



Department
for Transport

TAG UNIT A2.1

Wider Economic Impacts Appraisal

September 2016

Department for Transport

Transport Analysis Guidance (TAG)

<https://www.gov.uk/transport-analysis-guidance-webtag>

This TAG Unit is guidance for the **APPRAISAL PRACTITIONER**

This TAG Unit is part of the family **A2 – WIDER ECONOMIC IMPACTS**

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1 Overview

1.1 Introduction

- 1.1.1 Within welfare analysis, economic impacts are primarily captured by the estimation of user benefits e.g. as a result of time savings. Under a well-defined set of circumstances user benefits will capture the entire welfare effects of a transport investment. However, if there are 'distortions' or market failures that mean the economy is not functioning efficiently, additional benefits (or disbenefits) will arise as the impact of transport improvements is transmitted into the wider economy. These are termed wider economic impacts and are the subject of the A2 series of units.
- 1.1.2 Research has shown that these wider economic impacts can be significant and can arise in a number of ways. These include productivity gains resulting from improvements in how well businesses are connected to each other as well as potential employees, and benefits arising from structural changes as businesses and households relocate.
- 1.1.3 This guidance sets out a framework for the investigation and assessment of these wider economic impacts. Underpinning this framework is a number of principles:
- (a) The economic impacts of transport investments are context specific; the type and magnitude of economic impacts which occur will depend upon the scheme type and more importantly the local attributes, such as workforce skills and the availability of land for development. Given the importance of context specificity, all assessments of economic impacts should be informed by a context specific Economic Narrative that will inform the analytical approach and appraisal Specification Report.
 - (b) Modelling and valuing wider economic impacts is complex and subject to a high degree of uncertainty. This uncertainty increases when quantifying land use change. Clear, consistent and transparent reporting are required to ensure that the risks associated with wider economic impacts analysis are fully communicated. All analysis that reports economic performance should be reported in the Economic Impacts Report and presented alongside the Transport Business Case.
 - (c) The Department's appraisal process is based on the principles of the HMT Green Book guidance, which advocates the use of cost benefit (welfare) analysis to determine value for money. Welfare analysis is used as it captures a broad range of impacts, such as economic, environmental and social. Whilst GDP and GVA are useful economic indicators of economic performance they are not a substitute for welfare based measures used to inform the assessment of Value for Money.
 - (d) Decision makers may have an economic objective to stimulate a local/regional economy, which may be more readily informed by GDP rather than welfare analysis: GDP estimates should be reported in the Strategic Case next to the relevant economic objective. To ensure economic impacts are consistently communicated across the transport business case, Welfare and GDP measures should be presented alongside each other and differences explained presenting a clear bridge between these related measures of economic performance. Methods for deriving one from the other are provided in this guidance.
 - (e) Land-use change arising from wider economic impacts can have feedback effects on the transport market which affect transport users, the environment and wider society. The guidance stresses the importance of capturing these feedback effects as a way of ensuring that the analysis is comprehensive.
- 1.1.4 This following guidance sets out how to develop the Economic Narrative and reporting requirements; the framework for quantifying and valuing both 'connectivity' and 'structural' wider impacts, with reference to the methodologies to capture the welfare associated with the most

significant market failures (TAG unit A2.2 to A2.4); and the approach that should be taken when considering supplementary economic modelling for schemes which are driving significant regeneration or transformational schemes (TAG Unit M5.3);

- 1.1.5 Box 1 provides a summary of the key information required for the appraisal of wider economic impacts with links to the relevant parts of WebTAG for more detail

1.2 This TAG Unit

- 1.2.1 This TAG Unit describes the considerations and processes required in the assessment of wider economic impacts:

- Understanding the source of economic impacts and the interactions of secondary (non-transport) and transport markets (section 2);
- Quantification of economic impacts (section 3);
- Valuation of economic impacts and the sources of additional benefits (section 4);
- Defining and justifying the scope of the analysis on the basis of the expected economic impacts and documenting analysis in transparent manner (section 5); and
- Reporting impacts in the value for money assessment and informing economic objectives in the Strategic Case (section 6).

Box 1: Summary of Key Information for Appraisal of Wider Economic Impacts

What do we mean by wider economic impacts?

Wider economic impacts refers to economic impacts which are additional to transport user benefits. They arise because market failures in secondary markets (non-transport markets), such as the labour and land markets, mean that the full welfare impact of a transport investment may not be reflected in the transport market.

Why does the Department care about welfare-based appraisal?

The purpose of transport appraisal is to estimate the welfare impacts of transport investment to satisfy the accounting officer responsibilities that public expenditure represents value for money; this is in accordance with the requirements of the Treasury's Green Book.

When should this guidance be used?

This guidance should be used throughout the process of wider economic impact appraisal. It should be followed from the very start of the process, when deciding the scope of the analysis, to ensure a proportionate and consistent approach is adopted to the transport appraisal.

Under what circumstances should wider economic impacts be appraised?

Wider economic impacts can be appraised whenever there are considered to be significant market failures in secondary markets (non-transport markets), which are likely to have a significant bearing upon the welfare impacts of a transport intervention.

The assessment of wider economic impacts should only be undertaken under the following circumstances:

1. it is proportionate to do so – see ‘Guidance for the Technical Project Manager’ for further information on proportionate appraisals; and
2. the appraisal is accompanied by an Economic Narrative – see section 5 for guidance on developing an Economic Narrative.

Under what circumstances should the impact of transport schemes on GDP be appraised?

GDP is not a substitute for welfare analysis; not all opportunity costs are reflected in GDP, and it is therefore only a partial measure of the full economic impact. It should only be used, if it is relevant, in assessing the extent to which economic objectives in the Strategic Case will be achieved.

Gross Domestic Product measures the value of marketable output during a given period of time. It is often used as a barometer of an area’s economic health. It is not necessary for GDP to be reported in Business Cases, as the economic impacts of a transport intervention should already be captured in the welfare assessment. GDP does not inform the value for money assessment and scheme’s which do not report estimates of GDP will not be at a disadvantage.

How should economy impacts be quantified and valued?

On the basis of the impacts which have been identified in the Economic Narrative, the relevant methodologies within the wider economic impacts chapters should be applied. These, together with the assessment of user benefits, environmental and social impacts, form the central estimate of the transport appraisal.

In specific circumstances supplementary economic modelling may be undertaken to produce sensitivity tests of the core WebTAG appraisal – see TAG Unit M5.3 for more information. Supplementary economic modelling may be undertaken in the following circumstances:

- To estimate the economy impacts associated with ‘transformational’ transport schemes, such as land use change.
- To estimate economy impacts not covered in WebTAG Units A1 and A2, for example productivity impacts arising from localisation economies;
- To obtain context-specific estimates for economy impacts in WebTAG Units A1 and A2, for example applying context-specific agglomeration elasticities; and
- SEM may also be undertaken to estimate sub-national economic impacts such as changes in local employment or GDP.

Under what circumstances will transport schemes expand the size of the national economy?

Transport investment can only expand the size of the national economy, if they have national supply-side effects. The most immediate supply-side of a transport investment is through its impact on transport capacity.

Transport investments may also induce supply-side effects of the other factors of production, such as the supply of labour. If there is no national supply-side effect, any local economic impacts related to these non-transport factors of production, such as higher levels of employment, will represent a displacement of activity from other locations.

With respect to supply-side effects of non-transport factors of production, the default assumption is 100% displacement; this applies for all types of economic modelling. The onus is on the scheme promoter to present credible evidence that the particular transport investment will affect a non-transport factor of production. If the scheme promoter is unable to present credible evidence of additionality, the particular economic impacts will be considered displaced from elsewhere. Within TAG Units 2.2 to 2.4, guidance is provided on evidence which could be provided to demonstrate a national supply-side impact.

How should the appraisal of economic impacts be reported?

The results of the welfare analysis should be reported in the Economic Case; if GDP has been estimated this should be reported in the Strategic Case and reconciled with the welfare estimates. See section 6 for more information.

The technical analysis, such as assumptions and modelling methods, should be reported in an Economic Impacts Reports, which accompanies the Business Case. The Economic Impacts Report is designed to improve transparency, so that analysis can be objectively scrutinised. For guidance on producing an Economic Impacts Report see section 5.

How should wider economic impacts inform a scheme's value for money assessment?

The Department for Transport recognises various types of analysis may be used to inform a value for money assessment, established monetised impacts, which are used to generate an initial metric, evolving monetised impacts used to generate an adjusted metric and indicatively monetised impacts and non-monetised impacts that are considered at the last stage of the assessment. Established monetised impacts, such as user benefits are included in the initial BCR, whilst valuation methods that are not considered sufficiently widely-accepted, well-researched or tried-and-tested to be definitive are included as sensitivity tests. No wider economic impacts are considered as robust as user benefits.

The following wider economic impacts are included in the adjusted metric:

- Labour supply impacts
- Static clustering
- Output change in imperfectly competitive markets

All other wider economic impacts should be reported as sensitivity tests within the value for money assessment – see value for money guidance for more information.

2 Understanding Economic Performance and Transport Investment

2.1 Introduction

2.1.1 This section outlines the transmission mechanisms through which transport improvements can impact the level and location of economic activity. The section is structured as follows:

- Section 2.2 explains the transmission mechanisms through which transport investments can impact the level and location of economic activity, and the importance of additionality;
- Section 2.3 summarises how economic impacts are captured in the Transport Business Case; and
- Section 2.4 outlines the role of GDP within the Transport Business Case

2.2 Transmission Mechanisms

2.2.1 This section outlines the mechanisms through which transport investment can impact the level and location of economic activity. These impacts will be context specific; the type and magnitude of economic impacts which occur will depend on the scheme type and more importantly the local attributes, such as workforce skills and developable plots. Given the importance of local attributes, complementary interventions, such as investment in skills and land zoning, may be required for the full potential of the transport investment to be realised. The rest of this sub-section presents the economic impacts of transport investment.

- 2.2.2 The direct effect of a transport investment is a change in accessibility, as measured by a change in generalised travel costs (GTCs), which can be observed in the transport market. Well targeted transport investments improve accessibility (reduced GTCs); in other words transport investments make travel between different locations easier.
- 2.2.3 The reduction in GTCs acts to raise productivity, as activities can be completed with fewer resources (time and financial).¹ Where the GTC reductions accrue to businesses this will directly impact economic performance (productivity increases).
- 2.2.4 GTC reductions are transmitted to secondary (non-transport) markets, as households and businesses change their behaviour in response to the new opportunities. The behavioural responses, such as induced investment and employment effects, will lead to changes in the level and location of economic activity – see Box 2 for summary of potential behavioural responses.
- 2.2.5 With the exception of static clustering, changes in secondary markets are associated with land use change (changes in the purpose or intensity of usage). For example, if a transport investment were to induce a housing developer to replace terraced housing with an apartment block (induced investment), this would be equivalent to an increase in the intensity of usage. Similarly, if a manufacturing business were to relocate from an urban to a rural area, it may involve a change in the purpose of land use, in the latter from agricultural to manufacturing.
- 2.2.6 Furthermore, for every scheme there will be a broad spectrum of responses, with the response of an individual transport user (household or business) dependent upon the specific context in which it operates. For example, a business operating in a market with elastic demand may find that it can profitably increase output, such that it either expands its operations on the existing plot (increased intensity of land use) or relocates to a new, bigger plot (change of land use purpose). Alternatively, a business, for which the delivery of output is not time critical may relocate, moving away from its customers to take advantage of lower rents in other areas with no change in the level of output or employment. The full spectrum of responses and impacts in secondary markets should be considered as part of the Economic Narrative.
- 2.2.7 Understanding these impacts in secondary markets is important – not least because any land use changes will change the demand for travel and hence accessibility. These feedback effects have the potential to change generalised travel costs and lead to further changes in behaviour and economic performance. An important role of the Economic Narrative is to understand the potential significance of these feedback effects and to consider how these can be represented in the modelling approach (see section 3 for further details).
- 2.2.8 Box 2 summarises the economic impacts which could occur in response to a reduction in transport costs.

Box 2: Summary of Economic Impacts

Impacts in the Transport Market

Generalised Travel Costs: accessibility changes as a result of transport investment.

Well targeted transport investments improve accessibility; in other words transport investment makes travel between different locations easier. Improvements in accessibility are measured by changes in

¹ Note only changes in generalised travel costs as a result of a transport capacity improvement (supply-side effect) will increase productivity at the national level. When reductions in generalised travel costs are the result of transfers, such as taxes, subsidies or reduced profits, there will be no increase in productivity at the national level.

generalised travel costs (GTCs). The reduction in GTCs will affect transport outputs, such as trip frequency, distribution, time period and mode choice.

Impacts in Secondary (non-transport) Markets

Induced Investment: changes in the productive capacity of the economy as a result of a transport investment. The change in attractiveness affects households' and firms' location decisions, it may also affect firms' opinions about the desired level of activity. Induced Investment changes land use, in terms of purpose or intensity of usage.

Employment Effects: changes in the level or location of employment. Changes in induced investment will affect firms demand for employment, in terms of the level and/or location, all else equal. The initial change in accessibility will also affect households' supply of labour, through the effect of the GTC reduction on the real wage. The employment effects are also associated with land use change, as land must be used more intensely or brought into production to accommodate the increased number of workers. It should be noted that if there is no change in the supply of labour at the national level, increased employment in one firm, locality or region will be at the expense of others; this is referred to as displacement. Nevertheless, even with displacement the relocation of employment may have productivity effects.

Agglomeration Economies: productivity is affected by the density of economic activity; this is a one of the reason for the existence of cities and specialised cluster, such as financial hubs (Venables et al. 2014). The productivity impacts may occur within or across industries, termed localisation and urbanisation economies respectively. Agglomeration economies are externalities and so are not reflected in transport markets.

Transport investments can increase the density of economic activity through two mechanisms:

- i. **Static clustering:** The density of economic activity can be affected by changes in generalised travel costs which brings firms and employees effectively closer together. Reductions in generalised travel costs will increase productivity arising from static clustering and vice versa.
- ii. **Dynamic clustering:** the physical density of economic activity can change as a result of changes to either the level or location of economic activity. Note that if there is a relocation of economic activity, the increased productivity in the area gaining jobs will be at the expense of those losing jobs but the total change in productivity need not sum to zero. Only an increase in jobs at the national level will have an unambiguous positive effect on productivity arising from dynamic clustering.

2.3 Capturing Economic Impacts in Transport Appraisal

2.3.1 The Department's appraisal process is based on the principles of the HMT Green Book guidance, which advocates the use of cost benefit (welfare) analysis to determine the value for money of investment spend. Welfare analysis captures a broad range of impacts, such as economic, environmental and social.

2.3.2 Within welfare analysis economic impacts are primarily captured by the estimation of user benefits – see User and Provider Impacts (A1.3). Under a well-defined set of circumstances user benefits will capture the entire welfare effects of a transport investment; these conditions are that the rest of the economy is operating perfectly efficiently. The methodology to value user benefits using the 'rule of a half' provides the best approximation when feedback effects into travel demand as a result of land use change are not significant. Whilst improvements in transport may be transmitted into the wider economy (e.g. reduction in business costs being passed onto consumers as lower prices) under these assumptions such changes are simply transfers and net out in aggregate and can be ignored (Venables et al 2014).

2.3.3 These conditions fail if there are (a) significant feedback effects into the transport market as a result of land use change or (b) ‘distortions’ or market failures which mean the economy is not functioning efficiently. In these situations additional benefits (or disbenefits) may arise when the impact of transport improvements is transmitted into the wider economy.

Land Use Change

2.3.4 The ‘rule of a half’ methodology that is used to estimate user benefits is less accurate where land use change is significant. For the majority of schemes assuming ‘fixed land use’ transport user benefits will not materially impact upon the value for money assessment, as land use change and the resultant feedback effects to the transport market are unlikely to be significant in the overall context of the appraisal. There may be a small number of business cases which are predicated on land use change, for example where journey costs changes are large where the missing user benefits could be significant. It is not possible to determine a priori either the magnitude of the missing user benefits and user costs or whether these would increase or reduce the user benefits, estimated with fixed land used. The missing user benefits may be approximated by land value uplift in the case of dependent development or through supplementary economic modelling – see sections 3 and 4 for more details.

2.3.5 If significant land use change is forecast, this will also have effects for the appraisal of transport external costs and non-economic impacts. For this reason care should be taken to ensure these impacts are appraised consistent with the do-something and do-minimum land use – see A2.2 Induced Investment for guidance on transport external costs under land use change, Environmental Impacts (A3), and Social and Distributional Impacts (A4).

2.3.6 The focus of the units A2.2 to A2.4 is the identification, quantification and valuation of those additional benefits, which arise due to ‘distortions’ and market failures: the additional benefits are termed wider economic impacts because they are estimated by analysing changes in non-transport markets.

Distortions/Market Failures

2.3.7 Market failures and distortions, which cause markets to function inefficiently, are observed through the divergence of private costs and benefits experienced by individuals or businesses and the costs and benefits to society at large. User benefits capture the private costs and benefits, while wider economic impacts capture changes in the divergence. Box 4 summarises the different types of wider economic impacts within each of the A2 units and the associated market failures and distortions; for a definition of the associated distortions and market failures refer to the relevant A2 unit.

2.3.8 The guidance provides methodologies to capture the welfare associated with the most significant market failures and distortions in secondary markets. However, there could potentially market failures, such as coordination failures and localisation economies (Venables et al. 2014). In addition, the methodologies are scheme neutral, such that they may not fully reflect the specific context of a particular transport investment. For guidance on estimating wider economic impacts not captured in TAG Units A2.1 to A2.4 or applying more context specific evidence in appraisal see TAG Unit M5.3.

Box 4: Summary of Wider Economic Impacts and the Associated Market Failures

Induced Investments (A2.2)

Dependent development: Refers to a residential or non-residential development on a specific plot, which can only proceed with a complementary transport investment, and is therefore dependent on the transport scheme.

Associated distortions and market failures: coordination, land rationing and imperfect competition

Output change in imperfectly competitive markets: In markets which are dominated by a few suppliers, prices may be above and the quantity below that which would occur in competitive markets. Transport investment may induce a price reduction and increase in the quantity supplied, through its impact upon firms' cost base.

Associated distortions and market failures: market structure

Employment Effects (A2.3)

Labour supply impacts: Transport investment may induce those who are economically inactive to enter the labour market. This is because the reduction in travel costs increases the effective return to work. Thus, a change in employment is associated with a change in tax revenue.

Associated distortions and market failure: tax wedge

Move to more/less productive jobs: Productivity varies across the country, due to a variety of factors such as agglomeration and natural capital. If a transport scheme causes a relocation of jobs, this may lead to a change in productivity, for example, if jobs were to move from an area of low to high productivity. The decision of employees and employers to relocate is assumed to be made on the basis of net rather than gross wages and profit, respectively. Thus, a change in employment is associated with a change in tax revenue.

Associated distortions and market failure: tax wedge

Productivity Impacts (A2.4)

Agglomeration impact: Agglomerations are an external economy of scale, in which a firm's productivity is affected via its proximity to other firms. Thus if firms become effectively closer together, their productivity will increase. Transport investment can affect agglomeration economies through two distinct channels, as noted above: (1) static clustering - Transport investment can change the density of economic activity by bringing firms and employees effectively closer together, thereby facilitating interactions; and (2) dynamic clustering - induced investments will change the absolute size of the cluster, thereby facilitating interactions.

Associated distortions and market failure: agglomeration externality

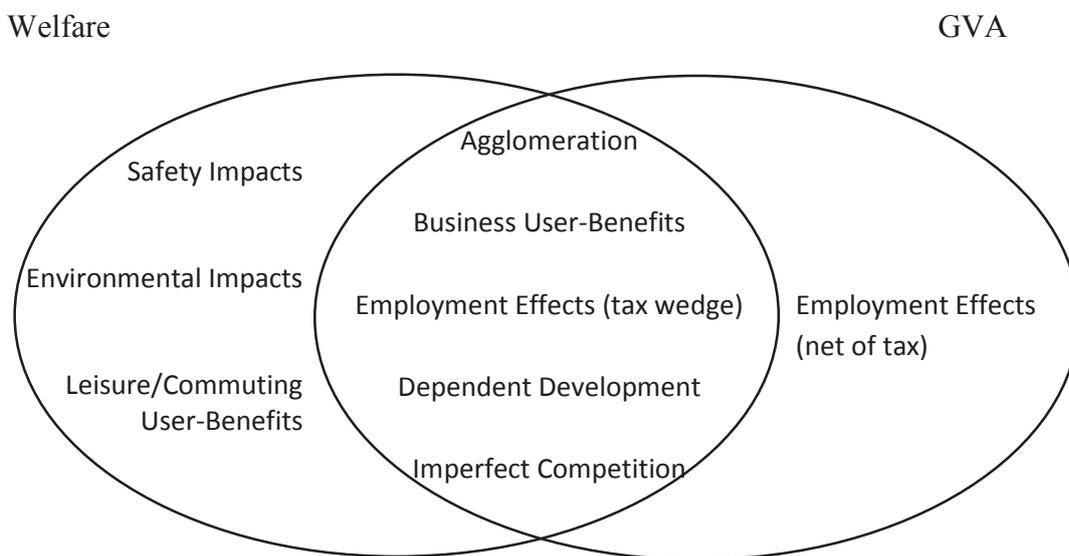
2.4 The role of GDP and other economy metrics in transport appraisal

- 2.4.1 In certain circumstances GDP analysis may be reported in the Strategic Case: the Strategic Case may contain an economic objective, such as to stimulate a local/regional economy, which may be more readily informed by GDP than welfare estimates.
- 2.4.2 Gross Domestic Product (GDP) measures the value of marketable output during a given period of time and is often used as a barometer of an area's economic health. It is not necessary for GDP to be reported within the Transport Business Case, as the economic impacts of a transport investment should already be captured in the welfare analysis. However, in specific circumstances GDP analysis may be presented in the Strategic Case to supplement welfare analysis.
- 2.4.3 Figure 1 is a stylised representation of the welfare and GDP effects associated with the impacts of transport investment; impacts are grouped according to whether they affect welfare, GDP or both. The latter includes only those impacts, for which the welfare and GDP changes are unambiguously equivalent and includes business user benefits and all wider economic impacts.
- 2.4.4 Business user benefits are a welfare impact which also affect GDP through improving productivity in the economy. However the relationship between GDP and welfare from other impacts is more

complex. For example a commuter travel time reduction, which induces someone into the labour market. The impact of that additional job on GDP is the value of the output of that job. However the benefit to the individual (welfare) is smaller. They have gained the wage from their job, but they now have to spend time and money commuting, they have lost leisure time and so on.

- 2.4.5 Indeed the benefit to the individual can be no greater than the value of the commuter travel time reduction – otherwise they would not have needed the time saving brought about by the transport improvement to enter the labour market. This is why commuter user benefits capture the welfare effects, and GDP impacts are not necessarily additional.
- 2.4.6 At the same time it is not always true that commuter travel time reductions will result in an increase in GDP. The commuter may choose to enter the labour market, or work more (which will have an impact on GDP), but they could equally choose to use devote the time savings to more leisure time (which has an impact on welfare, but not on GDP). For this reason commuter and leisure user benefits are not considered equivalent to GDP.
- 2.4.7 The only impacts which are additional to user benefits in both welfare and GDP are the result of distortions and market failures in secondary markets – wider economic impacts. In the example of a commuter entering the labour market, there is a distortion introduced by taxation; introducing a ‘wedge’ between the private benefit to the individual worker (i.e. their take home pay) and the value of what they produce to society (i.e. the value of goods and services they produce).
- 2.4.8 The value of the commuter user benefits reflects the private benefit of that person entering the labour market. However the increase in what is produced (GDP) and its value to society (welfare) is greater than the private benefit by the value of the tax distortion.

Figure 1: The Links between Welfare and Gross Domestic Product



2.4.9 The discussion above raises a number of important implications:

- Increases in economic activity do not necessarily demonstrate that “user benefits” fail to capture all benefits, rather that measures of GDP may fail to capture all of the opportunity costs.

- Wider economic impacts arise from market failures and distortions in secondary (non-transport) markets. It is only by identifying and understanding these market failures and distortions that robust estimates of these additional benefits can be estimated.
- Forecasts of GDP increases will include estimates of user benefits which have been subsequently transmitted into the economy.

2.4.10 GDP and welfare are not additive, and this guidance reflects this. Impacts on welfare (over and above user benefits) will only occur where distortions or market failures lead to differences between the private costs and benefits and social costs and benefits.

3 Quantifying Economic Impacts

3.1.1 This section summarises some of the key considerations when modelling the economic impacts of transport investment. The modelling approach selected should be informed by the Economic Narrative which sets out the mechanisms through which a scheme might impact on the economy. A key decision in selecting the appropriate approach is whether supplementary economic modelling is required in addition to a transport model. This will depend on whether significant land use changes are anticipated and/or further evidence is required on the prevalence and scale of market failures and distortions in the wider economy. It is important that when supplementary economic modelling is undertaken that key uncertainties are understood and assumptions about complementary investments clearly described.

3.1.2 The rest of this section is structured as follows:

- Section 3.2 introduces the different levels of analysis;
- Section 3.3 outlines the different scenarios which informs the transport model runs required to estimate wider economic impacts;
- Section 3.4 summarises the circumstances in which supplementary economic models may be applied in appraisal;
- Section 3.5 provides overarching principles which should be followed in cases of complementary interventions; and
- Section 3.6 outlines the importance of choosing an appropriately sized study area to minimise displacement.

3.2 Levels of Analysis

3.2.1 Transport investments can have a variety of impacts, not all of which are economic. In addition to user benefits and wider economic impacts, transport investments may be associated with Transport External Costs, Environmental, and Social and Distributional Impacts – these are defined in A2.2, A3 and A4 respectively.

3.2.2 The valuation of all these impacts requires the outputs from transport model runs: model runs of different scenarios will be needed when exploring the impact of land use change – see section 3.3. The impacts and scenarios from which they are derived are included in different levels of analysis.

3.2.3 There are three levels of analysis (outlined below), which are differentiated on the basis of the maturity of the analytical techniques:

- Level 1 includes a range of impacts which assume fixed land use with the exception of wider economic impacts.
- Level 2 includes wider economic impacts which assume fixed land use (connectivity impacts) or do not require land use change to be explicitly quantified.
- Level 3 includes analysis in which either land use change is explicitly quantified (structural impacts) or supplementary economic modelling has been conducted.

3.2.4 The levels are sequential and all Transport Business Cases should start with Level 1 and build upon this; the level of analysis conducted will depend on the economic impacts and market failures identified in the Economic Narrative. The use of levels has a number of benefits:

- Proportionality: The impacts included in levels 2 and 3 rely on increasingly complex analysis and in most cases their assessment may be neither proportionate nor relevant.
- Maturity of methodologies: The levels of analysis reflects the approach taken in the value for money assessment, in which impacts are differentiated on the basis of analytical maturity and the level of uncertainty around the scale of the impacts.
- Identify source of benefits: In deciding the required level of analysis, one needs to identify the individual impacts.

3.2.5 Within each level and for any given scenario consistent assumptions about land use change should be applied to the analysis of all relevant impacts (i.e. identified and justified in the Economic Narrative) with the potential exception of Level 3. In levels 1 and 2, land use is fixed and consistent between the 'do-minimum' and 'do-something' forecasts, whilst in the case of level 3, land use may vary between the 'do-minimum' and 'do-something' forecasts.

3.2.6 The requirement for consistent assumptions of land use change has the following implications:

- Only those impacts, including non-economic impacts, which can be estimated with the fixed land use assumption should be included in Levels 1 and 2; and
- In Level 3 analysis, for any given scenario all impacts must be estimated using a single land use change forecast. With the exception of user benefits, all Level 1 and 2 impacts should be re-estimated using the transport model outputs from a model run which has both the do-something transport schemes and details of land use change (see Section 3.3 for more detail).
- In Level 3 analysis, user benefits should be estimated with the fixed land use assumptions from Level 1 analysis; as mentioned in section 2 this will proxy for user benefits with variable land use.

3.2.7 The wider economic impacts, captured in TAG Units A2, can be divided into three distinct groups on the basis of land use change – summarised in Table 1. This determines within which level of analysis they are included:

- Static clustering, labour supply impacts and output change in imperfectly competitive markets are included in level 2 analysis.
- Dynamic clustering, move to more/less productive jobs and dependent developments are included in level 3 analysis.
- Labour supply impacts and output change in imperfectly competitive markets can also be estimated with variable land use assumptions and if this done they should also be included in level 3 analysis.

Table 1: Quantification of Economic Impacts in WebTAG and land use assumptions

	Fixed Land Use	Implicit Land Use Change	Explicit Land Use Change
User Benefits	✓		

Static Clustering	✓		
Labour Supply Impacts		✓	
Output Change in Imperfectly Competitive Markets		✓	
Move to More/Less Productive Jobs			✓
Dynamic Clustering			✓
Dependent Development			✓

3.3 Transport Models

- 3.3.1 Transport models should inform the core scenarios of all appraisals – for information on model development see Guidance for the Modelling Practitioner. They are required to estimate measures of accessibility (generalised travel costs), which are inputs to the assessment of user benefits, wider economic impacts, transport external costs (relevant in cases of variable land use) and supplementary economic models.
- 3.3.2 If significant land use change is forecast, the impact of this on trip distribution and generation **must** be captured in the transport model and the subsequent transport appraisal. This is to ensure the transport flows reflect the behavioural response, in order that the transport externalities, such as congestion, local air pollution and carbon emissions, are measured on a consistent basis with the economic impacts. Note user benefits will continue to be estimated assuming fixed land use, as the current methodology is inappropriate in cases of significant changes in land use. See section 4 for more detail on the valuation of impacts.
- 3.3.3 There are four ‘model-runs’ referenced for the estimation of the impacts of transport investment – Table 2. The relevance of these scenarios to any given transport appraisal is dependent upon the expected impact of the transport investment on land use, as identified in the Economic Narrative. The ‘model-runs’ relevant to each level of analysis are as follows:
- Level 1 assumes fixed land use and requires model runs of A and D.
 - Level 2 applies the fixed land use assumption in the transport model and requires model runs of A and D.
 - Level 3 assumes variable land use and requires model runs of scenarios A and C. In addition, user benefits should continue to be estimated on the basis of fixed land use and will require model runs of A and D.
- 3.3.4 In the case of Dependent Development model run ‘B’ is required for the dependency test and is subsequently revised, ‘A’, to account for non-dependent traffic – see TAG Unit A2.2 for guidance on undertaking dependency tests and developing the ‘*do minimum*’ scenario A’.

Table 2 – Combinations of Model Runs – with/without land use change and the transport scheme

	Without Land Use Change (Fixed Land Use)	With Land Use Change (Variable Land Use)
Without transport scheme	A	B
With transport scheme	D	C

3.4 Supplementary Economic Models (SEM)

3.4.1 Where considerations of land use change are required, supplementary economic models may be utilised in analysis. SEMs refer to a broad group of models, such as SCGE and LUTI models, the results of which could inform the value for money (VfM) assessment. The weight attached to analysis derived from SEMs in the VfM assessment will depend upon the quality and uncertainty of the analysis; this will be determined by an assessment of the extent to which the principles in TAG Unit M5.3 have been followed. It is, therefore, imperative the analysis is transparently reported – see section 5 for guidance on reporting impacts.

3.4.2 Supplementary economic modelling may be undertaken to obtain estimates of welfare effects of a particular transport investment for a number of different reasons:

- i. To quantify and value user benefits under significant land use change;
- ii. To obtain/apply more context specific estimates of welfare impacts than provided by the methodologies in the A2 guidance, such as mode specific agglomeration elasticities;
- iii. To capture a broader range of wider economic impacts than those provided for in the A2 guidance, such as localisation economies; and
- iv. SEM may also be utilised so as to estimate sub-national impacts, such as changes in local employment and GDP.

3.4.3 The choice of which supplementary model to apply in appraisal will depend upon the particular impact to be analysed. For this reason, it is essential that the modelling choice is justified in the Economic Narrative and reported in the Appraisal Specification Report (see Guidance for Technical Project Manager). The design of the transport model and economy model will need to be considered jointly, to ensure any interface issues are appropriately managed. Further information on the use of supplementary economic models can be found in TAG Unit M5.3.

3.5 Complementary Interventions

3.5.1 As outlined in section 2.2, transport investment directly affects accessibility, which may induce changes in secondary (non-transport) markets. Nevertheless, transport is only one factor which influences individuals' and businesses' decisions and complementary investments, such as the granting of planning permission by local authorities or policies to develop the skills of the local workforce, may be required to fully realise any induced changes. A consideration of complementary interventions may be particularly important for regeneration and transformational schemes. However, if the complementary investment exists in the do-minimum (as defined in TAG unit M4) then standard appraisal guidance should be followed.

3.5.2 Where complementary investments are identified as relevant to the appraisal, these should be set out in the Economic Narrative along with details on their current planning and funding status.

The core scenario

3.5.3 The core scenario should be constructed in line with the guidance in TAG Unit M4 'Forecasting and Uncertainty', and should assume that the transport investment occurs without any complementary investments.

Where complementary investment is not dependent on the scheme

3.5.4 Alternative scenarios should be constructed to understand the potential implications of complementary investments on the impacts of a scheme – these complementary investments should be added to both the do minimum and do something cases. In determining the weight to attach to these alternative scenarios the analyst should provide an assessment of the likelihood of the complementary investments arising. In line with the principles outlined in unit M4, this assessment should be supported by evidence on the planning and funding status of these interventions.

3.5.5 Analysis of alternative scenarios can be used to determine the sensitivity of the value for money case to complementary investments by considering how likely these investments would need to be for their inclusion to change the value for money assessment. One method to test this - outlined in footnote [2] – is to calculate the expected value of a scheme under different assumptions about the likelihood of these complementary investments being implemented. This information should be used alongside evidence on the likelihood of complementary investments occurring to inform the value for money judgement.

Where complementary investment is dependent on the scheme

3.5.6 Where complementary investment is dependent on the transport investment, TAG Unit A2.2 should be used to appraise the impacts of dependent development associated with a transport scheme.

Where expenditure decisions are linked together

3.5.7 Where a number of expenditure decisions are linked together and the costs or benefits are mutually dependent, the overall proposal should be appraised as a package, in line with Green Book guidance (see HMT (2013)) For the purposes of a business case seeking DfT approval, only the costs to the broad transport budget should be put in the PVC, with other costs represented as a dis-benefit in the PVB.

3.5.8 For further information on scenario testing see Forecasting and Uncertainty M4.

2 The expected net present value from the transport investment can be calculated using the formula in the table below, by multiplying each outcome by its associated probability. NPV(scheme | complement) is the NPV of the scheme from an appraisal where the complement is in both the without and with-scheme cases, whereas NPV(scheme | no complement) is the NPV of the scheme from an appraisal where there is no complement. The former should capture the positive interaction between the transport investment and other complementary investment. The expected BCR can be calculated in an analogous way.

NPV of scheme	$0.3 \times \text{NPV}(\text{scheme} \mid \text{complement}) + 0.7 \times \text{NPV}(\text{scheme} \mid \text{no complement})$
BCR of scheme	$\frac{0.3 \times \text{PVB}(\text{scheme} \mid \text{complement}) + 0.7 \times \text{PVB}(\text{scheme} \mid \text{no complement})}{0.3 \times \text{PVC}(\text{scheme} \mid \text{complement}) + 0.7 \times \text{PVC}(\text{scheme} \mid \text{no complement})}$

3.6 Size of Geographical Study Area and Displacement

- 3.6.1 Key to any assessment of wider economic impacts is displacement. As mentioned in section 2, transport investment may induce a relocation (displacement) of economic activity such that an economic impact in one local area is at the expense of another; in other words a local impact may not be equivalent to the national impact. Deriving the national (United Kingdom) impact is important because this is the geographical level at which the value for money assessment is conducted.
- 3.6.2 Transport investment can only expand the size of the national economy if they have national supply-side effects. The most immediate supply-side effect of a transport investment is through its impact on transport capacity.
- 3.6.3 Transport investments may also induce supply-side effects of the other factors of production, such as the supply of labour. If there is no national supply-side effect, any local economic impacts related to these non-transport factors of production, such as higher levels of employment, will represent a displacement of activity from other locations.
- 3.6.4 With respect to supply-side effects of non-transport factors of production, the default assumption is 100% displacement; this applies for all types of economic modelling. The onus is on the scheme promoter to present credible evidence that the particular transport investment will affect a non-transport factor of production. If the scheme promoter is unable to present credible evidence of additionality, the particular economic impacts will be considered displaced from elsewhere. Within TAG Units 2.2 to 2.4, guidance is provided on evidence which could be provided to demonstrate a national supply-side impact.
- 3.6.5 Where the study area is small it is more likely to miss the full extent of displacement. This is because the analysis will fail to capture the behavioural responses of households and firms outside of the study area. Thus, the study area should be sufficiently large that it captures behavioural responses – for further information see M2 – Variable Demanding Modelling.

4 Valuing Wider Economic Impacts

4.1 Introduction

- 4.1.1 The Department's appraisal process is based on the principles of the HMT Green Book guidance. Cost benefit (welfare) analysis is used to determine the value for money of investment spend. Cost benefit analysis is the preferred approach because it captures a broad range of impacts, such as economic, environmental and social, thereby demonstrating the effect of a transport investment on welfare. In certain circumstances, GDP analysis may supplement the welfare analysis in the Transport Business Case. In this section we only consider how economic impacts are captured, for guidance on capturing non-economic impacts see A3 – Environmental Impacts and A4 – Social and Distributional Impacts. This section is structured as follows:
- Section 4.2 outlines the approach to value economic impacts in welfare analysis;
 - Section 4.3 outlines how the user benefits associated with land use change may be approximated through Supplementary Economic Modelling or by land value in the case of dependent development;
 - Section 4.4 outlines which of wider economic impacts captured in WebTAG and which are additional to one another; and
 - Section 4.5 outlines the circumstances in which GDP analysis can be used to supplement welfare analysis.

4.2 Welfare Analysis

- 4.2.1 As mentioned in section 3, analysis of wider economic impacts should be presented at levels of increasing complexity. This section sets out where the different wider economic impacts should be reported within the levels of analysis; wider economic impacts are only included in level 2 and 3 analysis due to the maturity of the analytical techniques.
- 4.2.2 For the most part the wider economic impacts within TAG Units A2.2 – A2.4 are additional; the result from estimating one wider economic impact can be added to that of another without the risk of **double-counting**. However, there are two key exceptions – these are reflected in the sensitivity tests of Level 3 outlined below:
- Dynamic clustering is not additional to static clustering, as the latter is implicitly captured in the former – see TAG Unit A2.4.
 - Land value uplift, the methodology to value dependent developments, is not additional to other wider economic impacts occurring within that development, as there could be potential double-counting – see section 4.3.

Level 1: Assessment of impacts with fixed land use

- 4.2.3 The starting point for all transport appraisal is the estimation of user benefits with fixed land use; this forms the basis upon which all subsequent analysis builds.
- 4.2.4 Note: only those Environmental Impacts, and Social and Distributional Impacts, which are included in the initial BCR, should be included in Level 1 analysis – see TAG Unit A1.1 for information on the reporting of Environmental, and Social and Distributional Impacts within the value for money assessment.

Level 2: Assessment of wider economic impacts with fixed land use (connectivity impacts)

- 4.2.5 Some schemes may wish to build on Level 1 to include wider economic impacts and *other* impacts, which can be estimated without the explicit quantification of land use change. In the case of wider economic impacts these should use the standard assumptions set out in TAG Units A2.2 – A2.4 for static clustering, labour supply impacts and output change in imperfectly competitive markets, with decision of which to include justified in the Economic Narrative.

Level 3: Assessment of impacts utilising context specific parameters or variable land use (structural impacts)

- 4.2.6 Within Level 3 there are four potential sensitivity tests that may be conducted. Three of these sensitivity tests (dependent development, dynamic clustering and the move to more/less productive jobs, and full variable land use) relate to the explicit quantification of land use, whilst the fourth relates to the use of supplementary modelling.
- 4.2.7 In the case of explicit quantification of land use change all impacts, with the potential exception of user benefits, should be re-estimated to test their sensitivity to the land use assumption; as mentioned above, unless supplementary modelling is conducted, user benefits should be estimated assuming fixed land use.

Dependent Development

- 4.2.8 In the case of dependent development, only user benefits should be estimated assuming fixed land use, all other impacts should be estimated under variable land use. Wider economic impacts associated with non-land market failures should be carefully considered as part of the economic narrative due to potential double counting (see section 4.3 for more information).

Dynamic Clustering and the Move to More/Less Productive Jobs

- 4.2.9 When estimating dynamic clustering and the move to more/less productive jobs, all other wider economic impacts, with the exception of static clustering can be included in the analysis: static clustering is implicitly captured within the estimation of dynamic clustering. Thus the estimation of total benefits will include wider economic impacts which explicitly quantify land use change as well as those which do not.

Full Variable Land Use

- 4.2.10 As discussed in section 2, the 'rule of a half' methodology is less accurate for the estimation of user benefits in the case of variable land use. If a supplementary user benefits methodology is used, the results should be reported as a sensitivity test to those derived from the 'rule of a half' methodology under the fixed land use. In addition, all impacts in the sensitivity test should be estimated assuming variable land use.

Supplementary Economic Modelling

- 4.2.11 Supplementary Economic Modelling utilises alternative methodologies and evidence than that contained in TAG Units A2.2 – A2.4 and could be used to assess wider economic impacts under either fixed or variable land use.
- 4.2.12 Supplementary Economic Modelling may be undertaken if either market failures not captured in the wider economic impacts guidance have been identified or there are alternative sources of evidence which are considered more appropriate to the specific scheme context. In the case of alternative evidence sources or methodologies, the results should be reported alongside those derived from the standard approaches in TAG Units A2.2 – A2.4 – see section 6 for more information.
- 4.2.13 Note in the case of variable land use, transport external costs should also be included in the estimation of total benefits.

4.3 User Benefits and Land Value Uplift

4.3.1 This section outlines how the user benefits associated with land use change may be approximated by land value uplift in the case of dependent development or through supplementary economic modelling.

Land Value Uplift

4.3.2 Land value uplift measures the difference between the price of land in its new and former uses and represents the private gain to land owners. It should only ever be used in the appraisals of dependent development.

4.3.3 Land value uplift will capture any impacts which are capitalised into land values. It could potentially capture any of the following impacts: user benefits, land market distortions and other wider economic impacts, such as agglomeration economies that occur within that development.

4.3.4 In the case of dependent development the associated land value uplift will capture user benefits to new residents, which are missing from user benefits estimated under fixed land use; these can be considered additional to the fixed land use user benefits estimated via the 'rule of a half' methodology. Land value uplift will also capture any distortions and market failures in the land market. However there are significant drawbacks with the use of land value uplift in transport appraisal:

1. Theory suggests the relationship between land rents and GTCs is ambiguous; land rents need not necessarily increase in response to GTC reductions, the response will depend upon the elasticity of substitution between land and other consumption goods (Amott et al., 1981)
2. Land value uplift will capture any impacts capitalised into land, such that causal factors are ambiguous: it could potentially include the welfare associated with wider economic impacts and complementary interventions, which could potentially lead to double-counting or the false attribution of benefits respectively. For this reason consideration should be given in the Economic Narrative on the degree to which there is an overlap between land value uplift, direct transport benefits and other wider economic impacts; and
3. Land value uplift is a local site specific measure, as such it will not account for the loss of land value on other sites, which will occur if there is a relocation of economic activity. In other words it fails to account for displacement. Furthermore, there is a lack of robust evidence on displacement factors – the extent to which land value uplift at one specific plot is at the expense of another area – which could lead to inaccurate estimates of the net land value change.

4.3.5 For these reasons, the quality of land value uplift as a measure of welfare is considered low and only included as sensitivity analysis within the value for money assessment – see section 6 for details on reporting the land value uplift associated with dependent developments.

Supplementary Economic Modelling

4.3.6 For regeneration and transformational schemes, in which transport is only one of a number of interventions or the land use impacts are expected to be diffuse over the study area, it may be appropriate to undertake supplementary economic modelling.

4.3.7 Some supplementary economic models have the potential to quantify and value the user benefits associated with variable land use. However, due to the uncertainty surrounding these models, the results should be reported as sensitivity tests within the value for money assessment – see section 6 for more details on reporting the result from Supplementary Economic Models.

4.3.8 As mentioned in section 3, if significant land use change is forecast, the impact of this upon trip distribution and generation must be captured in the transport appraisal. This is to ensure the transport appraisal tells a consistent story in terms of the impact of the transport investment upon induced investment, employment effects and dynamic clustering and the transport network. This will ensure the transport flows and externalities, such as local air pollution and carbon emissions, accurately reflect the second round effects

4.4 Gross Domestic Product Analysis within the Transport Business Cases

4.4.1 Indicative estimates of GDP can be derived from the welfare methodologies laid out in the WebTAG A1 and A2 chapters; it does **not** require separate modelling. Table 4 demonstrates how the welfare estimates, derived from WebTAG, methodologies, relate to changes in GDP. For example, welfare analysis considers the benefits to all transport users (businesses, commuters and leisure travellers) but only business user benefits are considered commensurate to a change in Gross Domestic Product: leisure and commuter user benefits are not considered to change GDP because it is unclear the extent to which the former translate into economic impacts.

4.4.2 The GDP change can also be estimated using supplementary economic modelling. In such instances, the corresponding welfare change should be derived – see Supplementary economic modelling M5.3 for guidance on estimating GDP and deriving welfare estimates.

4.4.3 If the GDP change is estimated, only the net present value should be reported in the Strategic Case: the GDP analysis should adopt the same appraisal period and discount rate as that of the welfare analysis.

Table 4: Relation of Welfare to GDP		
	Welfare Impact	GDP
User benefits (1.3)	User benefits from business, commuting and leisure trips	Business User benefits
Induced Investment (A2.2)		
Dependent Development	Land Value Uplift	Additionality Modelling required – see SEM unit (M5.3)
Output Change in Imperfectly Competitive Markets	10% of Business User benefits	10% of Business User benefits
Employment Effects (A2.3)		
Labour Supply Impacts	40% of change to GDP (tax revenue)	GDP
Move to More/Less Productive Jobs	30% of change to GDP (tax revenue)	GDP
Productivity Impacts (A2.4)		
Agglomeration Economies (incl. static and dynamic clustering)	Agglomeration Impacts	Agglomeration Impacts

5 Documenting Analysis – Economic Impacts Report

5.1.1 All Transport Business Cases which have economic objectives should be accompanied by an Economic Impacts Report (EIR). The purpose of the EIR is to improve the transparency of economic impacts analysis within the Transport Business Case, in order that it can be objectively scrutinised. Improving the transparency of economic impacts analysis is important for a number of reasons:

1. Consistency between the Strategic and Economic Cases: The Strategic and Economic Cases report the results of alternative approaches to value economic impacts, GDP and Welfare respectively. Because the approaches measure a common impact, for any given scenario the Strategic and Economic Cases should use a consistent set of assumptions and forecasts in terms of the magnitude, nature and location of the economic impact, to ensure the Transport Business Case presents a consistent narrative. For example, the core scenarios of GDP and welfare analysis within a Business Case should have a single consistent forecast of employment effects.

2. Contextual Information: Economic impacts are context specific; they depend on the location's characteristic and the particular transport investment. The justification for the analytical scope and the methodological approach adopted is important to understand the appropriateness and relevance of the analysis.

3. Uncertainty Analysis: The results of all analysis are subject to varying degrees of uncertainty, as a result of the underlying assumptions and parameters. The sensitivity of results to the underlying assumptions is key to understanding the analytical risks.

4. Quality of Analysis: The results of all analysis are subject to the quality of the methodologies used. Therefore the methodology should be transparently reported, such that its robustness and appropriateness can be examined and its inherent uncertainties can be distinguished from other potential weaknesses in the analysis.

5.1.2 The Economic Impacts Report should contain an Economic Narrative, which defines the scope of the analysis, and technical analysis in order that stakeholders understand the derivation of the results and the key factors driving those results. Sections 5.2 and 5.3 provide guidance on producing an Economic Narrative and the type of technical information to be reported.

5.2 Economic Narrative

5.2.1 The economic impacts of transport investment are context specific, which has two implications:

- i. The inclusion of economic impacts within transport business cases should be considered an integral part of the appraisal design and not an add on at the end of the process; and
- ii. When applying WebTAG in scheme appraisal, the approach taken should be selective and not mechanical; it should be applied on the basis of a scheme's expected economic impacts.

5.2.2 To reflect the context specificity of economic impacts, the first stage of the appraisal process is the development of an Economic Narrative, which defines the scope of the analysis and informs the Appraisal Specification Report. The Economic Narrative should be subject to refinement as the appraisal progresses and additional information becomes available.

5.2.3 The Economic Narrative is the main tool through which scheme promoters articulate and justify the scope of the analysis and to this end should include information on the following: (1) identification of the expected economic impacts and description of how these achieve any economic objectives in the Strategic Case; (2) justification of why these impacts are expected to occur on the basis of

economic theory and context specific evidence; (3) identification of the welfare change associated with these impacts, arising, for example from market failures; and (4) identification and justification of the methods to quantify and value the impacts.

Identification and Justification of Expected Economic Impacts

- 5.2.4 Transport investments can have many varied economic impacts. The Economic Narrative should identify and justify all significant impacts, which are expected to occur as a result of the scheme under consideration, such as the relocation of economic activity in response to improved accessibility. The expected impacts should be justified on the basis of economic theory and evidence specific to the area affected by the transport scheme.
- 5.2.5 In addition to the quality of the analytical methods, the robustness and relevance of the economic theory and context specific evidence, used to identify and justify the expected economic impacts, will inform the weight placed on the analysis within the value for money assessment.
- 5.2.6 TAG Units A2.2 – A2.4 provide guidance on the type of information which could be presented in an Economic Narrative for the identification and justification of economic impacts.

Identification of the Welfare Effects of Economic Impacts

- 5.2.7 Once the expected economic impacts have been identified, scheme promoters should identify the effect these will have on welfare.
- 5.2.8 The starting assumption of all transport appraisals is that the welfare effects of economic impacts are captured by user benefits. If there are market failures, user benefits will not fully capture all of the welfare effects associated with economic impacts, in other words there will be wider economic impacts.
- 5.2.9 The assessment and inclusion of wider economic impacts in the economic case should only be undertaken, if scheme promoters can identify and justify the presence of market failures. The types of information required to justify the presence of a market failure will depend on the particular market failure. For more information on valuing the welfare associated with economic impacts see section 2.

Identification of methods to quantify and value the impacts

- 5.2.10 Having identified the expected impacts, causal factors and the market failures, the scheme promoter should be clear about the highest desired level of analysis to be conducted (i.e. Levels 1, 2 or 3) and attention should be directed to the identification of appropriate and proportionate methods by which impacts are to be quantified and valued.
- 5.2.11 All Transport Business Cases should at a minimum conduct Level 1 analysis of user benefits and non-economic impacts. A decision to progress beyond this should be based on the expected economic impacts and market failures.
- 5.2.12 The impacts assessed in Levels 1 and 2 should be informed by a transport model, in which the model scenarios assume fixed land use. This will form the basis of the core scenario presented in the appraisal summary table – see Forecasting and Uncertainty M4 for guidance on developing the core scenario. The model outputs may be used to estimate the wider economic impacts associated with fixed land use or where land use change does not need to be explicitly quantified – see TAG Units A2.2 – A2.4.
- 5.2.13 Level 3 sensitivity tests should be considered if land use change is explicitly quantified, supplementary modelling is deemed appropriate or economic impacts are dependent on complementary interventions – see Forecasting and Uncertainty M4 for guidance on developing alternative scenarios. In the first instance level 3 impacts, such as dynamic clustering and the move

to more/less productive jobs, should be estimated using the appropriate WebTAG methodologies, the results from supplementary economic models may be presented alongside these. Note in the case of supplementary economic models, the model choice will depend upon the specific impacts to be analysed – see TAG Unit M5.3 for guidance on model choice and the circumstances in which they may be applied.

- 5.2.14 The scope of the analysis should be proportionate to the size and impact of the scheme. In most instances, user benefits and wider economic impacts (level 1 and level 2 analysis) will be sufficient to inform the Transport Business Case. However, there may be transport investments for which the application of supplementary economic modelling is considered justified. For more information on proportionate appraisals, see Guidance for the Technical Project Manager.

5.3 Technical Analysis

- 5.3.1 Key to improving the transparency of Transport Business Cases is the reporting of analytical methods in order that results can be objectively scrutinised. The information requirement will partly depend upon the methods used and should be proportionate: generally supplementary economic modelling will be more information intensive than cases where the methodologies in TAG Units A2.2 – A2.4 have been applied. Below is a summary of the minimum level of technical information which should be provided in the EIR.

Quantification and Valuation Methodologies:

- 5.3.2 There should be a detailed description of the modelling and valuation methodologies used to analyse the economic impacts of transport investment. The description should outline the following information:
- a. Model type
 - b. Model area – size of area represented in the model
 - c. Input data and source
 - d. Model mechanics – how the model utilises the input data to derive quantities/values
 - e. Modelled years and how results have been interpolated and extrapolated
 - f. Description of what quality assurance checks (e.g. audit, peer review) have been undertaken on the analysis
- 5.3.3 Some quantification and valuation approaches may only estimate impacts at the local level. On the other hand, some approaches may provide national impacts but an understanding of the local impacts would be desirable. Whether deriving a national impact from local impacts or vice versa, the methodology to do this should be clearly outlined together with the underlying assumptions.
- 5.3.4 For all transport schemes, the core scenario should be quantified and valued in line with the methodologies and approach set forth in WebTAG, such that reference to the relevant methodologies should suffice.
- 5.3.5 However, in those instances where supplementary economic modelling has been undertaken, such as to forecast land use in an alternative scenario, a full description will be required of the methodologies.

Results:

- 5.3.6 The presentation of the results should be unambiguous within the report; the impacts driving the results and the reasons for this should be clearly laid out. This may best be achieved by the presentation of a table of results, disaggregated by impact type, with accompanying explanatory text.

- 5.3.7 As outlined in section 2.2, the core approach to appraise economic impacts is welfare analysis and the core scenario should be estimated using the methodologies set out in WebTAG units A1 and A2. If supplementary economic modelling has been undertaken to estimate welfare effects, the results should be presented alongside those derived from the WebTAG methodologies and any differences explained.
- 5.3.8 Where changes in GDP have been estimated, the net national effect should be presented alongside the corresponding welfare estimate and the differences reconciled; the association between the GDP and welfare estimates should be explained. In addition, if a local GDP change has been estimated, this should be presented and reconciled to the national GDP and welfare estimates. It should be noted that measures of GDP and measures of Gross Value Added (GVA) are related but not additional, GDP is measured in market prices whereas GVA is measured in factor prices. Measures of the estimated impacts should be converted to a common price level for the purposes of reporting an overall impact. The estimated GDP impact of a transport investment should be adjusted for inflation and reported as a net present value.

Key Assumptions and Parameters:

- 5.3.9 All of the key assumptions and parameters driving the results should be presented, together with sources and their implication within the analysis – example in Box 7.

Box 7: Example of Information Requirement for Key Assumption

The manufacturing agglomeration elasticity (0.021) describes the increase in productivity as a result of an increase in the effective density of the urban area. If effective density increases by 1% as a result of a reduction in generalised travel costs and/or the relocation of employment, productivity will increase by 0.02%. Source: Graham, D., J., Gibbons, S., Martin, R., (2009) *'Transport Investment and the Distance Decay of Agglomeration Benefits'*.

- 5.3.10 The identification of key assumptions is particularly important when supplementary economic modelling has been undertaken and a full account should be provided. Where WebTAG has been followed, reference should be made to the unit, which contains the relevant assumptions.

Understanding Uncertainty:

- 5.3.11 The results of all analysis are subject to varying degrees of uncertainty, due to the underlying modelling and valuation assumptions. This uncertainty should be reflected in the reporting of impacts, so that stakeholders have a fuller understanding as to the sensitivity of results to the underlying assumptions.
- 5.3.12 Within each level of analysis it is important to understand the range of outputs and the associated uncertainty. This can be informed by developing an uncertainty log – see TAG Unit M4.
- 5.3.13 Uncertainty analysis should be performed on all of the key assumptions, setting out the likelihood that different outcomes may occur. The uncertainty analysis should ideally be informed by evidence, however, in some circumstances this may not be possible.
- 5.3.14 In many instances assumptions are derived from empirical evidence. The uncertainty analysis that could be performed in such instances includes the use of confidence intervals from the empirical evidence or alternative empirical sources. If there are no alternative sources of empirical evidence, the analyst will need to consider what would be an appropriate sensitivity test. For more information about uncertainty and how it should be reflected in appraisal see TAG Unit M4.

Quality of Analysis:

- 5.3.15 If supplementary economic modelling is undertaken, the analysis should be presented in the Economic Impacts Report. In addition to the requirements laid out above, information should be provided regarding how the analysis has addressed the specific analytical principles set out in the Supplementary Economic Modelling guidance (M5.3).

Informing the Economic and Strategic Cases

- 5.3.16 The detailed technical information contained with the Economics Impact Report should be summarised in the economic and strategic cases; the welfare change associated with economic impact should be reported in the Economic Case, if the GDP change has been estimated, it should be reported alongside the relevant economic objective in the Strategic Case.
- 5.3.17 Given the plethora of factors which determine the magnitude and type of economic impact, the uncertainty analysis should be summarised and ranges around the central estimates reported in the appropriate part of the transport business case (economic or strategic case). The results and the level of uncertainty will inform the value for money assessment and the confidence placed in the analysis respectively.

6 Reporting Impacts

6.1 Introduction

- 6.1.1 This section outlines the various reporting criteria of economic impacts within the Transport Business Case. The section is structured as follows:
- Section 6.2 outlines where the different approaches to value economic impacts should be reported within the Transport Business Case;
 - Section 6.3 explains how economic impacts should inform the value for money (VfM) assessment; and
 - Section 6.4 explains how GDP should be reported within the Transport Business Case.

6.2 Reporting Impacts within the Transport Business Case

- 6.2.1 The purpose of analysing the economic impacts of transport investment is to inform the decision-making process. Decision-makers are presented with a Transport Business Case, which contains all of the evidence regarding the potential costs and benefits of the scheme under consideration.
- 6.2.2 The Transport Business Case is composed of five cases: the Strategic, Economic, Financial, Management and Commercial Cases. The two cases of most relevance to analysis of economic impacts are the Strategic and Economic Cases. The former contains the policy objectives of the transport investment and evidence should be presented which informs the extent to which these are achieved; this is where non-welfare measures of economic impacts, such as GDP, may be reported, if they are relevant and inform the economic policy objective. The latter presents evidence on the value for money of the different options and is where the welfare associated with economic impacts, as measured by user benefits and wider economic impacts, should be reported. Note: if the analysis suggests the economic impacts will affect the broad transport budget, such as increased ticket revenue, these effects should also be reported in the Financial Case.

6.3 Reporting Impacts within the Economic Case

- 6.3.1 This section provides guidance on where within the value for money assessment the welfare associated with economic impacts should be reported – see value for money guidance (forthcoming) for guidance on how to form value for money conclusions.

- 6.3.2 The impacts reported in the Economic Case inform the value for money assessment. The value for money assessment examines the relationship between the costs of the transport investment and the expected impacts, such as economic, environmental, social and distributional, of all options.
- 6.3.3 Within the value for money assessment of the Economic Case the geographical spatial scale at which impacts should be reported is always that of the United Kingdom. In other words, when assessing the welfare change associated with economic impacts, one must consider impacts which fall outside of the area of immediate interest.
- 6.3.4 As mentioned in section 2, one of the potential impacts of a transport investment is the relocation of economic activity. The relocation of economic activity means that one area gains at another's expense, such that the change in the level of economic activity is greater at the local than national level. Thus a local focus will tend to exaggerate the magnitude of economic impacts and the associated welfare change.
- 6.3.5 Within the value for money assessment, impacts are differentiated on the basis of their maturity; the weight placed upon impacts within a value for money assessment varies accordingly.

Level 1 – User benefits

- 6.3.6 The starting point of the value for money assessment is the estimation of user benefits assuming fixed land use, such that there are no feedback effects from secondary markets. As mentioned in section 2, this will miss the user benefits arising from changes in the level and location of economic activity. Nevertheless, this is considered a reasonable proxy, because for the majority of schemes the feedback effects will be not significant compared to the total travel demand change.
- 6.3.7 As the methodology to quantify and value user benefits is well-researched and robust, the results are reported in the initial BCR; this forms the foundations of the value for money assessment.

Level 2 – Inclusion of Wider Economic Impacts (Fixed Land Use, Connectivity Impacts)

- 6.3.8 The next stage – where relevant to the scheme – is the incorporation of any wider economic impacts as specified in TAG Units A2.2, A2.3 and A2.4, output change in imperfectly competitive markets, labour supply impacts and static clustering respectively.
- 6.3.9 These can all be added to the transport market effects to estimate the adjusted BCR which reflects the fact the methodologies are not as established as those in level 1.

Level 3 – Sensitivity Tests (Structural and context specific Impacts)

- 6.3.10 Other assessments, including dependent development, dynamic clustering and the move to more/less productive jobs are subject to greater uncertainty. These should not be reported in the initial or adjusted BCR, but can be presented as sensitivity tests.
- 6.3.11 Sensitivity tests includes those economic impacts which explicitly apply different assumptions to those reported within the initial and adjusted BCRs, such as the treatment of land use. By explicitly applying differing assumptions, these analyses test the sensitivity of the impacts reported in the initial and adjusted BCRs.
- 6.3.12 The methodologies to estimate these impacts are often subject to a high degree of uncertainty; for example, forecasting land use change is particularly uncertain and there is little evidence to validate forecasts. Nevertheless, sensitivity tests should be reported with the weight placed on these in determining the value for money assessment dependent on the evidence provided..
- 6.3.13 If supplementary economic modelling has been undertaken, whether to quantify and value user benefits under land use change, obtain more context specific estimates of wider economic impacts,

or estimate impacts based on the identification of market failures not captured in the A2 units, the results should be reported as sensitivity analysis.

6.3.14 Table 5 summarises where the welfare effects arising from economic impacts should be reported within the VfM assessment.

Table 5: Reporting Wider Economic Impacts within the VfM assessment (arrows signify previous levels analysis required)			
	Level 1 (Initial BCR)	Level 2 (Adjusted BCR)	Level 3 (Sensitivity Analysis)
Fixed Land Use	User benefits	→	→
		Static Clustering	→
Implicit Land Use Change		Output Change in Imperfectly Competitive Markets	→
		Labour Supply Impacts	→
Explicit Land Use Change			Dependent Development
			Move to More/Less Productive Jobs
			Dynamic Clustering
			Supplementary Economic Modelling

6.4 Reporting Impacts in the Strategic Case

6.4.1 The purpose of the Strategic Case is to determine whether a proposed transport scheme achieves Government objectives, such as to regenerate a local area or reduce noise pollution. It is here that

non-welfare measures of economic impacts, such as GDP, can be reported, if they inform the extent to which the proposed transport scheme achieves the Government's objectives

6.4.2 If reporting economic impacts in the Strategic Case, the following principles should be adopted:

1. **Use appropriate metric to inform Strategic Case. This may differ from Economic Case, which must be welfare based.**

Within the Economic Case welfare is the metric used to value economic impacts. This serves a specific purpose to inform the value for money assessment. In the Strategic Case, however, an economic objective may be better informed by other metrics, such as change in GDP. For example, an economic objective to boost economic activity in a regeneration area may be best informed by the change in GDP and growth of employment. Any reported GDP figure should be a net present value and in the same price base as the welfare estimate.

2. **Analysis should be consistent with that in the Economic Case.**

The Strategic Case scenarios should be the same as those in the Economic Case in terms of the magnitude, nature and location of economic impacts and the assumptions underpinning the analysis, such as population, employment and workforce skills.

3. **The core scenario of economic impacts should use the WebTAG methodologies.**

The core estimate of economic impacts in the Strategic and Economic Cases should use the WebTAG methodologies set out in User and Provider Benefits (A1.3) and Wider Economic Impacts (A2). TAG Units A2.1 outlines how the GDP change can be derived from the welfare estimates.

4. **Sensitivity tests of economic impacts should only be reported in the Strategic Case if the associated welfare effects have been reported in the Economic Case.**

Sensitivity tests reported in the Strategic Case should correspond to welfare estimate in the Economic Case; there should be an analytical "bridge" between the Strategic and Economic Cases, which explains the relationship between the welfare and alternative metrics to value the economic impacts.

5. **Local economic impacts should only be reported alongside the corresponding national impact.**

The economic objective may be locally focussed, such as the regeneration of a local area. In this instance, it would be appropriate to report local impacts. Nevertheless, the corresponding national impacts should be reported alongside to aid transparency: reporting the national and local economic impacts together clarifies the extent of the assumed relocation (displacement) of economic activity.

7 References

Arnott, R. J. & Stiglitz, J. E. (1981), "Aggregate Land Rents and Aggregate Transport Costs," *Economic Journal*, Royal Economic Society, vo. 91 (362), pages 331-347, June

HMT, "The Green Book", (2013), <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

Venables, A., et al, (2014); "Transport investment and economic performance: Implications for project appraisal" <https://www.gov.uk/government/collections/transport-appraisal-and-strategic-modelling-tasm-research-reports>

Annex A Glossary

- **Additionality** – the extent to which local economic performance impacts are additional at the national level, gross and net effects respectively. Impacts of Government interventions are described as 'additional' if the net increase in economic performance takes into account deadweight, displacement and leakage.
- **Additionality models** – Models estimating the impact of transport schemes on net economic performance by calculating the private benefit then adjusting for deadweight, displacement, leakage and multiplier effects.
- **Agglomeration** – this represents one of the mechanisms by which transport schemes can boost social welfare by raising the productivity of businesses due to better links to other businesses and sources of labour.
- **Central approach** – recommended methods to appraise the economic performance impacts of transport schemes detailed in Units XX of WebTAG.
- **Closure rules** – assumptions applied to supplementary economic models in order to impose supply-side constraints (e.g. assuming a transport scheme has no impact on total employment).
- **Deadweight** – this describes the situation in which a rise in economic performance is expected to occur in both the do-something (within-scheme) and the do-minimum (without-scheme) scenarios.
- **Dependent developments** – developments which are expected to gain planning permission in the do-something (with-scheme) scenario but not in the do-minimum (without-scheme) scenario.
- **Displacement** - the extent to which economic activity is relocated from one area to another. Displacement can occur in labour, capital and product markets.
- **Economic performance** – this refers to the level and/or growth of economic activity in an area. This includes metrics such as employment, investment, productivity and output.
- **Econometric model** - Models to estimate the impact of transport schemes on economic performance based on empirical relationships between economic performance and accessibility.
- **Gross domestic product (GDP)** – this is a measure of the value of goods and services produced in an economy within a specific time period. This is measured in market prices.
- **Gross value added (GVA)** – this is a measure of the monetary value of goods and services produced in an area, industry or sector of an economy. GVA is equal to gross domestic product (GDP) minus taxes on products plus subsidies on products. This is measured at factor costs.
- **Investment and Employment effects** - changes in the level and spatial distribution of investment and employment resulting from a transport scheme.
- **Land use change** – refers to changes in the purpose and/or intensity of usage.
- **Land use transport interaction (LUTI) models** - Models estimating the impact of transport schemes on economic performance, taking into account the interactions between the real economy and the transport network.
- **Leakage** – this describes the extent to which an increase in economic performance falls outside the target area of the scheme.
- **Movement to more productive jobs** – this represents the increase in tax associated with jobs relocating to more or less productive areas as a result of transport improvements.
- **Multiplier effects** - this describes the extent to which an increase in economic performance is propagated into a larger impact as a result of increased supply-chain and consumer spending.
- **Productivity impacts** – the impact of transport investments on the efficiency with which the factors of production (such as land, labour and capital) are used in the production process: productivity may increase because either fewer factors of production are required to produce a unit of output or there is a reallocation of the factors of production towards higher value added activities.
- **Social Welfare** – a measure of the overall wellbeing of society taking into account economic, social and environmental considerations.

- Spatial Computable General Equilibrium (S-CGE) model - Models estimating the impact of transport schemes on the economic performance taking into account the spatial interactions between households and businesses.
- Supplementary economic modelling– approaches used to estimate the economic impacts of transport interventions other than those detailed in TAG Units 2.2–2.4. This including Additionality models, Land Use and Transport Interaction (LUTI) models, econometric analysis and Spatial-Computable General Equilibrium (S-CGE) models.
- Transformational Scheme – these are transport investments which significantly affect the capacity of national transport infrastructure and/or regional attractiveness. Transformational schemes will usually refer to only the very largest of schemes, which likely require central Government financing.
- User benefits – a measure of the direct welfare impacts of transport investments on transport users, such as reductions in vehicle operating costs and journey time savings.