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Land use after ATAP O8 – suggestions for implementation and review

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Abstract

Predicting and quantifying the impacts of major transport projects on land use development has been a major driver in the evolution of transport cost-benefit analysis (CBA) over the past decade. Approaches to measure land use benefits followed the development of international guidance on the topic (such as from the UK TAG A2.3) but evolved in Australia primarily through practical implementation by departments, practitioners, and project teams across individual projects. In 2021, Australian Transport Assessment and Planning (ATAP) released guidance on the land use benefits of transport initiatives, representing the first official, detailed guidance on estimating land use benefits in an Australian context. However, from the viewpoint of CBA practitioners, there remains some questions still to be solved on how land use changes and benefits should be forecast, calculated, and justified in practice. This paper introduces a starting point for more standardised land use forecasting approaches. It also provides commentary and advice for practitioners and reviewers to help resolve questions on what work needs to be undertaken to support the inclusion of land use benefits in CBA.

1. Introduction

In the absence of formal guidance documents, the terminology used to describe these land use impacts has varied, from 'land use' benefits to 'urban development', 'urban renewal' or 'urban consolidation' benefits. Despite the difference in labelling, these approaches are designed to capture the same economic impacts — costs and benefits that arise from changes in the distribution of population and employment across a region because of a transport investment. It is important to distinguish these impacts from 'place benefits' that are a separate set of impacts arising from changes in local amenity or liveability. Place impacts are occasionally bundled with land use impacts but are quantified in different circumstances and are not discussed in this paper. The land use benefits discussed in this paper align with those documented in ATAP O8 and refer specifically to the following benefits:

- **Second-round transport benefits:** additional transport user benefits and transport externalities measured from changes in travel behaviour that results after land use change occurs
- **Higher value land use benefits:** economic benefits from 'unlocked' land development, where the value of the additional land supplied exceeds the resource cost of achieving the change
- **Public infrastructure cost impacts:** where a project reduces urban sprawl and promotes compact infill development, there may be a net change in the cost of providing public infrastructure to support population growth

- **Sustainability impacts:** changes in the type of built form may result in sustainability benefits or costs where they have different upstream or downstream environmental impacts than the type of built form created in the base case
- **Public health cost changes:** more compact land use patterns can induce additional walking and active transport trips, with associated health benefits for residents.[1]

Approaches to measure land use benefits followed the development of international guidance on the topic (such as from the UK TAG A2.3 dependent development) but evolved primarily through practical implementation by departments, businesses, and project teams across individual projects. Douglas (2013) noted on the historic use of land use benefits in the *International Comparison of Transport Appraisal Practice* that:

As regards urban consolidation (UC) benefits, their inclusion in project appraisal in NSW is not new but has lapsed over the last decade due to the emergence of WEBs. UC benefits were included in some rail economic evaluations in the early 1990s[2]

Land use benefits began to re-emerge as a major source of economic benefits in large scale public transport projects such as Melbourne Metro and Sydney Metro City and Southwest in 2016.

In August 2021, Australian Transport Assessment and Planning (ATAP) released guidance on the *Land-use benefits of transport initiatives*, representing the first official, detailed guidance on estimating land use benefits in an Australian context. However, there remains some uncertainty on how the ATAP guidance can best be implemented in practice, from the point of view of both practitioners and reviewers. This paper provides some initial recommendations and suggestions, focusing on a limited selection of topics, namely:

- Standardised definitions for terminology used in discussion of land use forecasting and land use benefits
- Approaches to defining the relevant geography for land use change, and forecasting land use change with respect to the use of open and closed-city approaches
- How to demonstrate a sufficient evidence base exists to justify the inclusion and scale of land use benefits in cost-benefit analysis.

A common issue that has arisen in this area of practice is the lack of standardised language to describe established concepts, leading to confusion and misinterpretation between reviewers and practitioners. The practice of land use forecasting deals with many different types of changes in land use – including natural changes over time, changes in specific areas, or changes resulting from the project. For clarity, this document uses the following definitions:

[1] These benefits are discussed in more detail in ATAP O8 (2021) *Land Use Benefits*, pp6-7

[2] NL Douglas (2013) International Comparison of Transport Appraisal Practice Annex 6 NSW Australia Country Report, pp40

Table 1: Land Use Change Glossary

Term	Definition
Land use change	Forecast changes in the distribution of population and employment across a region because of a transport investment. This term covers changes in population distribution between the base case and the project case that are assessed within the CBA framework.
Land use growth	Forecast changes in population and employment in an area *over time* (including naturally occurring changes[3]). Land use forecasting uses time series data of population and employment by area. Given the long horizon for impacts of projects on land use, it is often more correct to say that a transport project changes land use growth, or growth rates, than saying that it changes existing land use.
Land use uplift	Forecast localised *increases* in population and employment growth in particular areas because of a transport investment. Where an investment improves the relative accessibility of an area, it can attract additional people and jobs to that area
Land use redistribution	Forecast localised *decreases* in population and employment growth in particular areas because of a transport investment. Where a transport improvement makes a localised area more attractive for people and businesses to locate to it, new people to the area are drawn from elsewhere. The land use redistribution process identifies the locations that are now relatively less attractive for land use growth that land use uplift is drawn *from*.

In addition to the different types of changes discussed in the table above, land use projects must define and then work across different geographical areas.

In current practice, land use changes are often described over standardised geographies such as electoral regions, Statistical Areas (e.g., SA2) produced by the Australian Bureau of Statistics (ABS), or Travel Zones produced by transport departments for use in travel modelling. However, these established boundaries do not neatly map against the different types of land use change discussed above. For instance, if a new rail station is located within a travel zone or SA2, it does not necessarily mean that all associated land use uplift from it would occur within that travel zone or SA2. Changes in population or employment might be reported for a 'station catchment' or a 'project corridor' though these are subjective definitions that vary between projects.

[3] Often naturally occurring land use growth is supported by a base level of transport and social infrastructure development, such as local road and bus network provision. Economic appraisals that measure impacts over a long time horizon will always include some level of additional growth in infrastructure to maintain reasonable minimum service levels – this interrelationship should not be confused with land use *change* which is driven by and dependant on specific, major infrastructure projects.

What is needed for clearer discussion and reporting is a geographical area defined explicitly in terms of the kind of land use change that occurs there – e.g., the areas, as defined by a set of travel zones, that encapsulates fully the different types of forecast change in population and employment in response to a project. Currently, there is no consistent terminology amongst the different practitioners and guidance documents used in Australia.

The framework discussed below attempts to define consistent language that can be used when documenting and undertaking land use forecasting for transport projects and cost-benefit analysis.

2. A framework for land use geographies

ATAP O8 includes a brief discussion on land use forecasting and land use change. With regard to understanding the relevant geographies for land use forecasting, ATAP cites:

Land-use change generally results in an increase in population or employment in a localised area, in response to a transport policy, investment, or initiative. This localised increase could occur entirely at the expense of growth elsewhere within the modelled area, or from attracting new residents from elsewhere in the State or Country outside of the area that is explicitly modelled. These alternative approaches to modelling land-use change are referred to as ***'closed city'*** *and* ***'open city'*** *approaches, respectively.*[4]

From this paragraph we can see that modelling land use changes for CBA requires dealing with several different, discrete geographies over which analysis should be conducted:

a) A 'localised area' which experiences increase in population and employment (defined here as a Local Catchment)
b) A 'modelled area' or an area that is 'explicitly modelled' for the CBA (defined here as a Modelling Region)
c) Elsewhere in the State
d) Elsewhere in the Country
e) Elsewhere in the World (not listed, but included here for completeness).

Section 2.2. attempts to define these regions in more detail.

2.2 Defining Geographies for land use change

Project teams need to define the following regions for land use forecasting, because based on the extent of the demand model, the use of an open or closed city approach, and the definition of the CBA referent group, different costs, benefits or corrections may need to be estimated in the CBA. It is also important for understanding and estimating impacts from displacement.

The geographies discussed below are defined in terms of whether they include *Land Use Uplift* or *Land Use Redistribution*, as defined above. They map to the geographies discussed in ATAP O8:

[4] ATAP O8 (2021) Land-use benefits of transport initiatives, pp8

- **Local Catchments:** This covers the area directly impacted by the transport project in question, where localised increases in population and employment growth are expected to occur. For major urban rail and light rail projects, this is typically the station walking catchment, while for a motorway project it may be defined in terms of the driving catchment for a specific motorway on-ramp/exit or other access point. For projects such as high-speed rail that extend into outer metropolitan and regional areas, the local area may be larger than a walking catchment if mechanised access modes are anticipated to account for a greater proportion of feeder trips. Local Catchments are relevant for understanding where direct versus indirect land use change occurs. Land use uplift occurs fully within Local Catchments, which then leads to land use redistribution in the Modelling Region. Depending on whether an open or closed city approach is used, indirect land use change may be limited to the Modelling Region or may extend beyond it.
- **Modelling Region:** The modelling region is defined by the extent of the transport model being used in the economic appraisal. For projects large enough to generate land use change (and therefore land use benefits), these will typically be major strategic transport models such as the Brisbane Strategic Transport Model - Multi-Modal (BSTM-MM) or the Sydney Strategic Travel Model (STM). The region definition should be specified to be large enough to cover all land use uplift and a majority of land use redistribution. It is important that the Modelling Region captures areas of indirect land use change to ensure that all benefits and costs are included in the CBA. It is also used to determine where all Land Use Uplift in the Local Catchments are redistributed from, if a 'closed-region' model is used.

The Land Use Redistribution approach will differ depending on whether a 'closed city' or 'open city' approach is taken. Under an 'open city' approach, total population in the Modelling Region can increase as population is drawn from intrastate, interstate, and international migration. Under a 'closed city' approach, the Modelling Region population is fixed. As a result, 'open city' appraisals also need to consider other regions and jurisdictions in addition to those listed above. The extent of the regions included in the 'open city' approach also creates additional requirements and considerations for the economic appraisal framework and cost-benefit analysis used to assess the project.

The geographies listed below are relevant for understanding the boundaries of certain benefits or impacts. While CBA in general is designed to assess the benefits to society as a whole, in practice the perspective or 'standing' of the analysis will differ between jurisdictions.[5] Most state treasuries suggest that CBA considers only the costs and benefits for the population or community residing within the state (the referent group). For example, all impacts that occur outside of NSW are not included in TfNSW cost-benefit analysis, which uses NSW as the referent group.[6]

The relevant geographies for projects using an open city approach are:

- **Rest of State:** The state in Australia that the project occurs in, which usually aligns to the referent group. As a result, impacts or benefits outside the state are typically excluded from the appraisal. However, the corollary of this is that if the Land Use Redistribution approach draws population and employment from outside the Modelled

[5] ATAP (2022) T2 Cost Benefit Analysis, pp18
[6] NSW Treasury (2017) NSW Government Guide to Cost-Benefit Analysis, p iii

Region, but within the state, then some of the traffic impacts captured in the transport model may represent transfers and will need to be adjusted for out of model.[7]

- **Rest of Country:** In certain projects, it may be possible that the changes in accessibility will result in an increase in net population for a state, as high growth in the Local Catchments results in net interstate migration. This may mean that the CBA is required to account for the costs and benefits of new migrants to the existing community, to ensure that the CBA complies with referent group requirements. This could mean providing an estimate of benefits such as an increase in Government tax revenues, offset by the costs of providing additional social infrastructure. Projects that use rely on federal funding may also be required to report the CBA results using Australia as the referent group and make an assessment on whether the Country itself (as opposed to merely the state the project is in) is better off due to the project.
- **International:** in some cases, a nationally significant project may attract population and employment growth from outside of the country, leading to an increase in international migration into the Local Catchments. As with other forms of Land Use Redistribution into the Local Catchments, it is important to understand and consider whether this requires adjustments to the in-model results, or to account for changes in impacts for the referent group.

Other definitions commonly used in practice include 'Project Corridor' which is generally used in transport project business case development to define the approximate area of influence of the new infrastructure. The project corridor is frequently defined for a business case but is generally not relevant for land use forecasting save for use in reporting results. Local Catchments contain direct land use change, while the areas outside (whether in the project corridor or elsewhere in the Modelling Region) all contain only indirect land use change from redistribution.

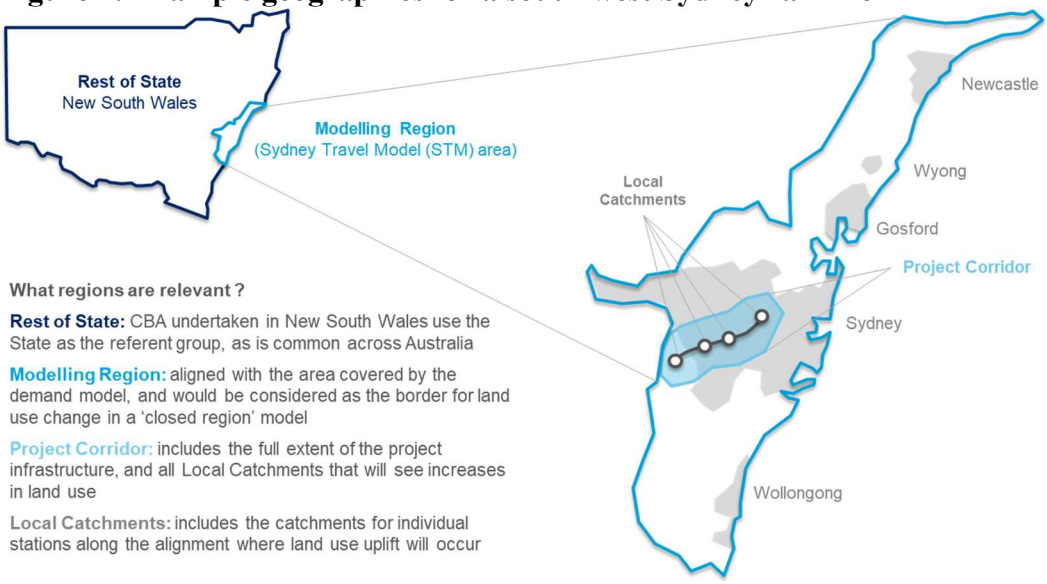
2.3 A worked example – a new South-West rail line

These concepts can be worked through for an example project – in this case we will imagine a hypothetical new rail line in the South West of Sydney, extending from the Central City out towards the new Western Sydney Airport and beyond. Let's also assume that it will have a total of four stations (one at each terminus, and two in between) and that the Local Catchments would centre around these new stations.

For this hypothetical project, the following geographies would be relevant:

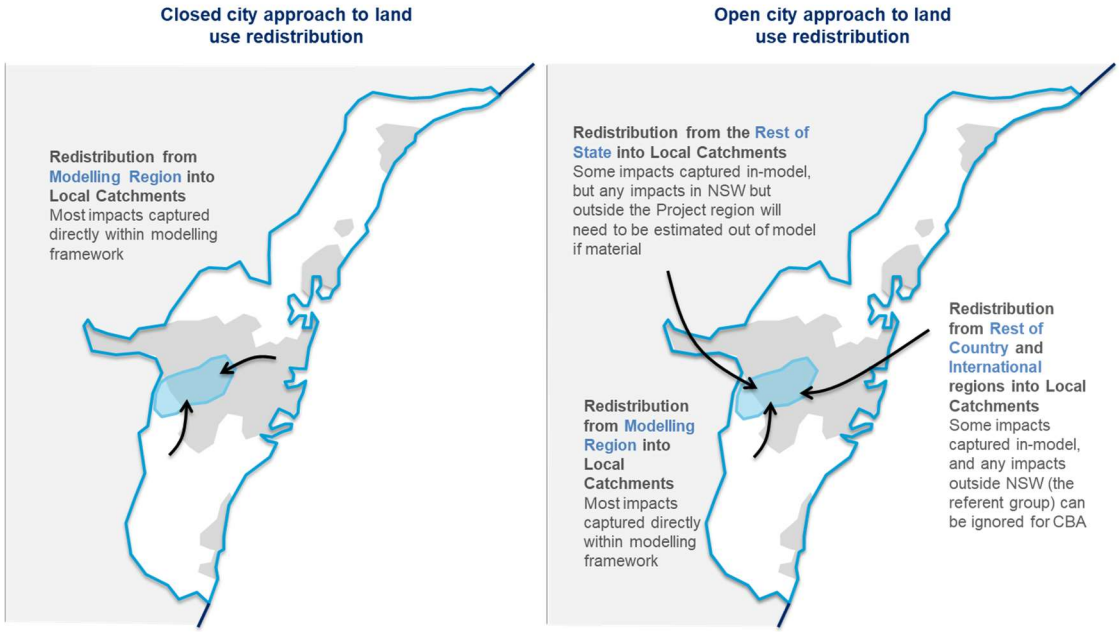
[7] Open city approaches are still largely theoretical and there is no existing precedence in either guidance documents or established practice for estimating the types of impacts or transfers that would occur in open city approach. From conversations with practitioners, impacts outside the Modelling Region may be impractical to estimate, or immaterial where redistribution is widely dispersed and there are no meaningful market imperfections.

Figure 1: Example geographies for a south-west Sydney rail line



Depending on whether an open city or closed city approach is adopted for the CBA, the Land Use Redistribution approach would influence population and employment within the Modelling Region or beyond. The difference in approaches is shown below:

Figure 2: Redistribution in open city and closed city approaches



3. Summarising a land use forecasting process

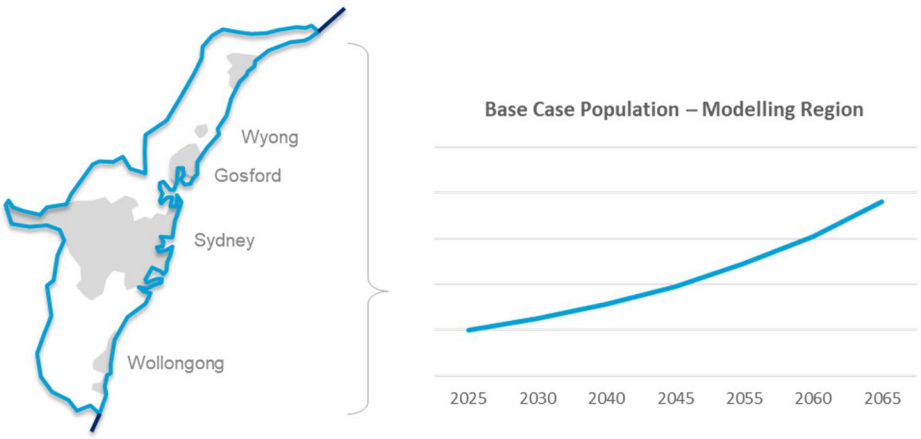
Given the discussion above, we are now at a stage to provide suggestions on how to forecast land use changes in practice, and to outline what issues and choices practitioners and reviewers should be aware of at each stage. This high-level summary represents only a starting point from which further discussion and guidance can be developed.

1. ***Define the base case land use growth***. Several alternative approaches have been used in practice to determine what an appropriate base case is, given that land use forecasts

provided by state agencies sometimes contain high land use estimates that pre-suppose the delivery of the project or an equivalent level of transport infrastructure. While useful at a project level, ad-hoc or one-off base case forecasts are difficult to sense test and (more problematically) can create challenges or result in inconsistent land use assumptions being used across a state's full transport program or portfolio. The most conservative approach would be to ensure that changes to existing, endorsed land use forecasts released by state planning agencies should be limited to error fixes (i.e., to correct for clear misattribution of population or employment). However, where base case land use forecasts already pre-suppose the delivery of major transport infrastructure, it is critical that the CBA should not forecast additional land use uplift in those areas in the project case.

a. **Output:** change in dwellings, population and/or employment at a Travel Zone or equivalent level for the base case, taken from the appropriate jurisdiction's Department of Planning or Department of Transport. This represents the *base case land use* against which project-dependent land use change is to pivot from (e.g. as per Figure 3)
b. **Level of subjectivity:** low
c. **Use in existing practice:** high
d. **Reviewers should ask:** What is the base case land use forecast, and does it differ from Department of Planning forecasts? Is the base case forecast premised on an assumption that the project will proceed? What justification has been used for any departure from the Department of Planning forecasts?

Figure 3: Base case land use growth



2. ***Undertake a top-down forecast*** to assess what land use change is likely from the improvements in accessibility created by the project across the Modelling Region. The location and extent of the Local Catchments should also be defined as part of this stage. In an open region approach, allow for entry of additional population and employment into the Modelling Region because of the project. LUTI modelling, spatial CGE modelling, or another form of access-based forecasting is suitable here. The method should be robust and not refined or influenced to account for non-transit characteristics

such as improvements to visual amenity, place-making initiatives, or similar changes in the relative attractiveness of a location.

a. **Output:** change in dwellings, population and/or employment at a Travel zone, SA2 or equivalent level. This represents the *maximum attributable land use change* that can occur in a Local Catchment, as well as defining the general regions from which redistribution should occur at **Step 5** (e.g. as per Figure 4)

b. **Level of subjectivity:** moderate (high in existing practice)

c. **Use in existing practice:** low

d. **Reviewers should ask:** How has the project team determined the land use demand response to the implementation of the project? Is the demand response directly linked to the change in accessibility provided, or is it aspirational? Does the justification for land use uplift rely on non-transport interventions such as place-making improvements?

Figure 4: Forecasting land use change

3. ***Undertake a bottom-up assessment of land use demand and capacity*** at the Local Catchment. Generally, these should act as refinements on the top-down forecast undertaken at **Step 2**. Identifying available land that can support additional development would involve removing any parcels that are preserved for new public space, heritage protected, inaccessible for any reason, host existing high-density residential lots with no opportunity for redevelopment, or are in some other way not suitable for development (e.g., prone to flooding). Note that some constraints may change over time or only be relevant for part of the appraisal period. At this stage, practitioners should also try to determine whether the project will create Higher Value Land Use (HVLU) benefits in addition to other forms of benefits. HVLU benefits are only created in specific circumstances where zoning or transport capacity constraints exist and can be relieved by the project.

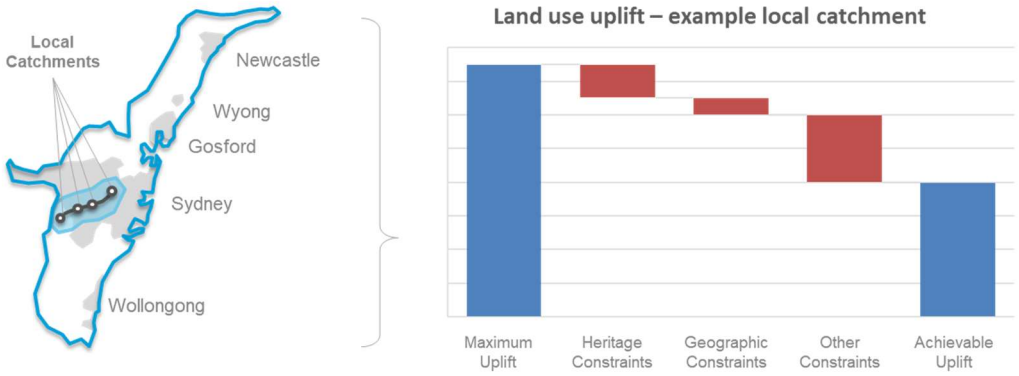
a. **Output:** change in dwellings, population and or employment at a Travel Zone or equivalent level, reflective of local limitations on land use uplift. This represents the *maximum achievable land use change* that can occur within the Local Catchment (e.g., as per Figure 5)

b. **Level of subjectivity:** moderate

c. **Use in existing practice:** high

d. **Reviewers should ask:** Has the project team assessed whether the demand for land use uplift can be achieved in practice? Has a review of geographical, heritage, ownership, legal, and other constraints been undertaken as part of the land use assessment? Would the built-form outcomes necessary to achieve the forecast population density be within community standards? What evidence has been provided that existing zoning or capacity constraints exist that would be unlocked by the project?

Figure 5: Assessing achievable land use uplift



4. ***Forecast the rate of take up of development*** potential to assess the length of time over which the land use uplift will occur, and at what point in time it will begin. This should be undertaken for each Local Catchment and reflect market evidence. Significant discussion has been broached regarding the value of existing capital demolished to make way for growth in the project case.[8] An assessment of existing capital impacts should be made at this step – higher or above average take up rates should be linked to the potential for inefficient removal of existing capital, where it is identified that that would not have occurred in the base case. Given the uncertainty and technical challenges associated with this step, it may be more appropriate to limit analysis of existing capital impacts (e.g., the first 10-15 years of land use change).

   a. **Output 1:** change in dwellings, population and or employment at a Travel Zone or equivalent level, reflective of local limitations on land use uplift, over time. This represents the *achievable land use change over the appraisal period* that can occur within the Local Catchment (e.g., as per Figure 6)

   b. **Level of subjectivity:** high

   c. **Use in practice:** high

   d. **Reviewers should ask:** Has the project team forecast a significantly faster take-up of land in the project case than in the base case? What evidence is presented to support the rate of land use uplift, and does it compare reasonably to historical examples of urban renewal precincts?

[8] For example, ATAP O8 (2021): Chapter 5: Higher value land use, and Appendix C: Treatment of existing capital in estimating higher value land-use benefits

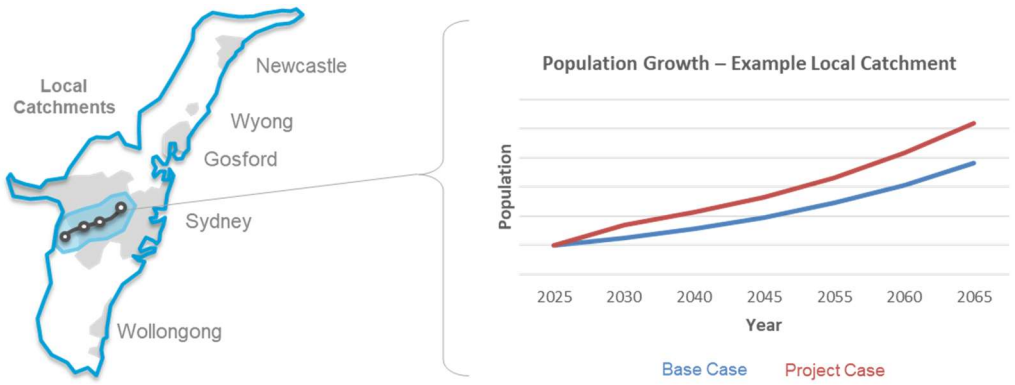
e. **Output 2:** An assessment of the approximate quantum and value of existing capital in the local catchment, for parcels identified as being likely to host land use uplift in the appraisal period earlier than what would have been achieved in the base case. For practical reasons it may be necessary to limit this to the initial years of land use change, or for parcels over a certain size only. This represents the *potential for reductions in HVLU benefits due to the destruction of existing capital*

f. **Level of subjectivity:** high

g. **Use in practice:** low

h. **Reviewers should ask:** What is the average age of dwellings, apartment buildings, or commercial developments within the Local Catchment? What likelihood is there that existing capital would need to be demolished in the short term to make way for new types of built form? What are the largest sites flagged for redevelopment, and what is currently on those sites?

Figure 6: Forecasting take up in development



5. ***Undertake redistribution analysis*** to forecast where in the Modelling Region the *achievable land use change over the appraisal period* forecast in **Step 4** will be drawn from. Note that based on whether a closed city or open city land use approach is used, the total population and employment redistributed from within the Modelling Region will either be exactly equal to the Local Catchment uplift, or it will be lower than the Local Catchment uplift, respectively. This is because in an open city redistribution, part of the Local Catchment uplift will be drawn from other areas outside the modelled region. Redistribution should always be cost-based and systematic (rules-based) as opposed to ad-hoc or subjective analysis. Cost-based redistribution refers to redistribution that takes into account the level of accessibility across all regions in the modelling area (e.g. through measures of the generalised cost of travel, or number of jobs accessible) when estimating where redistribution will occur. It will tend to mirror the outcomes that *land use attractiveness models* and *Land Use and Transport Integration (LUTI) models*[9] generate and avoid redistributing growth from areas with high attractiveness to areas with low attractiveness, which can be unlikely in reality. It is preferable to pro-rata redistribution as it considers change in access, which is the basis upon which the location change forecast in **Step 2** is made. Ideally the

[9] See ATAP O8 (2021) *Land use benefits*, pp10 for further discussion of these models

redistribution will map closely against the top-down land use change forecasts undertaken at **Step 2**.

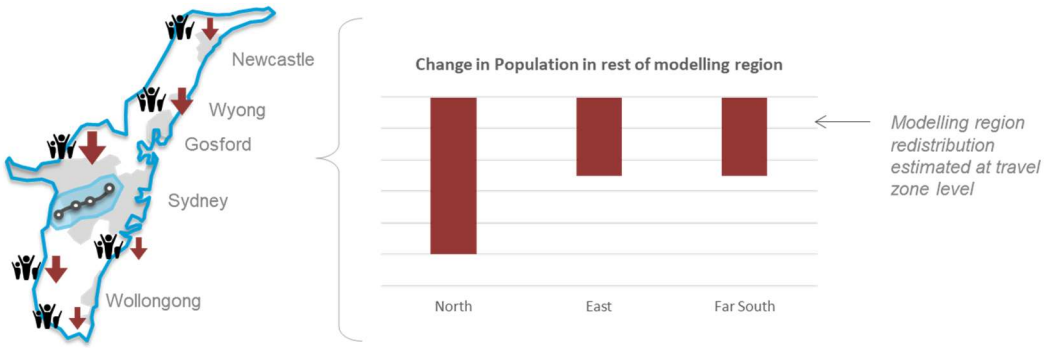
a. **Output:** change in dwellings, population and or employment at a Travel Zone or equivalent level, reflective of access considerations, over time, for the entire Modelling Region. This represents the *Redistributed land use growth over the appraisal period* that will occur outside the Local Catchment but within the Modelling Region (e.g., as per Figure 7)

b. **Level of subjectivity:** moderate (due to the options for specifying the cost-based approach)

c. **Use in practice:** high

d. **Reviewers should ask:** Where within the region has the greatest amount of population redistribution? Do any travel zones or areas within the region have land use outcomes in the project case that are below the existing population or employment totals? Is the redistribution cost-based, or has another method been used to determine where growth is displaced from? Have any areas been excluded from redistribution analysis, and for what reason?

Figure 7: Forecasting land use redistribution



6. [*open city only*] Identify the proportion of uplift that is from international migration and/or the proportion of uplift that is from intrastate migration. Economic impacts from these changes will need to be assessed out-of-model as the changes occur outside of the Modelling Region.

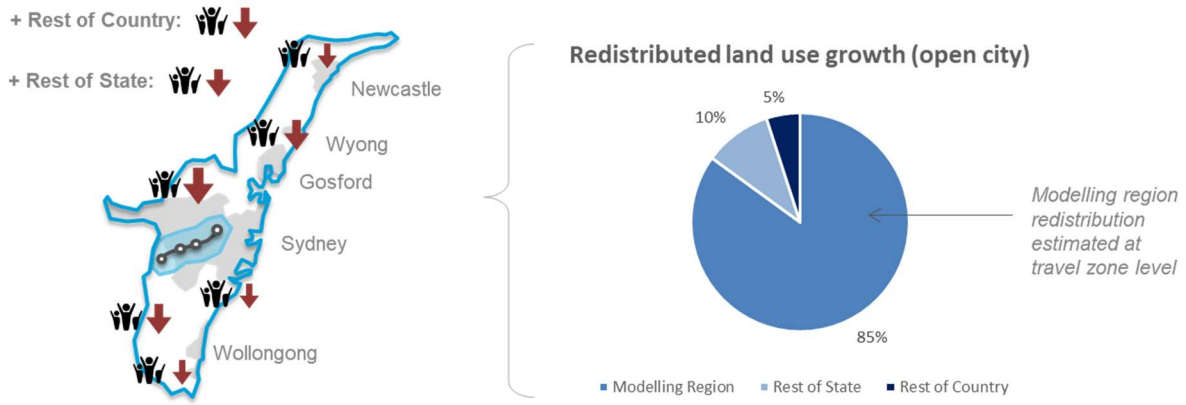
a. **Output:** change in dwellings, population and or employment at a Travel Zone or equivalent level, reflective of access considerations, over time, for the entire Modelling Region, as well as for the total *Rest of State* and *Rest of Country* regions. This represents the *Redistributed land use growth over the appraisal period* that will occur outside the Local Catchment (e.g., as per Figure 8)

b. **Level of subjectivity:** moderate (as per Step 1)

c. **Use in practice:** low

d. **Reviewers should ask:** What analysis has been undertaken to support that interstate or international migration would occur because of the project? Does the migration forecast rely on the capital spend of the project, or does it reflect the change in access that the project will provide?

Figure 8: Forecasting land use redistribution in an open city approach



3.1 Conclusions on land use forecasting in practice

From this we can see that approaches already used in practice cover many of the recommended steps above, which are aimed at providing a justification and compelling evidence to answer dependency and conditionality requirements outlined in ATAP O8. Existing practice is, however, limited by several steps having a high level of subjectivity.

The absence of **Step 2**, a top-down assessment of the project's inherent ability to influence location preferences, represents a major issue with existing practice. Adding this step is likely to address the subjectivity of current land use forecasting approaches and help to ensure that forecasts meet the attribution and dependency requirements outlined in IA (2021) and ATAP O8.

One limitation to this suggested approach (Step 2 in particular) is that it relies on changes in accessibility to drive land use change. Some practitioners believe that changes in capacity alone can drive land use change, absent any improvement in access. This would occur in a situation where existing transit services are overcrowded or roads are severely congested, and a new project allows for additional capacity without materially changing the speed or frequency of services. An example might include moving from a train with 400 seats to one with 800, where the existing service is always crowded to capacity. As with any other recommendation outlined in the process above, that would require supporting evidence as to whether changes in relative crowding can influence location choice.

Regardless, no approach (no matter how comprehensive) would be sufficient to create a universally accepted standard of land use analysis that applied across all project types. It remains to individual practitioners to persuade decision makers in each case that land use benefits are worth including in CBA, and that their scale is appropriate. It is necessary to provide a strong, transparent evidence base for their inclusion. As stated in ATAP O8:

Transport appraisals should only include land-use benefits when there is compelling supportive evidence and clear justification for the reasons why the project is expected to generate significant land-use change.[10]

However, there is no established consensus between practitioners and reviewers on what that means in practice, or whether current approaches to demonstrating an evidence base could be codified or improved.

[10] ATAP O8 (2021) Land-use benefits of transport initiatives, pp14

4. What should the evidence base be?

For practitioners and reviewers alike, it can be difficult to determine not only whether a project will create land use change, but also what the scale of that change should be. If top-down land use change forecasts have been undertaken, these are likely to form a foundational part of the evidence base. However, views differ as to what is 'too much' or 'too little' change for a transport project to create. To answer these questions, practitioners and reviewers can examine the forecast changes through the lenses of 'dependency' and 'conditionality'.

ATAP O8 sets out a need to demonstrate dependency – i.e., directly linking the land use change to the project in question – and to provide 'compelling supportive evidence'. The specific guidance is shown here:

Supporting material for dependency could include evidence of current or predicted capacity constraints on nearby infrastructure, modelling of land-use change in absence of the transport project demonstrating adverse outcomes on the network, infrastructure needs assessments from infrastructure providers and/ or government agencies, or findings from consultation with local, regional and state planning agencies.[11]

From this we have at least three tests that we can apply:

1. Evidence of current or predicted transport network capacity constraints
2. Land use 'dependency' modelling
3. Cross-government support, as evidenced by infrastructure needs assessment and/or findings from local, regional, or state planning agencies.

These tests concentrate on one side of the evidence base, specifically on whether a supply constraint exists or will exist in the future. The other side of this evidentiary test covers *conditionality*, rather than dependency:

Conditionality refers to the supporting conditions and activities necessary for the expected land-use impacts to materialise and ensuring that costs and delivery of these are part of the economic appraisal and business case. For example, whether the underlying demand for residential or commercial stock are likely to exceed supply[12]

These tests should cover whether there is sufficient demand for dwellings or commercial space in the area for the forecast land use changes to actually be realized once the project is completed. It is important to prove that:

4. There is already existing unmet demand for property in an area, or
5. That the project will sufficiently change the local property market such that it will create new demand equal to or greater than the amount of land use change that has been forecast.

Current approaches in business cases for justifying land use change (both its scale and whether to include it at all) are ad hoc at best, or not present at worst. It is difficult to recommend a 'one size fits all' approach, but not providing any specific guidance creates uncertainty for

[11] ATAP O8 (2021) Land-use benefits of transport initiatives, pp16
[12] ATAP O8 (2021) Land-use benefits of transport initiatives, pp16

practitioners and, on the other end, a host of frustrating questions and conversations for reviewers and decision makers.

An explicit test of these criteria is needed, but how can it be specified? A test or approach that is too restrictive may provide an erroneous result, lacking the flexibility to accommodate different types of projects. Conversely, a test that is so vague that it could be always passed or always failed is not useful for understanding whether the application of land use change and benefits is appropriate for a project.

There are broader questions to consider even before that stage. One major discussion point is whether these land use tests – dependency and conditionality – should be considered at the project level, or at the level of individual catchments. Given how much land use markets and transport networks differ across even small geographic regions, analysis conducted across the full project region is not likely to provide a detailed, accurate enough picture for decision makers. It is entirely conceivable that a project may have only a subset of local catchments that fulfil the land use evidence requirements. It is also possible that some local catchments may meet the requirements for justifying land use change and a subset of benefits, but may not meet the specific requirements for Higher Value Land Use (HVLU) benefits. For these reasons, individual catchment assessments are likely to be preferred.

Similarly, it is important to realise that the quality and amount of evidence that is available at earlier stages of project development (i.e. planning and strategic/preliminary business case stages) is often lower than at the final business case stages when an investment decision is being made. The evidentiary requirements should reflect the point in the investment decision-making process that a project is at, as well as the scale of the funding request being made.

The tests discussed below reference the dependent development scenarios discussed in ATAP O8:

Figure 8: Dependent development scenarios

		Transport infrastructure	
		Base Case	Project Case
Land use	Base Case	Scenario A	Scenario D
	Project Case	Scenario B	Scenario C

Source: *ATAP 08 (2022) p41, Citing UK DfT (2020)*

3.1 Evidence of a transport network constraint

Transport modelling is undertaken as part of all business cases and can produce evidence of the level of network capacity constraints. Table 2 provides example evidence that can be presented in business cases where time and resourcing permit.

Table 2: Example evidence of a transport network constraint

	Test	Criteria	Example Evidence
1	Evidence of current or predicted transport capacity constraint	*Strategic Modelling*: Average Volume to Capacity Ratio (VCR) in the Local Catchment in Scenario A during peak hour (for the current year, first modelled year, and final modelled year)	VCR over 0.8 in the current year, and over 1.0 on both the first and last modelled year
		Traffic Modelling: unreleased demand – i.e. the number of vehicles unable to enter the modelled network - in the Local Catchment in Scenario A during peak hour (for the current year, first modelled year, and final modelled year)	Unreleased demand in all modelled years
		Average bus patronage to bus capacity ratio for services leaving the Local Catchment in Scenario A during peak hour (for the current year, first modelled year, and final modelled year)	Patronage as a proportion of seated capacity over 100% in all modelled years
		Average bus patronage to bus capacity ratio for services leaving the Local Catchment in Scenario A during peak hour (for the current year, first modelled year, and final modelled year)	Patronage as a proportion of seated capacity over 100% in all modelled years

3.2 Land Use dependency modelling

This test is discussed in some detail in ATAP O8:

One way to establish the dependency and conditionality of land-use impacts of a transport project is to undertake modelling of future scenarios with and without both transport infrastructure and land-use impacts… The underlying principle behind establishing dependency is to compare the transport flows and costs on the existing transport network (i.e. Base Case transport infrastructure), with and without the change in land use (i.e. base and Project Case land use). Under the Project Case land use, demand for the local transport network will increase. As such, dependency can be demonstrated through showing that transport outcomes are unacceptable in either Scenarios A or B[13]

Project teams could undertake a comparison of Scenario B to Scenario A to test the impact of land use uplift in the Local Catchment without the project infrastructure. The analysis would show that the land use change in isolation of the project does not result in an overall transport benefit for the Local Catchment. It may show that overall network benefits are comparable, lower, or higher – but that these can only be achieved at the expense of those within the corridor.

[13] ATAP O8 (2021) Land-use benefits of transport initiatives, pp41

Table 3: Example evidence from land use dependency modelling

	Test	Criteria	Example Evidence
2	Land use dependency modelling	Public transport user benefits for OD pairs with an origin or destination travel zone within the Local Catchment (for the current year, first modelled year, and final modelled year)	Public transport user benefits should be negative or immaterial under scenario B compared with Scenario A
		Road user benefits for OD pairs with an origin or destination travel zone within the Local Catchment (for the current year, first modelled year, and final modelled year)	Road user benefits should be negative or immaterial under scenario B compared with Scenario A
		Public transport crowding on services departing the Local Catchment (for the current year, first modelled year, and final modelled year)	Public transport crowding costs should be higher under scenario B than Scenario A

3.3 Cross government planning and support

Often criticism that can be levelled at integrated transport and land use business cases focuses on the probability of land use change occurring, or the ability of government to effectively realise the planned changes. Project teams should be able to demonstrate consistent cross-government support for addressing constraint problems, by presenting evidence from a range of different government departments.

Supporting material for dependency could include… infrastructure needs assessments from infrastructure providers and/ or government agencies, or findings from consultation with local, regional and state planning agencies.[14]

Project teams should undertake a review of work undertaken by the relevant transport and planning agencies to identify issues and potential solutions in an area. Particularly at the Detailed Business Case stage, it is important to have already undertaken consultation with other relevant government agencies and jurisdictions to ensure there is alignment on what land use change outcomes can be achieved.

Table 4: Example evidence of cross-government support

	Test	Criteria	Example Evidence
3	Existence of cross government planning and support	Identification of a relevant infrastructure need or problem	Completion of an Infrastructure Needs Assessment report relevant to the area and infrastructure in question
		Support at both a state and federal level	Submission / acceptance of a problem or solution to the Infrastructure Australia Infrastructure Priority List to Infrastructure Australia

[14] ATAP O8 (2021) Land-use benefits of transport initiatives, pp16

	Alignment with local government planning for the area	Alignment of population or employment forecasts for planning department or local government project with land use outcomes
	Support from both Department of planning and local governments	Documented support or endorsement of land use outcomes from local government and department of planning responsible for the Local Catchment

3.4 Residential and commercial demand for the local catchment

It is important to be able to convince reviewers and decision makers that the land use forecasts are achievable and not based on aspirational or heroic assumptions. Of particular concern for the realisation of land use benefits is whether there is real demand for the forecast land use uplift in the location where the project is being built. It is incumbent on practitioners to persuade reviewers that the CBA uses realistic assessments of underlying demand, rather than adopting aspirational forecasts that are unlikely to be realised.

Table 5: Example evidence of base demand in a local catchment

	Test	Criteria	Example Evidence
4	Residential and commercial demand for an area	Existing demand for residential dwellings under Scenario A in the Local Catchment in the current year	Vacancy rates below the modelling region average, measured across multiple dwelling types
			Auction clearance rates, or duration that properties are listed on market, relative to the modelling region average, measured across multiple dwelling types
		Future demand for residential or commercial development in the Local Catchment in Scenario D	New construction Development Application lodgements above the modelling region average
			Projected population of the local area in Department of Planning forecasts

5. Land use benefits and the core BCR

Recent updates to land use guidance from ATAP and Infrastructure Australia have begun to walk back or temper the ability of project teams to include land use benefits in 'core appraisal results' or the central estimate of the BCR. This change is reflected in evolving language across a series of government frameworks and guidance documents. For example, the 2021 Infrastructure Australia Assessment Framework recommends that:

When presenting CBA results you should… report results with land use impacts as a 'below the line' item.[15]

This represents a change from previous guidance that recommended that 'second round transport benefits' should be included in the core results. ATAP O8 does not go so far as the Infrastructure Australia guidance and does not make explicit recommendations as to whether

[15] Infrastructure Australia (2021) Guide to Cost benefit Analysis, pp47

benefits should be included as ‘core’ or ‘above the line’. However, it echoes similar wording, and raises concerns on the inclusion of land use benefits:

As there is there is a higher level of uncertainty surrounding land-use change benefit estimates compared with usual benefits estimated in conventional transport CBAs and size of land-use benefits can be large, it is recommended that CBA summary results (net present value, benefit–cost ratio) be reported without and with land-use change benefits.[16]

These recommendations are yet to be picked up or endorsed by the various state treasuries, which tend to be the true arbiter for what is counted as the CBA core results. That said, ATAP and IA are major organisations, with a clear remit to investigate these issues, and their views frequently reflect or influence those of other government departments.

This approach – to provide a blanket recommendation on the inclusion or exclusion of benefits – is not without issue. The inclusion of land use benefits in CBA should instead be based on whether the analysis has been undertaken to a high quality. As discussed across the rest of this paper, land use forecasting and benefit estimation can be done well and can also be done poorly. Projects may gather a strong evidence base to measure and include land use impacts, or they may have scant to little evidence at all. Blanket restrictions on the inclusion of legitimate benefit streams in CBA has distortionary impacts on decision making, as well as on the development of transport economics and cost-benefit analysis as a discipline. It can lead to perverse incentives in base case scoping or mean that real world impacts of major transport projects on land use outcomes are ignored.

Finally, a complete restriction on the inclusion of these benefits impacts on the ability of governance, assurance, and review bodies in the CBA process to determine whether a project represents value for money to the community. If, when best practice is followed, legitimate land use benefits can be accurately estimated for CBA, then it is difficult to justify excluding them from the core decision criteria in totality. Transport departments, state treasuries, and other government agencies such as INSW and IA have the capability and means to review economic appraisals on a case-by-case basis and make a finding as to their merit. At the least, the option to include these benefits in core results should be left open – so that these agencies can assess whether the benefits have been estimated to a sufficiently high standard as to warrant inclusion. Where benefits demonstrate adherence to existing guidelines, provide well documented and robust evidence to support land use change, and draw a clear nexus between the project infrastructure and the forecast change, a strong case exists for the inclusion of these benefits in the core decision criteria.

6. Conclusion

This paper has provided some initial thoughts on how land use forecasting can be undertaken, and documents some of the processes and approaches that are already occurring in practice. It also provides some suggestions for both practitioners and reviewers on the best way to test whether compelling evidence exists to support the inclusion of land use benefits in CBAs.

Land use impacts are an important outcome of major, transformational land use projects. In the current post-pandemic environment defined by increasing costs and reduced public transport ridership, it is important to understand the implications that these benefits can have on determining whether large-scale public transport investments still represent value for money to the community.

[16] ATAP O8 (2021) Land-use benefits of transport initiatives, p. 1.

Given the reliance that decision makers often place upon the central estimate or ‘core BCR’, decisions to exclude certain types of benefits from consideration entirely should be made in rare circumstances only. It is important that developing practice and guidance in this space provides incentives that reward detailed, evidence-based estimates of land use benefits. It is also important that CBA practitioners make conservative, achievable forecasts of land use change and benefits, and report the assumptions and outputs of their analysis transparently.

The inclusion of land use benefits in transport projects is now entering a new stage where a wide variety of different pre-existing approaches are coalescing into a uniform, established practice aligned with standardised national guidance. There remains much work to be done by academics, practitioners, and government agencies to ensure that this is done in a way which promotes best practice and informed decision making for the benefit of communities across Australia.

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