

Justifying investments in cycling infrastructure: 10 lessons learnt

January 2016

CTthink!

Introduction

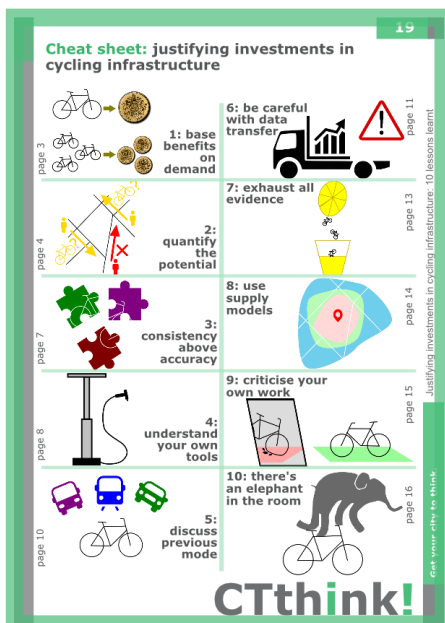
Public bodies in England who wish to fund cycling infrastructure need to present a business case that justifies the investment. The idea of spending money to encourage people to cycle wasn't central to public policy in the UK until quite recently. We therefore make the case for investment in cycling using an approach that evolved from the appraisal of more traditional transport projects, like highway improvements or new railway stations. The established techniques, such as the monetisation of travel time savings, don't make it easy to demonstrate the value of implementing cycling policies.

Government has published guidance on how to apply the standard appraisal approach when the investment is in less traditional policies. The guidance marks an important step forward, although the practice of assessing cycling projects is still quite young. The best practice is not always shared widely, because much of the funding for creating bike-friendly urban areas is allocated through bidding processes, where local authorities compete against each other.

Most professionals find the work on cycling policies exciting and engaging, although the enthusiasm doesn't necessarily help justify the investment. It sometimes has the opposite effect, when the visionary narrative comes at the expense of providing reliable evidence on the need for investment and the likely impacts.

In this report I suggest some key lessons learnt from a review of many funding bids and cycling strategies, both successful and unsuccessful ones. These lessons can be applied when writing a business case or a strategy which include a justification for improving cycling infrastructure. The suggested lessons are informed not just by formal documents but also by a dialogue I've been having since 2010 with planners working on cycling projects across the UK and Ireland. This dialogue developed following presentations I gave at the "Cycle City" and "Cycling Show" events, "Modelling World" conference, LSTF workshops, and several other events.

Justifying better infrastructure for cyclists shouldn't be as difficult as many of us think. We sometimes work too hard or present the wrong types of evidence. I hope this report can make this slightly easier.



There's a cheat sheet on page 19

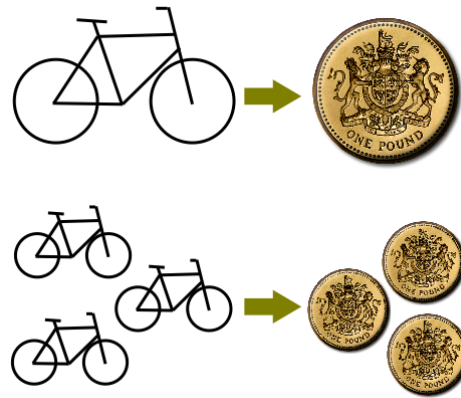
CTthink!

Lesson 1: base benefits on demand

The most significant benefit from the investment in cycling is the improvement to the traveller's physical and mental health, including various secondary benefits gained from having a healthier population. There is plenty of evidence demonstrating this, so I avoid listing dozens of references here. Cycling is a top priority not only from a transport planning perspective; it's also one of the top recommendations from health specialists that don't have any transport agenda. In the cost-benefit analysis, health benefits are applied to the expected number of people that start cycling following the investment, so obviously the benefit is directly based on demand.

Other outcomes which could be significant, either positive or negative, relate to the impact that new cycle routes or priority measures may have on other users of the road network. There are also related safety impacts and environmental impacts. All of these will be related to the change in the number of cycling trips.

All business cases I've seen know this and base the estimation of benefits on the expected change in the number of cyclists. What is less obvious is whether the promoters of cycling projects should also claim additional benefits, which are not based on demand. It is sometimes quite tempting to do so because intuitively, improving the cycling environment is associated with



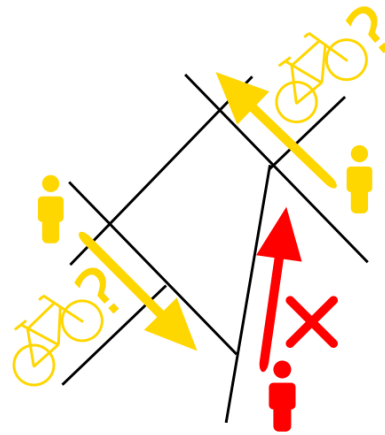
additional benefits. So some business cases blur the boundary between types of benefits which economists see as very different:

- i! Benefits from the direct impacts of the investment. These include the health, traffic and environmental impacts mentioned earlier.
- ii! Impacts of the investment which the standard appraisal methodology doesn't see as a benefit. These include, for example, impacts on the housing market and on rental prices in areas where more people cycle. There are different views about such impacts. They do capture economic value, but the mainstream approach doesn't see them as a net benefit because they're just a price that one person pays to another person.
- iii! Benefits from other changes which are linked to the investment but aren't covered by the project costs. These include, for example, improvements of the urban realm which are implemented along a cycle route but have extra costs.

In an economic appraisal which follows the standard rules, you can only include the first of these three types of benefits. My review of the appraisals of different cycling programmes suggests that including the second and third types in the economic assessment is not worth the risk. This is not to suggest that housing, regeneration or urban realm impacts do not exist. These impacts do exist, but their exact relationship with the project can be easily debated. Since transport economists have not yet come up with a complete theory that addresses the treatment of these benefits, they should be discussed as part of the strategic case, which describes the broader logic behind the investment. Even in the strategic case, the wider impacts make a better impression if presented modestly.

When the only benefits quantified in the economic case are demand-based, the result is a more confident and more focused assessment. These benefits may add up to a lower figure, but this figure is harder to challenge.

Lesson 2: quantify the potential



The main benefits from cycling infrastructure come from a shift of users of other travel modes to cycling. But the estimation of the number of people making this shift is a major challenge. Cycling demand is difficult to estimate even if the cycling network doesn't change, and harder when we add the impact of the project we assess.

I dedicated an article and several conference talks in the past to the various reasons why cycling demand is so difficult to estimate (readers who are interested in these can contact me). In brief, the reasons include our partial understanding of the trends and factors that make people cycle; lack of data even on those factors that we do understand; the difference between cycling and other modes

Consistency above accuracy
Use supply models and your own tools
Discuss previous mode
Understand Elephant in the room
Quantify potential
Exhaust all evidence
Base benefits on demand
Careful with data transfer
Criticise your own work

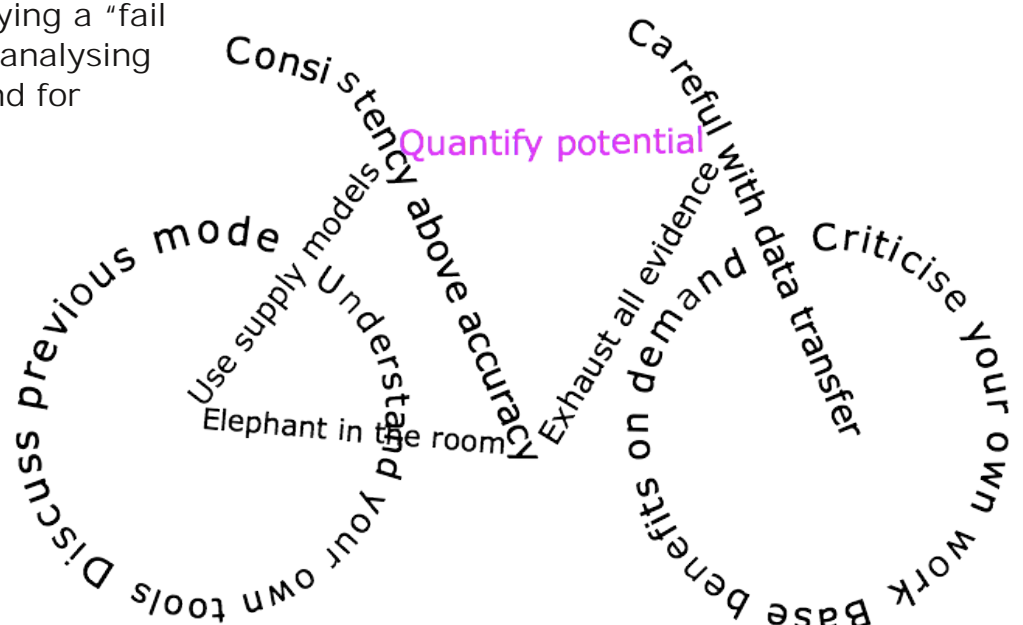
in terms of the demographic and personal features that explain behaviour; statistical issues resulting from the low proportion of this mode out of the total number of trips; and the seasonality of cycling demand.

Many recent business cases for cycling programmes have followed a practice which I wouldn't recommend. They give a very brief explanation of the assumptions they made when estimating cycling demand, and then they dedicate dozens of pages to calculations and conclusions which are all based on these assumptions. The demand assumptions are often difficult to find when you browse through the business case document, but they are implicit in every figure showing health, ambience and other impacts. If you do find the description of how demand was estimated, and you're not sure it's robust, then the entire logic of the economic case might collapse.

Since it's so difficult to establish a reliable forecast of the demand impact, the best appraisals follow a "fail safe" strategy, i.e. they remain convincing even if the reader doesn't accept the demand assumptions. An effective way of applying a "fail safe" approach is by analysing the **potential** demand for cycling in addition to the analysis of the **expected** demand. A high potential means that the investment has good chances of success even if the forecasts are wrong.

The flagship study that followed this approach was Transport for London's Analysis of Cycling Potential in 2010. The study looked at characteristics of travellers and their journeys, such as the age of the traveller and the distance they travel, to determine how many trips in each part of the study area could be made by bike in a "dream scenario". The rationale is that more people **will** cycle if more people **can** cycle, even if the numbers are unknown.

It has to be said that the approach established in TfL's cycling potential study wasn't followed in a consistent manner later; some of TfL's subsequent work adopted the original interpretation of the potential demand, whereas other studies somewhat blurred the hypothetical nature of this measure and treated a fixed part of the potential as if it was a forecast. But the important point to make here is that the analysis of cycling potential is powerful and quite easy to undertake, so every authority investing in cycling should consider following this practice.

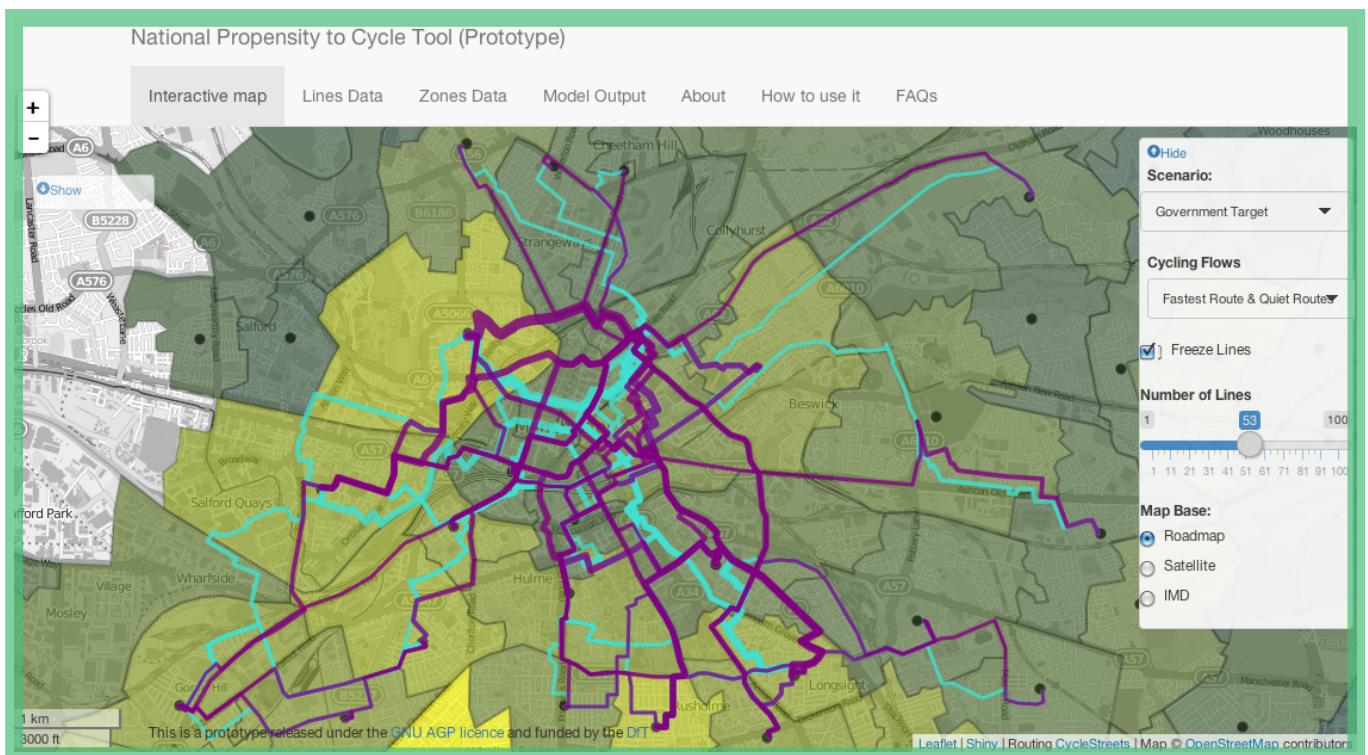


A similar approach is used by the National Propensity to Cycle tool, which is still in development, but a first version is available on <http://geo8.webarch.net/master/>. One illustrative screenshot is shown below. This tool is developed for the UK Department for Transport by the Centre for Diet and Activity Research with a group of university researchers.

The analysis of cycling potential in your own area can be tailored to match the data you have available. To consider which trips could be made by bike, you could look at detailed characteristics of these trips, such as whether the traveller carries baggage and whether they accompany somebody else who would also be able to cycle on this trip. But the analysis is worth doing even if such information is not available. The analysis of cycling potential is also an opportunity to

state your level of ambition in terms of the expected cultural change: what's the youngest and oldest ages you consider for a potential cyclist? Do you consider a trip to be potentially cyclable if it includes 500 meters of pedalling uphill? Your policy should answer these questions, which translate into the potential level of cycling demand.

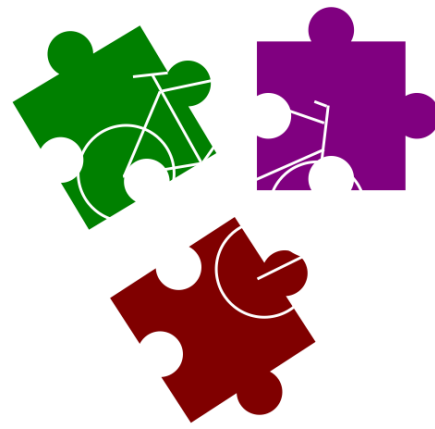
Your definition of the potential demand needs to match the local geography, demographics and travel habits. The fact that you included certain trips in the potential demand doesn't mean that they will become cycling trips. But if you apply the same definition consistently in different parts of your study area, then it can help you show why investment in some areas is more promising than in others. It can introduce consistency across different scenarios where real demand forecasting is too difficult.



Lesson 3: consistency above accuracy

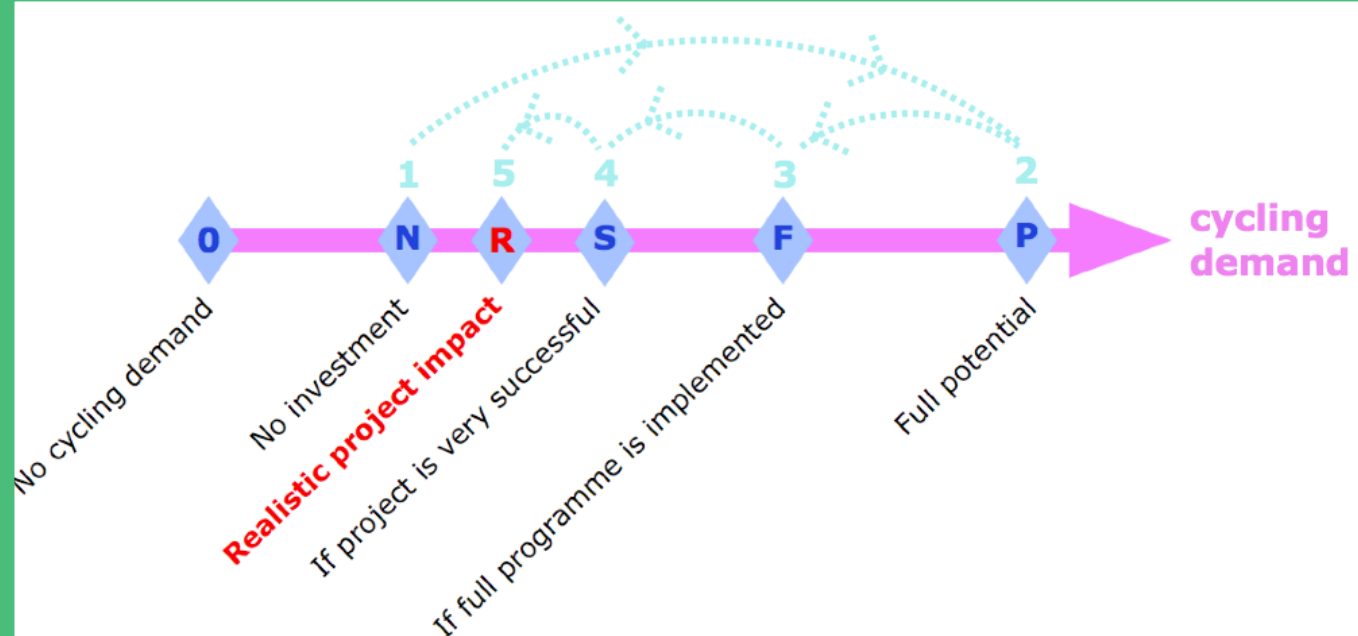
Some improvements of cycle routes are handled as an independent project even if they are one component in a series of related investments. In the economic assessment of such a component, project promoters sometimes include the cost of the individual component only, but when they state the desired impacts, they implicitly assume that some other improvements from the same programme are in place. Unfortunately, this counts as cheating!

We already mentioned the genuine difficulty to estimate the demand impacts of projects that focus on cyclists. For smaller projects it is even harder, since we don't have good tools to examine how people's behaviour is influenced by microscopic traffic measures. So whichever forecasts you use, they don't count as strong evidence, and the credibility of your different project assessments depends more on the level of consistency between



them, and less on the demand estimation technique used in each one. A consistent approach is one where the added impacts of many small investments can be seen as the impact of the whole programme, without double-counting of the same impact in two projects.

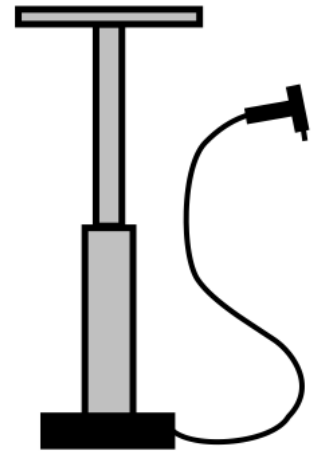
The process described on the next page, and also in the figure below, is nothing more than a logical checklist. It very much just states the obvious, but it still isn't always followed. When it is followed, it can help impose consistency on your appraisal work whenever your cycling project is part of a programme. And if such consistency is maintained in all your cycling projects, it could make the difference between a project that gets funded and one that doesn't.



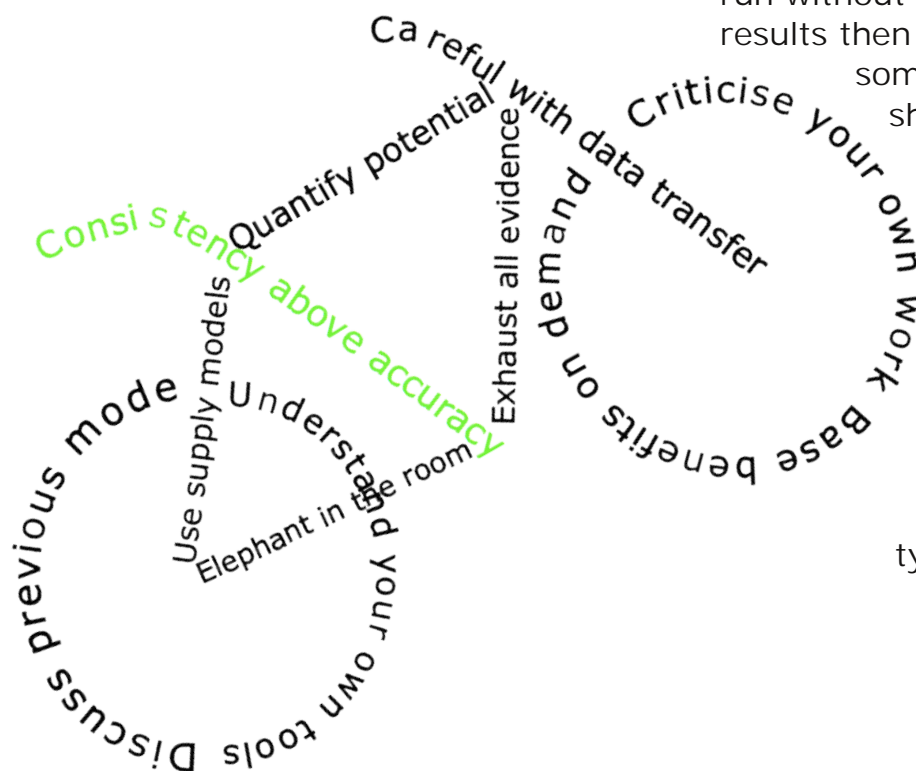
- 1) Show your expected cycling demand without any investment (N).
- 2) Show the full potential for cycling (P).
- 3) Show your expected cycling demand if the full programme is implemented (F). Note that F has to be more than N but much less than P.
- 4) Show your expected cycling demand if your project is extremely successful (S). Note that S has to be more than N but less than F.
- 5) Bring some evidence on how successful your project is likely to be. Show your expected cycling demand (R), reduced to reflect a realistic level of success. Note that R has to be more than N but less than S. The difference between R and F also needs to match your demand forecasts for other projects in this programme.

Lesson 4: understand your own tools

Transport planners are often under pressure to show evidence that they are confident in the future impact of the projects they work on. I dedicated a whole report in November to the way this can lead to irresponsible use of transport models. This problem is highly relevant to the work on cycling projects because, as mentioned earlier, our ability to forecast cycling demand is even more limited than our general modelling capability. Over the last few years I spoke to many local government officers, who worked on cycling projects, and were under pressure to squeeze from their models some insight that the models simply weren't suitable for.



I've seen a microsimulation model run without a demand model, and the results then discussed as if they say something about modal shift to cycling. If you're not familiar with the terminology, I'll just note that this modelling approach doesn't look at modal shift at all, not even implicitly, so you can't reach any conclusion about mode choice from this type of modelling work.



I've seen work where modellers set the bike PCU (i.e. the amount of road space taken by one bicycle) at a certain level, which seemed like a logical assumption, and then ran a model to reach conclusions about the amount of road space taken by the bike traffic. Again, you may not be confident in these technical terms, but this is another example of quite a weak methodology.

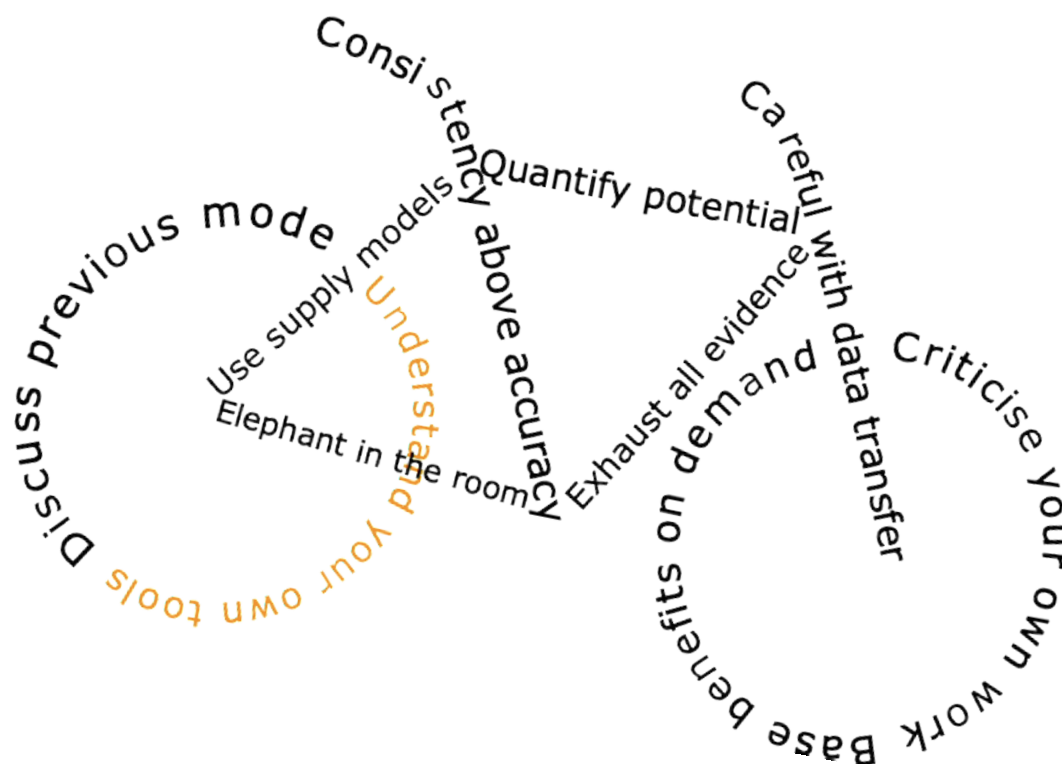
I've also seen the total demand for cycling estimated using a large scale, multi-modal demand model, and then used to make various policy arguments, ignoring the fact that the entire demand for cycling was at an order of magnitude that the model would consider insignificant.

There is no need to be a modelling expert in order to avoid such critical mistakes. You need to list all the types of traveller behaviours that must to be examined in order to look at the impacts of your project (for example, "starting to cycle" and "changing cycling route"). You should include key traffic phenomena

in your list as well (for example, "how the number of cyclists affects bus delays"). Then you need check whether each item on your list is looked at by the model you use. Your modelling colleagues can help you with this, but you shouldn't try to guide them towards the answer you want.

I'm pretty sure that some behaviours or phenomena from your list are not covered by the model. If you decide to use the model results as they are all the same, for example because this makes the subsequent work stages easier, then unfortunately your business case won't meet an acceptable standard.

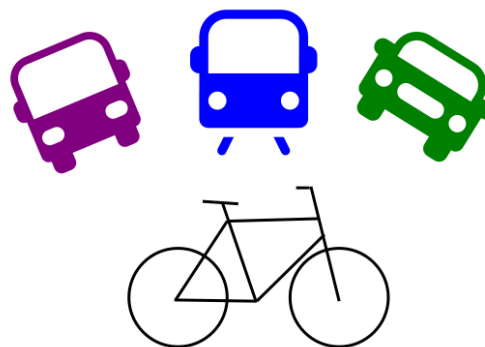
By contrast, if you explain in your business case that some of the questions of interest are not supported by the modelling capability, and if you follow the other lessons listed in this report, then you are relatively safe. The case for your cycling project will be stronger than if you base it on the impressive outputs of flawed modelling work.



Lesson 5: discuss previous mode

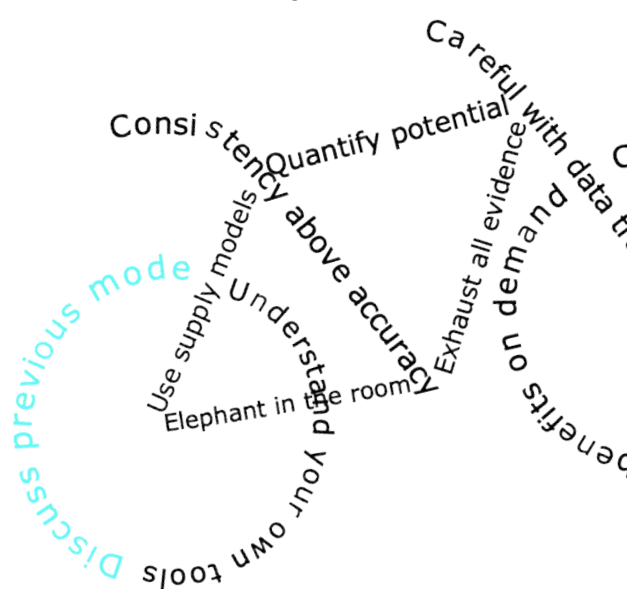
Benefits from traffic relief will accrue only if the new cyclists previously used to drive. Health benefits will only accrue if the traveller wasn't previously physically active, and reduced crowding only if new cyclists previously used public transport. If your estimated changes in cycling demand come from a multi-modal model then the model can show you which mode people shift to cycling from. But in areas where the cycling demand is a low proportion of the overall travel demand, very few multi-modal models exist that can be reliably used to predict modal shift to cycling. Even where these models do exist and include a cycling mode, information on when people shift to cycling often needs to come from an external source, and the model just ensures that the demand that came from each mode is deducted from the remaining demand for that mode.

It is therefore well worth paying attention to any other available source of information regarding which mode people used before they started to cycle. In places that have good data of this type, we often see that most new cycling trips are made by people who cycled already (for different purposes), or people that previously used public transport. Statements about the traffic impacts and health impacts of the project are not always consistent with these findings.



There's a very effective way to show awareness of this issue, even if you can't model how many users of each mode will start cycling. This approach is an extension of the study of the potential cycling demand, which I explained under lesson 2. What it involves is adding another calculation of cycling potential, but this time the cycling potential amongst car users only. Showing both these definitions of the cycling market, i.e. the general potential and the potential amongst car users, can provide some truly convincing arguments for your business case. If the promoted project has a high proportion of car users within its potential demand, or if a high proportion of its potential demand travels along congested corridors, it may be viewed more favourably even if the number of cyclists it can attract is lower.

Note that in order to present such powerful evidence in your business case, you don't need to carry out any modelling work at all. Most towns and cities have all the inputs they need for this analysis.



Lesson 6: be careful with data transfer

There is a tendency in the UK transport sector to see forecasts of project impacts as the primary type of evidence you need before a project can be approved. This approach doesn't have clear theoretical foundations, and even less so when the project focuses on cycling infrastructure, because of the modelling difficulties we mentioned earlier. In the absence of strong evidence from a forecasting tool, checking the outcomes of similar investments in other places can be an excellent alternative. Looking at data about the actual impact of past projects should be seen as the primary source of evidence even when we do have good models, let alone when we don't.

Not every data source is equally helpful, though. I've seen cases where the outcome of a different investment in a different place at a different time was presented as relevant evidence, without explaining why it is considered relevant. You can't assume, for example, that building some cycling infrastructure like they have in Denmark will result in Danish cycling behaviour, because the cultural and historical context probably makes figures from Denmark inapplicable to your case (unless you're in Denmark!). Even when you look at data from somewhere much closer to your study area, its transferability to your area isn't so obvious.



The following questions should be discussed in your business case whenever you argue that you can learn from the impacts of a previous project (the "reference project") about the possible impacts of your project:

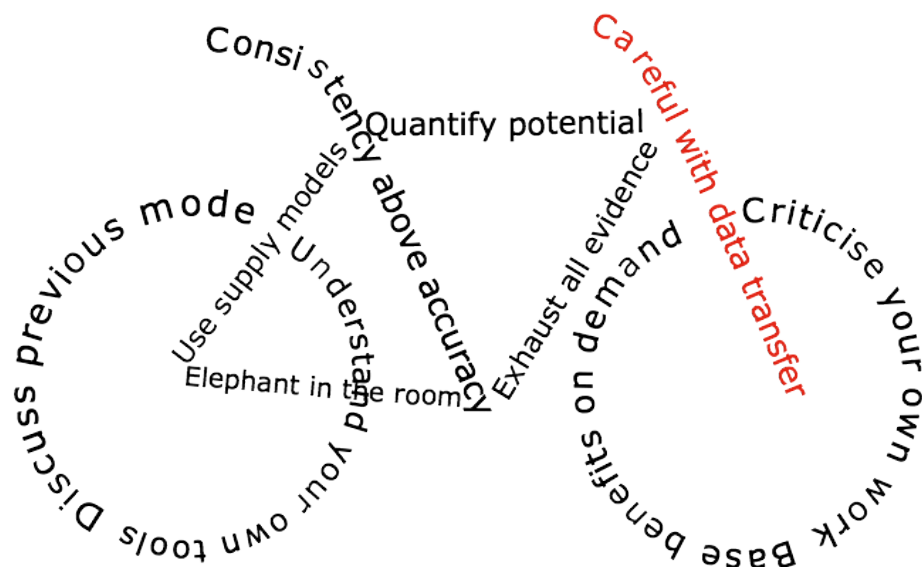
- i! Were the people who responded to the reference project similar to the people you're targeting, in terms of their travel behaviour and preferences?
- i! Is the surrounding transport system similar between the reference project and your own project, for example in terms of levels of congestion and public transport alternatives?
- i! Is the cycling experience before and after the investment similar between the reference project and your own project, for example in terms of hilly paths, signage and cycle parking?
- i! Are the conclusions from the reference project still relevant today, despite the time that may have passed?

- !! How long after the implementation of the reference project did they collect the data you're using? Are you using this reference with a similar timeframe in mind?
- !! Is there evidence that the impacts reflected in the data are really impacts of the reference project, and not of other factors or trends?

There's no need to have positive answers to all these questions. Any information about the level of success of previous projects may strengthen your own case, if you simply clarify what is and what isn't relevant to your case in the reference project. It's good if you can show that a very similar investment in a very similar setting led to a significant increase in the number of cyclists, and then assume that your project could lead to such impact. But it's even better if you refer to the impacts of past projects as an upper limit, and say that you expect the impacts in your case to

be more modest. This adds realism to your appraisal, and realistic appraisals are generally more successful than over-optimistic ones.

When commenting on where your project is likely to perform better or worse than previous ones, you can touch on many different aspects of the investment. You can comment on similarities between the cases in terms of the public perception of cycling, existing cycling network and facilities, competing modes, opportunities for a continuous ride, and many other things. It is important to remember that the assumptions about the demand impacts of your project are made earlier in your work, and then many other parts of the work depend on them. Basing these assumptions on unsuitable precedents, or showing over-confidence in the expected outcomes, is quite common amongst projects that weren't successful in getting funding.



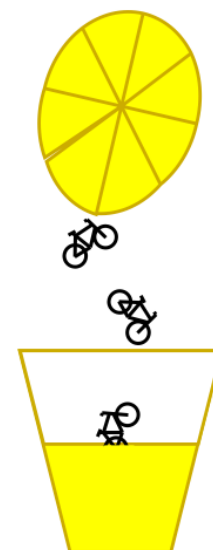
Lesson 7: exhaust all evidence

We're still talking about the difficulty to establish that your work on cycle routes or similar improvements has a good chance of bringing the desired benefits. It's not uncommon that referring to other projects in the area, or similar projects elsewhere, still isn't sufficient to demonstrate that your project has what it takes to be successful. It is important to remember that many bits of evidence, which may seem too small or anecdotal to you, can help justify your intervention. Such sources may include:

- !! Stories that demonstrate the appetite for the project amongst potential users.
- !! Information about the level of support from local groups and residents.
- !! Information about measures introduced by local businesses that complement the investment.
- !! Stories about local opportunities that were missed in the absence of suitable cycling infrastructure.
- !! A description of how the technical design of the planned infrastructure maximises its ability to attract potential cyclists.
- !! Information about other measures taken to remove some of the known barriers to cycling.
- !! Any evidence that recent activities to remove barriers to cycling are bearing fruit.

In some business cases, these facts and figures are lost on the boundary between the "strategic case" and the "economic case". They are not included in the economic case, maybe because of a tendency to wrongly see such information as a inferior to model outputs. They are also not included in the strategic case, maybe because project promoters feel they have to put more emphasis on how strong the need for the investment is, so they focus more on deprivation, health issues and links to employment.

No matter in which part of the business case it is included, information like this can be directly used to explain why you believe that the impacts of your project (point R in the figure on page 7) will be closer to their maximum potential (point S in the same figure).



Lesson 8: use supply models

When we make the case for new infrastructure for highway users, we run highway network models and can then look at the outputs presented as a map of travel times. Such capability is not yet common when working on cycling infrastructure, although Transport for London plans to launch a cycling time feature in its mapping website, tfl.gov.uk/webcat. Maps of cycling times before and after an improvement are one example of analysis that focuses on the supply side (given that cycling times aren't strongly influenced by the cycling demand). Other supply-side measures include aspects of the journey experience such as the maximum altitude difference that needs to be cycled or the number of junctions that need to be crossed, with and without a new route.

The demand side is critical of course, as discussed earlier, but supply-side thinking adds an extra dimension when working on cycling projects, and it may be worth the effort. If your vision is to turn the bike into a mainstream mode of transport across an area, then you may want to ensure that the cycle network provides a decent level of service to most people and to most destinations. Focusing on the places where demand potential already exists makes good sense as a short term strategy; but addressing issues of poor connectivity by bike opens opportunities which you might miss if you think about the demand side only.



Since I'm often asked, it's worth clarifying that mapping the travel time by bike is not the same as using the bicycle option in an online journey planner. Many authorities and operators already include a cycling option in their journey planners. This is an important tool but it's not so related to strategic planning, since the user needs to define a specific origin and a specific destination, and this is too detailed to provide a strategic context. For planning and appraisal purposes, a typical map would look at the cycling times from a selected location to all other places (as in the "time mapping" option on tfl.gov.uk/webcat). Presenting the levels of bike connectivity this way, even if this requires some bespoke analysis, is very effective in highlighting gaps in the cycle network and opportunities to attract new cycling demand.

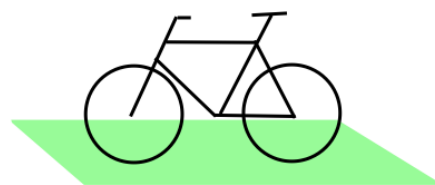
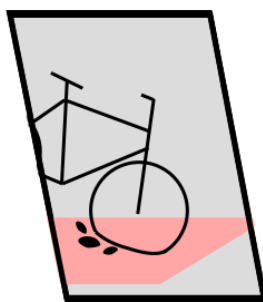
Consistency above accuracy
Quantify potential
Careful with
Exhaust all evidence
Benefits on demand
Understand
Use supply models
Elephant in the room
Discuss previous mode
Discuss your own tools

Lesson 9: criticise your own work

The point I make under this lesson just repeats things I said earlier, and is actually relevant in any appraisal of any investment. But it's worth repeating it when it concerns the assessment of cycling projects, because teams working on cycling policy can sometimes be so enthusiastic about their work, that they forget that transport appraisal is a matter of bureaucracy.

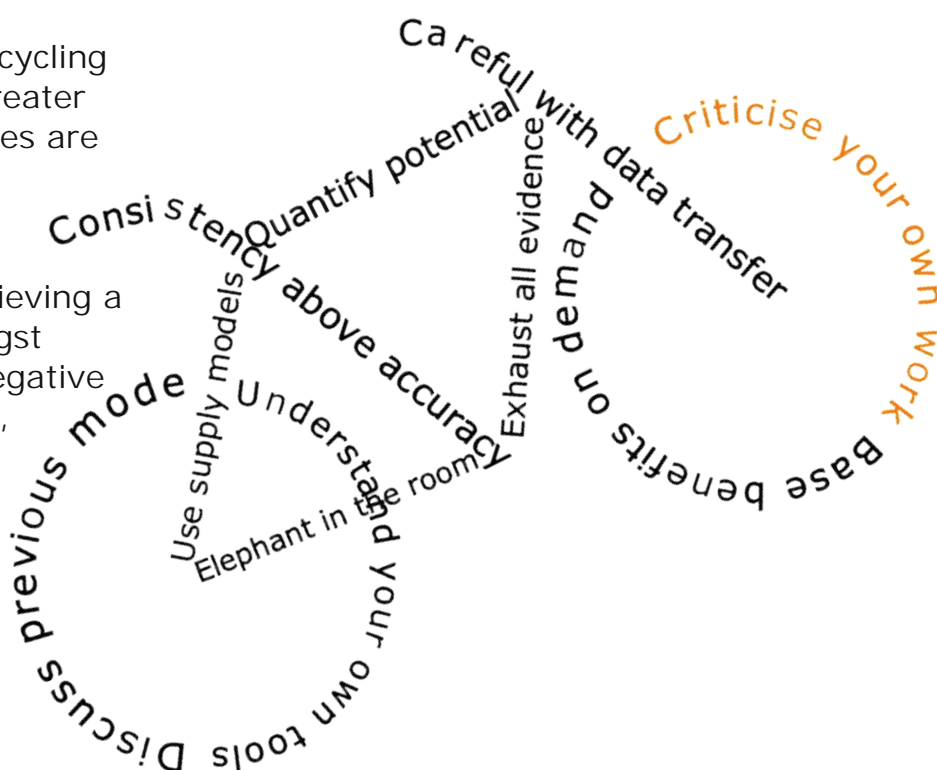
The great faith that planners have in improving infrastructure for cyclists is a great thing, but there is a gap between the optimism that radiates from our strategic documents and the real-world difficulty of getting people on their bikes. The people that read your business case know this, and they look for signs that indicate to what extent you've applied realistic adjustments which take this gap into account. It's in your interest to show that you've done this yourself, because otherwise they'll apply their own adjustments.

Your case for investing in cycling would be reviewed with greater empathy if all the difficulties are discussed openly. This includes difficulties in estimating the demand impacts, difficulties in achieving a behavioural change amongst travellers, and also any negative impacts of the investment, such as conflicts in traffic between bikes, cars, lorries and buses.



A particular topic where self-critique is insufficient, in many bids to fund cycling programmes, is the shift from cycling back to other modes. When an improved cycling network has the desired impact of getting people to cycle, the modal shift is permanent for some travellers but temporary for others. Assuming that every new cyclist will remain a cyclist throughout the appraisal period will give an appearance of higher benefits, but will reduce the credibility of the whole work.

The best cycling strategies don't sound like a sales pitch. A conservative view on disbenefits, uncertainties and implementation difficulties can help ensure that your audience trusts your assessment of the benefits and the positive impacts.

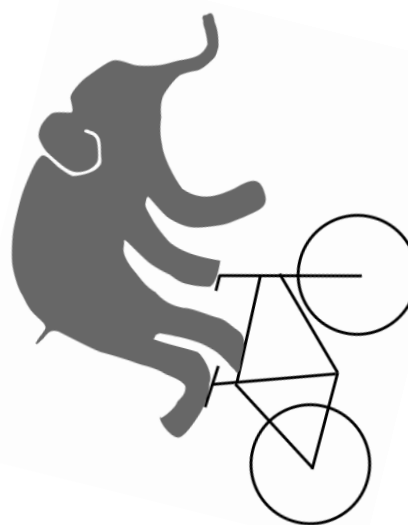
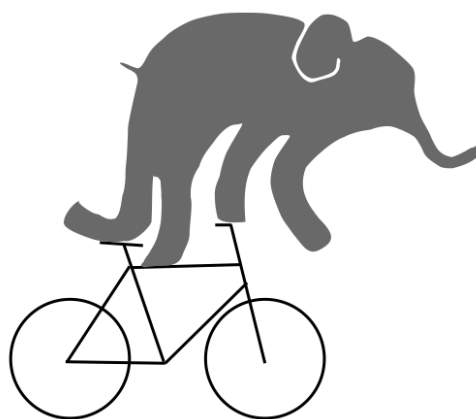


Lesson 10: there's an elephant in the room

Everything I said here is based on the basic economic practice, which says you should weigh the benefits from your investment against the cost. You can only claim a benefit that results from your own investment. I have no doubt that following this rule, and the other tips suggested here, will make your case for investment more convincing.

At the same time, I retain a degree of cynicism about the whole process, and I'd recommend that you do the same, because the assumptions we make aren't true. If we really have to limit the benefits of each project or programme only to those that result directly from this specific investment, then cycling infrastructure doesn't have much value. Many of the investments made to cycling networks throughout the UK during the last decade haven't shown yet a clear impact. In many places where cycling levels have grown, it's not clearly attributable to a specific investment.

The main benefit from most of our cycling work is meant to be the way it contributes to a major cultural change. The millions invested in cycling are meant to gradually add up into a critical mass which will, at an unknown point in the future, turn England into a cycling nation, with all the huge benefits this would finally bring. We don't know how feasible such change is, how successful it will

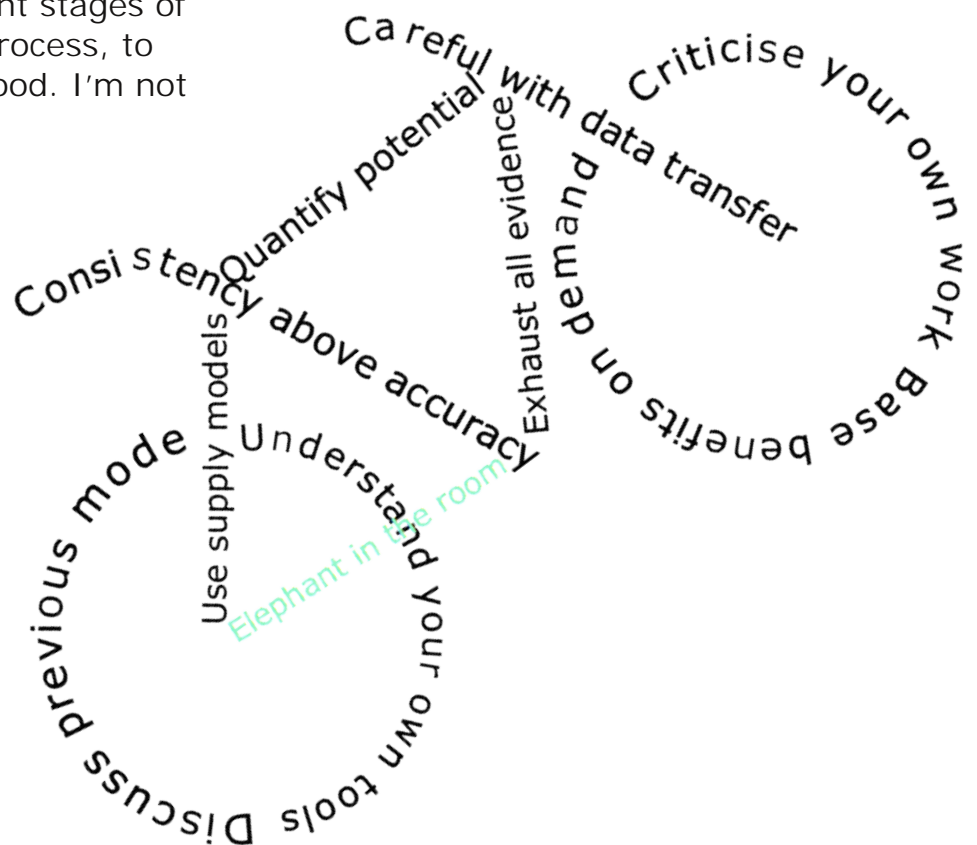


be in practice and when it will occur. And if it does happen, then the benefits will probably take a different form to what we currently know how to quantify.

We don't have a better economic theory than the one we use, so we rely on the existing one, but an appraisal based on this theory needs to be taken with a pinch of salt when the focus is on bringing a cultural change. The idea of building infrastructure in order to create new behaviours is a stranger to the current appraisal approach, because the new behaviours haven't been observed yet so they cannot be forecast. The need to write traditional business cases for such investments is understandable, but it should be remembered that this is one bureaucratic aspect of the policy-making process, and it isn't the policy itself.

Some bids for cycling funds make special efforts to push the figures upwards, and inject generous factors or parameters at different stages of the number crunching process, to make the results look good. I'm not

sure this is worth the effort, because there is nothing about this process to indicate that the investment is bad, even if the figures are low. It's important to make a convincing case for the investment using the common conventions, while not letting our rough arithmetics dominate it. The reliance on such calculations, whatever they show, can't beat the simple logic of encouraging active non-mechanised travel.



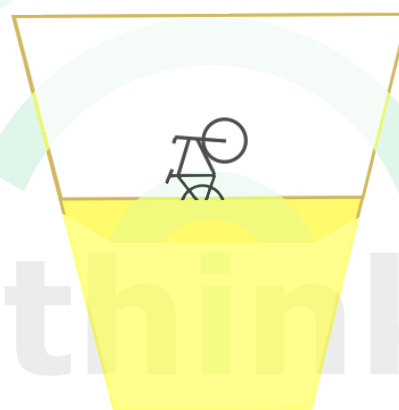
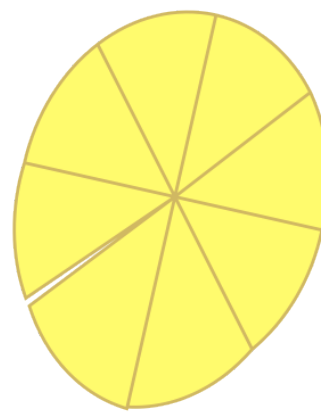
Conclusion

I've included in this report some recommendations which can help you, I believe, make a strong case for building or improving cycling infrastructure.

The difficulty to guess what the impacts of the investment will be is a key issue. This difficulty is sometimes wrongly handled by trying to squeeze forecasting tools beyond their capabilities. There is also a tendency to be over-optimistic about the potential impacts of our cycling project, or mix the impacts of this project with the impacts of other projects that have additional costs. A degree of enthusiasm is a good thing, but there's a risk of working too hard, or losing the credibility of the appraisal, or both.

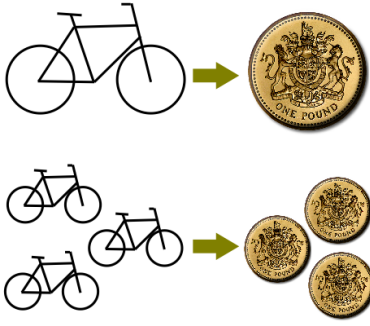
Justifying intervention in the cycling network shouldn't be difficult. There is currently more support for such investments than ever before, so the best way to tick the right boxes is to write a simple business case that is informative, modest, logical and transparent.

I hope that my suggested lessons, summarised in a cheat sheet on the next page, can help you achieve your cycling vision and ride your bike off into the sunset.



Cheat sheet: justifying investments in cycling infrastructure

page 3



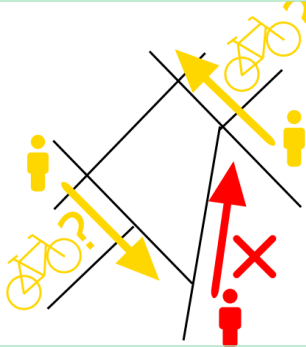
**1: base
benefits
on
demand**

**6: be careful
with data
transfer**



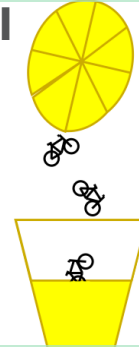
page 11

page 4



**2:
quantify
the
potential**

**7: exhaust all
evidence**



page 13

page 7



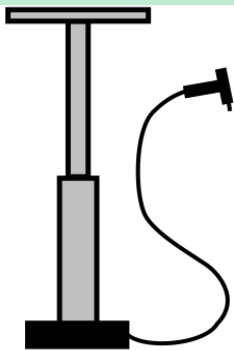
**3:
consistency
above
accuracy**

**8: use
supply
models**



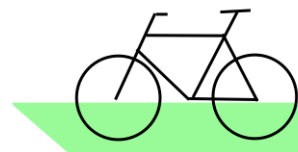
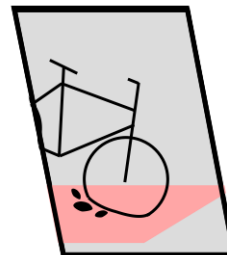
page 14

page 8



**4:
understand
your own
tools**

**9: criticise your
own work**



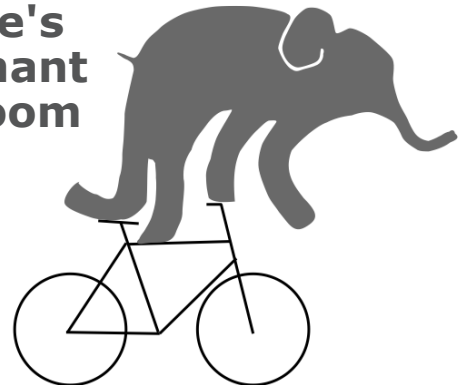
page 15

page 10



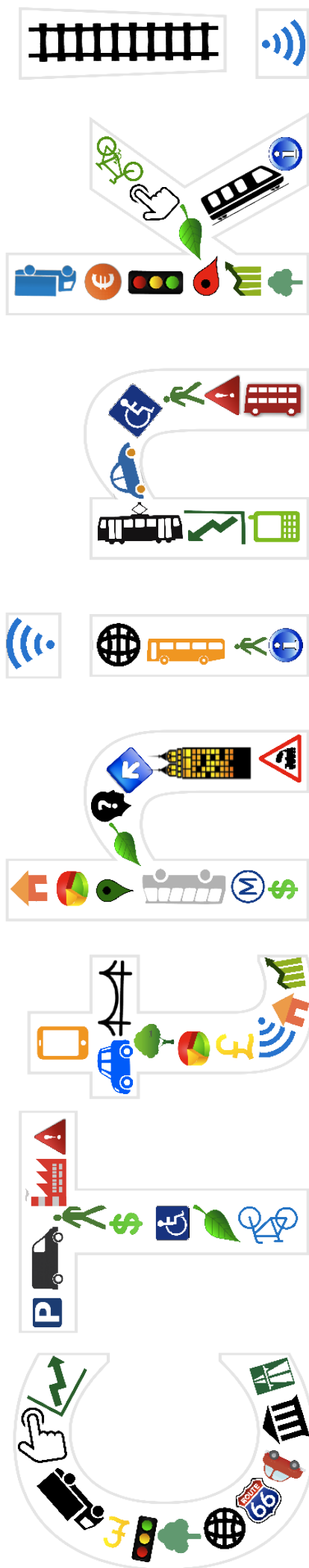
**5:
discuss
previous
mode**

**10: there's
an elephant
in the room**



page 16

CTthink!



CTthink!

info@CTthink.com

A report by
Yaron Hollander

© Copyright 2015-16
CT Think Limited.
All rights reserved.

We are a consultancy specialising in infrastructure appraisal, transport analytics, and IT solutions for the planning sector.

CTthink!

Get your city to think.