without the housing development and without any form of transport intervention
- Scenario B - with the housing development but without any form of transport intervention
- Scenario C - with the housing development and with a transport intervention
- Scenario D - without the housing development but with a transport intervention.

		With transport intervention?	
		YES	NO
With housing development?	YES	C	B
	NO	D	A

3.3 Step 1: Determine whether new housing is dependent on a transport intervention.

3.3.1 This is a key step in the process. If housing development is **not** dependent on a transport intervention, then the need for a transport intervention should be considered solely on transport grounds. There is no need for the complexity and uncertainty associated with appraising a combination of housing development and a transport intervention.

3.3.2 The definition of dependency that we have established focuses on the impact of housing development on the transport network. Housing development may be dependent on a wide variety of other factors, but, for a transport authority this is the key issue, determining whether a transport intervention is required.

3.3.3 This step in the process must achieve two objectives. First, it must determine whether new housing is dependent on the provision of some form of transport intervention. Then, if dependency exists, the analyst must determine how many planned new homes are dependent.

3.4 Defining dependency

3.4.1 We define dependency as follows:

New housing¹ is dependent on the provision of some form of transport intervention if, with the new housing but in the absence of any transport intervention, the transport network does not provides a reasonable level of service to existing and/or new users.

¹ Note that, for later stages of the analysis, we need to know how many new homes are dependent on a transport intervention. Thus, while it is often convenient to consider new housing at the level of a whole housing development, this definition focuses on new homes.

- 3.4.2 It is not easy to define precisely what we mean by a 'reasonable level of service'. We suggest that, if additional traffic can be accommodated by the network without significant increases in the costs of travel for existing users, then it can be assumed to be providing a reasonable level of service.
- 3.4.3 Thus, for example, if traffic flows on a road network remain within the 'flat' part of the speed/flow curve, the network may be assumed to be providing a reasonable level of service. Similarly, if there is no crowding on a public transport network, it may be assumed to be providing a reasonable level of service.
- 3.4.4 This definition of a 'reasonable level of service' suggests that new housing may be assumed to be dependent on a transport intervention if, in the absence of any transport intervention, it would cause travel costs for existing users of the transport network to increase to an unacceptable level.
- 3.4.5 This approach is consistent with the proposition that what is of concern to the transport authority is the transport external costs resulting from the new housing. Transport external cost attributable to new housing is the change in costs (including time, vehicle operating costs and charges) caused to all other transport users on the network by the traffic generated by the new housing. Transport external costs should also include the change in revenues for transport providers as a result of additional public transport usage generated by the new homes, changes in the numbers of accidents and changes in environmental conditions (noise, local air quality and so on). Transport external costs are discussed in more depth in Annex B.

3.5 Testing for dependency

- 3.5.1 In practice, transport networks often operate beyond the limits of a 'reasonable level of service'. So it is not practical to define specific thresholds for a dependency test. However, it should be possible to form an opinion, based on readily available network characteristics. Thus, this guidance is not prescriptive, but relies on the application of judgement, supported by local evidence.
- 3.5.2 To carry out a test for dependency, two scenarios must be considered:
- Scenario A - without the new housing and without any form of transport intervention; and
 - Scenario B - with the new housing but without any form of transport intervention.

- 3.5.3 In what follows, it is assumed that, in Scenario A, the network provides a reasonable level of service. Clearly, if that is not the case, then it is probably reasonable to assume that the new housing is wholly dependent on some form of transport intervention. However, analysts must demonstrate that Scenario A does not provide a reasonable level of service before this conclusion can be reached.
- 3.5.4 Attention should focus on those parts of the network where the new housing is expected to have greatest impact. If, in Scenario B, the network no longer provides a reasonable level of service in those locations, then at least some of the new housing can be assumed to be dependent on some form of transport intervention.
- 3.5.5 The simplest approach to determining whether the network provides a reasonable level of service is to compare forecast transport demand at key locations with available capacity. This is the approach recommended in **DfT Circular 02/2007, Planning and the Strategic Road Network** (DfT, 2007). This approach is likely to be appropriate where new housing is restricted to a single site. It may be possible to adopt this approach without using a transport model.
- 3.5.6 However, where the number of new homes is large and/or new housing is located in a number of different places, and/or the impact on the transport network is complex, this approach may be difficult to apply and interpret. In these circumstances, a transport model and a more detailed assessment of the impact of the development on the network will be needed.
- 3.5.7 Model runs for scenarios A and B will usually be required. In some cases, it may be impossible to carry out the model run for Scenario B - the model may not converge, for example. *Provided the model is properly specified*, this may be taken as evidence that the new housing is at least partially dependent on a transport intervention. Further guidance on modelling these two scenarios is given in Annex D,
- 3.5.8 Comparison of the model outputs for Scenarios A and B will reveal where the new housing has had greatest impact on network level of service. Dependency testing should focus on those key locations where there are significant increases in traffic flows or passenger loadings.
- 3.5.9 Increases in traffic flows on highway networks will usually result in increases in travel costs. To demonstrate dependency, increases in travel costs in key locations affected by new housing must be exceptional, demonstrating that the network has reached a critical point. Analysts should examine link transit times and junction delays in those key locations. If link transit times have increased sharply, or if significant junction delays have emerged, this may be taken as evidence of dependency.
- 3.5.10 It may be helpful to calculate the transport external costs for links at key locations in the network – for details of how to do this, see Annex B. Transport external costs (or transport external costs per existing transport user) will reflect the size of the housing development and its impact on existing users.
- 3.5.11 Where housing development is expected in a number of locations, it cannot be assumed that all of the new housing is dependent. Further analysis is required to determine which housing development is dependent and which is not. Select link analysis at key locations will enable the analyst to determine how many trips are being made from each housing development. Housing developments that contribute only a small number of trips to the flows at key locations may be assumed to be not dependent on a transport intervention. To understand why this is so, consider the impact of a housing development in isolation, rather

than as part of a package of developments. If its impact at the key location is small, it would be assumed that it is not dependent on a transport intervention at that location.

- 3.5.12 The next step is to explore whether a reduced level of new housing could be accommodated on the network without some kind of transport intervention. This will allow an estimate to be made of the number of new homes that may be assumed to be dependent on some form of transport intervention. This analysis may be carried out by a trial and error process, reducing the number of homes (and hence the number of trips generated) and repeating the dependency analysis discussed above until a level of new housing is found that does not lead to an unacceptable level of service on the transport network. Where housing development is expected in a number of locations, that housing development that has been demonstrated to be not dependent on a transport intervention should not be included in this analysis. It should, however, be included in the background pattern of housing development (that is, assumed to be present in both Scenarios).
- 3.5.13 At the end of this process the analyst should have an estimate of the number (and, where multiple housing development locations are being considered, the location) of new homes in the housing development(s) that are dependent on the provision of a transport intervention. All other new homes should be included in the background pattern of housing development. Scenario A may, therefore, be revised to include these new homes and used with Scenario B to calculate for the entire network the transport external costs attributable to the dependent new homes. This result will provide a useful benchmark for the transport external costs with the transport intervention.

3.6 Step 2: Identify an appropriate transport intervention

- 3.6.1 Standard transport project identification procedures (see TAG Unit 2.1: **The Overall Approach - The Steps in the Process**) should be used to identify the intervention required. The analysis carried out to determine whether housing development is dependent on some form of transport intervention (see above) should provide a good understanding of the location and nature of the problems that need to be addressed. Where a transport intervention that is being developed to address transport related goals could also address the needs of new residents, the selection of an appropriate intervention should take account of the need to resolve dependency as well as the wider aims for the transport intervention. A selection of different transport interventions, including low cost measures such as junction improvements should be assessed.
- 3.6.2 A key element of the assessment should be to explore whether each transport intervention considered resolves dependency. To carry out this assessment, a third scenario must be considered for each potential transport intervention:
- Scenario C - with the new housing and with the transport intervention
- 3.6.3 This scenario should be subject to the same tests and analyses as were used in the dependency testing, discussed above. Attention should focus on those parts of the network where the new housing is expected to have greatest impact. The expectation is that, in Scenario C, the network will provide a reasonable level of service in those locations, broadly comparable to that in Scenario A.
- 3.6.4 For some transport interventions, this analysis may suggest that dependency has **not** been fully resolved. There may be good reasons for retaining an intervention that does not fully resolve dependency. For example, if a transport intervention is being developed to address transport related goals, it may not be

appropriate to address the needs of new housing as well. In these circumstances, further analysis should be carried out to determine the numbers of homes that the transport intervention does 'unlock'¹. Only those homes that would be unlocked by the transport intervention should be used in the assessment of the benefits of the dependent housing.

- 3.6.5 If a low cost transport intervention can be shown to resolve the dependency, any more costly transport interventions should be tested as increments to the low cost transport intervention. The incremental analysis should assume the low cost transport intervention **and the housing development** are part of the 'without intervention' scenario. A conventional transport appraisal should be used to assess the incremental transport benefits of the more costly transport intervention.

3.7 Step 3: Assess the benefits of the transport intervention in isolation

3.7.1 This step comprises a conventional transport user benefit assessment, requiring two transport model runs:

- Scenario A - without the new housing and without any form of transport intervention; and
- Scenario D - without the new housing but with the transport intervention.

3.7.2 **Both** model runs must be carried out assuming that dependent new housing is **not** present. This ensures that the principles of transport appraisal are not violated.

3.7.3 Transport user benefits should be assessed using conventional transport appraisal methods - TUBA, COBA or similar.

3.8 Step 4: Assess the benefits of the dependent housing

3.8.1 The approach set out in Annex C, provided by CLG, should be used to estimate the benefits of the dependent new homes. In summary, this is a two part process: estimate the 'planning gain' arising from the dependent new homes; then subtract the net external costs caused by the dependent new homes.

3.8.2 The external costs caused by the dependent new homes may be divided into two parts: those related to the transport system; and the rest. Annex C discusses the estimation of the non-transport related external costs. Guidance on the estimation of the transport related external costs are discussed in Annex B.

3.8.3 To assess the transport external costs of the land use development, two transport model runs are required:

- Scenario D - without the new housing but with the transport intervention and.
- Scenario C - with the new housing and with the transport intervention

¹ Note that the nature of the dependency test is such that this cannot be done with great precision. For study areas with multiple housing development sites (housing growth areas, for example), it may be sufficient to consider only which sites are 'unlocked' by the transport development and which are not. For study areas where there are fewer housing development sites, it will usually be sufficient to consider this issue in terms of broad proportions only – does the transport intervention unlock half or three quarters of the homes, say.

3.8.4 Both runs should employ the same transport network, which should *include* the transport intervention. Both of these model runs should be straightforward to carry out, since both represent realistic scenarios.

3.8.5 An important point to note is that the transport intervention should *reduce* the transport external costs, compared with the without transport intervention scenario. Thus, the transport external costs estimated at this stage in the analysis should be less than those estimated in the first (dependency testing) stage.

3.9 Reporting the analysis

3.9.1 Each step in the analysis should be reported. For Steps 1 (dependency testing) and 2 (identify appropriate interventions) , the report should set out the criteria used in the analysis and the reasons for their choice. It should then set out the impact on the selected criteria of the tests for Scenarios A (without the new housing and without any form of transport intervention), B (with the new housing but without any form of transport intervention), and C (with the new housing and with the transport intervention). This part of the report should conclude by presenting the numbers of homes unlocked by each transport intervention considered.

3.9.2 The analysis in Step 3 should be reported as for any other transport intervention, including presenting the results in standard Transport Economic Efficiency (TEE) and Public Accounts (PA) tables.

3.9.3 For Step 4, the number of dependent homes should be reported, together with their hectareage subdivided by previously developed and undeveloped land (PDL and non-PDL). The report should also set out the existing and residential land values, the value used for the external benefits of undeveloped land and the transport external costs, as well as the net benefit of the dependent housing. Where local values have been used, the report should set out the basis of those values, including evidence that they are significantly different from those recommended by the Department.

3.10 The Appraisal Summary Table (AST)

3.10.1 The results from Step 3 should be reported in the AST in the usual way. Note that the results from Step 3 may be based on some 'new housing', as defined in Section 2, which deals with standard transport appraisal. However, the 'support the delivery of housing' reporting requirements of Section 2 should **not** be applied here. That is, the proportion of total transport user benefits that is attributable to that new housing should **not** be reported here. The following paragraphs outline the 'support the delivery of housing' reporting requirements for analyses carried out in line with the guidance given in this section.

3.10.2 The results from Step 4 should be reported under the 'support the delivery of housing' challenge on the Appraisal Summary Table. The analysis in Step 4 is likely to result in a large estimated value for the benefits of the dependent housing. This is because the surplus of value of land in residential use over land in, for example, agricultural use, is, as an empirical matter, typically large. The January 2009 Valuation Office Agency **Property Market Report** states typical values of farmland at below £20,000 per hectare across all Government Office Regions, compared to an average value of residential land of £2,000,000 per hectare across England and Wales excluding London. This surplus is a major component of the welfare gain to society that arises from a planning decision in favour of residential use.

3.10.3 A transport intervention may play a key role in facilitating development – the dependency test discussed above tries to identify this role. But transport is one of a range of infrastructure items (water, electricity and so on) required to facilitate development. So whilst it may be true that a development would not proceed without the transport improvement, it is likely also to be true that it wouldn't proceed without other infrastructure investments. Thus the benefits of development arise from a planning decision that depends on

a package of infrastructure investments. It is not appropriate to attribute all of the benefits of the dependent housing to the transport intervention in isolation.

- 3.10.4 A further consideration is that the dependency testing process and the assessment of the benefits of the dependent housing unlocked by a transport intervention are subject to significant uncertainty.
- 3.10.5 We recommend, therefore, that the benefits of the dependent housing unlocked by a transport intervention should **NOT** be included in the Analysis of Monetised Costs and Benefits table and thus not be included in estimates of the Net Present Value (NPV) and Benefit to Cost Ratio (BCR) for the transport intervention.
- 3.10.6 However, these benefits, together with the number of dependent homes unlocked by the transport intervention, should appear under the ‘support the delivery of housing’ challenge on the Appraisal Summary Table in the ‘**Metrics**’ column.
- 3.10.7 The entry in the ‘**Assessment**’ column of the Appraisal Summary Table should be a qualitative score, based on the following table:

3.10.8 Qualitative scoring for the benefits of dependent housing unlocked by a transport intervention	
Benefits	Score
Greater than £100m	Large beneficial
Between £100m and £25m	Moderate beneficial
Between £25m and zero	Slight beneficial
Zero	Neutral
Between zero and -£25m	Slight adverse
Between -25m and -£100m	Moderate adverse
Less than -£100m	Large adverse

- 3.10.9 The information in the ‘Metrics’ and ‘Assessment’ columns of the AST for the ‘support the delivery of housing’ challenge will be taken into account in the assessment of the overall value for money of the combined housing and transport project.
- 3.10.10 Finally, the entry under ‘Key Points’ should note that housing is dependent on the scheme.

4 Other Kinds of Land Use Development

- 4.1.1 This guidance has focused on new housing developments. However, the Department recognises that other kinds of land use development (industrial, retail and so on) impact on transport and can, in some cases, be dependent on some form of transport intervention.
- 4.1.2 Much of this guidance is likely to be readily applicable to other forms of land use. In particular, the need to demonstrate dependency will be equally important for these developments. The approaches outline above are likely to be applicable. Similarly, the two stage approach to appraisal – assess the benefits of the transport intervention in isolation, then assess the benefits of the land use development assuming the transport intervention is provided – is likely to be suitable for developments other than housing.
- 4.1.3 The Department will consider how the approach might be extended to consider non-residential development.

5 Further Information

The following documents provide information that follows on directly from the key topics covered in this Unit.

For information on:	See:	TAG Unit number:
Transport project identification procedures	The Overall Approach - The Steps in the Process	Unit 2.1
Values of time and vehicle operating cost information for use in TEC calculations	Values of Time and Operating Costs	Unit 3.5.6
Principles of marginal external costs	Modelling Road Pricing	Unit 3.12.2

6 References

CLG (formerly ODPM) (March 2001) Planning Policy Guidance Note 13: Transport
[\[http://www.communities.gov.uk/documents/planningandbuilding/pdf/155634.pdf\]](http://www.communities.gov.uk/documents/planningandbuilding/pdf/155634.pdf).

CLG/DfT (March 2007) Guidance on Transport Assessment
[\[http://www.dft.gov.uk/pgr/regional/transportassessments/guidanceonta\]](http://www.dft.gov.uk/pgr/regional/transportassessments/guidanceonta)

CLG (July 2007) Homes for the future - more affordable, more sustainable
[\[http://www.communities.gov.uk/publications/housing/homesforfuture\]](http://www.communities.gov.uk/publications/housing/homesforfuture)

CLG (November 2006) Planning Policy Statement 3: Housing
[\[http://www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement3.pdf\]](http://www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement3.pdf)

CLG (formerly ODPM) (October 2004) Valuing the External Benefits of Undeveloped Land
[\[http://www.communities.gov.uk/documents/planningandbuilding/pdf/158136.pdf\]](http://www.communities.gov.uk/documents/planningandbuilding/pdf/158136.pdf)

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7 Document provenance

This is a new TAG Unit, released in 'for consultation' form in April 2009. In January 2010 it was revised to reflect comments received, and released in 'in draft' form.

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8 Annex A: Principles Underlying Appraisal of Combined Land Use and Transport

8.1 Appraisal of combined land use and transport

8.1.1 Our objective is to estimate the combined benefits¹ $S[T\&L]$ of a transport intervention, T, and a land use development, L, where the land use development cannot proceed without the transport intervention.

8.1.2 In principle, the combined benefits would be estimated by comparing a scenario that includes both land use development and transport intervention with an alternative that includes neither. However, we do not have the tools to allow us to make that comparison. In particular, we know that conventional transport appraisal methods *cannot* be used if land use differs between with and without transport intervention scenarios.

8.1.3 An alternative approach would be to assess the benefits of the two components separately, then combine them. But we cannot simply assess the benefits of the two components in isolation, then add them:

$S[T\&L]$ is *not* equal to $S[T] + S[L]$

where $S[T]$ is the benefit of the transport intervention **without the land use development**, and $S[L]$ is the benefit of the land use development **without the transport intervention**.

8.1.4 Because the land use development is dependent on the transport intervention, the land use development cannot proceed in isolation and hence $S[L]$ does not reflect the true benefits of the development.

8.1.5 However, we can assess the benefits of the transport intervention in isolation, then assess the benefits of the land use development incrementally, adding the two to give:

$S[T\&L] = S[T] + S[L/T]$

where $S[L/T]$ is the benefit of the land use development, assuming that the transport intervention already exists.

¹ We use the term 'benefits' here to refer to the net present value (NPV) of benefits less costs.

- 8.1.6 S[T] can always be estimated, though the result may suggest that the transport intervention **in isolation** is not good value for money. There is no change in land use between the without- and with-intervention scenarios, so conventional transport appraisal techniques may be applied. In both scenarios the only determinants of demand will be growth and the limitations of the transport network, so there should be no extraordinary inconsistency between network capacity and demand.
- 8.1.7 S[L/T] - the incremental benefits of the land use development, assuming the transport intervention is already present - can also be estimated satisfactorily. Because the transport intervention is assumed to be present, the problem reduces to that of estimating the benefits of the land use development alone.
- 8.1.8 Note that the alternative form - $S[T\&L] = S[L] + S[T/L]$ - is not acceptable. As discussed above, the land use development cannot be built without the transport intervention, so S[L], the benefits of the land use development in isolation, is not useful.

8.2 Benefits of land use development

- 8.2.1 CLG have developed a methodology for estimating the benefits of land use development based on 'planning gain' arising from the development, PG, less transport and other externalities, TE and OE:

$$S[L/T] = PG - TE - OE$$

- 8.2.2 The planning gain - PG - arising from the land use development may be estimated by subtracting the value of the land in its 'without development' use from its value in residential use. Note that, because the transport intervention is assumed to have been implemented, the value of the land in residential use will reflect the improved accessibility provided by the transport intervention. However, the benefits S[T] of the transport intervention will not have captured these benefits because it is based on a land use scenario that excludes the land use development L. Thus, there is no double counting across S[T] and S[L/T].
- 8.2.3 Further discussion of the principles of the benefits of land use change and the practical approach to their estimation are discussed in Annex C below.
- 8.2.4 The transport externality, TE, is the additional costs imposed on users of the transport system as a result of the construction of the land use development. These costs may be estimated from a transport model. The underlying theory and the practical issues arising are discussed in Annex B below.

9 Annex B: Transport External Costs Arising as a Result of Land Use Development

9.1 Principles

- 9.1.1 Most land use developments give rise to journeys on transport networks. These journeys are usually regarded as 'new' journeys (though, in reality many will have been diverted from other locations). These new journeys take place on transport networks already being used by other, 'existing' users. Thus they exacerbate current congestion, crowding and so on, leading to increases in costs (including journey times, the money costs of journeys, unreliability, crowding and so on) for existing users. These increases in costs are termed the *transport external costs* of land use development. Transport external costs are an important consideration in the analysis of land use developments that are dependent on (that is, cannot proceed without) transport interventions.
- 9.1.2 These costs can be estimated using the principles of marginal external costs, discussed in TAG Unit 3.12.2, **Modelling Road Pricing**. In that context, marginal external congestion cost is the change in costs (including time, vehicle operating costs and charges) caused to all users of a given link in the transport network as a result of one additional - or 'marginal' - vehicle on the link.
- 9.1.3 In the context of land use development, we can consider the marginal change in costs imposed on existing users of the transport network as a result of one additional trip generated by the development. This leads us to a matrix based analysis, rather than the link based approach adopted for road pricing.
- 9.1.4 The transport external costs of a land use development can be estimated using the following equation (the derivation of this equation is set out at the end of this Annex):

$$TEC = \sum_{ij} (C_{ij}^{1*} t_{ij}^1 - C_{ij}^{0*} t_{ij}^0) - \sum_{ij} C_{ij}^{1*} t_{ij}^D$$

where c_{ij} and t_{ij} are, respectively, the cost per trip and the numbers of trips between zones i and j . The superscripts 1 and 0 denote the with and without land use development scenarios and the superscript D denote the matrix of trips generated by the development.

- 9.1.5 The transport external costs of a land use development can also be estimated on a link basis. This formulation may be useful in establishing dependency. The following equation should be used:

$$TEC_L = c_L^{1*} (f_L^1 - f_L^D) - c_L^{0*} f_L^0$$

where TEC_L , c_L and f_L are, respectively, the transport external costs, the link transit costs and the link flow for link L . TEC_L may be summed over all links in the network to give:

$$TEC = \sum_L TEC_L$$

9.2 Practical considerations

- 9.2.1 The transport external costs of a development can readily be calculated using results from a conventional transport model. Model runs for two scenarios are required (both scenarios must be based on the same transport networks):

- (a) a scenario without the land use development, providing the matrices c_{ij}^0 and t_{ij}^0 ; and

- (b) a scenario including the trips generated by the land use development, providing the matrices c_{ij}^1 and t_{ij}^1 .

- 9.2.2 The matrix t_{ij}^D of trips generated by the development will usually be estimated separately from the model itself, then added to a matrix t_{ij}^{E1} of existing trips to generate the matrix of trips t_{ij}^1 input to the 'with land use' scenario modelling. In most cases, the requirement to constrain overall trips to TEMPRO will mean that the matrix t_{ij}^{E1} will *not* be equal to t_{ij}^{E0} . Note also that the matrix t_{ij}^D will only contain non-zero entries for those origins and destinations where land use development trips are generated.
- 9.2.3 The costs c_{ij}^0 and c_{ij}^1 for each scenario should be based on the same values of time, vehicle operating cost models and so on as are used in the application of any associated transport appraisal. In most cases, these will be those provided in **Values of Time and Vehicle Operating Costs**, TAG Unit 3.5.6.
- 9.2.4 It is important to note that TEC may be positive (implying that the land use development imposes costs on existing users) or negative. In particular, negative values may arise as follows:
- If trips generated by existing land use take place on congested parts of the transport network; and
 - Trips generated by the development take place on uncongested parts of the network; and
 - The application of TEMPRO constraints reduces the number of trips generated by existing land use; the result may be
 - A reduction in congestion in congested parts of the network.
- 9.2.5 Clearly, a negative result is more likely when estimating TEC assuming a transport intervention has been provided. In these circumstances, those parts of the network used by trips generated by the development are likely to be uncongested.
- 9.2.6 Conversely, if the development is dependent on a transport intervention, then, in the absence of a transport intervention, those parts of the network used by trips generated by the development are likely to be congested. Thus, an analysis assuming the transport intervention is not provided is more likely to yield a positive value for TEC.

9.3 Derivation of equation for estimating transport external costs

- 9.3.1 Let us define C as the total travel costs in the transport network. We can represent C as:

$$C = \sum_{ij} c_{ij} * t_{ij}$$

where c_{ij} is the cost of travel from i to j and t_j is the number of trips between i and j.

- 9.3.2 With the land use development, the number of trips between i and j is the sum of the existing trips, t_{ij}^E , and the development trips, t_{ij}^D

$$t_{ij} = t_{ij}^E + t_j^D$$

- 9.3.3 We are concerned with costs for existing users only, C^E (note that all trips, whether existing or generated by the land use development, experience the same costs, c_{ij}):

$$C^E = \sum_{ij} c_{ij} * t_{ij}^E$$

- 9.3.4 The rate of change in costs to existing users as a result of a unit increase in trips generated by the land use development is given by:

$$dC^E/dt^{**D} = \sum_{ij} d(c_{ij} * t_{ij}^E)/dt^{**D}$$

where t^{**D} is the total number of trips generated by the land use development.

- 9.3.5 At this point it is worth noting that a unit increase in trips generated by the land use development will, in general, affect both the costs for existing users and, as a result of variable demand responses to changes in costs, the numbers of trips made by existing users.

- 9.3.6 The formulation for dC^E/dt^{**D} given above takes account of both of these effects. This can be illustrated by decomposing the term $d(c_{ij} * t_{ij}^E)/dt^{**D}$ as follows:

$$d(c_{ij} * t_{ij}^E)/dt^{**D} = t_{ij}^E * dc_{ij}/dt^{**D} + c_{ij} * dt_{ij}^E/dt^{**D}$$

- 9.3.7 Here, the term dc_{ij}/dt^{**D} is the rate of change in costs c_{ij} with respect to trips t^{**D} generated by the land use development. This is multiplied by t_{ij}^E , the number of trips affected by the change in costs. The term dt_{ij}^E/dt^{**D} is the rate of change in the number of existing trips t_{ij}^E with respect to trips t^{**D} generated the land use development. This is multiplied by c_{ij} , the cost of each trip affected by the change in trips. Together, these two terms provide the rate of change in cost to existing users as a result of a unit increase in trips generated by the land use development.

- 9.3.8 The total transport external costs, TE, arising as a result of a land use development can be estimated by multiplying the rate of change in costs to existing users as a result of a unit increase in trips generated by the land use development, dC^E/dt^{**D} , by the total number of additional trips generated by the land use development, Δt^{**D} :

$$\begin{aligned} TEC &= \Delta t^{**D} * dC^E/dt^{**D} \\ &= \Delta t^{**D} * \sum_{ij} d(c_{ij} * t_{ij}^E)/dt^{**D} \end{aligned}$$

- 9.3.9 The term $d(c_{ij} * t_{ij}^E)/dt^{**D}$ may be approximated by the following quantity:

$$\Delta(c_{ij} * t_{ij}^E) / \Delta t^{**D}$$

where $\Delta(c_{ij} * t_{ij}^E)$ is the change in total costs for journeys between i and j resulting from an additional Δt^{**D} trips generated by the land use development.

- 9.3.10 Hence

$$\begin{aligned} TEC &= \Delta t^{**D} * \sum_{ij} \Delta(c_{ij} * t_{ij}^E) / \Delta t^{**D} \\ &= \sum_j \Delta(c_{ij} * t_{ij}^E) \\ &= \sum_j \Delta(c_{ij} * (t_j - t_{ij}^D)) \end{aligned}$$

$$= \sum_j \Delta(c_{ij}^* t_{ij}) - \sum_{ij} \Delta(c_j^* t_j^D)$$

9.3.11 Using superscripts 0 and 1 to denote without and with land use development scenarios, and noting that there are no land use development trips in the without land use development scenario, this becomes:

$$TEC = \sum_{ij} (c_{ij}^{1*} t_{ij}^1 - c_j^{0*} t_j^0) - \sum_{ij} c_{ij}^{1*} t_{ij}^D$$

10 Annex C: Assessing the impacts of housing development

10.1 Introduction

10.1.1 Section 3 of this TAG unit outlines a test to identify the dependency of new housing development upon a transport intervention proceeding. This Annex provides an approach to valuing the impacts of that housing development that has been identified as dependent. Also, practical guidance is provided on the use of a spreadsheet model¹ to implement this valuation approach

10.1.2 Note that this Annex lists *all* impacts of housing development. But the following discussion of estimation of those impacts covers only those that do not relate to transport. Guidance on estimation of transport-related external costs of development is provided in Annex B.

10.2 The approach to valuing impacts of housing development

10.2.1 The value to society of a planning decision to grant permission for new development may be separated into 2 elements:

- i) the *private benefit* associated with the change in land use, as represented by the uplift in land value arising from the decision to grant planning permission for that development. This uplift is defined as the value of the land in its new (in this case residential) use minus the value of the land in its existing use (e.g. agriculture), and it typically accrues to landowners.
- ii) *net external impact* of the resulting development, including:
 - the loss or gain in amenity value of land compared to its existing use;
 - transport-related external costs (see Annex B).

The equation below summarises:

Net private value of housing = Residential land value [1] – existing land use value [2]

Net social value of housing = net private value of housing + net external impact of housing development [3]²

10.2.2 The release of new land for development reduces the scarcity of residential land, and so reduces the value of existing residential land. This reduction in value should be regarded as having purely distributional effects – there is a transfer from the asset-rich who lose out from new development, to the asset-poor, including

¹ This model is available as a separate spreadsheet “D Housing Impacts Valuation Model.xls” on the same page as this document.

² Note that external impacts will usually be costs, thus the net social value will usually be lower than the net private value of housing. Whilst the net social value of housing is expected to be positive in the majority of cases, there may be cases where the uplift in land value arising from the planning decision is low or negative, and/or where externalities arising from development are substantially negative, yielding a negative net social value.

non home-owners, who gain. These distributional effects are difficult to estimate, but the valuation approach recommended above is not affected.

10.3 Defining the area of dependent development

10.3.1 The area of dependent development should include only those site areas which will be developed for housing and directly associated uses, including access roads within the site, private garden space, car parking areas, incidental open space and landscaping and children's play areas, where these are provided.¹

10.4 Non-transport infrastructure costs of development

10.4.1 A range of non-transport infrastructure is required to facilitate new development, including water, sewerage and electricity connections. The impacts of granting planning permission may be attributed **jointly** to the land use development and any accompanying infrastructure improvements, including those relating to transport. It would not be appropriate to ascribe the impacts to the development, or to the transport intervention, in isolation.

10.4.2 Note that costs of infrastructure (including affordable housing), whether borne by developers or by the exchequer, do not affect the overall valuation of the change in land use outlined above. However, the incidence of infrastructure costs does have distributional effects – to the extent that developers contribute towards these costs, we would expect the costs to be 'passed back' to landowners in the negotiated price of undeveloped land, so reducing the surplus that otherwise accrues to landowners on the grant of permission.

10.5 Using the valuation model

10.5.1 The model allows the user to estimate the value of a housing development that has been identified as dependent upon a given transport intervention.

10.5.2 Below is a discussion of the three key elements of the model, including the data inputs and underlying assumptions. Note that a number of data inputs must be specified by the user on a case-by-case basis as they relate to the nature of the development in question – as such, these data are required of scheme promoters.

10.6 Residential land value [1]

10.6.1 Residential land value = hectareage of dependent housing × residential land value per hectare

10.6.2 Users must calculate the hectareage of dependent housing. The total value of the land in planned residential use is then estimated in the model by multiplying that hectareage by a per hectare residential land value. Here, the model draws upon sub-regional per hectare residential land values provided by the Valuation Office Agency (VOA) – these data are updated twice each year as part of the VOA's **Property Market Report**².

¹ This is in line with guidance in **Planning Policy Statement 3: Housing** on defining areas of housing development in the estimation of dwelling density.

² See VOA's **Property Market Reports** at <http://www.voa.gov.uk/publications/index.htm> . Also, note that VOA is currently considering moving to an annual (rather than twice-annual) report, covering a smaller sample of areas.

10.6.3 VOA's published residential land values should be regarded as illustrative, and represent typical levels of value for sites that are ripe for development, in that they have the following conditions:

- no abnormal site constraints;
- a residential planning permission of a type generally found in the area;
- services to the edge of the site.

If planning permissions in the location generally include an element of affordable housing, that will also be reflected in the land values to the same extent as the market would do so.

10.6.4 VOA's reported land values should be regarded as being at market prices (i.e. gross of indirect tax). Therefore it is **not** recommended that the values be scaled up by an indirect tax correction factor.

10.6.5 In practice, land values vary substantially on a site-by-site basis, given differences in, for example, proximity to amenities or density of development. Users are therefore encouraged to draw upon alternative sources of evidence to inform estimation of land values in areas of dependent development. In light of the volatility of land values over the economic cycle, it is recommended that values be averaged over 3 years.

10.7 Existing land use value [2]

10.7.1 Existing land use value = {hectarage of dependent housing on PDL × (per hectare) value of land in industrial use} + {hectarage of dependent housing on non-PDL × (per hectare) value of land in agricultural use}

10.7.2 Users must calculate the hectarage split between previously developed land (PDL) and undeveloped land (non-PDL), of the land for residential development.¹ The overall value of the land in existing use is then estimated in the model by multiplying the PDL and non-PDL hectarages by corresponding per hectare values. For PDL, the model uses a regional-level per hectare value for industrial and warehouse land; for non-PDL, the model uses a regional-level per hectare value for agricultural land in mixed use. Both sets of land values are provided in the VOA's **Property Market Report**¹.

10.7.3 In practice, land values vary substantially on a site-by-site basis. Users are therefore encouraged to draw upon alternative sources of evidence to inform estimation of land values in areas of dependent development. In light of the volatility of land values over the economic cycle, it is recommended that values are averaged over 3 years.

10.8 Net external impact of housing development [3]

¹ Note that, in practice, a given development is likely to occur either wholly on PDL or wholly on non-PDL.

- 10.8.1 Net external impact of housing development = {hectarage of dependent housing on non-PDL × (per hectare) external impact of development on non-PDL} + transport-related external impact of development
- 10.8.2 The existing hectarage split, between PDL and non-PDL, of land for development, is also used to estimate the overall value of the external impact of the development. For non-PDL, the model draws upon estimates of the external benefits of undeveloped land, reported in Table 7.10 of the ODPM study **Valuing the External Benefits of Undeveloped Land**. The model employs the mean average of the reported estimates of external benefits of 4 types of land: urban fringe (forested land), urban fringe (greenbelt), intensive agricultural land and extensive agricultural land.
- 10.8.3 For PDL, the external impact of development is assumed to be zero – this can be regarded as a conservative assumption, as we might expect redevelopment to bring external benefits through, for example, improving the aesthetic value of the area surrounding the development.
- 10.8.4 In practice, the external impacts of development are often highly locationally specific – they will vary substantially on a site-by-site basis. Users are therefore encouraged to draw upon alternative sources of evidence to inform estimation of external impacts of development.
- 10.8.5 As noted earlier, there is a further external impact of development to be considered in the overall valuation - the transport-related external impacts of development. These should be added to the non-transport-related external impacts discussed above – guidance on estimation can be found in Annex B.

11 Annex D: Modelling the Four Scenarios

11.1 Introduction

11.1.1 It is important to ensure that the model runs for the dependency test (step 1) are correctly specified and carried out. The following paragraphs outline some of the issues to be considered.

11.1.2 The dependency test requires the comparison of two scenarios:

- Scenario A – without the housing development and without any form of transport intervention; and
- Scenario B – with the housing development but without any form of transport intervention.

11.1.3 The Department recommends that both scenarios be modelled using standard modelling methods. In particular, the trip end growth constraints dictated by TEMPRO should be met and variable demand modelling should be used where appropriate. Where non-standard approaches are proposed, analysts should discuss this with the Department.

11.2 Modelling Scenario A

11.2.1 The key issue to be considered when modelling scenario A is how to apply TEMPRO trip end growth factors. As discussed above, TEMPRO combines official projections of population growth from the Office for National Statistics, CLG household forecasts and plans established by the regions in the RSSs to provide an internally consistent and geographically detailed database. Thus, TEMPRO should, in broadbrush terms, reflect planned housing growth and associated trip end growth.

11.2.2 Scenario A requires selected housing developments to be omitted. On the face of it, this suggests that the TEMPRO growth factors cannot be applied. However, analysis has shown that a major part of new household formation (and hence the demand for new dwellings) comes from existing households. Moreover, net immigration and longer distance internal migration are relatively limited, compared to within region migration. See, for example, “On the Economics of the Barker Review of Housing Supply” (Meen, G, 2005). This suggests that, although the number of dwellings and therefore households in this scenario may be less than specified in TEMPRO, the numbers of people and, to a first approximation, the numbers of trips made, will be as specified in TEMPRO.

11.2.3 Thus, the Department recommends that the TEMPRO trip end growth factors be used without making any adjustment for the omitted homes when modelling Scenario A.

11.3 Modelling Scenario B

11.3.1 The first step is to explicitly model each housing development that is expected to have a significant impact on level of service on the transport network and thus is likely to be dependent on a transport intervention. Guidance on this process is given in TAG Unit 3.15.2, **Use of TEMPRO data**. Briefly, the recommended approach is to model the number of trips generated by the housing development, then reduce the trip end growth factors to be applied to the non-development trips.

11.3.2 The area over which these adjustments should be applied must be considered carefully. For small development it may be appropriate to apply the constraints at district level or similar. However, for larger developments or groups of developments, as may be found in housing growth areas, a wider, sub-regional level may be appropriate.

- 11.3.3 A key issue to consider when modelling scenario B is whether variable demand modelling is needed. The Department recommends that the usual standards should be applied: if a fixed matrix analysis suggests that the housing development significantly increases network congestion, variable demand modelling of some sort should be applied. The application of variable demand modelling may suggest that the traffic generated by the housing development can be accommodated on the network. In that case, the housing development is not dependent and the appraisal of any transport intervention may follow standard guidelines, taking scenario B as the 'without scheme' scenario.
- 11.3.4 It may be argued that the application of variable demand modelling means that the new housing is imposing costs on existing transport users. This may be true, but is irrelevant. Growth in the number of households over time and its impact on user costs in the 'without scheme' scenario is an integral part of forecasting for standard scheme appraisal. Provided the overall level of service remains satisfactory, some increase in costs to existing users is acceptable. This guidance is intended to address circumstances, where specific, localised housing developments result in an unacceptable – and therefore unrealistic – level of service on the network.

11.4 Modelling Scenarios C and D

- 11.4.1 Modelling for scenarios C and D should follow standard modelling procedures. In each case, the analysis must add a transport intervention to the appropriate 'without scheme' network. Scenario C should build upon scenario B, with scenario D building on scenario A.