Bee a champion

Training course

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RESEARCH | PLANNING | STRATEGY | DESIGN

BEE A CHAMPION Training course

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CONTENTS

NOTE: This training manual is designed to work alongside the following documents as a design reference until a full GM Streets Manual is developed:
Global Streets Design Guide
Designing for Cycle Traffic - John Parkin

This is a walking and cycling manual but the focus is on introducing cycling infrastructure whilst also enhancing the walking experience. On most streets the basic conditions for walking are met. On practically all streets, conditions for cars are met. But few streets have been specifically designed to accomodate cyclists. Therefore, this manual covers the retrofitting of streets so that the walking and cycling experience is enhanced to the point where these modes are the natural choice.

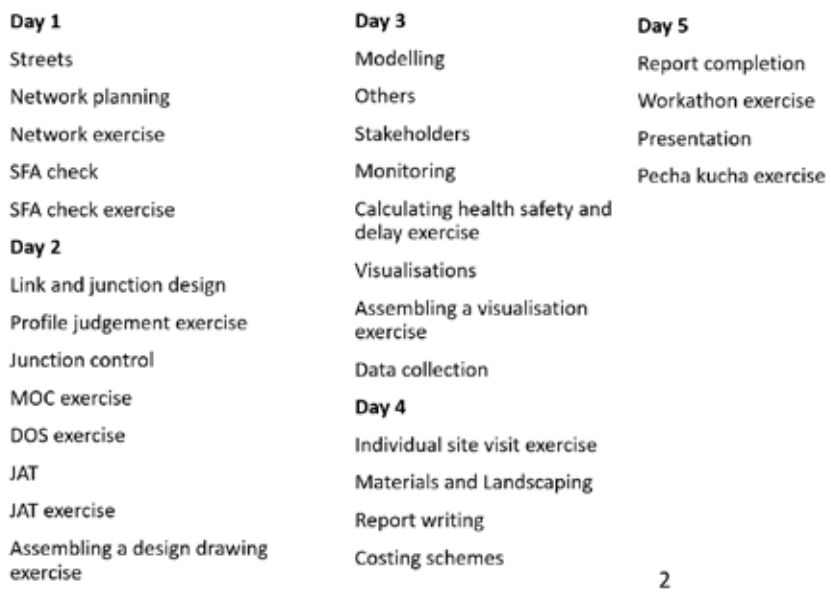
Day 1: Streets

Introduction & Principles

The first thing a champion must realise is that there is no such thing as a walking and cycling scheme, but there is also no such thing as a scheme that isn't a walking and cycling scheme. All public highway schemes affect everyone and it is up to civic authorities to decide whom they will affect positively and whom they will affect negatively.

There has never been a perfect scheme on planet earth where everyone has benefited and so whoever has the strongest, most pertinent case tends to win out. Most highway schemes around the world have negative consequences for people who walk or cycle and this is not because the world is evil, it is because these considerations are lost when compared with the considerations of other modes.

Slide 2 course contents



Slide 1 let the kids out

To understand why walking and cycling is important it is advised to take a look at your city from a bird's eye perspective. The view of the land use planner: the officers who carve up regions and play SimCity with all our lives. We will return to this perspective later today when we look at planning networks. For this course I will mostly be referring to London when using examples. This is mainly because I have been working in London for twenty years and so know all the data off the top of my head. I would strongly encourage you to quickly translate any London facts and figures into those from your own area and see how they compare. It seems to me that most cities have the same issues and it also seems to me that the human-powered modes promoted in this manual go a long way to addressing many of them.

The main other mode that dominates any attempt to design streets is the car. This symbol of freedom, in reality, traps people in their homes or in sedentary lifestyles, damaging themselves and society. This, however, is not an anti-car course but it is a pro streets-for-people course. Civic authorities around the world are starting to realise that designing streets for the sole purpose of moving cars efficiently may not be the wisest course of action, and yet car voices are so clear, and their owners make such a sound economic case.

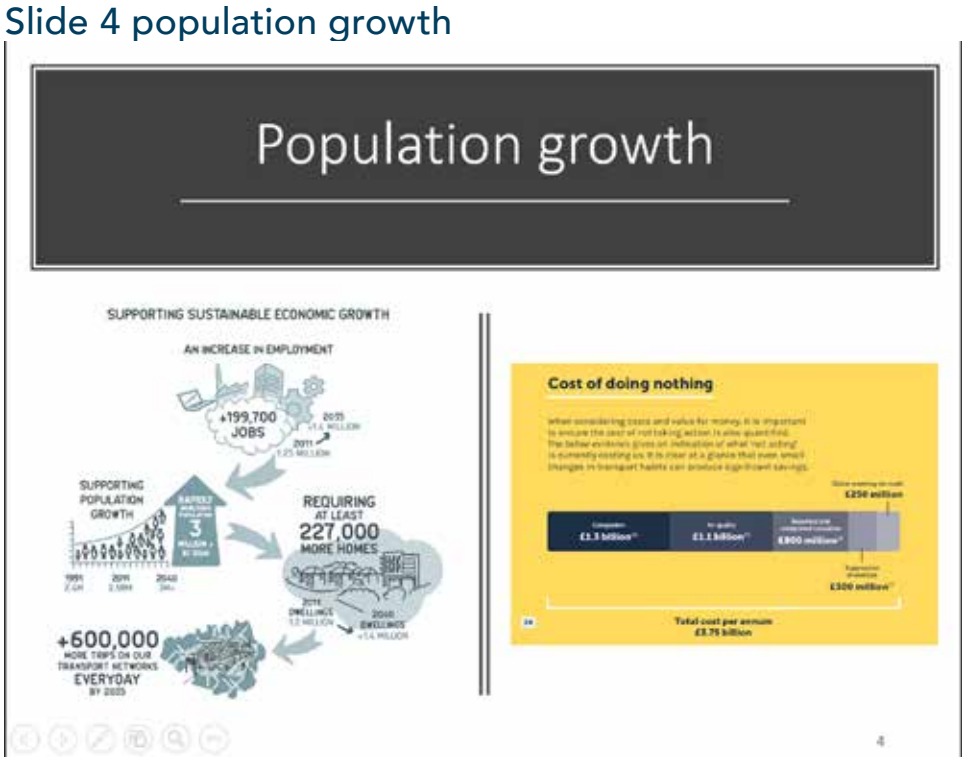
Nothing is easier to quantify than the driver's view of congestion and we will look at how to do it ourselves on Day 3. But just because the maths is easy, it should not necessarily distort our entire economic view. There are other considerations and we will look at how to quantify these in detail on Day 3 as well.

Slide 3 made to move

The issues

London is growing by six residents an hour, which is a car load every forty minutes or two buses a day or two tube trains a week. Today the population is 8.6M but by 2030 it is expected to be 10M. How can the transport system cope with this many new passengers or users? That is the major question that city planners face, and one of the major issues that affects the quality of life of its residents. Most cities around the globe are densifying, to use a planning term, but this can be an opportunity and is certainly better than sprawling in sustainability terms.

Slide 4 population growth



1.4M new Londoners will equate approximately to a total of 11B annual trips, which is quite a lot of movement to accommodate. If London were to carry on as it is today, it should expect an annual cost of £9.3B from congestion, which is rather a large bill to receive. So, put simply, London needs to increase its capacity to move people or it faces going bankrupt. Our first citywide question then becomes: how do we move people more efficiently? The answer is walking and cycling, as bikes take up only a fifth of the space of cars, so you can get five of them past a point in the same time as one car. Average vehicle occupancy in London is about 1.5 people per car, so even then cyclists are three times more efficient. Cars also spend over eighty percent of their time parked, taking up valuable space. One car parking space can easily accommodate twelve bikes. Double that if you stack them. Walking also gives high flows of people past a point, although speed is a limiting factor in this case. Walking and cycling gives back space and time to a city.

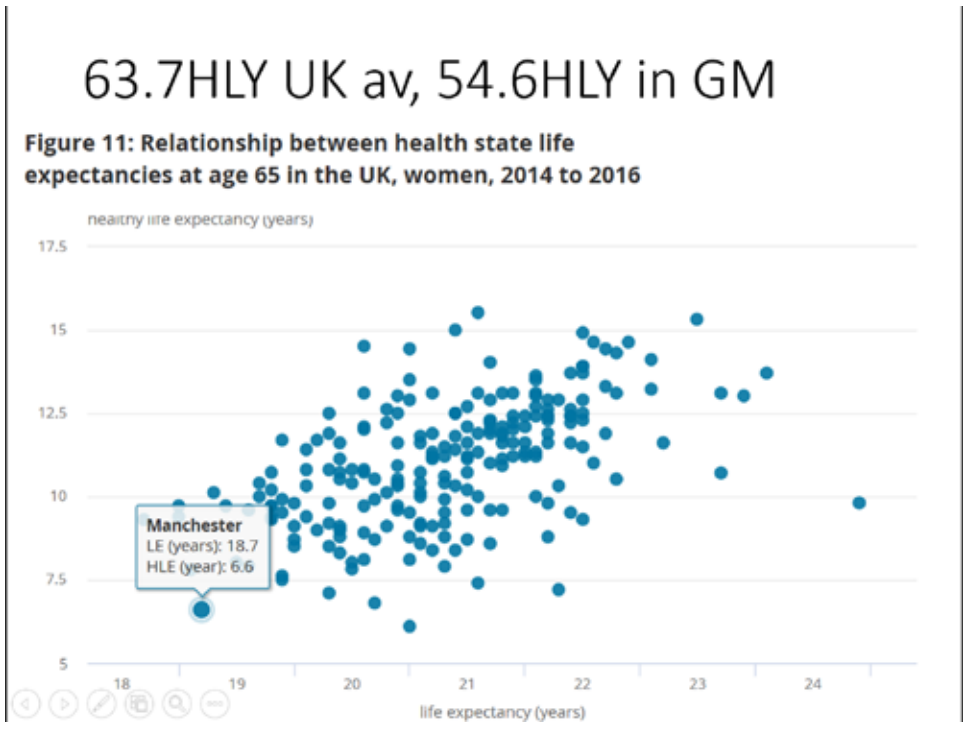
Slide 5 congestion

Greater Manchester Mayor Andy Burnham has announced funding for new trams and other measures to tackle congestion.

The Congestion Deal includes £80m for 27 new trams and £160m to be spent on new cycling and walking lanes.

London, like many other cities, is facing a health crisis in that many of its citizens are living longer but unhealthier lives, which, in a country that prides itself on its free health service, is putting a huge strain on the state. Only twenty percent of Londoners get the UK Chief Medical Officer's recommended one hundred and fifty minutes of exercise a week, but this figure could move up to sixty percent if they switched their short trips to active modes such as walking and cycling. So if our second citywide question is: "What do we do about our health crisis?", then the answer again is walking and cycling. We will return to health on Day 3 and look in detail at how to quantify the health impacts of schemes.

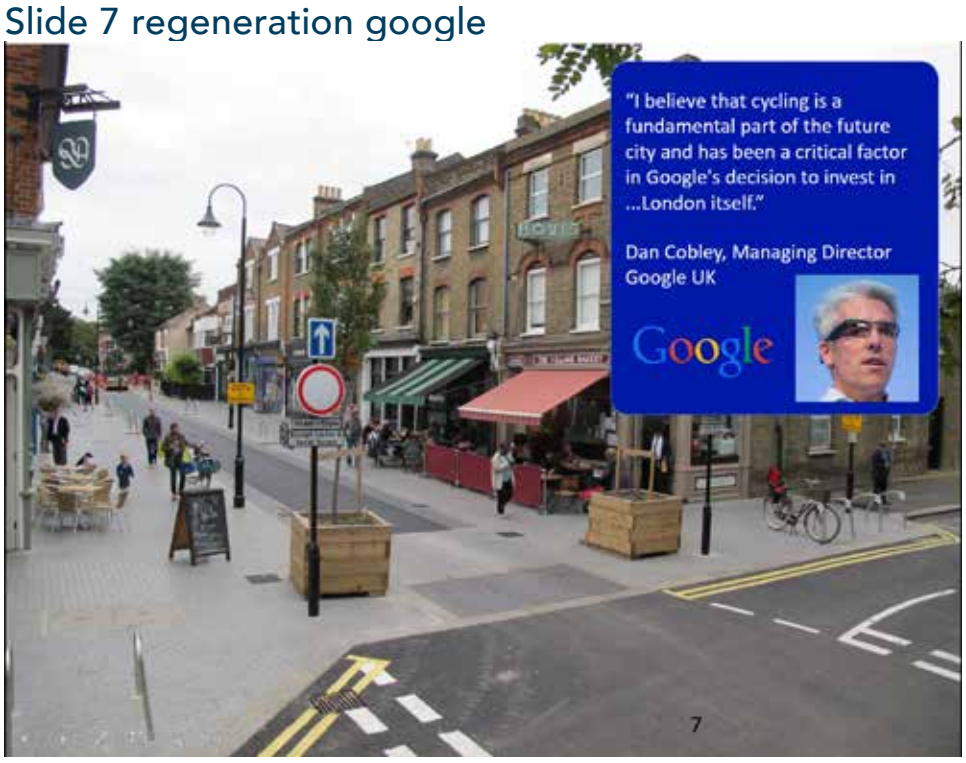
Slide 6 health



The economy

Most countries are still engaged in fighting their way out of the last economic crisis and so city officials are keen to support anything that helps the economy to recover and grow. This is traditionally viewed as an area where the case for walking and cycling suffers, as businesses work to the clock and want to move goods and services as quickly as possible. However, this traditional view has changed over the years in London, as many employers realise that the majority of their staff are not arriving by car but instead walk and cycle.

Slide 7 regeneration google



This is particularly true in the financial sector where the most time-sensitive and high-earning employees have realised that nothing gets them around town quicker than the common bicycle. Top companies seem attracted to places with excellent walking, cycling and public transport links. Google, for example, cited walking and cycling as a critical factor in their decision to open a new office in Camden, London.

Over one hundred and sixty companies from the finance, technology, law, media and healthcare sectors have now signed up to the CyclingWorks website (cyclingworks.wordpress.com) which supports segregated lanes. So, if the question is: "How do we improve the economic prosperity of the city?" then the answer is walking and cycling.

Slide 8 cycling works


London businesses support 'Crossrail for Bikes'

Employee demand

Healthy lifestyles

Our environment

A world class city

Supporting retailers

Reduced congestion

In periods of economic strain, public services are subject to cuts and every penny in the public purse is scrutinised. Day 3 will cover the business case process in relation to walking and cycling but it should be noted here that schemes that promote walking and cycling tend to have excellent benefit cost ratios. In fact, for many years, these were so high that they were not taken seriously by those who appraise transportation schemes. Even with the most conservative estimates taking into account every known disbenefit, and with these amped up to the worst case scenario level, it is very rare to see a scheme promoting walking and cycling come out with a negative benefit costs ratio. The benefit cost ratio for the billion pound Mayor's Walking and Cycling Vision programme was three to one, and this is on a par with the Department for Transport's Cycling Demonstration Town project. Their Cycling City Ambition grant has a value of over five to one and these values have been assessed by the same people who write the business case evaluation guidance. So, if the question is: "How does the public sector maximise its impact in strained financial times?" then the answer is walking and cycling.

Slide 9 business case DfT extract CBR

Table 2.1: Summary of BCRs discussed

	BCR	Comment
Sustainable Travel Towns	4.5:1	Decongestion benefits only
Cycling Demonstration Towns	2.59:1	Adult health benefits only
Local Sustainable Transport Fund [ex ante appraisal]	5.1:1	Based on 12 large schemes business cases
Cycling Ambition Grants [ex ante appraisal]	5.5:1	Based on business cases for 12 funded schemes
Linking Communities Fund	10:1	Based on eight representative schemes
Literature Review	5.6:1	Average BCR for UK case studies, overall average 6.3:1
Transport for London Cycling Vision [ex ante appraisal]	2.9:1	Very large programme - conservative BCR
Living Streets	0.1-37:1	Only subset of benefits monetised

The answer

Climate change threatens the lives of everyone on the planet. Decades of reliance on private motor vehicles has seen us tear through the planet's resources, seriously compromising the ability of future generations to meet their needs. To tackle this global issue affecting every city on the planet, we need to reduce vehicle emissions and improve air quality.

According to research undertaken by the European Walking and Cycling Federation, cars give off 271 grammes of CO2 per passenger kilometre whereas cyclists equate to 5 grammes per passenger kilometre. Cycling is not carbon neutral as there are emissions in the production process, but they are definitely in a different order of magnitude.

People walking and cycling who fuel themselves on meat should probably know that it needs 1500 grammes of CO2 for every 100 calories whereas most vegetables are around 20 grammes for the same amount of calories. Vegetarians should therefore be viewed in a more favourable light than is usually the case in society – and I am not just saying that because I am one. So, if the question is: "How do we save the planet from climate change catastrophe?" then the answer is walking and cycling.

Slide 10 12 years left

By now you may well be spotting a pattern, so I will not labour the point other than to say that the wealth of academic literature on the positive benefits of walking and cycling is starting the rival the amount of literature showing that climate change exists. It is the role of the champion to make sure this evidence is not lost in decision making.

Slide 11 walking and cycling is the answer

A standard sales technique is to sell the outcomes rather than the process, or, in some cases, the pain of getting there. We have seen the positive effects that walking and cycling can have on society and so a vital lesson for the champion to learn is what to ask during consultation. "Do you want a healthy, economically vibrant street?" This is usually a better question to ask than: "Do you mind if we put a cycle route down your street, messing with your parking and sending lawless renegades past your doorstep?" A champion must see the bigger picture and must be able to communicate the bigger picture. A walking and cycling champion should also have a key set of principles in mind that they will not break however challenging the situation.

Slide 12 I fancy that

The Walking and Cycling Infrastructure Plan document has a set of such principles. What is more important is that you develop your own principles and that you keep them at the front of your mind. These should be triggers for discussion or argument.

Principles

Slide 13 12 year old test

Slide 14 double buggy test

A key principle is that walking and cycling should be viewed as a mainstream transport option and not a lunatic fringe activity. It is important that transport professionals take walking and cycling seriously and do not consider them a delay-inducing factor on motor traffic or an ambient benefit.

When I first started working in walking and cycling infrastructure design fifteen years ago, other highway engineers would give me the: "Are you serious?" look. "Obviously roads are designed for cars and highway engineers exist in order to smooth the movement of traffic along them so why are you messing with the programme?" The negotiation back then would revolve around fighting for scraps of carriageway left over when motor traffic had gorged itself and satisfied its economically crucial needs.

Slide 15 principle 1

I would eventually talk senior managers into letting me build something, albeit heavily compromised and camp out to try and get a picture of someone I did not know using it so I could justify the expenditure. In those days only, puppy dog levels of enthusiasm kept me going and I know that many engaged in promoting walking and cycling are still at that stage. Things do change, and now London has the same number of cyclists as Amsterdam, although Amsterdam is equivalent in size and population to one of London's thirty three boroughs. Things do change, and this principle means that others should now take it seriously. We built things and they did come.

Slide 16 principle 2

Cyclists are vehicles capable of speed but they are a vehicle with very different properties to motor traffic. Most notably in terms of mass and speed differentials, but more subtly the ability to change direction quickly, particularly when avoiding hazards. Cyclists also can self-regulate en masse. For example, there is a 20m

More principles

wide shared crossing near Hyde Park in central London which has Dutch levels of cycling. Each time the crossing is called there can be as many as sixty cyclists gathered on either side. When the crossing is triggered these cyclists are released pointing directly at each other. It is an incomprehensible miracle to most traffic engineers but they just flow past each other without incident.

Each cyclist makes the micro adjustments necessary to sail past the other cyclists on both sides. Cars, as we can imagine, would have none of this ability and their drivers would leap out demanding a side of the road. So yes, cyclists are vehicles but they have very unique properties. Pedestrians, on the other hand, exhibit even greater hive mind capabilities even despite the great range of body types and power capabilities. Crowd dynamics. They also have the capability to collide without issue in most cases which makes this mode the most laudable in safety terms.

Slide 17 principle 3

Walking and cycling requires human power fuelled by food. The power required to walk and cycle should never be taken for granted. Those who cycle need to do more than twitch one of their feet to move: they must engage their whole frame, overcoming inertia, rolling resistance, mechanical efficiency and air resistance.

Likewise, the mechanics of walking should not be taken for granted. There is a lot of calculated precision required and thousands of multiple draft assumptions that take place. A trip hazard could almost be defined as a failed assumption. “Why are you telling me this?” I hear you say, “and how can I affect this?”

Slide 18 principle 4

Designers can provide streets that minimise all the forces acting against people who choose to walk and cycle. In this instance, ‘easier’ means that it does not take as much power to maintain a constant speed. By planning routes that avoid stopping and starting, a lot of that initial power required to overcome inertia can be avoided. By providing smooth high grip surfaces rather than loose unmade paths we can reduce the dragging effect of resistance.

Slide 19 principle 5

Manufacturers are responsible for mechanical efficiency of cycles, but it is interesting to note how the common form of the bicycle is designed to decrease the speed of cyclists and increase the effort. Recumbent bikes are far more efficient and require less power to do equivalent speeds. I am told this is an issue dating back to the birth of the bicycle, when recumbents were going so fast compared to automobiles that they became a menace on the roads.

Slide 20 principle 6

Even more principles

Nothing else was capable of 40mph on the streets back then and so it was decided to focus on the slower upright versions where air resistance would regulate speeds. Air resistance itself can be reduced in open spaces by providing trees which are great fractal dispersers of wind energy via their leaves. There are so many highly paid scientists making careers out of minute adjustments to the engines of cars that I think we need to join them, get serious and acknowledge how to fine tune human power generation through street design choices.

People who walk and cycle need separation in space and time away from heavy traffic volumes. Walking and cycling is a pleasant activity on most streets, but some streets feel like roads. The urban design catchphrase comes to mind that 'a road is somewhere where you save time whereas a street is somewhere where you spend time'. More of this subject is coming later.

People who walk and cycle do not particularly like spending time mixing and negotiating space with high volumes of large, fast-moving motor traffic. So, if we want to promote walking and cycling activity and achieve all the benefits to society that were mentioned at the start of the day, then we need to protect them. Protect to entice.

Slide 21 principle 7

The road, or street, network is made up of links and junctions. On busy links, people who walk and cycle feel protected if they are separated from motor traffic and the stronger the separation, the safer they tend to feel. The skill is in doing just enough within your budget to entice, knowing that full segregation can be expensive and make for unappealing public realm in the wrong context. At junctions, positioning is the paramount concern and this will be discussed in detail on Day 2, but the principle should be kept at the front of the champion's mind.

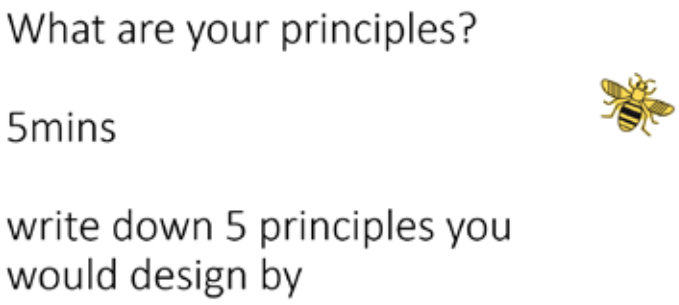
Slide 22 principle 8

At busy signalised junctions, the key is to find separation in time and space, which is a lot harder than it sounds. The champion needs to understand both when pushing through improvements, and Day 2 will cover this in detail. For now, have a go at writing down what your key principles are. You need to know where you have room for negotiation and where you will not budge.

Exercise: principles

If you cannot change yourself, then you must change your world. The visual analogy I like to keep in mind is banging my head against a brick wall: eventually if I keep head-butting it, the wall will break but I absolutely will not stop. Find your own, it helps.

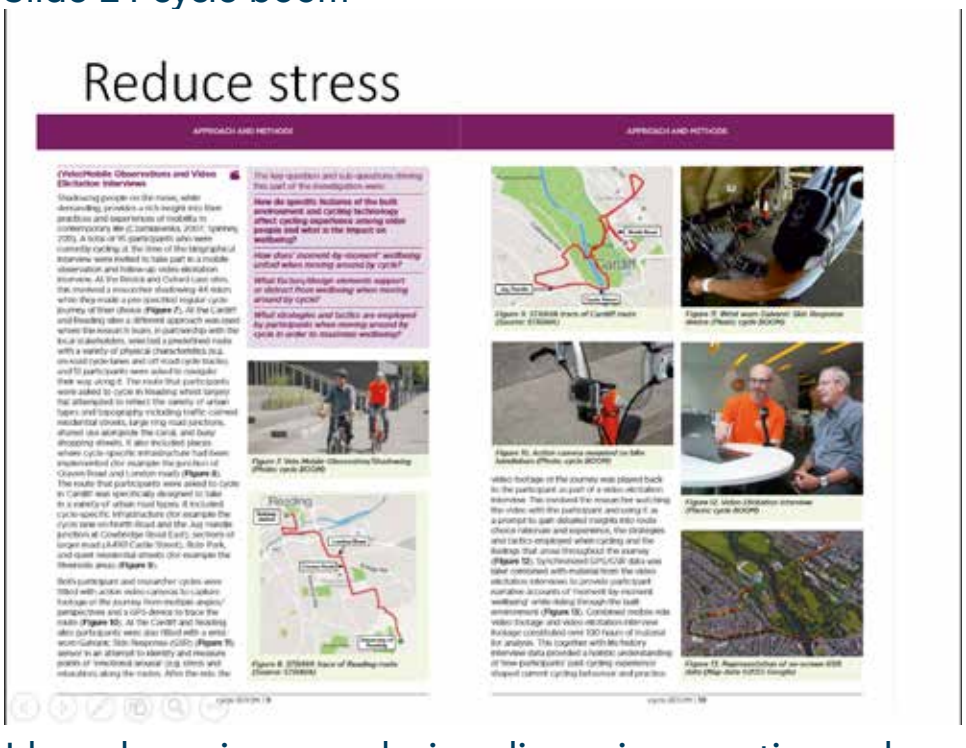
Slide 23 what are your principles exercise



Routes must flow intuitively. Transitions between different street types and different infrastructure interventions can cause anxiety in people who walk and cycle. This is acutely felt where the layout is confusing. The Cycle Boom project in the UK highlighted this extremely well when they recreated a famous pedestrian study and fitted cyclists with lie detector equipment to monitor stress and anxiety in certain scenarios.

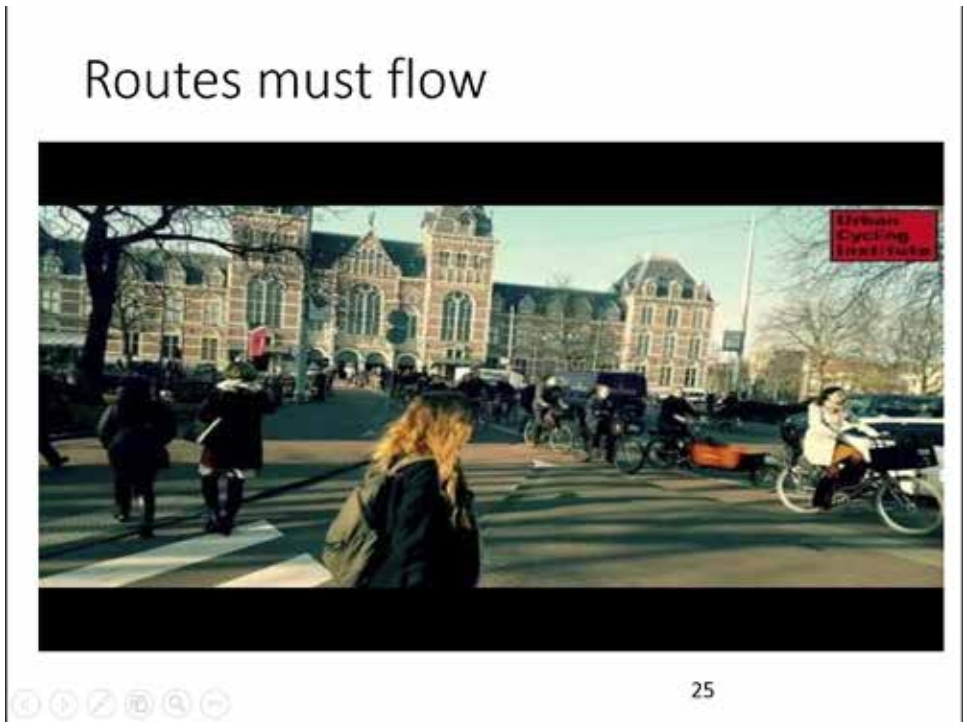
Complex signalised junctions obviously ranked highest, but even simple transitions from park paths to back streets caused spikes of anxiety. As shown earlier, momentum and flow are crucial for people, and when level and surface differences occur, or tight complex movements are required, then the cognitive overload can compound to deter walking and cycling.

Slide 24 cycle boom



I have been in many design discussion meetings where engineers have plotted and planned circuitous routes for pedestrians and cyclists through junctions and considered their scheme a success as they found a safe way through. The only problem with this approach is that the engineer is not on site to explain to people where they are supposed to go. Even with the strongest set of warning signs, pedestrians and cyclists tend to head off in the direction they want to go and all the best laid plans are laid to waste.

Slide 25 bromnelstroet flow



The Dutch introduced the concept of sustainable safety into the transport terminology lexicon, and the phrase that rings out most for me from this approach is the term forgiveness. When I first said to a room full of engineers that I was training that they needed to make junctions forgiving, I was met with that same old "Are you serious?" look. But the Dutch know a thing or two and, libertarians that they are, they have acknowledged that designers should design to accommodate behaviour, and not design to control it.

Slide 26 sustainable safety

The dutch approach

This first hit home to me in a Damascene moment when I was riding around Holland in 2005 with a Dutch engineer. I was bemoaning the fact that British cyclists are not the greatest at stopping at red lights. He turned to me and said, “Well, what is the matter with your junctions?” In one moment, my world flipped upside down and I understood sustainable safety and the designer’s responsibility.

It forced me to look long and hard at UK junctions and try to understand why they seemed to promote non-compliance. I had to acknowledge that, in many cases, UK signal-controlled junctions are safer to pass through if you jump the lights, particularly if you cross during pedestrian-only stages. Junction design will be discussed in detail on Day 2.

Slide 27 What’s wrong with junctions?

If you struggle generating your own principles, then you could always adopt those of the Dutch masters. The Design Manual for Bicycle Traffic from Holland has helped establish five key principles. I played my part in making London transport policy makers adopt these and wholeheartedly support them, even if I do have my own, more nuanced, ones.

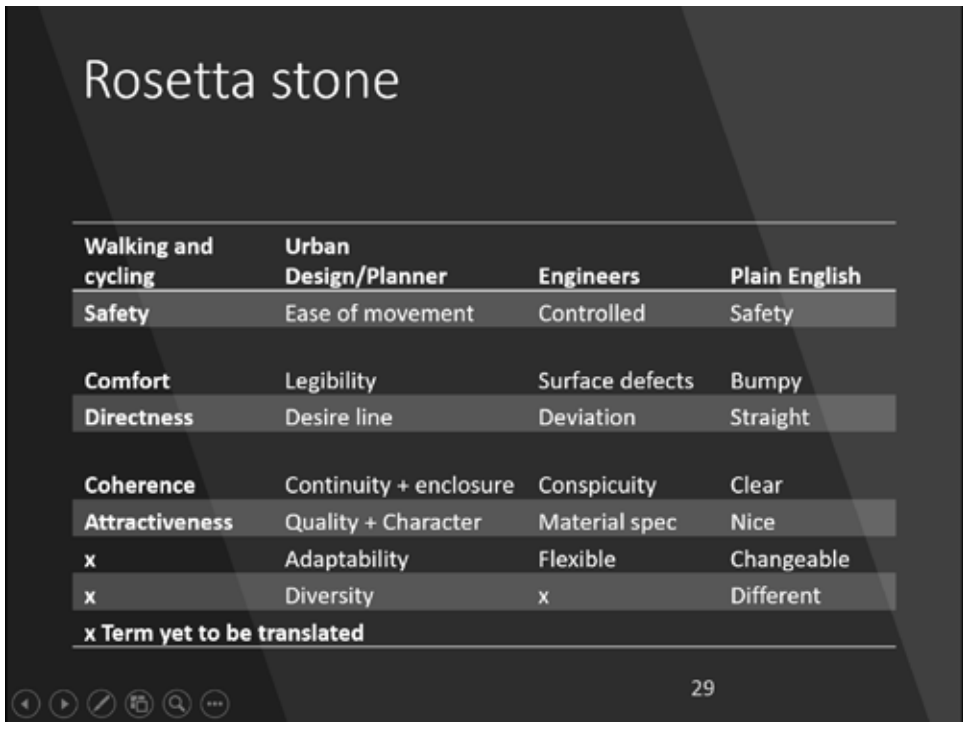
The famous Dutch five are that routes should be Safe, Direct, Comfortable, Coherent and Attractive. If you say them fast it does not seem so hard to achieve but trust me, meeting these criteria can take years of legislative, technical and political attrition. Later today we will look at quantifying these in more detail.

Slide 28 famous Dutch five

It takes advanced negotiation skills to translate your own principles into clear design outcomes that others can interpret and hopefully follow. Each profession has their own language, and the way simple words are interpreted can be widely different.

Each champion must translate their principles into the language of Land Use Planners and Engineers if they wish to proceed with any kind of plan to improve conditions. It helps to know what they want and what they are trained to look at. For this purpose, I have prepared a ‘Rosetta Stone’ table to help you through.

Slide 29 Rosetta

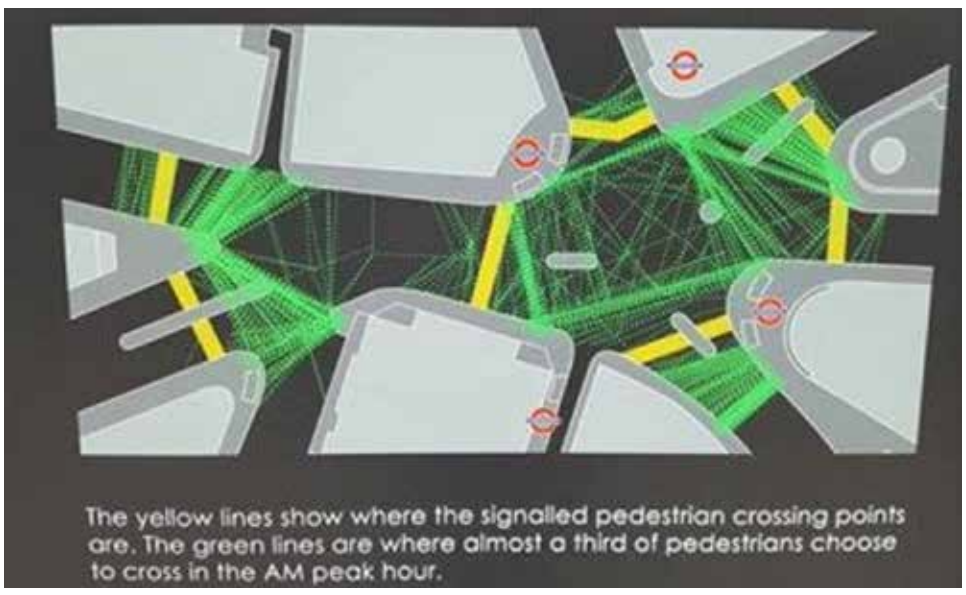


This may seem silly, but it honestly works. Explaining to an urban designer that you need to get the cycle route more on the desire line will get you a lot further than saying you need to be direct. This sounds like a pushing word that will disrupt and divide the character of the space they are creating.

Outcomes

Whereas you can say to engineers that you need a route that has less than 10% deviation from the nearest direct main road or as the crow flies and they will understand it instantly. They will have no clue what a desire line is and think a direct route will take cyclists directly where they want to put them, which is usually at odds with where they want to go.

Slide 30. Desire lines

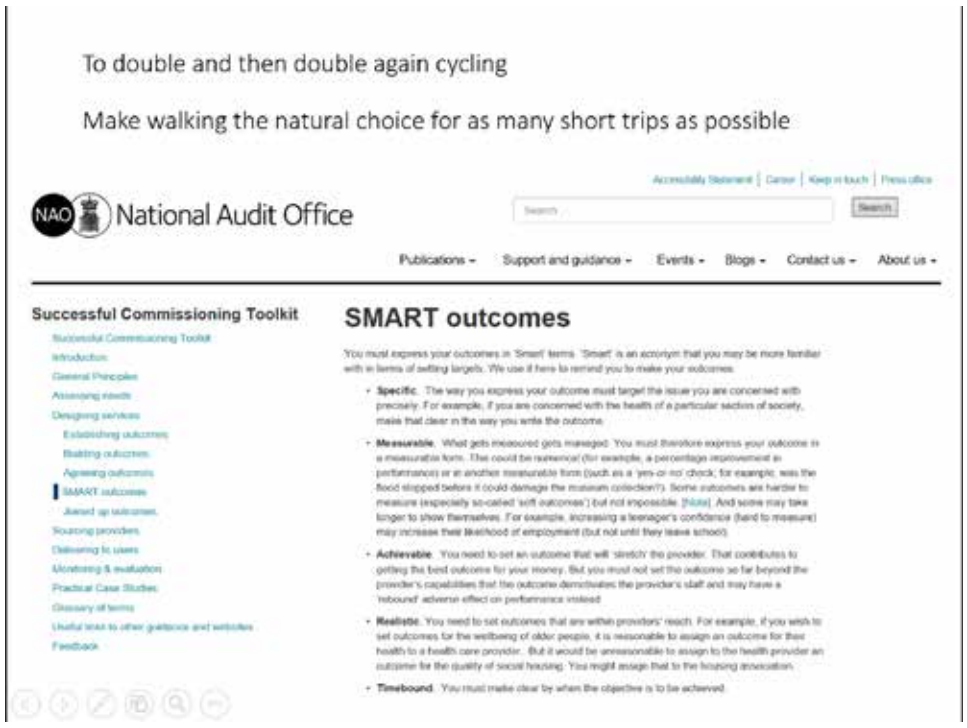


Now you know the terms, you should be able to translate the terminology of your own principles into the appropriate semantic form, demonstrating you understand everyone's needs. This should help you get what you want and improve conditions for walking and cycling.

When looking at any street that needs improvement you should think: "What would be the best outcome here?" Outcomes should be general enough so that those delivering schemes can interpret them in different ways, but clear enough that they offer a clue as to what success or failure might entail.

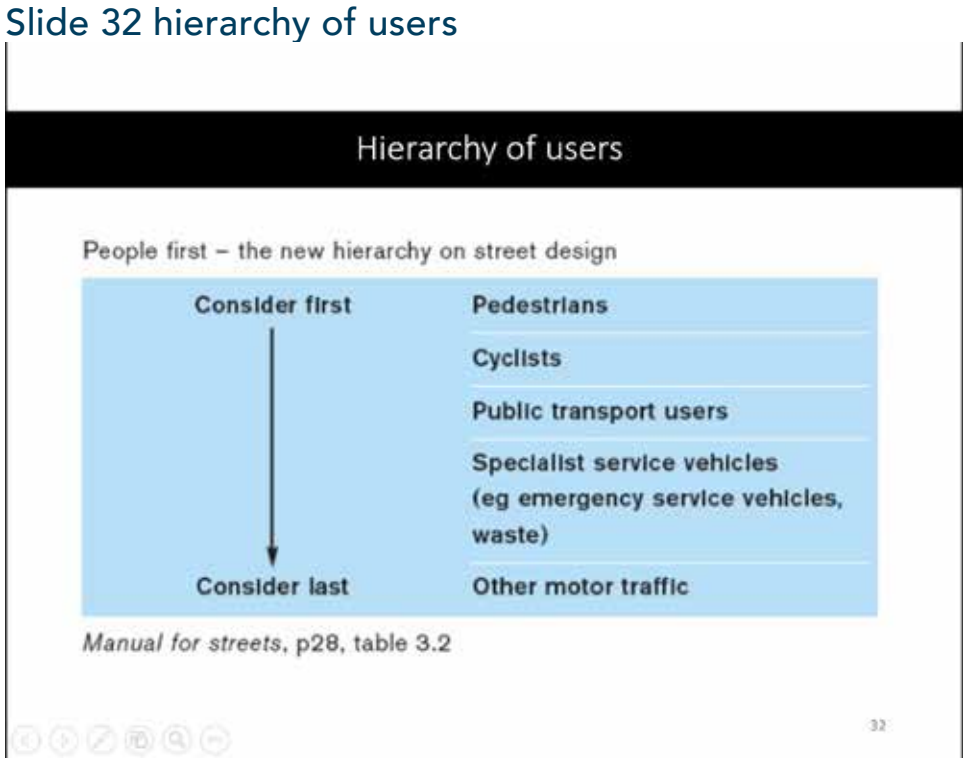
An outcome such as: improve economic vitality in the area might be stated. You now know that this can be interpreted through the introduction of better walking and cycling facilities but beware – others might interpret this as a desire to add extra road capacity and free parking to promote light industrial business.

Slide 31 outcomes



Another example would be: improve access to the town centre. The word improve is the most overused and much maligned word in transportation. Exactly who is the access being improved for? Most civilised countries have a hierarchy of needs, with pedestrians first, followed by cyclists, public transport, freight and finally private motor cars. Policy states it but in practice the situation is often car, car, freight, car, bus, pedestrians – and cyclists if there is room. It is the role of the champion to hold organisations to the policy they put in print and not to the under-the-table assumptions serving to maintain the status quo.

Slide 32 hierarchy of users



We are now briefed on how to talk to the professionals, but what about the politicians and the people they represent: the public? It is almost impossible in modern times to make a clear statement of intent without facing a barrage of ill-informed opinion. The champion must have evidence. The person with the number usually

Policy meets practice

wins the argument. Please note that making them up does not help as once you lose credibility you lose your power to be a champion. You must do it the hard way and research the evidence, memorise it and quote it.

If someone then says: "Everyone drives to my shop so why put in walking and cycling facilities?" you can say with authority that the last person who drove to their shop was in 1974, a Mrs Ethel Newbody who bought 20 cigarettes. Subsequently 64,000 people have arrived by bus, 447,000 arrived by foot and 125,000 cycled. This is obviously a silly example but the point stands that the person with the evidence wins the argument.

Slide 33 evidence – Waltham Forest account

As there is such an overwhelming case for walking and cycling, the arguments do get diffuse, specialised and localised. For example, in London the 'bikelash' started with: "well, they can do that in Holland but it wouldn't work here", before moving onto: "well, they might do that in central London but it wouldn't work here", to: "that's the north of the borough and it's nothing like that here" to finally: "I have never liked the people on that street so I don't care what they do, but you're not doing it here".

Slide 34 - video

The more localised and hemmed in the opposition get, the more irrational and dogmatic the arguments can become. Nobody comes up with more perversely obtuse arguments against walking and cycling than the British and this forced the Cycle Embassy of Great Britain to launch a highly successful website Cycling Fallacies (www.cyclingfallacies.com). I could never do it justice but I recommend that champions peruse this and familiarise themselves with the arguments and the evidence cited to support the rebuff.

Slide 35 fallacies

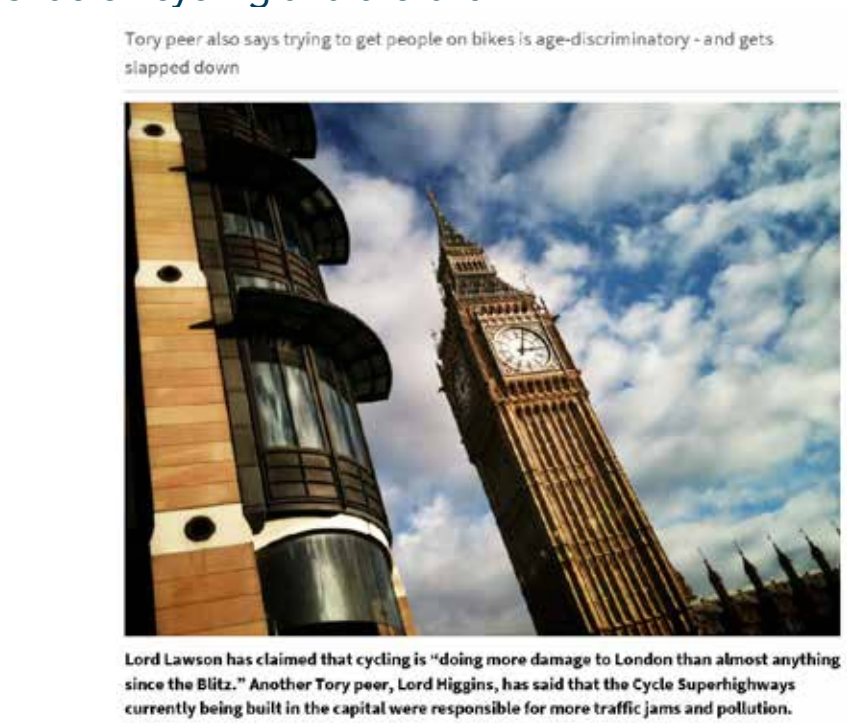
As I write this, the latest fallacy doing the rounds is that walking and cycling is bad for air quality as it slows traffic down, meaning vehicles emit more pollutants and the congestion caused by a few cycle routes has brought the town to a standstill, leaving engines idling and creating clouds of poisonous gases. This seems the equivalent of saying: "It is your fault for having a face that I wanted to punch" as a defence in an assault case.

Idiot wind

Slide 36 kids in masks

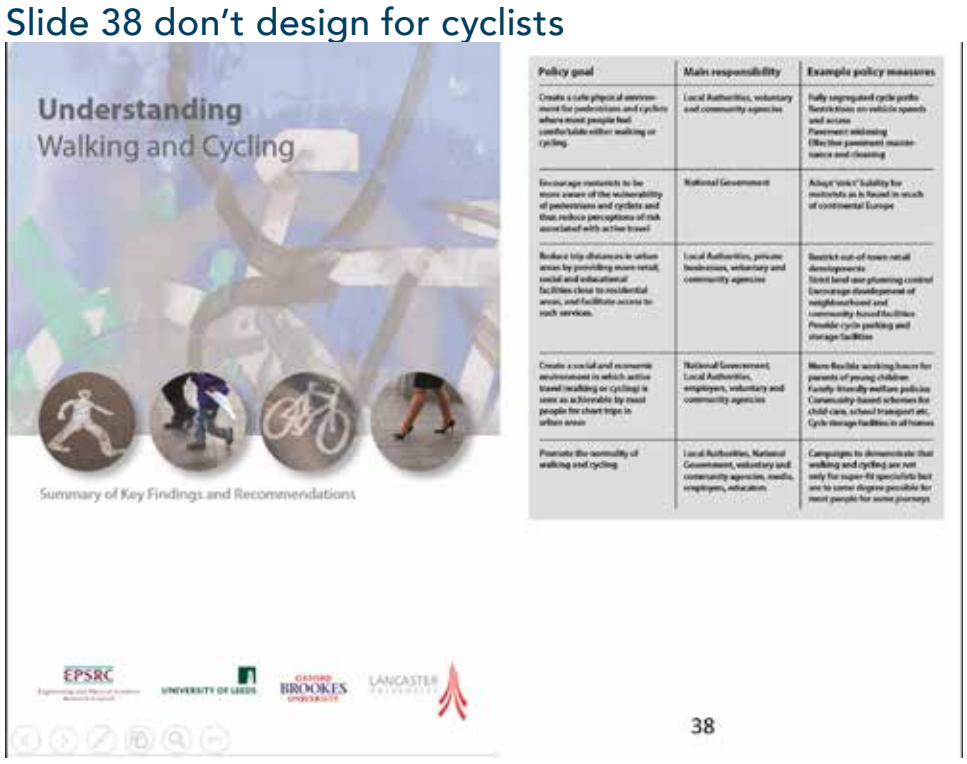
I personally stood up in an EU meeting in Brussels full of international walking and cycling experts and asked if anybody had any evidence to refute or support this claim. The dumbfounded shrugs and "What is the problem with the English?" stares really told me everything I needed to know. The serious point is that bad ideas spread quicker than good ones. Simple stupid reasons are easy to grab hold of and help support intransigent positions. Be wary, as they can permeate all the way up the chain to the major decision makers. Hold onto your evidence and stay fact based, and hope that reason prevails.

Slide 37 cycling and the blitz



Controversially, there is one more foe that you must encounter and defeat if you want to deliver high quality infrastructure and that is cyclists. It took me twelve years of delivering schemes to the best of my ability and within the regulations before cyclists liked anything I did. This can be spectacularly disheartening. It is difficult to hold your nerve when the people you are trying to provide for are the most vehement critics. This conundrum plagued me for years and I will talk in detail of how I attempted to resolve this on Day 2, when I show how we introduced protected cycle lanes to the UK.

Slide 38 don't design for cyclists

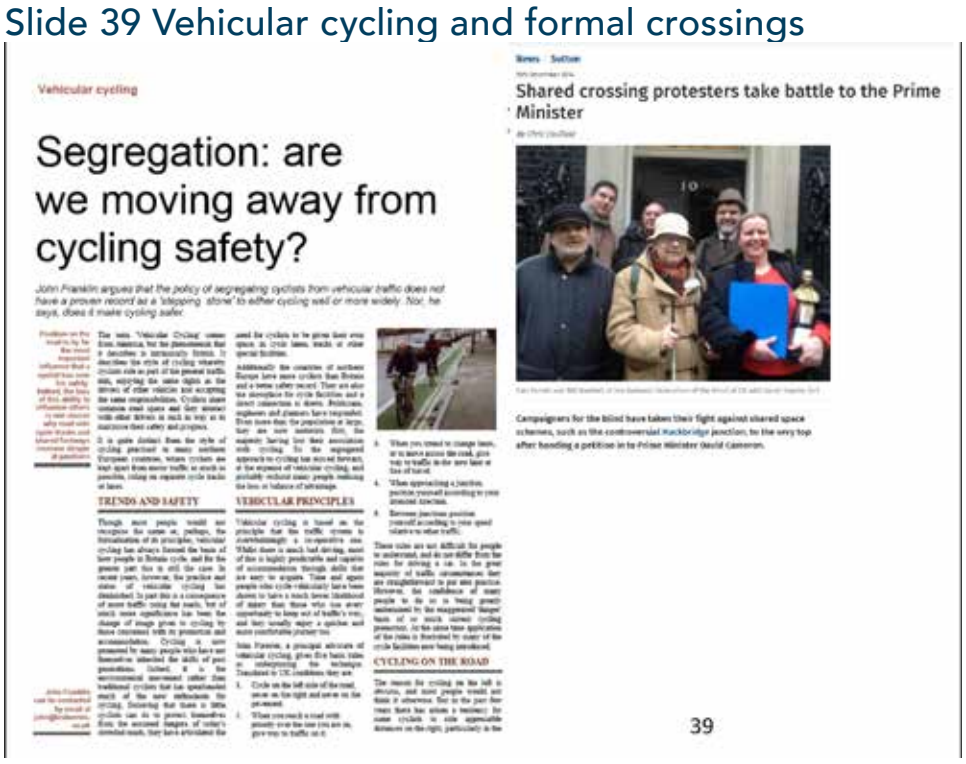


At this stage, all champions need to be aware that there is a war at the heart of cycling and that is between the vehicular cyclists and the segregationists, more affectionately called the 'kerb nerds' in the UK. These viewpoints are mutually exclusive sets, with one side insisting on riding in full parity and mixed in with motor vehicles and the other camp insisting on being fully separated from motor vehicles wherever they go, either through segregation or filtering.

Filtering will be discussed on Day 2. Likewise, there is a war at the heart of walking between accessibility and priority. Most people walking want the excesses of motor vehicles to be curtailed so they can cross where they like and not risk high speed collisions. Other would trade this for formal control.

Internal rifts

Slide 39 Vehicular cycling and formal crossings


Vehicular cycling

Segregation: are we moving away from cycling safety?

John Franklin argues that the policy of segregating cyclists from vehicular traffic does not have a proven record as a 'stepping stone' to either cycling well or more widely. Nor, he says, does it make cycling safer.

TRENDS AND SAFETY

VEHICULAR PRINCIPLES

CYCLING ON THE ROAD

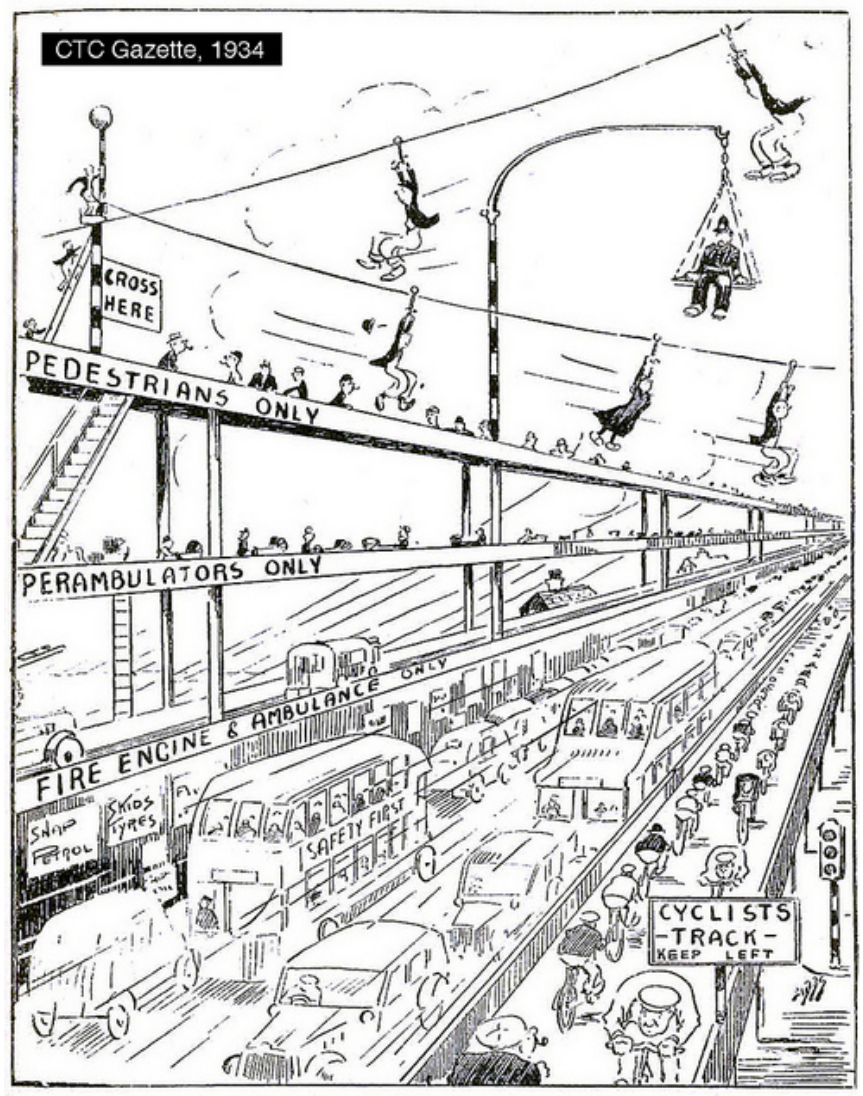
39

Shared crossing protesters take battle to the Prime Minister

Campaigners for the blind have taken their fight against shared space schemes, such as the controversial Hackbridge junction, to the very top after handing a petition in to Prime Minister David Cameron.

On the one hand, if you spend anything on cycling-specific infrastructure you will be heavily criticised for denying cyclists the right to ride where they choose. Some may feel pressured by general traffic to move into the facility provided, even if it is poorly designed. On the other hand, if you do nothing, you risk heavy criticism for ignoring collisions and fatalities and leaving cyclists at the mercy of machines which cannot be negotiated with on equal terms.

Slide 40 ctc classic

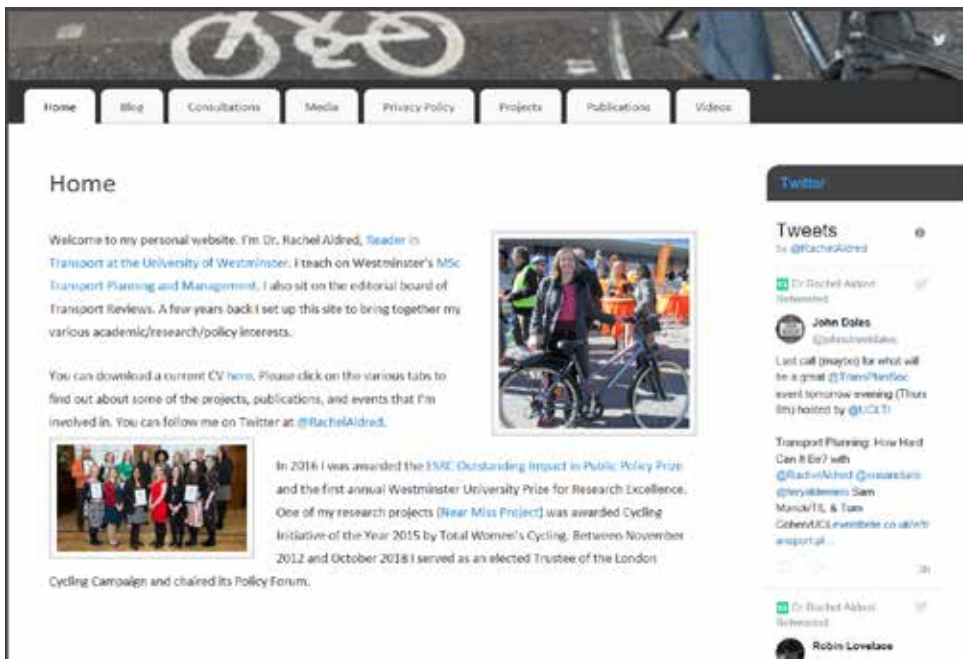


There is now overwhelming international evidence that if you want to promote walking and cycling you must protect people and so the kerb nerds have won, but there is a strong caveat which is that the facilities must be exemplary and on a par with those routinely provided in Denmark and Holland. If they are not, then your facility could be putting cyclists into more danger than doing nothing and letting them ride defensively.

The battle over the formality of crossings, and whatever shared space actually means, is still raging and it is up to champions to decide how to make designs inclusive in different contexts. The needs of all users must be balanced. There was once a battle to stop dropped kerbs by blind and partially sighted groups despite the fact that it would leave some wheelchair users stranded to not have them. It is difficult emotive territory and, like all scheme design, solutions are never perfect.

This issue will be returned to on Day 2 in terms of design and Day 3 in terms of safety. I suggest that champions seek out the work of Dr Rachel Aldred, as I feel she makes the most compelling academic case for protection, particularly in terms of gender and equality.

Slide 41 Rachel RCS report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Home

Welcome to my personal website. I'm Dr. Rachel Aldred, Reader in Transport at the University of Westminster. I teach on Westminster's MSc Transport Planning and Management. I also sit on the editorial board of Transport Reviews. A few years back I set up this site to bring together my various academic/research/policy interests.

You can download a current CV here. Please click on the various tabs to find out about some of the projects, publications, and events that I'm involved in. You can follow me on Twitter at @RachelAldred.

In 2016 I was awarded the ESRC Outstanding Impact in Public Policy Prize and the first annual Westminster University Prize for Research Excellence. One of my research projects (Near Miss Project) was awarded Cycling Initiative of the Year 2015 by Total Women's Cycling. Between November 2012 and October 2018 I served as an elected Trustee of the London Cycling Campaign and chaired its Policy Forum.

Twitter

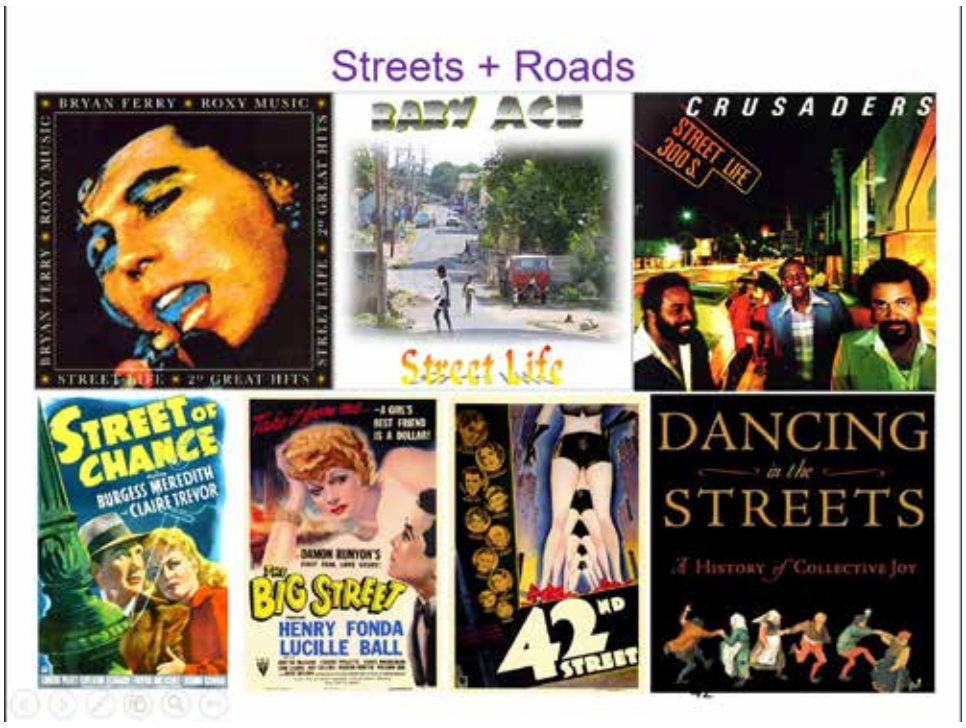
Tweets

Ok, would-be champions, let's take stock. It is going to get a lot more technical from here on but stay firm, hold on to your principles and remember you are saving the planet. It is not like this is a small task. Treat being a champion with the gravitas it deserves.

Streets and roads

So many people, Jan Gehl and Jane Jacobs to name but two, have covered this area so eloquently and beautifully that I almost fear to tread here, but tread here I must as people are still not listening. I also have none of their gravitas so will stick to telling you how to build streets rather than philosophise about them. First things first: as a champion you need to support the wider agenda of making liveable, breathable streets, where quality of life trumps consumption-based movement. You need to be all about the place.

Slide 42 streets



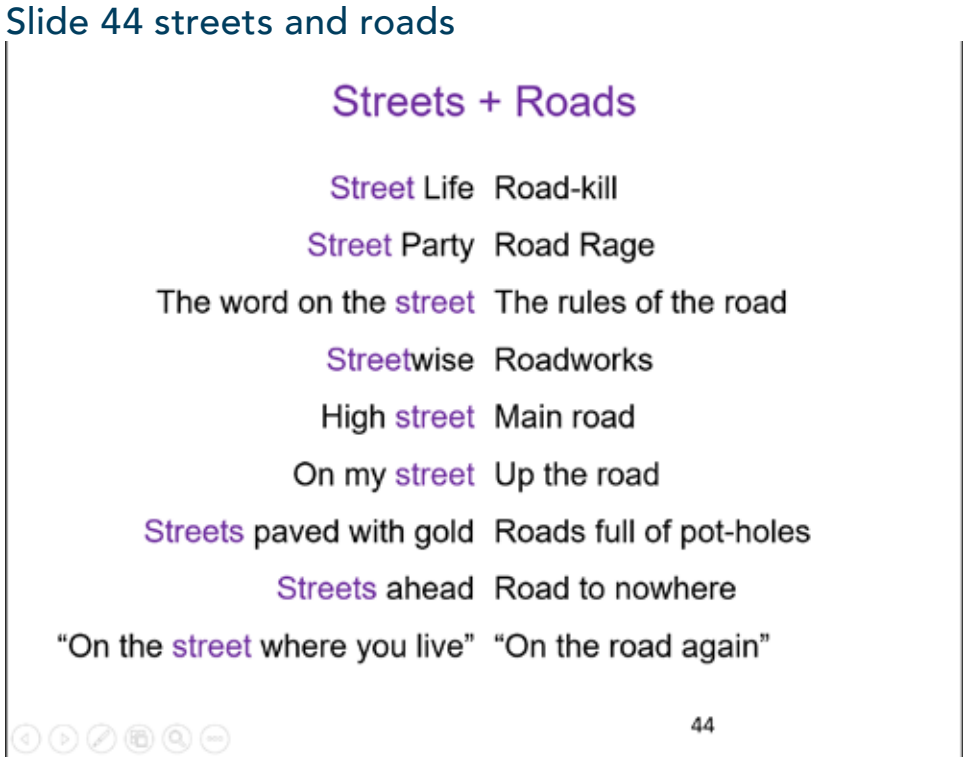
Evil engineers, like me, are trained to build roads. We know how to do flyovers and bypasses. We know about geometry and design speeds. It can be a distressing first day on the job for engineers working for civic authorities when they are told to design streets where people live rather than geometrically perfect shapes to expedite the efficient movement of traffic. The maths does not add up, and the physics is fuzzy and crude.

Slide 43 roads

Streets have public realm functions; they offer a sense of place and provide access to buildings and public spaces. All of these things are alien concepts to the engineer on day one. Some choose never to learn what any of this means and sit in grumbling silence until the talk ceases and they can go back to designing roads the way they were trained. This needs to stop.

Professions need to be sensitive to each other's needs, and engineers need to be trained to make better places and not just move traffic. I made this transition personally and was initially viewed with suspicion by both sides, but as I speak both languages I am now offering this third way. You can be technical, yet have a vision, and the street can be part of the place and not detract from it.

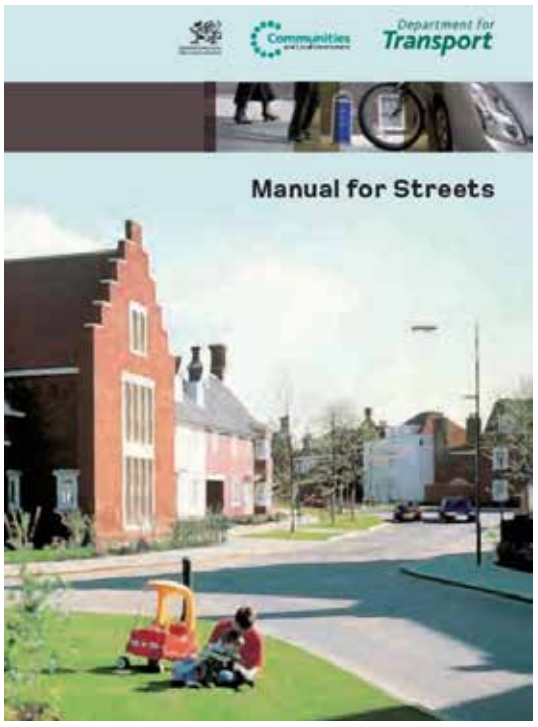
Slide 44 streets and roads



I have mentioned the term place a few times now but it is time to delve into what that actually means to the potential champions reading this manual. Certain places are more important to society: culturally, socially or historically. These are places where people want to get to and not necessarily where they want to move through. Manual for Streets is the definitive text on this subject.

Manual for Streets

Slide 45 manual for streets



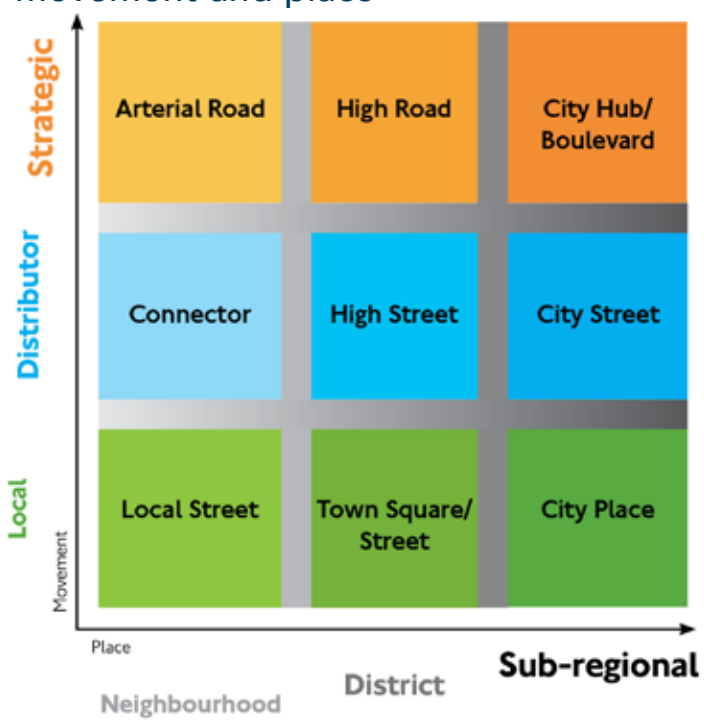
In Manual for Streets, place was plotted on the x axis and movement was plotted on the y axis as a method of developing different street types. This is a positive move in that it gets engineers to acknowledge that place exists as a consideration, but could turn out negative if movement values become locked. The dream would be that private motor car travel vanishes from the commuter option table and that all street types can trend towards place, but that, alas, is just a dream at present.

Slide 46 manual for streets 2

Some street types have a dizzying array of functions, with several modes competing for space, and place activities such as shopping, playing, socialising, eating, drinking, sitting and events having to be accommodated. The demand for space in these places is at a premium and so these can be the hardest streets to design for. As a thought experiment, imagine a 20m wide street. First think of it as a residential street. How would you apportion the space? "You would probably need some footways. Let's say 2m either side for those. Then you would need some parking spaces. Let's say 2m either side for those as well. This is where the Japanese win out as they ban on-street parking in most residential areas and so win back 4m straight away. Ok how much have we got left: 12m. Acres of space so we can have cycle lanes, floating parking, two-way cycle tracks, stepped tracks." Please note that all these terms will be explained on Day 2.

"We also have space for some general traffic lanes. Perhaps we have too much space here? Maybe we should have had a wider footway and put in a row of trees or a grass verge? Then we could have had 4m footways with a verge either side then parking and then two general traffic lanes. Depending on the motor vehicle flow, we might not necessarily need walking and cycling facilities unless of course you were really trying to entice the local residents to take up walking and cycling."

Slide 47 movement and place



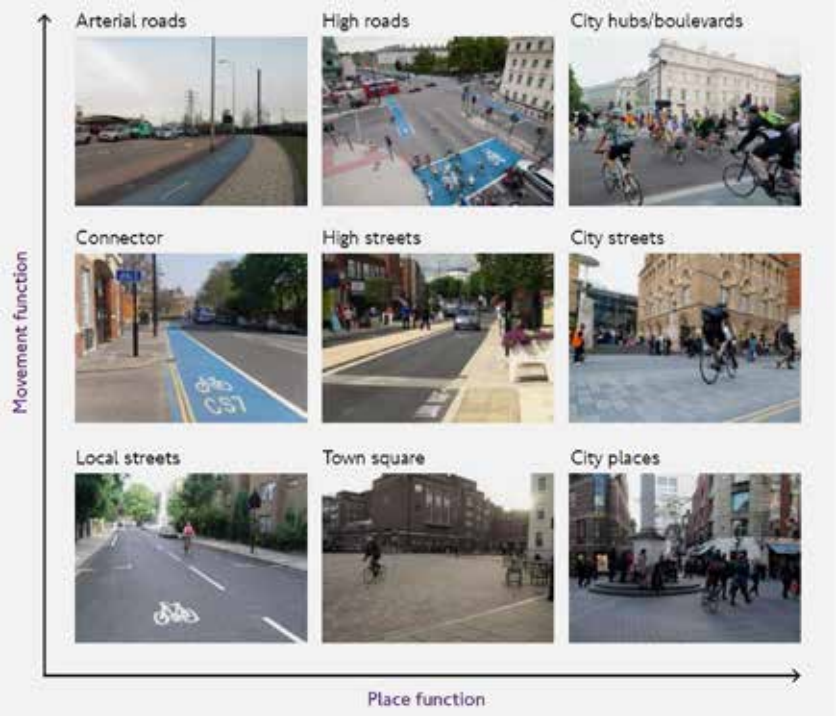
Ok, now let's imagine a high street scenario. How would you carve up this space, given the same width of 20m? "Well, there would be more pedestrians so you would need 3m of footway, and actually the trees were good so let's do that again. People need to drive to the shops, don't they? So let's put in the parking. Hang on, there is only six metres left and I still have to do my traffic lanes. It's a tight squeeze, but most city planners would be happy with that.

Hold on, what about walking and cycling? A high street is going to be busy with traffic and cyclists want to go there as that's where the action is. They will need to be protected or they may not risk it. What is

Street types

removed in order to provide for them? Well, obviously we need a road or no goods or services will get there. We also need a parking bay or they won't be able to load. Nobody wants the trees removed and all those pedestrians need a clear space to walk. We regret to inform you cyclists that there is no space for you. Do the maths for yourself."

Slide 48 cycling facilities by street type



These decisions and discussions happen all day every day around the world in every language. In most cases, walking and cycling lose out, as frankly how could they not? So, champions, how do we win? We win by doubling up on space and changing uses. There is always a way. Stay positive. Perhaps the loading can be inset into the footway and be at the same level. We call these loading pads in the UK. In that way, when vehicles are not loading, we have additional footway.

Perhaps then we do not need parking everywhere, as people can arrive by bus or cycle or on foot. We can also frame our loading pads with trees then we do not need a whole continuous strip for them. How are we looking now? "Well, we have 3m footway with 2m loading pad on the busiest side of the high street. A 3m footway will do on the other side. We definitely still need our 6m minimum for general traffic but now we have 6m left. That is 3m either side for walking and cycling. We can go Dutch and do a 2.5m track on either side with 500mm of segregation from general traffic. Or go Danish and have a wide stepped track either side. Perhaps we can even give another metre to footways on either side and still have great facilities."

The point here is serious. The Dutch and the Danish divide up space with those who walk and cycle in mind, even in their most tricky to manage streets. They find a way. They do not give up and let other needs take precedent. They do not have wider streets or different layouts – they just think long and hard and find space. It is therefore the job of the champion to think long and hard about space.

Slide 49 better streets

But what if the space cannot be found? What if the high street is 10m wide? How does the champion make a case for space here when there is none? If you cannot find the space, then make a better place. Start by tidying it up and showing you care. Do those advertising boards really need to be in the middle of the footway?

Slide 50 tidy up

Then follow that up with a de-cluttering programme. Do you really need all those warning signs and parking signs? If you do, do they all need to be on different posts? Are all the bollards necessary or should you just trust that drivers will not drive on the footway?

Transform streets in stages

Slide 51 declutter

Are there any functions that can be merged? Perhaps the bin could be fixed to the lamp column. Perhaps even the lamp column could be mounted on to the buildings. The clear space for walking would look a lot better after just doing a few simple things. But what about walking and cycling? This is a walking and cycling manual. Ride quality can be improved just by removing a row of physical objects at the edge of the footway as you ride past. It can stop you striking your elbow or handlebars on them, and the perception of clear space reduces the stress-inducing tunnel effect. We are not done here however.

Slide 52 relocate/merge functions

Think about the way you manage traffic through the area. Do they really need to go so fast? Can we slow them down? This is a high street. People need to cross the road. Inviting people to cross the road regulates the traffic and lets cyclists know that this street is more civilised. Put some parking controls in place so that it is not a free-for-all for those selfish enough to demand more space for themselves, which thousands of pedestrians could have benefitted from.

Slide 53 rethink traffic management

Finally, why not just recreate the street and make it a place? Change the materials and move away from tarmac and white racing lines. Consider making a level surface where no one has obvious priority. Consider a shared surface approach or even full shared space. All of these things can make a street look like somewhere that you may actually want to cycle down. Standard layouts promote a sense of entitlement in drivers that can be harmful for pedestrians and cyclists. If we make streets look like racetracks with hatching and go faster stripes then drivers will get the message: put your foot down and insist everyone gets out of your way. In tight spaces people have to learn to share.

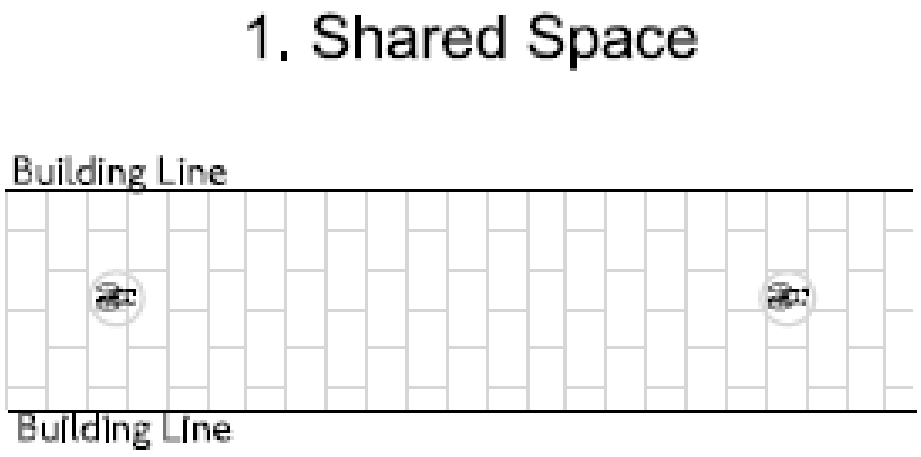
Slide 54 recreate the street

At this stage I think it is appropriate to explain what this

Shared _____

manual means when it refers to shared space. It is one of the most overused but little understood concepts, particularly in the UK. This manual defines shared space as a building line to building line continuum, where pedestrians, cyclists and general traffic mix with no restraint on their direction or movement. The key here is for priority to be uncertain, so that a car may in fact give way to a person walking. Many people have defined this more eloquently but you are stuck with me for now.

Slide 55 shared space definition



This should not be confused with shared surface schemes where the same material palette is used on the footway as the carriageway, but height differences and kerbs can be used to maintain the divisions between areas suggested for traffic movement and areas suggested for pedestrian movement. This also differs from level surfaces where no height difference is used, but flush kerbs or different material choices divide the footway from the carriageway. All of these can be good or bad for people walking and cycling, depending on the context and design quality.

Slide 56 shared surface

There is, however, generally one bad guy amongst the shared space bunch and that is shared use footways. These can work well, and Japan are the masters of delivering them, but in countries like the UK, shared use footways usually mean that the street designer has given up on providing safe protected conditions for cyclists and has chosen to throw them onto the footway. This helps them say they have provided a safe space for walking and cycling, without doing any actual work to treat them like a vehicle. When shared use footways are narrow and well used, they can annoy pedestrians and cyclists in equal measure. I even did a paper for the UK-based Institution of Civil Engineering in which I attempted to prove that this type of provision actively discourages walking and cycling, rather than providing a safe haven.

Slide 57 the case against shared use

However, and this is a big however, shared use paths are fine. In the complete absence of motor traffic, in parks or by canals for example, cyclists sharing space with

When to segregate

pedestrians is completely legitimate. Both modes are away from the dangerous toys so should be expected to relax, calm down and share some tranquil time.

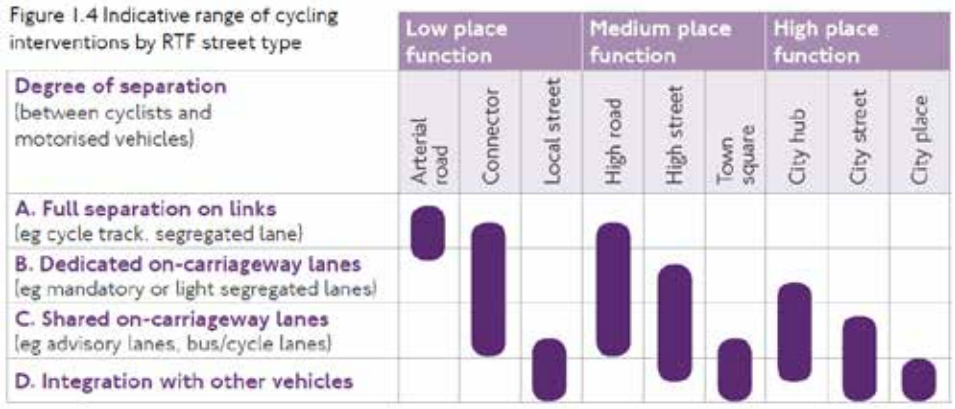
If flows of either mode get too high for the space available, then it can be appropriate to try and divide this space up, but my strong advice is never to make it look like a road. I do not even like roads looking like roads, as previously stated, let alone paths. Try and be subtle, gentle and considerate of the surroundings. Ok, so now we have defined some terms, let's get back to street context.

Slide 58 shared paths are fine

Context is everything. If you meet anybody who is absolute about anything in street design, you should be immediately wary of them. For example, if someone says 'We must have bus lanes', then your answer should be: "OK, in the right context perhaps, where there is medium or high traffic flows and in places with medium or low status." Maybe this could be done on a high road or strategic connector road, but probably not in a town square or central city street.

This argument stands for cycle lobby groups as well. I assume most people reading this want to make walking and cycling happen en masse everywhere and so to an extent we are all lobbyists, but you cannot be a champion if you are fixated on one solution.

Slide 59 context



If you hear "We must have segregation everywhere like the Dutch", then you have to jump in with the fact that segregation is appropriate in medium or low traffic areas but other approaches may be just as successful at enticing and providing for cyclists in low movement areas. Likewise, high place function areas could see their character downgraded by providing full segregation in them.

This might lose you some die hard advocates, but no civil authority in the world, including the Dutch ones, can provide one solution that fits all contexts. The argument must become more sophisticated and your argument needs to be nuanced, or you risk being marginalised and becoming an ineffective champion. This is no kind of champion at all.

Slide 60 suggested route

I will provide an example of this just to hammer home the point, as sometimes we can be our own worst enemy. Camden Cyclists in London came under heavy fire for supporting a scheme where cyclists mixed with buses. The group knew that they were getting a parallel, fully-segregated route 500 metres away as part of the scheme and so were satisfied that the local authority had addressed the needs of local cyclists.

Design evolution

This level of compromise was unacceptable to other groups and certain bloggers, who lambasted them for moving against agreed policy. Do not get me wrong here. I would ban all private commuter traffic from cities if I was in charge, but I am not and so in order to make improvements, I have learned to compromise begrudgingly.

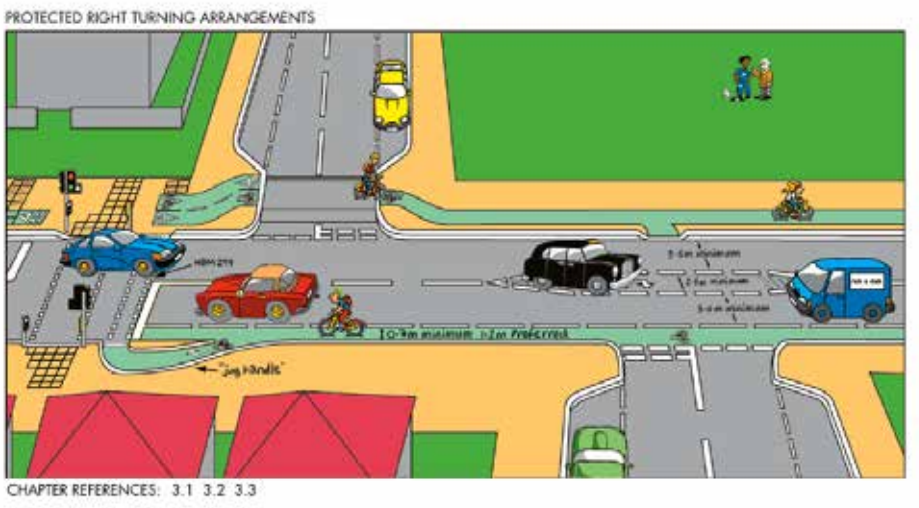
A successful champion must be willing to get their hands dirty. If you want to keep shouting about utopia and bemoan that no one listens to you, then you will never be an effective champion. You have to jump into the mud and start building the dream to make it happen. One painful step at a time. I know in London that many passionate people sweated blood to get facilities on the ground, and these are widely ridiculed today so their life's work seems miniscule and irrelevant. But if they had not taken those early steps, we would not have been able to take the next one and the next one and get better and better.

Slide 61 west end project

At the turn of the millennium, the London Cycling Design Manual came out; this specified that cycle lanes should be 1.2m wide. This was a landmark statement in that it represented the width of an average cycle plus the kinematic envelope, or wiggle room if you prefer. A line was literally drawn, asking that this minimum width be maintained. Previously, cycle lanes may have appeared if highway engineers had some spare bit of tarmac in the middle of a link. They may also have been told to put in some cycling provision and did not want to compromise on the 12foot or 3.65m lanes that they were trained to provide and so would mark out lanes barely wide enough to fit the smallest prescribed cycle symbol.

This is 750mm by the way, but I have seen narrower lanes than this in the UK, and sadly this practice continues outside of London to this day. 1.2m was clearly a tremendous achievement in these circumstances. It was all we dared dream of in those far-off days. Even then, cycle campaigners insisted we build to Dutch design guides and put 3m segregated cycle tracks on both sides of the road, but my profession had just claimed a remarkable game-changing victory and the Dutch approach seemed like a fairy tale.

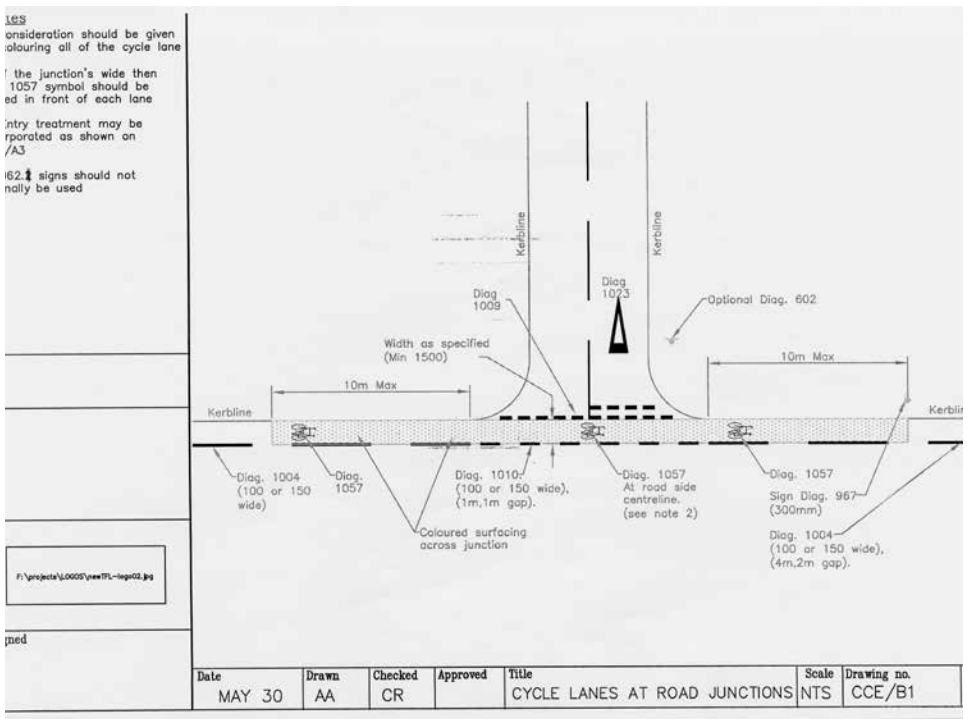
Slide 62 LCN design manual



Skip forward five years and London had installed hundreds of kilometres of 1.2m cycle lanes, but the cracks were showing and the evidence was mounting that maybe these were not wide enough and, worse still, cars seemed to be passing cyclists closer when they were in lanes, potentially making them unstable or intimidating them.

The decision was made to update the design standards and go for 1.5m. "Could it be done? Well, it had to be." This would sensibly allow more of a buffer between the cyclist and passing motor vehicles, and allow cyclists to ride not directly in line with gullies and detritus at the edge of the carriageway. Another victory was claimed for Team Cycling and so off we went, widening existing lanes and adding another 100km of new ones.

Slide 63 LCDS 2005



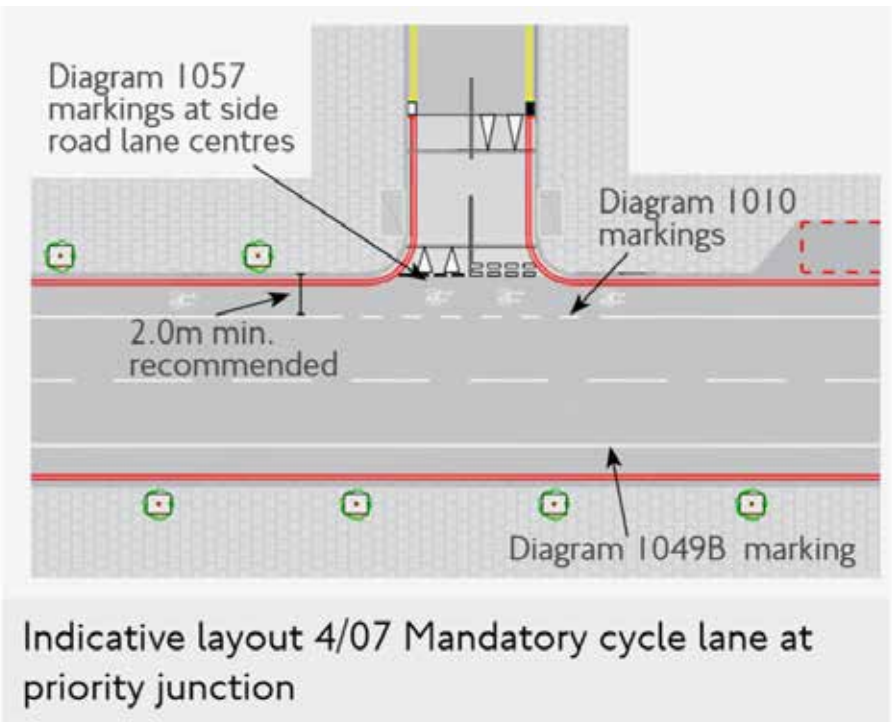
Lexicon

Skip forward ten years, and I was given the honour of co-writing the new London Cycling Design Standards. “What should I do? Go for 1.8m, dare I dream of 2m or even 2.4m to enable social walking and cycling?” Honestly, I had had enough of cycle lanes and over the years had seen them do more harm than good, particularly on the approach to junctions, but also past park cars and side roads. We will get into this on Day 2.

I decided that in terms of providing a level of service that would entice people to take up cycling, cycle lanes were almost irrelevant. In busy contexts, full segregation was the only thing that could work to entice people, whereas in quiet areas, filtering seemed to be a much more sensible and attractive approach. The question it seemed to me was far bigger than cycle lanes – it was about the reallocation of road space and modal shift.

“How many cyclists do we want? How many cyclists can we get? How do we entice and provide for these?” The answer being shouted out around the world from other cities emerging from consumption-based slumber was that cyclists need protection, and so I had to find a way to protect them and allow them to function en masse in a planned and strategic manner.

Slide 64 LCDS 2014

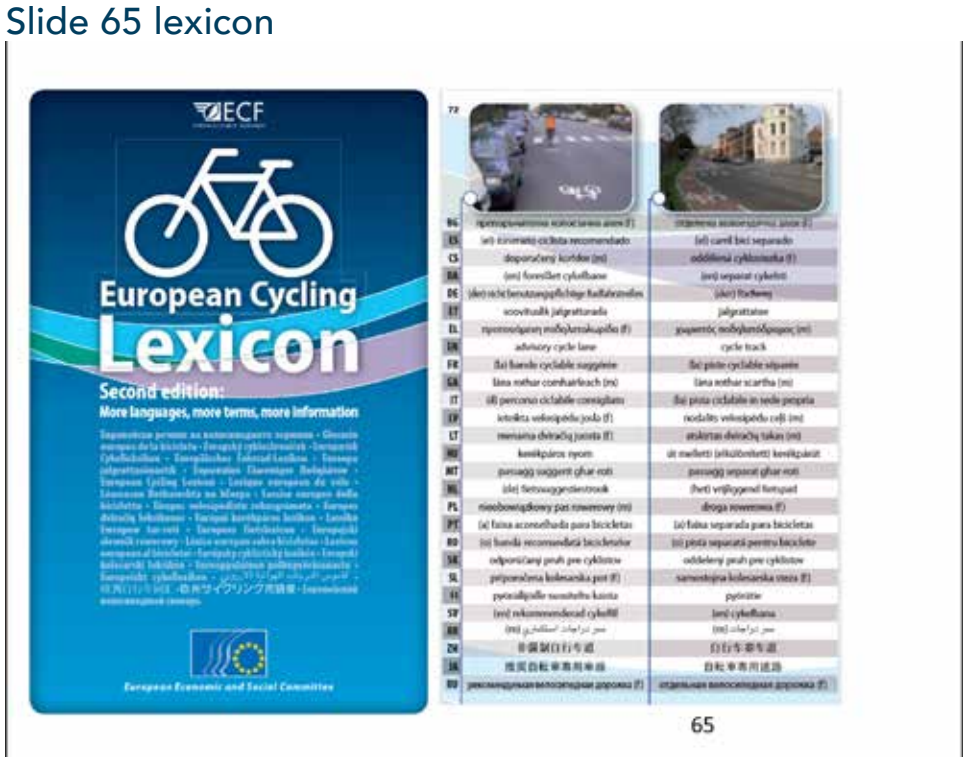


Indicative layout 4/07 Mandatory cycle lane at priority junction

My focus then shifted to deciding what level of separation to provide in different street contexts to entice new cyclists and unlock the full extent of cycling potential. If you have been paying attention, then that would unlock £4.2B in annual health benefits so it was worth giving some thought to. So let’s have a look at the different forms of separation. Note here that I am nothing if not a European and so I will be using the European walking and cycling lexicon terms provided by the European Cycling Federation and not the UK terms.

Sorry, but when it comes to cycling, you need to think more European in my view. It seems a peculiarly British condition to make up our own terms for everything.

Slide 65 lexicon

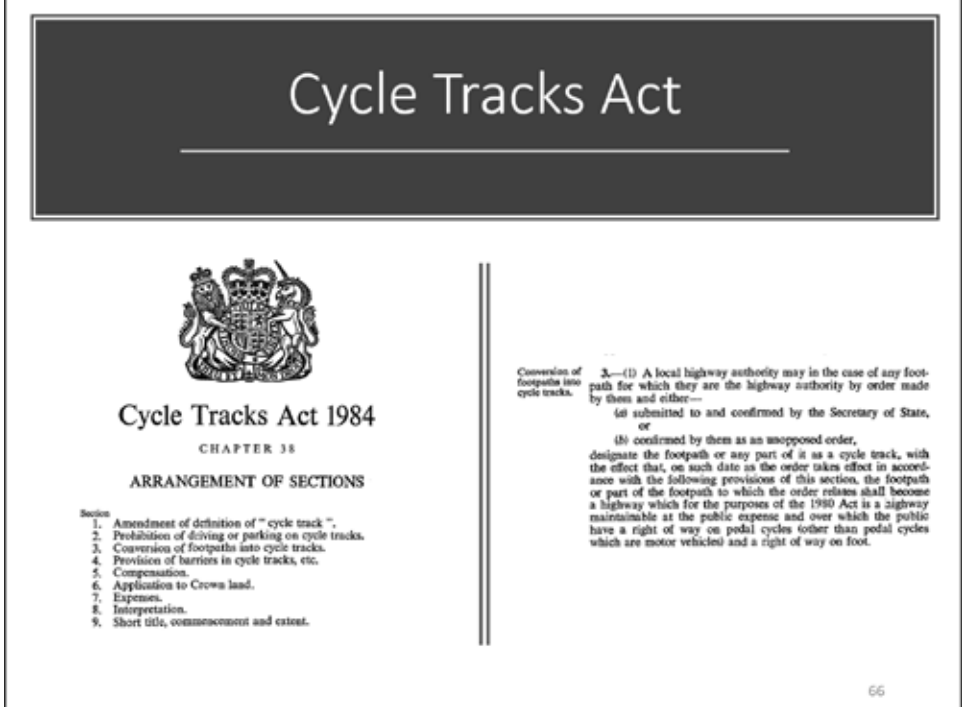


For example, a cycle track in the UK is a bad thing. Whereas a cycle track everywhere else in the world is usually a great thing. This is because the cycle track act from 1984 refers to the conversion of a footpath to allow walking and cycling and so a cycle track is essentially a shared use footpath in the UK. Whereas a cycle track in the Netherlands or (het) vrijliggend feitspad is very much a segregated mini version of a road for the exclusive use of cycle traffic.

I once told a colleague to examine the Dutch bicycle balance approach to cycle route delivery and she came back saying she could not find anything online. I recommended she type fiets balans into google and hey presto. The moral of the story is that if you want to be a walking and cycling champion and you want to be inspired, then you need to learn some Dutch. Danish infrastructure fans should look up (en) separate cykelsti. Better still, download the cycling lexicon and look up everybody’s infrastructure. It is not hard but it is amazing how few people I meet who know how to find high quality photo examples of international cycling infrastructure on the web. The problem with being cut off from the mainland I suppose.

Better Streets

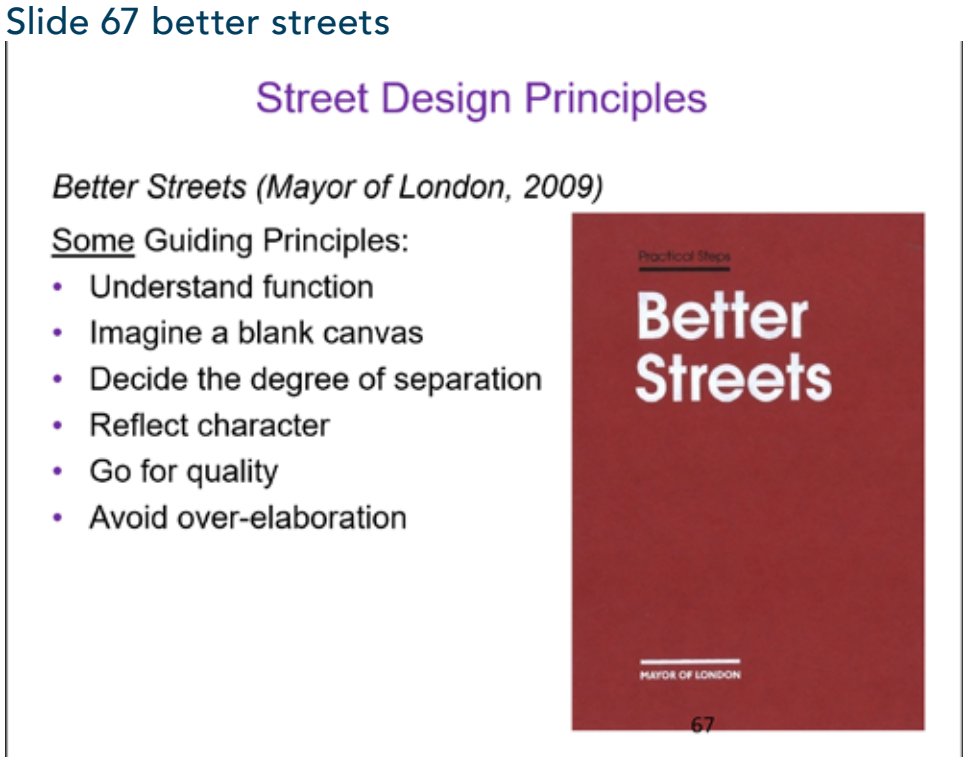
Slide 66 cycle track act



Back to separation. It is completely legitimate to provide for those who walk and cycle by sharing space in the correct context. Likewise it is legitimate to mix those who walk and cycle on streets with general traffic in the correct context. It may also be appropriate to mix cyclists with general traffic but give them priority through a cycle street or install a cycle lane, be it advisory, mandatory or unbound.

Protected lanes can be enticing and cheap, and, finally, dedicated cycle tracks can provide an embedded sense of protection and belonging in the correct context. Have I said the word context enough? If you classify roads by their movement function, put simply, their volume and speed, then high movement functions need protection or segregation. It is as simple as that. Getting them built on roads built for the expeditious movement of motor traffic is another matter entirely, particularly if the road is at capacity, but we will save that discussion for Day 3. The choice is binary. You either provide for those who walk and cycle or you write them off.

Slide 67 better streets



If the movement is medium, then really you still need protection to entice, but perhaps some of these cycle lane things may help. You cannot guarantee they will not be parked in or encroached into, but this discussion should be on the table to be accepted grudgingly in certain contexts. Shared space might also help here, but you probably want to do more than just let people mix with general traffic.

If the movement is low, then you might still want to protect space, to encourage the wary to venture out of the house and leave their car behind, but it would probably be more appropriate to mix with traffic, share space or, ideally, create a street where those who walk and cycle have a legitimate feeling of priority through design choices or, if possible, regulation.

Slide 68 understand function

But remember champions, that when it comes to street context we are all about the place function. We are part

Better streets approach

of the living, people-friendly, quality, whole-streets movement and so we are sensitive to the character of a place first and foremost.

Slide 69 imagine a blank canvas

So if the place function is high, then we may want to shy away from full segregation, unless of course the town planning is so bad that the city place with the highest cultural and social interest also has a high capacity road corridor running through it. For example, the Tower of London, the Arc de Triomphe and the Colosseum are of the highest international significance and are fronted by motorway-like roads, to name but three. In this case, it is not our fault that the character of the place is diminished and so we need to fight for protection.

Slide 70 Decide the degree of separation

If the place function is high but the movement is medium or low, then we need to give the character of the place and its street designers some slack and not be so insistent on kerbs, level differences and our own slice of the street. Let's be reasonable here champions, and acknowledge some cultural significance. Let us not forget that we are the planet's saviours, not selfish consumers demanding tarmac. All I am asking for is the debate to be nuanced. If the place function is medium then we can stick to our movement versus separation guns, and if it is low, then movement is the sole determining factor over what we should be prepared to expect. Please be considered and you will be listened to. "What is the street context?" This should always be your first question for any scheme or route you are considering.

Slide 71 reflect character

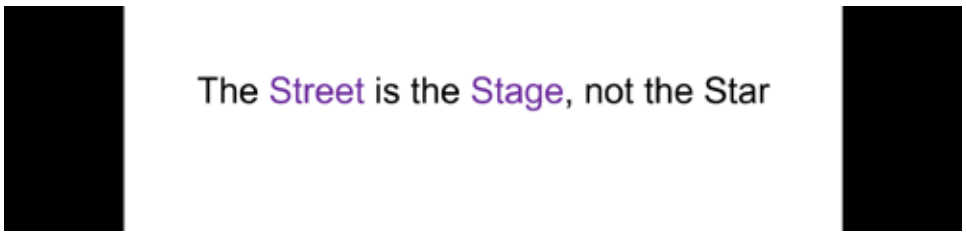
By this stage, I am hoping you are starting to see the world a little bit differently and through a wider lens. If you are still on the journey with me, than let's look at how we actually look at streets and their contexts. I wrote the London Cycling Design Standards with a colleague from an Urban Design/Land Use Planning field, whereas my background was in highway engineering. It amused me that when he opened up google maps he did so with the satellite view preference, whereas I preferred the street name view. He recognised areas by their buildings and the street patterns. The urban morphology was second nature to him. I, on the other hand, recognised the shapes of roads and intersections and liked their text names to be visible.

When I go on holiday, my partner is often shouting at me to look up and appreciate the buildings as I am usually staring at the road and its line markings. I saw the London Cycling Design Standards as an attempt to make Highway Engineers look up and see the place whilst making Urban Designers and Land Use Planners look down to see the roads. A change of perspective is incredibly useful, as we are all guilty of getting trapped

The street is the stage

into narrow fields of perception and subsequently believing that that is all there is to the world.

Slide 72. Reflect character



Streets are designed from a height and scale of 500m. From the top down view. But they are experienced from a height of 1.5m. From eye level. I always encourage anybody doing street design to include a visualisation, as most stakeholders will not recognise this top down view and will struggle to interpret what it means to them and their street. This course will cover visualisations in a workmanlike manner, without any of the fancy talk, on Day 4, so hold tight.

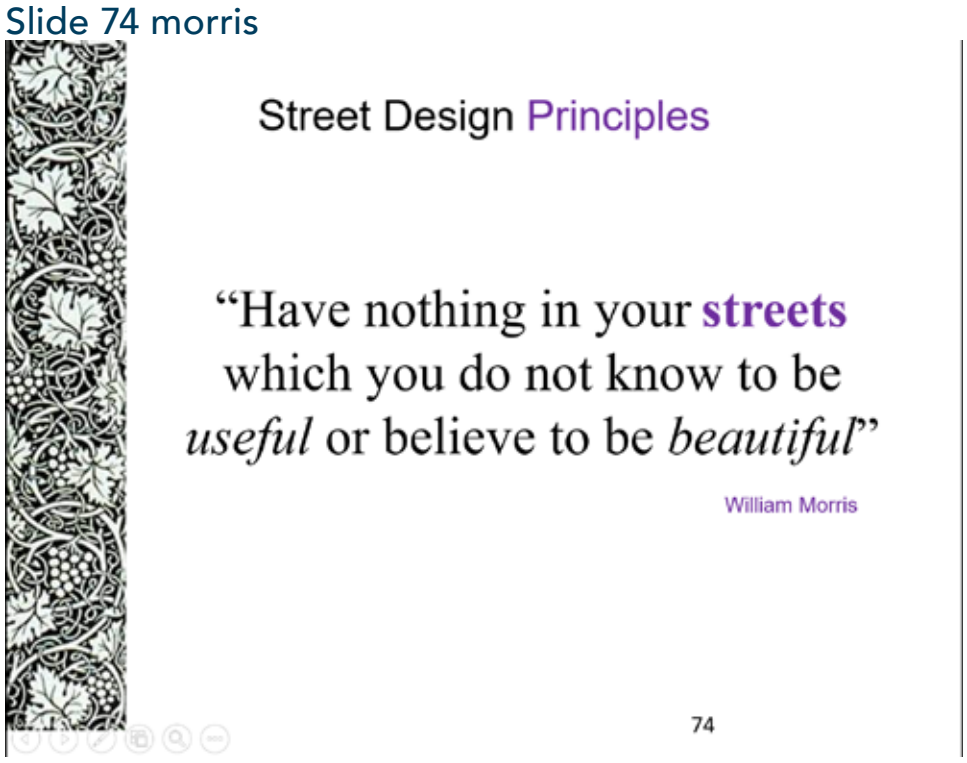
Streets will outlive us all, and they are the main places where we encounter and experience society. The way we design them can affect society, directly through encouraging civilised discourse and healthy activity, and indirectly through the diseases associated with poor air quality. Each designer has a responsibility to try and improve people's lives through their street design. This is an incredible responsibility. I have had many restless nights thinking about whether I did the right thing, dreading collision statistics that maybe, if I had employed a different design approach, I could have avoided.

Slide 73 go for quality

Street designers have people's lives in their hands. Some do not want or appreciate this responsibility, and so they want to follow established guidance and practice to the letter. When I speak to people in this mindset, they are concerned about what context and place means, as they are comfortable following their tried and tested methods. The fundamental issue is, however, that tried and tested methods only work in certain contexts and can be more dangerous than doing nothing in others.

The road to hell can be paved with good intentions. Discourse on street design can descend into violent disagreements, as the implications of getting a design aspect wrong can cost people's lives. Cycle champions must acknowledge this, but they must also be mindful that failure to promote walking and cycling and active travel condemns the next generation to an increasingly sedentary lifestyle that will reduce the quality of their lives, increase the burden on the state and potentially ruin the economic vitality of the area. The stakes are high when it comes to street design. Be under no illusions.

Slide 74 morris



I play my part in trying to make my industry more aware of context, but it is not ingrained in street designers yet, and each new graduate emerges from university with a head full of bypasses and flyovers, and the deprogramming begins again. Become enlightened and think of the bigger picture. Then your arguments will not run dry. I always advise that if you are championing a scheme and you are backed into a corner where the constraints seem insurmountable, then you must play the health card.

People are dying earlier and suffering on a mass scale whilst we decide as a generation whether we are moving towards more active travel or stabilising in the current consumption based system. "Two ways to choose, which way to go? Champions assemble."

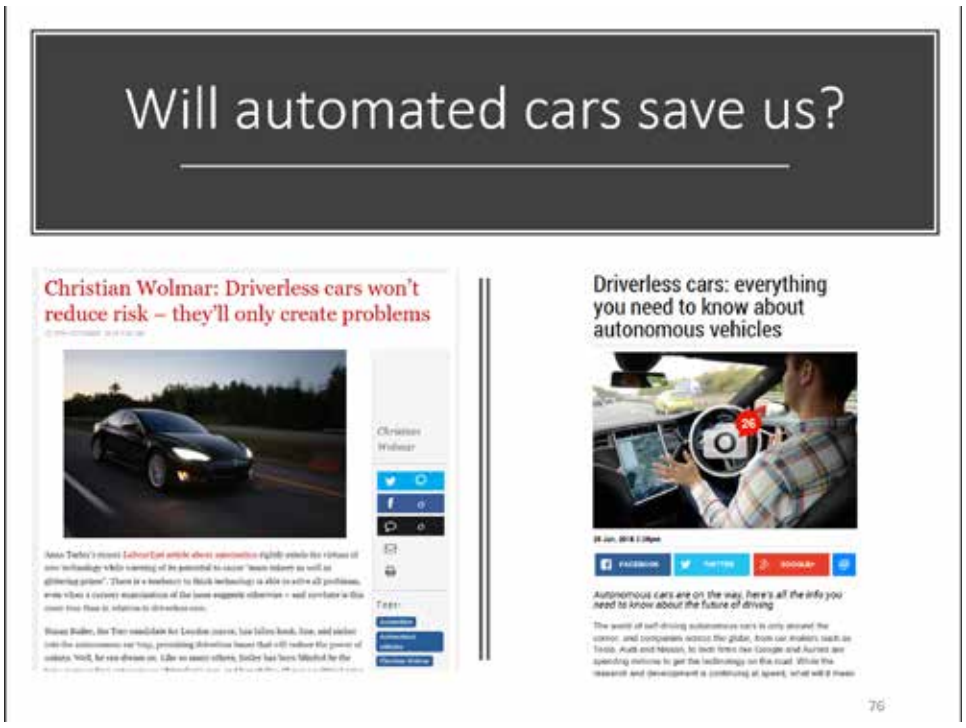
Healthy Streets

Slide 75 healthy streets

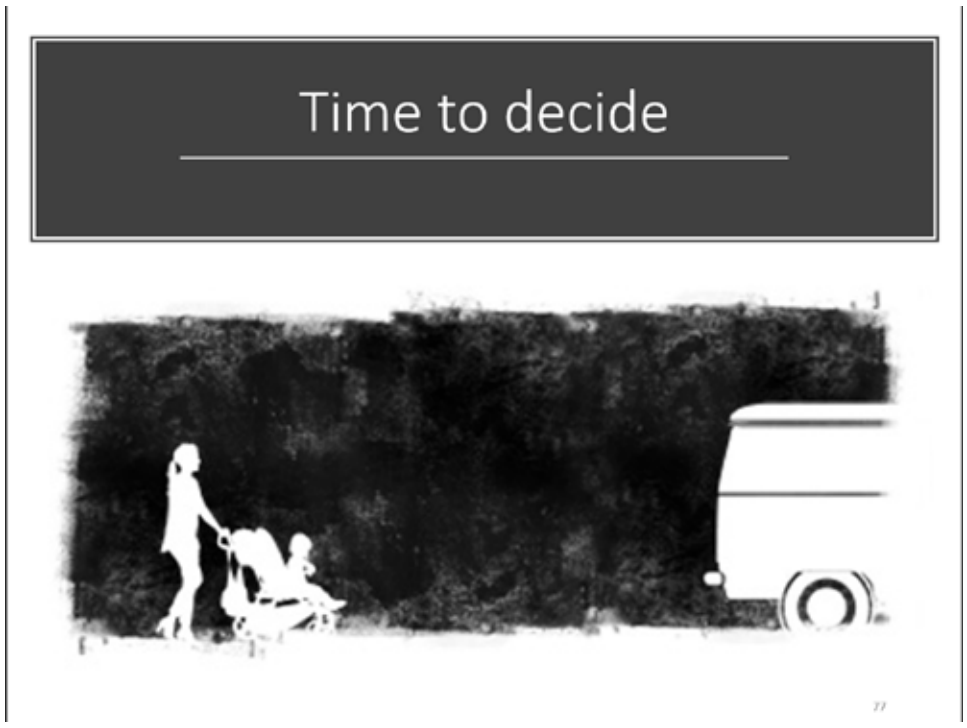
Ok, enough polemic, it is time to delve deeper into the profession of street transformation and walking and cycling provision. So let's look at planning your network and assessing the existing state of the streets. As a final note on context, some may argue that people just need to develop the skills to cope, or that safety in numbers will save us and so promotion is the answer, or even that automated cars will make the streets safe for all.

These people are all dead wrong; they need to wake up and realise what ordinary people need in order to make them consider walking and cycling and undertake it regularly as a mainstream transport option. They need a network of high quality routes. There is no fudge, no way around this; there is just the hard graft of making it happen. Roll your sleeves up champions – we are going in!

Slide 76 will cars save us



Slide 77 time to decide



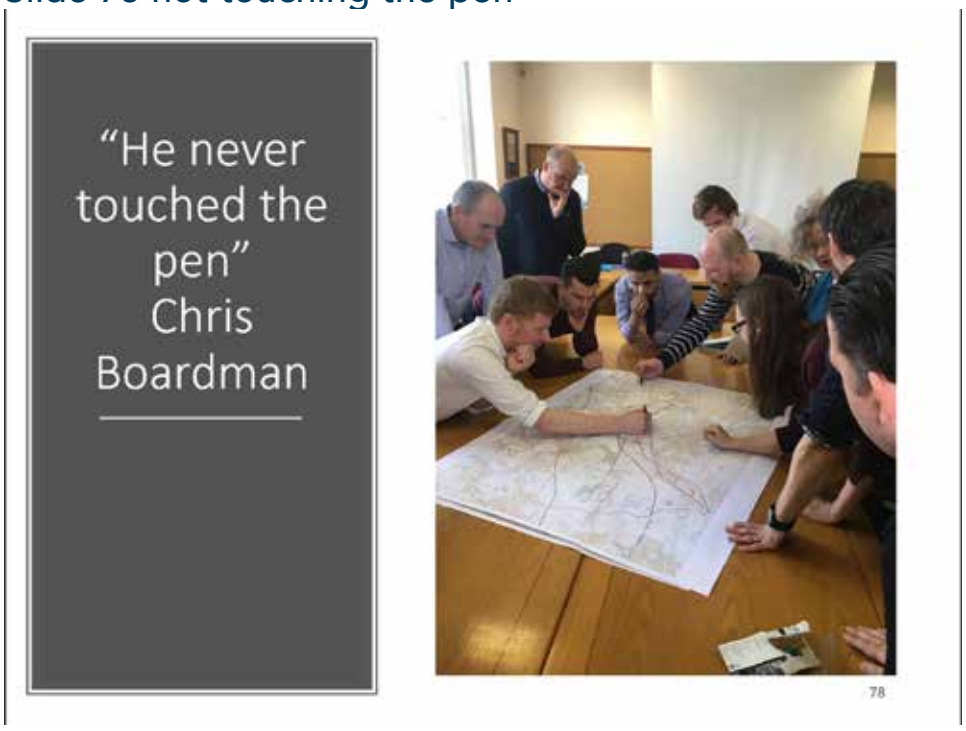
It may sometimes seem like you are starting from scratch and that conditions for walking and cycling are appalling, but this is not actually the truth. We all remember the worst parts of our walking and cycling journeys but tend to forget the parts that were alright or even the parts that were actually pretty good. Walking and cycling have been around for a long time and, wherever you are in the world, somebody would have tried to improve conditions for those who choose to walk or cycle somewhere.

You need to take stock and analyse what is there and add to it; maybe, in some cases, you also need to take it away, but we will come to that. A champion should be able to point specifically and locally to what works in an area and not just criticise everything. All civic authorities like to know what they got right and what is working about their approach. These can be hard to spot sometimes, but you need to find a positive or you will never get to change the negatives.

This section is about giving you a systematic process for assessing where you want to make a change, rather than just rushing straight to specific infrastructure requests. The wrong infrastructure choice can do more damage than good, as we saw earlier, so please do not rush in without scanning the horizon.

Network planning

Slide 78 not touching the pen

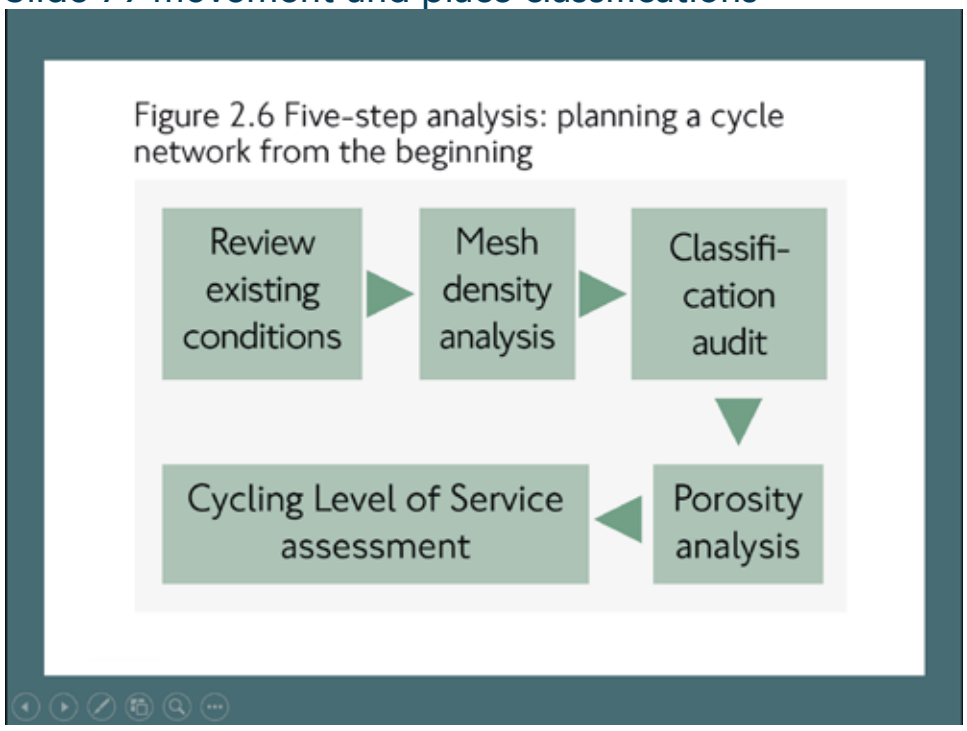


We will start at the macro view and gradually work our way in. We are also going to look at how we generate statistics to support our case. Remember the person at the meeting with the number usually wins the argument. Many cities have existing, defined walking and cycling networks, and at this stage I just mean lines drawn on a map. These can represent great routes or in some instances the least bad option. Nevertheless, they have them and so you need to find them and analyse them.

Where are the core routes? Where are the greenway routes? Where are the cut-throughs? Where are the area treatments? Find them and draw them on your own map. At this stage if you have any access to GIS software you can start plotting it. Free open source software packages are available and so this does not have to be expensive. This will make analysis a lot easier later. But do not worry if you lack the IT skills, as rulers and pens work as well.

At this stage you might also want to recall the road classification based on movement and place that was discussed earlier. Where are your high place function streets and where is all the movement happening? Classifying the streets in this way will help when you come to recommending solutions later.

Slide 79 movement and place classifications



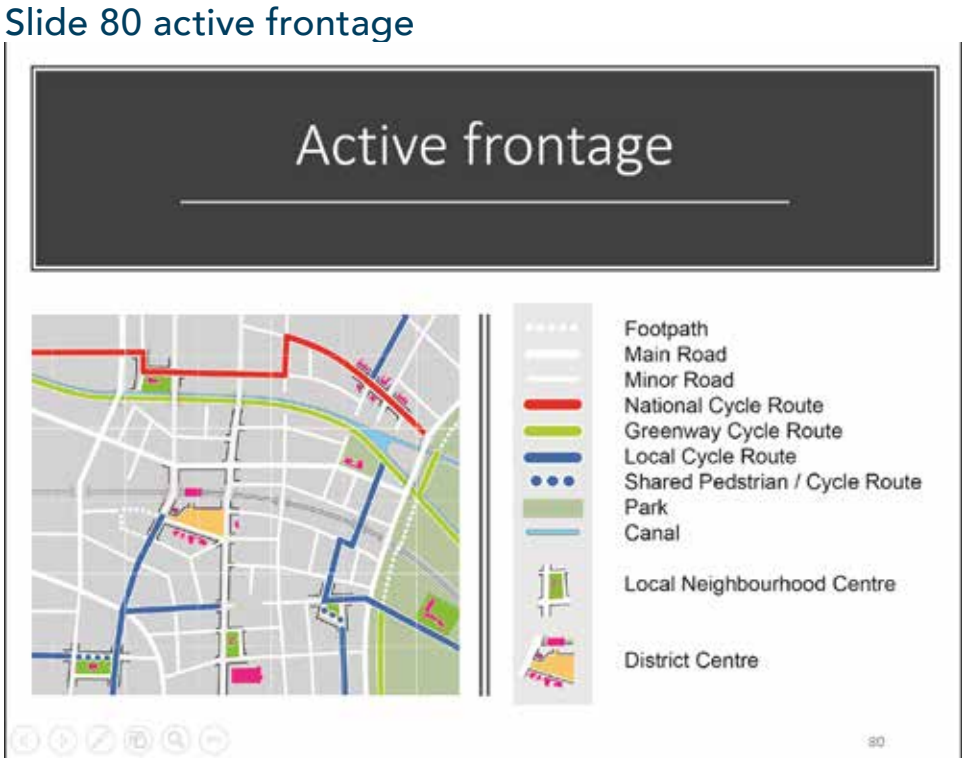
It is also useful at this stage to highlight what transport planners refer to as trip generators: places where people want to go. Commuting trip generators are particularly relevant as they tend to be places that experience the most network strain at key times. These are places such as stations, workplaces and educational establishments. Leisure trip generators are also worth highlighting, such as sports centres, parks and shopping centres.

Personally, I like to highlight active frontage which is another planning term for places where there are shops or cafés. Residential streets and industrial zones tend not to have these and they contribute to making areas feel isolated. We will come back to area characteristics in detail before this section ends. At this stage it is worth highlighting these as places people want to go, and also as places with kerbside activity.

Sorry, the jargon is coming thick and fast now and I will try and catch myself dropping the terms so I can pause and explain them. Hopefully this can be done without breaking the flow too much. Kerbside activity can refer to pedestrian footfall, oops, did it again, that is: the number of pedestrians, and also to the frequency of parking, loading and informal crossing movements. By informal we mean with a dedicated and regulated facility such as a zebra or signal controlled crossing.

Lost in terminology

Slide 80 active frontage



It is worth coming to terms with these terms when addressing transport professionals. Every profession has its short-hand terms and terminology and it is nice if you can converse in it. Make sure that you do not let anything slide though, and always ask for a plain explanation if you do not know. If you pay attention to this course, you should have a handle on most things but using jargon to obfuscate is the first lesson in being a transport professional. I personally recall being in a meeting and asking for a zebra crossing to be installed to break up traffic and allow people to cross.

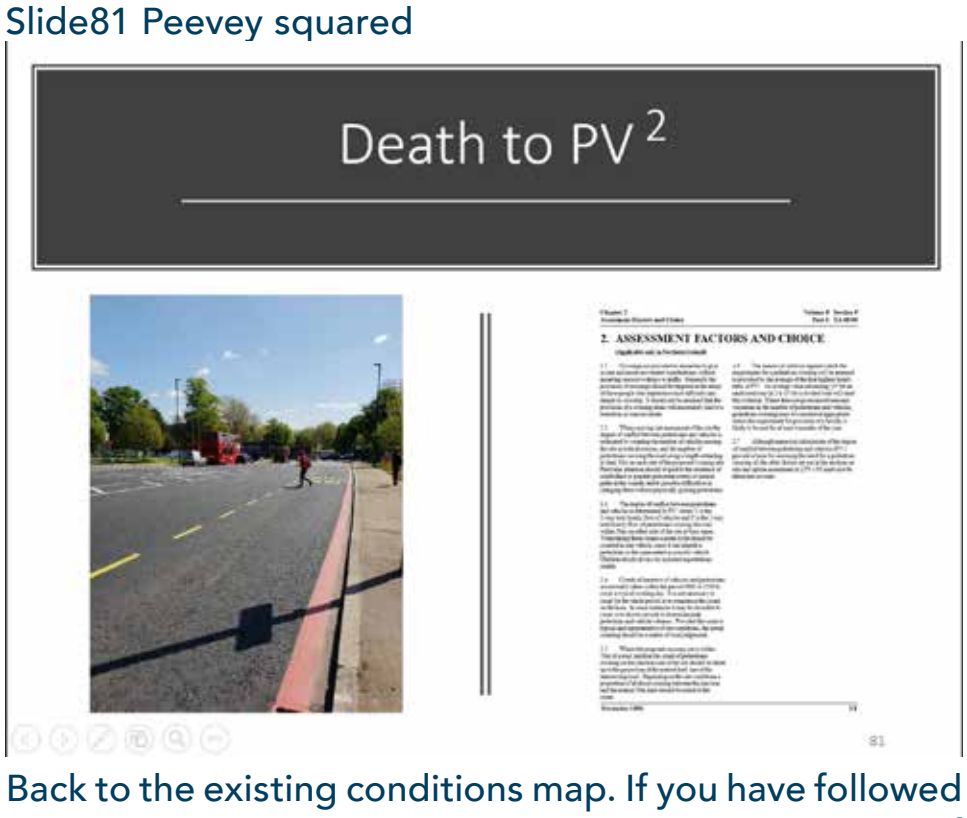
An engineer at the meeting said something to me like: peevey squared too low. To my shame I did not ask for clarification and assumed that a robust measure beyond my current area of expertise had been done and the computer had said no. This is a textbook example of how transport arguments are lost. It is up to the champion to find out and research and come back with the answers.

I took it upon myself to find out what this peevey business was all about. How was it derived and upon what assumption is it based? Should I challenge these assumptions? What in my experience supports or refutes this? The lesson here is not to let the jargon win but to question it, particularly where jargon stops you from improving conditions for pedestrians or cyclists.

Peevey squared actually refers to a very simple justification equation: P times V squared, which helps inform whether formal crossings are required. P refers to the sum of pedestrian movements which are given different weightings based on age and subsequent crossing speed. P refers to the volume of traffic with larger vehicles given extra weighting. In practice people tend to multiply this figure by a factor associated with the number of accidents and factor based on how difficult the road conditions are. That is to say: how wide is the crossing and how fast the cars are moving past?

The engineer could have said to me that only a small amount of people cross there and that there are not many cars passing but he quite rightly referenced a figure that said all those things to the informed ear. Now that I know I can reply that maybe people are not crossing at that point as the motor traffic is too aggressive and fast and this could account for the low volume. Provision should not be denied because enough people are not ready to take on a treacherous crossing point. Learn from what I did and either get the terms in your head, or ask a lot of questions.

Slide81 Peevey squared

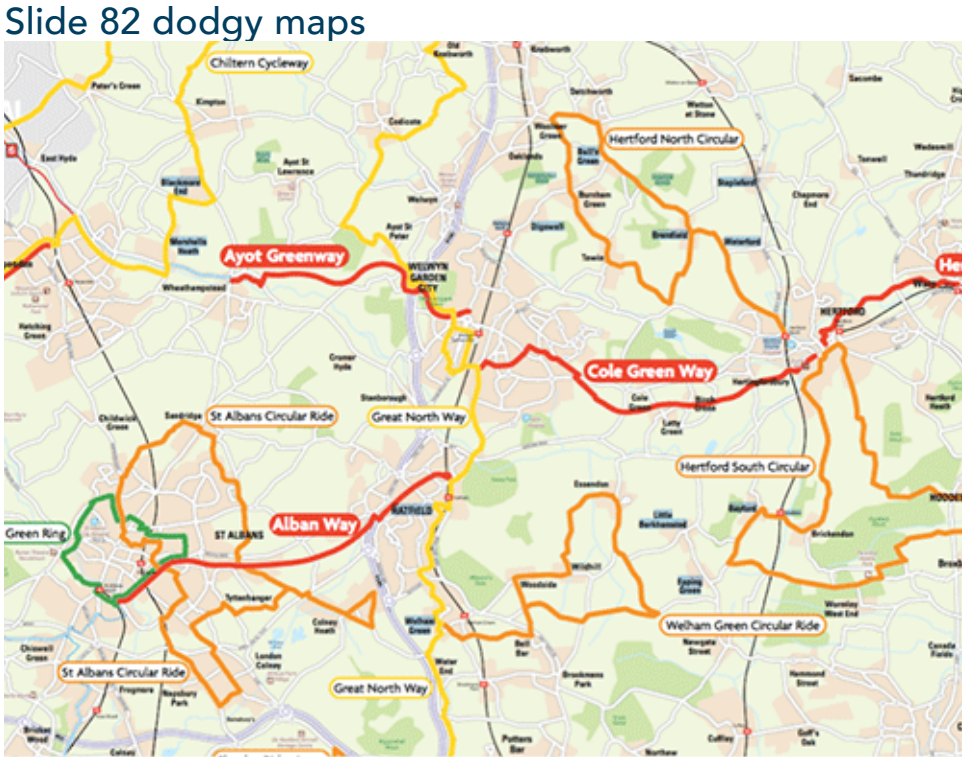


Back to the existing conditions map. If you have followed the instructions, you should have a current state of play map and obvious gaps should come jumping out of the page. Why does the route not connect to the town centre? Why is there nothing provided east of the railway line? What are all these gaps? Outside of Denmark and Holland, picking up city cycling network maps can be depressing.

I have at least 200 in my personal collection and as they are mainly from the UK the networks are not really networks at all. They look like their Dutch and Danish counterparts in terms of font and maybe even the base map and colour choices, but the key difference is that not much actually connects to form an actual network.

Network assessment

Slide 82 dodgy maps



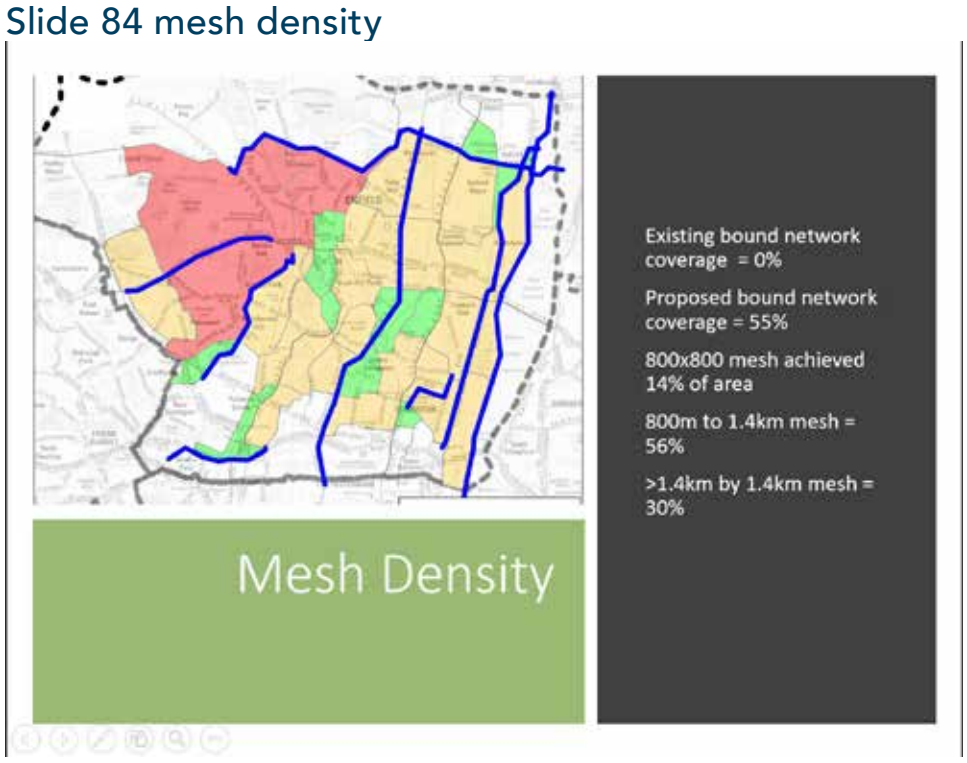
Those cycle network maps that do show a connected network are often outrageous lies. For example there are streets shown on the London Cycle Network maps that carry over 20,000 vehicles a day that are referenced as quiet roads. A further example: according to the EuroVelo project, all the British cross country routes are completed, as someone told them all the national cycle network routes were open. They may be open but they are not all that great to ride on.

Parts run along very busy roads and other sections lead to pebbled beaches or unmade paths. Being open and being usable at any kind of level of service are two different things. Be wary of taking any cycle network map seriously. You need to experience them yourselves and decide what you think the ride quality should be like before accepting it in your own network plan.

Slide 83 eurovelo

The Dutch, masters that they are, aim for a basic network mesh density of 400m falling to 250m in their town centres. That is to say that if you find yourself on a cycle route then rest assured that there is another parallel route within 400m. You do not need to ride more than 400m before you come across an intersecting route. They build networks and as such they can start defining terms for the specification of the density of these networks. In London we have no routes that run across the city in any direction without severe breaks in quality. Even at the individual borough level there are only one or two boroughs with reasonable quality routes spanning their extents. London does have pockets of brilliance but no connecting network to speak of.

Slide 84 mesh density



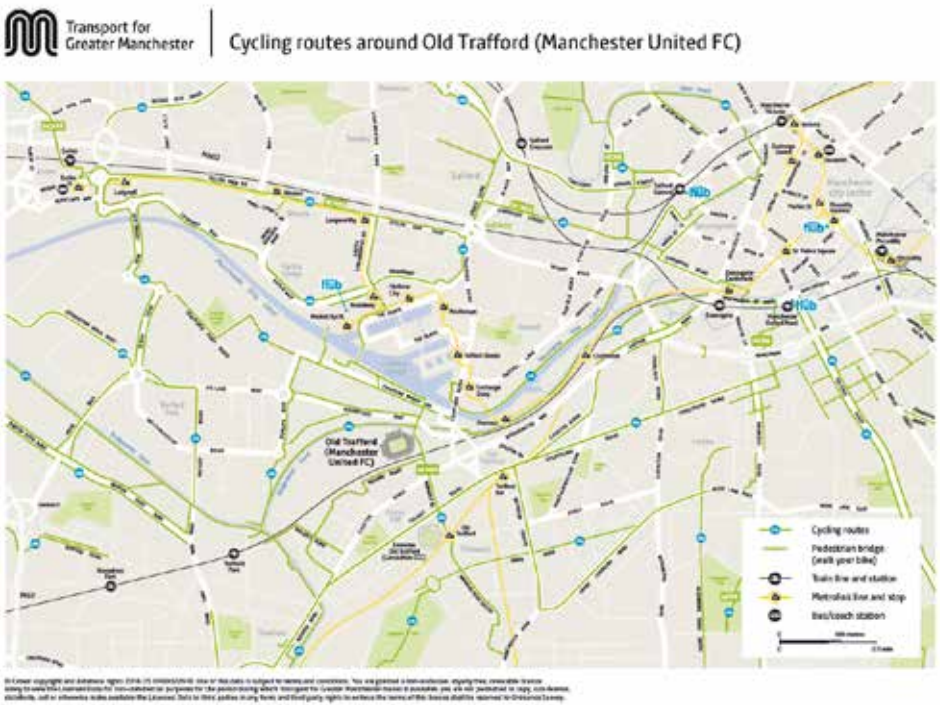
The superhighway routes for which London is most famous were planned as mid-range discreet radial routes. That is to say that they are not very long and do not join up. The current Greater Manchester cycling network maps looks like a series of oxbow lakes scattered across the region. How are you supposed to get to these linear splashes of quality? Put your bike on top of your car perhaps and then drive to them?

The Hertfordshire cycle network map looks like a series of small loops and so at least they have thought about getting you back to your car without having to double back on yourself. This course is not here to poke fun; at least these last few maps are honest representations. This course exists to open our eyes to the fact that we are currently, in most places around the globe, not actually planning anything in terms of cycle networks, but instead waiting for opportunities and little pockets of delivery which we can publicise and pretend we are on the way to becoming Denmark or Holland. So look again at your own map that you have developed showing the existing situation. How far off a 400m mesh

Good news and barriers

are you? Be honest.

Slide 85 GM maps



That was a depressing start to network planning so here is a positive statistic. 80% of London's roads are classified as local streets, by which I mean that they serve no strategic traffic-moving function and do not have any special place functions either. This ratio seems to be similar worldwide, in that there are more residential streets than there are high traffic trunk roads.

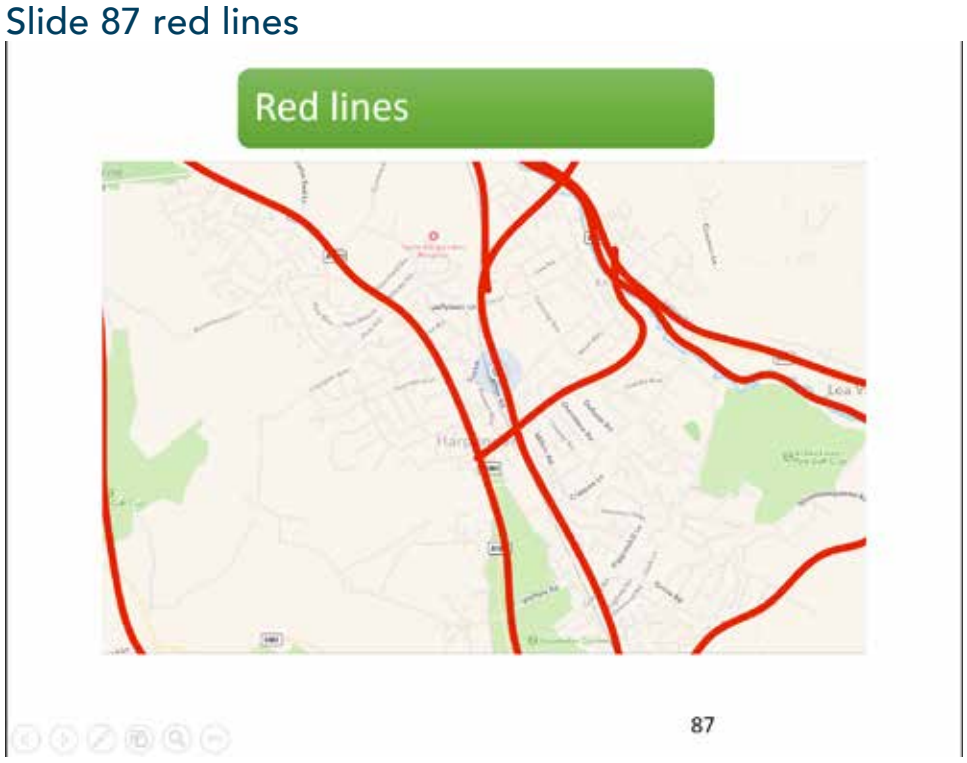
This is great news for cyclists as most of these roads need hardly any intervention to make them rideable to anybody with basic skills. In fact, efforts have been made in the UK to classify all streets in terms of the level of walking and cycling skill you would need to ride them.

Ok, so there are a few local streets carrying medium volumes of traffic which is perhaps deviating from the main roads to avoid congested junctions. These are cheerfully referred to as rat-runs in the UK. Be careful though before you put this label on a street, as some campaigners view all cars as rats and request that they are exterminated, even if they are just dropping off some shopping at their house. We have to learn to mix nicely with some cars as by the looks of things they are not going away.

Slide 86 80% London

"Why, if the story is so rosy, did you start off by showing how bad the network picture is?" I hear you asking. Well, although the majority of streets are great to cycle on, you do not have to head off in one direction too long before you come across a road that is not so great. Large, high-capacity trunk roads bound areas like hedgerows in fields, and can be just as annoying and scratchy to get through. Areas are effectively bound by roads requiring a high-enough skill level effectively to put the majority of would-be active travellers off the activity. They may not remember the 80% of good stuff but they will remember forcing themselves across three lanes of traffic and then waiting in the middle of the road, with cars streaming past on both sides, for an opportunity to turn right. This moment will linger in the mind of even the most experienced person. They may have found a way of dealing with it but the anxiety is still there, every single time.

Slide 87 red lines

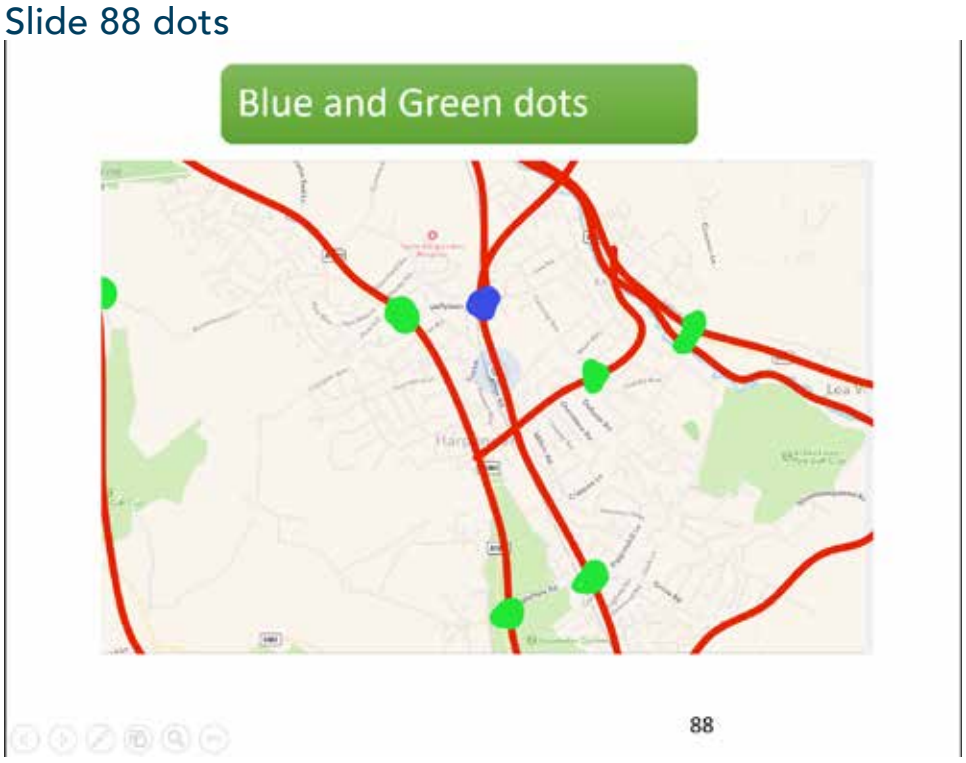


Coloured pens

In order to provide a basic network for cyclists in a planned, logical and affordable manner, the key is to provide crossings of the busy roads. If people can quickly skip across the difficult roads, then they can utilise the quiet streets to traverse large areas in a relatively untroubled manner. I can feel some readers' temperatures rising as I offer support to the back street network. "People want to be direct you said. What about Denmark – they switched to main roads, as cyclists were not happy with the backstreets?" Well, it would be great if you could get segregated provision along all your main road corridors, and if you have the political will and several billion in the bank, then go ahead.

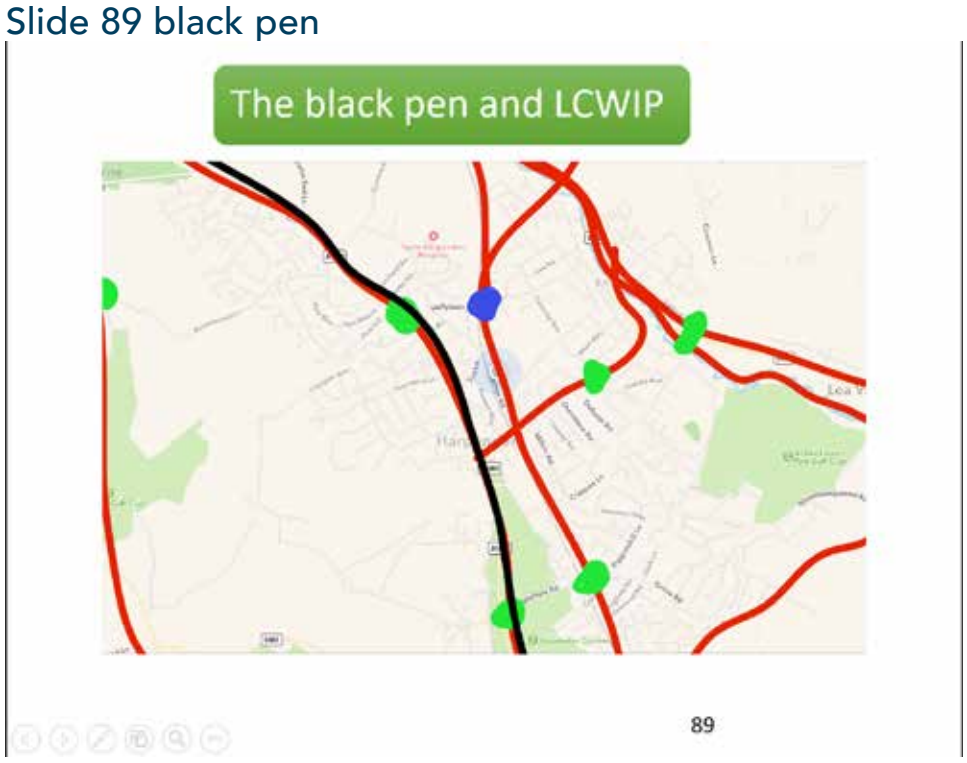
I am offering a pragmatic way of enabling those who choose to walk and cycle across areas without being in mortal danger. Systematically delivering a network of back streets and crossing points would help deliver this idea. One of the UK's main issues is that young people get trained to ride bikes but then have no safe routes to walk and ride on. If we could show parents that a network exists that is tailored to the skill level they are trained for at school, then we might get somewhere.

Slide 88 dots



All these approaches can be used to quantify how far your existing network is from Dutch ideals, and this should help you prioritise and plan. Civic authorities love prioritised lists, especially deliverable ones. Champions need to engage and deliver to a plan. Try not to be the little person fighting the system: be the person pushing the industry wheels in the right direction. If you cannot work for the man, then you cannot be a champion.

Slide 89 black pen



I recommend that your masterplan for walking and cycling should consider the following two main options as they are associated with increasing usage around the world and have certainly worked in London. The first is to consider area traffic management, which is a euphemism for blocking some roads to motor traffic. The skill in this approach is deciding exactly which roads to block without ruining people's lives and livelihoods. You will ruin lives if you displace all motor traffic to what was once a quiet residential street. In network terms, the route created may be brilliant but it came at too high a cost to the local population. You will ruin livelihoods if businesses cannot easily load or gain access to their place of work. There is quite a skill to getting this right and it is not the sort of thing a computer or spreadsheet can easily predict. There are usually lots of variables and little ways of controlling flow, which we will see on Day 3 is the trickiest situation to model.

Slide 90 hatched back

The conditions for culture

We had a famous example in the London borough of Waltham Forest where temporary blockages were installed and traffic flow was monitored live in order to trigger adjustments should issues occur of the type mentioned above. This approach helped the council decide what the optimum arrangement was, in order to promote walking and cycling trips without disturbing essential journeys made by car. Filtering goes a long way towards delivering favourable conditions for walking and cycling as it effectively removes most of the through traffic, allowing cyclists to move freely within zones. The downside comes with the impact on certain roads, as the traffic has to go somewhere. This approach can lead to the creation of very difficult roads to cycle on if you are moving between filtered zones. However, if you can get good crossings in on these roads then theoretically this gives you the whole package.

Slide 91 Network Planning exercise

Traffic management goes a long way to providing favourable conditions for walking and cycling and should be encouraged; the only problem is that nobody actually realises you have done it. It keeps those that are walking and cycling safe, but doesn't really entice those that are considering it. When they look out of their window, with their hand hovering over the car keys or bike keys, as in the Catch up with the Bicycle advert, they will see nothing other than cars moving up and down the street and not even a marking saying "Hey, we have made this street great to ride".

This is where the good old-fashioned network route comes in handy. If they look out of their window and see a sign saying "5 minutes to the town centre by cycle" and a few cycle symbols and markings, perhaps with a number to make it all seem planned, maybe they will hover their hand more firmly over the bike keys. If our theoretical near-market considerer looks out and sees congestion, perhaps they live on a busy road, but they also see a fully segregated cycle track with happy smiling cyclists high-fiving as they pass, then the bike key is going to get grabbed and the car key kept for weekend breaks.

Slide 92 creating culture

The main reason for being systematic about your network planning is so that you can make a strategic case for infrastructure. "You need a bridge at that point as there is no connection across the railway line for 2km." "You need to put in segregation at another point as it will link two network routes via a high capacity main road."

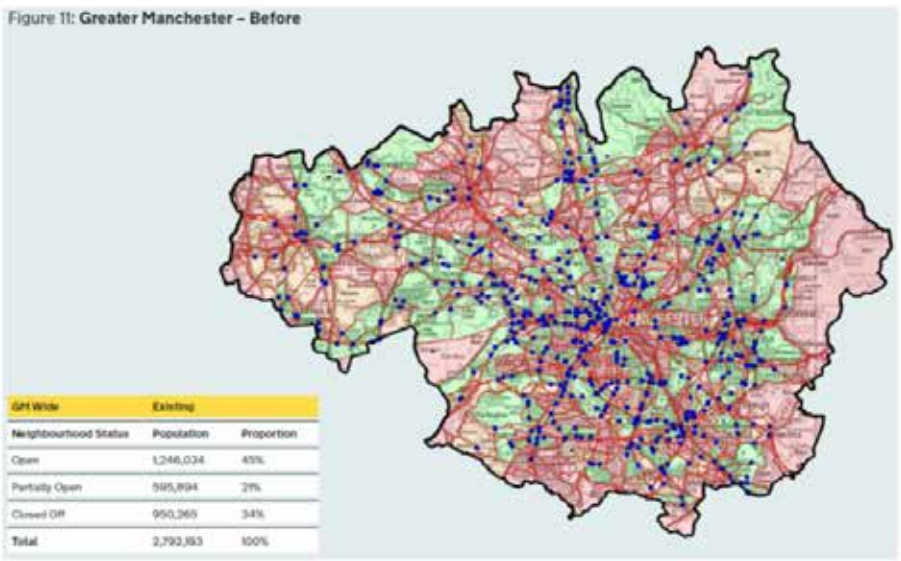
All infrastructure ideas should be led by the network plan, and not just be reliant on opportunities that arrive via development, or a confluence of collisions. Champions need a plan and without one you will never make walking and cycling a mainstream transport option. Engineers building a motorway network do not think, "well, we will leave that bit there as it's too hard, and make a start on another bit 5km away and hope something happens to the land in between so that we can ask for the middle bit".

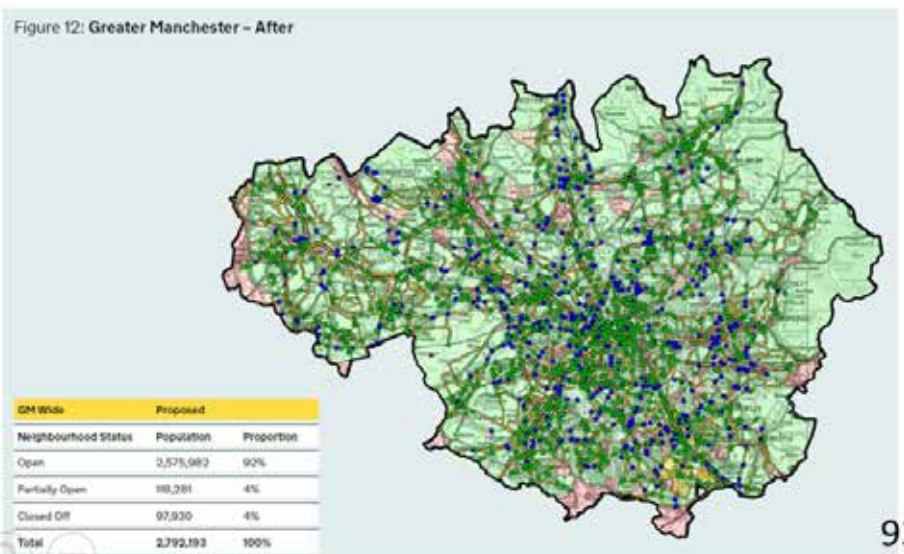
They also do not ask car drivers to get out of their cars and push for certain sections – although if they did, this would be an excellent traffic calming feature! If your city or region already has a plan, then check it against these techniques and see how it holds up. There are limited funds available to civic authorities in most countries, so a plan helps with prioritisation. I would personally recommend doing a mixture of big-ticket, high-profile schemes that entice new cyclists, and more low-key

The plan

pragmatic crossings and filters to enable a basic service functioning. Nobody should accept a small portion of any transport budget going to the occasional walking and cycling scheme. We need more things built. This brings about a new set of issues which will be familiar to all and they need to be tackled head on: how do we build good stuff?

Slide 93 the plan 1





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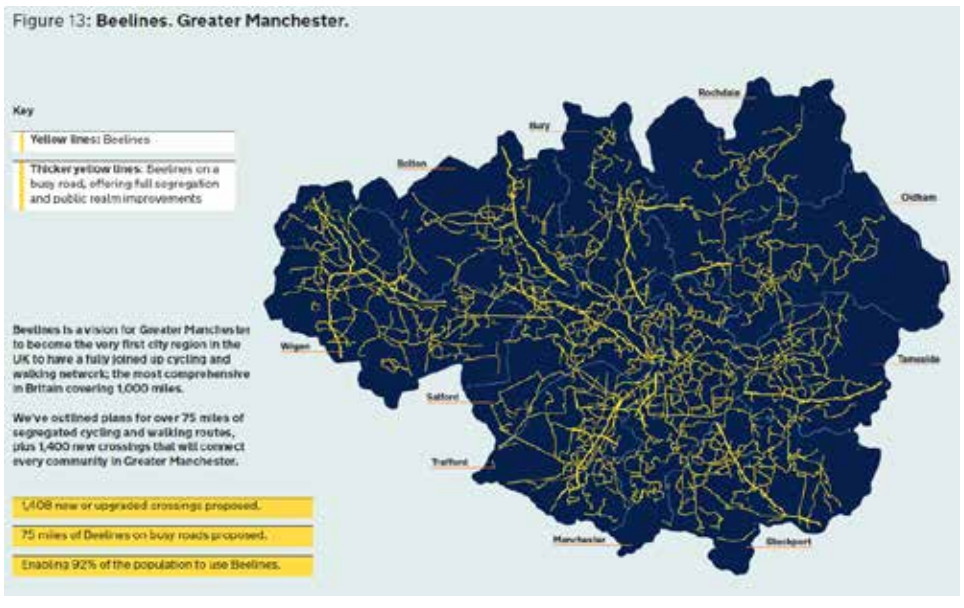
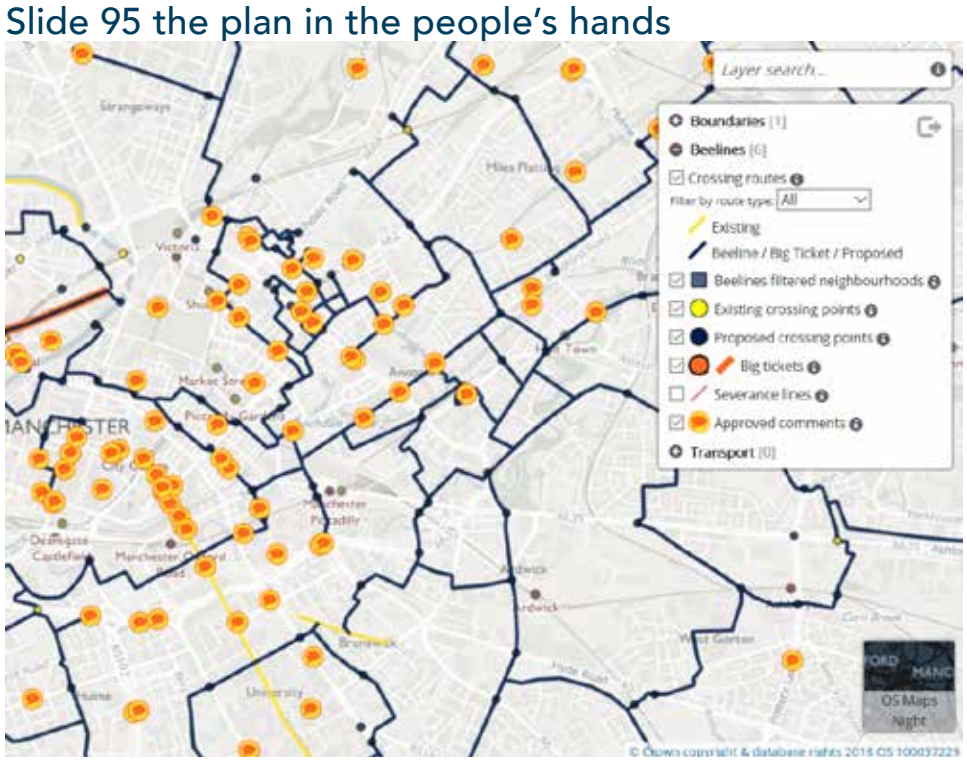
Slide 94 the plan 2

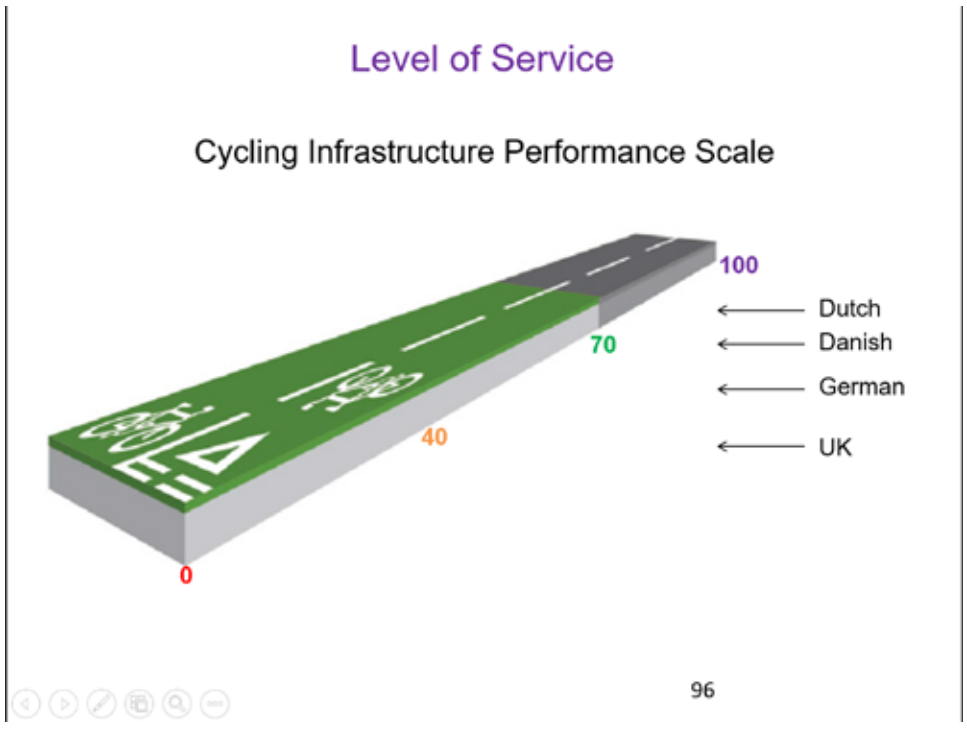


Slide 95 the plan in the people's hands



As I mentioned earlier, most people hate most infrastructure, as most infrastructure is designed by infrastructure people who hate people the most. There needs to be a way of making infrastructure neutral, technical and effective. I have to believe there is a way, as this is what I do for a living. This is the area where the Dutch and Danes have really succeeded. People like and accept what they build, as it offers them a high level of service. The term level of service is key as it moves beyond lip service and derisory afterthoughts towards actually providing conditions where a mode of transport can flourish. Most streets were designed with cars in mind, but there are parameters we can change and approaches we can tweak that enable walking and cycling to flourish. Being a cycle route designer in any country other than Denmark and Holland is about retrofitting.

Slide 96 level of service



Turning the corner

The Danes and the Dutch originally retrofitted their streets in the seventies and eighties and now concentrate on maintenance. This means they are not really the masters of retrofitting anymore. The rest of us need to find our own ways. At this point, I will point out that a collection of Dutch engineers worked with New York's transportation department in creating the New Amsterdam.

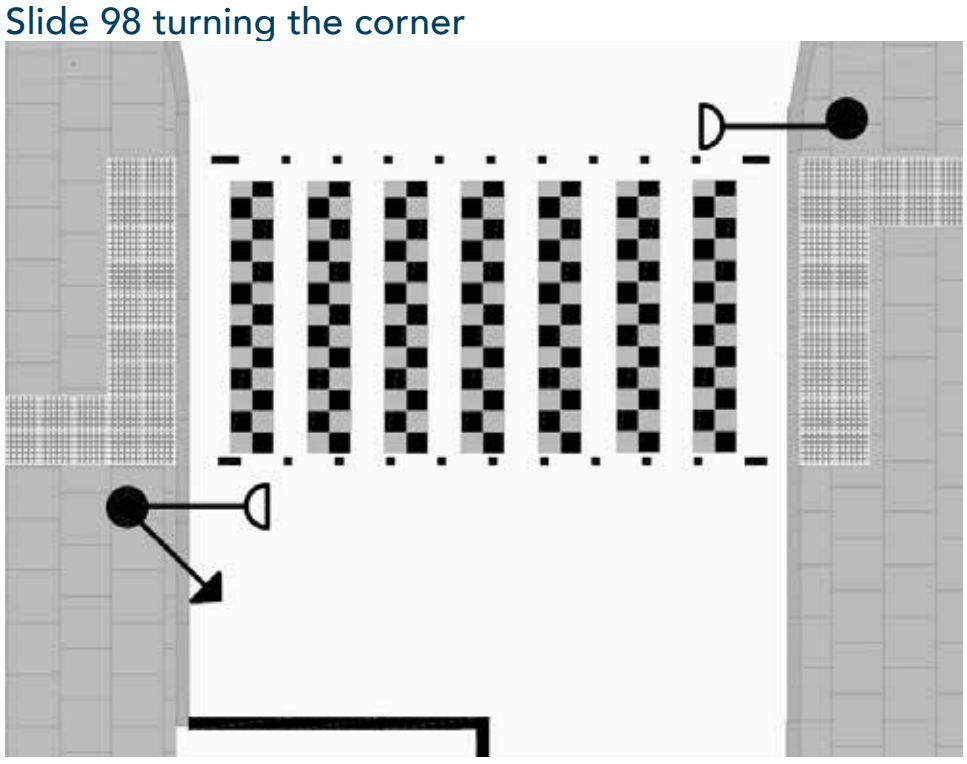
This work led to the temporary approaches to street redesign championed by New York and collated in the NACTO Urban Bikeway Design Guide, and so it is clear that they can retrofit if asked. However, the point I am trying to make is that you know your city or region best. You know the street pattern, the regulations, the behaviour and attitude of the people. So you need to find out what works for them.

Slide 97 standing on the shoulders

In London, we tried to copy the Danish approach to delivering superhighways, and transplanted their designs directly onto London Streets – albeit by flipping them so that they were on the right side of the road. The right side being the left side in the UK and the right side being the wrong side elsewhere from our perspective. The Danish superhighways needed the merest suggestion of blue across the nearside of a junction to remind drivers of their legal requirement to look out for nearside cyclists.

Danish law presumes that the driver was at fault in any collision with a cyclist as, quite rightly, they are the more dangerous mode and so subsequently should be looking out for others. Danish truck drivers do a stop turn movement, where they position the front of their vehicle in such a way that they can look directly down the nearside to make sure it is completely clear of cyclists before turning.

Slide 98 turning the corner



Alas, all this embedded behaviour was lost in translation in the UK, where drivers assume priority when turning left, the equivalent of the Danish right turn. UK law also states that evidence must be presented to prove guilt and so all UK drivers can claim that they did not see any nearside cyclists as they were in a blind spot. This claim is very hard to prove wrong, and is so commonplace in the UK that it has developed the only acronym amongst cyclists: SMIDSY, which stands for Sorry Mate I Didn't See You.

UK cyclists are also just as likely to pass you on the offside as the nearside, as frankly they know that drivers do not seem to look out and only rarely indicate, and so on the offside you are looking straight at them and you are away from the turning movement. All these behavioural factors, and many more that were specific to UK walking, cycling and driving, manifested themselves into frequent collisions, which led to an abandoning of the Danish approach and an embracing of Dutch-style protected junctions, where cyclists are separated in time and space.

We will consider junction design in more depth on Day 2, but for now the key point to remember is that you have to set your own level of service based on your street layouts, regulatory standards and behaviour. Social norms are enforced by design and can be undone, but you need to be aware of them and not just ask for straight adoption of other countries' standards. Even the Dutch adapted their standards for the US. One size does not fit all, and so you need to adapt with awareness and not adopt without thinking.

Road danger reduction

Slide 99 stop SMIDSY

Having said that you need to find your own way in terms of design, the famous five Dutch principles, Safety, Directness, Coherence, Comfort and Attractiveness, are general enough to be universally adopted. They can then be calibrated to your own street contexts, regulations and behaviour. Obviously, and it should be obvious, walking and cycling routes need to be safe. But what does this actually mean? Does it mean that you should have low number of collisions? If so, then this could be achieved by providing conditions that are so harsh that only true maniacs will even consider walking or riding there.

There is a huge reluctance amongst the engineering profession to alter streets if they have a low collision record, even if people are not walking and cycling there due to their intimidating nature. It could even be the intimidating nature of the street that is keeping collision rates down, as people are wary and so become more careful. Collision statistics on their own are therefore not a reliable indicator of whether safety has been addressed in your route design.

Slide 100 feeling of safety

Clearly if there are lots of walking and cycling collisions, then this should prompt action but sometimes this can be because there are large numbers of cyclists and so the rate of collisions is much lower. It is a bit like another town the size of Amsterdam saying they have better walking and cycling safety as they have fewer collisions, when the percentage of trips made by cycle is 1% compared to 50% in Amsterdam. Safety statistics can be distorted to help make political points.

The UK is often heralded by Transport Ministers as being a world leader in road safety with road traffic accidents continually falling, year on year. Yet most UK residents would and often do say when surveyed that they would not consider walking and cycling as the roads are too dangerous. The falls in collisions could be the result of safer vehicle design or even that roads have become so saturated with cars that pedestrians and cyclists fear to use the roads, and so there are fewer vulnerable people present on the streets.

Slide 101 Is it safe?

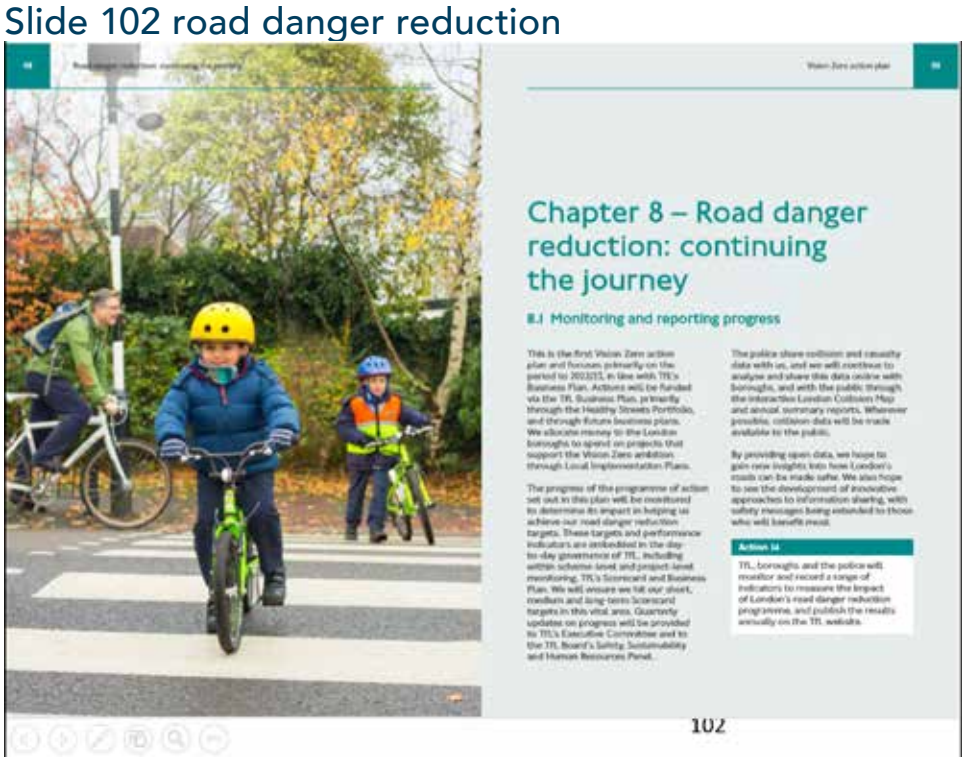
This schism in actual versus perceived safety led to the launch of the Road Danger Reduction lobby, and this is a fairer way to judge the impact of walking and cycling promotion than road safety. Statistically, the safest road for people would be the road in which they were banned, whereas the least dangerous road for people would be the road in which they were present in large numbers, dominating the space. Walking and cycling makes streets less dangerous for everyone.

The founder of the Road Danger Reduction forum used to start talks by asking: “Do we want more cycling collisions or less?” To which people would obviously respond: “less”. At this point he would say: “Wrong! We want more, as that means there are more cyclists.”

Collision risk

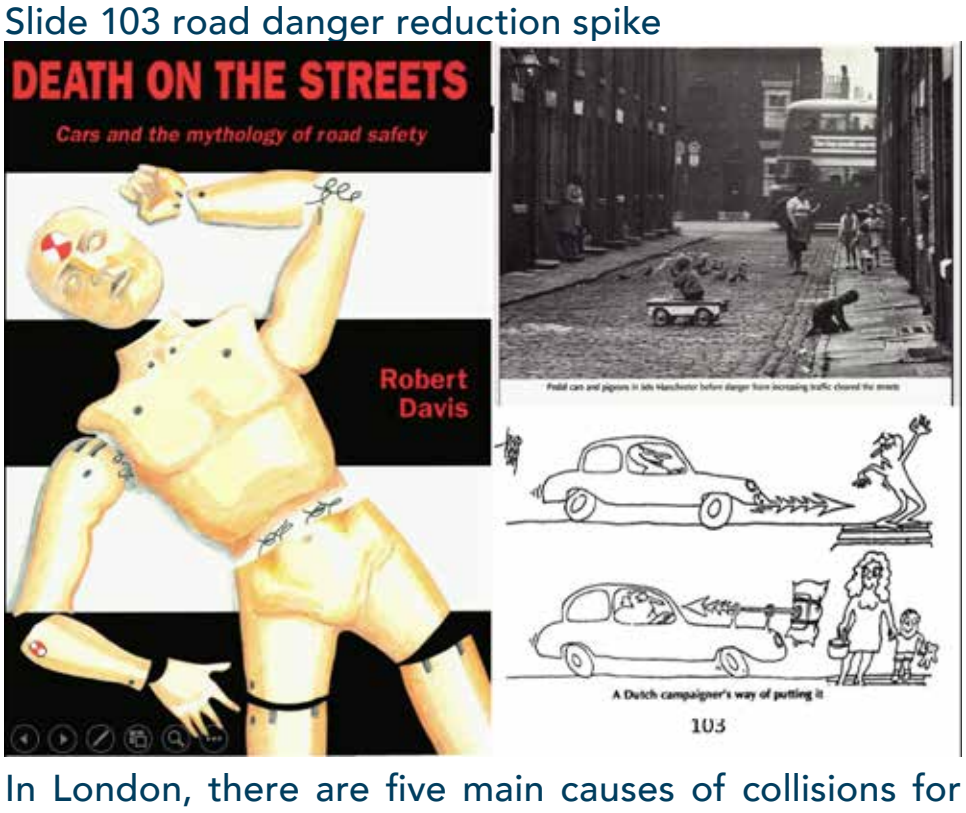
Statistically, he was completely correct, even if it was not the most enticing of statements to new cyclists.

Slide 102 road danger reduction



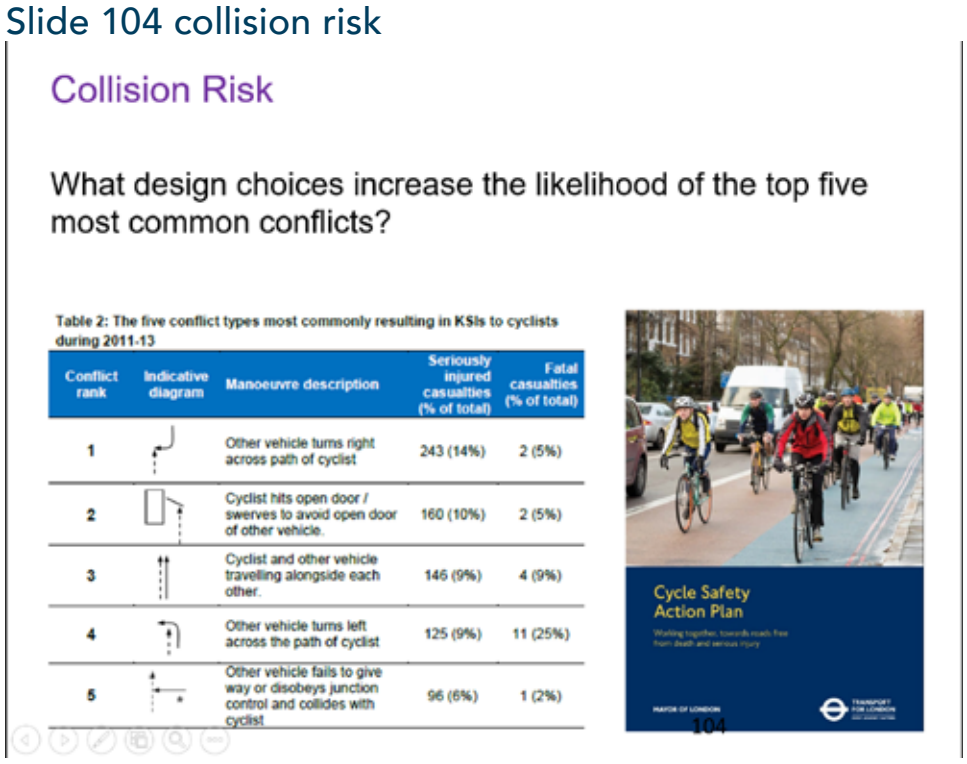
Even if we cannot rely on the collision statistics themselves, we can examine their causes and look for scenarios in which these are more likely to occur. Before I do this, I should probably explain why I use the term collisions rather than the more commonplace term 'accidents', or even the American term 'crashes'. In the UK, the theory is that accidents are literally accidental and cannot be predicted, whereas certain street layouts give rise to the same types of accidents again and again. Collision suggests a more knowledge-based approach, which puts the responsibility on the street designer to remove collisions.

Slide 103 road danger reduction spike



In London, there are five main causes of collisions for cyclists, evidenced by police records. On Day 2 we will look at how to analyse collision reports and make predictions as to how many collisions the schemes we are working on will hopefully save. The most frequently occurring collisions are hooks, with right hooks accounting 12% of collisions and left hooks accounting for 9%. Left hooks make up a quarter of all fatalities in London concerning cyclists and so this has been a big focus for civic authorities. Hooks tend to occur at junctions, which are where 80% of walking and cycling collisions happen in London. We will look at junction design on Day 2 and try to unravel this, but at this stage if you are trying to deliver a good level of service that entices new cyclists and protects current cyclists, then you need to stamp out the causes of the most common collisions.

Slide 104 collision risk

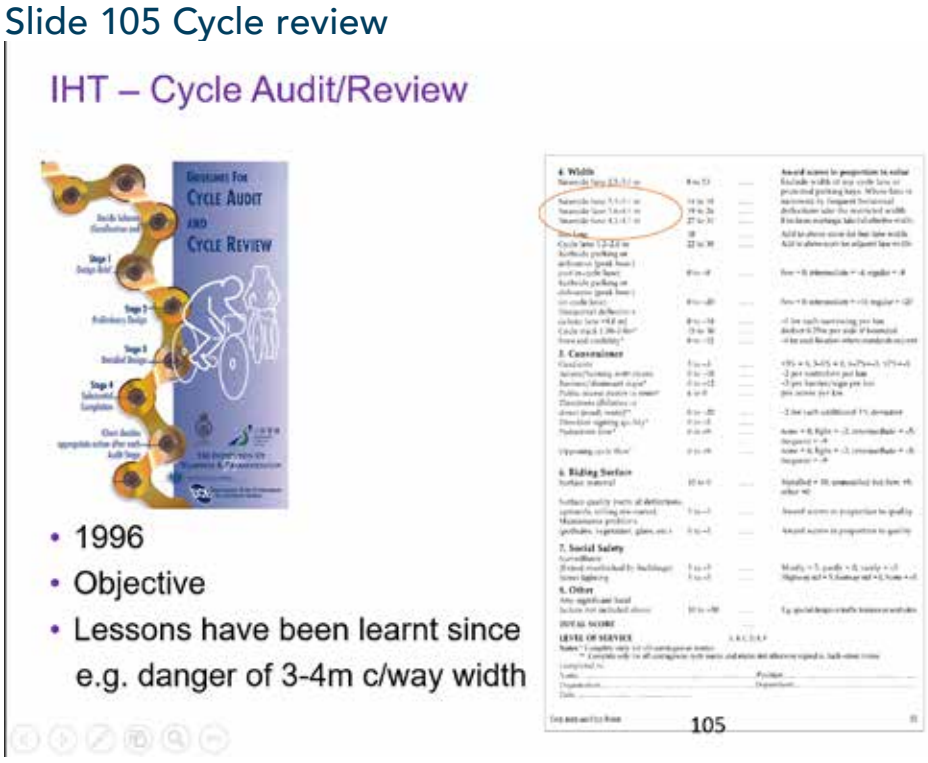


At this point I should give a full disclosure that I was part of a team that developed a walking and cycling level of service assessment tool at Transport for London and so this subject is very close to my heart. We developed it so we would know what good actually stacks up as. Several other countries have similar approaches but rather than plug the one I developed as the best, I think is more important to know and understand the approach so that you can develop your own.

Personally, I like working everything out from first principles, to use a mathematical term. The true champion should have the knowledge and grasp of the subject matter to form their own tools to inform debate or indeed use a blunt object to smash with. A quick google search will tell you everything you need to know about the London method should you not want to put all the effort in. I realise I am asking a lot of people in this course and so I forgive you.

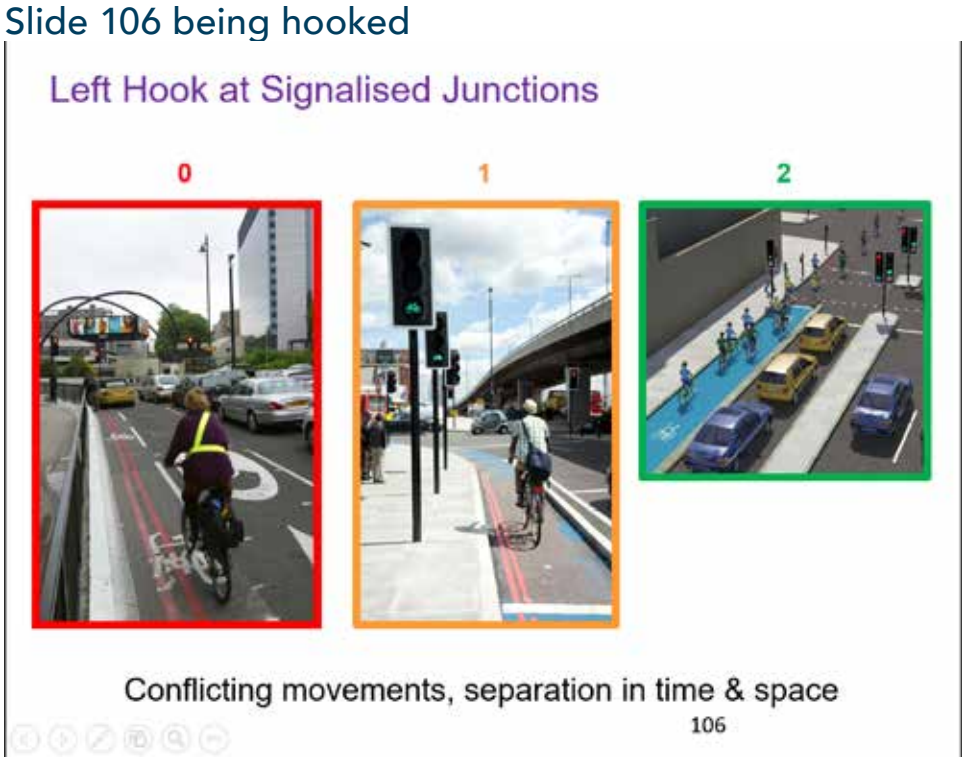
Being hooked

Slide 105 Cycle review



So back to being hooked at junctions. Champions should be able to look at a junction and assess the likelihood of being hooked. If you are a keen cyclist then you have probably got this instinct hardwired into your brain. If this is the case, ask yourself what the triggers are. Is it the presence of filter lanes? Is it the signal timing? It is the volume of turning traffic? Is it the number of large vehicles? To an extent any signal controlled junction where cyclists are not separated in space and time carries the risk of being hooked. In particular, those with multiple approach lanes where cyclists are mixed with general traffic should be flagged for improvement almost every time.

Slide 106 being hooked



I know myself when I go past any side road priority junction that I become twitchy, expecting someone to suddenly race out without looking. At some stage in my life I realised that the layout of the side road was directly proportional to my twitchiness. If the side ride had a tight geometry and traffic calming features I was less concerned than if the junction radius was large, providing a wide mouth for motor vehicles to enter and exit at speed.

Slide 107 side roads

I am fairly well attuned to instances where left hook collisions occur and I am sure most people on this course are as well. This explains why there are more right hooks. These are the type that you do not see coming, particularly at side roads. It is therefore quite difficult to spot highway layouts where right hooks take place, as they are very much dependent on traffic conditions.

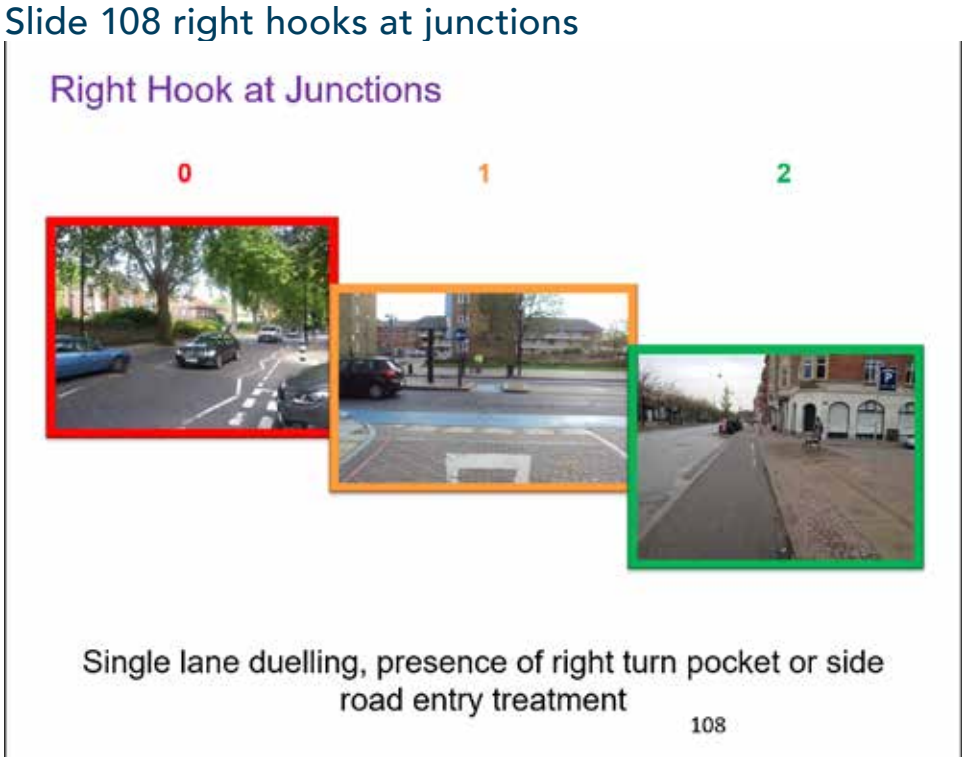
For example, the classic hook of this type occurs when people are passing stationary vehicles on the nearside across a side road with single lane operation in both directions for general traffic. A vehicle turning into the side road tries to force a gap to cross into the side road so they have to be a bit aggressive. Drivers also seem to be acutely conscious of the delay they are causing to other likeminded drivers and so they do not like holding up the lane as they prepare to turn. When a driver does create the gap for the turning vehicle then they expect it to be taken immediately as they have been so amazingly accommodating by delaying their progression momentarily.

Like the swiss cheese of road safety lore suggests, all the conditions are in place for a vehicle to do a quick blind sprint across the road. If the final hole in the cheese lines up, in this case our nearside person walking or cycling approaching, at the same moment completely visually blocked by the vehicle providing the gap for the oncoming vehicle, then that is the stuff of which collisions are made. In London's case this amounts

From alongside

to over 50 a year.

Slide 108 right hooks at junctions



Single lane duelling, presence of right turn pocket or side road entry treatment

108

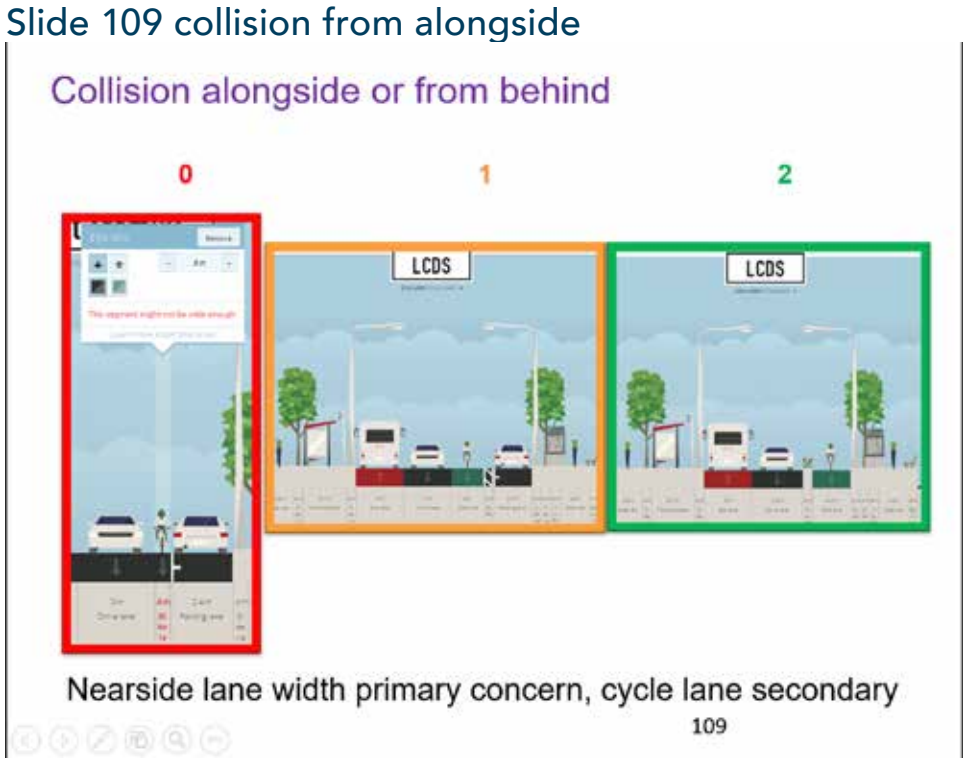
When assessing walking and cycling level of service in safety terms, the key is to look long and hard at how motor vehicles are behaving. If you see consistent wince inducing behaviour, then it is a poor level of service and a design solution must be sought. With that in mind, the next most frequent collision in London is the collision from alongside, which accounts for 12% of collisions. You should already be thinking: "Hmmm what would cause that? What do I come across on my ride that makes me think I might get driven into from the side?"

This one is all about inconsistent lane widths and recommended riding position. 12 foot, or 3.65m wide general lanes that cyclists share are the epitome of evil when riding in the UK. It is doubly annoying as this is the standard lane width that highway engineers are trained to deliver. Why is it so bad? Well, because there is real uncertainty about where to position yourself. If you go nearside to let general traffic pass then there just is not enough room for them to pass you safely. If you go central then drivers get angry as it looks like there is enough room for them to pass. Add to that the fact that drivers can easily reach speeds in excess of 40mph in such comfortable lanes and you have a recipe for anxiety and the conditions for the collision from alongside to occur.

If there is one thing I could stamp out from the industry, it would be 3.65m nearside traffic lanes and so I ask you champions to help fight the good fight and stamp them out in your area. In fact any width between 3.2m and 4m is awkward, so try to get professionals to avoid them. Going narrower at least removes the ambiguity about having to ride defensively and drivers intuitively get that cyclists need to take the lane. Going wider means cyclists can comfortably ride nearside to let faster vehicles overtake. It should be simple, but in practice in the UK you do not have to go very far to see this cycling level of service key requirement broken routinely and frequently.

Pinch points caused by pedestrian refuges are also guilty of increasing the probability of the collision from alongside, as too are cycle lanes that just end as the general traffic lane merges across. Parking bays can create them as well; in fact so many things create these conditions that the UK has an epidemic of inconsistent lane widths and pinch points. If you segregate cyclists, then this issue goes away at that location but it will be everywhere else. Look out for it.

Slide 109 collision from alongside



Nearside lane width primary concern, cycle lane secondary

109

A frequent level of service issue for pedestrians is the trip hazard. The worst trip hazard is the one you do not see, and so any height difference that does not have a contrasting material is a problem. This most frequently occurs at developments where architects have worked to one level and the highway engineers have worked to another. A small step can occur if these do not tie in properly. Thinking they are doing the right thing, materials are matched to make the mistake look part of the character of the street and hey presto an invisible tripping device is installed.

Trip hazards

Slide 110 trip hazard

Dooring collisions take the fourth spot in London, accounting for 8% of collisions, and although these are usually caused by inconsiderate drivers or passengers not looking before swinging a door open, there are still design features of the street which may increase their frequency. There are so many cycle lanes past parking bays out there in the world that it is almost beyond belief. Why would anybody lead a vulnerable road user to a position where a car door could be opened into them?

I have even seen this in Holland and was aghast, but then maybe people are so used to looking out for cyclists that it is not an issue. They do have the Dutch Reach after all. Cyclists are often wary of doors flying open at them and so tend to keep a safe distance passing parked vehicles. I have never met a cyclist who has not had this happen to them. Why then should designers work against this instinct and entice cyclists towards potential conflict? The first rule of any cycle facility design – excuse me for pre-empting Day 2 – is: good positioning should never be contradicted by line markings.

Slide 111 dooring

How does the pedestrian cross the road? If only more designers would consider this. Please bear in mind that in the UK people can cross wherever they like on any road they are not banned from. It is a duty of care consideration to accommodate this, not to frown and try to sheep-pen people to a point that you think is safe. They are going to do it. Be forgiving in your design.

On a busy road, just how far is too far to walk to find a formal crossing. 400m is surely so far that people will make a dash for it. 2m can be too much for some people, but on dual carriageway type roads most people expect a detour – but try to aim for less than 100m. On smaller roads, it is more important to accommodate desire lines.

If a path leads to a high street, then it is probably not the best idea to put a row of parking at this point as people may want to cross the road there to get to the shops. The fundamental issue is that designers design streets to accommodate car traffic accepting no compromises, and, as a result, basic pedestrian needs are not met. Think about where people will want to walk.

Crossing the road

Slide 112 crossing conflict

The next most frequent collision type for cycles is when cars fail to give way or disobey signal control, and subsequently run into cyclists either turning across them, which is 7%, or going straight into the side of them, which is 6%. This suggests that drivers are law-breaking maniacs, but all drivers know that there are rules of the road and then there is how everyone actually decides to drive. It is up to legislators and civic authorities to decide who wins this, and so far the social norm is winning in the UK.

In America, running a stop line is a serious offence, carrying with it serious ramifications, and yield means yield. In the UK, the norm is that give way means third gear and stop lines mean second gear. UK drivers point blank refuse to stop at stop lines if they can see the way is clear, but, as mentioned earlier, cyclists are small enough not to be noticed and tend to ride nearside, reducing the visibility splay. If cyclists are moving quickly, then this problem is compounded.

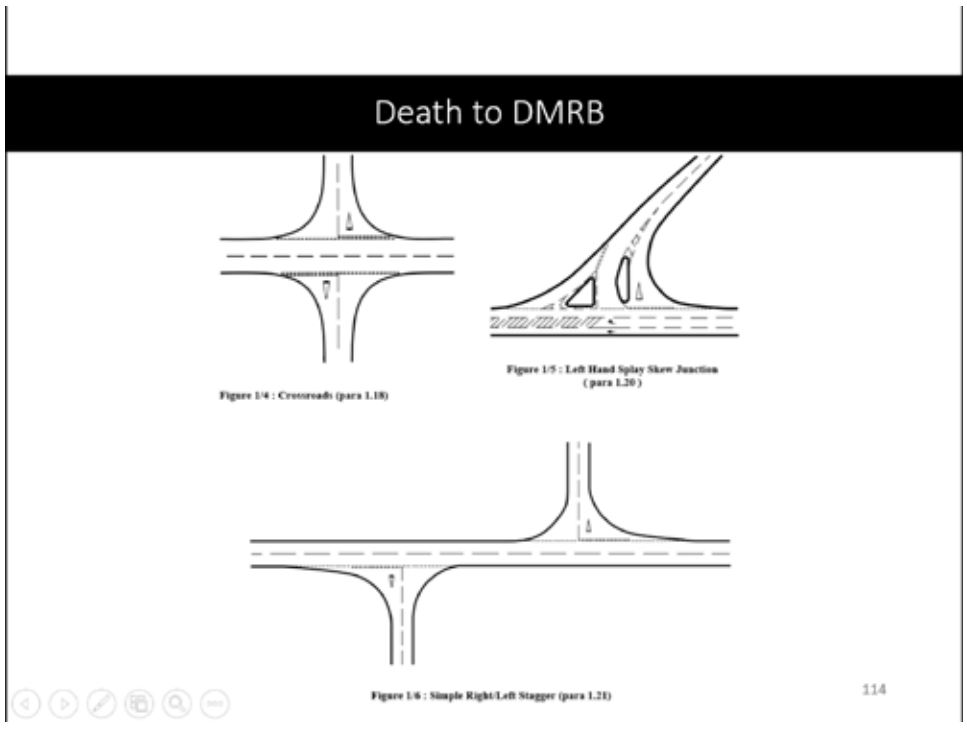
I will admit that there are some things most champions will not be able to change, and the everyday acceptance of law-breaking behaviour in certain situations seems to be one of those things. Until we get more national politicians taking on the champion mantle, then we are slightly stuck in this area.

Slide 113 highway code changes

There are however certain design features that encourage this law-breaking driver behaviour, and poor visibility of the presence of cyclists is one of those. If cyclists are led to the nearside of a junction but then no indication is given to drivers of this likely position, then that must be viewed as a poor level of service.

Visibility is poor on the nearside and route continuity is also poor across junctions, and so the driver is not made aware of any immediate repercussions for encroachment. Every line and every kerb placement affects the safety of cyclists on our streets, and so champions must become well versed in spotting the tell-tale causes and insisting that they are ruled out from future designs.

Slide 114 death to DMRB

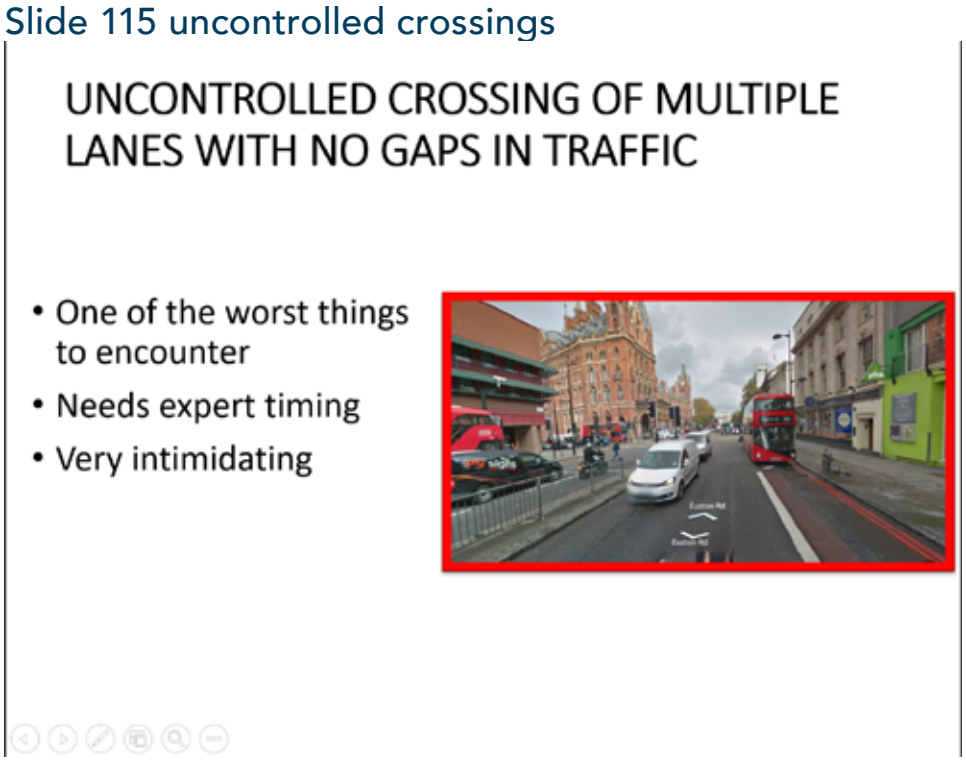


When crossing facilities are provided for people walking, then it should not be too much to ask for them to be effective. Most signal-controlled junctions in the

Social safety and danger

UK have no dedicated green man invitation to cross. The choice for people is then to time their sprint across behind the back of the last vehicle to race through on amber and before the turning vehicles get the red amber flag to go for it, or turn around go home and get in a car so they can be the powerful, prioritised one. This is the choice faced daily across the UK, so it is no wonder people choose the car. If we want walking to increase and streets to belong to people, then we have to change this.

Slide 115 uncontrolled crossings



There is another aspect to safety which is harder to define and yet is crucial to the promotion of walking and cycling, and that is the feeling of safety. How safe does a route feel? Just because the street design is not manifesting regular collisions, it does not mean that it works well for people. As stated earlier, it might well mean that they are avoiding it. But how do you quantify a feeling? As an engineer I feel I can quantify anything in an empirical and objective manner. I share the view of one of Hal Hartley's characters in the film Trust, that love is a combination of trust, respect and mutual attraction, all of which can be objectively verified through scenario setting experiments. If I can quantify love, then I can definitely have a go at the feeling of safety.

Empiricists quite rightly get nervous at this point as feeling sounds so subjective, but, like collisions, we can look for indications on street which we have evidence to suggest cause anxiety in people. Social science is a science, even if institutions insist on it being categorised as an art. Anyone who works on street schemes affects people directly, and understating the mechanism causing this affect must be an aim. You also have the greatest instrument for testing the feeling of safety. Yourself. Do you feel it's safe? Put yourself there. Walk around. Soak it in. What do you think?

Slide 116 feeling safe

For people, having to mix in with vehicles up to 200 times your size and mass induces fear and anxiety. This factor is independent of whether you are confident or not. Confident people have just learnt either to convert this fear into adrenalin or begrudgingly accept that their life is in another's hands.

There is another coping mechanism involving being super-positive and blind to any risk, but I would not advise it personally, although I have met a few powerful people who seemed to survive well on it. Cars cause fear and so the number of cars, and in particular the number of large or very large ones, has a direct correlation with this. Any study with any group of any sample size around the world would confirm the same thing. Cars are the danger. They are the ones who knock.

Slide 117 cars are the danger

Attitudes and feelings

Transport for London conduct annual Attitudes to cycling surveys that cite the main reasons that people do not cycle in the capital. Number one and two are health reasons and the weather which, with the best will in the world, champions can do little about. It could be claimed that if people had cycled then maybe health problems could have been avoided or not become so acute, but we should deal with where we are in practical terms. Number three is that people consider it too dangerous to cycle on London's streets due to the traffic conditions and fear of collisions. This is something that falls within the remit of a champion to tackle, but remember that fear of collisions is not the same as actual collisions, and the feeling of safety is not the same as actual safety.

Slide 118 attitudes to cycling

Junctions with guardrail and yellow boxes and multiple entry and exit lanes feel unsafe but some perform well in safety terms. This may be down to cyclists gritting their teeth, staying on their toes and battling their way through on high alert or as previously stated they might just be avoiding it altogether as they do not want to deal with the hassle. In this case the junction is statistically safe but definitely does not feel safe.

Slide 119 Does it feel safe?

Conversely, a similar junction layout with the same amount of general traffic might have been treated to entice cyclists. Perhaps an advanced stop line has been installed so that cyclists have an area to wait ahead of traffic when the signals are red? Or even a cycle lane on the approach to help cyclists make their way through queuing traffic? Maybe the lane has even been continued through the junction to maintain the continuity of the main walking and cycling route like the Danish do?

Cyclists in this case may well feel safer but in reality not much has changed. General traffic still poses the same threat, although perhaps drivers might be more aware of the presence of cyclists. Cyclists, on the other hand, have been sent signals to pass down the inside of traffic, ride across junctions on the nearside and make their way to the front of the queue in order to position themselves. Cyclists may feel safer and encouraged to perform these actions, but all these actions are only safe during a period in the traffic signal cycle when general traffic is stationary.

Otherwise if you move down the nearside of a turning vehicle as the lights change, then you are in the vehicle's blind spot and beware: this blind spot is very large on most heavy goods vehicles. They have no idea cyclists are there yet cyclists may feel that the lane encourages them to take on one of the riskiest manoeuvres known.

Likewise, riding across a junction on the nearside puts you in a position when any motor vehicle which turns can collide with you. If cyclists had ridden defensively and positioned themselves in front of the nearside motor traffic then any turning vehicle would not collide. The only risk then is from offside motor traffic turning. Half the risk is gone. I am not saying all cycling infrastructure

Critical issues

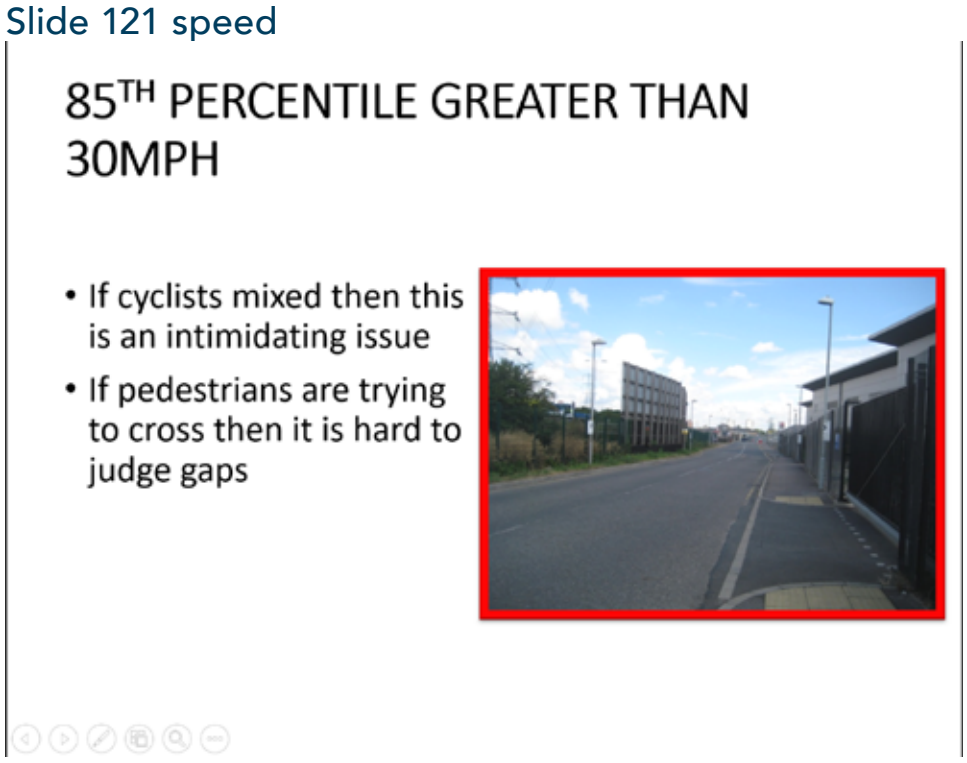
should be removed, as this discourages vehicular cycling. I am just saying that if you put in infrastructure that suggests cyclists stay in a nearside position then you have a duty of care to protect them, as it is not the best defensive riding position.

We need to save cyclists from half measures. Either protect them or leave them to defend themselves, but absolutely do not entice them into the wrong position without protection in time and space. That is what I am saying. The conspicuity argument of warning general traffic about the presence of cyclists does not wash if these warnings lead cyclists into riskier positions. Conspicuity is one of those engineering words that means: how conspicuous is the presence of said mode?

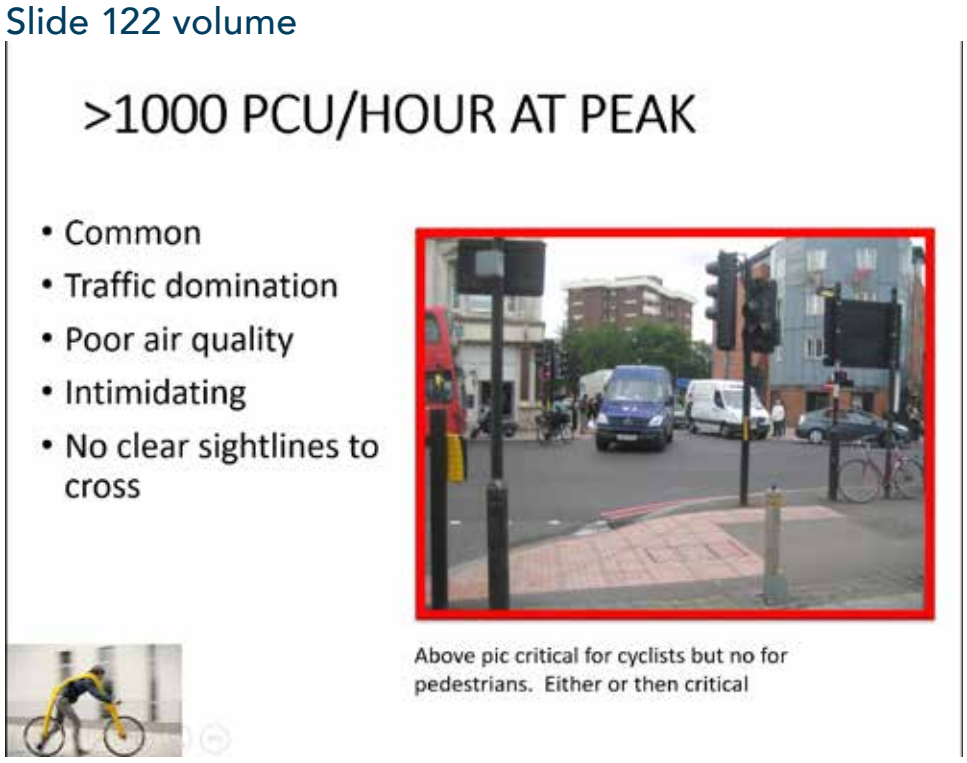
I have had this argument a thousand times over the years and the argument goes something like this: Most cyclists ride in the nearside position so surely it is better to warn drivers that they might be there? Whereas the reply is: But you are strongly suggesting that cyclists take up the riskiest position and compelling them not to fully assess the general traffic conditions. You decide as a champion which camp you fall into.

Slide 120 does it feel too safe

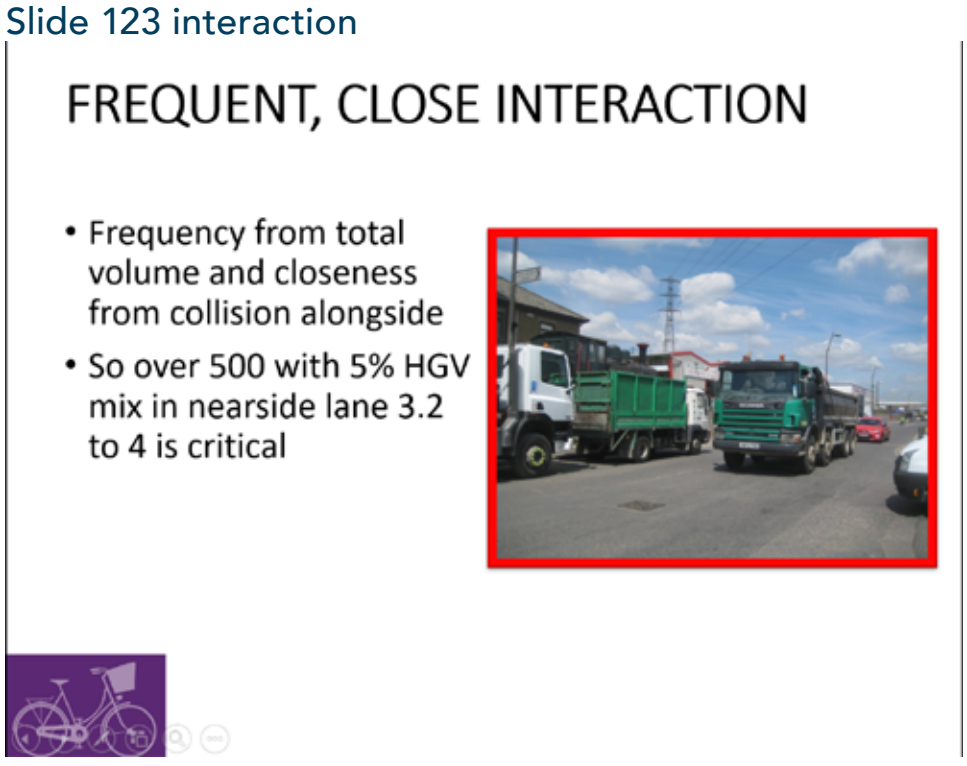
Slide 121 speed



Slide 122 volume



Slide 123 interaction



The answer really is to not do a half measure. If you are at a major signalised junction, then protect cyclists

Double buggy

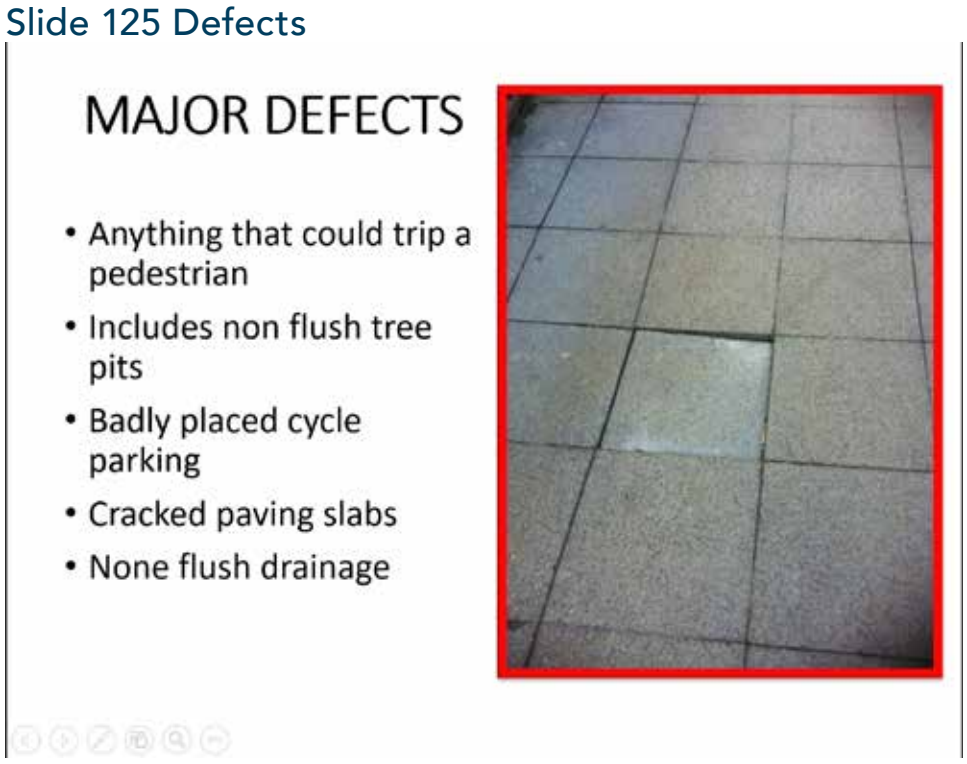
in time and space like the Dutch do. If I have learned anything over the years it is to not take baby steps. I have only recently persuaded leading cycle trainers in the UK that some facilities are worth riding in, and that is following the most concerted effort in the history of the UK to protect cyclists at junctions. We cannot go back to half measures now and risk dividing the cycle nation again. Learn from us, do it right and protect or do not compromise on recommended riding position.

Slide 124 cycle training manual

For pedestrians the key is to get the basics right. Practically every footway has defects but some can cause trips or sprained ankles. People rely on the certainty of solid ground and hardly anyone walks looking for defects the way a surveyor might. This expectation is let down regularly, usually with little or no consequence but when it does, it can cause life-changing injuries or reduce the accessibility of the street to those with impairments.

Lots of defects are caused by cars mounting the kerb, which is a UK-wide epidemic. It is almost a moot point to suggest that we concentrate on fixing defects, knowing full well that as a nation we are doing practically nothing to stop drivers mounting kerbs to park on the footway. In Greater Manchester we have the double buggy test, which is a clever way of saying clear walking space. It is not the same as saying building line to kerb distance, as a bin, chair or phone box could be blocking the footway. People need space to walk and people need space to pass each other without stepping into the road. If there is less than 1.4m provided, then this is not always possible.

Slide 125 Defects



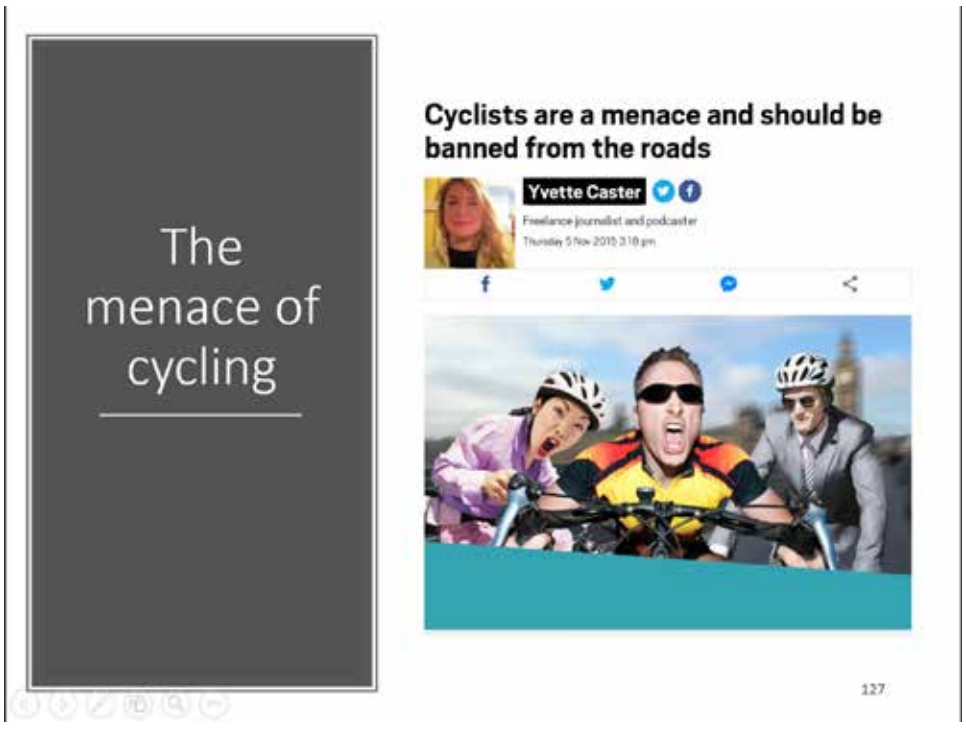
Slide 126 clear width on footway

I am a bit nervous about this next part as cyclists are not particularly ready to hear this, but champions need to be able to defend themselves against it. Pedestrians fear cyclists and some, only some, cyclists act in an anti-social manner. I caused a certain degree of controversy in the UK when I tweeted that cyclists should try and abandon aggressive use of the bell in order to get people out of their way, but many claimed that pedestrians get angry if you don't signal your presence.

I do not have it in me to ignite this debate, but you need to be armed against accusations that cyclists are a menace. Firstly, cyclists are not actually dangerous, as there are only a few recorded collisions involving cyclists striking pedestrians and causing injury. What they can cause is lots of annoyance to pedestrians who claim they are dangerous as they once got shocked by one.

Priority and equality

Slide 127 the menace



When I cycle, I never assume priority over anyone and so I do not expect anyone to get out of my way. This admittedly is a delay-inducing philosophical choice about egalitarianism. However, when my mother-in-law walks on paths, she tells cyclists off for not indicating their presence even if they passed slowly and safely. Luckily, we have yet to meet out on the street and attempt to reconcile our diametrically opposed views. As a way of cutting short the discussion of the danger posed to pedestrians from cyclists, I advise the following response: "If you treat cyclists badly, you get bad cyclists, and if you treat them in a civilised manner you get civilised ones." On most UK roads you still need twitchy road warrior skills, but it is hoped that social pootling will preside when we build enough infrastructure. This seems to be the case in the meccas of Holland and Denmark. Ok cyclists, you can come back in the room now – I have finished with the criticism.

Slide 128 provide to civilise

This is one other area of safety which is often overlooked, but is crucial to the uptake of a route particularly by female, young and elderly people and that is social safety. Everybody loves greenways. They are traffic free, have better air quality and allow you to take some time to cruise and relax. Unless of course you are on it at night and then you can feel like you are in a horror movie, completely isolated in the woods.

My social safety catchphrase on the perils of relying on greenway routes as your sole network choice is: "At night a bush becomes an ambush". Greenway routes are a worthy part of any network but they have serious drawbacks at night. Even if you decide to light greenway routes, they will still be intimidating because of the sense of isolation. Human beings are social animals and feel safer where there is social activity. At night, it can be more comforting riding down a main road as even the heavy traffic can help you feel that you are not on your own.

Slide 129 social safety

Some streets promote civilised discourse whereas others certainly do not. Subways have a bad reputation in most countries and yet the Dutch and the Danes swear by grade separation. This brings us back to the context point, but personally I need a lot of convincing that grade separation can be anything other than bad news in the UK. This stems from being raised in central Manchester in the shadow of the Mancunian Way, which represents one of the worst examples of sixties road space planning, with a motorway-looking road heading directly into the town centre and a series of interlocking passages and spaces riddled underneath it.

For my entire childhood, these passages and spaces were abandoned. Nobody dared set foot down there

Designing in issues

as the feeling of being trapped was acute and the fear of crime was palpable. I always preferred riding my bike along the motorway to going down there, and most people would get the bus past it even though you could see the town centre. This ring of inaccessibility divided south Manchester off from the town centre even though traffic free paths were provided.

I have been in underpasses in Copenhagen which were open and inviting, with gaps in the structure letting natural light in, and so they can be done well. I personally, however, am so poisoned to the notion of grade separation that I would never consider it and I know these issues are felt acutely around the world in many major cities that embraced the dream of concrete-based mass personal transportation. That dream has died as far as I am concerned, and all the automated cars in the world will not bring it back. Walking and cycling and public transport are the only ways of moving commuters around en masse during the peak times. Get over it already, society.

Slide 130 grade separation

Flyovers and underpasses should not take all the blame for encouraging aggressive driver behaviour, as there are lots of little things that designers do which help perpetuate the myth that our streets are racetracks and not places for people. “White lines, don’t do it”, as Grandmaster Melle Mel would say. The staple of all global street design is the white line. They can be dashed, continuous or doubled up with hatching in between. White lines are there to help drivers easily interpret road position at speed.

Street designers should ask themselves first and foremost: “Is this the behaviour that we actually want?” Proponents of sustainable safety and shared use have argued that clarity breeds speed, and that the fewer pieces of information drivers have to digest, the faster they will go. Being told to follow a line is so clear as to override other considerations, such as whether a pedestrian is trying to cross the road or whether a cyclist is present. Placing objects in the carriageway and installing direct conflicts has been shown to greatly reduce drivers’ speed and make them open to negotiation.

This sounds a lot more like the behaviour we want out of our streets. Every white line serves as a go faster stripe, sending the clear signal to drivers that “this is your side of the road and if you stick to it you will be alright”. It does not say that “this is a street where people live and work and cross and play and you are a dangerous guest who should move with caution”. In London, we undertook surveys on busy roads where we removed the centre line and found that speeds fell by 13%. A report from the UK Transport research laboratory on the effects of drivers’ speed on the frequency of road accidents showed a reduction of 5% in accident frequency for every 1mph reduction in speed. The conclusion has to be that removing centre lines saves lives.

Slide 131 white lines don’t do it

I see thousands of designs as part of my job and spend most of my time crossing out white lines and removing hatching. I understand the nervousness of consultants who, having been given a substantial amount of money to design a street by a client, may not want to hand back a blank sheet of paper with all the lines rubbed out, but that is what we need. We need to stop designing racetracks that fast-moving motor vehicles can easily interpret, and putting huge signs up along the footways so that they can plan manoeuvres early at

What are people like

speed. It is saddening and infuriating that procedures and techniques developed for safety have reverse, perverse effects. "It is surely obvious to point out to drivers where their side of the road is and what position they should be in" but it is this clarity that gives them the confidence to put their foot down.

Designers should think long and hard about putting in any white line rather than just slapping them on the ground as that is what they do. This may seem a moot point to those championing segregation, but marginal differences save lives, and standard approaches create social safety and behavioural issues. Find solutions that promote civilised discourse where negotiation and forgiveness are promoted, rather than perpetuating the myth of cars as kings of the street.

Slide 132 White lines on paths

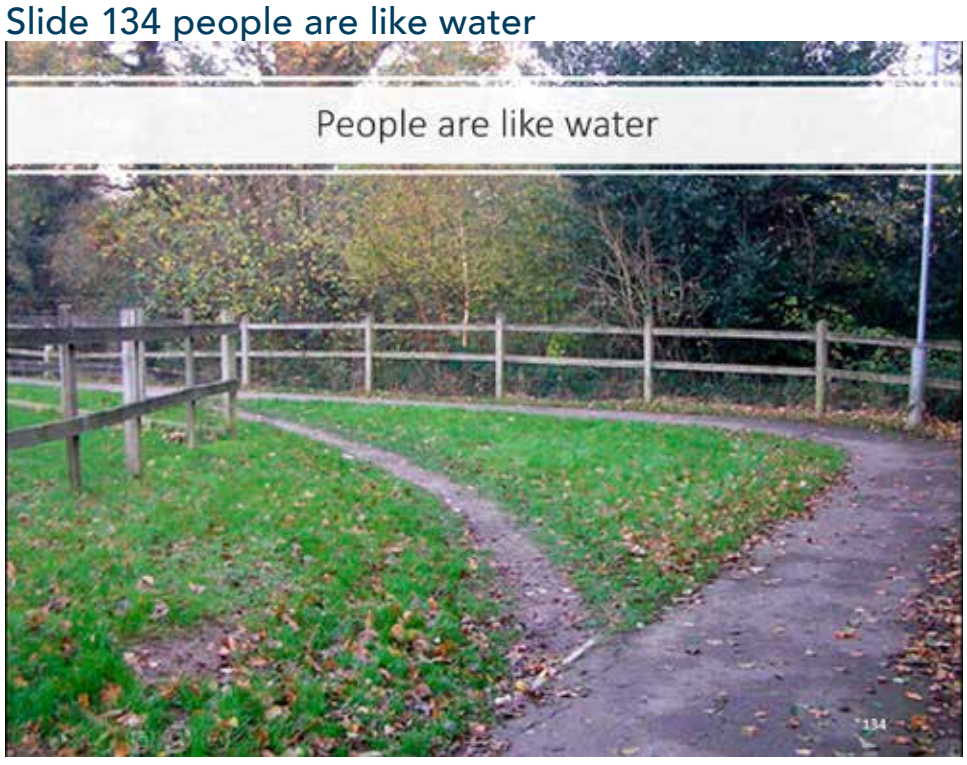
The pleasantness of walking and cycling is inversely proportional to the sense of entitlement of car drivers. Drivers are polite in Denmark as they are all walk and cycle as well. So, they drive like they ride, watching out for others and not being accustomed to having a protective exoskeleton shielding them from society.

Drivers who seldom experience the world on a bike tend to see cyclists as fidgeting bringers of chaos, popping up in unexpected places on streets that are clearly designed with the sole movement of motor vehicles in mind. "Get out of my space." Champions, we need to treat social safety seriously, and challenge common practice if it is not helping.

Slide 133 entitlement

There are more things to consider when assessing conditions for walking and cycling, so let's return to the famous Dutch five. Directness. A Dutch engineer once said to me that people are like water. Initially this brought up masculine Bruce Lee quotes to my mind of being able to flow or roar, but they clarified that people always go the quickest way between two points. As walking and cycling relies on human power generation, then humans are generally going to take the path of least resistance or effort. Should it then be a surprise when cyclists head down one-way streets the wrong way or pedestrians leap guardrail? For drivers, a twitch of the foot moves you along; for people, following the more circuitous car route tends to be a step too far.

Slide 134 people are like water

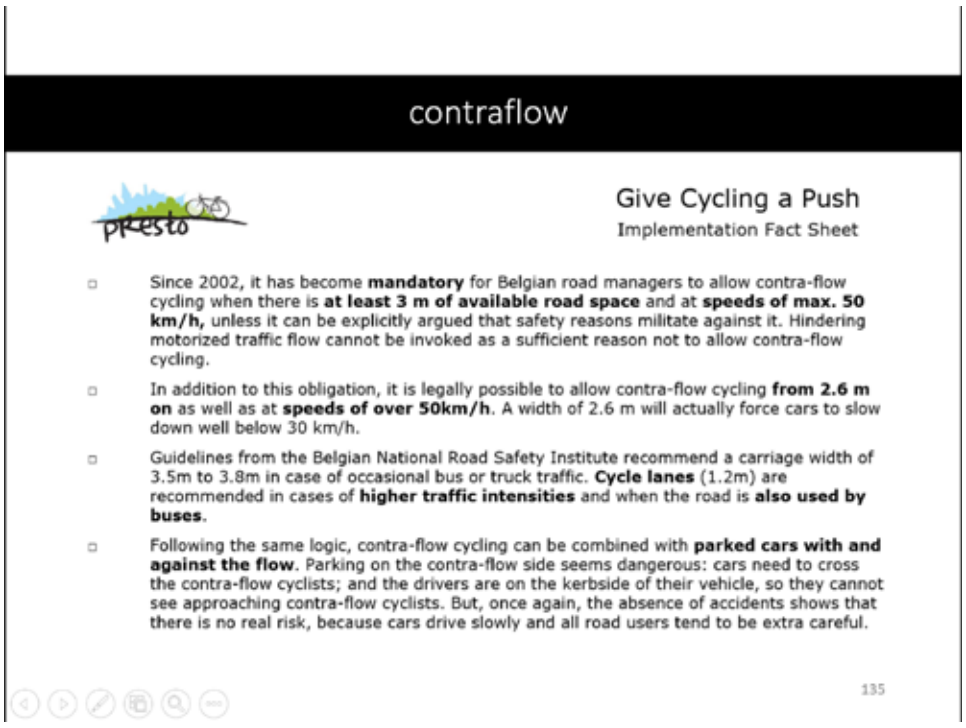


Civic authorities can either try and enforce things and discourage walking and cycling, or acknowledge, accept and design for this behaviour. The great case study in this area is Brussels, when prior to the 2006

Overcoming constraints

Velocity Conference they passed a blanket order to allow cyclists to ride two-way on all their one-way streets, bar a couple of major gyratories. The message was simple and effective. Brussels streets can be so narrow that you can struggle to get a car down them, but nevertheless they did it. Several years later they reported that they had not had any collisions as a result, which was actually superior to their with-flow analysis. The conclusion seemed to be that walking and cycling in a contraflow direction is actually safer.

Slide 135 contraflows



This is very difficult for car-centric people to grasp, as they picture head on collisions occurring with alarming frequency. But there is little ambiguity with contraflow walking and cycling about visibility. Cyclists and drivers are staring directly at each other and so SMIDSY is irrelevant. It would take a psychopath to drive over a cyclist who they can clearly see and, despite belief to the contrary, we tend not to have too many psychopath drivers in our cities.

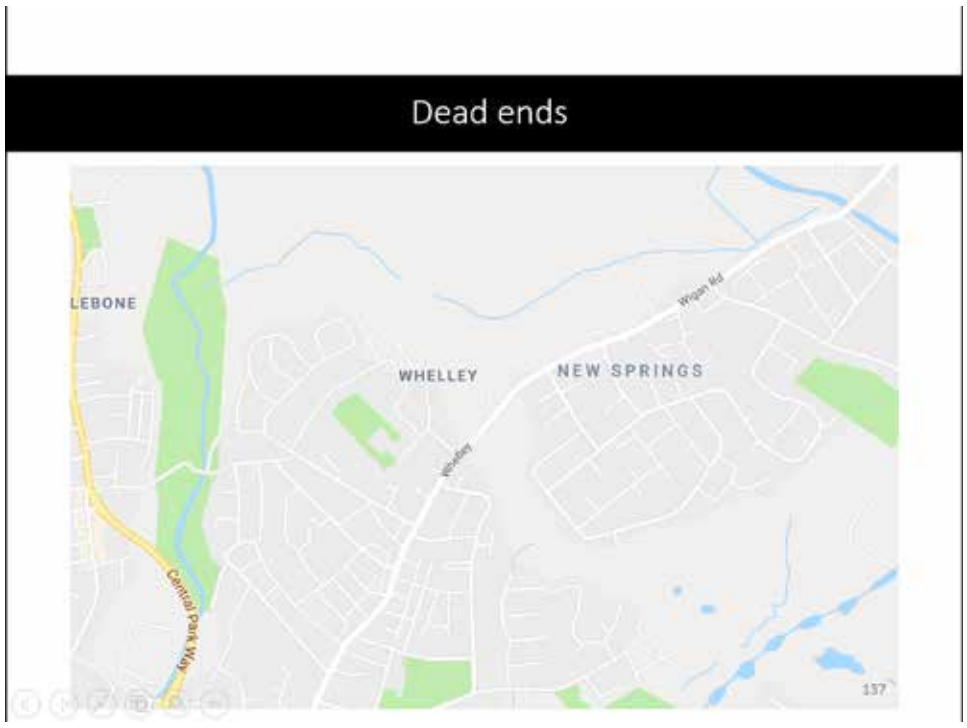
In the UK, we have the countryside code which states that you must walk facing oncoming traffic on rural streets so they can see you. This cycling equivalent seems to hold up. Depending on context, you could still be intimidated and harassed for cycling the wrong way, but statistically it is safe. Cycle routes should therefore be mapped to the closest routes, wherever possible, that lead to where people actually want to get to. If you want to get technical, then any deviation over 40% compared to a straight line or the nearest main road direct alternative risks the creation of an oxbow lake. There is research showing that cyclists will deviate for more pleasant routes, but beyond 40% is usually a bit much for anyone, so watch out for it.

Slide 136 deviation

If we want walking and cycling to flourish, and, as champions, of course that is what we want, we need to guide people to the best known routes. All that human power generation can go to waste if people get lost or confused. The urban form in many UK cities is confusing, as it tends not to conform to a grid layout and unless you are privy to two thousand years' worth of planning information, it can seem totally illogical.

This is acutely felt when networks rely on back street routes. For example, several weeks ago I was riding in the leafy suburb of Sutton thinking to myself that the back streets were calm, quaint and attractive. After ten minutes riding on a winding street with no traffic I began wondering why hardly anyone cycled when suddenly I came to a dead end and realised. Sixties street planning had raised its ugly head and the dreaded cul-de-sac pattern had emerged.

Slide 137 dead ends



Wayfinding

Many streets in the UK were designed to wind towards a dead end so as to maximise the number of dwellings that could easily access the street, whilst removing any through traffic element. This is perfect for living the commuter-driving-idyllic-lifestyle-American-dream but a nightmare if you are considering walking and cycling and live at the end of one of these Closes. Close as in closed is the British word for these layouts.

A shop or bus stop can be 200m away as the crow flies but take 20 minutes to walk to or 5 minutes to cycle to. These streets tend to feed from spine roads, which can be very busy as all traffic is directed to them, and so the backstreets do not join and the main roads are horrible. Finding a way through mazes like this can be very troubling, and so when someone does find a way or they actually build one, then it is a good idea to signpost it thoroughly so others can feel the benefit.

Slide 138 Way through the maze

People like me have spent twenty years walking and cycling around trying to figure out new routes and plug the gaps so other people do not have to. This may sound completely obvious to a lot of countries, but in the UK route direction signs come and go, get broken and are not replaced, get de-cluttered off the streets and are generally treated with little or no respect, to the point where people barely trust them at all.

Most towns and cities have decent routes or, at the very least, paths of least resistance, and so these are worth showcasing and highlighting on street where people will notice. Most customer research suggests that people just want routes to continue and not leave them stranded. Coherence is vital, especially if you have but a few decent routes to show off.

Slide 139 broken sign

How comfortable do you feel while riding? In the UK, most people ride leaning over their handlebars like they are leading a peloton on seats that are sometimes so narrow as to necessitate the wearing of padded trousers. This may seem silly to the Dutch and Danes whose commuters tend to ride upright with wide seats, chain guards and front baskets. Comfort, for them, is then directly related to the road surface conditions and not self-induced masochistic equipment.

I think we will stick with their definitions, as surface condition is a crucial factor enabling safe and enjoyable riding. Bicycles are inherently unstable devices. We all get used to this instability but it can unseat us if we are not expecting it, particularly when turning on shiny, wet, service covers, or catching our wheel in a non-cycle-friendly gully with large slots, or slipping sideways on some gravel or petrol that did not drain to the gully as the crossfall of the highway was incorrect, or losing our back wheel as we glide across a tramline, or skid off a path with loose edges, or hit a pebble or coke can on a speedy descent, or merging onto a shared footway with a non-flush surface, or clipping our steering wheel on some guardrail or a titled sign post, or ice patch from a cold spell and poor drainage, or wobbling uncontrollably on a heavily-rutted, badly-built new road, or clipping our pedals on a cycle track kerb or speed table that was too steep or high.

The point has been made that cyclists can be unseated by a great many defects. Defects that highway inspectors driving around would barely even notice. I once met a cyclist employed by the Danish civic authorities whose sole job was to ride around the network on a road bike all day long, logging surface defects for repair. We all need to take cycle route maintenance seriously if

Comfort

we want this mode to prosper. This might sound like expensive maintenance regimes but remember if an asphalt street is used exclusively by cycle traffic it will last 10 years longer than streets eroded by the passing of motor traffic. Large vehicles in particular get away without paying any of the true costs of the damage they do to road surfaces. In the UK, cyclists pay for this through general taxation despite the commonly held view that cyclists do not pay road tax. Every cyclist, even though they do barely any damage to street surfaces, subsidises all those who do. What a nice bunch we are.

Slide 140 defects

The last principle to measure level of service against is often overlooked in the UK, but I have personally learned how important it is, and how many enemies you can convert to friends if you get it right. Walking and cycling is a healthy vibrant activity and so why do its facilities look so unattractive? Urban designers pride themselves on creating clean vistas where the beauty of architecture can take centre stage and then along I used to come, painting fluorescent green stripes everywhere. I worked on a project in which the outcomes were to deliver a fast, safe and comfortable cycle network, and so it got heavily criticised for not being coherent or attractive enough. Learn from me and do not leave any of these out.

Slide 141 green stripes

Noise and air quality can have direct mental and physiological damaging effects on people, and so an attractive route will seek to minimise these. In the concrete jungles that we call our cities, greening can provide patches of calm, which reduce stress levels and make cities more liveable. Walking and cycling is the greenest of mid-range transport modes and so we should advertise this by showing that life is not all about concrete functionality. Walking and cycling can be a breath of fresh air to a city, helping social interaction and democracy flourish, whilst connecting people to a city in a way few other modes can. Walking and cycling should enhance an area, and walking and cycling journeys should be beautiful. Late night walks and rides though a city cannot be equalled as sensory and intimate portraits of life. We are Baudelean painters of street life. Embrace the elegance of your journey.

Slide 142 le flaneur

Alas, our routes are often planned to keep us out of the way of the street, to tuck us around the back of

The joy of cities

the houses. “We are the carnival, invite us in.” Walking and cycling design absolutely should not try to mimic the nomenclature of road traffic design. We need to find our own palette of materials which add to rather than subtract from public spaces. We are a liberating symbol of freedom and naturalism, so please let that inspire your design choices. Some would have us locked behind low maintenance concrete kerb barricades, but we need our own form and our own place in streets for people.

Obviously, all this hyperbole comes with the context disclaimer mentioned earlier, and will be reviewed for buildability and practicality on Day 4 but for now let’s soak in some more of the indescribably joy of walking and cycling in the city. We are not sailors; we are the captains of our own ships. Ok, we are set up and energised. Tomorrow we will talk about the bread and butter of being a champion: instigating and affecting street design transformation.

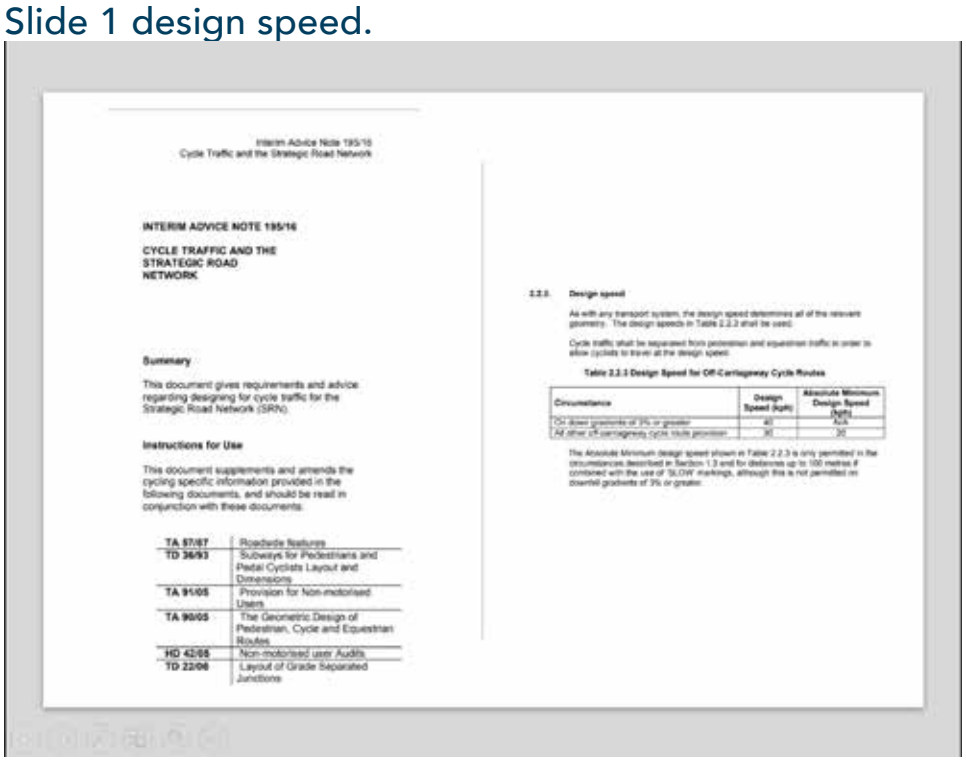
Slide 143 the joy of cities

Day 2: Design

At this stage I think it is about time we started thinking about engineering. The first question any highway engineer asks is: "What is the design speed?" This speed dictates all the layout characteristics of the street, as well as, in some cases, regulatory requirements. You should note that this can be different to the actual speed limit. In the UK this tends to be 30mph, on most urban roads, but engineers deal in reality, not arbitrary limits, and so we measure things.

Engineers like to know what the 85th percentile speed is. This means that if you measured and plotted all the speeds that vehicles were doing during a set period, then you plotted this as a distribution table and looked at the point where 85% of the volume under the curve was located, you would get this speed. You can think of it as the highest speed most cars do, so discounting the boy racers and psychopaths, but making sure that you are accounting for the worst case scenario speed that common drivers do, when designing.

Slide 1 design speed.



Interim Advice Note 195/16
Cycle Traffic and the Strategic Road Network

INTERIM ADVICE NOTE 195/16

CYCLE TRAFFIC AND THE STRATEGIC ROAD NETWORK

Summary

This document gives requirements and advice regarding designing for cycle traffic for the Strategic Road Network (SRN).

Instructions for Use

This document supplements and amends the cycling specific information provided in the following documents, and should be read in conjunction with these documents:

TA 57/87	Roadside features
TD 36/93	Subways for Pedestrians and Pedal Cyclists Layout and Dimensions
TA 91/05	Provision for Non-motorised Users
TA 90/05	The Geometric Design of Pedestrian, Cycle and Equestrian Routes
HD 42/05	Non-motorised user Audits
TD 22/06	Layout of Grade Separated Junctions

2.2.2. Design speed

As with any transport system, the design speed determines all of the relevant geometry. The design speeds in Table 2.2.3 shall be used.

Cycle traffic shall be separated from pedestrian and equestrian traffic in order to allow cyclists to travel at the design speed.

Table 2.2.3 Design Speed for Off-Carriageway Cycle Routes

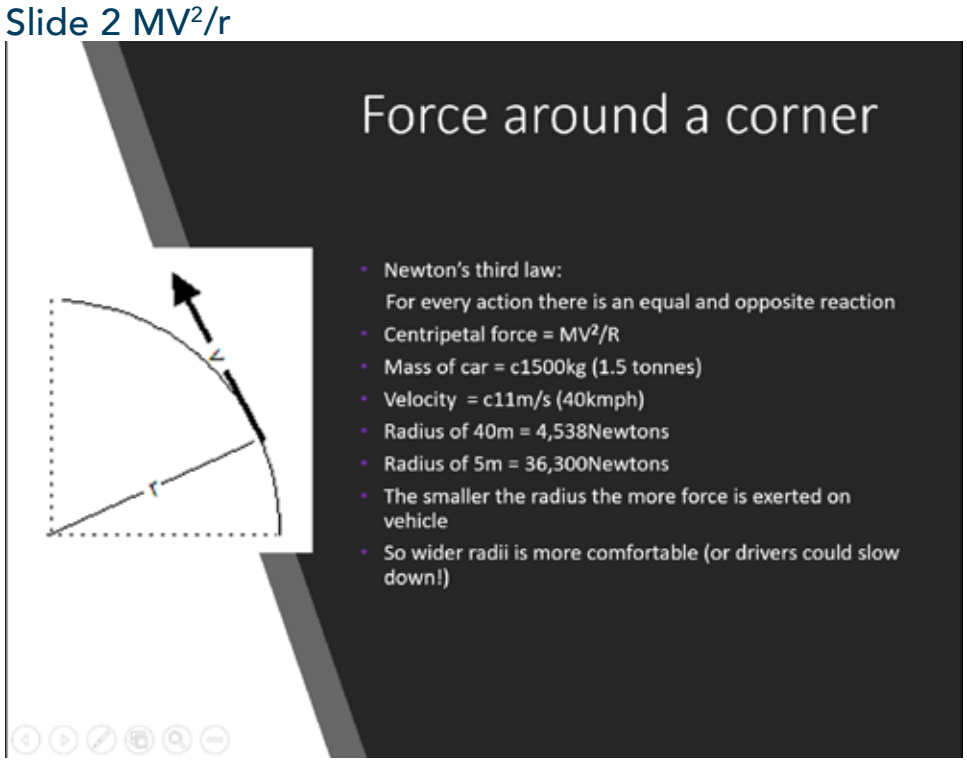
Circumstance	Design Speed (kph)	Absolute Minimum Design Speed (kph)
On down gradients of 3% or greater	40	N/A
All other off-carriageway cycle route provision	30	20

The Absolute Minimum design speed shown in Table 2.2.3 is only permitted in the circumstances described in Section 1.3 and for distances up to 100 metres if combined with the use of 'SLOW' markings, although this is not permitted on downhill gradients of 3% or greater.

"Why is this so crucial?" I hear you ask. Well, it is because of physics. Let's think about corners and vehicles going around corners. A vehicle has a set mass and in some cases quite a high one, up to a couple of tonnes. This is the kind of mass that can do a lot of damage to humans and property if it is propelled towards them at force. When this mass turns, a centripetal force is created propelling the vehicle outwards away from the turn. If you remember your physics class at school, you will recall that the equation for centripetal force is mass times velocity squared divided by the radius. If the mass is fixed and the velocity has been determined from the design speed, then engineers have but one variable to play with and that is the radius. As the force is determined by dividing by the radius, then we know that the radius is inversely proportional.

Put in plain English, the larger the radius the smaller the outward force is. Drivers can only deal with certain levels of force before they may physically lose control, and car wheels can only grip up to certain levels before they lose resistance. For this reason, engineers have developed radii that work for different vehicles at different speeds.

Slide 2 MV^2/r



When I started in engineering, and this is still common practice in some parts of the UK, corner radii was determined on local streets by tracking a refuse truck at 30mph. This is obviously a large mass and, as far as I am concerned, a high speed, and so it needs a large radius. Depending on the width of the lane, the vehicles heading into this would usually dictate turning radii of at least 7m. This means the junction mouth is wide making it an annoyingly far distance for pedestrians to cross.

For cyclists this can have devastating results. If a refuse truck can turn comfortably at 30mph, a standard car could do it at 40 or 50mph. If cyclists are in a nearside position, then this potentially means other vehicles cutting across them without needed to regulate their speed. This does not feel nice.

Side road collissions

Slide 3 side road radii

“What do we do about this? I am sorry cyclists, but the laws of physics cannot be bent to suit your hippy, free-thinking ways.” Ok, far be it from me to alter the laws of physics, so we need to look at the equation again and challenge the assumptions. Hang on! If vehicles slow down, then the radius can be reduced. The engineers are getting nervous now and saying: “But we measured the design speed and that is what people are doing.” At this point, champions should point out: “But what if they slowed down to turn? We know it is crazy, but could we envisage a world where people slowed down to turn?”

By now, increasingly nervous engineers might well play the safety card and say: “But if they slow down to turn, then the other vehicles who we have recorded doing high speeds might well drive into the back of them.” They may even have evidence and say: “Shunt collisions are associated with tight junction radii and so we cannot support this.” At which point you may feel you have lost the argument, as there are not enough cyclists to have any measurable stats. There are, however, enough pedestrians to mount a very strong case. This is a key point to remember for champions.

As unprotected road users, cyclists and pedestrians have a lot in common, and so if you can win a case for each other, then you can get benefits vicariously. Armed with a new tactic, you can say: “How many pedestrians have been injured crossing at junctions with wide radii, and were these more severe than the shunt type collisions?” At this point the argument is over: “Tighten that damn radii for the good of mankind.”

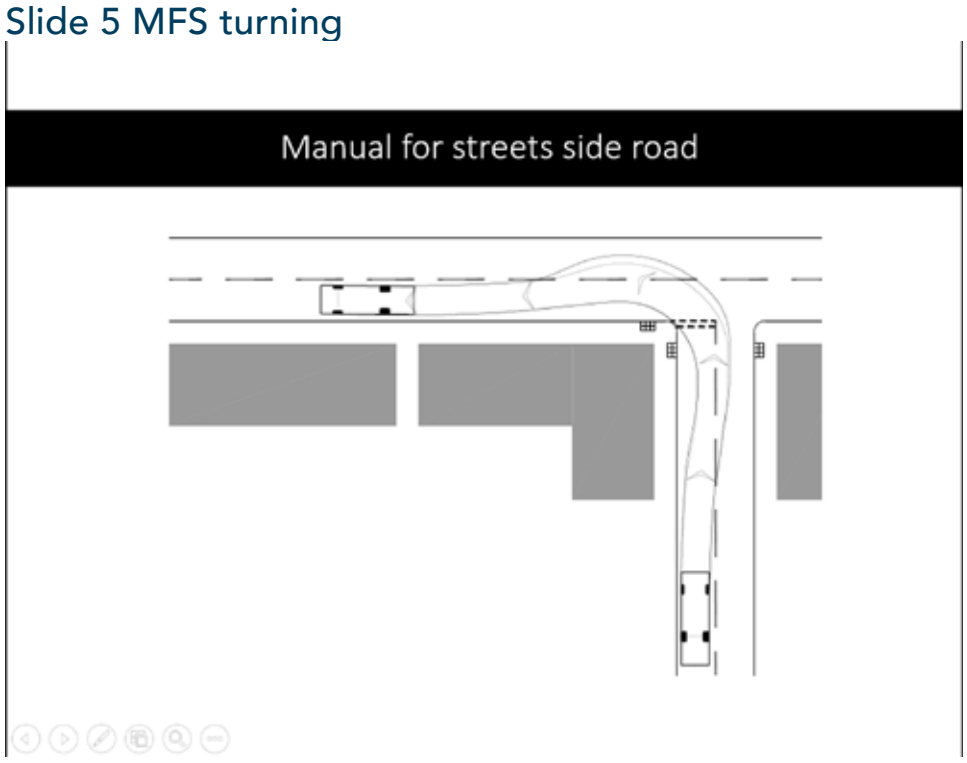
Slide 4 side road collisions in GM

Greater Manchester Reported Junction (at Give way or Uncontrolled Junction only) Injury Collisions by Junction Side Roads (Second Roads), Road Type, Severity and District, 2015-2017

District Name	Second Road	Total Three Years (2015-2017) Fatal	Serious	Slight	Total
	C	0	22	86	108
	Unclassified	3	84	424	511
Bolton Total		**3**	**110**	**578**	**691**
	C	0	12	27	39
	Unclassified	2	36	191	229
Bury Total		**2**	**57**	**261**	**320**
	C	2	16	157	175
	Unclassified	13	169	833	1015
Manchester Total		**15**	**199**	**1064**	**1278**
	C	0	16	68	84
	Unclassified	7	53	263	323
Oldham Total		**7**	**84**	**384**	**475**
	C	0	9	41	50
	Unclassified	6	47	245	298
Rochdale Total		**7**	**67**	**331**	**405**
	C	0	7	30	37
	Unclassified	2	65	260	327
Salford Total		**3**	**82**	**350**	**435**
	C	0	13	36	49
	Unclassified	6	69	238	313
Stockport Total		**6**	**90**	**319**	**415**
	C	1	10	46	57
	Unclassified	2	53	248	303
Tameside Total		**4**	**67**	**327**	**398**
	C	2	14	61	77
	Unclassified	3	41	195	239
Trafford Total		**6**	**71**	**313**	**390**
	C	1	12	36	49
	Unclassified	5	90	256	353
Wigan Total		**6**	**110**	**331**	**447**
	C	6	131	588	725
	Unclassified	49	707	3155	3909
GM Total		**59**	**937**	**4258**	**5254**

To add some further nuance to this, you could also argue that the vehicle does not have to track around the bend in one lane. If volumes are low, then even the largest of vehicles can turn into tight radii bends if they use the whole width of the carriageway. For pedestrians and cyclists, the tighter the junction radii the better the level of service, and the less likely they are to be hooked. Only mass is a constant, not design speed. Design speed is a variable guide. If you tighten, you can slow down traffic. This is, in fact, one of the key tools street designers use.

Slide 5 MFS turning

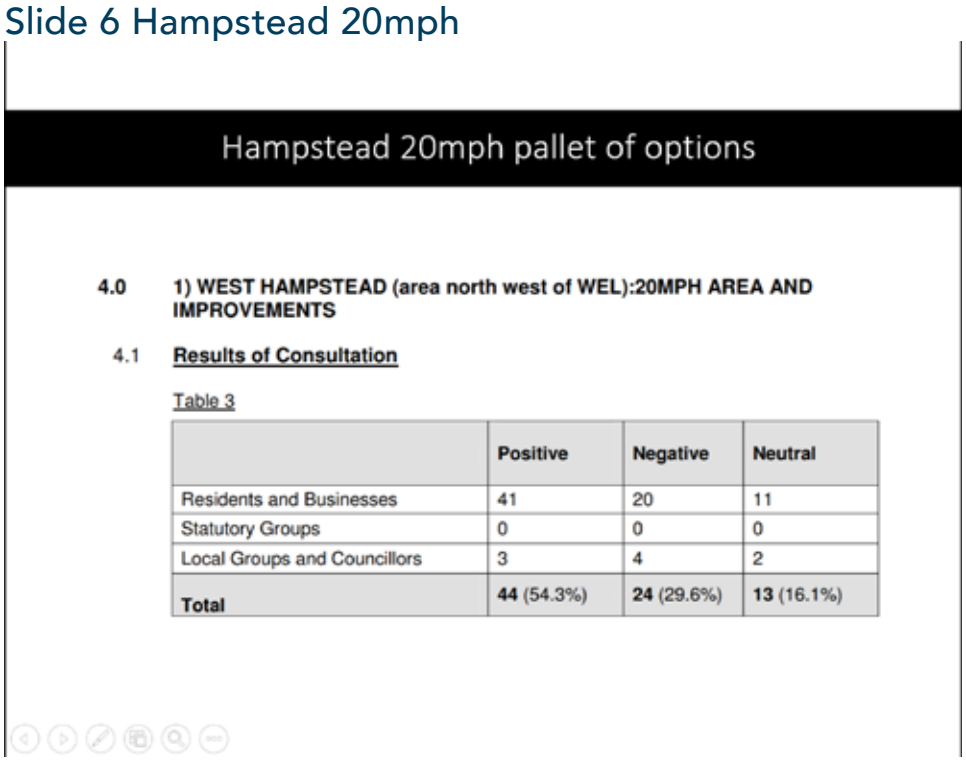


I used this argument personally when trying to persuade residents in an affluent area to adopt a lower speed limit of 20mph at a public meeting. After the screams of derision and shouts that I had “messed up the streets so badly that they would be lucky to ever even reach those speeds”. I explained the physics of corner radii and asked how what type of junctions they

Pursuading with evidence

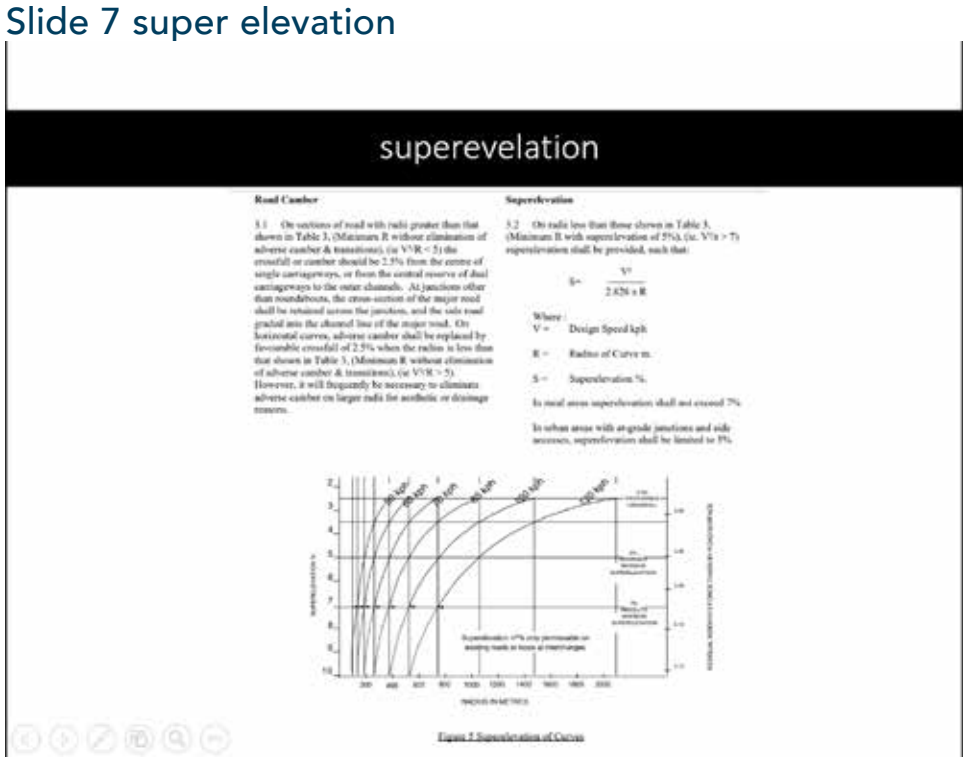
preferred to walk across. I explained that everything I designed was in relation to design speed, and that most street design choices associated with improving the public realm and street character were not possible at higher design speeds, due to regulatory constraints. Designing a street to a lower speed limit opens up a whole new palette of options, where control can give way to negotiation and courtesy. Signals, poles and signs could be removed, offering clear space, and in-character materials could be used, rather than rugged hard-wearing functional forms. “What kind of street do you want me to design?” I asked. If you want the latter, then you need to lower the speed. The result was unanimous support. I am not saying this to prove how awesome I am, but to show that if you understand your audience’s concerns, then you can get big wins for people walking and cycling in different, more subtle ways.

Slide 6 Hampstead 20mph



Back to engineering, those with a keen interest in physics or highway engineering may be champing at the bit to point out that there is another way to reduce centripetal force on a bend, and that is super elevation. That is to say angling the road like a Nascar circuit. This angle, or camber as we like to call it, can help reduce the forces going around a bend, as gravity effectively works against the centripetal force. Most bends are angled towards the tighter radii to gain this assistance, and where it is angled the other way, warning signs are usually used so that drivers expect extra centripetal force. It is not particularly practical to start angling roads dramatically to reduce forces in urban areas, so please do not think this will save you from arguments about tightening. However, in the interests of science, you had a right to know.

Slide 7 super elevation



This section is going to be about installing cycling provision onto streets, without ruining provision for those who choose to walk. Pedestrians do not fare well in terms of crossing the road or walking in clear space, but at least the basic ingredients are there for them. My career has focussed on delivering infrastructure for cyclists, but it cannot come at the expense of pedestrians and nor can it be left out.

If you remember back to Day 1, you are armed with the knowledge that cycling provision may not always be the right thing for different street contexts, but we should put that aside now and assume the right choice has been made, and so discuss the practicalities of actually fitting it in. There are clearly a thousand things you need to know about designing Links and there will be a thousand people better than me at telling you how to do it. Not many, however are better at crowbarring cycling onto streets without ruining everybody’s lives. The space got handed out before cyclists got anybody’s attention, and so it is the biggest challenge for champions to win back. That is why this is the focus.

Space for cycling

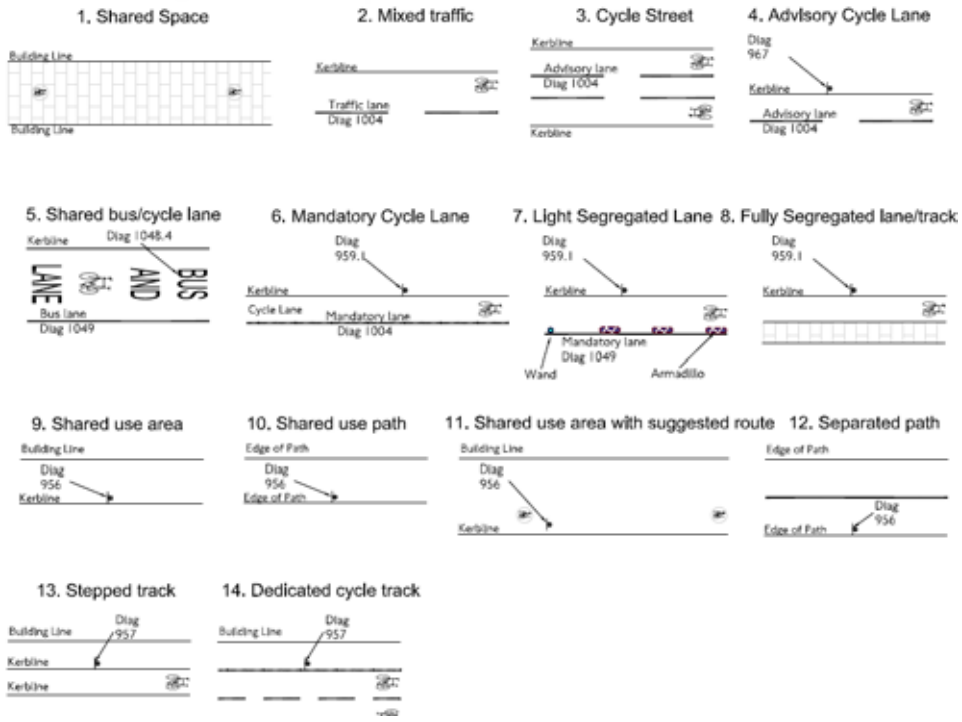
Slide 8 vauxhall bridge. hmmm

Cycle lanes are the main method of suggesting to drivers that cyclists may be present. This may be obvious in some countries, but in others it can be quite a shock to see a cyclist on a road, and so lanes at least suggest that this foolhardy action was anticipated. My 8 year old nephew, for example, was made to stand at the front of assembly and explain to the school why he was so foolish as to cycle to school in his small town.

Cycle lanes go some way to legitimising the presence of cyclists, and so should be appreciated. They also encourage drivers to leave some space for cyclists if they do not necessarily need it. Cycle lanes can also help legitimise undertaking by cyclists if general traffic is queuing. One of the joys of cycling is sailing past queues of cars. The big caveat here is, of course, safety, and the fact that for most of these undertaking manoeuvres cyclists will be in the blind spot of HGVs who may be getting ready to turn obliviously.

Cycle lanes have also been used grumpily by highway engineers to say: “Hey, you cyclists stay there and let all of this lovely motor traffic flow. You keep getting in the way and annoying them and I am getting letters.” Cycle lanes are also spectacularly useful as a wayfinding tool, providing continuity and coherence.

Slide 9 degrees of separation



Cycle lanes come in many flavours, and their usefulness is dependent on the cultural and regulatory acceptance of them by the local populace. By which I mean that in a country like France, a passing car may toot you so they can shout “Vive liberte!” out of the window, whereas in the UK you are more likely to be passed closely and the tooting becomes a honking request to make way for the entitled ones. Ah well, as stated previously, I will use the European terms for the different types of cycle lane. It is one of those areas of walking and cycling where there is a lot of technical nuance. A bit like advanced stop lines, which have so many variations but actually do not amount to much when you are out there riding. More on those later.

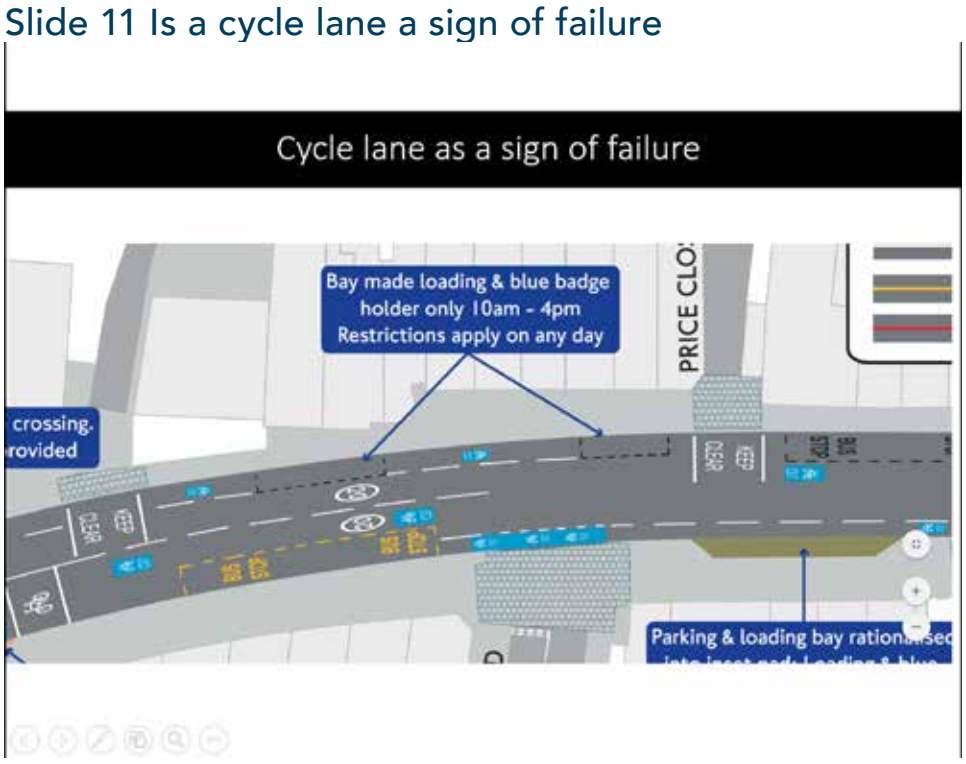
Slide 10 do cycle lanes promote close passes

I sometimes get asked by international colleagues doing benchmarking policy documents how many kilometres of cycle lanes there are in London. I always give a long-winded response trying to clarify what a cycle lane is

Advisory cycle lanes

and whether it is effective or not. Should a 0.8m line at the side of a road be classed as a cycle lane, even though you can barely fit the smallest regulatory cycle symbol inside it, let along an actual person walking and cycling? If not, what about 1.2m lanes – we have hundreds of kilometres of those? What about cycle lanes where people are free to park in them? Do they count, or cycle lanes that put you in poor positions at junctions? Just like car ownership is no longer the chosen international measurement of prosperity, cycle lanes should not be the measure of cycle friendliness.

Slide 11 Is a cycle lane a sign of failure



At a European level, there is no difference between what the UK refer to as mandatory and advisory cycle lanes: solid lines or dashed lines. In the UK this means a lot, as advisory lanes can be placed without any legal traffic order being written. They also require less regulatory signage and can be used freely past and through junctions, on narrow roads and adjacent to parking bays. This flexibility is also their downfall, as they actually, in reality, almost literally mean nothing. UK police have no powers to enforce them as they are not compulsory.

Evidence of a motor vehicle encroaching into one, when it did not have to, and causing a collision, could be used in court to suggest liability but I have never actually heard of this happening. The effect then is purely psychological. It shows cyclists that their needs have been considered, and shows drivers that cyclists have been recognised as a street user. The flip side of this psychological argument is that it suggests to cyclists that they have some clear space when they do not, and it legitimises drivers routinely crossing cycle lanes. How can we expect mandatory cycle lanes to be respected if we have advisory ones that are routinely encroached upon, for example the ones on Ashton Old Road? In the UK, drivers can freely encroach into cycle lanes without any recourse, so this is not an especially effective way of enticing new cyclists on to the network.

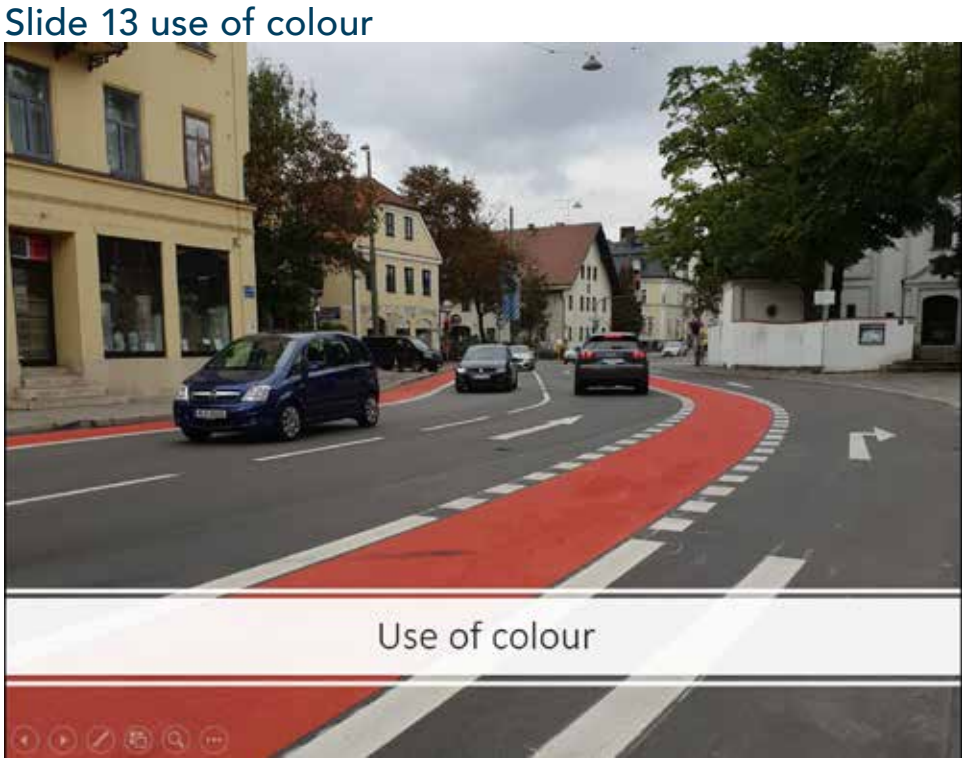
Slide 12 advisory cycle lane

I was once involved in customer research into driver's perception of cycle lanes, and sat behind a one way mirror as they were discussed. Hardly any drivers made any distinction between advisory lanes and mandatory lanes, and so perhaps the European lexicon is correct to have no distinction. Interestingly, several drivers considered coloured lanes to be of a higher status and so stayed out of them. This seemed to make a great case for the use of colour in lanes, but alas these same drivers then said if they saw a coloured lane that they would relax, assuming cyclists would be in it.

This was not a helpful observation in the UK, as our cyclists take up many varied positions in the carriageway, and anything that makes drivers relax is usually a problem in an urban environment. So, coloured or not, this approach is very much a half measure that there seems little strategic case for. If traffic flows are low, then you may not need any lane and if they are high then you should probably physically protect cyclists in order to reduce encroachment.

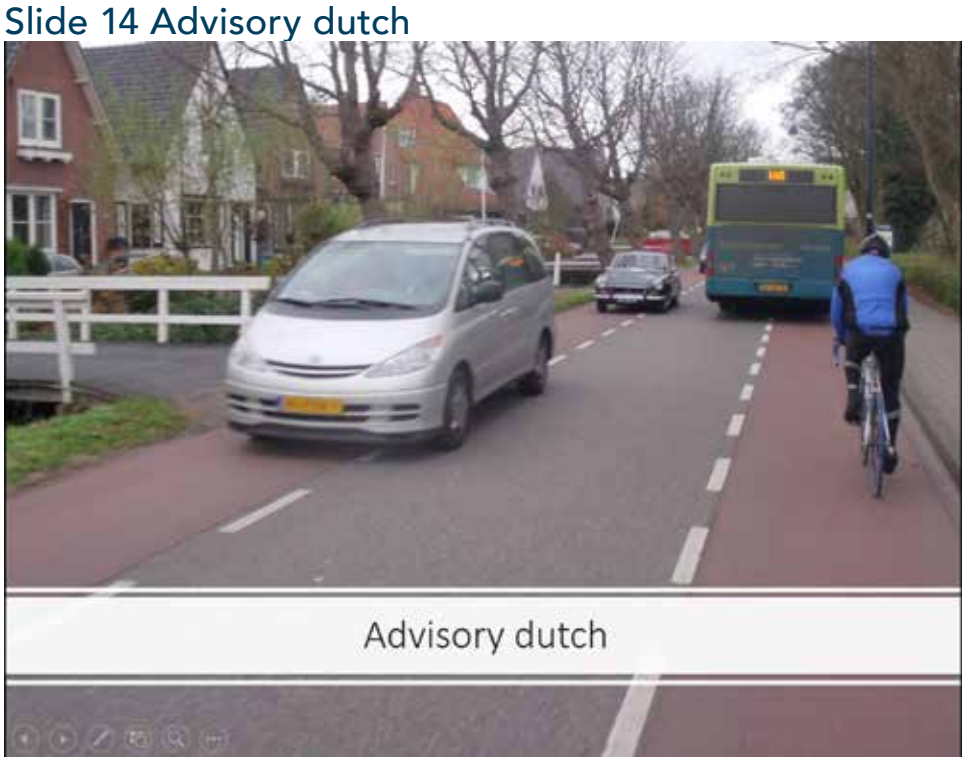
Symbolism

Slide 13 use of colour



However, dashed advisory cycle lanes do have an interesting effect that is worth noting, particularly if centre lines are removed. They can serve visually to narrow a street, or to use the American term: a street diet. The Dutch have done this for years, particularly on cycle streets, which we will hear more from later. Visually narrowing a street creates a tunnel effect, which can slow motor traffic down considerably.

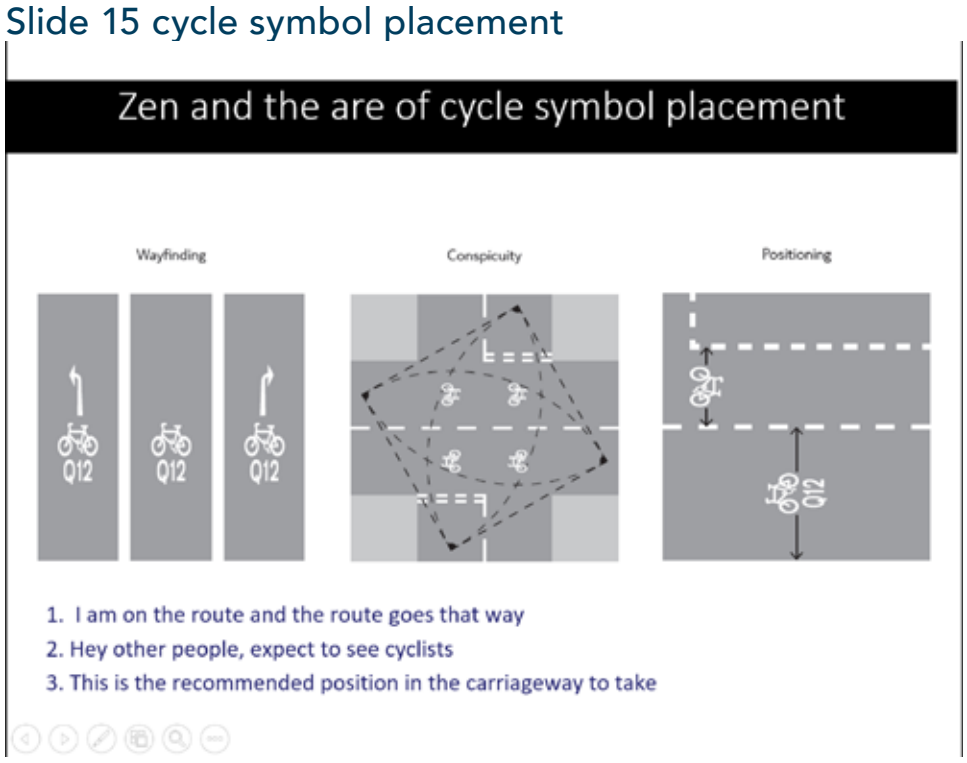
Slide 14 Advisory dutch



European advisory cycle lanes can be used without any actual line marking, and these would just be referred to as cycle symbols in the UK. I was once described as having a PHD in cycle symbol placement, and although I am not actually that clever, I am incredibly pedantic about where these tiny representations of the bicycle form are placed. The placement of the cycle symbol is the greatest suggestion an engineer can give as to what position they think a cyclist should ride in. For engineers who cycle, this can be very helpful, as it can help avoid obstacles or warn other traffic that cyclists may be in certain positions. For those who do not ride, it can often mean placing symbols in the gutter, or right up against parked cars, as they need to step aside to let the kings of the road pass with comfort. The placement is therefore very telling of the civic authority's view of walking and cycling.

I may be reading a lot into this, as, traditionally, placing symbols was one of the few design options we had in the UK, and so I have spent a lot of time thinking about this. In Holland, I have seen symbols placed right next to parked cars but nobody paying the slightest bit of attention, as it is not in a standard riding position where everyone expects you to be. However, if you are enticing new cyclists you should be extremely careful where these are placed, because someone might actually follow them. Never compromise position.

Slide 15 cycle symbol placement



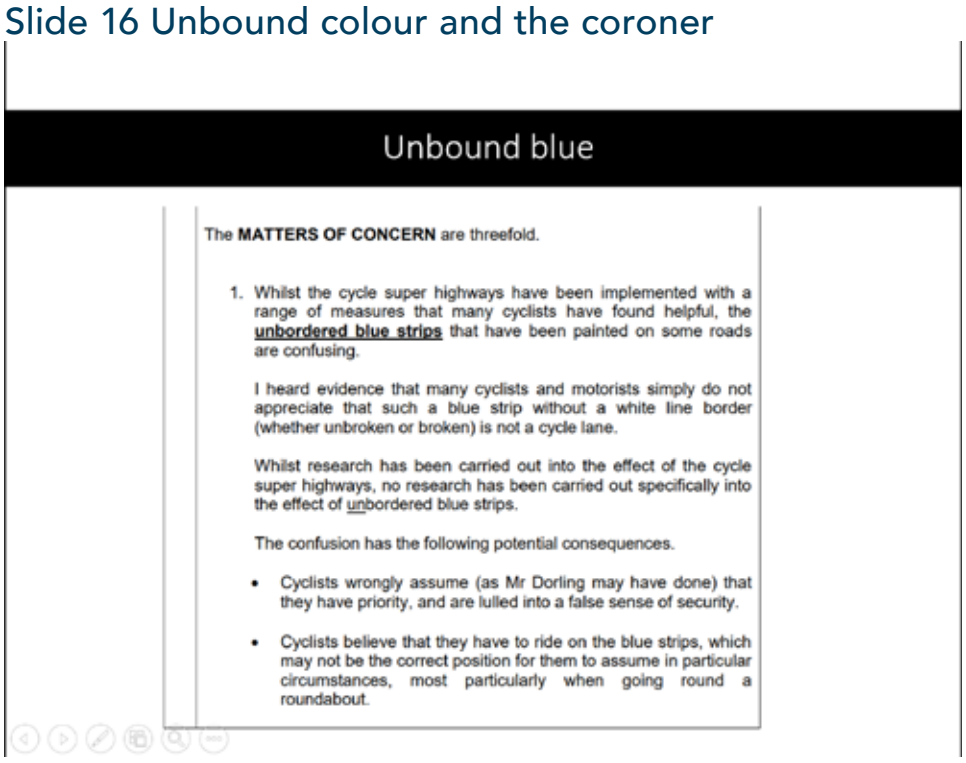
In the UK and Denmark, there is a strange cycle lane variation called the … ahem, it doesn't really have a name. We used to call them ghost lanes in the UK and then we changed this to unbound blue, which sounded more poetic and justifiable. It basically means using colour without any lines, and so it highlights the presence of cyclists and even perhaps suggests where they should go, but is not actually anything other than colour. The general public are no wiser and, as stated previously, might think that these are actual cycle lanes, as colour is that much more visually arresting.

Personally, I say: either provide something or do not, as I don't like pretending people have been provided for. Following a spate of fatalities in London on lanes of this type, one coroner suggested that they provided a false sense of security and seemed to suggest that

Other lanes

they enticed people into danger. Nobody wants to hear things like that about their schemes, and so be wary of using them. In Denmark, they seem to work well as they hint at a well-established behaviour of yielding to cyclists when turning. If you do not have that behaviour, then I suggest that you do not pretend it is there.

Slide 16 Unbound colour and the coroner



A mandatory cycle lane – or cycle lane to use the European term – is for the exclusive use of cyclists. "Well, shouldn't they all be?" These can be enforced as a moving traffic offence in the UK. A recent revision of the standards in the UK means that a traffic order is no longer required, although as they permit no vehicles to cross either at certain times or all the time, some additional parking restrictions are usually required and so orders crop up.

An interesting variation is where they appear within bus lanes. This effectively gives cyclists a 3m buffer away from general traffic and they only need to be cautious when buses pass. This can be quite a pleasant experience, although it may not appear particularly enticing for new cyclists, and we need to make a lot more of those.

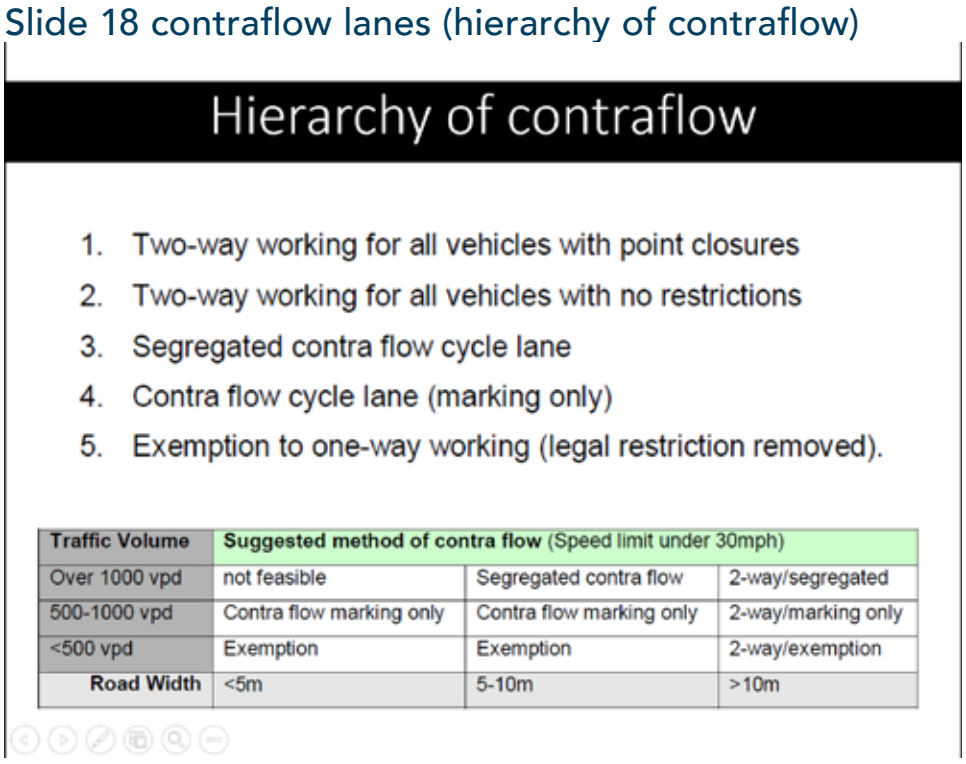
Slide 17 cycle lane in bus lane. Old shoreham road

When allowing walking and cycling in both directions on one-way streets, contraflow cycle lanes can be used, and these can take all the forms mentioned above: solid, dashed or symbol only. We used to have an infuriating regulation in the UK that you could not exempt cyclists from no entry signs, and so we would have to install a traffic island and put in an additional sign. In a lot of cases we did not have room for the contraflow cycle lane once we had put in the island, as in the UK an island with a post on it should have 450mm clearance to the carriageway. If the sign was 300mm wide then island would be at least 1.2m wide.

This limited our opportunity to deliver contraflow walking and cycling in lots of streets and seriously held us back. In the late 2000s when we finally had an 'except cyclists' sign it began raining contraflows. One small area of central London called The City of London, where the financial district is, converted sixty streets in one 12 month period. In regards to the use of islands, I would not consider islands necessary when entering contraflows, but they could still be useful at the exit where general traffic could be tracking over the exit position of cyclists, particularly if the adjoining road is also one way.

Contraflow

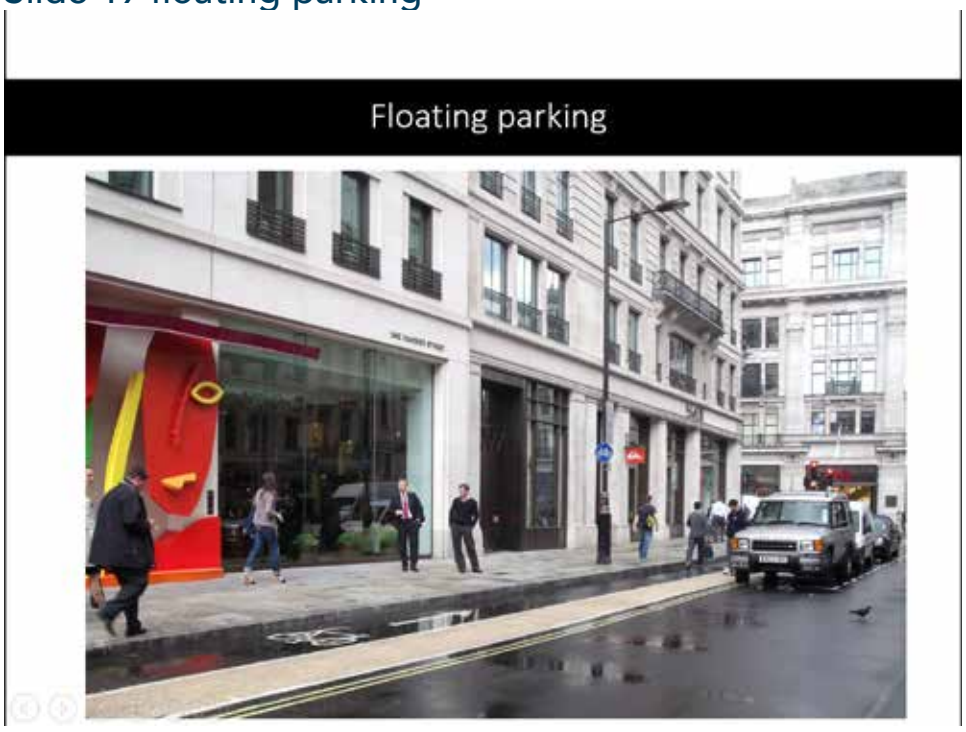
Slide 18 contraflow lanes (hierarchy of contraflow)



If you are taking a cycle lane past parked cars, then absolutely make sure there is at least half a metre of space between the lane and the cars to avoid dooring. You also need to consider the taper if the lane is moving from kerbside, so that cyclists do not suddenly jut out into the general traffic stream. One in ten should be the minimum taper here. Smooth transitions are crucial.

You should also give strong thought to floating the parking away from the kerb, like they have done so successfully in New York. This reduces the risk of cyclists weaving into the path of through traffic, and can provide protection as long as there is a buffer for car doors. Bus stops can also be floated in this manner, as long as you leave enough space for people to get onto and off the bus.

Slide 19 floating parking



The use of bus stop bypasses is a hot issue in the UK which may be a surprise to countries who do them as standard, but may also be unsurprising for those countries who are worried by them. London has one of the most, if not the most, extensive bus networks in the world and the operators and planners pride themselves on accessibility. The bus is the everyman form of transport. This is so embedded in UK folklore that until recently our legal definition of a reasonable person was the man on the Clapham omnibus. I believe they changed it to the man mowing his lawn, but lots of people still conjure up an image of a man on a bus in south London when seeking to define a portrait of reasonableness. Messing with bus stop passengers is therefore by legal definition an unreasonable act. I am making light of this but it is a heavy issue taking thousands of hours of professional and legal officer time to resolve.

Slide 20 interaction with buses

"How then do we get cyclists past bus stops?" Our first option and the one most commonly used entails simply stopping the lane and starting it again on the other side of the bus stop. If there is no bus present, then no problem and if there is then cyclists can either wait soaking in the ambience of diesel fumes or overtake, negotiating a gap in passing traffic. Not particularly enticing. I know I use the word enticing a lot, but that is what the role of the champion is. You must entice, cajole and persuade. Society needs those bums on bike seats.

Getting past bus stops

Slide 21 stop and start

The next option would be to have a wider nearside lane which would enable cyclists to overtake without merging with passing traffic. The issue of criss-crossing paths with buses remains and again, this may not be as enticing as we want. That word again. You will think about it, you will, you will.

Slide 22 wider nearside lane

The next option is a slight upgrade, but improves coherence and flow and that is to half inset or fully inset the bus stop and continue the cycle lane. Buses still criss-cross but the presence of the lane hopefully makes them do it with care. It is enticing, but it also gives cyclists the impression that they are in their own space when they are not, and so the juxtaposition between actual and perceived safety raises its head.

Slide 23 layby

Another variation would be to stop and start the lane and put symbols or patches on the outside of the bus stop. This basically warns and papers over the cracks, but again fails our enticement test.

Slide 24 patches

“Stop showing me problems, show me solutions, I hear you say.” “Well, what about shared bus boarders?” “Go on.” This is a common practice in Denmark, and involves the cycle lane rising to the same level as the footway enabling pedestrians to step across it and onto or off a bus. “But won’t bus passengers be stepping directly into the path of cyclists?” Yes they will, but cyclists will see a bus stopped and know that they need to watch out for bus passengers, and negotiate for space with them as they would in a shared environment. Cyclists have to yield priority but only occasionally, when the bus is dwelling to allow passengers to embark or alight, and the rest of the time they get the space to themselves.

Boarders and bypasses

A little bit of compromise can do us all some good. Not convinced? I have built them and think they work great, but perception of them is poor, even if this poor perception never seems to manifest itself as collisions. The risk of a cyclist striking a passenger is low, and the risk of this being serious enough to result in a recorded injury collision is even lower. However, the risk of people being mildly put out and getting a tad annoyed is extremely high. I love them, but have yet to convince the UK that they are the way to go. Give me time.

Slide 25 shared bus boarder

There is a French-inspired option showcased in Nantes which takes the cyclists and bus stop out of each other's equations and that is to do a central cycle track or lane. If cyclists are riding two-way in the middle of the road then they avoid all the kerbside activity and can simply glide by. This seems to work great in Nantes but so far in the UK nobody has tried one, as they are concerned about getting in and out of it. Washington DC has another famous central cycle track, but I believe parking, rather than buses, was the key consideration there.

So I have been teasing for a while and here it is: the star of the show. I have seen enough correspondence on bus stop bypasses to fill several encyclopaedias. It is as if we just imported a radical new anarchist concept from Christiania and used it to destroy our social fabric. Few seem to realise that we have had them for years in the UK. Cycling is now on everyone's radar in the UK, and infrastructure schemes are picked apart by all members of society in the same manner Kim Kardashian's latest outfit is.

Cycling is the celebrity of UK transport. Everyone has an opinion. They either love it or hate it, but in reality it lives in some otherworldly bubble where few normal people ever go. This is a blessing and a curse, as in real celebrity I suppose. It is a blessing, as cycling has never been so far up the political agenda. It is debated endlessly in national parliament, and by local councillors, and consulted, explained, researched and debated like never before.

When I started working in cycling in the early 2000s, I used to cut clippings that mentioned cycling out of papers and rush in to show people in the office. I still have these clippings in a folder. These days I would need to dedicate a room in my house to the maintaining the collection, and risk becoming an eccentric hoarder. Interest can also be a curse, as it seems that all people want to do sometimes is debate, and the views can become polarized and simplified to the point where it is hard actually to build anything. Once things are built they are scrutinised, called for review and campaigned against, and sometimes for, to the point where delivery authorities have to plan for the backlash – or bikelash as it is commonly known.

Slide 26 bus stop bypass bikelash

Bus stop bypasses are one of these issues. This common practice from our European friends has attained such a status in the UK as to become a symbol around which the future sustainability of society hangs. The polarized view is: Do we sacrifice passenger comfort for walking and cycling safety? I believe we can have both, but with fame comes caricature, and so this is where we are.

On one side of the polarized view, people maintain they are dangerous, but are they dangerous or are they just places where interaction happens? How many of these interactions would it take to become a collision? As a trained road safety auditor, I classify an interaction as an

Interaction not collision

unplanned or uncontrolled event that could potentially lead to an injury collision. In the case of bus stop bypasses, the classification is more along the lines of street negotiation. This is a big step down from safety considerations. The currency of negotiation is civilised discourse, and so the research question is: How civilised is the negotiation at bus stop bypasses? not How likely are collisions? as collisions so seldom occur on this type of infrastructure anywhere in the world.

Slide 27 interaction at bus stops

But I cannot have it both ways, as I did ask you to consider the feeling of safety, and it seems that bus stop bypasses do not feel safe to vulnerable pedestrians. When customer research was undertaken, most passengers were actually fine with the approach, but the fear is that vulnerable pedestrians avoid the bus stops with this treatment and this undermines the accessibility credentials of the bus network. I would recommend that every effort is made to reassure pedestrians that these are safe places to be, and to encourage cyclists to slow down and negotiate for space in a civilised manner, rather than just snatching and holding on to priority.

I therefore favour zebra crossing markings on bypasses. It is up to each champion and designer to form their own view, but I support the use of zebras as the Transport Research Laboratory said they reduced the probability of interactions, and they can add extra reassurance to vulnerable pedestrians. Design choices can minimise the rate of interactions, and so if it is a choice between replacing known collision types for cyclists with occasional interactions with pedestrians it is a simple answer to a complex polarising question.

Slide 28 accessibility

Cycle tracks are less controversial, unless of course you are removing someone's parking and taking road space away from heavy flows of motor traffic to install them. These have a very high perception of safety from cyclists and so are the most enticing of measures that you can build. The view is almost universal that providing cycle tracks encourages more walking and cycling.

There is however one tiny chink in this armour which is known in the UK as: The Stevenage Question. Stevenage is a medium-sized town in Hertfordshire, England and was built as a show town. My secondhand copy of The Cycle Planning Book from the early seventies is full of glorious illustrations of it. It is also claimed that many famous Dutch walking and cycling towns adopted the network model of Stevenage and ran with it to create walking and cycling utopias.

Stevenage has an extensive network of fully separated cycle tracks covering the whole area. Main junctions are grade separated and the tracks are flanked by trees. Why then does hardly anybody cycle there? For thirty years it has stood as testament to the statement: If you build it, they may not necessarily come.

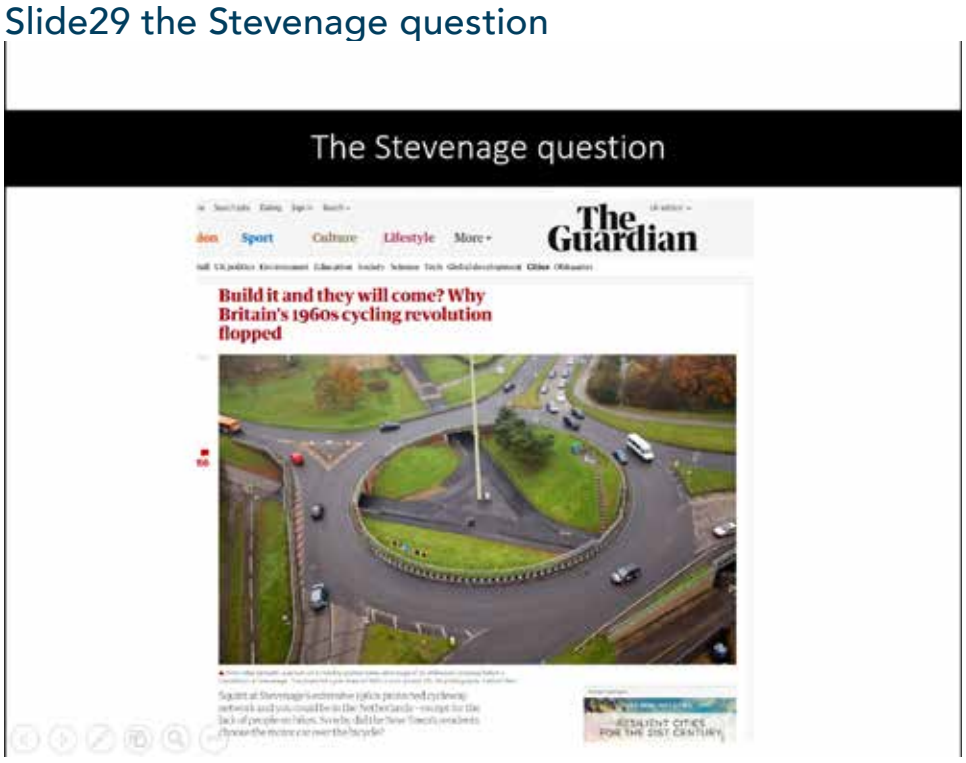
My theory, and there are others, is the carrot and stick defence. They dropped the carrots everywhere but held back the stick. Stevenage also has an extensive, wide road network with multi-lane roundabouts and a high speed limit. They also have near universal free parking. Our rational economic man, I know I should say person but I did not come up with this antiquated nonsense, who is sitting on the bus debating his travel options would see how easy, quick and convenient driving is and think in aspirational terms of joining the club. When it is easier to get to their destination by driving, people

Stevenage question

will take the easy option and that is the Stevenage question.

How do people value their time? Cycle tracks are the answer, but civic authorities need to ask a few more questions about the cycle friendliness of their local policies before committing to them. We do not need any more examples of the waste of money protecting cyclists can be. A bold civic authority leadership could make Stevenage a bastion of active travel through some initially unpopular policies. If you build it, you need to prod them to make them come.

Slide29 the Stevenage question



Cycle tracks can represent barriers and trip hazards for pedestrians, and can also fall foul of maintenance if they are not wide enough to get street cleaning equipment down. Drainage is also essential to usability, and so money needs to be spent to make sure they last. They need to be treated like roads for the exclusive use of cycle traffic and not cordoned-off parts of the footway. Cycle tracks can be expensive, and require a high cost per head of population to focus on.

I have been depressed more than once by Dutch speakers suggesting we need to have thirty years of continuous investment to reach their standard. This is a poisonous thing for politicians to hear, as they want to show big improvements in four year periods, and if your plan cannot deliver that then you are sent away. Why on earth would they do something that a mayor or politician of the future will benefit from? This proved quite a conundrum to resolve in the UK and so thank goodness for the invention of protected bike lanes, or light segregation as well call it in the UK.

Slide 30 road for the exclusive use of cycle traffic

What if there was a way of upgrading cycle lanes cheaply and quickly to the point where they would entice new cyclists and deliver huge safety benefits? Welcome to the world of light segregation. I was a pioneer of this technique in the UK and so settle down and I will tell you the story of what it is, how it works and its many and manifold benefits. It certainly put me in a position where people might actually listen to what I have to say about walking and cycling, and so our fates are tied together. Here is our tale.

Slide 31 Protected bike lanes

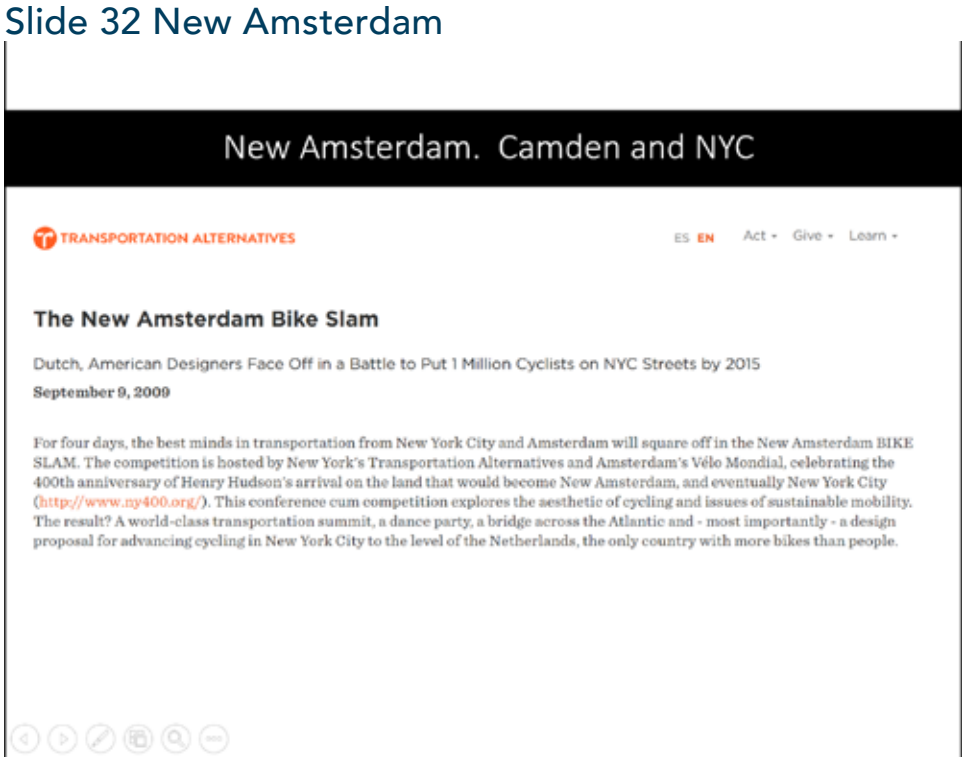
In 2008, I had a visit from some cycle campaigners from New York who were doing a European cycle route fact-finding mission, looking at best practice. I showed them some of the segregated cycle tracks in Camden that I had been involved in, and explained in my honest engineering way some of the issues I was having with them. Camden tracks were mainly two-way tracks on one side of the street and so the main issue was motor

Segregation, quick and cheap

traffic not expecting cyclists to be coming at them from certain directions. I also wowed the campaigners with lengthy descriptions of the rules of tactile paving, but I will spare you that lecture now. Cycle planning is a small world and we all steal, or appropriate if you prefer, each other's ideas, try them in our own contexts and feed back to each other.

This New York group went back home, convinced others and lobbied the regional authorities. In one of those only in America moments, the regional authorities actually brought them in house and they started New York's great walking and cycling experiment. They wanted to go Dutch, but being a nation not blessed with patience, they wanted it all now. They organised a New Amsterdam conference and got the Dutch experts to come over and help them redesign their streets. This was the catalyst of the Urban Bikeway Design Guide.

Slide 32 New Amsterdam



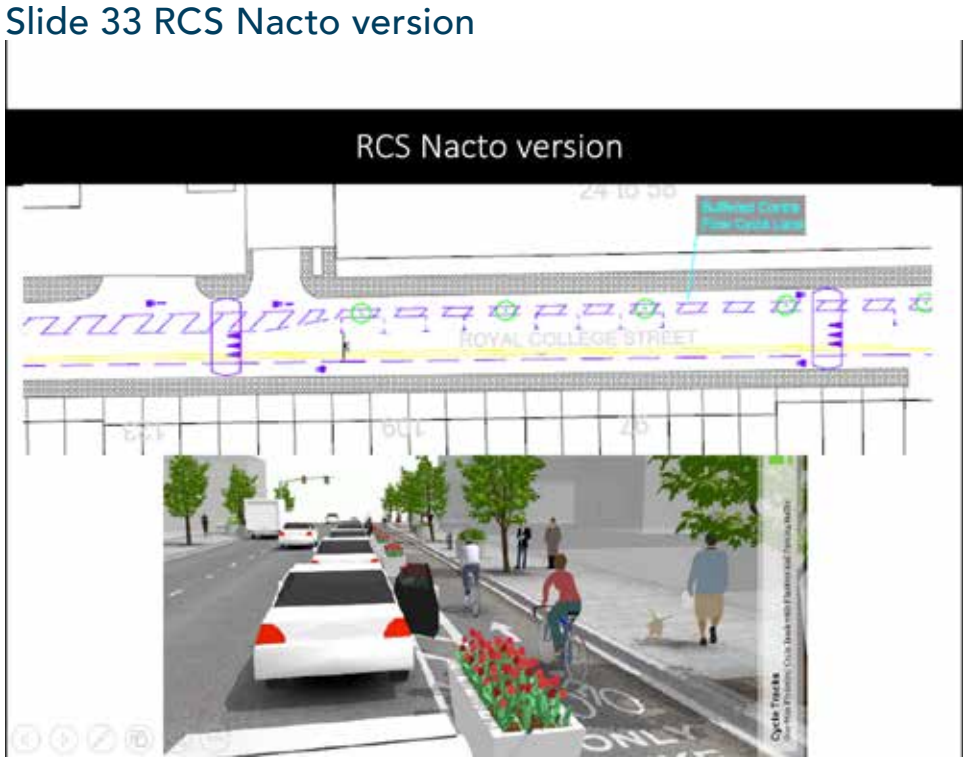
Meanwhile back in Blighty, I was struggling to find solutions to the incessant two-way track safety issues, and was being instructed to either sort it out or pull it out. Segregation was pretty much frowned upon in London at the time, as the tracks I had been involved with had poor collision records. One was even named the most dangerous place to cycle in London in a popular regional newspaper. Looking at the statistics it was hard to argue, but the track had attracted huge number of cyclists with flows going from a couple of cyclists a day to one every four seconds.

I knew segregation enticed, but I was struggling to keep them safe. I needed new ideas. Picking up the Urban Bikeway Design Guide filled me to the brim with new ideas, all of which looked quick and easy to deliver by repurposing space, another great American phrase.

I quickly mocked up a New York Version of the two-way track we were having the most issues with and showed it to my boss. It had buffer strips, floating parking, bollards and planters, and was immediately shot down as being too out there.

I licked my wounds and watched the world as this protected bike lane phenomena seemed to grow. The Spanish developed a product called a zebra which they were rolling out by the kilometre every week and it was amazing to see how fast the progress was. New York was delivering the basis of a city wide network in a few years and I desperately wanted us to be part of the action.

Slide 33 RCS Nacto version



I made a few adjustments, sought some urban design help, and decided to not take no for an answer until we had a UK version to share in this worldwide phenomenon. Until then, I had been a fairly anonymous civil servant delivering what I could for walking and cycling under the radar, and without causing too much friction. It was now time to think big.

I hatched a plan with a climate change consultant who just happened to call me, serendipitously, about the phenomena and was amazed when I told him about every international example and what I wanted to do. He used his influence to generate political interest, first with my own civic authority leaders so they could instruct me actually to work on it, and next at regional and national level.

How lanes got their spots

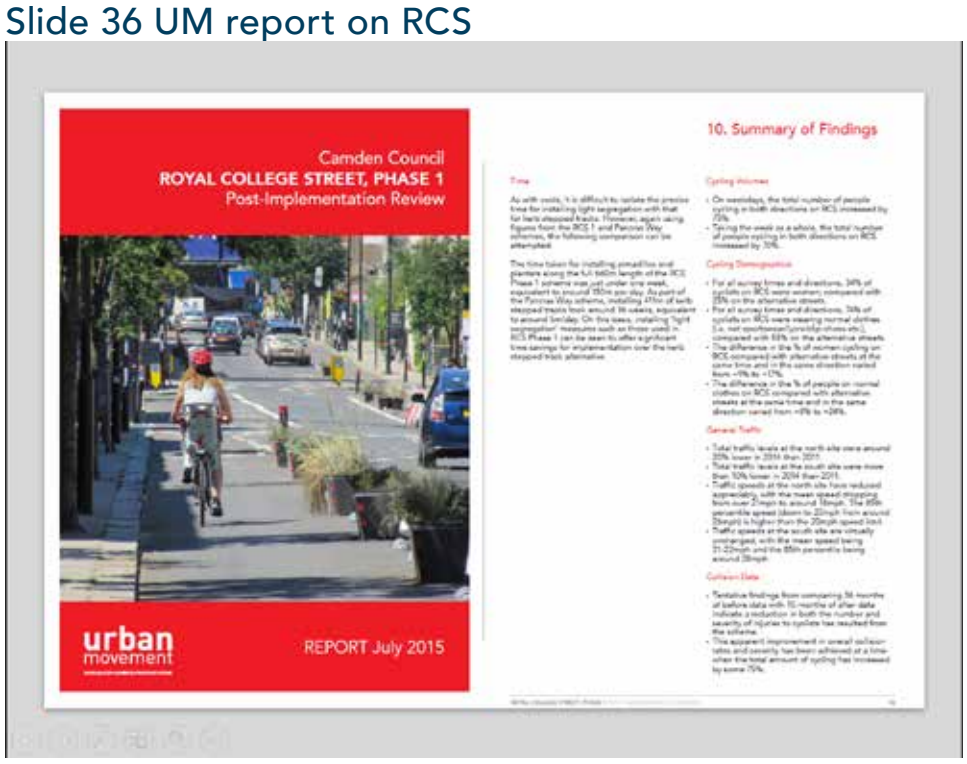
Slide 34 Air quality RBKC

A few regulations needed to be bent, and so I needed big political help. The Secretary of State for Transport came to my aid as well as the new Cycling Commissioner and Camden's very own Cycling Champion, Councillor Braithwaite. All these great powers and influencing machines converged to help me push it through. All I had to do was push on and take the blows. By this stage all my colleagues were pulling together and everyone was starting to realise that we were working on something special. The visualisation alone made one of my colleagues cry with happiness, and before it was even built I was lecturing on the new approach. Royal College Street arrived with much fanfare amid TV slots, news articles, national and international interest, and light segregation in the UK was born.

Slide 35 RCS on ITV

Every engineer wants be involved with something new, and for me it was light segregation. I became Brian Armadillo Deegan, which was the UK name given to the zebra separators from Spain which we imported for the scheme. Zebra was too confusing as that animal's name had already been given to a crossing type. My boss, I believe, coined the term and it seems to have stuck. Light segregation costs a fraction of the price of full segregation as it involves hardly any construction: no kerb lines changes, no additional gullies and no extra maintenance. It is adaptable and flexible in that you can lay a kilometre of it in an afternoon and then change it the next day if it was not quite right. It seemed to offer enough protection to encourage people to cycle, as trips doubled following implementation. So it offered the UK a chance to make up for 40 years of planning for motor traffic in a few short years.

Slide 36 UM report on RCS



It also showed that segregation could be safe, which sounds crazy, but was not the case before this scheme, as segregation had been plagued with side road collision issues. Light segregation protected but did not trap, so cyclists could keep protected in a nearside position, but could also move out to cross the road or position themselves more centrally past junctions.

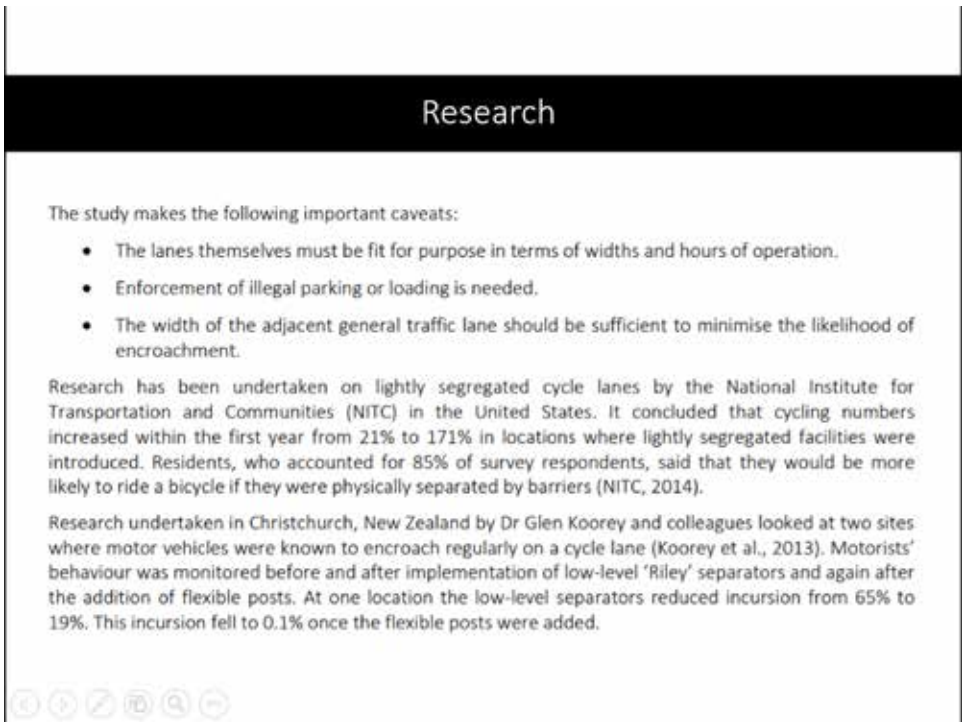
It seemed to unite both schools of walking and cycling: the vehicular cyclists and the segregationists. Or rather neither side had any major problems with it, which is good enough for me. The kerb nerds, as segregationists had been amusingly named in the UK, were big supporters from the outset and I was delighted not to be a lone voice championing segregation any more. I took a pilgrimage to Cheltenham to see the god of vehicular cyclists, John Franklin, and was skipping home when he said he liked it. Ok, enough of my memoirs.

The world of protection

Slide 37 protect, don't trap

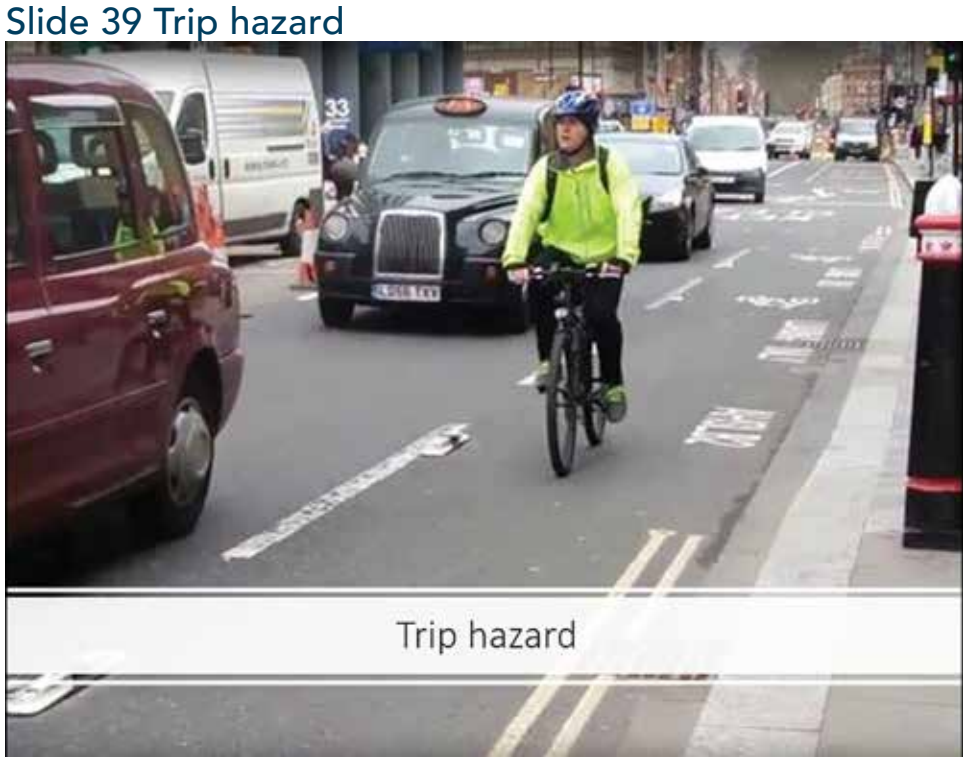
The Transport Research Laboratory in the UK earnestly researched it and concluded that it did not feel as safe to cyclists as full segregation. Thanks for that nugget of wisdom. On the street, however, it seemed to be making cyclists feel safe enough to give it a go. New Zealand did a study which showed one location where a cycle lane was encroached by 65% of drivers before light segregation and that this dropped to 0.1% after. Other sites were less dramatic, but I obviously like quoting this one when trying to win arguments. Research from America highlighted that 10% of people who were stopped and questioned on protected bike lanes said they would not have cycled without it, and so the case continues to grown. Changes have not been as swift as I would have hoped in the UK, but change is coming and most civic authorities are giving it a go.

Slide 38 research



There have been a few hiccups along the way and it would be remiss of me to suggest that this solution is perfect. Absolutely nothing in street design is perfect in my world view, but you can get close. Salford did a trial and the poor Armadillos got smashed to pieces. This helped develop the rule that you need to start a run of them with something vertical. When they did this the little creatures survived. The City of London put in some tiny ones which confirmed the vertical rule and the it must be distinct from its neighbouring road marking rule, as pedestrians were tripping on them and cars rolling over them oblivious to their presence.

Slide 39 Trip hazard



Other early rules, and by 'rules' I mean advice and guidance based on trial and experimentation, are that they should be repeated at regular intervals, and that they should be accompanied by solid white lines. There is still a risk when putting any physical object in the public highway, but this can be mitigated for and the results for cyclists speak for themselves.

Any champion should be able to persuade their local civic authority to give this technique a try. Why not upgrade a nearby cycle lane and measure the effect? The objects are approximately £40 each and can be laid in an afternoon if they are bored. We need to find new ways to protect and encourage walking and cycling. Join the movement.

Trunk roads for bike traffic

Slide 40 join the movement

Fully kerb-separated cycle tracks can work brilliantly. I had problems in Camden, but when working on the new batch of fully segregated superhighways we attempted to solve these problems on wider roads and with a larger budget. I therefore have a few tips for those kerb nerd purists for whom light segregation is too much of a compromise. Try and signalise all major junctions, and aim for separation in time. We will discuss this in a lot of detail on day 2, so do not worry if this makes no sense at the moment.

At side roads, try and get an offset of 5m so that turning vehicles can give way to the track. Continuous or blended footways are also the natural bedfellow of cycle tracks, and in particular stepped tracks, but more on them in a moment. “What on earth is a blended footway?” I hear you ask. “I think he’s just making things up now.” Honestly, trust me, these things are useful to know and have major safety implications if not utilised. We will look at these things shortly as well. You have so many things to look forward to.

Slide 41 roads built for the exclusive use of cycle traffic

The new kid on the block in terms of segregation in the UK is the Danish style stepped track. There was never anything regulatory stopping the UK providing these, but nobody got around to doing one. In large part this is down to the practicality of installing stepped tracks. The official name in the UK is hybrid tracks, but in Europe they are just called cycle tracks. Stepped tracks give cyclists their own height as well as their own space, as the area cyclists are suggested to ride is higher than the carriageway, usually by 60mm, and lower than the footway, again by approximately 60mm.

The good news is that no space is lost to the width of the segregation. In the UK until recently, segregation islands had to be wide enough to install a bollard, and have 450mm clearance on the general traffic side and at least 250mm clearance on the cycling side. Making the case for space for walking and cycling can be hard enough without writing off over a metre of width for the segregation itself. So stepped tracks offer space efficiency savings.

Slide 42 Stepped cycle tracks

This also brings its own problems, as cyclists do not have the same buffer from general traffic. If the nearside general traffic lane is narrow, then traffic could be moving very close to the edge of a stepped track. Cyclists could be close to the edge and even have their handlebars over the edge if they are passing someone. This could lead to uncomfortable close passes or even strikes.

It is therefore best advised to do what the Danish do and have stepped tracks as wide as possible. Once they are below 1.8m, things get a little bit critical, as cyclists cannot easily pass each other. If a cyclist is stuck behind another cyclist, then the tricky manoeuvre of a sideways

Variable height

bunny-hop is needed, either to get onto the banned footway or to return to the track once the cyclist has moved down into the carriageway. The sideways lateral transition is the enemy of thin wheels as anybody who has negotiated tram tracks will attest.

I took my Brompton over to Brussels for a week once and became an expert at handling rear wheel slides. This is not a manoeuvre I would recommend as being enticing to new cyclists, so beware. Engineers may use stepped tracks if they run out of space and people have been demanding segregation, but they need to be wide enough to be safe, or the step has to rise at the footway level or drop to the carriageway level. When done well they do look great, but can be confused with loading and parking pads if tried in isolation. Even in Denmark I have seen trucks parked in them, and so if they get confused in Denmark where it is the staple infrastructure choice, imagine what they will think in your area.

Slide 43 stepped track with van parked

Stepped tracks can also be expensive if, based on the topographical levels available, you have to cut into footways with shallow services, add extra gullies, move street lighting columns or reconstruct footways.

Consistency is the key, so if you do support this approach, make sure you can see it through. It is much easier to tarmac the edge of a footway and keep the level the same, and so beware the stepped track at footway level. Please don't laugh – I see this on designs all the time. Remember as well that we want walking and cycling improvements to come at the expense of private car use, and not at the expense of pedestrian provision.

Slide 44 footway level cycle track

Some streets are just made for cycling, and other streets we have to make for cycling. The Dutch have a great concept called the Fietsstraat or Cycle Street, which I am hoping will take off in the UK. In some street contexts, segregation may not be required, and these streets can be of low strategic importance for traffic engineers. However, some backstreets attract so many cyclists that the movement function really needs to be acknowledged and some design considerations given.

On Dutch streets, where cyclists outnumber general traffic by two to one and there are at least a thousand cyclists per day, the cycle street treatment may be applied. For them, this can mean placing a sign on the street suggesting cars are guests and must therefore be prepared to yield priority and not overtake. It also suggests a lower speed limit can be employed. In the UK we have no such signs official signs to apply to a street, as our legal system seems to prohibit us regulating behaviour. The Dutch do not have a cycle street traffic order – they just do them.

Cycle streets

Slide 45 cycle street nice

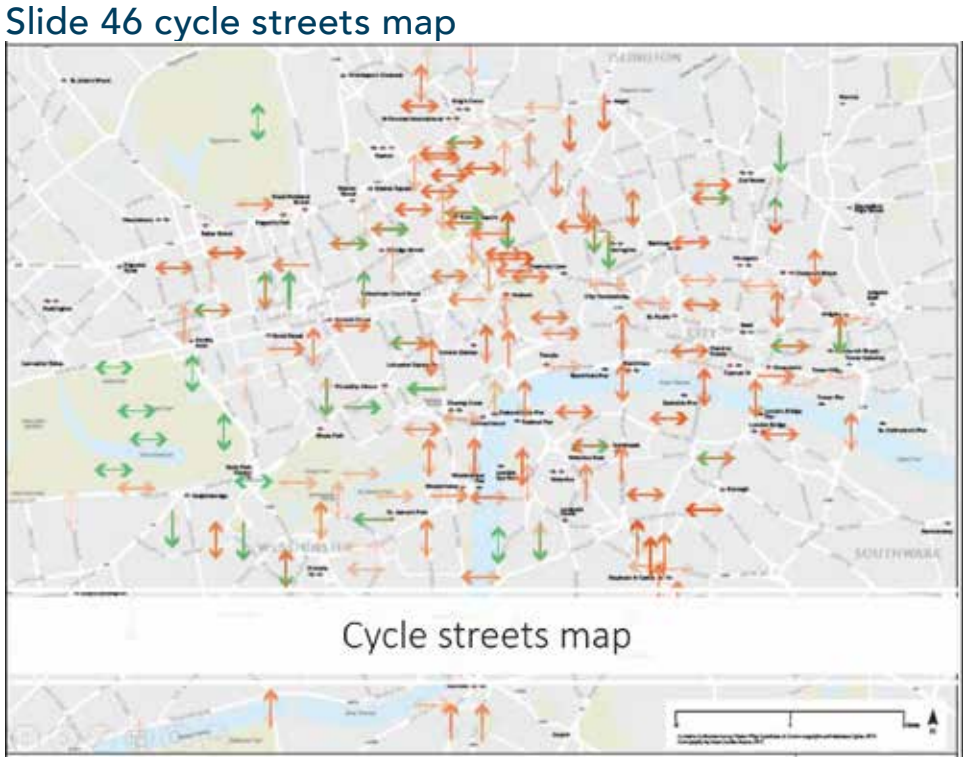
Allegedly, overtaking is a behavioural consideration, unlike speed limit which is an absolute. I am not sure I am philosophically convinced by the DfT argument, but we are where we are. This should not mean that the cycle street concept is dead, as the UK has a strong history of self-enforcing through street design. When I started, and alas this is still the case in many areas, the Police would not enforce 20mph areas. Maybe they felt they did not have enough hours in the day to stop people from driving at what they considered to be a reasonable speed, or perhaps there were other reasons.

What matters is that street designers then had to take on the responsibility of making 20mph streets self-enforcing. The rise of the speed hump began, and hundreds of thousands were employed throughout the land at enormous cost to society. A similar coordinated approach could launch the cycle streets brand, with creative design choices suggesting that motor vehicles should not overtake cyclists, and speed reduction measures trying to encourage a slower design speed.

Some of the approaches we have looked at so far could encourage this, such as centre line removal and visual narrowing, or even material choice, greening and level surfaces. Filtering can help streets feel like they are for access only by general traffic, whilst still accommodating a strong through movement function for cyclists. There are, at present, hundreds of streets in London where cyclists vastly outnumber general traffic. We effectively already have cycle streets, and so the question is more about analysing what makes these streets so effective and attractive for cycling, and trying then to replicate this elsewhere.

This concept is cheap, easy to roll out and can transform whole areas. It would be great if we did have a traffic order but it's unlikely ever to happen.

Slide 46 cycle streets map



The concept is alive and well and should be at the forefront of all champions' minds. Full segregation can be prohibitively expensive for civic authorities but cycle streets can be delivered for peanuts, and a few well-placed bollards can give you the best cycle infrastructure in the world. Nothing beats the actual carriageway for riding purposes; if we can just get rid of most of these cars, conditions could be perfect.

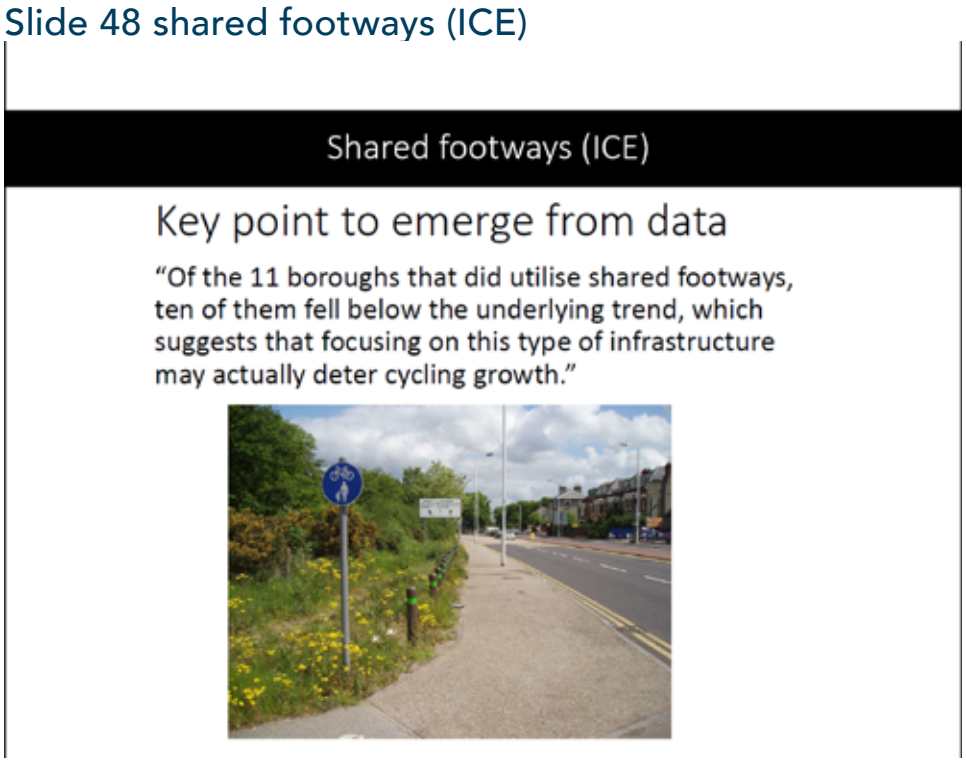
Slide 47 tower hamlets cycle street

At this point it is time to drop a warning, don't let them fool ya or even try to school ya, cycling on the footway is bad. Honestly, it is really bad. I did a paper for the Institute of Civil Engineering in the UK, in which I compared infrastructure delivery by thirty three different civic authorities, and stumbled on to the stark conclusion that the authorities which had concentrated

Sharing again

on shared footway provision seemed to have arrested the growth of walking and cycling beyond a do nothing scenario. Riding on a footway seems in the UK to actively arrest growth. Japanese readers might at this stage point out that footway cycling is very efficient at moving huge numbers of cyclists around in Japan, but I think even they would admit that if they had the space they would separate things a bit. Shared spaces can work, if the whole place is shared, but shared strips by the side of the carriageway seem to suggest that cyclists are not legitimate vehicles and need to get out of the way of the kings of the road and into the way of pedestrians. Think long and hard before supporting shared footways.

Slide 48 shared footways (ICE)



If you do find yourself with no other choice, then you could try and make subtle, or not so subtle suggestions, that cyclists will be present, or even, if widths permit, sub-divide the area with material choices. We have in the UK a classic oxymoron term called the segregated shared use footway which usually entails an engineer drawing a white line down the middle of the footway and pretending it is a cycle track, which it could very well be classified as in UK regulations.

There is a UK meme of crap cycle lanes and this type of provision dominates the top of the charts. Remember, however, that it is all about context, and when beside dual carriageway-type roads linking towns where barely any pedestrians are present, as perhaps the walk is too long, shared use footways can be effective solutions. In urban areas, I think you get the message to avoid them like the plague.

Slide 49 shared use footway avoiding barrier

Away from the public highway and therefore away from motorised traffic, through parks, by canals, across greenspaces and converted railway lines then sharing is caring. Cyclists in these instances are the ones who bring the danger and pop the tranquillity bubble, so we should be expected to slow down, interact, negotiate and cruise. We need to hold the mirror we hold to drivers to ourselves, and make sure we are not being menaces. We should all rejoice that we are in an area without motor traffic and not try and bring the rules of the road with us.

Any use of white lines and give way markings should in my view be avoided, as paths are not mini versions of roads. As stated previously, I hate most line markings on streets, let alone on paths. Every pedestrian we shout at to get out of our way or step out of our side of the path is another human turned against the civilising, health-inducing cause of cycling. I know this annoys a lot of cyclists, but I have to say it: take a breather on a path.

Exercise: Profile decisions

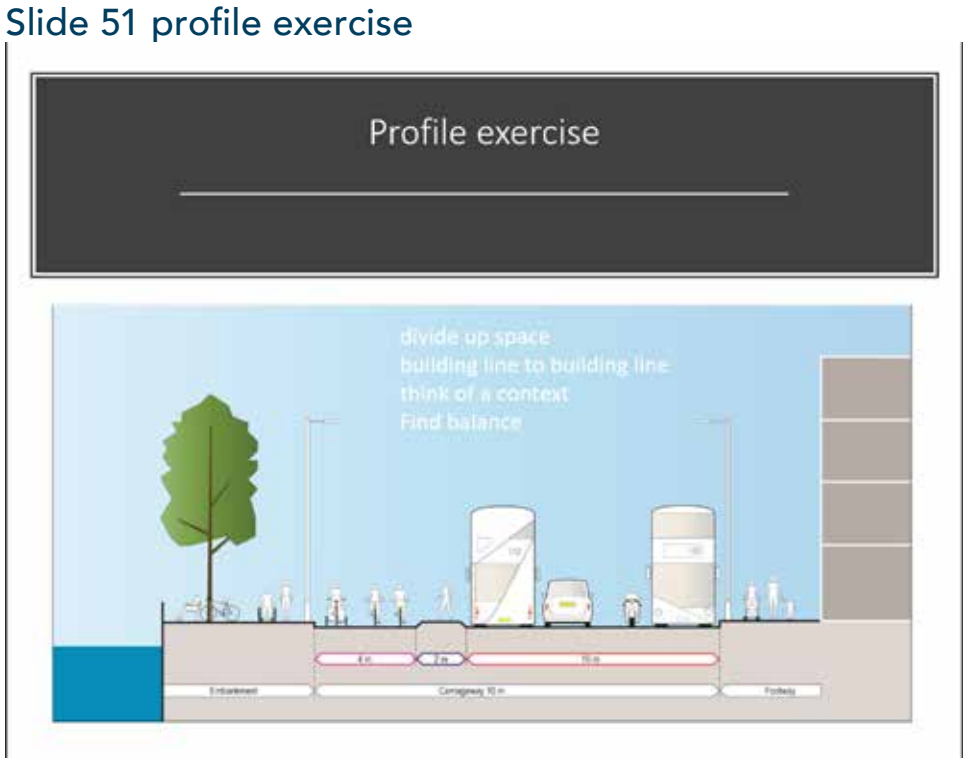
Slide 50 shared path, take a breather

It is up to people like me to provide nice conditions where people can pleasantly interact, and if the best provision is provided in each street context, then behavioural issues will be few and far between. From all I have seen and experienced, I have only seen behaviour get worse when paths are not shared. Ok, just before you throw your pen down in disgust, I will qualify this further and state again that consideration of context is the key.

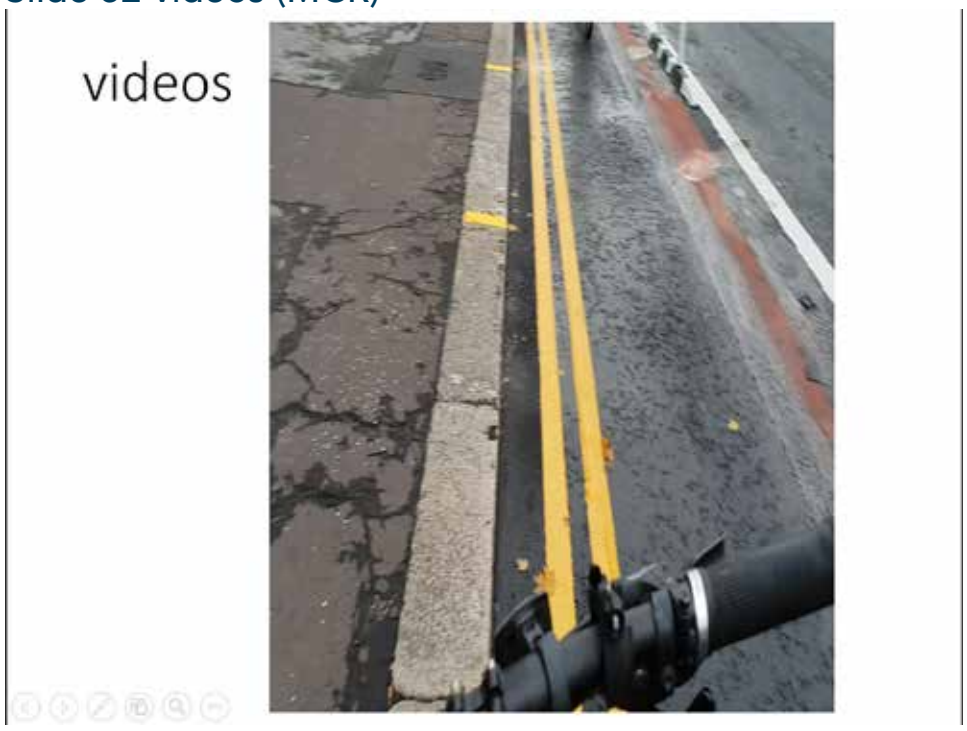
There are some amazing segregated paths in the world and I would not change any of them. Minneapolis has greenway which is fully separated and forms a strong commuter route. Routes of this type, where there is space, work really well. My rule of thumb would be: if there are high flows of cyclists and there is enough space to cope, then separation on paths can absolutely be the optimum solution. I am labouring this point as I hold on to an idyll of cycling as a calming green force which civilises areas.

This is the dream I sell to senior officials. Cyclists should civilise spaces, and spaces should civilise cyclists. Sometimes, however, you just need to start allocating priority to movements and control things. I wish we could all just get along and nobody felt they were better than anybody else and that their direction and mode of getting there should take precedence, but that is just not the world we have made. We therefore need junctions and signals to bring some order and allow positive modes to flourish.

Slide 51 profile exercise



Slide 52 videos (MCR)

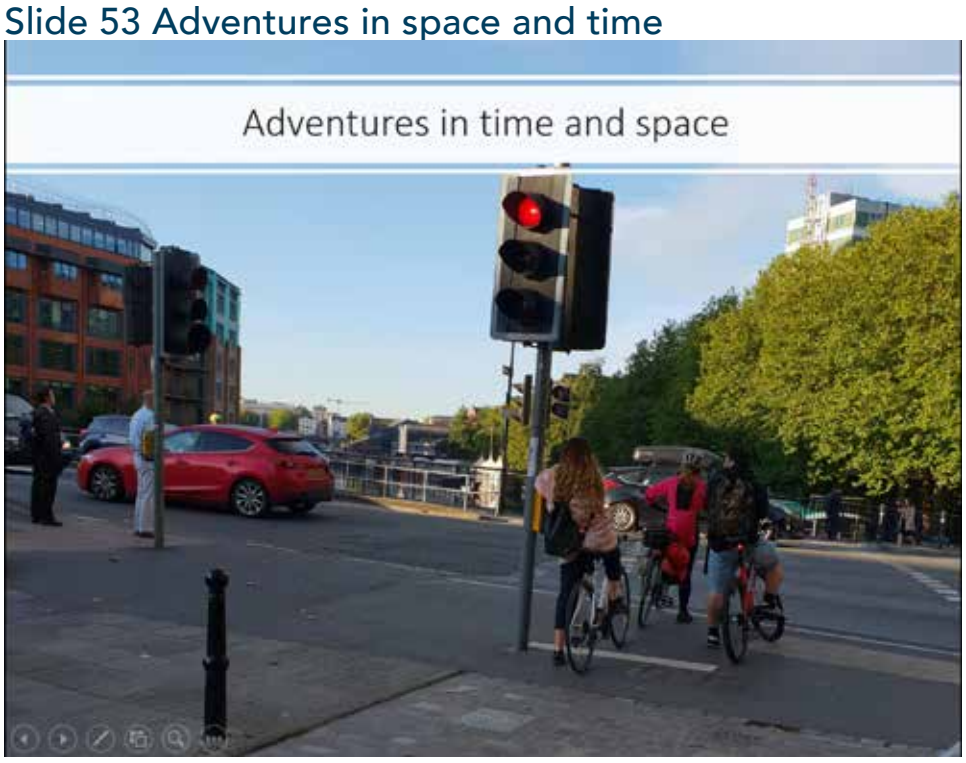


Junction design

This is a dry subject, but it is the biggest one you need to get your head around. The terminology is confusing and the approaches are mystifying, but if you want to be a walking and cycling champion then you need to get to grips with junction design. On day 3, we will talk about modelling and simulated reality, but for now we shall cover time and space. Junction design is very much about adventuring in time and space. It sounds more fun already!

At this stage, I will confess to my obsession with junction design and so I have no shame in trying to share this obsession with you now and make you equally enthused. I took a four-hundred-mile trip to Liverpool from London to look at a signal junction with early start, as they put five seconds rather than the four seconds used in London and I wanted to experience the difference. All this will make sense by the end of this section, so get comfortable and welcome to my world.

Slide 53 Adventures in space and time



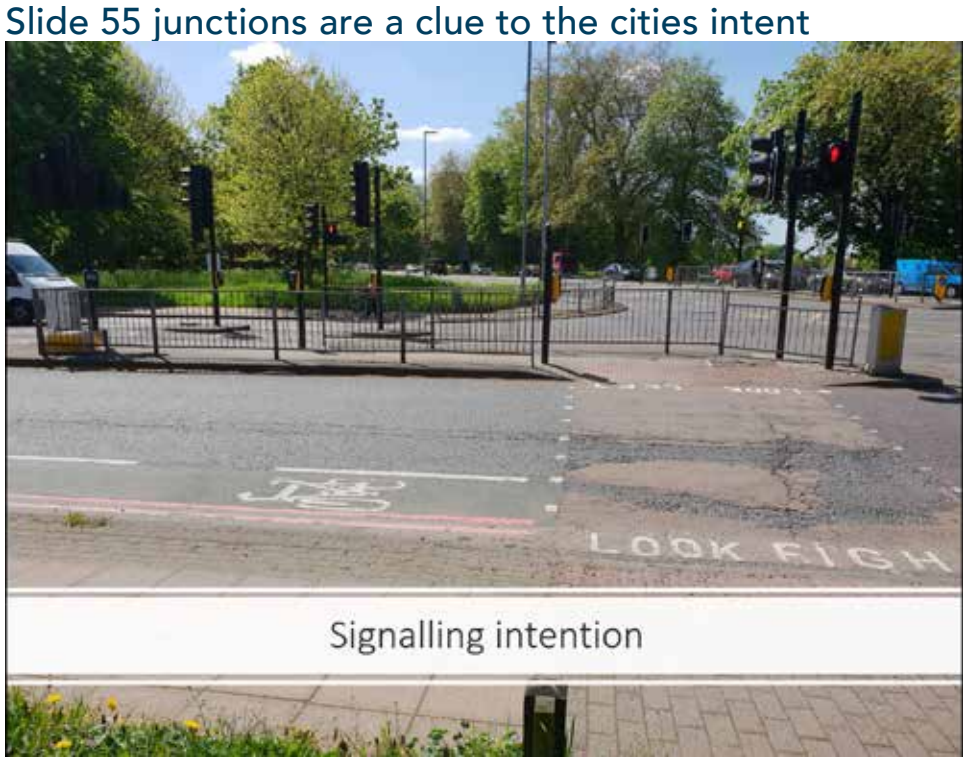
Junctions are tragic places and not just because approximately eighty percent of collisions occur at them. They are tragic because they were invented to liberate streets from the excesses of traffic, and to bring order to chaos.

Somewhere along the line, however, engineers saw the potential to minimise delay and maximise flow through increasing control, and they became so good at it that everything flowed and everyone wanted a piece of the action. It quickly reached the point where more and more elaborate solutions were needed, such as grade separation, and we began the endless spiral of traffic congestion doom.

Slide 54 traffic signals as liberation

It is a truth, now universally acknowledged, that if you provide more space and increase flows, then more traffic rushes in to clog it up again. It is a truth, less universally acknowledged, that if you take space away and reduce flow, traffic evaporates or finds more efficient forms of transport. All major cities have this issue and it is through junction design that a city's intent and direction can be read. The wider and more elaborate the junctions, the more the city believes in the great lie of private automated vehicles for all; the smaller and simpler the junctions, the more the city believes in sustainably and efficiently moving humans, rather than cars. The truth is written as plain as day in our cities and etched into the street fabric and pattern. Undoing this is never easy.

Slide 55 junctions are a clue to the cities intent



The basics of junction design are that all movements should be considered and that conflicts should be minimised or eliminated. There are many regulatory and

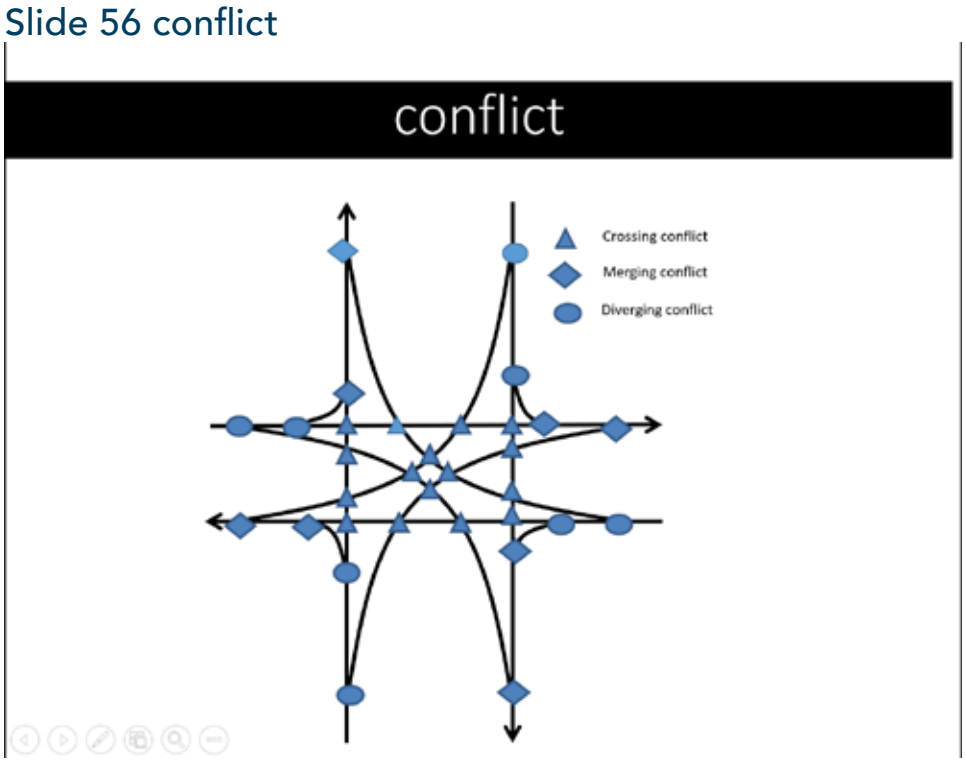
Conflict and priority

design tools at our disposal, based on the geometrical layout and complexity of the junction. There are three types of conflict that occur at junctions: crossing, merging or diverging conflicts. Put simply, crossing is when one vehicle cuts across the path of another; diverging is where vehicles approaching the junction separate to make different movements; and merging is when they reform on junction exits.

At a standard crossroads junction, there are thirty two of these positions of potential conflict, which seems like quite a lot of conflict to avoid. If the junction was offset into a dog leg, then the number of conflicts shrinks dramatically to eighteen, which sounds like good news. In fact, lots of engineers will swear by this layout for this reason. But is reducing potential conflicts for all vehicles actually a good thing for those who walk and cycle? If motor vehicles sense a clear and present danger, then they might actually slow down and turn with care. If the junction is offset, they might feel free to swing in and out, as obvious conflicts have been removed. Be careful what you wish for.

One of the principles of shared space is to make the conflict obvious and acute so that vehicles adjust their behaviour. This is a damn tricky thing to explain to engineers, but keep this in mind as junctions are damn tricky to get right, especially for vulnerable road users. Tiny geometrical errors can have big consequences, and it is not always obvious where the fault lies.

Slide 56 conflict



At junctions, the link choice you made based on the street context gets severely tested. If you mixed modes in the same space then you have one set of issues, and if you segregated them, then you have another set of issues to overcome. There is no perfect solution and so you need to find the optimum approach for the situation you are addressing. The first junction type we will test our link choice against is the plain old priority junction. These can be side roads or crossroads, and be geometrically offset or aligned. The first design question you need to answer is: "Who has priority over whom?" It is common practice to give the dominant flow the priority, but switching this can have a traffic calming effect. I particularly like the bike boulevards of Portland, which give priority to certain back streets and make all priority junctions give way or stop to yield priority. This can make for a very pleasant cycle ride, as everyone is formally told to make way for you.

Slide 57 priority and boulevards

The basics of cycle-friendly priority junction design are to slow traffic down on the approaches, minimise the number of lanes and tighten the radii to as close to ninety degree approaches as possible. You may also want to raise the side road with a side road entry treatment, as these have been linked with significant reductions in walking and cycling collisions.

Slide 58 SRET

Bending it

If you have chosen to segregate cyclists, then giving them priority past side roads is a much more difficult proposition, and all I can really offer is clues on how to get there. In line priority may be done, but in the UK this priority is seldom given by turning vehicles that are in the terrible habit of doing an assumed major to minor road turn without looking out.

We could decide to wait for them to behave properly, but we have decided to be more pragmatic and opt for bending the segregation out or in. If you bend the segregation out away from the junction mouth, then turning vehicles from the main arm have space to yield to the cycle route after turning. At least 5m is recommended here, but smaller distances have been accommodated, depending on layout complexity and sightlines.

This approach means creating another junction next to the junction and parallel to it, and can be effective if turning flows are light. It is still reliant on good driver behaviour, but there is no avoiding them forever. At some stage, segregation must end and conditions to manage the interaction with general traffic smoothly need to be provided. This is the approach favoured by the Dutch in general.

Slide 59 bend out

The Danish seem to have adopted the second option, which is to bend the segregation in and back to the carriageway, so that it becomes integrated with the nearside general traffic lane. They consider this to be much safer, and drivers can see cyclists merge on the junction approach and so know that they must yield when turning. If they remained set back from traffic, then the motorist would be less aware of the presence of cyclists until he or she turned into the junction. Likewise, a cyclist would be looking back over his or her shoulder to see if any vehicle was coming. This poor combination of visibility leads the Danish to support integration at junctions. They make a solid point, but it needs to be measured against the feeling of safety, and also driver behaviour.

As previously stated, UK drivers are much less likely to yield when they turn than their Danish counterparts, and so we tend to prefer bending out. If you are insisting on keeping the segregation in line or bending in, then I strongly suggest you adopt common Danish practice of continuing the look and feel of the footway across the mouth of the junction, so that the side road effectively looks like a crossover. This is great combination with all segregation, as it forces turning vehicles to yield by giving them no visual cues of priority. Pedestrians are also asked to just keep walking and not stop to concede priority.

This blended footway approach is still controversial in the UK, but it has been used with great results so far and so I suggest that champions become familiar with them. Any approach which forces drivers to slow down to minimal speeds before turning has got to be supported for reducing the likelihood and severity of turning collisions.

Slide 60 bend in with continuous footway

Ok, let's talk about prioritising pedestrians at priority junctions. "Wait – what's that? What do you mean, you can't? Not possible, no way, not in the UK." There are no markings. There is no legal discourse. People who walk always must yield priority to vehicles at side roads. End of. Does the rest of the world share our view that people without vehicles mean nothing? Well, no, they don't. They use zebra crossing markings to let drivers

Crossing

know that people walking across the road have priority. So let's get this straight, the rest of the world uses a British marking associated with pedestrian priority to give pedestrians priority but we don't. Just how bad are we? We are working to change this.

Slide 61 full zebra at side road

We really should talk more about crossings at this point as we work our way through the junction forms. How did the cyclist cross the road? If your answer to this joke is: "By having them undertake a jug handle movement onto the footway, pressing a button and then riding with pedestrians onto a staggered sheep pen crossing", then you have not been paying attention. If your answer is: "By providing a wide parallel direct crossing", then your answer is still not very funny, but there is hope for you. We have a lot more of the former than the latter in the UK and so I guess the joke is on us.

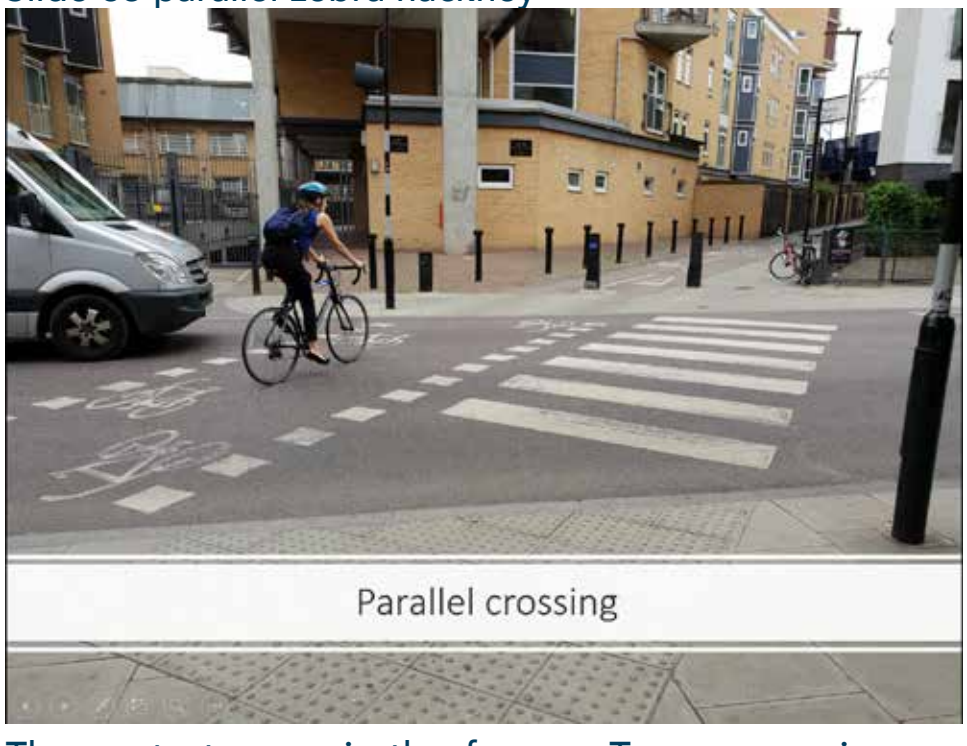
Slide 62 jug handle crossing

If you have more than three thousand motor vehicles a day using a street that people want to cross, then you probably need some kind of crossing, whereas if it is over eight thousand, then you probably need a signal-controlled crossing. A crossing can be achieved by simply switching priority and having general traffic yield to cyclists, although this is not too common. And of course, pedestrians have no priority in this instance, which is nice. The most common technique is to utilise a zebra or parallel crossing (AKA parallel zebra). This common technique in Europe has only recently arrived on British shores, but we are making up for lost time.

We previously had to make do with a legal loophole meaning cyclists could ride across pedestrian zebra crossings if the footway on either side was shared. This eventually annoyed regulators enough to let us adopt the common parallel version, which gives users priority. Zebras are very good for helping maintain flow, as full priority is given to users. Our usual bad behaviour crops up and I have to say I have seen this behaviour in many countries: that pedestrians and cyclists wait for priority to be given, rather than take it.

There is also the issue of cyclists' approach speeds. If cyclists approach with speed and assume full priority, then they can risk not being anticipated by the traffic they are crossing. Visibility is the key, as in all successful crossings. Drivers need to see far enough back on the approach to anticipate, slow down and stop. If cyclists are approaching at high speeds, and the street itself is high speed, then impractical visibility splays may be needed. I may be worrying too much, as drivers are supposed to be looking out when approaching zebras, but UK drivers do make me twitchy.

Slide 63 parallel zebra hackney



The next step up is the famous Toucan crossing, so

Crossings

named because two can cross; the two in this case being cyclists and pedestrians. Most of the applications of toucan crossings in the UK reek of compromise and stem from a time, not that long ago, when protecting cyclists at junctions meant putting them on the footway and having them wait to cross with pedestrians before dumping them back in the carriageway on the other side.

Slide 64 toucan

The preferred signalised crossing of choice is therefore the parallel signal crossing (AKA junction with separated cycle stream) with its associated elephant footprints markings. They have all the subtlety of an elephant standing in white paint and marching across the road and this is what makes them good. It is clear for cyclists where they go, so gives them confidence that they might even get there in one piece.

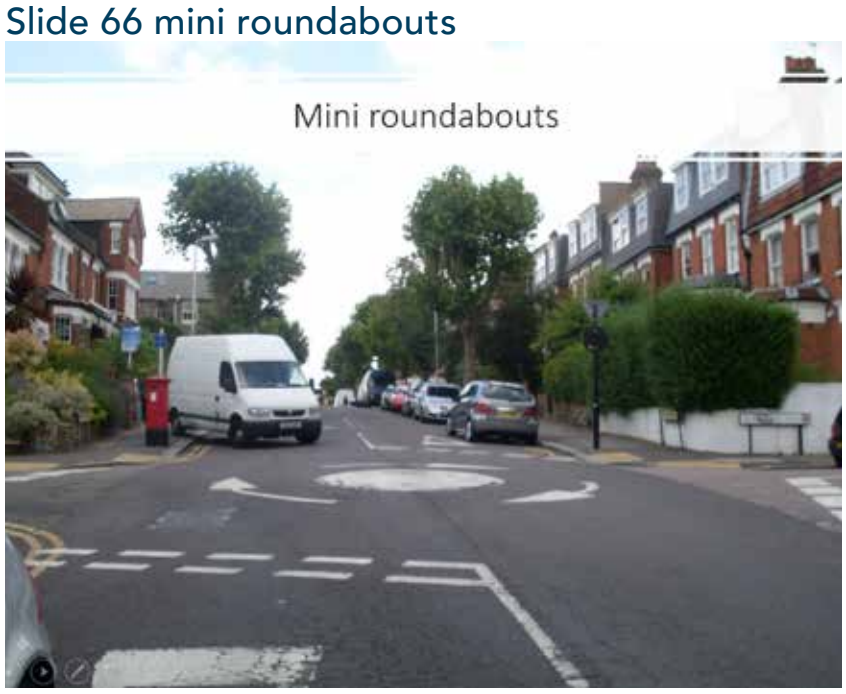
Nothing makes me happier than a new signalised parallel crossing, or whatever they are called, going in. I keep a personal list of my favourites and take pilgrimages to observe new ones. In London they have been hugely successful at attracting cyclists, and have turned quiet back streets leading to them into cycle-dominated thoroughfares. I referred to them in the London Walking and Cycling Design Standards as gateways, and I stand by that. May they go out and multiply across all the difficult roads and lay out a basic network in an affordable and effective manner. They are the pragmatists' dream solution. Please champions, help me build some more.

Slide 65 parallel signalised crossing/junction

I once attended a presentation by a senior French engineer extolling the virtues of mini roundabouts, and explaining philosophically how they worked at the human scale. It was refreshing to hear a French man so passionately support a British invention, but I have to say that I hate them with a passion. Sling shot is the phrase that comes to mind about the way UK drivers manoeuvre through roundabouts, and the geometry seems to support and encourage this.

At this point, I should announce that UK roundabouts are different to those of continental Europe. They are different in that they are much worse. The argument for mini roundabouts is that they slow motor traffic down. They may slow them down slightly, but it comes at a horrible price and that is lateral shifting of positions. This shift can be terrifying if you are cycling near a car. The sling shot effect means pedestrians can't rely on gaps appearing in any kind of moderate flow, so it can be very difficult to cross near them.

Slide 66 mini roundabouts

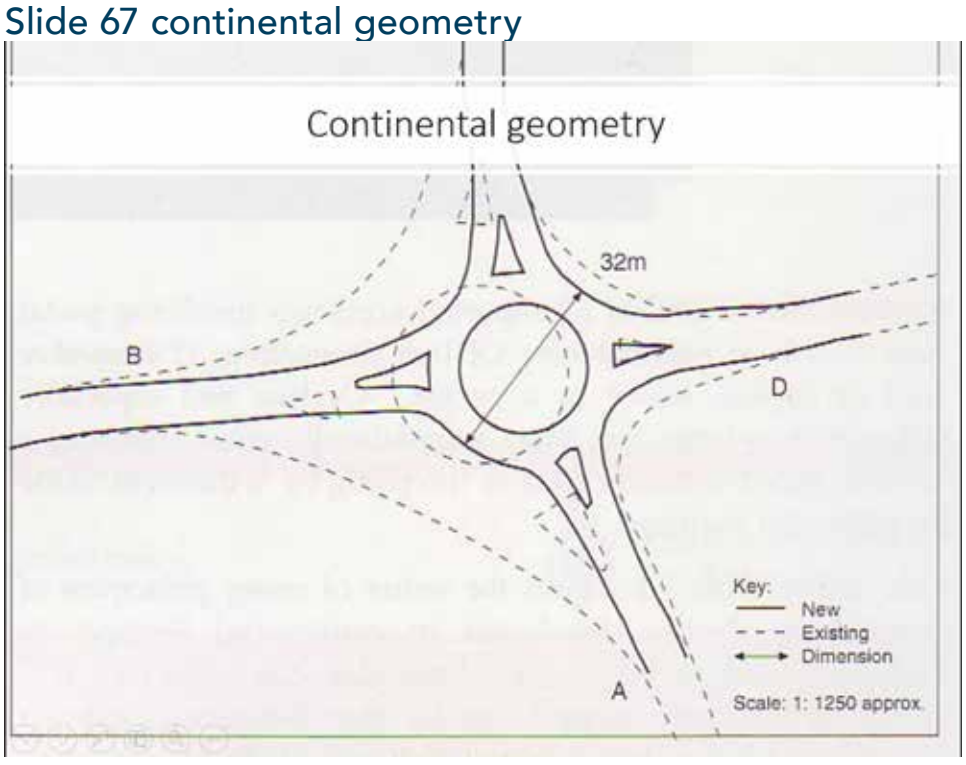


Roundabouts

Standard UK roundabouts have multiple entry lanes, wide diameters and easy exits. Easy in this context means that drivers can hold their steering wheel on lock, and floor it through the junction in a very satisfactory formula-one type way. If you add in free flowing left slip lanes, then you have arrived at the perfect picture of UK roundabout geometry. The Dutch love roundabouts and they also famously love cyclists, so what do they do right that the UK gets so wrong? "Is it possible that I could love a roundabout if a Dutch person designed it?"

Dutch roundabout design is so alien to the UK, that we lump it in with the classification of continental geometry. It is almost as if the UK believes that Europe has different laws of physics to the UK. In continental geometry, approaches and exits are perpendicular with the centre of the roundabout, and tight so there are no full lock easy turns to accelerate through. Different steering wheel positions are needed to get through. Diameters can be much shorter, down to as little as 25m, with central islands being much wider, promoting single circulatory lanes. Clearly the UK Department of Transport is not sure what continent the UK is in, but, champions, you must think European when it comes to roundabouts, as standard UK types are extremely hostile to people who walk and cycle.

Slide 67 continental geometry



If you are choosing to segregate on the approach to a roundabout, then, as usual, you can go Dutch or Danish. The Danes like annular cycle lanes as they do not want to break their law about nearside cycling. Riding around one of these in Copenhagen was one of the strangest experiences of my life, as all the drivers kept looking out for me and giving way. Weird. I would not recommend doing this unless you are in Denmark with Danish drivers, and so you might want to adopt what we refer to in the UK as a Dutch roundabout approach. Dutch roundabouts have protected islands maintaining the segregation and parallel crossing facilities across the entrance and exit lanes. I rode one of these in Holland and did not feel weird, but did feel very safe and protected. In the UK, we built one in a field and tested it and it was a nice ride. It had some major drawbacks though, which have prevented us building one on street so far.

Slide 68 Annular cycle lane

Firstly, it takes up an enormous amount of space and only gives one circulatory lane for traffic, so it is not very efficient. Secondly, the parallel zebras give pedestrians and cyclists priority which is great, but if there is a steady flow of them then general traffic never gets to move. General traffic must give way five times when passing through, to pedestrians, then cyclists, then the roundabout traffic, then cyclists, then pedestrians. It can be a huge struggle getting motor vehicles to give way once in the UK, and so the approach has high aspirations.

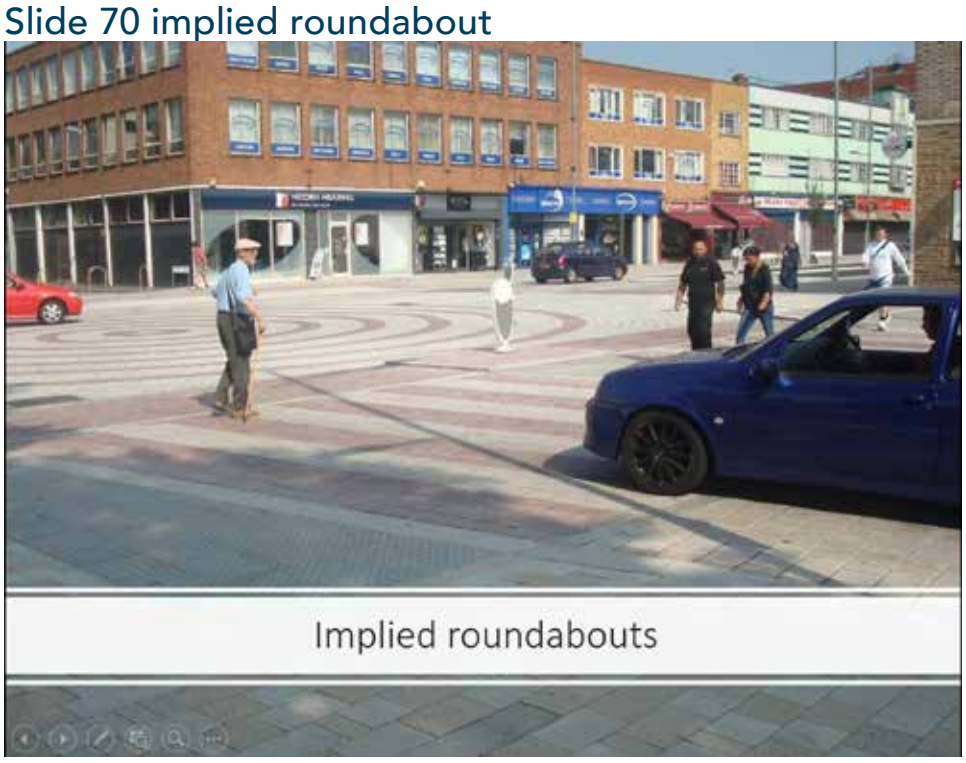
Fundamentally, roundabouts are used in the UK to smooth traffic flow, and this kind of roundabout does the exact opposite. This is great for humanity but terrible for network managers judged solely on traffic flow, and they have the keys to the United Kingdom at the moment and the laws to back them. Other options exist for managing cyclists at roundabouts, including full signalisation, greatly offset crossings and even grade separation, but what can I say: I hate roundabouts so I am moving on.

Dutch roundabouts

Slide 69 Dutch roundabouts

I cannot really leave it there without talking about the new roundabout kid on the block. In this case, it is a roundabout that is not really a roundabout at all. I suppose if it is not really a roundabout, then I might like it? We call them implied roundabouts in the UK, and they are implied through material choice and suggestion, and, in some cases, legally they are priority junctions. All the geometrical regulations can be thrown out of the window as they are not really roundabouts. These seem quite nice to ride through on the few examples we have so far, and seem to work particularly well for pedestrians. There are some which seem to extend the rotational material blocks onto the footway, which look really inviting the cross. This area of roundabout design might convince me, but I am still not sure I would actually build one personally. The only good roundabout as far as I am concerned is one I replace with a priority or signalised junction.

Slide 70 implied roundabout



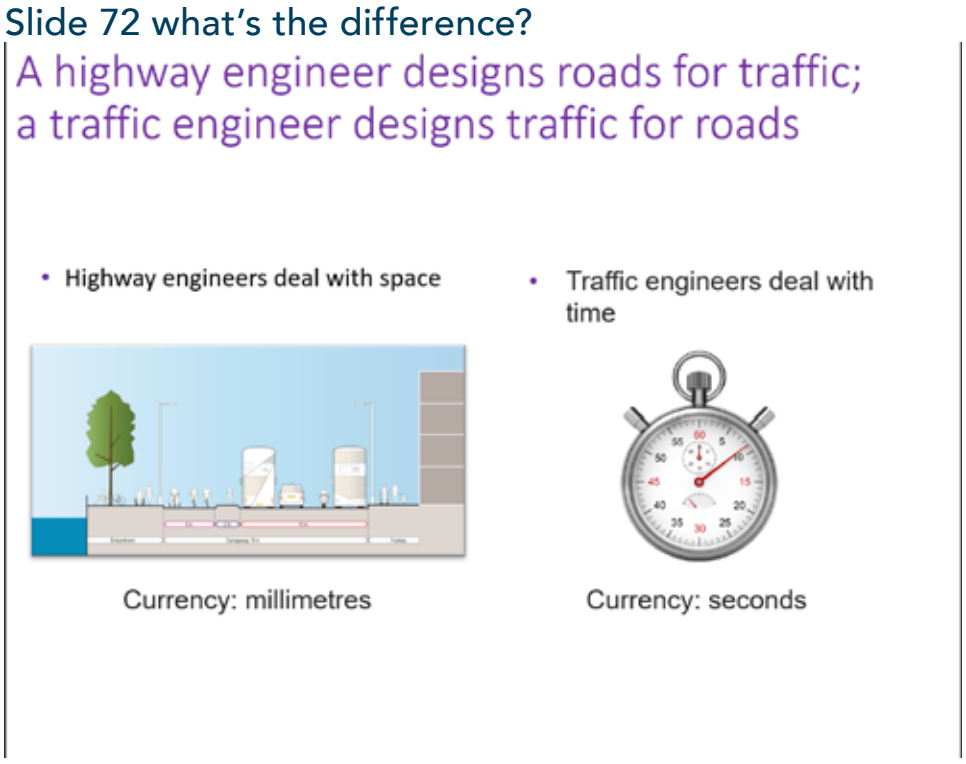
It is finally time to talk about signalised junctions. I am shortly going to go through the options with signalised junctions and step up the level of protection for cyclists through each stage. Eventually, we will reach signalised junction nirvana, although initially the outlook might seem grim. With pedestrians, the key is to have green men invitations to cross on as many arms as possible. This is often left out in the UK, and we will get to the reason shortly. You probably guessed that it has something to do with prioritising cars and you would be right, but wait until we get there. First things first though. Signal junction development is an entire field of study, with its own rules, regulations and terminology, so I am going to give you a bluffer's guide. If you have the basics and you know the principles, then you need never be confused, hoodwinked or mathematically misled every again.

Slide 71 Signal junctions

"What's the difference between a highway engineer and a traffic engineer? A highway engineer designs roads for traffic and a traffic engineer designs traffic for roads." Highway engineers deal with space and their currency is millimetres, whereas traffic engineers deal with time and their currency is seconds. So far we have been in the world of the highway engineer, and it is a tangible three-dimensional world of length, width and volume. We have been asking: how do we add things and what should we take away? We now need to ask: how does it change over time? Dividing priority into time segments that we can control and order. This is the key to understanding signal junction control. Time is a precious commodity in the urban environment, and so deciding who gets it and who gets to wait is an emotive instruction which can make or break the effectiveness of any scheme.

The terms

Slide 72 what's the difference?



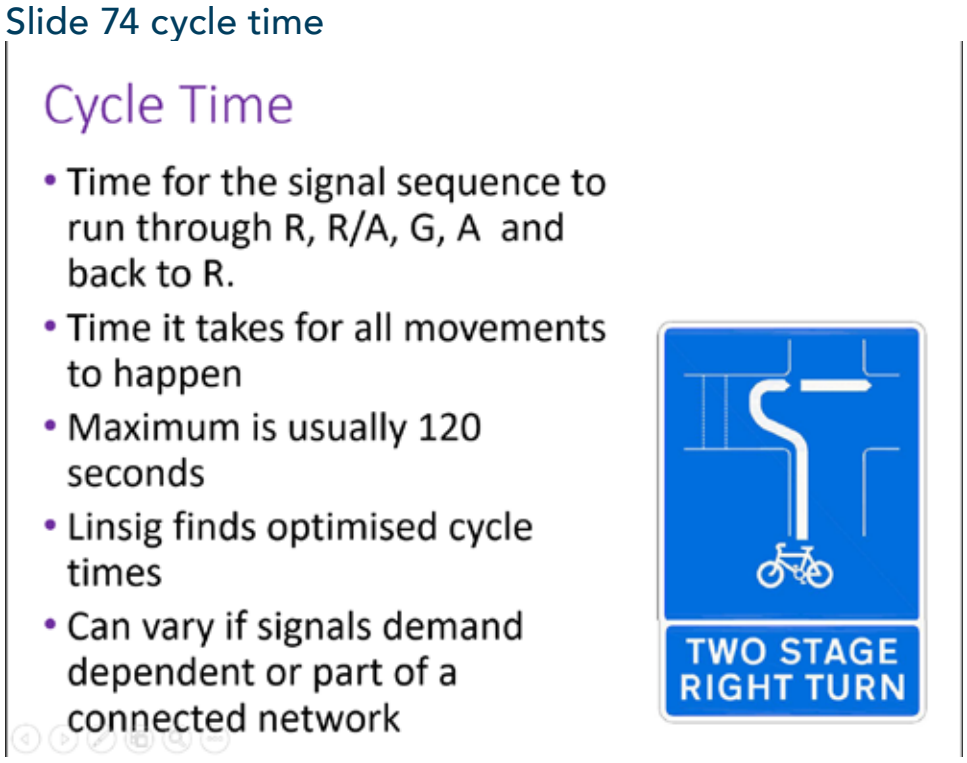
In the UK, every signal junction needs time allocated for the following sequence to run through: red, red amber, green and amber, on each and every junction arm. Two of those sequences have set times: red and amber together is always two seconds, and amber is always three seconds. The other two are the big ones. How long must you wait and how long have you got to move?

Slide 73 light sequence

Everybody gets their turn at signal junctions, and so an overall cycle time is decided which gives enough green time to get all vehicles through each arm. The maximum cycle time in the UK is usually one hundred and twenty seconds, but most signal junctions come in around the 80 second mark. Cycle times can be altered at different times of the day, but we will get to that soon enough. Step by step. Australia is famed for its very long cycle times and we will see how this improves efficiency later.

It is also very annoying if you are waiting, particularly for pedestrians and cyclists – but let's not muddy the traffic management waters with their presence just yet.

Slide 74 cycle time

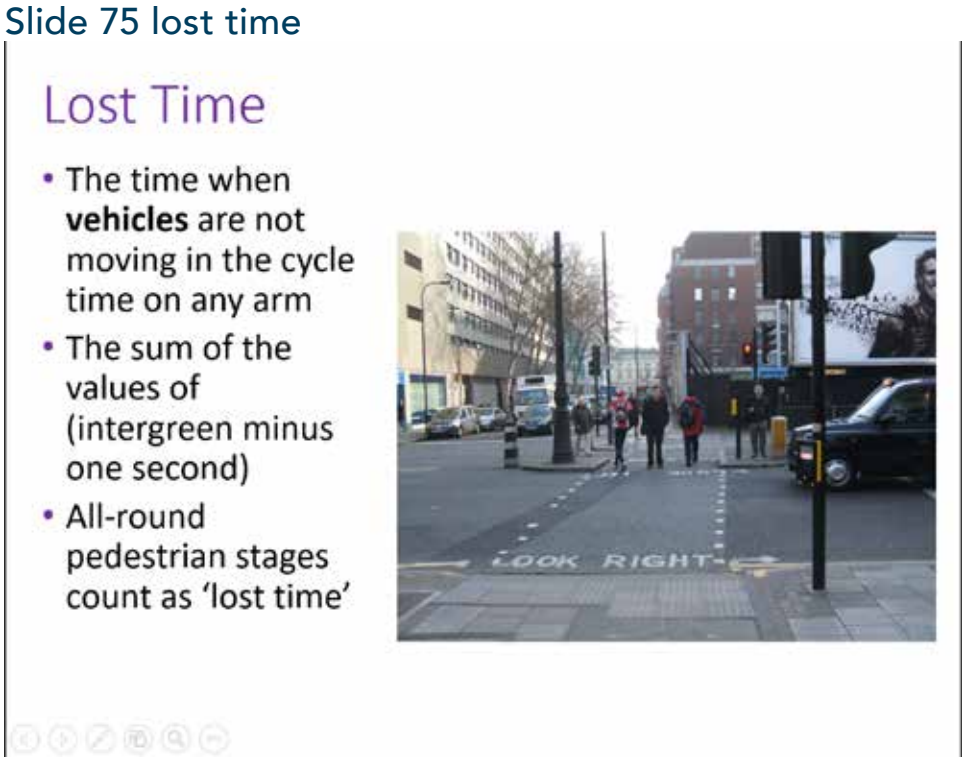


Lost time is the next term that it is worth coming to terms with. Nobody wants to lose our most precious resource, of which we have so fleetingly little in life. Rather than having any existential meaning, lost time refers to any time when vehicles are not moving. Note that cyclists are vehicles, particularly when it comes to UK signal regulations, which can be a blessing and curse. More is coming on that later.

This hints at the real purpose of signalised junctions: to keep traffic moving and so any time when this is not happening is lost. All-round pedestrian stages count as lost time to traffic engineers. From their perspective, moving pedestrians across traffic is something that needs to be endured until they can get back to the real business of pushing metal through. To calculate lost time, you can add up all the intergeen values and then minus one second, and do not forget to add any pedestrian-only stages.

More terms

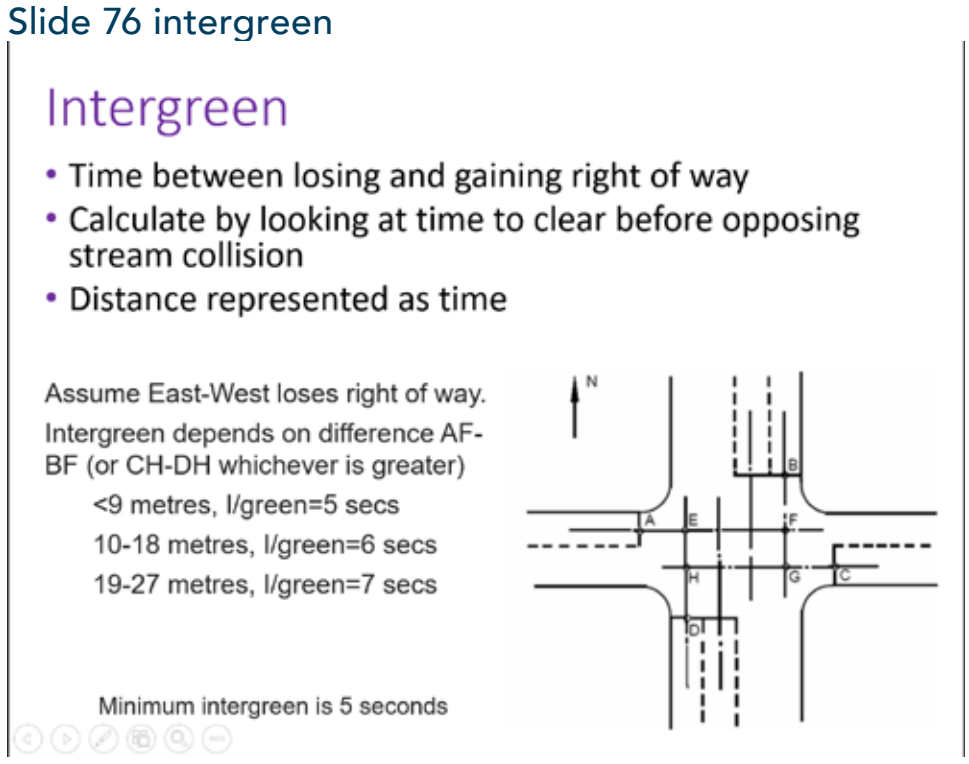
Slide 75 lost time



An intergreen is defined as the time between one arm losing and another arm gaining right of way. You can calculate it by measuring the distance from the stop line that has received a red signal, to a point perpendicular to the arm receiving the green signal. Obviously, if one went red as the other went green then one car could crash into the side of another, so we need to allow time for one stream to clear the area before the other is released. This distance is represented as time, as that is the currency, based on speed observations collected from thousands of signal junctions.

In the UK, if this distance is less than 9m, then the intergreen is 5 seconds. If it is 10-18 metres, then it is 6 seconds, and if it is 19-27m, then it is 7 seconds. "What difference does a second make?" I hear you ask. Well, seconds literally count in traffic engineering. If every vehicle is delayed 1 second in every cycle, and there are ten thousand vehicles a day, then that adds up to a cumulative delay of close to 3 hours. We will look on Day 3 at how this is quickly converted into a monetary value, based on the value of time associated with motorists, but for now just know that delay can build up and cause congestion, which we will define shortly. Hold on tight, it is coming.

Slide 76 intergreen



You cannot hold a conversation with a traffic engineer, and trust me you are going to need to if you want to deliver benefits for walking and cycling, without understanding phases and stages. A phase is defined as a specific movement that has a unique signal identification, which in plain English means any movement that always goes at the same time. It can help to think of a phase as all the possible movements that can be made at a junction.

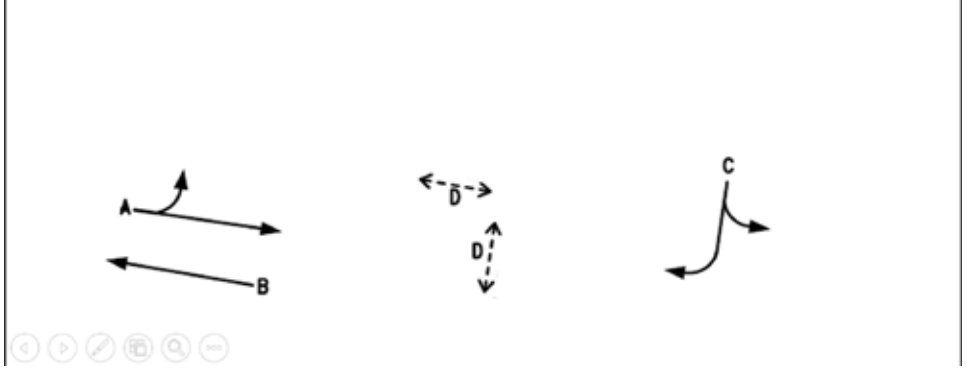
Draw a junction and then draw all the movements. We usually use letters to classify them, so letter your movements A, B, C, D. Any movements that always go at the same time, you can group under one letter and they are locked together as a phase, never to be parted. For example, if you have a single lane junction approach and all movements are permitted: ahead, left, right, then those three movements could be grouped as one phase. They can be grouped on multi-lane approaches as well, but then you would lose the flexibility to add more time to certain movements, and release other non-conflicting movements. Phase allocation is the key to understanding signal junction control. So do not move on from this section until you have got it. Promise me.

Even more terms

Slide 77 phases

Phases

- A specific movement that has a unique signal identification
- Any movement that always goes at the same time
- Can help to think of it as all the possible movements at the start then group them depending on your method of control
- Usually given letters on a method of control



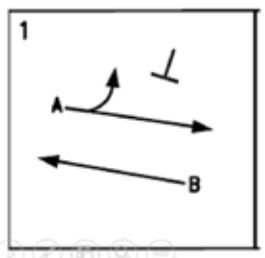
Non-conflicting phases can be grouped into stages. Phases make stages is my catchphrase, which even now I say in my head, as the two are so often confused. By conflict, I mean any movement which shares the same trajectory as another movement. The definition of conflict is where two or more objects want to be in the same space at the same time. In the UK, all conflict, apart from opposed right turns, is banned through regulation and this sounds like a safe situation.

It means we have long cycle times and short green times, so traffic builds up as we try and fit all the non-conflicting phases into different stages. In most of the world, a common practice would be to let vehicle-turning phases happen at the same time as exit arm pedestrian crossing phases. This saves on lost time and reduces cycle time, which sounds good but does mean that pedestrians are crossing in between cars. This is theoretically unacceptable in the UK, although as a result we have very high numbers of jay walkers, as pedestrians seem to have little patience when waiting for their non-conflicting phase. Stages are usually numbered. Again, do not ask me why, they just are.

Slide 78 phases make stages

Stages

- The period in a cycle that gives right of way to one or more traffic movements
- Non conflicting phases can be grouped into stages. (opposing right turn)
- Usually given numbers
- Phases make stages

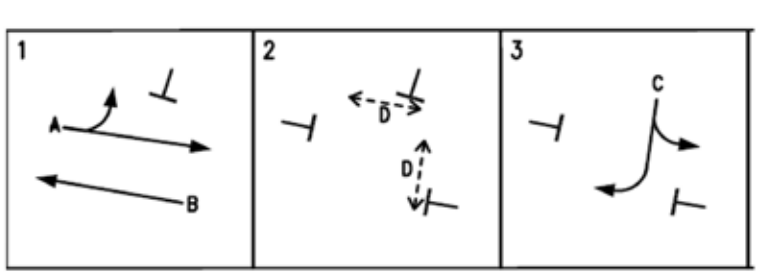


Are you getting all this? Good. When phases are grouped into stages, these stages are then ordered, so that everybody gets their turn to move through or cross. The order stipulates the number of the stage. This is called the method of control, and shows how you plan to organise time for people to pass through a junction.

Slide 79 method of control

Method of Control

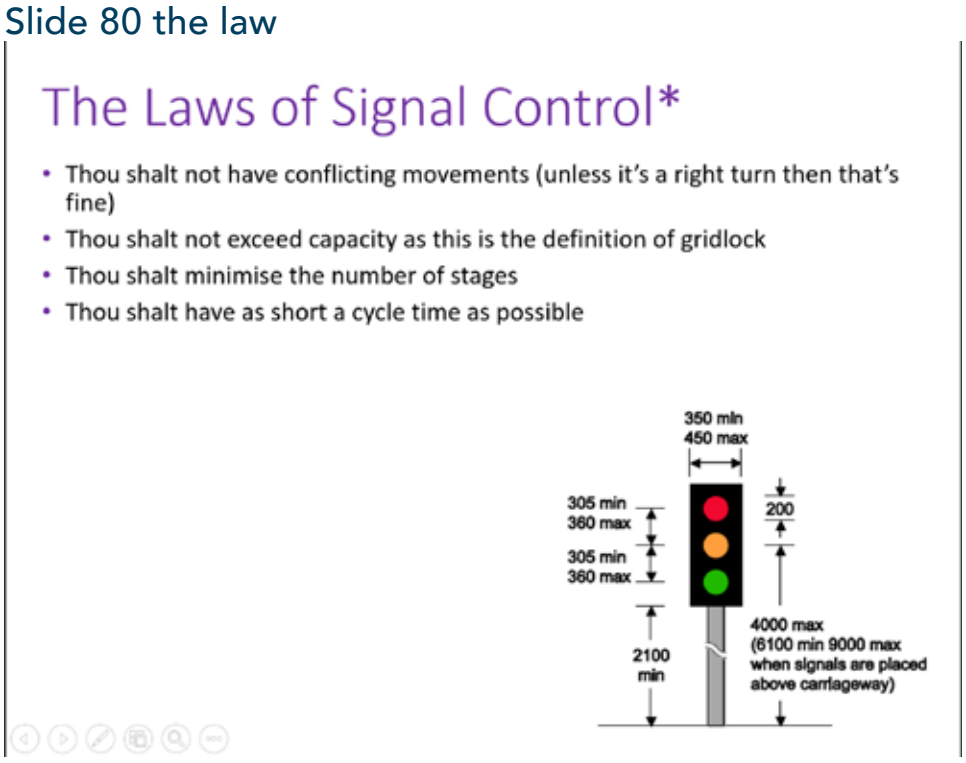
- A diagram showing how the junction works
- Made up of phases and stages



The golden rule is to minimise the number of stages, as every time you switch between one stage to the next, you need an intergreen period, and this is lost time. Having lots of lost time means the junction is not very efficient at moving people. The two basic laws of traffic signals design are therefore: thou shalt minimise conflict, and those shalt minimise lost time.

Method of control exercise

Slide 80 the law



Slide 81 exercise MOC

If you group two or more phases together in the same stage, but they have different intergeen periods, then this is called a phase delay. It basically means you are delaying traffic when you do not have to, and so you are reducing the efficiency of the junction. If it stops you using another stage however, then it is definitely worth it. It helps to look at method of controls as logic puzzles with simple rules. I have been waiting for the traffic engineering app for children for years. It is so much fun.

To an extent, a traffic engineer can lose any sense of responsibility about the layout and just maximise the throughput in as efficient a way as possible. In the walking and cycling world, many people ask for dedicated walking and cycling stages. Or maybe they will get confused and ask for dedicated walking and cycling phases. This will rub most traffic engineers up the wrong way, as their life's work is to minimise the number of stages to promote efficiency. When we eventually get around to the design of signal junctions, I will show you a few ways to have your cake and eat it in this area.

Slide 82 phase delay

Dividing up green time for everyone is controversial, as everybody wants more time to get through and enough time to do their manoeuvre. The amount of green given to any specific stage referenced against the total cycle time is referred to as the green split. Cyclists need their fair share of green split. particularly if they have been given their own stage. I once fought against a scheme which provided separate time and space for cycling. That is to say, segregation up to a junction and a separate stage to pass through it. In this instance, the minimum green time of 7 seconds was given to cyclists. This sounds like a reasonable time to cross a junction but in this case cyclists made up over 40% of the traffic on a busy connector road. The segregation forced cyclists to queue up in line and so each time they received a green signal in the cycle only stage, ten cyclists would legally be able to make it through. The rest might then decide to jump out of the segregation and go through with general traffic, which might have safety issues.

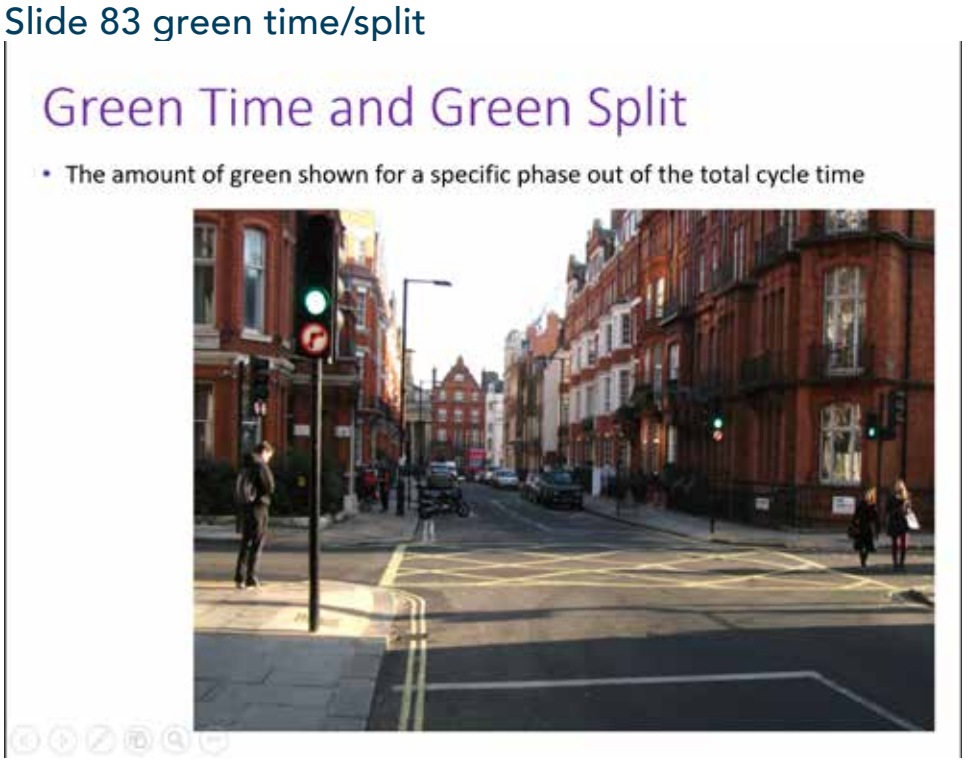
Green split must be apportioned as a ratio of flow. Cyclists are vehicles and so they need a high enough green time to get them all through. Beware minimum green times. You may well be delighted to get separation in time for cyclists, but if they have to wait for ages and they see general traffic getting more time on the same approach arm, they may well start undertaking risky, unanticipated movements.

Time is everything at signals. Waiting time is quantified

Spliting and fixing time

in highway economics, and there is no more frustrating a waiting time than the wait for the signals to change. A minute can seem like an hour. Most cyclists will start getting twitchy after 30 seconds; you need to be aware of this if you are to provide for them properly. Minor signalised Dutch junctions often work with 20-second, two-stage sequences, with conflicting pedestrian stages on turns. These are much less frustrating than common UK practice.

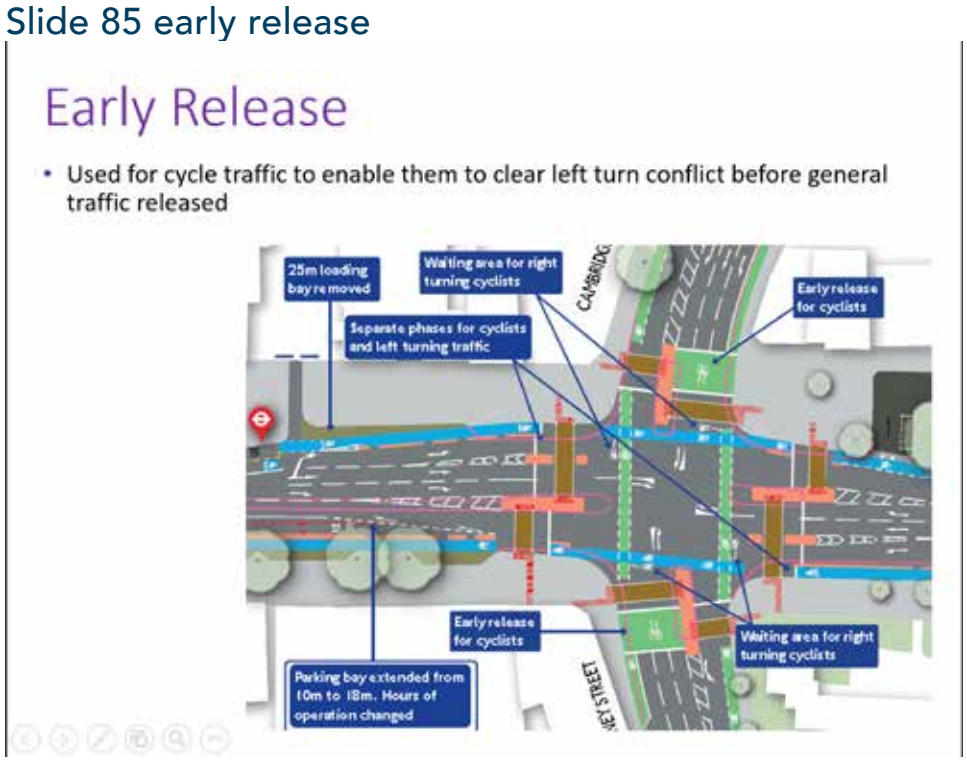
Slide 83 green time/split



Early cut off means that one or more phases that were sharing the same stage are stopped, but one of the non-conflicting phases continues into the next stage. This is common for opposed right turns in the UK, as they may have been unable to move across the junction because of opposing ahead traffic. This should not be confused with early release when one phase is released ahead of its main stage. A walking and cycling specific version has been trialled in the UK and I will talk about this soon.

Slide 84 early cut off

Slide 85 early release



Next up, you need to understand the plan, which in traffic signal terminology refers to the timings given to each stage during the day. There are fixed time plans where settings have been predesigned. Traffic signal controllers can switch between different fixed plans at different times of the day. For example, a tidal flow, commuter-style, fixed time plan might allocate more green time for vehicles heading into town in the morning, and then switch for those leaving in the evening. It might also split fifty-fifty during the day.

Slide 86 fixed time plan

A plan can also be responsive, in that it applies a suitable plan from a collection of pre-set ones based on real time traffic monitoring.

Time plans

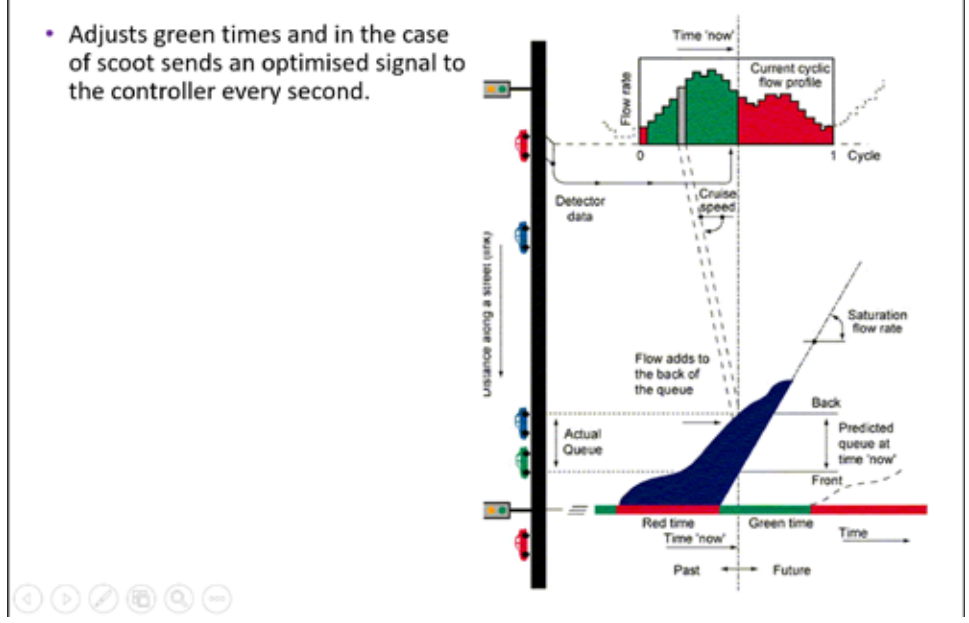
Slide 87 responsive plan

It might even be fully responsive, and adjust green times based on live traffic information. In London, they use a system called SCOOT, which stands for Split Cycle Offset Optimisation Technique, and I hope by now that this jargon is starting to make sense. Loop detectors are placed on junction approaches, and these pick up the presence of traffic and then send this demand information to the signal controller every second. So, if a long queue forms, then it will allocate green time until it goes away.

I found myself in Transport for London's traffic control centre during the Olympic games of 2012, where we had to hold traffic for 10 minutes on an extremely busy main road corridor while the torch relay passed. It was genuinely thrilling to then switch on one arm for 4 minutes to let the 5 mile queue clear. It was not as thrilling for the pedestrians waiting to cross the road, and I still feel guilty for prioritising the movement of traffic on the one time my hands were on the controls.

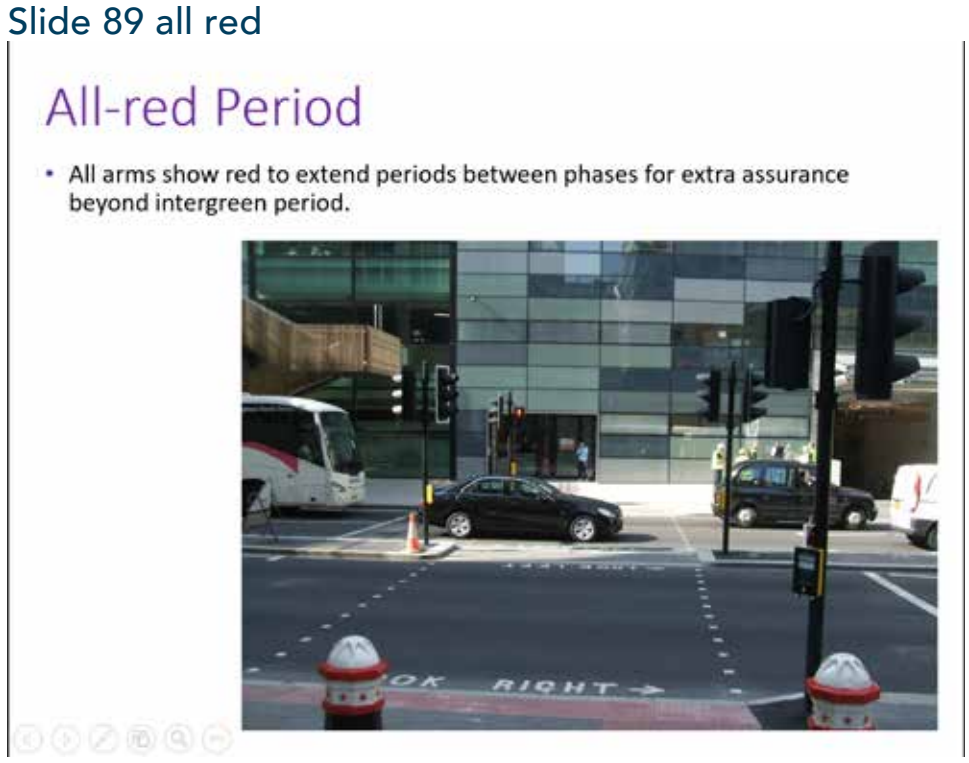
It was an Olympic priority road, and, in my defence, we did promise the IOC that we would keep it flowing, so please forgive me. In London, they are in the foothills of walking and cycling SCOOT. Whether the general traffic queue takes precedence over the queue of cyclists is up to the computer algorithm to decide. If you do not think your fate is tied to any algorithms, then you really have not been paying attention to the world.

Slide 88 fully responsive plan



Signals can also have an all red period as a failsafe, telling everyone to just stop. Intergreen periods can be extended in this way. This should not be confused with all green stages for pedestrian crossing movements, which are generally called to allow for pedestrians to cross diagonally safely.

Slide 89 all red



There is a strange time that exists in UK signal junction design called the blackout period. This relates to pedestrians mainly, but is relevant to cycling, particularly when countdown is in place. At a pedestrian crossing, in the UK, a green man signal presents a formal invitation to cross. Note how polite UK signal terminology is. The American Walk or Don't walk instruction is far too blunt an instrument for our delicate and refined manners. A few seconds after being formally invited to cross by her majesty's government, this invitation is rescinded when the green man goes blank. This is because pedestrians or cyclists are no longer being invited to cross, as they

Still more terms

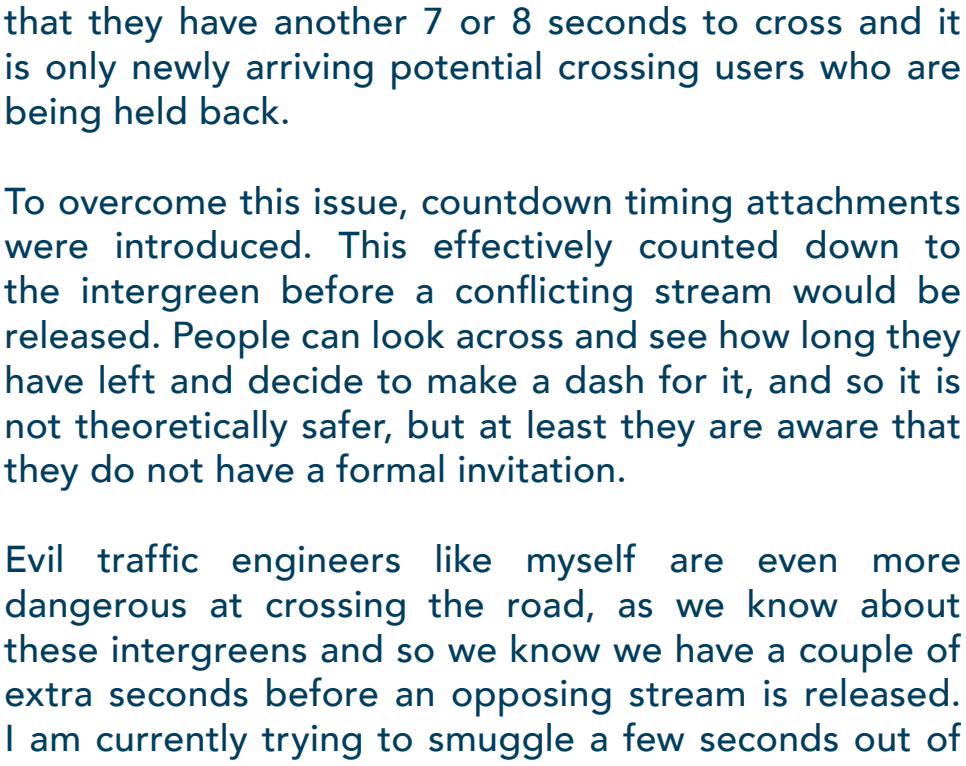
will never make it to the other side in time. Pedestrian crossing speeds are judged as 1.2 metres per second in the UK, so if the crossing is 10m wide, then at least 12 seconds is needed.

Local authorities have the option of using 1 metre per second to give people more time to cross the road, but they rarely choose to do it as, you know, cars would have to wait. Pedestrians can get anxious during this blackout, as they may feel another traffic stream is about to be released at them. They may not be aware that they have another 7 or 8 seconds to cross and it is only newly arriving potential crossing users who are being held back.

To overcome this issue, countdown timing attachments were introduced. This effectively counted down to the intergreen before a conflicting stream would be released. People can look across and see how long they have left and decide to make a dash for it, and so it is not theoretically safer, but at least they are aware that they do not have a formal invitation.

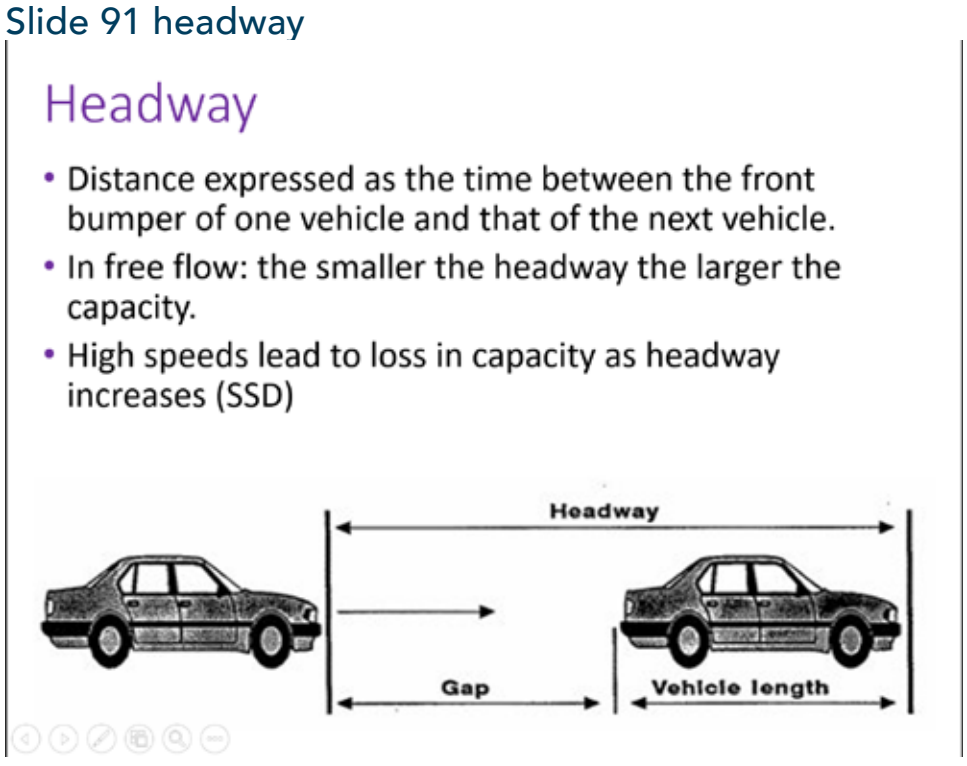
Evil traffic engineers like myself are even more dangerous at crossing the road, as we know about these intergreens and so we know we have a couple of extra seconds before an opposing stream is released. I am currently trying to smuggle a few seconds out of this strangely unregulated blackout period to extend cycle stages. It is a murky business in the UK trying to find time and get multiple uses out of the same second.

Slide 90 blackout



There are still a few more concepts to grapple with before we are fully armed. Headway is the distance between the front of one vehicle and the front of the one following. In free flowing conditions, the smaller the headway, the higher the capacity. Put simply, the more tightly they are packed, the more you can get through. Contrary to what drivers would have you believe, greater speeds lead to less capacity, as the headway increases in order to maintain a safe stopping distance. If you have found yourself driving on a motorway, perhaps on a bank holiday leisure trip, as I cannot bear to think of you driving to work, you may have wondered why speed was being limited when the conditions do not look too congested. It is to minimise the headway and increase the capacity, to stop congestion forming downstream. Headway is a distance, but like all traffic engineering terms, it is expressed as a time, in this case the time for a vehicle to move the headway distance.

Slide 91 headway



Saturation flow is the maximum flow through a junction when it is performing at its best. When a traffic signal goes to red and amber, drivers have to wake up and react. In the case of cyclists, they react a lot more quickly and so clear through junctions much quicker than drivers, who have to engage engines, drop the hand brake, stop adjusting the radio or playing on their phone and move off. This reaction time is lost time. They must then start moving and get up to speed.

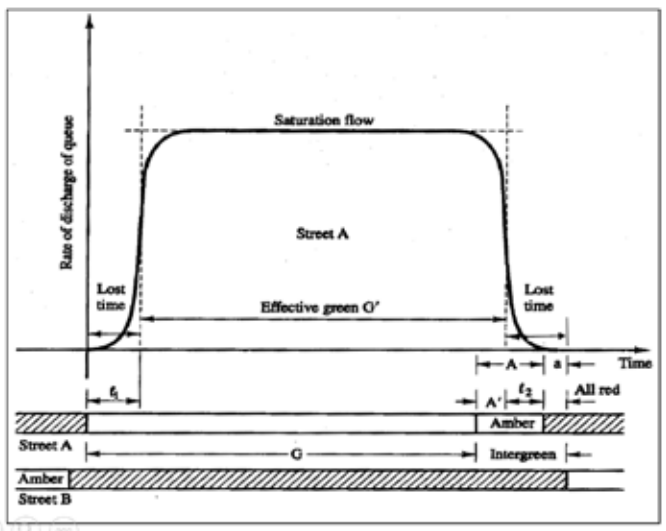
At some point, the arm in question will flow at its maximum smooth throughput, and this is the saturation flow. This is a key measurement for junction analysis, and varies for every junction, depending on layout, context and conditions. Once the amber signal comes up, drivers must react again and slow down or stop. Or potentially try to race through knowing they have 2 seconds until it's illegal.

Degree of Saturation

Slide 92 sat flow

Saturation Flow

- The maximum flow through a junction (at its best)



Capacity is the measure of the maximum discharge over a stop line in a given time. It is the saturation flow expressed as a ratio of the allocated green time to the total cycle time. Obviously, one arm is not always running, and capacity just corrects for this reality to give you a workable value.

Slide 93 Capacity

Capacity

- The maximum discharge over a stopline in a given time.
- The fewer the stages and the longer the cycle time the higher the capacity

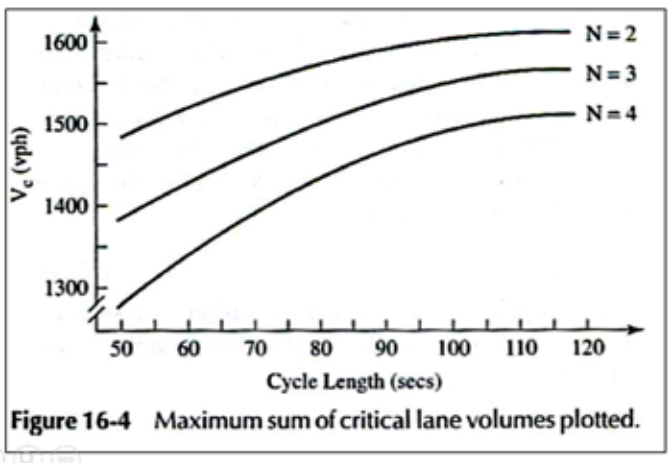


Figure 16-4 Maximum sum of critical lane volumes plotted.

One of the key junction performance indicators worldwide is the RFC value: the Ratio of Flow to Capacity; also known as the degree of saturation. It is a ratio of the actual flow, or, if you are modelling, then the estimated demand flow, to the maximum potential flow or capacity. Any walking and cycling scheme that adversely affects this figure usually gets dropped or radically changed. If a civic authority asks for this figure, then the movement of traffic is paramount to their concerns. This is the great unwritten law of signal control: thou shalt not affect capacity. If demand flow or actual flow exceeds capacity, then this is the definition of gridlock. It is a simple supply and demand problem. The magical value for this ratio is 85%, as this means that there is enough capacity to cope with the flow and some slack is given to reaction time. This is the hallmark of an efficient junction. This is the bottom line figure. Walking and cycling schemes demanding space and time tend to affect this adversely, and so, at this point, a robust defence is needed, particularly if the model shows the degree of saturation is over 100%.

Slide 94 DOS

1. **Saturation Flow**
   a) Measure time between 4 and 10 cars passing stop line then divide by 6
   (NB count buses and HGVs as 2 cars)
   =_____(seconds)
   b) Convert to number of vehicles per hour 3600/time
   =_____(vehicles per hour) Saturation Flow

2. **Capacity**
   a) Measure green time for study arm
   =_____(seconds)
   b) Measure entire cycle time
   =_____(seconds)
   c) Divide green time by entire cycle then multiply by saturation flow
   =___(vehicles per hour) Capacity

3. **Degree of Saturation**
   a) Measure the actual flow for a peak hour period (15min count x 4)
   (NB trainer will give you this figure)
   = _____(vehicles per hour) Flow
   b) Divide Flow by Capacity
   = _____ (Ratio of Flow to Capacity) Degree of Saturation

Being over capacity is not the end of the line for walking and cycling schemes, although sometimes it might feel that way. If you find yourself in the computer says no bracket, then you have some cards to play. Traffic reassignment and area strategic modelling can help you out of a fix. If you cannot make things work locally, take a wider network view. We will look at this on Day 3.

At this stage, remember the adage that you can design the traffic for the road and not just the road for the traffic. Banning turns can free up capacity, particularly if you ban right turns, as these are the ones that tend to cause the most delay. If you are modelling and using standard modelling software, then be aware that it is very sensitive to lane widths and turning radii, although if you have been paying attention you may not want to make this compromise personally.

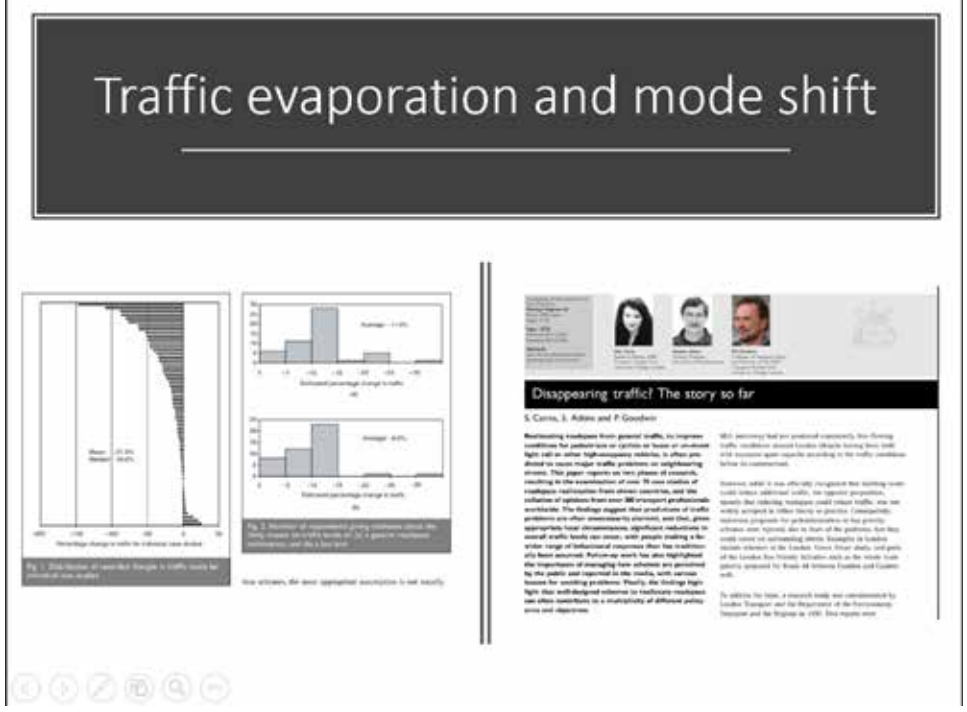
Going over capacity

Slide 95 what to do if over capacity

Some movements are strategically important, for example those carrying public transport, and so you can allocate more green time to these and perhaps sacrifice the flow on less important arms, forcing it to redistribute. With any redistribution, the issue is finding out where the traffic will reappear. There is lots of international evidence suggesting that if you make a positive transformational change to a place, then approximately 10% of the traffic might just disappear and not reappear on the network, perhaps due to people switching to walking, walking and cycling, or public transport.

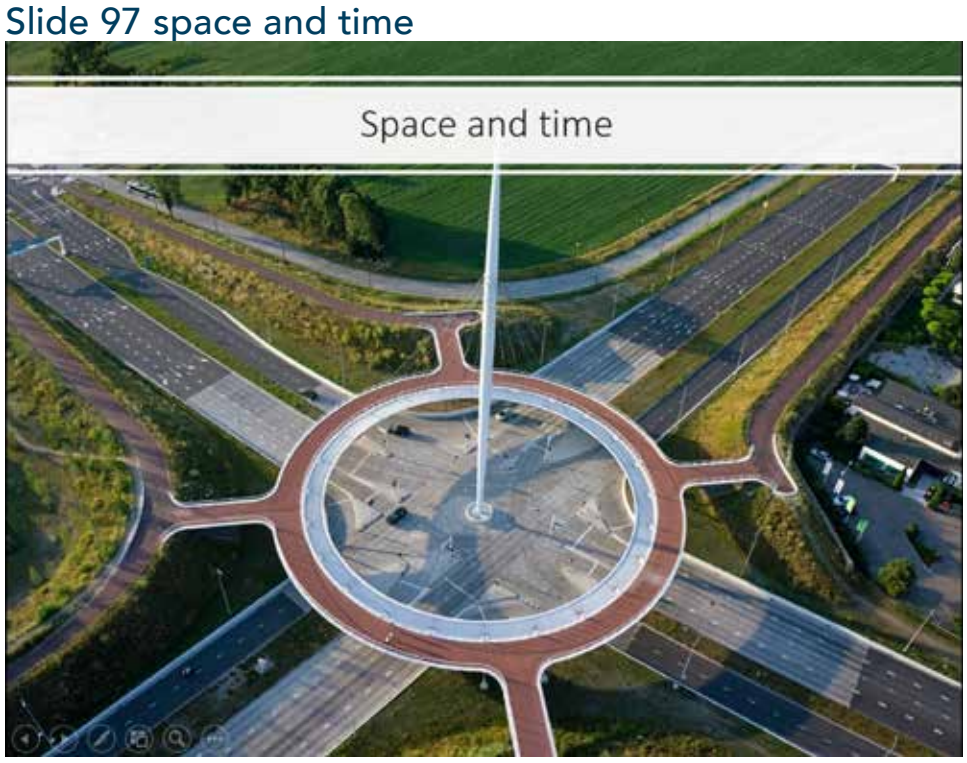
Convincing traffic engineers about traffic evaporation can be a very tall order, and you might instead scare them into thinking you are a lunatic, so play this card with caution. The key is to find out early, so you can plan and make a case. Do not find out two years after a project has started and you have spent hundreds of hours pushing it through. This is a costly waste of public funds. If you want to make time and space, then you need to assess the impact on capacity early and plan your case.

Slide 96 traffic evaporation and mode shift



Thanks for bearing with me through that terminology trawl: it helps make this next part a lot briefer and easier to interpret, as I do not have to keep stopping to define terms or describe them in full. All this will help you champion walking and cycling schemes, believe me. Do not leave it up to those with specific skills, as they are all trained to do the opposite of what people want. You need to challenge the maths and debunk the bad science. Evidence is on our side. We can have space and time.

Slide 97 space and time



In the UK, up until 2012, if I wanted to protect cyclists at junctions I had two choices: I could either keep them on carriageway and do nothing for them, or take them onto the footway and convert pedestrian crossings into shared-use crossings. The former offered no safety benefits and left cyclists open to all known common collision types, and the latter annoyed and delayed cyclists, and gave them the message that they were a

History of protection

nuisance and that there was nothing we could do to help. Cyclists were instructed formally to behave like the rest of traffic or become a fake pedestrian. Neither were particularly enticing prospects.

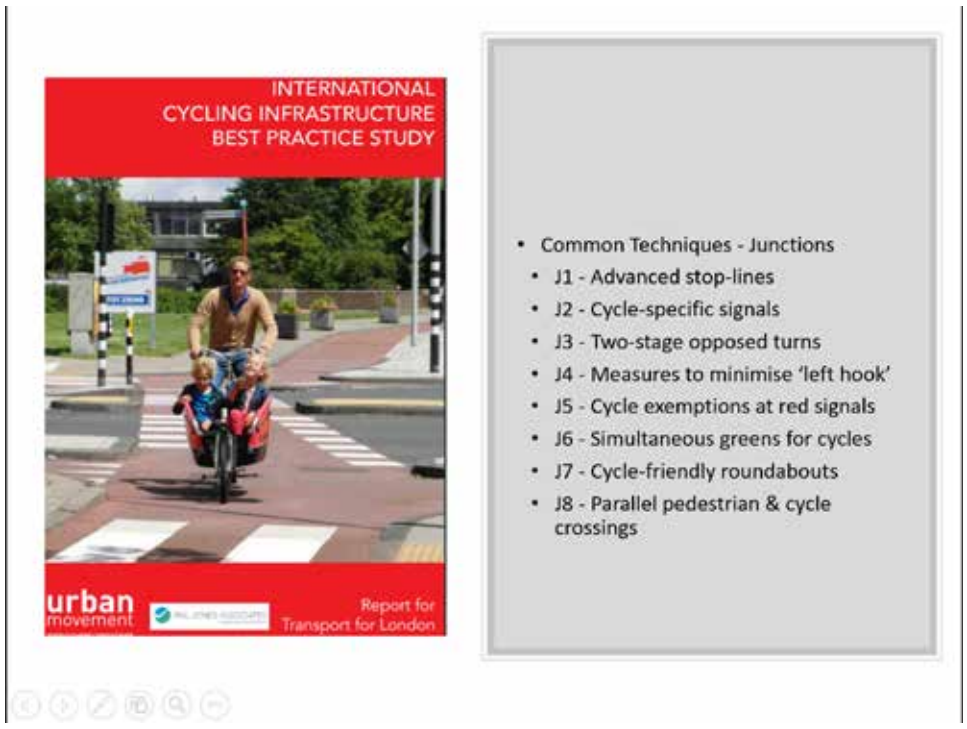
Slide 98 in the beginning

Fortunately, this approach to junction design was not shared with countries who promote walking and cycling, and so it was my generation's responsibility to find out what they were doing right and then try to replicate this in our own context. When I promoted light segregation, I personally felt I had all the link tools I needed, but I was still embarrassingly without answers at signalised junctions.

Slide 99 2010 to 2014

When I joined Transport for London, I joined the crusade to do something about this. I am going to share this tale now and, although it is London focussed, it should help all champions, wherever you are, as it will show how we translated Dutch and Danish junction designs into UK practice. You simply cannot transplant them wholesale. You need to consider context, culture, behaviour and regulation and embrace the conceptual form rather than the layout specification.

Slide 100 ICIBIBS



London junction design was led by our attempts to resolve hook collisions at signal junctions. In particular, left hooks were significantly over-represented in collisions that resulted in fatalities. The concept of a hold the left junction was formed. It was originally championed as an eliminate left hook junction design by the London Cycling Campaign, but I happened to be writing the cycling standards at the time so my sillier title has stuck.

I wanted to mimic the polite formality of signal junction instructions, as shown earlier, and so in my mind I pictured a city gent waving a newspaper and saying: I say, old chap, would you mind holding the left whilst I pass? I should stress that this concept was not my idea, but I was involving in its testing and implementation. A lot of technically brilliant people helped make this happen, and I just tried to help push things along and add my knowledge to the movement.

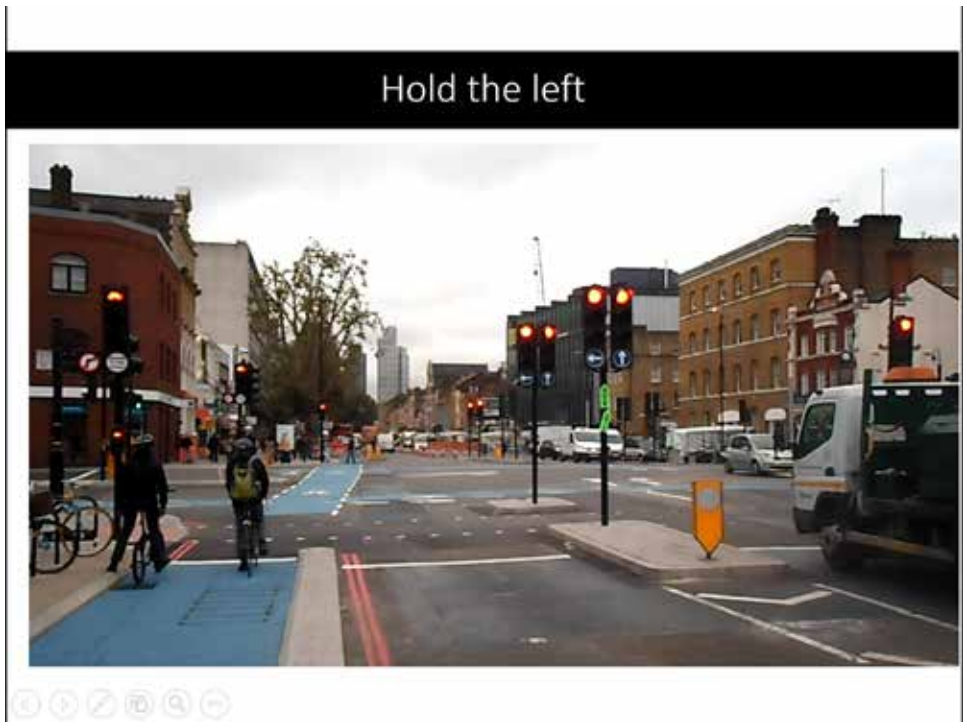
Hold the left

Slide 101 hold the left design

A hold the left junction has some unique properties, and minimises delay for cyclists whilst providing them with full protection in time and space. It even does this without taking away too much capacity, as cyclists move ahead from segregation when general traffic moves ahead. Left turning general traffic is held, and comes in after the cycle stage has ended. As cyclists move with the main flow of traffic they get more green time with less impact than if they were waiting for their own stage, and so everyone is a winner.

If you cannot resolve the left hook, then take it out of the equation. Quite simple really and yet it took us a long time to get there. One of the walking and cycling campaigners suggests that he came up with the idea when lying on a foreign beach, and I cannot verify this or deny it other than to say whoever, whenever, whatever, it works – so thanks! The only downside to this ingenious approach was that it needs lots of space and many splitter islands to house all the signal posts separating the different movements. It means it is not really applicable to many street contexts. If you do want to get cyclists through major junctions then you really need to think about major transformational changes.

Slide 102 Hold the left built



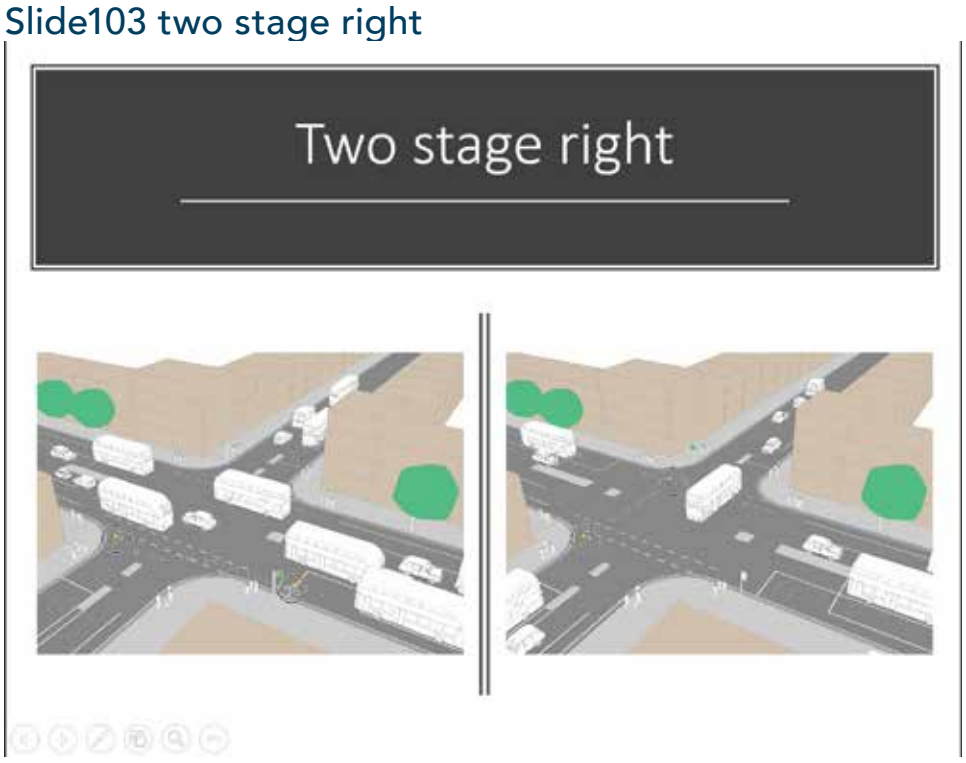
The hold the left approach does a fantastic job of protecting cyclists in the nearside segregated position, but what if they want to turn right? At this point, being pinned to the left is a major hindrance in positioning terms, which is why we closely examined the Danish two stage left turn and quickly translated it as a two stage right. This approach involves giving cyclists a signal to move ahead with traffic, but then requires them to do a little twisty turn stop and wait for the far-sided signals across the junction to signal them to move. Cyclists are then ahead of general traffic and so can glide across the junction before they are caught up.

This is the way all left turns at signal junctions in Denmark must be undertaken. It is the law. Everybody knows it and everybody does it. Cyclists expect it and drivers always know that cyclists will be in the nearside position, and that some of them will be undertaking this manoeuvre. If you are not born with the inherited learning of doing a twisty turny stop, then this seems about as natural as bowling rather than throwing a cricket ball. That is to say: not very natural at all.

Moving away from your intended destination to get there is a headache inducing concept. I have demonstrated this movement personally to fellow cyclists over fifty times and every time they look at me and say: that's not right, surely? Anti-intuitive movements can be safe, but they take a lot of learning. It always confused me in Denmark until I picked up on the little flick hand gesture two stagers were doing and then it became easier, but still weird.

Two stage right

Slide103 two stage right



In the UK, we have combined this approach with what we call early start. That is to say that the cyclists get a small time advantage over the rest of traffic on the same arm, in order to move forward and reach first stage position. This helps avoid left turning vehicles. We decided four seconds was about the right time to do this, which sounds reasonable. The only issue is that this reason might not be translated to the street, where we cannot stop every cyclist and explain two stage rights and early starts to them.

I actually saw a member of the British Transport Police stop a cyclist who was on the outside of two lanes and explain to them that if they looked nearside then there was a small set of signals just for cyclists which would give them a four second advantage. Once the cyclist realised they were not being picked up for an infringement, they looked with utter incredulity at the officer, suggesting who cares?

At this point, champions should not be disheartened, as you need to remember that you are designing more to encourage people to cycle, whilst maintaining a duty of care for those that do it already. Some cyclists get along just fine without minor time advantages. Others need advantages even to consider giving cycling a try. But all cyclists should get some advantage, whether they think they need it or not. The jury is still out on whether the two-stage approach will be a success in the UK.

Slide 104 2sr built

Our signs probably do not help much, as they ask people to turn right in two stages. I spent a good portion of this chapter explaining what a stage was, but, alas, I have not done this to the whole cycling community. Beware of letting jargon creep into public communications. Maybe saying stay left to turn right might have helped, or maybe people will just learn to do it organically. We have to test things, but we also have to learn quickly from the testing, as cyclists need protecting and we need more tools to do so. Two stage rights are again fairly capacity-neutral. The couple of seconds of time advantage is not too much of a strain, and the four seconds includes 2 seconds of red and amber lost time for general traffic. So in a way we are making lost time usable for cyclists who are much quicker on their toes to take advantage.

Slide 105 2 sr video

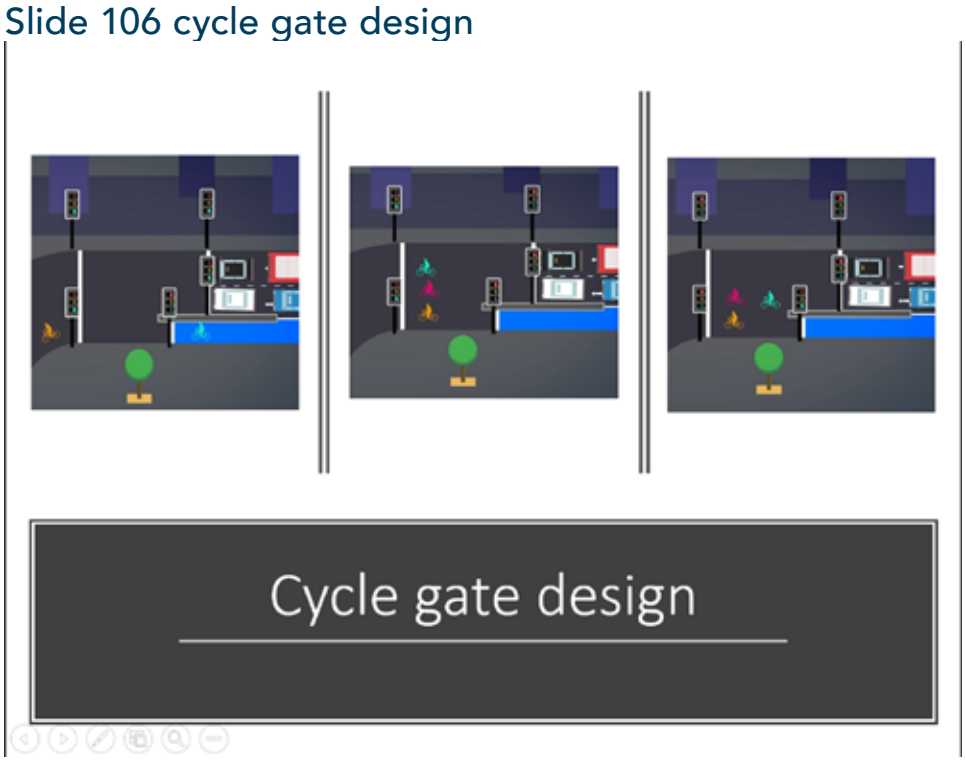
Another reasonably capacity-neutral solution we developed in London is the cycle gate. This approach

Cycle gate

had a controversial birth as we used it at a site where there had been a series of cycling fatalities. Engineers had to come up with something quickly, but leaders were not ready to affect capacity and bus journey times, so the gate was born. A cycle gate effectively meters cyclists towards the front of traffic stop line at a time when general traffic is stationary. Traffic is held at another stop line approximately 17 metres away. When lights go green for general traffic, cyclists then have an early start advantage as they are 17m in front.

The controversial element is that cyclists who arrive when the arm is green get held at a gated red signal as it is no longer safe to filter through the junction without the risk of being hooked. Cyclists therefore get an advantage, but also get a guaranteed delay.

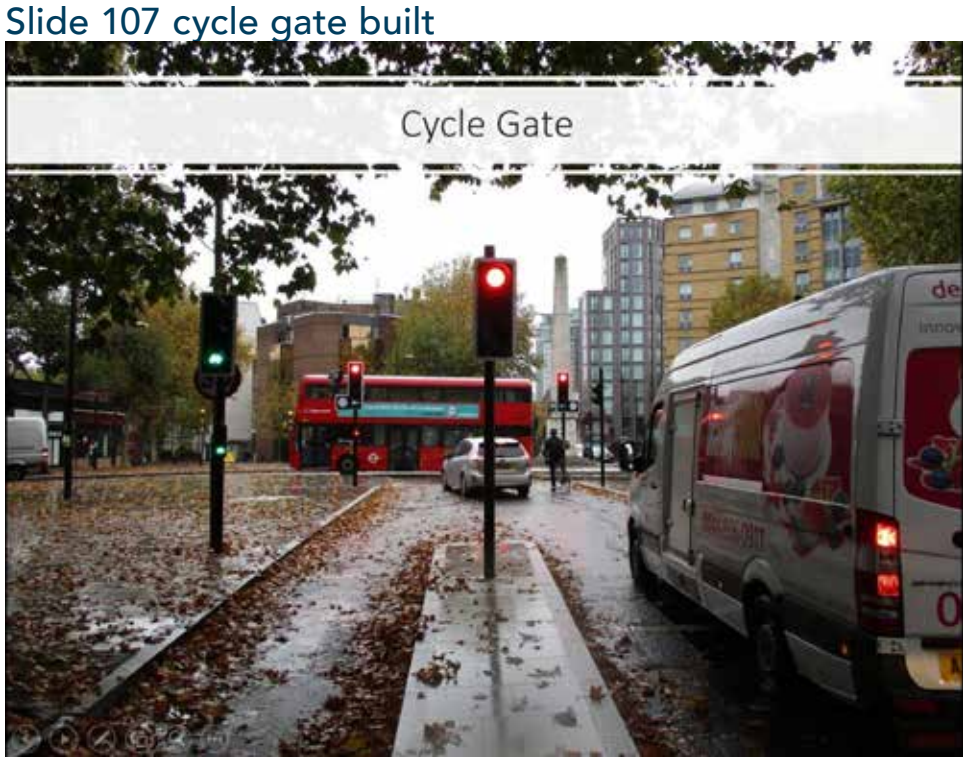
Slide 106 cycle gate design



It is the exact opposite of the Danish green wave, which registers the approaching cyclists through detector loops and adjusts signal timings to guarantee green signal progression. The cycle gate acts more like a turnstile, delaying cyclists for their own good. This might say more about the Danish view on cycling, as they are prepared to lose the efficiency of their signal-controlled junctions in order to create a smooth cycling experience.

In the UK we have yet to reach that level of enlightenment. The Danish acknowledge the effect that loss of momentum can have on human power generation, whereas we acknowledge that capacity reigns over us all. Cycle gates are an incredibly useful tool for offering protection to cyclists without ruffling traffic engineer's feathers and they are basically a realisation of the advanced stop line dream.

Slide 107 cycle gate built

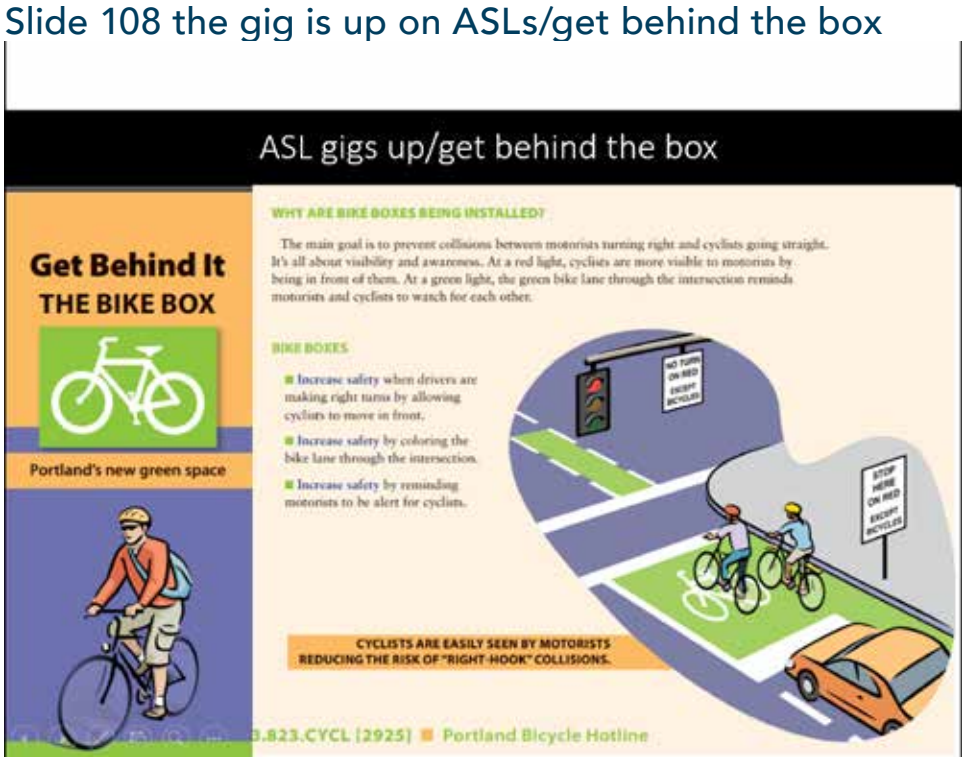


Nobody has been involved in implementing more advanced stop line boxes than I have. From 2005 to 2010, I was involved in dropping over two hundred onto the streets of London. I once shared the optimism of the recent Portland, Oregon campaign to get behind the box. It is the UK contribution to providing for cyclists at junctions and, like our other great contribution, the mini roundabout, I just do not particularly like them anymore.

Do not get me wrong, I would rather see them there than nothing, but in the UK they appear to mean very little to drivers who regularly encroach into them with seeming impunity. An advanced stop line box puts a second stop line set back from the first one by approximately 5m. This allows cyclists to filter to the front of the queue and position themselves to move. "Sounds great, why are you moaning?" "Well, what if you arrive when the signal is green, then no such advantage is given?" and "What if you are squeezing down the nearside in a feeder lane to the advanced stop line and traffic starts moving, leaving you in an exposed, unsighted position?" and "What if you do get to the front and position yourself in front of a heavy goods vehicle with a high cab, then you have just placed yourself in the middle of a blind spot?" This last design flaw was spotted early, and so we moved from advising 4m deep boxes to 5m and then to 7.5m but really, honestly, they do not mean much beyond telling drivers to watch out for cyclists. In terms of enticing new cyclists, they do not seem to be effective and so I prefer to promote looking at more protection for cyclists and relying less on half measures. Details about nearside, central and offside feeders, split, part width and half ones are really matters for those who think line markings can save us. I think we need to try a bit harder.

Protected junctions

Slide 108 the gig is up on ASLs/get behind the box



So then, let's try really hard to think of a way of protecting cyclists fully at junctions without blowing capacity and increasing delay by bringing in extra stages. I went through this mental experiment and, as usual, the Dutch had the answer all along, as they went through this headache themselves decades ago. The Dutch-style protected intersections really are the bees knees and we are getting very close to having our first one in in the UK.

Protected intersections rely on parallel signalised crossings being installed on each junction arm so that cyclists can move across the junction at the same time as pedestrians but in a parallel position. At the exit point, where cyclists cross the path of pedestrians, they are asked to yield priority and filter through. No extra stage is required. In Holland this approach can be done in two stages with the parallel pedestrian and cycle movement running with turning vehicles cutting across them, but in the UK it requires its own stage.

Slide 109 lcds concept protected

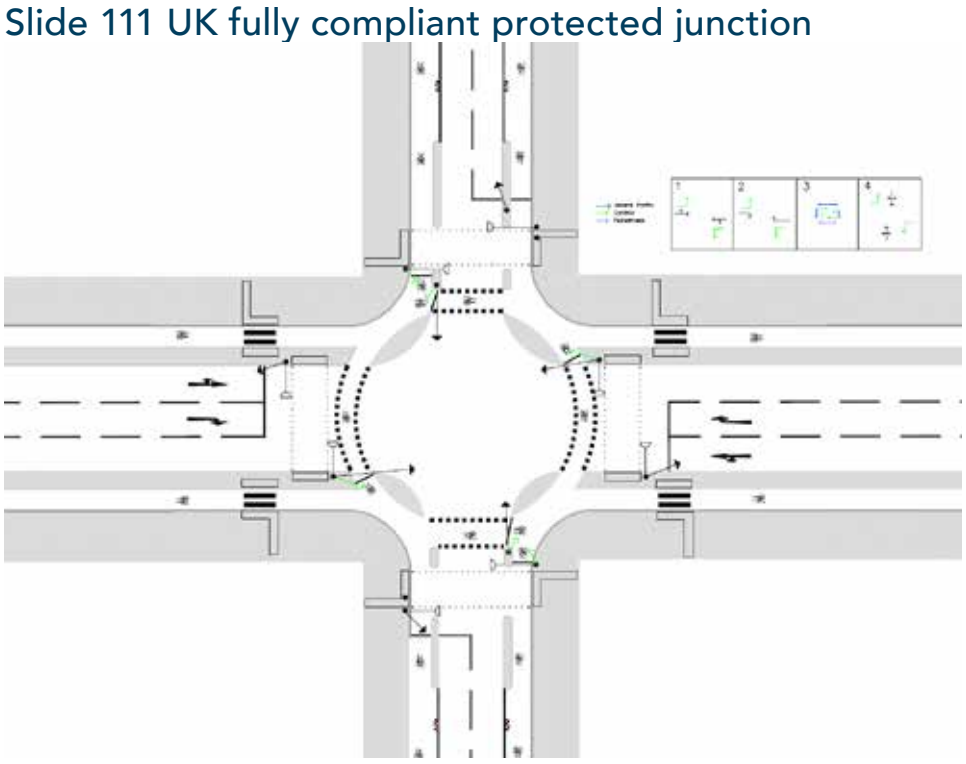
Many UK junctions have pedestrian-only stages and so the lost time is effectively in place to give this solution a try. As cyclists are treated as a vehicle in signal terminology, it reduces lost time and improves vehicle capacity. Cyclists are effectively rotating around the junction and so there is no vehicle on vehicle perpendicular conflict, and so another law has been bent but not broken. This approach can also be done whilst giving full priority to cyclists, and having pedestrians yield when crossing their path, and this choice should be dependent on flows. The essence of a protected intersection is that segregation leads up to and through the junction in the form of separator islands. This makes cyclists feel protected, and the time separation means they actually are protected when undertaking all manoeuvres.

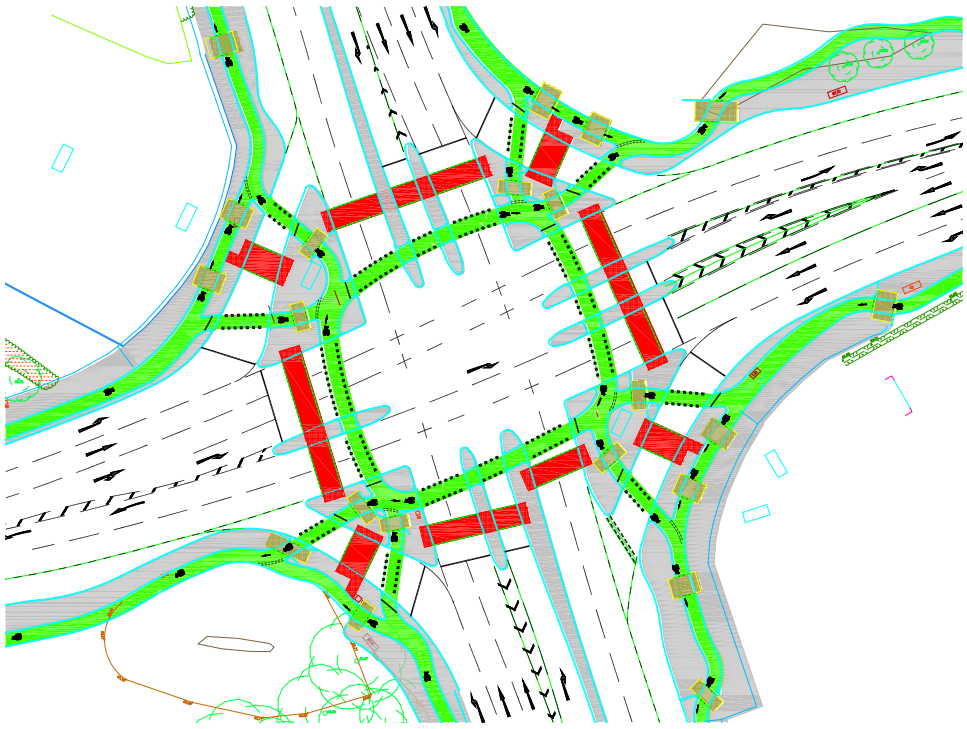
Slide 110 protection

"These junctions are a godsend; why are there not thousands of them?" Some would argue that you do not get as much green time as the hold the left approach, as cyclists have to wait for the pedestrian stage. They also have to watch as their arrival arm gets green time if they choose to stay in the protection. But, and this is a huge but, this approach can be transferable to most signal junctions in most contexts, and so the dream of protecting cyclists at all signal junctions can be realised. I love the Dutch.

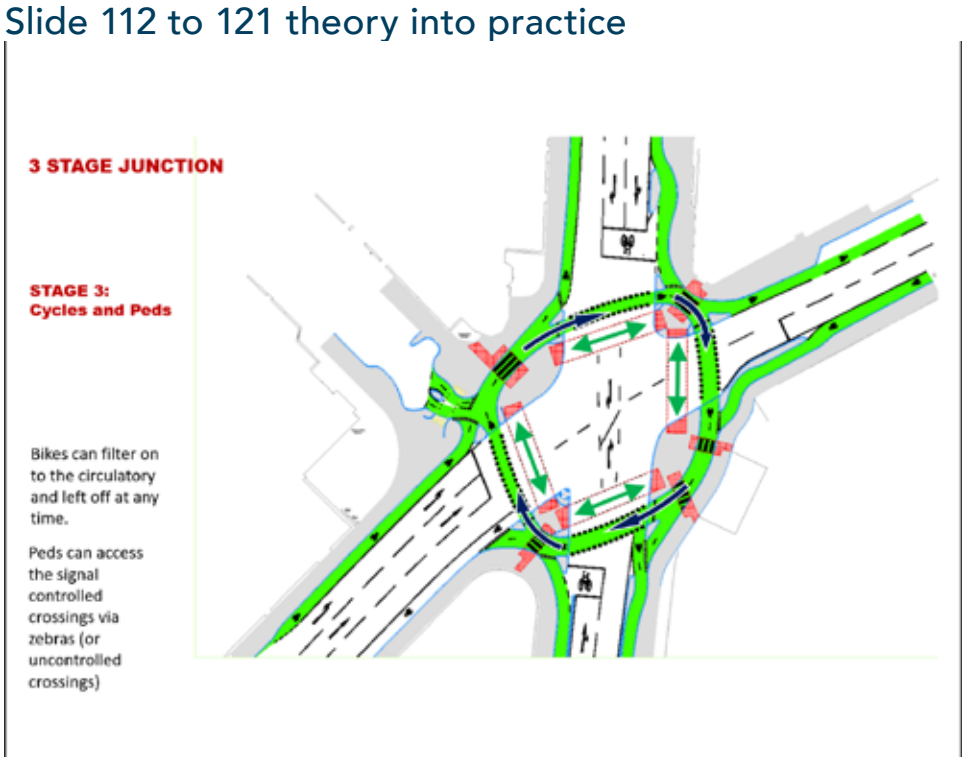
Theory into practice

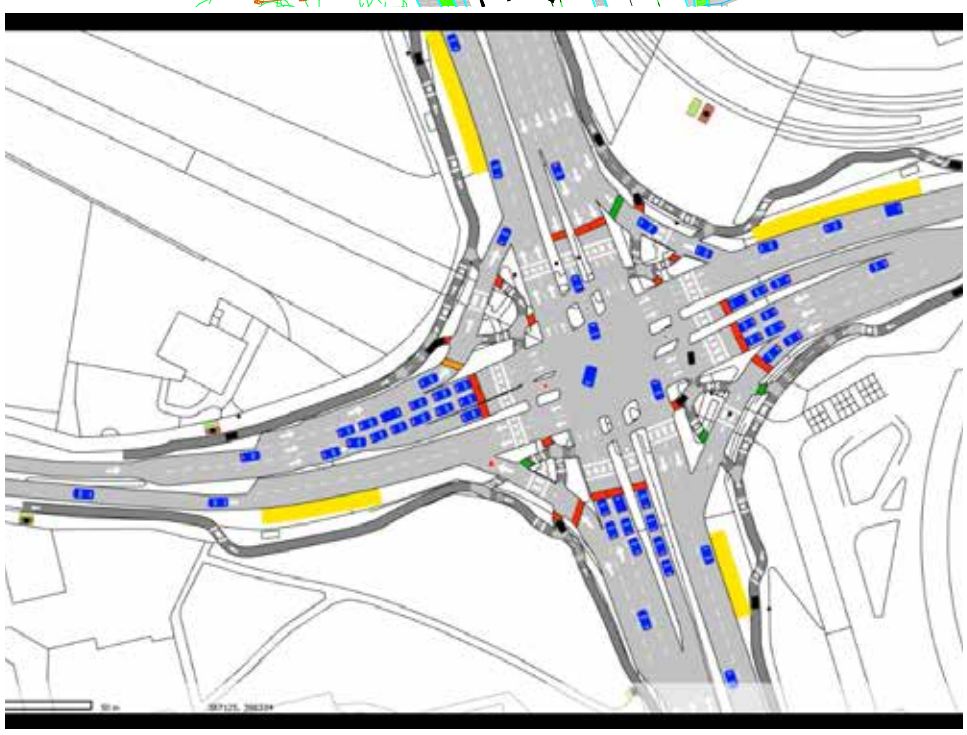
Slide 111 UK fully compliant protected junction



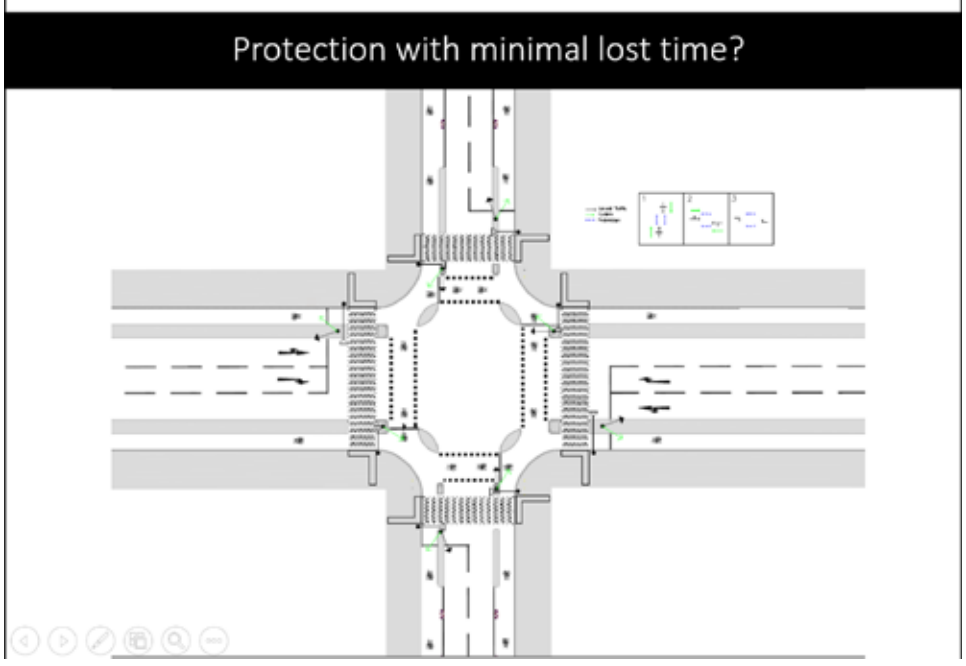


Slide 112 to 121 theory into practice





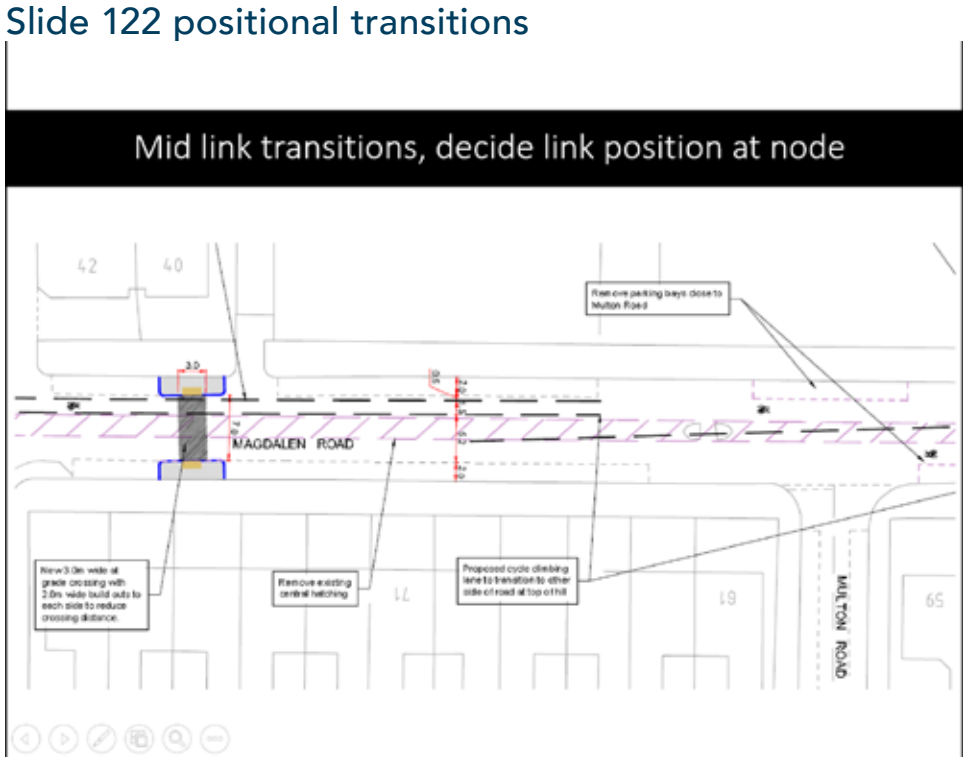
Transitions



I really cannot leave this section without talking about the transition between junction and link. If there is one thing you remember from this course, it should be this next sentence. Link position is chosen at the node and must be maintained until the next node. Cyclists should never have to change position from recommended secondary or primary mid-link. Consistency is key.

Whatever position the designer suggests a cyclist take through the junction, this must be maintained throughout the link. I see designs all day long where there was space for a cycle lane, and then it gives way to a bus stop or parked car, and so the cyclist is forced to move out into traffic in a defensive position and back again. This is stressful and potentially risky, and should be avoided. Have a look at the constraints of the link, and if cyclists must cycle defensively in a primary position anywhere and this is unavoidable, then that should be the position for the entire link and the junction should feed them into this position.

Slide 122 positional transitions



The first ask for any scheme, whether it be a walking and cycling scheme or not, is to have a consistent width. Consistently-defensive positioning beats so-far-so-good provision hands down, as it is at the transition point where collisions are most likely to occur. If a cyclist thinks they are safe in secondary, and are gradually transitioned into primary without realizing, due to perhaps a cycle lane ending, or a refuge island, or a carriageway narrowing, then this is a classic case of lulling someone into a false sense of security. Positioning must be maintained consistently.

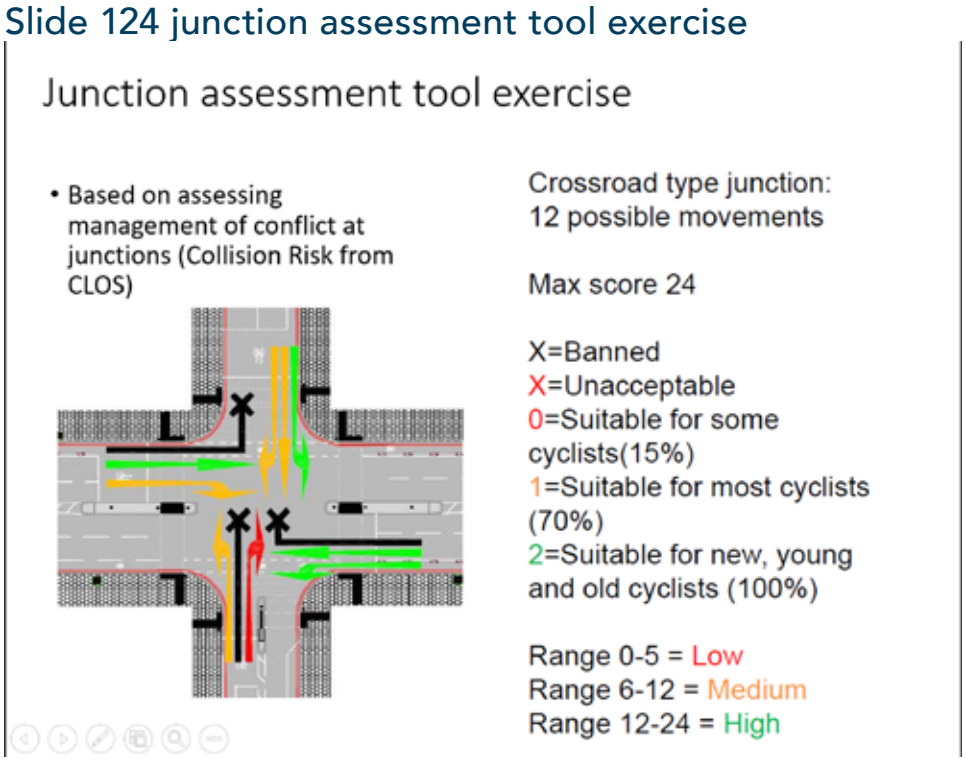
Likewise, depending on your junction treatment, cyclists need to arrive in the best position, and so, unless you are doing any of the measures mentioned in this chapter, cyclists should arrive in primary. Never suggest cyclists stay nearside, unless you are providing for them the whole way through both link and junction. I have just written off 90 percent of UK cycling infrastructure as it breaks these rules, but there is a reason that UK cycle trainers advise cyclists to avoid infrastructure, and this compromise and inconsistency is it. Stop the rot.

Every champion should check this routinely and never let it slide, even if it means removing small sections of high-quality segregation. The awkward nature of transition positioning beats short stretches of comfort any day. Do it properly or do not do it all. I have had enough of half gestures that actively increase the potential for collisions. The road to hell is paved with half-baked good intentions.

JAT exercise

Slide 123 awkward transitions

Slide 124 junction assessment tool exercise



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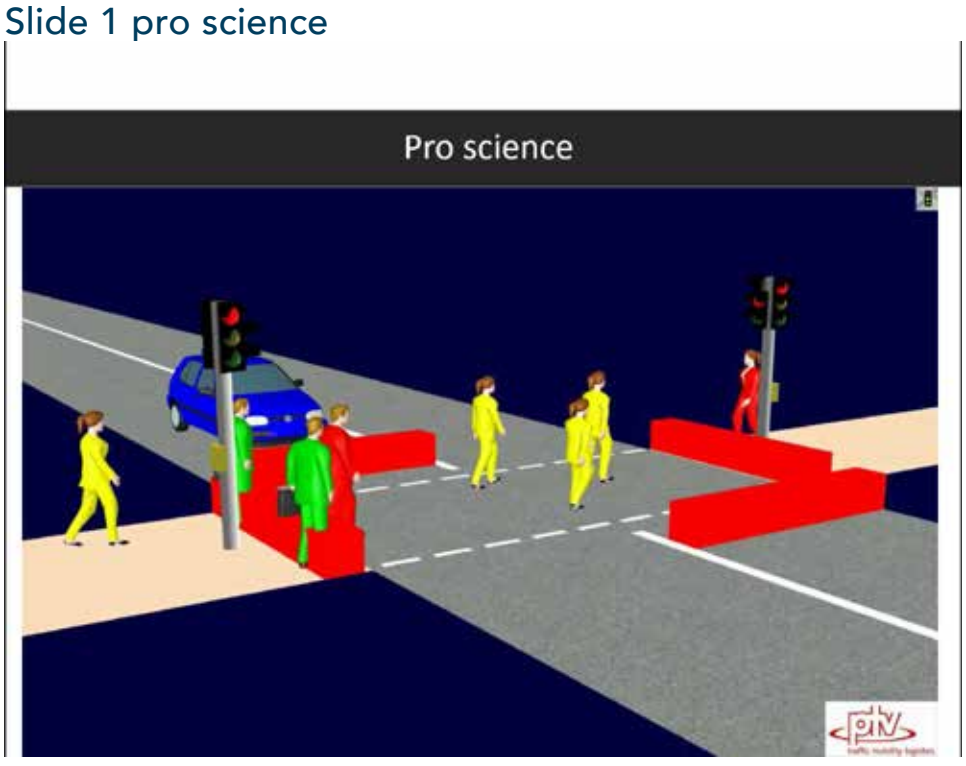
Day 3: Modelling

A champion must be scientific, and as most scientific evidence supports global issues of sustainability and environmental conservation, then we are well-placed to benefit from the wealth of evidence. Politicians may well choose to turn a blind eye to this, with phrases such as "evidence has a liberal bias" and "people in this country have had enough of experts", but the way of scientific progress is the only way. We need to be scientific to sort out our messes as it looks like it is too late just to go back to a simpler way of life. Scientists build models and test theories, and so we need to influence these models and make sure they are truly representative.

Traffic modelling has been viewed with suspicion, and in some case outright hostility, by walking and cycling advocates, as it seems hopelessly balanced towards maintaining the status quo and rejecting modal shift away from cars. There is some evidence to support this view, but today we will attempt to show and reveal how we can work within standard modelling frameworks to make sure that walking and cycling is represented and its positive effects fully quantified.

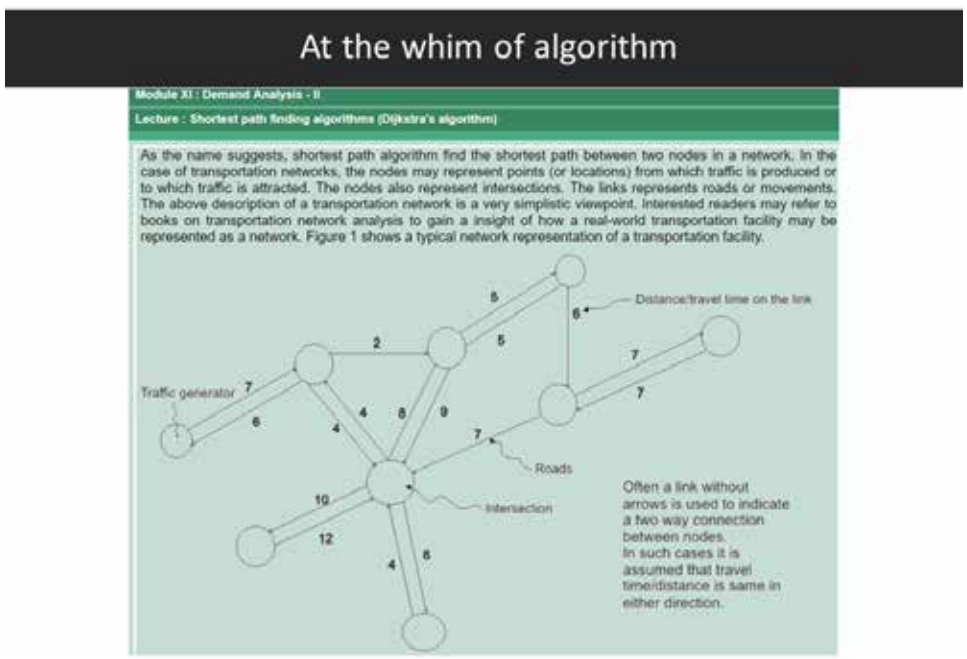
Champions, please try not to dismiss modelling as a subject, as it can make us look like the irrational ones. If we understand the models, then we can challenge the assumptions. A model is only ever a model where simple rules are followed, but if we give up on models, then we give up on science and our ability to forecast and plan. The lords of chaos must not have dominion over the planet. The idea of the Faustian scientist corrupting nature's laws and bringing catastrophe could not be further from the truth of everyday scientific endeavour, which is focussed on solving issues encountered with modern life and our methods of living it.

Slide 1 pro science



Most civic authorities have models which underpin decision making. Remember from Day 1 where it was stated that the person with the figure wins the case: be the one with the figure. Understand the modelling. Today we will look at modelling that will help us forecast demand and estimate traffic impacts. Later, we will look at how to quantify benefits and quantify disbenefits, which is another key output of strategic modelling. We will also cover the modelling of behaviour today, and more specifically behaviour change. As a word of warning, once you look at behaviour change models, you cannot help but see them applied to society to manipulate the masses. This chapter is a bit like putting on the glasses in They Live. I probably should have used the blue pill analogy from The Matrix, but the glasses analogy is a little less patronising, I feel.

Slide 2 at the whim of algorithms



In the vast melting pot of society, it is very difficult to model anything as the variables are manifold, and the data is limited and crude. We cannot even rely on the stated responses of citizens as they are dripping with bias, and nobody ever really says what they would do, but what they think they would like to do. For example, if you ask people why they cycle, they will probably recall what they think they should say, such as: "It is good for the environment" or "it keeps me fit", when in reality the reason could be deep and personal such as "my friend got killed by a car as I watched" or "the sound of car engines scares me".

It is therefore difficult to base rational decisions on this evidence, but social psychologists do have methods of attaining true intentions and so can get something from the people. For now we will focus on traffic. Most walking and cycling schemes that are any good impact on general traffic, and so a champion must be familiar

Supply and demand

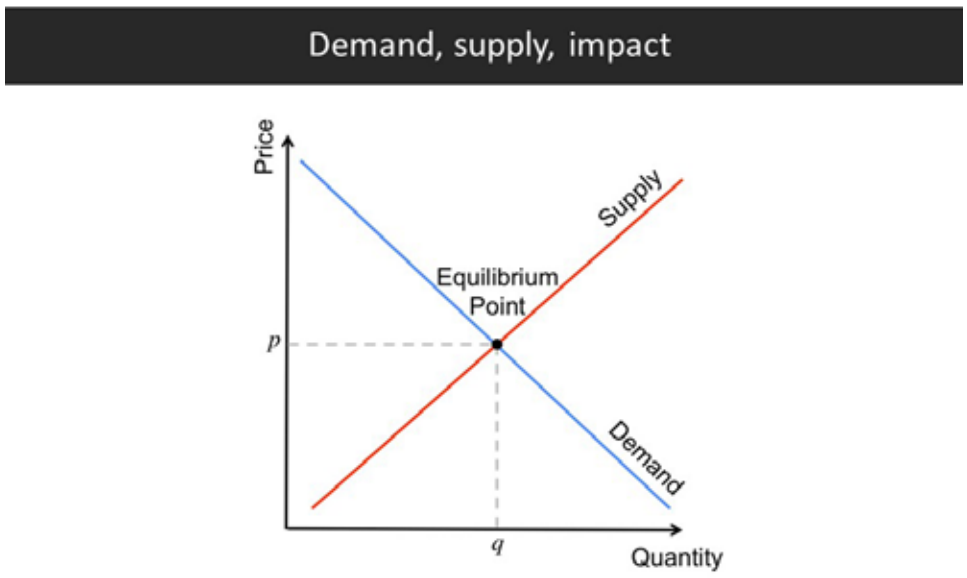
with area strategic modelling. Put simply, you need to know where the rest of the traffic is going to go to make a case for space for walking and cycling.

Slide 3 what's the real reason

Strategic traffic models, when all is said and done, tell you just three things: demand, supply and impact. Demand relates to the trips people need to take around the city for commuting, leisure or as part of their work. Supply relates to the infrastructure and vehicles that use it. Impact relates to all those affected, some positively and some negatively.

A twenty-four-hour train service supplies to meet a demand for trips, but impacts on anyone who lives along the line, who may have to give up on the idea of sleeping and so may see their quality of life diminish. Like all supply and demand scenarios, the trick is to find a happy equilibrium where the supply meets the demand. If there is more demand than supply then you have congestion; if there is more supply than demand you have empty streets and taking all those trees to pave paradise was not actually necessary.

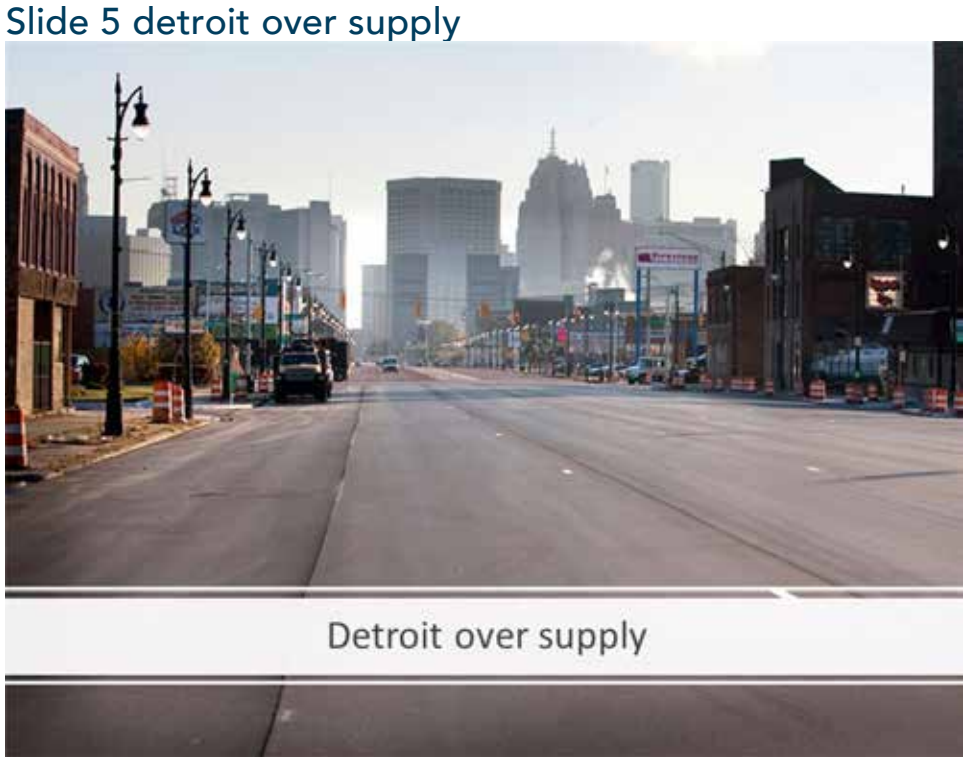
Slide 4 demand supply impact



A colleague of mine went on a walking and cycling trip around America and when she came back I asked her where the best place to cycle was. I was expecting to hear the name Portland, as it is so walking and cycling friendly and has a genuine walking and cycling culture. Instead she said Detroit, the motor city itself. I was baffled, until she explained that all the roads were smooth and wide, and there was hardly any traffic due to population migration.

Detroit had built roads for massive growth in motor traffic and had built them to the highest specification. We refer to them as fixed pavement types in highway engineering, where tarmac is laid on a thick bed of concrete. These roads can handle huge volumes of cars and last for forty or fifty years. With low traffic they can last even longer. A high supply with a low demand can therefore be good news for cyclists but is generally viewed as a terrible waste of resources by city planners.

Slide 5 detroit over supply



Strategic modelling

Most cities do not have Detroit's situation, and are therefore more concerned about congestion. In this case, assignment models are crucial and traffic management is the tool to keep the city moving. Every mayor in every town sends out the message to keep the city moving, and so traffic engineers do just that. Assignment models look at trip information and flow data on network links, and then assign traffic accordingly. If you need to visualise this, picture a person standing in front of three doors. Two have long queues and one has only one person – the computer helpfully suggests that you join the shortest queue. This mental image is very important as most micro-simulation modelling takes place at the level of on street simulation where the presence of other doors is ignored.

Slide 6 assigning traffic based on queues

Assigning traffic multiple doors

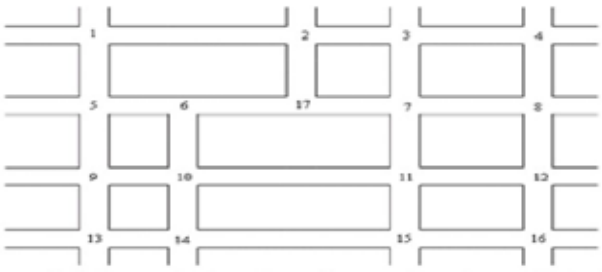


Figure 1 Schematic drawing of several main roads in this example

Table 1 Part of OD demand

	End point(D)	End point(D)
Starting point(O)	12	16
1	900	600
5	500	700

Queues that are formed as a result of walking and cycling provision are then showed to back up infinitely, causing infinite chaos. Always keep in mind that there are other doors that traffic can go through. The question is: how will traffic be dispersed across the network? If all the doors have long queues then you are in trouble, but this is seldom the case. I worked on a scheme in which we wanted to remove all traffic from a very busy corridor, apart from buses and cyclists. We simply counted the traffic on parallel roads and assigned the removed traffic to them accordingly in a model, to make the case. If we had said that we wanted to remove all traffic without taking this wider view, we would have been laughed out of town.

Because we took a strategic view, the scheme was passed, and removing heavy flows was deemed as a reasonable thing to do. I have said it before and I am going to say it again: think strategically. Take a wider view. If you start losing the case for walking and cycling, take the case wider until you win.

Slide 7 TCR strategic modelling

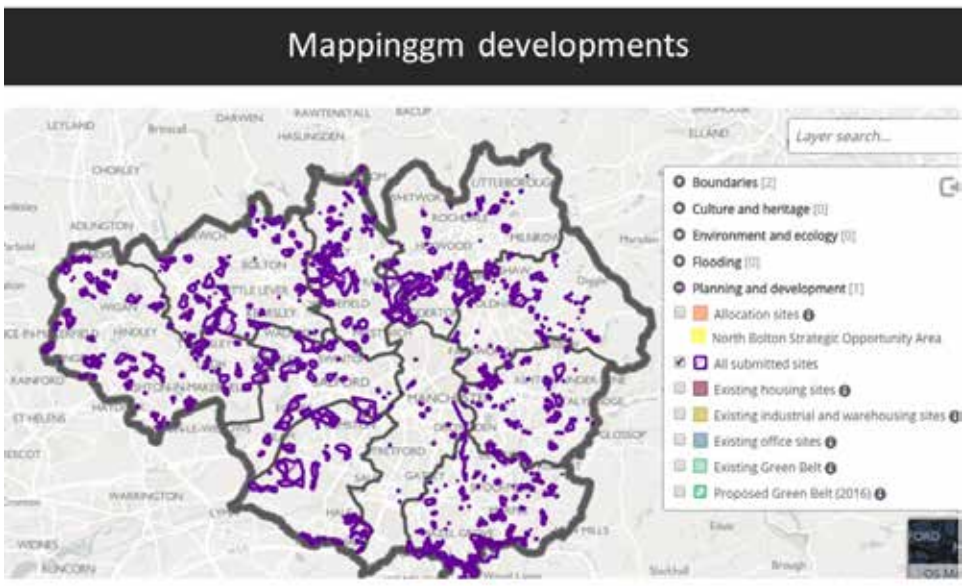
TCR strategic modelling

This is the realm of the transport planner and this is the realm where the case for walking and cycling on street gets made. If you want to make a people-focussed scheme happen, you should look at the surrounding zone. You then need data on supply and demand as well as land use for the measurement of impact sensitivity. Remember, if you decide to assign all your traffic past a primary school, then you may come unstuck. Analyse the trips: what regions or places are people attracted to and what mode are they using? Have a look at what is planned in the area. Development opportunities are often missed by walking and cycling advocates.

In London, there is the London Development Database, and Greater Manchester has MappingGM and this should be scrutinised by walking and cycling advocates so they can get in early with their demands to the civic authority. Are these new developments going to be car free, or are they affluent flats with multiple parking options? What is the public transport accessibility like? If it is low, then people arriving in new developments may drive and worsen walking and cycling conditions. What impact does your proposal for walking and cycling have on this model of society and what forecasts can you make? Does the business case stack up?

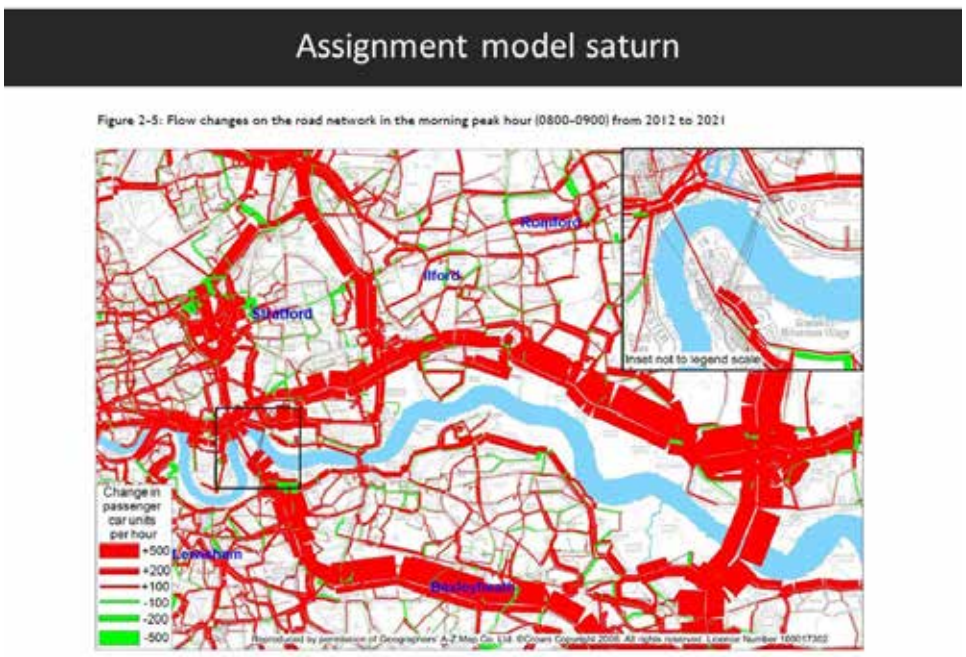
Assignment modelling

Slide 8 Mapping GM developments



Assignment models are usually capacity-restrained, in that they assume that people do not want to sit in long queues and so reassign themselves to other links. The value people put to time can be quantified, and later we will look at how this is done, but at the assignment level this monetary or time/distance value is used to assign traffic in the model. Remember, time is money, especially in traffic modelling. Real people are influenced by many other factors such as aesthetics, habit and road layout, but this nuance is lost in these types of model. There have been studies suggesting that cyclists will take longer detours if surrounding conditions are pleasant, and so these variables may be more significant for cyclists than the simple stochastic method, but I am trying to give you an overview so I will not dwell here.

Slide 9 assignment model saturn



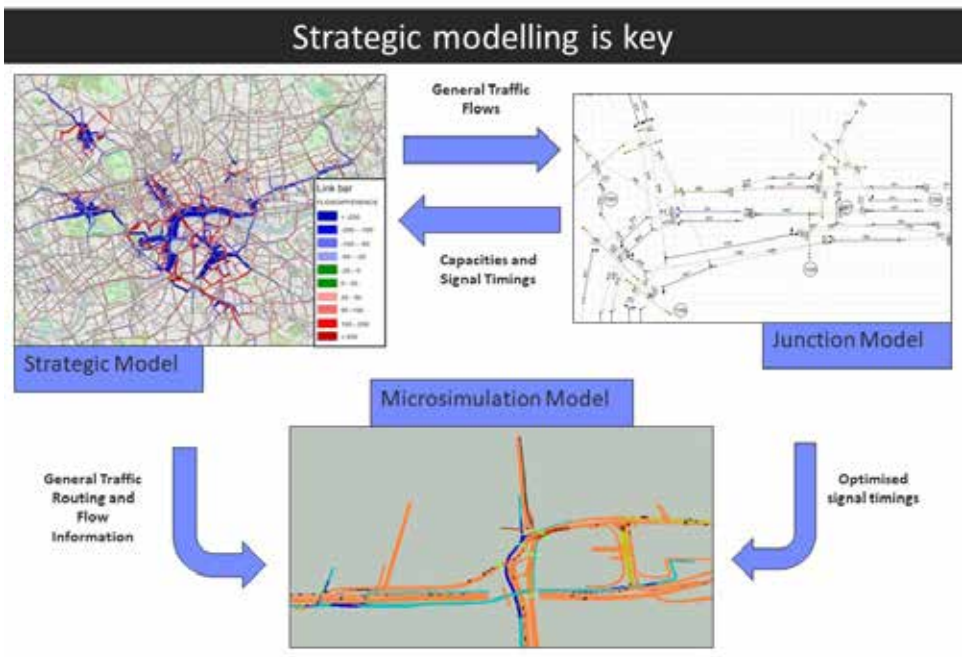
Leading modelling experts Ortúzar and Willumsen say that time and distance account for 60% to 80% of route decision making, so I will not argue, but I did once attend a lecture in which Ortúzar was the first to point out that a model is just a model, and that 'big shocks', as he called them, can bring about widespread transformational changes in distribution and behaviour. Walking and cycling infrastructure can come as a big shock for some, but really we are talking about national catastrophes or orchestrated widespread traffic management events, such as car free days.

Slide 10 big shock theory

I am bouncing through a huge subject area here so as to make it understandable and also point out the key parts that are relevant to making the case for walking and cycling. I am determined to share with you that strategic modelling is a key tool for walking and cycling, in that it takes the blinkers off local constraints, and helps you find balance and equilibrium. Strategic modelling is complex, and standard software solutions blow their gaskets if there are more than two hundred junctions, but we need to make it our friend and bring it back into use, even if it is just in spreadsheet form, based on observations and counting.

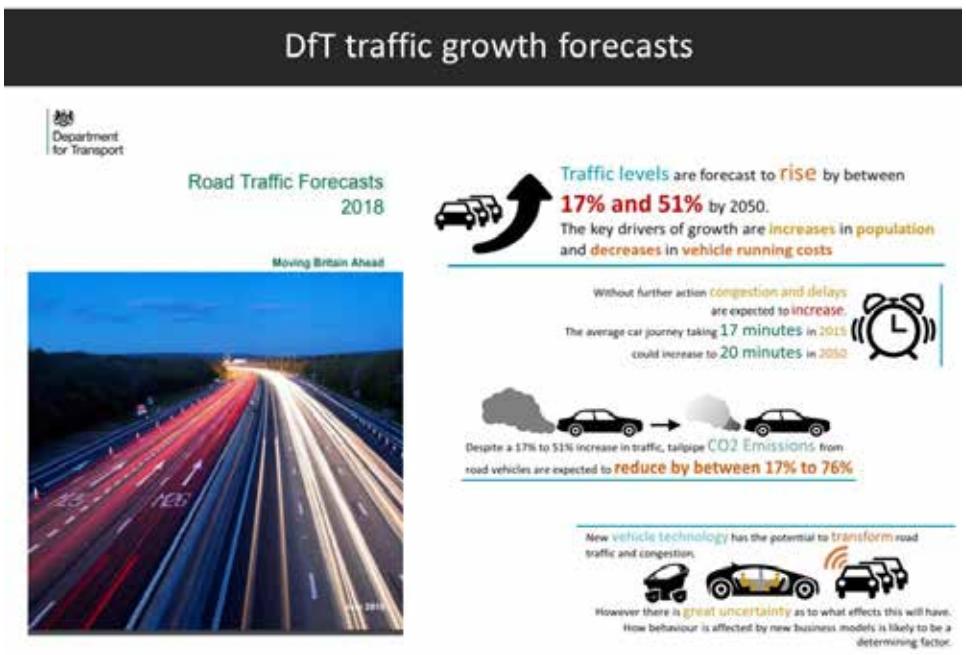
Growth and peak

Slide 11 Strategic modelling is key



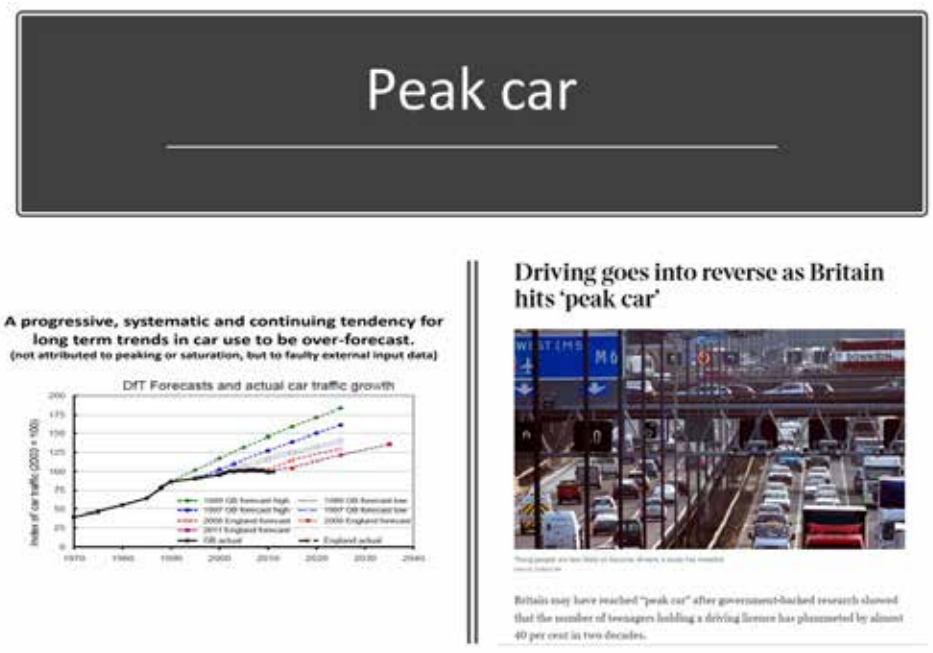
I will end this strategic business by stating that car ownership is lower in the UK than it is in the Netherlands, and that most of the countries with the lowest car ownership are horrible to cycle in. Statistically-minded people might jump to the conclusion that car ownership is not a factor in determining great conditions for cyclists. Cars are fine as long as people do not use them, it seems. In all seriousness, the evidence of peak car use is upon us, and this greatly affects modelling forecasts. In the UK, the department of transport has been forecasting traffic growth based on an early 1980s trend for the past twenty-five years. Cynics might argue that this helps make the case for road building. Why would any highway engineering consultants ever predict traffic going down, when they exist to receive government funds for increasing the efficiency of car movement?

Slide 12 DfT traffic growth forecasts



Others might point out the long-held tradition that we are heading towards car saturation, which is when there are approximately 650 cars per thousand members of the population. The USA and Luxembourg got pretty close to realising this dream, but in the UK we stalled around the 400 mark. Official forecasts still maintain we will reach 570 by 2031, but this date is forever shifting onwards but never upwards.

Slide 13 peak car



What does peak car mean for transport appraisal? It means end-times basically, as all our appraisals are built around growth and so we do not know how to plan for taking it away, like in Detroit for example. If transport planners do not build roads, then what do we do? Best not to think about it and keep forecasting upwards.

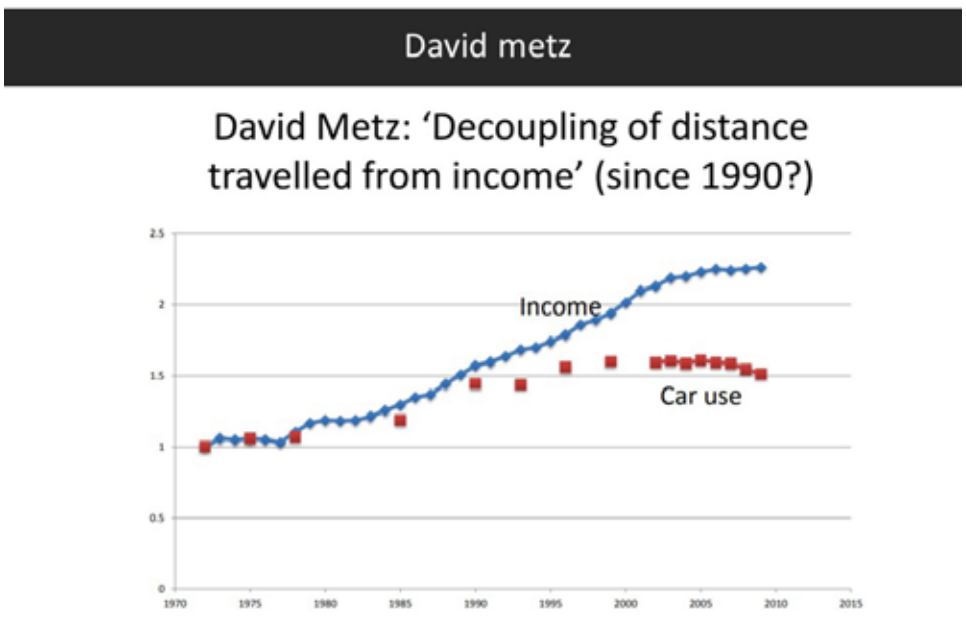
As David Metz has stated, distance is being decoupled from income and so the 'distance as cost' paradigm is becoming unravelled. In fact, it seems to be the really high earners that do not drive anymore. This is acutely felt in London, where the main walking and cycling demographic is young high-earning professional males. It could be argued that if we planned more road building, then we could win them back into their cars and the government seem quite keen on this, but this is a worldwide trend. Cars aren't all that anymore. The love affair is over.

Assignment modelling becomes very easy if cars start disappearing. If parked cars are removed when a switch to automated taxis comes, what will do with all the space? A Fordism-style economic crash could come, with supply far exceeding demand. Strategic transport modellers are standing at the precipice, so we should help them out: Why not put in protected cycle infrastructure to take up the space? Cycles are vehicles, so let's model their movement; walking and cycling is

Microsimulation

growing; forecasts are still going up; it is just a switch of vehicle type. There is a hole in our transport appraisal techniques, but we should make people walking and cycling fill it, rather than abandoning the science of network planning. Model human movement and do not just follow the car.

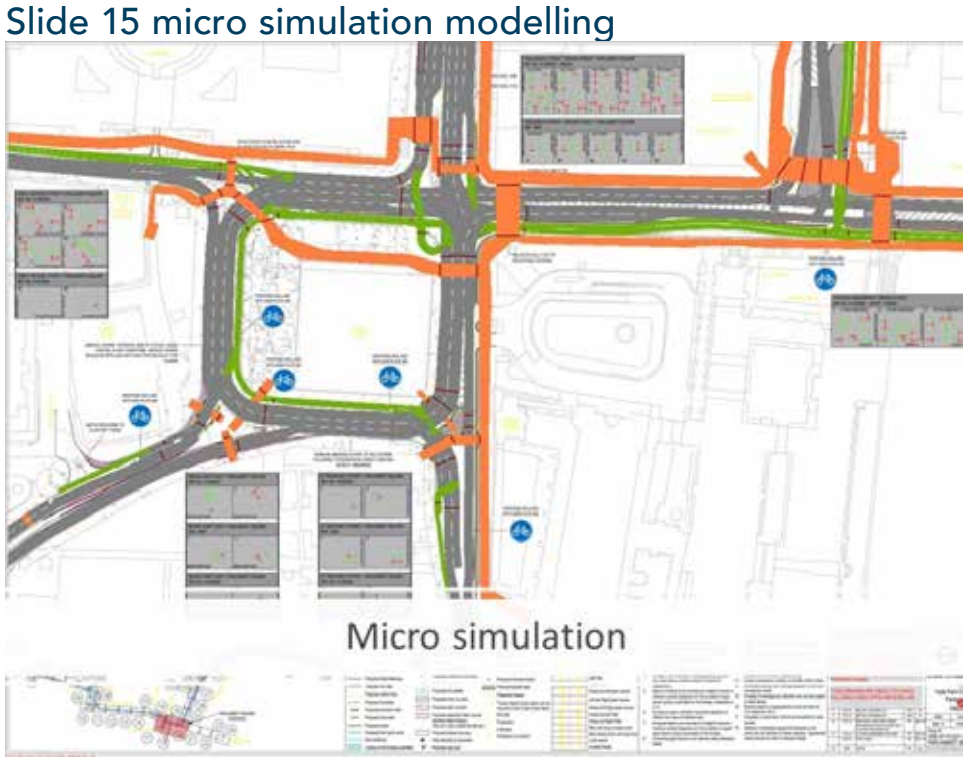
Slide 14 david metz



Ok, so we dipped our toes into macroscopic modelling to get a simplified view of flow and density, and to think about who goes where, so let's delve deeper into microscopic modelling, where we will attempt to simulate the movement of individual vehicles using car following and lane changing theories. Macroscopic modelling might have lost favour in the eighties, when it was annoyingly pointing out a future where cars did not fit, but microscopic modelling, which focusses on evaluating congested complex smaller networks, has gone from strength to strength.

In London, any and every major scheme must be modelled, and depending on the complexity, this can take anything up to two years and can have costs in the millions. All this before you have actually put a spade in the ground. Microsimulation is big business, and visual microsimulation is even bigger, as decision makers do love to see little cars running smoothly on fully rendered videos before approving things.

Slide 15 micro simulation modelling



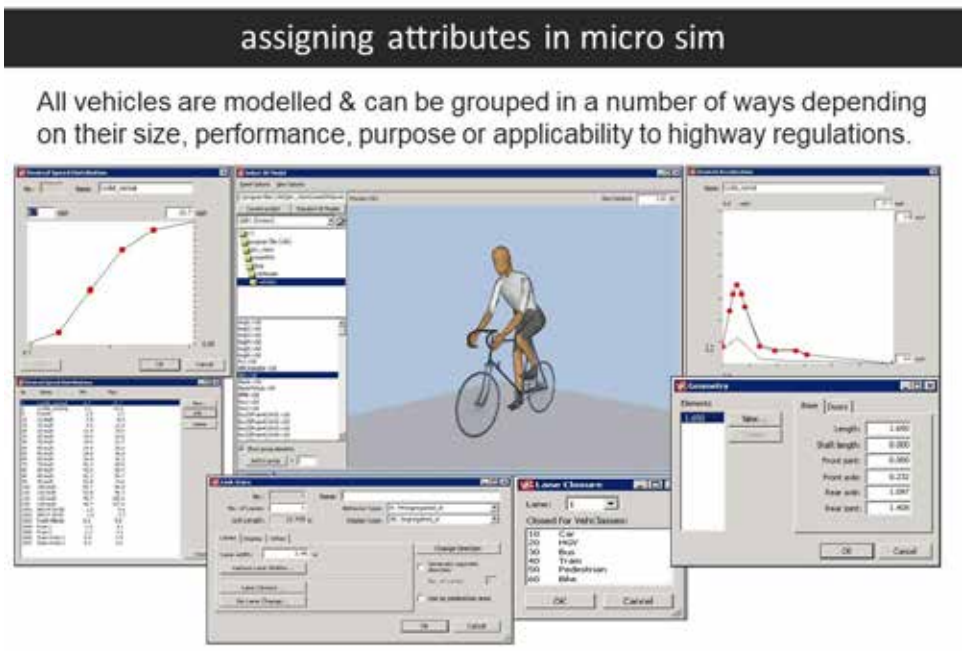
Microsimulation is a wonderful tool for transport planners. It is often mystifying to onlookers to fathom why we spend such time and resource on using it, but, without it, quantification is difficult, and mistakes might be even more costly. In London, every minute of delay to a bus service can cost £200,000 a year, as extra buses may need to be provided to regulate the service. When figures like that are floating around, people like to have assurance.

Each individual vehicle can be rendered, including cycles, and these vehicles can be assigned attributes within the system to help them mimic reality. Aggression is one of the behavioural parameters that can be assigned, and this will represent itself in overtaking behaviour and acceleration profiles. It also contains stochastic random behaviour, so that no two modelling runs are ever the same.

The software is also sophisticated enough to provide a second-by-second simulation which looks smooth when animated. Like any model, the aim is to make it reflect what the observed reality is, and then start messing with the variables and testing layouts. What if everybody slowed down? What if I added extra lanes? The joys are endless.

Attributes

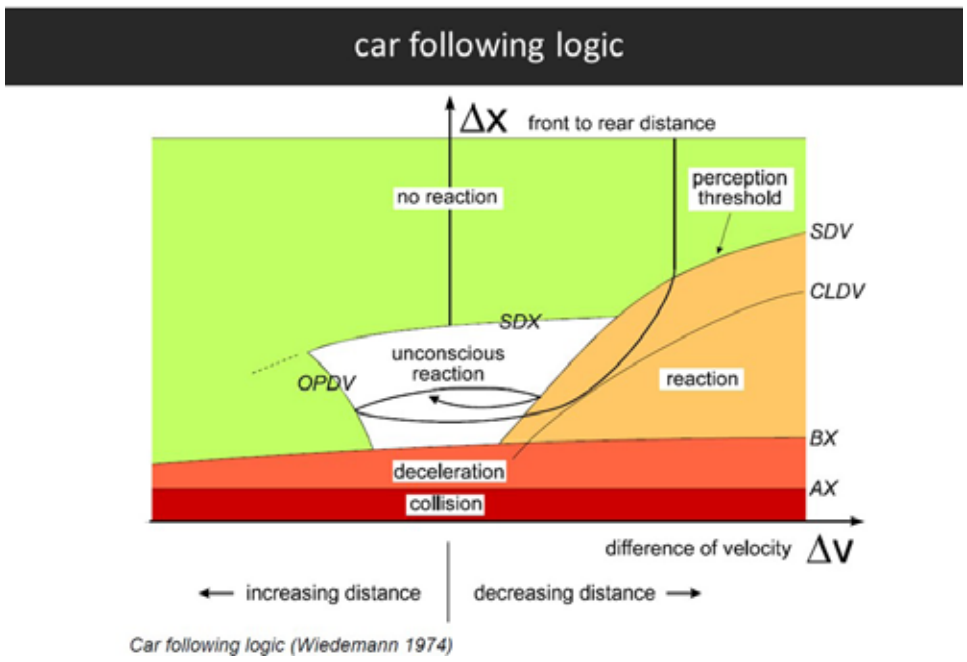
Slide 16 assigning attributes in micro sim



Signal configurations can be tested and network saturation points can be highlighted, and these offer great ways for traffic engineers to test ideas before the systems go live. In order to get the model running, a network layout is needed, as well as flow composition and turning counts. Signal timings and controller plans are also needed, as well as saturation flows, journey times and queue lengths for validation. Once all this is tip tapped into a computer, a model is generated that hopefully reflects reality.

In attempting to reflect reality, assumptions are made, and these are based on driver behaviour models, the most famous of which is the 'car-following logic' model which was first formulated by Rainer Wiedemann is 1974. This logic stipulates that when a subject car approaches a lead car, then they enter a perception area where they must reduce speed. There is then a second area threshold where the driver reduces speed further, and unconsciously begins following the car ahead. This second threshold is referred to as the closing delta velocity. Which sounds cool but has a problem when it comes to cyclists: err, we are not cars and we are not born to follow.

Slide 17 car following logic

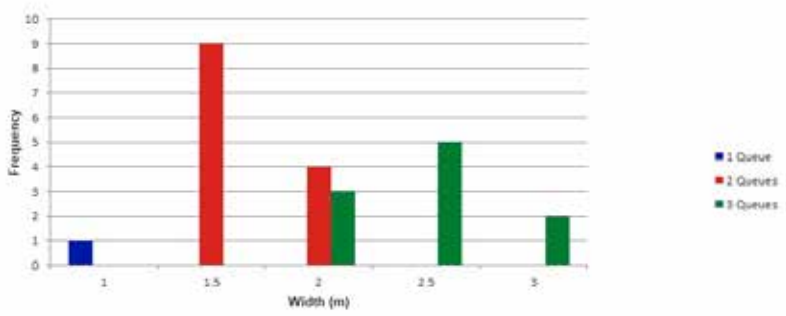


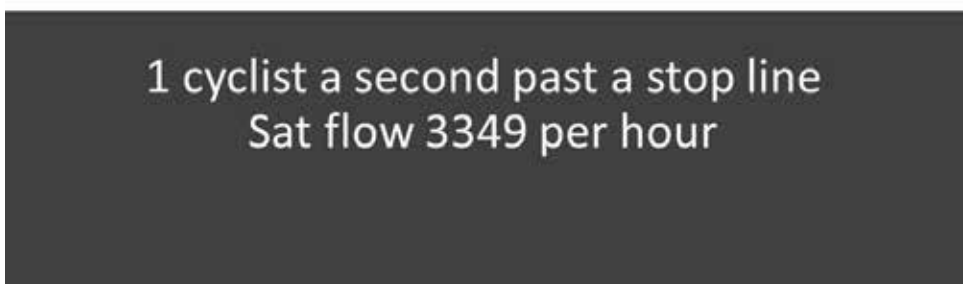
Car following logic (Wiedemann 1974)

Cyclists are treated as mini versions of cars in micro simulation, which looks weird on the simulated model. Who has ever seen a cyclist queue behind another cyclist in free-flowing traffic? Cyclists swarm through and bunch up. Cyclists may well encounter the first threshold of perception and slow, but this very often triggers an overtaking or undertaking movement. Given 20mm of space, a cyclist may try to squeeze through by tilting or popping on the footway for a second.

This behaviour of passing through stationary cars is so common as to render this model unusable for cyclists. Other driver behaviour models, such as lane changing, and gap acceptance, are also uniquely different, in that cyclists can turn very quickly and into smaller spaces when lane changing, and are seldom given gaps to accept in traffic by cars and so simply make their own way through.

Slide 18 , issues mimicking cyclists behaviour

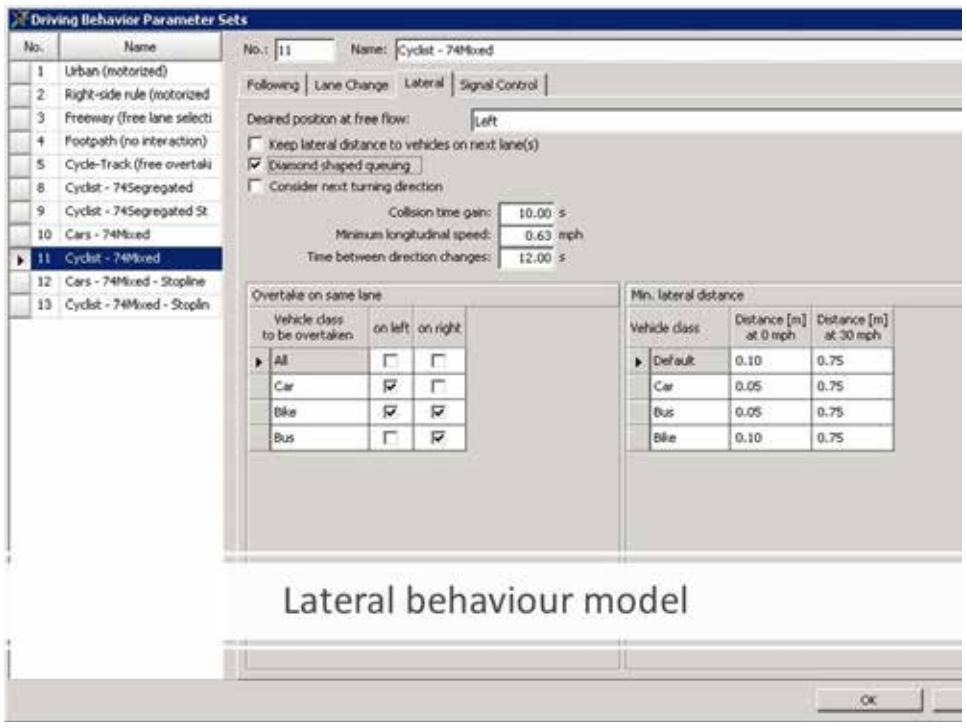




Replicating behaviour

There is a behaviour model called the lateral behaviour model however, which does seem quite representative of cyclists, and so if the other models' influence is turned down, then this behaviour can be ramped up to make simulations look more realistic. The lateral behaviour model introduces a bias for traffic to stay on the nearside lane, which seems to be very acutely felt with cyclists who, despite the best efforts of cycle trainers, do like to occupy a position close to the kerb.

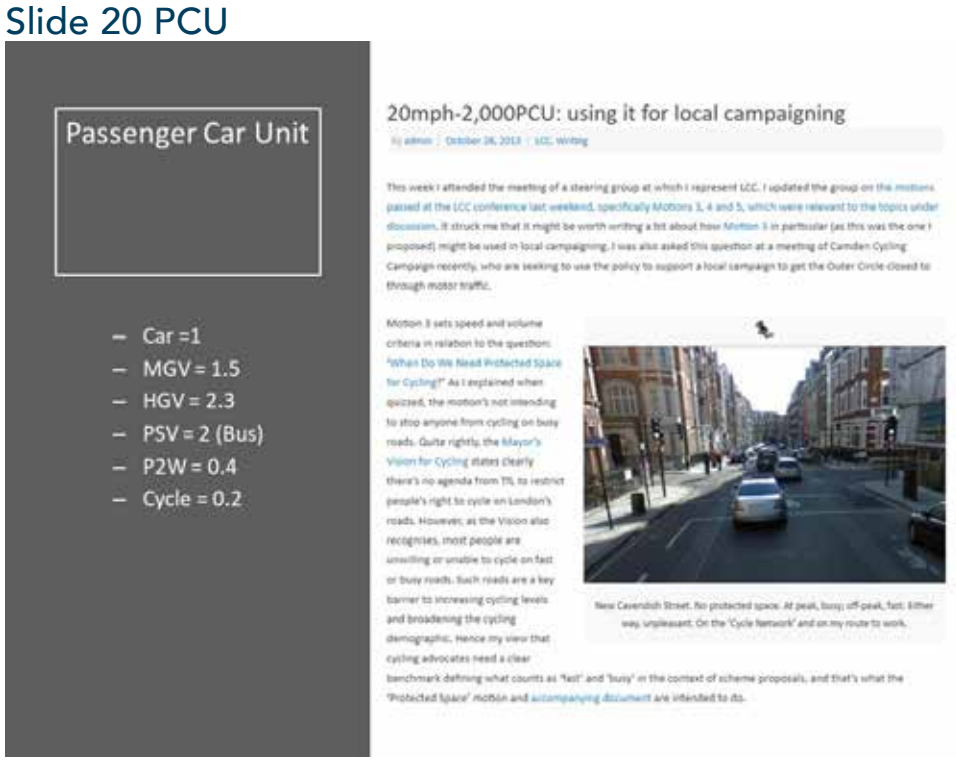
Slide 19 lateral behaviour model



Cyclists at a signal junction queueing in single file discharge at approximately the rate of one per second, but in reality, if cyclists have over 2m of space, they are likely to form three queues and discharge at three a second.

Cyclists are often represented as passenger car units in junction modelling as a way of representing that you can get approximately five through in the same time as one car. A car is one passenger car unit, whereas a cycle is usually 0.2 passenger car units. All this warping of cycle characteristics to fit car based modelling is annoying I know, but if you know this assumption is being made, you can at least challenge things when they go wrong.

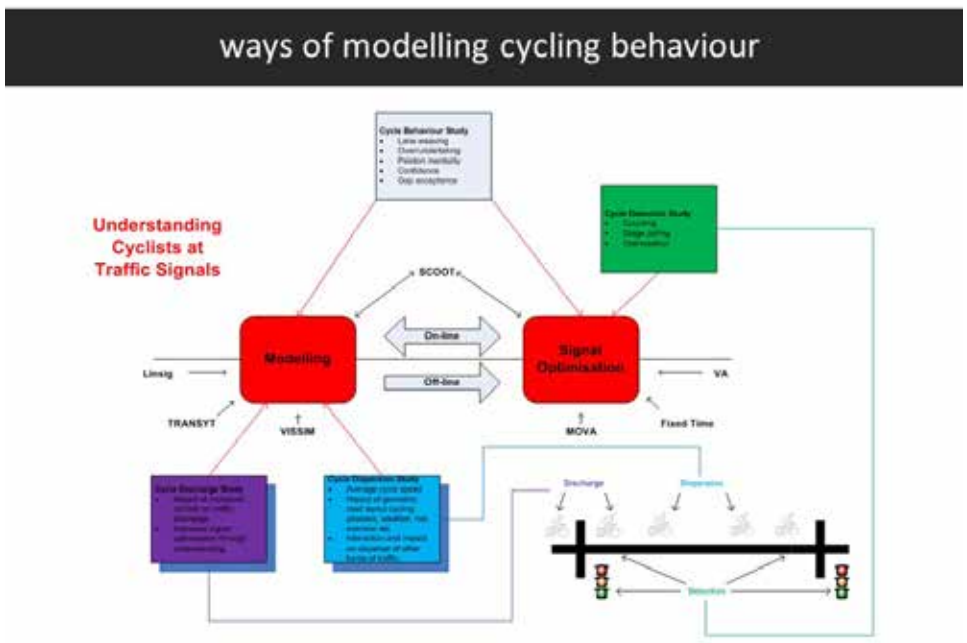
Slide 20 PCU



For example, if a junction is modelled where there are majority cyclists, then it can be quite a painful experience using standard behaviour models to get the model to represent the reality of the throughput. In London, modellers struggled with this on the new superhighways, and ended up having to programme in new behavioural parameters based on lane weaving, over- and undertaking, peleton mentality, confidence and gap acceptance.

The results were astonishing, as cyclists suddenly looked like cyclists. It might not be the way we might want them to behave, but it looked like London cyclists. These creaking old models are being made to work for cyclists, but it can still be frustrating when the future of a pro-cycling scheme rests in the hands of a car-based behavioural model.

Slide 21 ways of modelling cycling behaviour



Modelling pedestrians is rare, which is weird considering

Modelling pedestrians

we are all pedestrians at some point on all our trips. I have heard cycle campaigners complain about only being a fifth as important as cars in modelling as they are 0.2PCU. Imagine then how annoyed people who walk are by being 0PCU. Obviously, this is a measure of the space taken up and the fact that you can get 5 cyclists through for every car is good. But you cannot get infinite pedestrians past a point as PCU values suggest, and so maybe – just maybe – we should think about them. If cyclists are like water, then pedestrians are like air. They can get anywhere. They can even stack via piggy backs, although I have never seen this simulated. They don't wait at signals and unlike cyclists they don't even have to.

In London, most people cross junctions without waiting for the green man. This is annoyingly random to model and so people do not bother, but this is reality. I would love to see an urban model where pedestrians step out in front of traffic. The model would not look so smooth, and so perhaps decision makers may push for speed limiting and frequent crossing points.

What pedestrian modelling is undertaken, is usually reserved for pedestrian-only spaces. Some inroads have been made at modelling pedestrians in shared areas, but it is early days and no-one is using it to assess schemes. This is the most obvious and striking flaw of microsimulation modelling. It models a world without people. Only cars and fake cars count. Still, it's the best we have, so let's crack on.

Slide 22 Pedestrian modelling

Modelling pedestrians

I will end this section by briefly mentioning behaviour change models, as these are quite interesting and can help you formulate plans to nudge people in the right direction. I am by no means an expert on behavioural economics, but it is a subject that is worth exploring. It can be useful to utilise the same tools marketing people use to get people to gorge on sugary fatty snacks, and use these to encourage people to get some activity in their lives.

Slide 23 nudge in transport

Nudge in transport

Many social norm people view the application of walking and cycling facilities to their street as somehow removing a treasured utility, such as access to parking or the ability to drive 200m down the road to get a pack of cigarettes. The terminology and regulations of cycle provision do not help either. There is nothing Orwellian double speak about a UK-style No Entry sign with an exemption for cyclists. Although these are key pieces of provision, it sends a message that something is being taken away for the many and given exclusively to the few.

Slide 24 no entry

No entry

Planned behaviour

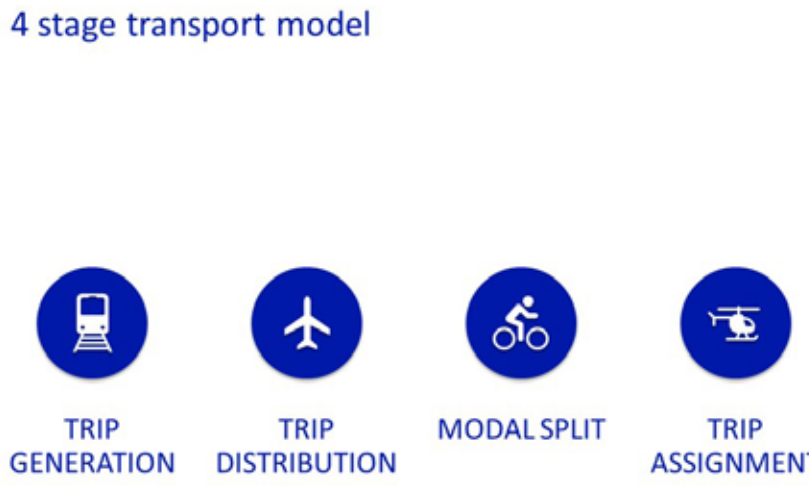
Precisely what these could be renamed as is a moot point for me, as I am tied to regulation forbidding me from calling them anything else. However, in popular walking and cycling parlance, we call them filter points which sounds nicer, if still a little bit reminiscent of social profiling.

I tried to introduce the term gateway into the infrastructure lexicon for people-friendly crossings, and this was my attempt to focus on what is being given rather than what is being taken away. Perhaps filters could be referred to as mid-link gateways to test this theory. Champions: think long and hard about what you call things and how this will be interpreted by those natural foes around us. Terms should seek to draw them in, rather than shut them out.

Slide 25 play street

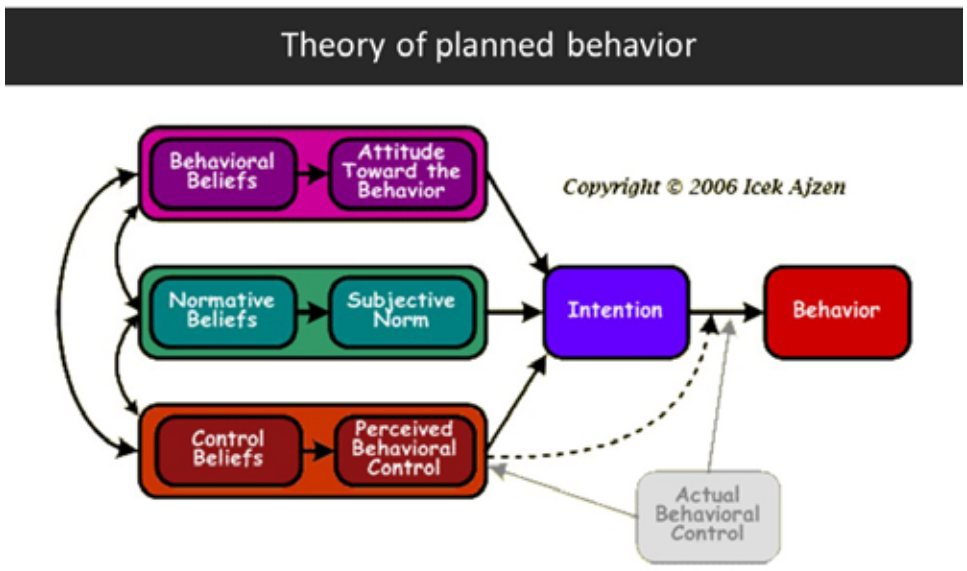
If you plan on learning any theory of behaviour change I would recommend Ajzen's Theory of Planned Behaviour, as this has really embedded itself in transport planning circles as it can be used to predict mode choice. Any transport modellers reading this who are aghast that I have left out two of the classical four-stage transport models should understand that I do not have much to add to the world of trip generation and distribution, and am just cherry picking snippets to help those who would wish to promote walking and cycling.

Slide 26 four stage transport model



The theory states that there are three things influencing an intention to adopt certain behaviour, and, for this manual, the behaviour we are interested in is the choice to walk or cycle. These are behavioural, normative and control beliefs. Most people have the behavioural belief that walking and cycling is healthy, cheap and environmentally friendly. This is a positive attitude, that hints at a latent demand for people to participate in the activity. Normative belief refers to the social pressure a person may feel from their friends, family, colleagues and community. Back to our example, friends may want our self-interested person to go walking and cycling, but their family and colleagues would think they are mad. They may also living in an area where the self-entitlement of drivers is manifested in aggressive action. The control beliefs act as the reality checks: is our person physically able, do they know where they are going, is the distance too far?

Slide 27 Ajzen theory



All these three combine via a handy equation to inform

Exercise: Intention

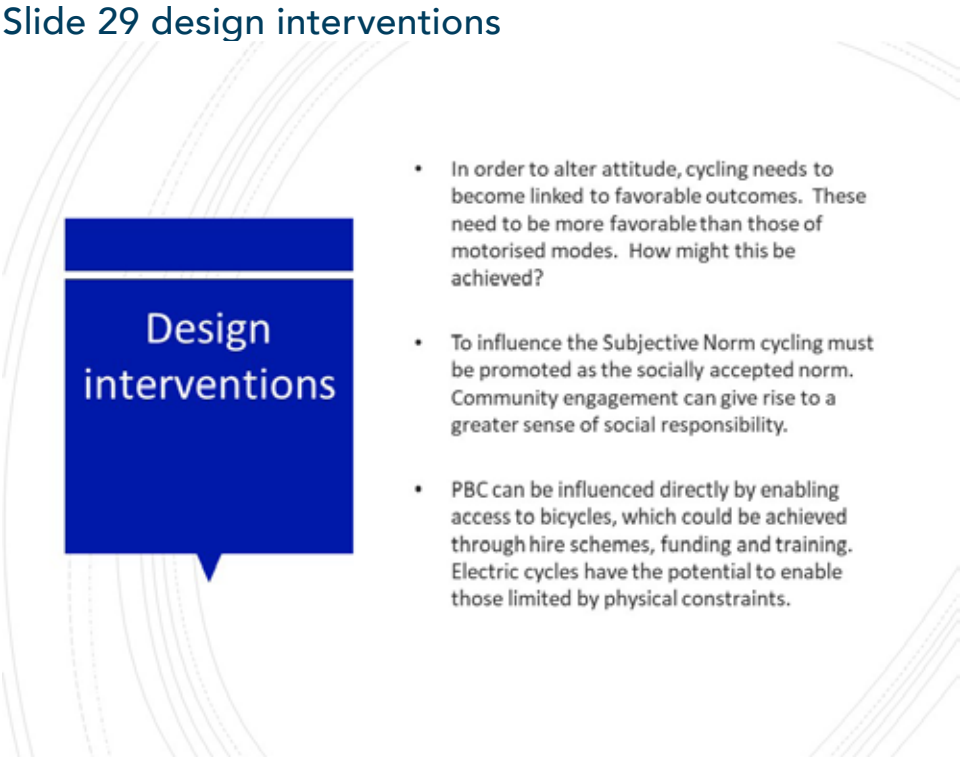
you of someone's intention to perform the behaviour. You did hear that correctly: you can put all people's mental baggage into an equation and then scientifically decide if they are a lost cause or not. This may sound like an obtuse assumption, but we need some way to predict potential use, and this method is clear and well documented, and accepted as actually being quite accurate.

Slide 28 questionnaire to find out intent (sustrans bike life)

Questionnaire exercise

- How do you score?

Slide 29 design interventions



Assessing the needs of others
What do people want from a city? Fundamentally, people just want to go about their business or leisure without being impacted too greatly. Changes to the street require reprogramming of the automated routines that people take for granted. I once brought an old lady to tears when I changed a crossing position as she had been crossing to go to the hairdressers there for forty years. Small changes can have big impacts.

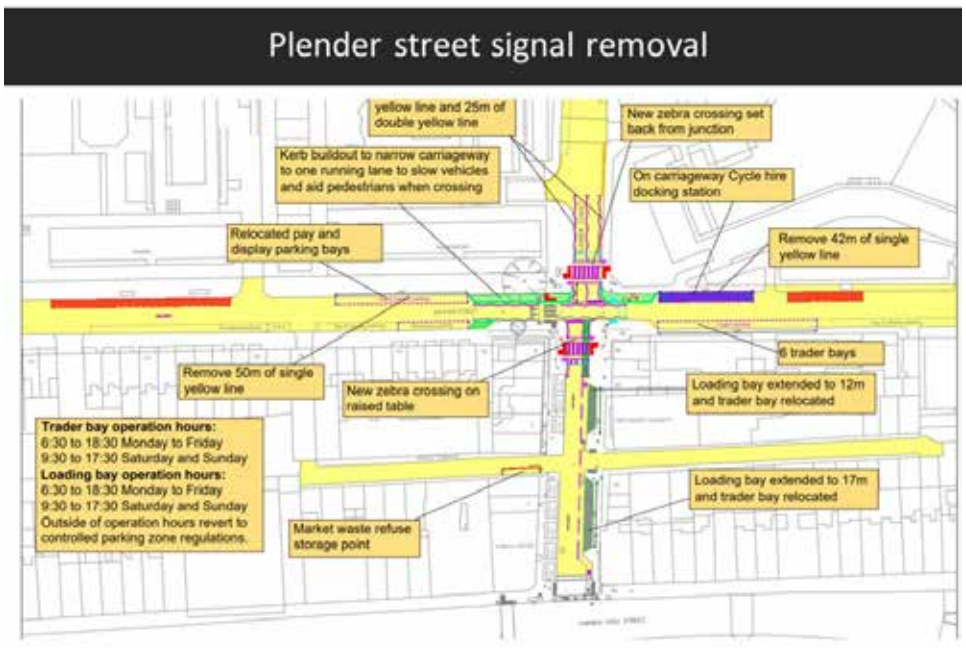
It might very well help you, as champions, to examine your community in this manner and plan interventions accordingly. Ask yourself: Are people associating walking and cycling with unfavourable outcomes, like the No Entry example? In this case, you need to win hearts and minds. Are people frightened to go against the community? In this case you need to do some engagement and get some role models established.

To a very large extent that is what I am trying to achieve with this course, which is all about making community champions of walking and cycling. Or is the problem that people just do not have access to bikes or any knowledge of the routes in the area? In this case, maybe a hire scheme is your best bet, or some visually arresting street signs. It is the role of every champion to get more people walking and cycling, and so you need to understand more people.

In the spirit of dropping continuously more obscure references, I am reminded of the scene in the film Jabberwocky where Michael Palin's character makes one tiny change to the process in a factory which ends up destroying the whole building, as the automated worker swinging the hammer could not make the adjustment. I will also confess to having a misspent youth wandering the streets ripping out and breaking anything new that the council had installed to improve the street quality. "Why would you want to change the street?" I stupidly thought to myself.

Hierarchies

Slide 30 plender street signal removal



I have moved on in my thinking but still see the attitude. It perversely reached its logical conclusion when certain residents' groups in the London Borough of Waltham Forest were arguing against a walking and cycling scheme as it was gentrifying the area, meaning that they could no longer afford to live there. Not everybody likes improvements, especially if it involves changes to their behaviour.

Shopkeepers will swear blind that walking and cycling will destroy their business, when really it is that they do not want to park slightly further away from their shop. Parents will argue that cyclists are a menace, when really they just want to be able to drive to drop their kids off at school. Never underestimate the rigidity of habit. Champions must see the bigger picture, but they must also address the local concerns.

Slide 31 stop gentrifying

If we think back to the hierarchy of users that most civilised countries employ, then we should acknowledge that pedestrians are at the top. Cyclists are number two and although this is a high ranking putting people ahead of public transport and freight, and leagues ahead of private cars, we should acknowledge that some things take preference. A cycle route that stops an old lady getting to the shops is not a good thing. It is a better thing that a flyover running past her window, but it is still not the most desirable.

As a design engineer by trade, I have my own hierarchy of design considerations which is usually just kept at the back of my mind as a guide to how to deliver in an effective manner. Number one is freight and loading, number two is car parking provision, number three is pedestrian amenity, number four is public transport, number five is cycling provision and number six is private car use. This may not sound like the list of a champion, but believe me, if you do not get the first four, right then walking and cycling will never prosper.

Slide 32 my personal design hierachy

hierarchy

	official policy	reality	Personal
Consider first	Pedestrians	**Cars**	**Freight**
↓	Cyclists	Cars	Pedestrians
↓	Public transport users	Cars	Public transport
↓	Specialist service vehicles (e.g. emergency services, waste, etc.)	Cars	Cyclists
Consider last	Other motor traffic	Other stuff	Motor traffic

A world-beating cycle track will become blocked with trucks if you have not considered freight movements. Cycle schemes will not even get off the ground if anybody's parking provision is affected. The local population will campaign and complain against you, and vulnerable people will suffer if you do not take care of accessibility, and civic authorities will hound you out of the profession if you try to affect public transport negatively. These arguments are rock solid, and although I would love to see cycling near the top, it just is not there in reality.

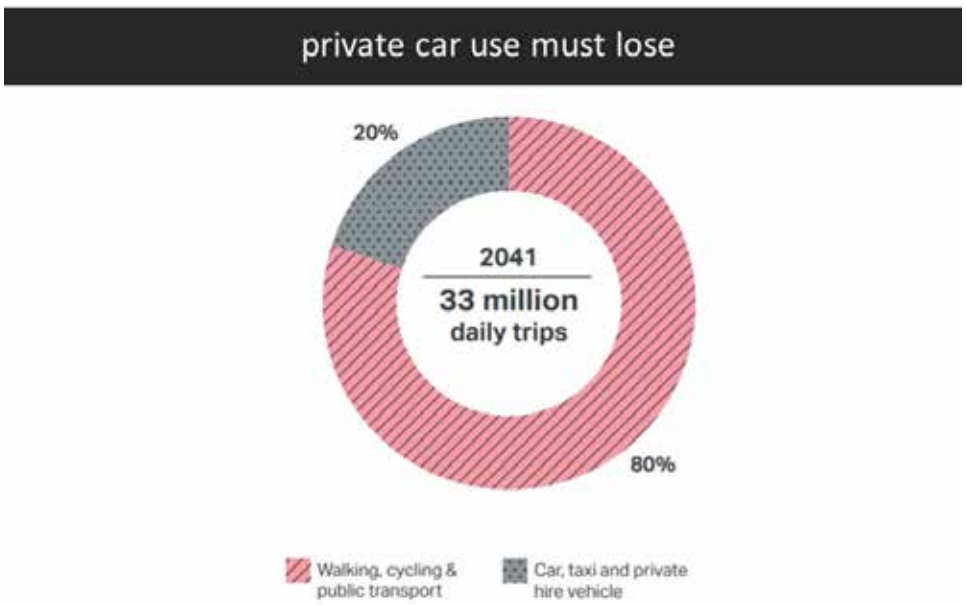
This does not mean that you cannot deliver world-beating cycling schemes, it just means that you have to consider these four things carefully before looking

Private car reduction

at cycling provision. What a champion should never be forced to do is consider the use of the private motor vehicle first, and this is where the lines are drawn. Nobody in an urban area needs to drive, and if your authority is skewing layouts to enable this, then your first move as champion is to make them stop.

This is a statement that is easier said than done, but by showing consideration of the other street user needs, you can gather allies to the cause and bring about the dream of liveable streets. Let's look at these other user needs as they can be our allies or fight against us every step of the way. You might be thinking: "How will on street parking become an ally?" Keep listening and I will show you. But first, freight.

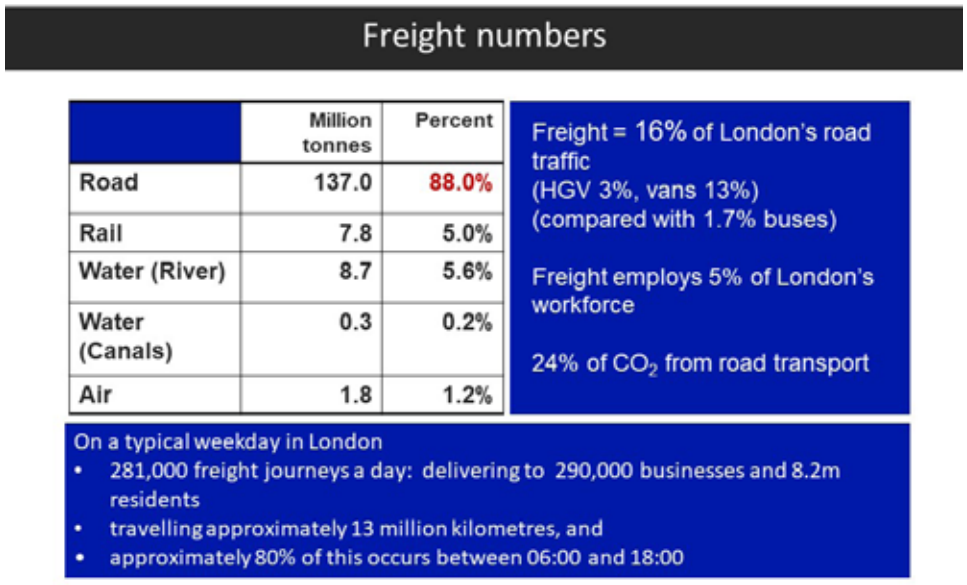
Slide 33 private car use must lose.



The number of walking and cycling fatalities caused by freight vehicles in London stands in testament to our mismanagement of this vital service. 137 million tonnes of goods are moved by freight on road in London every weekday. That is 281,000 journeys a day delivering to all 290,000 businesses and 8.2 million residents. That is 13 million kilometres travelled between 6am and 6pm by 5% of London's workforce.

Freight is essential to economic prosperity and so we cannot simply wish it away or suggest it stays outside of the city. All this business needs to happen. It can become more efficient, and we could even use cycle freight at end of stage deliveries but with those kinds of numbers it cannot be forgotten about.

Slide 34 freight numbers

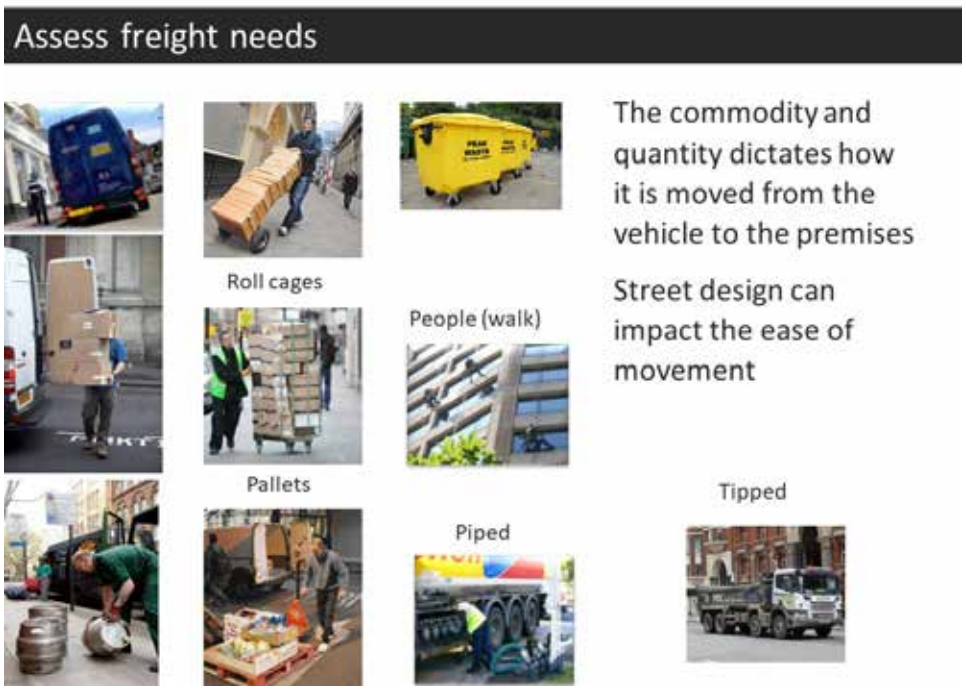


Freight includes delivery of goods, servicing and waste removal, and different land uses can have different freight requirements, such as frequency of delivery, vehicle type, duration and the commodity. A residential building will usually be served infrequently by small vehicles who may stop for a short period, or longer if servicing is being carried out. The requirements are therefore variable. Residential property planners therefore like to keep a certain amount of flexibility in the area surrounding properties for short- or long-term deliveries and servicing. This can affect the placement of infrastructure.

Loading does not necessarily need to be right next to the property however, as the goods being transported are seldom heavy and rarely require specialist equipment. Let's compare this to a large retail premises which might have regular controlled deliveries from large trucks. These deliveries might be short due to commercial overheads, and so specialised equipment might needed, such as forklift trucks to transfer pallet swiftly so that the driver can be on his or her way as quickly as possible. The first thing I do, and I suggest you do this as well, is look at the land-use mix and think about what the freight requirements will be. If you plan the walking and cycling infrastructure first, it could go horribly wrong without this consideration.

Freight

Slide 35 assess freight needs

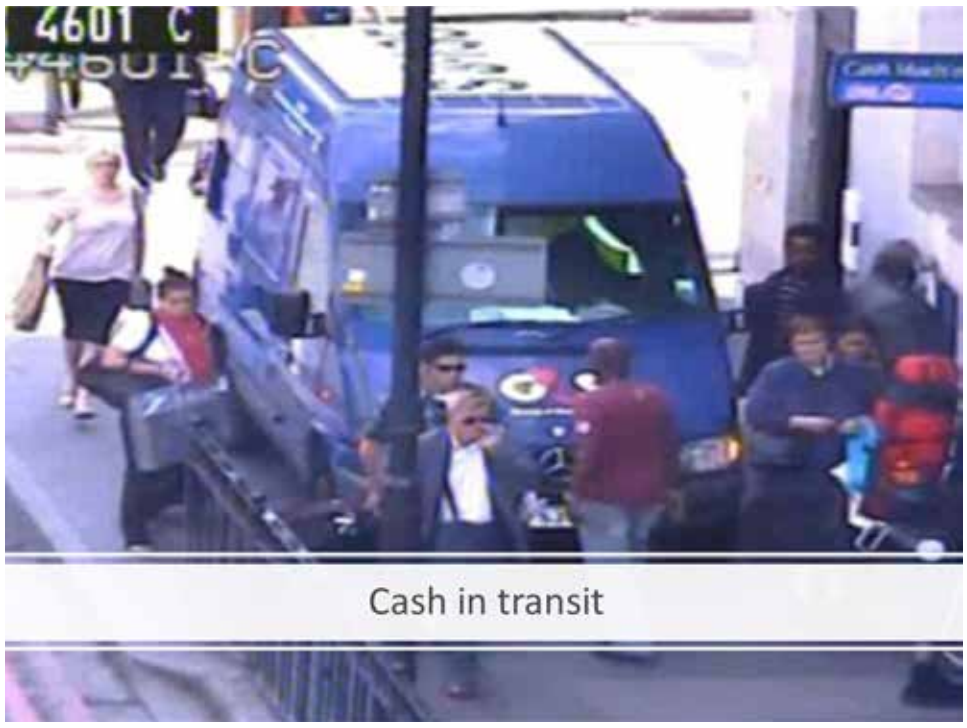


Will the freight be carried, trolleyed, wheeled in cages, lifted in pallets or tipped? Each type requires its own street consideration. For example, a segregated cycle track next to a pub will have to accommodate beer barrels being rolled across it at least once a week. There are many other land uses to be wary of when planning infrastructure, such as banks. When transporting cash, the vans absolutely must stop near to the bank, even if it means driving onto a footway or track as no provision has been made.

In London, flower shops can be tricky as the Dutch send over double-articulated lorries to stock our shops with tulips. This is a real problem if you have taken my previous advice to tighten radii. Civic authorities have a duty of care to those transporting goods and delivering services to keep our cities running, so please try and be sensitive to their needs and they will work with you rather than against you.

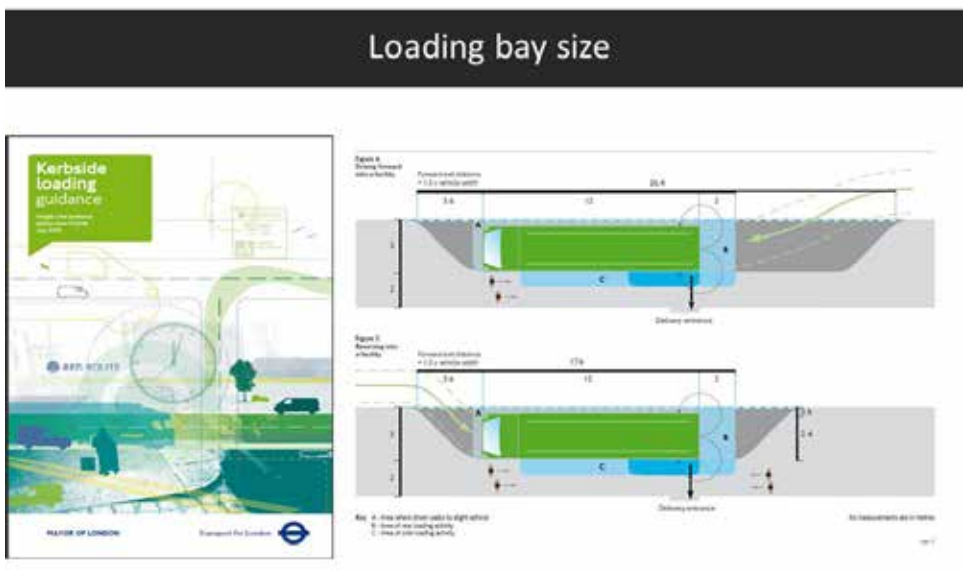
When working on my first floating parking scheme, I spoke personally to every business and tried to provide to meet all their loading requirements. In return, I asked them to promise that they would not block the cycle lane. This approach worked well as everybody likes being considered. Loading pads also work well in this context, as they suggest a clear temporary space for loading, whilst offering extra footway and keeping cycle lanes clear.

Slide 36 cash in transit



Loading bays need to be at least 2.4m wide and preferably 3m to allow some buffer area. A 2m or 1.8m loading bay is not fit for purpose, particularly if cyclists are in a nearside position, as larger vehicles will overhang. I have seen this on a lot of design drawings where designers are trying to utilise every mm of space but the size of trucks is a physical characteristic that cannot be fudged.

Slide 37 loading bay size



Kerb segregation can have a big impact on deliveries and, if not planned, can lead to vehicles loading on the track. I have seen this in Holland and Denmark, so for once this is not just a UK issue. When building London's north/south superhighway, designers widened the segregation to allow for loading pads, and installed drop kerbs so cages could be dragged across. Raised sections have also been used so that delivery cages do not have to bump up and down several kerbs.

Loading

Slide 38 freight consideration on cycle tracks

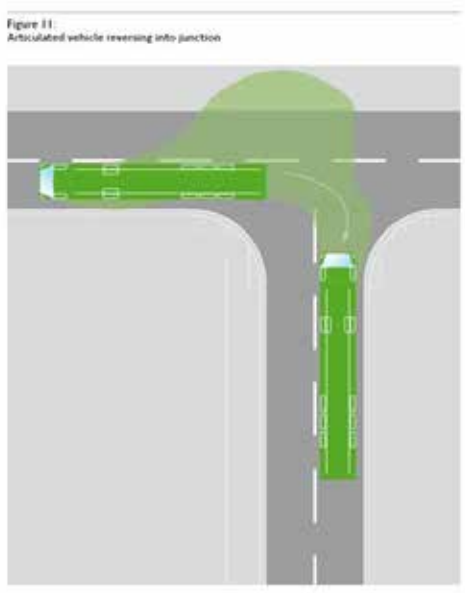
In the UK, there are dozens of parking regulations and double yellow lines can still be used for loading, unless they have two little blips on the kerbside. The last thing you want a driver in a vehicle weighing several tonnes to be doing is scanning the kerb line looking for tiny blips. This course has favoured suggestion and subtlety in street design, but here is the exception. It should be totally obvious where vehicles load, and not just for drivers, for everyone. If a large vehicle is going to be in a space, people need to know.

These drivers are professionals, so we need them to be focussed on the surrounding vulnerable pedestrians and cyclists, and not worried about where to load. Parking clarity is paramount. I am a huge supporter of what we refer to in the UK as restricted parking zones, where vehicles can only park or load in marked bays. Bring back marked bays and remove parking and loading ambiguity. This is not a statement often uttered on walking and cycling advocacy courses, but it makes a big difference.

Slide 39 make loading bays obvious

On high streets, side road loading can be considered to keep channels clear for cyclists but again, scan for banks as they cannot load at side streets. Also, large vehicles may not be able to turn into side streets, and so they may just risk the fine and block your best-laid cycle provision plans. I hope I have explained why this consideration is at the top of my list. I now have the trickier job of explaining why parking is number two.

Slide 40 side road parking does not always work



If we think back to Day 1, we can recall that lane widths are of paramount importance. In a scenario where there is a 7m wide carriageway, an engineer might decide to put a dashed white line down the middle, making two 3.5m lanes. Indecision about positioning will arise, and the risk of collision from alongside will increase.

But if the engineer allows parking down one side of the road, then two 2.5m lanes are created and in low flows there is no ambiguity about position. Parked cars also seem to be the most effective traffic calming feature you can use, as drivers of cars seem to be very polite to each other and so do not like hitting each other's wing mirrors.

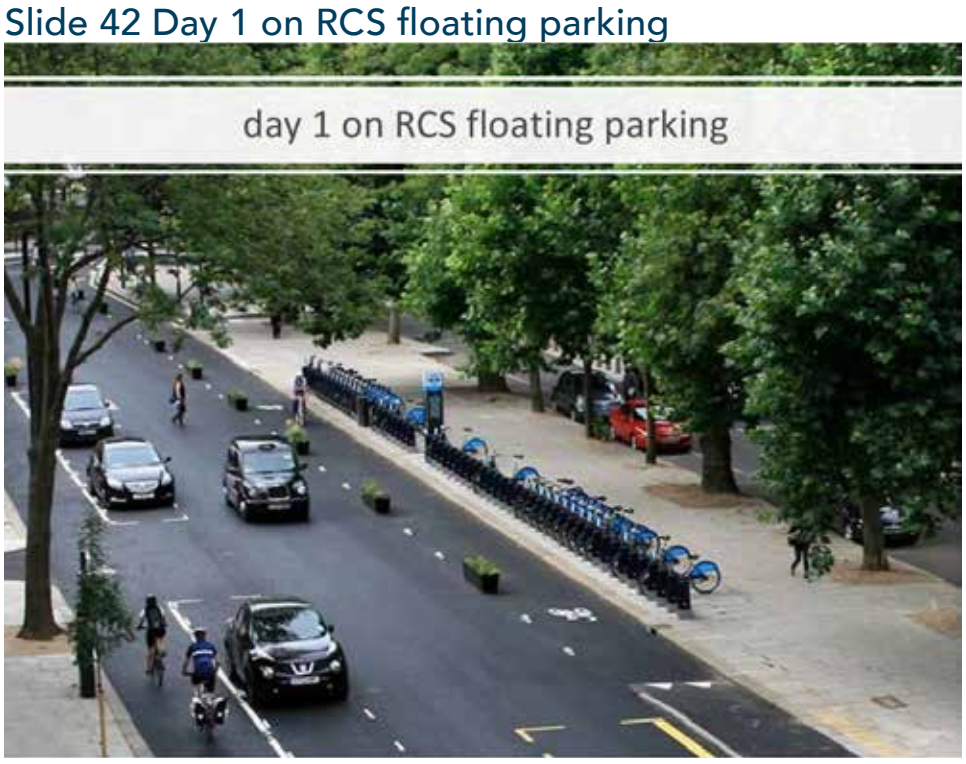
Parking

Slide 41 parking as visual narrowing and traffic calming

I can sense you are still not convinced, so let's go further into this. In London, most private cars lay dormant all week, waiting for a weekend shopping run or trip to the countryside. If we shift these dormant beasts a few metres away from the kerb, we can create instant segregation. Most cars can have a dual purpose as portable segregation devices, protecting cyclists from other cars.

I must admit when I first tried this approach I was very nervous. I had seen it work in New York but was concerned that UK drivers just would not get it. I waited in the rain on day one as the cars returned, and by some miracle they all lined up away from the kerb, keeping the cycle lane free in a perfect line. I hope this works as well for you. I now swear by it. Cars are not so bad, if they are stationary.

Slide 42 Day 1 on RCS floating parking



Let's talk about pedestrians' and cyclists' needs, as they share a lot in common. Both thrive on quality, relaxed street environments where the excesses of motor vehicles are controlled and managed. Dutch and Danish experts have been very clear that cycling cannot come at the expense of pedestrians and so space needs to be found in the carriageway and not on the footway. I say: do not look for space by munching pavements.

Slide 43 pavement munching

Public transport keeps the people in most major cities moving and so should be cherished. In London, there is an extensive tube, train and bus network. The tube and trains present no real issues for cyclists beyond the huge street layout detours that are needed to line up with bridges to cross their infrastructure. Buses, on the other hand, are an ever-present reality.

These vehicles are large, heavy and spurt diesel fumes, so they are not that easy to mix with. They are, on the other hand, transporting everyday people to work and keeping them out of cars, so they are a blessing. Every one of these buses could be replacing twenty car journeys and so we really do need them. The counter-argument would be that maybe these people would use cycles to get to work like in Holland and Denmark.

Personally, I am not prepared to risk 2.36 billion annual journeys coming back on line. Even if half chose to cycle and half chose to drive, that would be a congestion-inducing disaster. Nothing gets more people past a point better than a full bus. Being a city transport planner is all about getting people past a point efficiently, and cycling is number three behind walking and buses. This is a great place to be, but mathematically speaking buses are the top dog.

Buses

Slide 44 buses are the most efficient

Shared bus lanes were a staple of cycling in London for many years and considered to be best practice. A 4.5m lane was considered a luxurious place to cycle, as both bus and cycle could pass each other in the lane. The issue really is in the feeling of safety. Buses are huge red beasts to cyclists, and when they pass you it is uncomfortable, and when you pass them it is with fingers crossed that they don't suddenly veer out towards you. There is also the greater risk and annoyance of constantly moving across each other's paths.

Buses need to pull in to pick up and drop off passengers, and cyclists like to pass when they are stopped. There is an optimum annoying speed to ride on most bus routes where, as a cyclist, you will always be passing a bus at a stop, only for it to catch you up on the link, pass you, and then swing in again. This can mean cyclists either go as fast as they can to keep ahead, risking high-speed collisions, or slow down, suck up the diesel and delay themselves.

A scheme in Brighton on Lewes Road offers an interesting approach, in that a cycle lane is placed inside a bus lane, and so with no buses, cyclists effectively have a 3m buffer from parked cars. At bus stops, nearside bypasses are used so that crisscrossing is eliminated. This may offer a way to make both modes prosper. The issue of the subjective feeling of safety will still be there, and so it may not entice people to cycle in the same way segregation can, but it is adaptable and may protect those that already have to mix on their daily commute. The eternal puzzle of pragmatism versus enticement rears its head again, to become an underlying theme of this book.

Slide 45 bus cycle only

The only people left to talk about now are the shameful ones: those who choose to drive for commuting trips, when they have access to high quality public transport. In outer London, this equates to 40% of trips, and these people are disproportionately at risk of health issues to themselves, and causing road danger for others. It is easy for me to say that we need to eliminate this practice, so I will say we need to eliminate this practice but they are the antithesis of low hanging fruit. The entrenched minority who refuse to give up the dream of automated individualism. Transporting your own space around with you. Having a permanent protective bubble securing your safe easy passage. Taking their hands off the wheel is the equivalent of prising a gun from Charlton Heston's cold dead hands. They are a disease, but we must deal with them, as there is a reasonable basis for wanting to protect yourself and your family from the ills of society.

Slide 46 drivers sense of protection

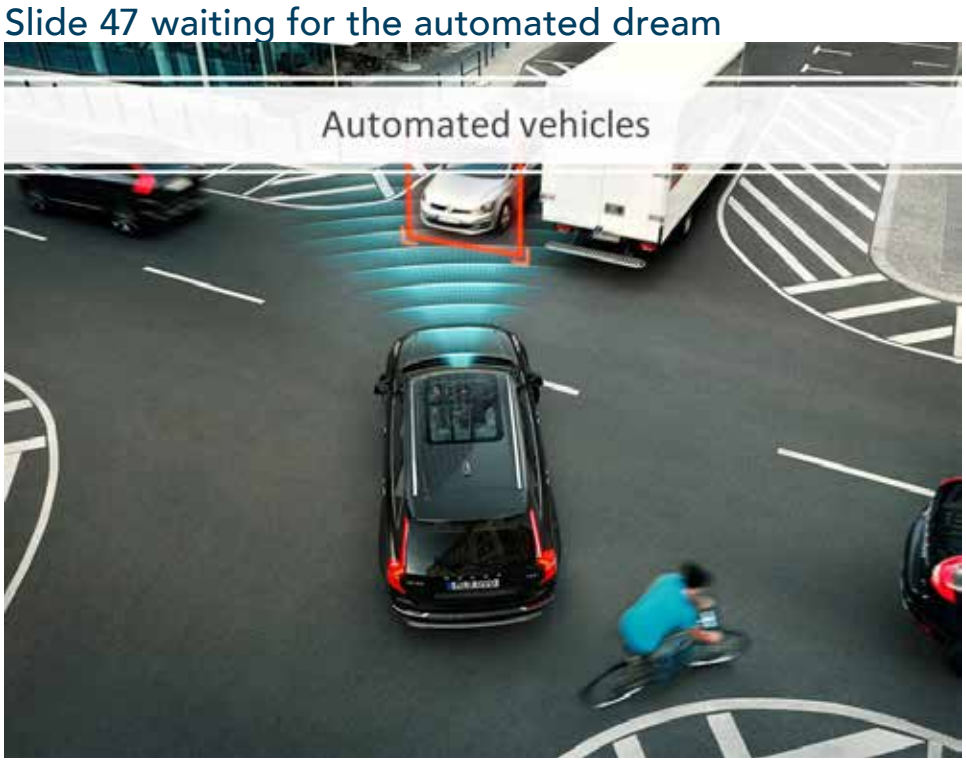
Citizen participation

It is my job to create streets where these drivers feel they do not need this protection, but I am very far away from achieving this, so who could blame them? The tragedy is that they are driving to protect themselves from people driving. They are the danger from which they seek protection. They all need to stop at once, put the guns down and step away, or the situation will always be there. To answer this conundrum, many cities are looking at the new kid on the block: automated cars. Will they save us? Will people be able to bully them into automatically braking? Will cars save the streets?

I honestly do not know, but looking back through modern history and the damage private cars have done, I doubt it. If it does get the entrenched ones to give up control, then this is worth pursuing, but I classify it as the least bad case and not the best case. It could increase car use, particularly if civic authorities start supporting it. Most progressive civic authorities have been trying to remove private car use for years and now some will be actively promoting it.

Hackney in London is the area with the highest number of cyclists, and they have also been leading the way to supporting automated vehicles. Is this good? Is this bad? It is definitely weird. "What about electric vehicles and velo-mobiles, Mr Deegan, what about human-powered electric-assist cars?" "Yeah, yeah, yeah, and what about jet packs and hoverboards?" My view is not to let weird extremes distort the message. We just want better streets and there are many ways to get there, but let's all agree that we want to get there.

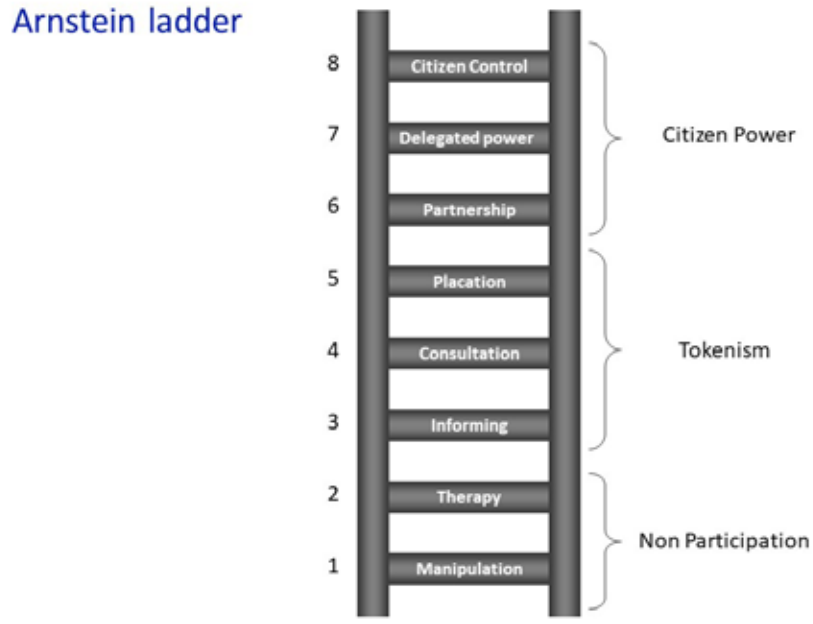
Slide 47 waiting for the automated dream



Now that we have a modal view of other people's needs, I think it is best if we think about managing and communicating with people. For this, I am going to frame everything using Sherry Arnstein's Ladder of Citizen Participation. She wrote the paper containing this in 1969 but in my view it has not been bettered. If I had my way all consultations would state what rung of the ladder they were on, so people could actually gauge how much of an impact they can have. In walking and cycling, we are blessed with stakeholders (sorry, it's an awful word for interested people, but I cannot help using it due to years of training), who are enthusiastic to a fault.

I would struggle getting car drivers to meet me at 7am in the frost to look at an intersection, yet I rely on walking and cycling stakeholders always to be there. And they are. We should therefore be aiming to get as high up this ladder as possible. Let's go through these rungs one by one and I will share examples, and perhaps these will open your eyes as to how you would like to involve citizens, or how you would like to be involved. Society only works if we get involved in it.

Slide 48 arnstein ladder



The first rung on the ladder is manipulation, which is as it sounds. A great example of this comes from the London Borough of Enfield, where anti-walking and cycling groups tried to stop a scheme progressing with a poster headline of Old or infirm? They don't care. With the solution suggesting: Send the money back to the mayor. Engaging the public with an emotive opinion is a sure-fire way to get skewed results.

Even if the question had been promoting activity such as: Do you want this child to die when walking and cycling to school? It would still reek of manipulation. Sometimes, according to politicians, manipulation is necessary, but I would warn champions against

Low rungs

championing the dark arts. Our facts should speak for themselves and any meaningful question that a decision may be based on should be neutral.

Slide 49 manipulation in enfield

The second rung is named therapy and not in a good way, as it carries the arrogance of power. An example of this might be the campaign that Manchester ran with the fat lane, for cars, and fit lanes, for bikes. A clever marketing hook could be viewed as insidious by certain members of society, as it is coming from those in power.

Slide 50 therapy in manchester

The next rung is informing, which does not hint at any participation but instead relates to a blank telling of facts. Not all things need to have participation and yet they are still legitimate. For example, a notice, eg 'potholes in a cycle lane are to be repaired on a given date', helps people to plan, but they really should be not be expected to comment on routine maintenance techniques.

On the other hand, when major decisions are passed onto society without any kind of public mandate, the use of this level of engagement becomes suspicious. In London at present, a four-billion-pound sewage tunnel is being built to manage drainage issues and citizens are blankly being informed of this despite the disruption. It is viewed as essential, and yet a planned programme of sustainable urban drainage across the city attenuating water would have the same effect and increase the greening of the city. Why was this option not given to the people?

Slide 51 sewage or suds

The next rung relates to consultation, which suggests that people are actually being given a chance to affect something, albeit often within a tight range of options beyond their control. For example: "Do you support Option 1 to fully segregate the dual carriageway, or Option 2 to traffic calm it?" Someone greater than the citizen has decided what the options are, and because they must, are asking the little people to guide them one way or the other, as they can't quite make up their minds.

High rungs

Slide 52 consultation

Consultation this or that

The Barnet (East Finchley)(On-Street Parking Places)(No.1) (Amendment No. **) Traffic Order 200*

NOTICE IS HEREBY GIVEN that the Council of the London Borough of Barnet propose to make the above-mentioned Orders under Sections 6 45, 49, 51and 124 and Part IV of Schedule 9 of the Road Traffic Regulation Act 1984 and all other enabling powers

In order to prevent obstructive parking, improve traffic flow and general road safety, the general effect of the Waiting and Loading Order would be to introduce new waiting restrictions in the borough, as follows.

Further information on the proposals, including more details of their exact locations, may be obtained by telephoning the Design Team on 020 8359 7539, 7541 or 7549.

Any person wishing to object to the proposed Orders should send a written statement explaining their objection to the Parking Design Team at the above address within 21 days of the date of this Notice.

Dated 3rd May 2007

The next rung, placation, is a slightly more nuanced version of this, but to use the Arnstein terminology is still a degree of tokenism. Going back to our example, perhaps a member of a local resident committee will be invited to work with the civic authority in deciding as part of a panel which option will be supported. They clearly will not have the casting vote however.

Slide 53 placation

Placation. Residents committee on board

Ok, so now we move into the realm of citizen power. How often do you feel you have been given power to affect decisions with big consequences for the quality of your life? Rung six relates to partnership. Perhaps the community has been engaged, for example, in London, the charity Sustrans has a project called DIY Streets, where local residents get together and come up with options for their street.

These options are still from a limited box of options that the civic authority will endorse, and they will ultimately endorse the options as being feasible or not, but we are still positively moving up.

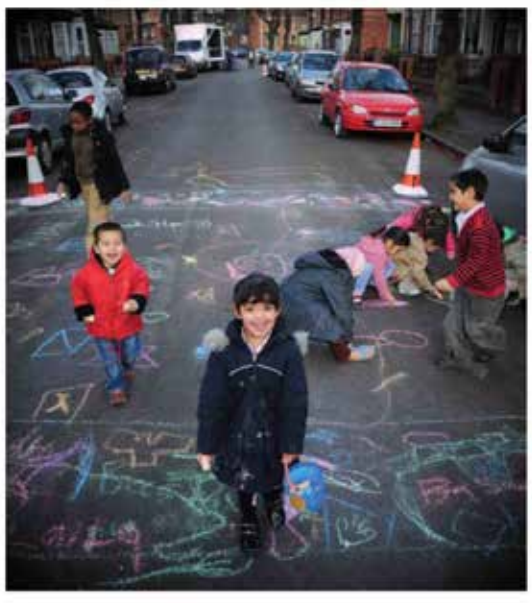
Slide 54 partnership

Partnership. Travel plans

At rung seven, delegated power, citizens have been given the power to decide, although again from a limited set of options. Having ultimate decision-making capabilities is power.

Slide 55 citizen power to decide

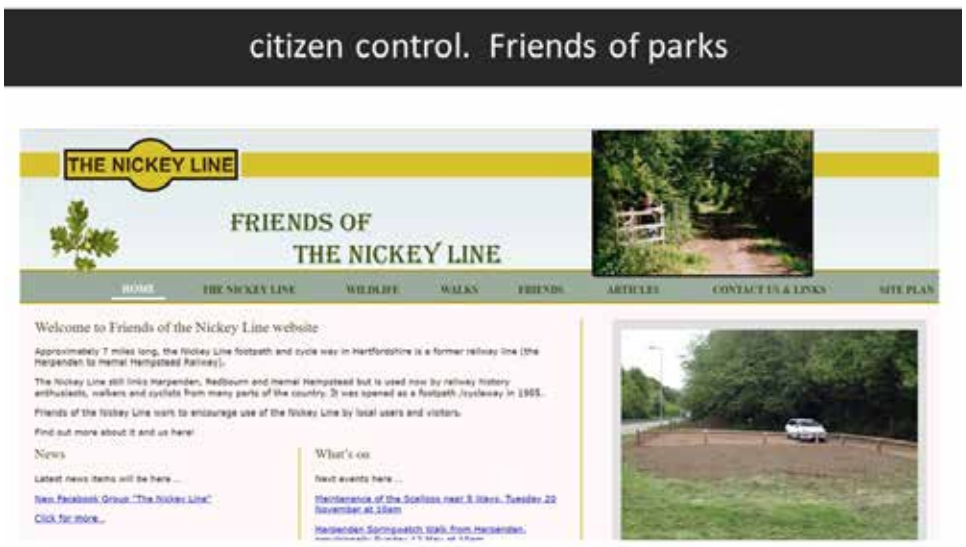
Citizen power to decide not choose



The final rung is citizen control, where the options and approval all rest with the citizens. There are many examples of communities being given pots of money and the right to decide what it should be spent on. I can't think of a single case in the UK where these pots of money were not small, but it exists. For example, the friends of a park may get funding to help the park, and they can decide whether to print posters telling cyclists to slow down, or maintain the surface of the path. They get the options and they decide.

Citizen power

Slide 56 citizen control. Friends of parks



To be a walking and cycling champion is to aim high and demand that some degree of citizen power is afforded to you and the community. The needs of others are important, but here is the key message: in most places people genuinely do want walking and cycling to take off as mainstream transport mode. There is a heavy caveat that it is safe and inclusive and doesn't remove any of their existing utility, but they do want it. Annoyingly, in most countries, our key decision makers are old rich men who are the most likely to support private car use. We therefore need to demand a fairer representation of the democratic view to let the will of the people be heard. Champions: I never said this job was easy.

Slide 57 the will of the people

Trialling and monitoring

If there has been an underlying theme to this course so far, it has been to support the scientific method and let this influence decision making. Faith in science and progress, and the role walking and cycling can play in it, is central to my personal drive to champion schemes, and so the message cannot help but keep seeping through. At this stage I am not being subtle anymore: you need to conduct actual experiments to make walking and cycling work in your area. You need to try stuff, learn from it, adapt it or scrap it entirely. Most urban spaces have not been designed for people, and so retrofitting is tricky. This course tells you as much as I can, but you will still need to test everything before it is accepted. If you are testing new ideas and recording results, then guess what? You are a scientist, so let's do what they do.

Slide 58 trialling, you are the scientist. Translate science into society

Before any trial, you need to consider the context and objectives. What do you want to achieve? If the answer is more walking and cycling, then that is what you need to monitor. Do you want to measure impacts? If so, then you can look at collisions, or methods of quantifying street performance quality. Where do you want to apply this approach? If the answer is many places, you might want to monitor a sample of junctions. You should also ask yourself why you cannot just do it anyway; who are you trying to prove something to? What, at the end of the day, is holding you back? Is it an attitude, or is it a regulatory issue? All these things will greatly alter the type of evidence you want to collect.

Research questions

Slide 59 what do you want

The next thing you need to ask yourself is: “What are the research questions?” This is the conundrum of science, you need to ask the right questions, but you may not know what the questions are until you undertake the trial. Here is a tragic example: Does Thalidomide help with morning sickness? Answer: yes it does, so we can prescribe it to expectant mothers. The research question really needed to be: Does Thalidomide cause deformities in foetuses? The answer was yes, but nobody asked the question and so the tragedy occurred.

Think long and hard about your research question and think about what the people that will oppose the innovation will ask for. In the case of light segregation, the transport research laboratory asked the question: how protected do cyclists feel behind it? This is a legitimate question, but those opposing it will say it is a trip hazard to crossing pedestrians, and so the research questions could have been: How visible are different forms of light segregation to crossing pedestrians? or What is the likelihood of tripping incidents based on different set layouts? If you have not asked the correct questions, then expensive and time-consuming work can easily be shot down.

Slide 60 research questions

I was involved in a series of research trials in the UK, and we kept coming up with different questions, meaning we had to keep re-running the trial numerous times, while measuring different things. Learn from my mistake and think a long time before you start, to avoid this. The form of a research question should always be: how can something we can control affect something we can measure?

In scientific terms: what is the impact of a variable? There can be several measurable impacts, but try and keep as few variables as possible, or the permutations can lead to multiple trials. For example, if you wanted to measure a simple thing like the impact of speed tables on general traffic, you would have variables of table height, width and length, number of lanes, crossing provision, parking provision, street context (times nine at least), pedestrian density, land use types (mixed, residential, commercial, educational, industrial), vehicle type (times hundreds), surface construction (times dozens), surface quality (times several), behaviour (times several) and regulations.

This is not even an exhaustive list and yet all these variables can affect the speed of traffic over tables. Just four variables will mean you have to run twenty-four different scenarios multiple times. In the example I gave, even if you simplify it down to ten generic variables, you would need to run 3,628,800 scenarios to isolate which combination of variables had the effect, which is quite impractical. This is why, in answer to the question: “How much will a speed table slow traffic on my street?” the answer is: “We do not know. Probably about 10km but it could be more or it could be less.”

In this case, we can look at evidence from thousands

Data

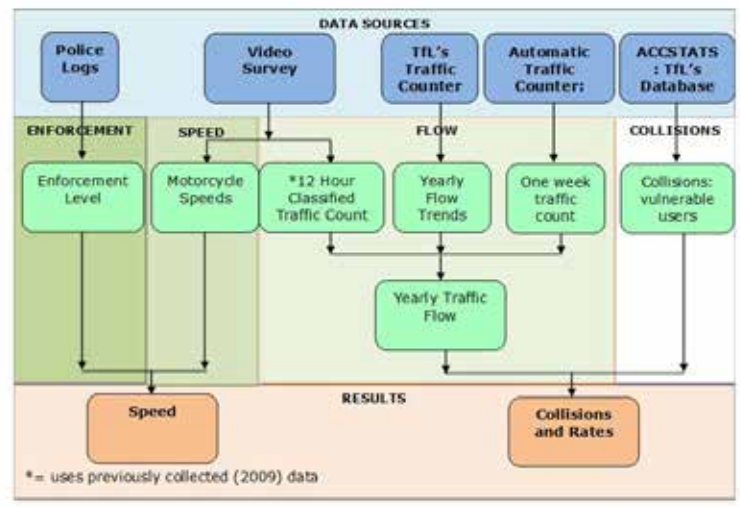
of cases and work out an average, but averages are no guarantee. When it comes to cyclists and vertical traffic calming, all the evidence I have seen suggests that it does not alter cycling speed at all, but there is so little evidence in this area that it is hard to say, and, as previously shown, it would be very difficult to test this in a trial.

Slide 61 variables

So what kind of thing can we test? To answer this, it is sometimes more helpful to look at the data that is available and work backwards to see how changes in these data sets will influence decision makers. The ultimate dataset in transport planning is collision statistics, also known as accidents or crashes. All schemes and interventions are ultimately judged on whether collisions went up or down.

In the UK, this data is collected by the police at the scene of collisions and is therefore quite reliable. Other countries may have to rely on hospital information or insurance company information, but safety is the prime dataset for analysis so you will need to get some data. The biggest issue with this data, apart from getting hold of it in the first place, is the amount of time it takes to process and become meaningful. It usually takes three years for subtle trends to become apparent in collision statistics, and so you need a lot of patience to test new ideas this way.

Slide 62 safety collisions



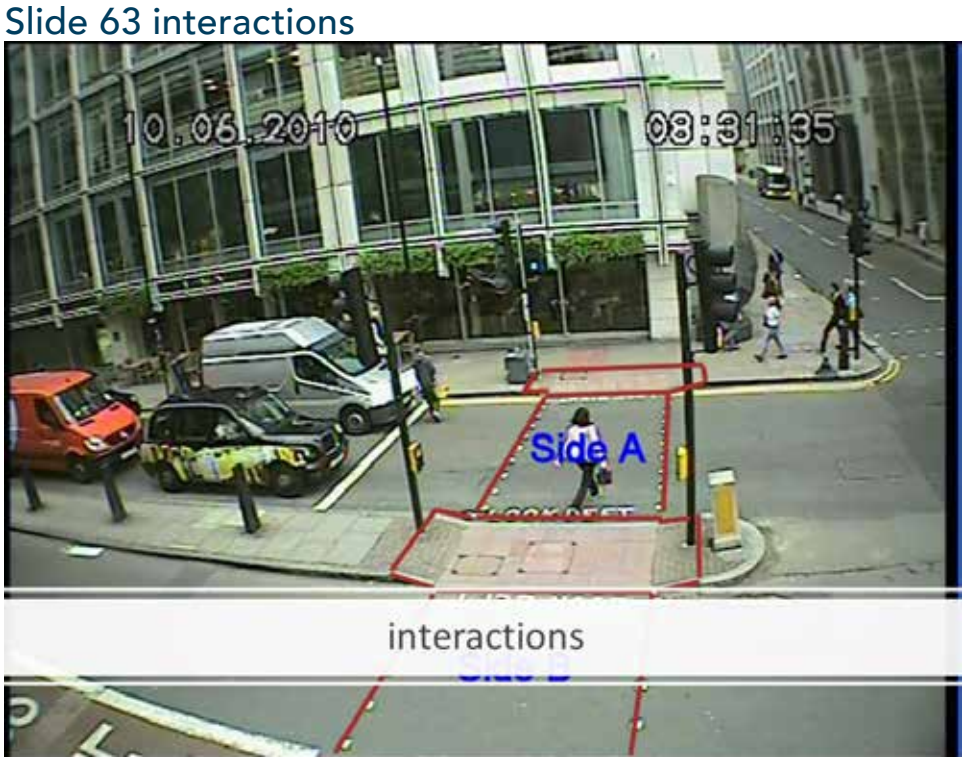
If you are not quite that patient, then you could adopt the Transport Research Laboratory approach to measuring conflict, through counting the frequency and severity of interactions. They define conflict as being when any two people want to be in the same space at the same time. This space can be exchanged through negotiation, or it can happen violently at speed. They suggest a five-tier approach, ranging from full anticipation with appropriate adjustment, through unanticipated near misses, towards a level five actual collision.

If, when you start your trial, you observe several level four near misses, it may be time to adjust, rather than unethically waiting for an actual collision. I find this approach really useful, and so I suggest you research it and get used to it. Here are their five levels for reference: level 1: precautionary; Level 2: controlled; Level 3: near miss; Level 4: very near miss; Level 5: collision.

I cannot help but think about Chris Marker's 1997 film Level Five at this point. Watch this if you want to get in the right headspace for interaction analysis. Knowing figures for how many interactive conflicts you had before and after a trialled intervention helps to back down those who hit you with a blanket that isn't safe or it looks dangerous response. Quantify evidence to fight ignorance, champions!

Assumption

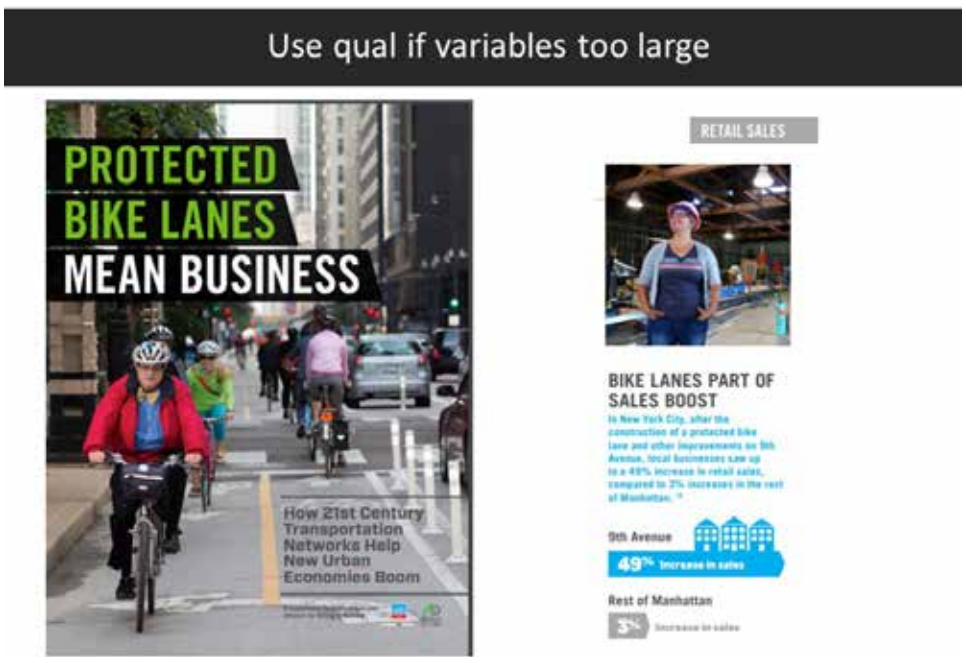
Slide 63 interactions



Measurable increases in speed and position of all users can be picked up via video survey, and so I would always recommend getting video footage. This also helps counter those who need to see it to believe it. I would suggest that qualitative data can also be extremely useful, especially for politicians who make a career out of worrying about opinion.

Knowing that users understood your innovative approach and supported it is great evidence to collect. Even better, is recording that they would be willing to use it. I often quote American research into protected bike lanes that showed a third of people stopped and questioned would not have ridden without it. This argument can be easily flipped into an assertion that if we provide more, we will get a thirty percent increase in cycling.

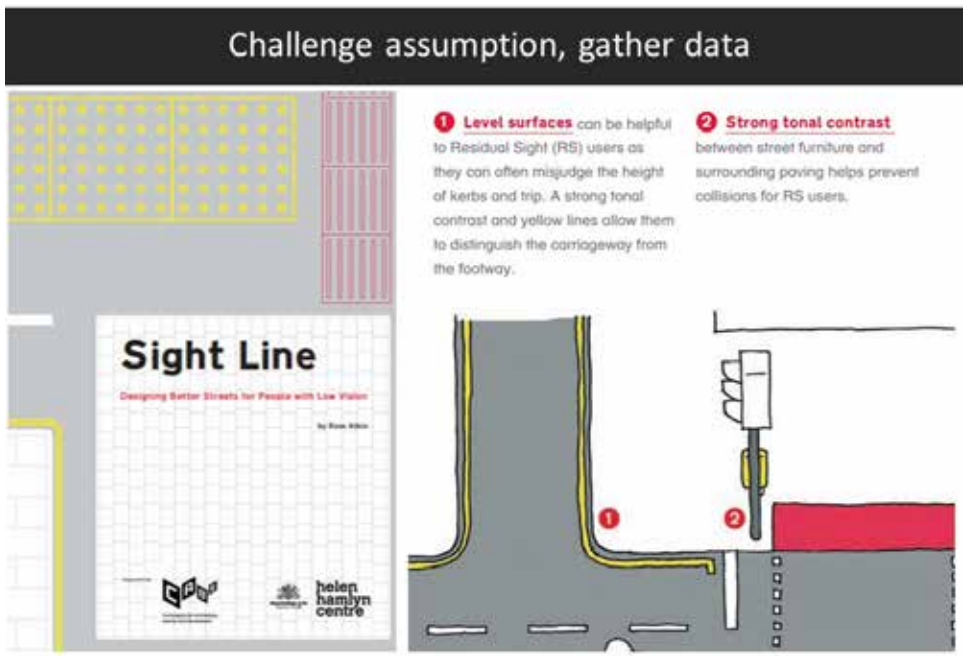
Slide 64 get qual if variables too large



Always be on the lookout for data that you can use to build your case. User perception analysis is sometimes the only data you can gather if the variables are too large, and so do not underestimate its effectiveness. User surveys nearly always point you to a conclusion or topic of interest that you had not considered, or challenge an assumption that you may have held dear but is false.

For instance, it is often argued by groups representing the partially sighted that they hate level surfaces as it is confusing to them where the road is, but I have seen research from users which shows that partially sighted users prefer level surfaces as they are less likely to trip and just want some warning tactile paving. Assumptions always need to be questioned. What if the world was not actually flat?

Slide 65 challenge assumption gather data.



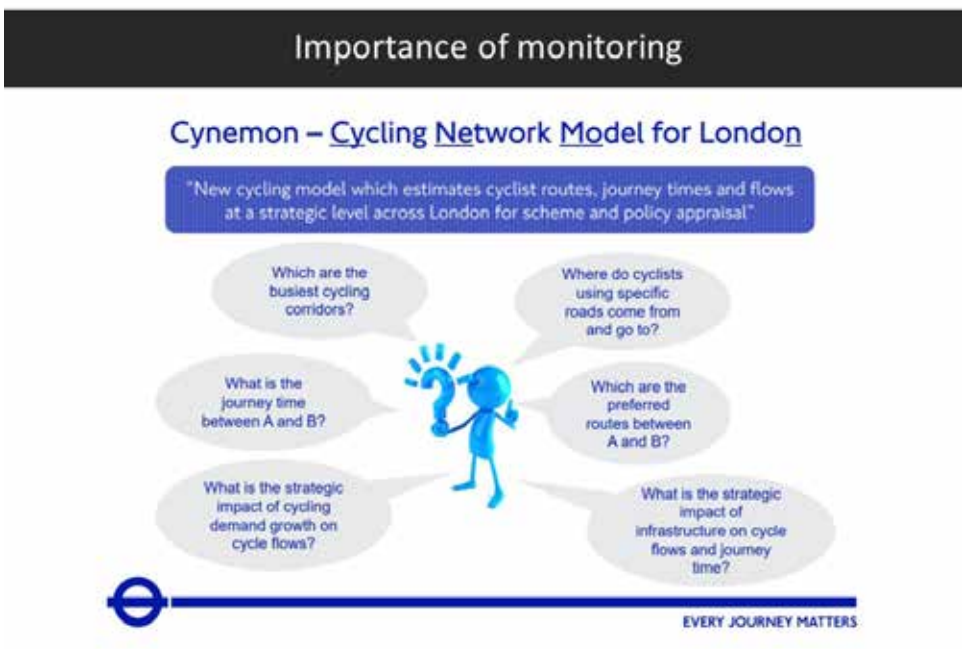
Monitoring is the most civil-servant-orientated word in the dictionary. Whenever anybody at a civic authority is cornered into admitting potential liability, or where no action has been taken but they want to make it seem like there has been, the we are monitoring the situation card is played and the question is diffused and delayed. It is almost impossible to prove whether someone is actually monitoring something, or whether they are just waiting for something to happen that they can react to. Is this the same thing? No, champions, it is not.

Monitoring should be systematic and focussed, and provide the ongoing record of your success. Without monitoring, we are condemned to repeat the same mistakes over and over again. Monitoring is the historic record of our society's progress. In short, monitoring should have outputs and these should be easy to communicate. How many cyclists have you got? How much have you delivered this year? How many

Monitoring

collisions are associated with this kind of infrastructure? A consistent and robust approach to monitoring is essential if policy is to be evidence led. Ignore it at your peril.

Slide 66 importance of monitoring

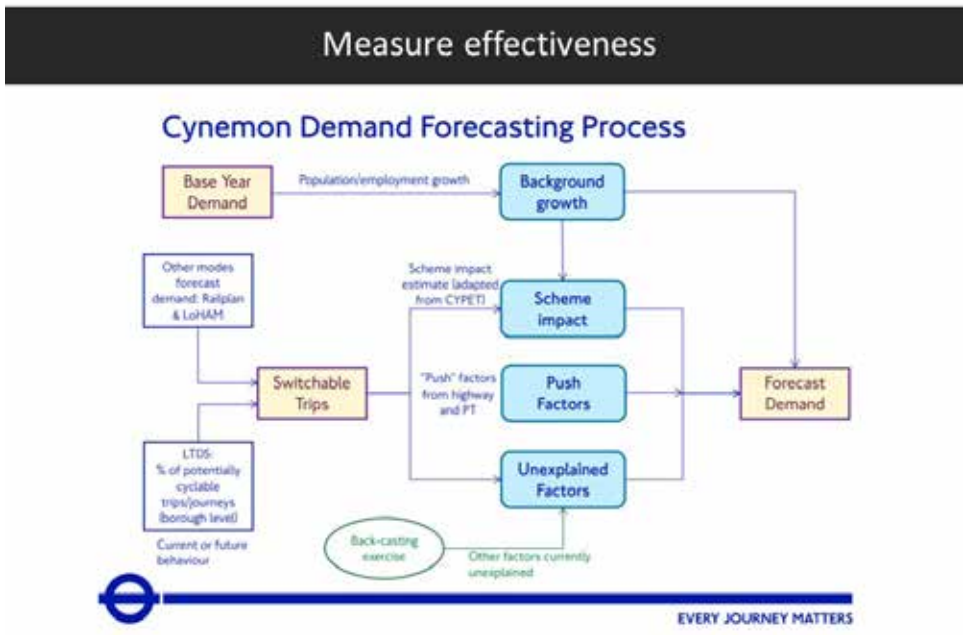


If you stop monitoring, then something truly bad could happen as a result of your policy and nobody would know. In society, the first thing a leader will do if they are going to cut the budget on something is to remove the monitoring budget. This ensures that any tragedy that ensues is not recorded.

Populist misconstrued agendas can only prosper if no one is monitoring the damage they cause. If you do not count collisions, then who can say how bad your roads are? If you do not monitor air quality, then who can say why people seem to die ten years younger in your town compared to the next.

Every policy decision has an impact and without monitoring we could not discern the good from the bad. What honestly is the point of doing anything if you do not measure its effectiveness? Yet so few look back to see if approaches worked or not. Please champions, be one of the few who do.

Slide 67 Measure effectiveness



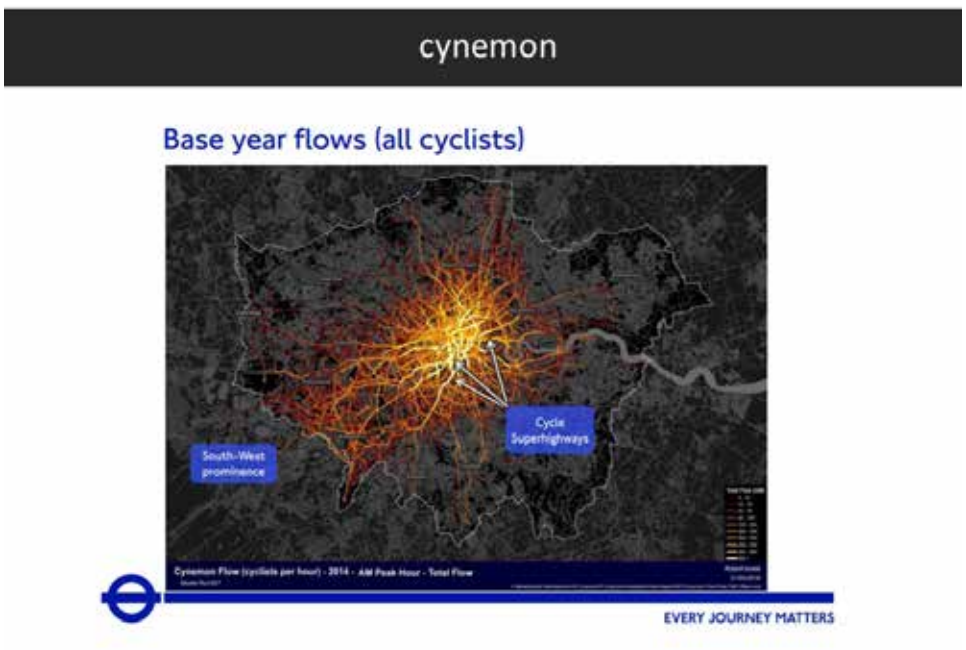
Monitoring people is a science, but, unlike most sciences, it is better to mix quantitative and qualitative data to build up an evidence base. When you are monitoring changes in society, then you must acknowledge that only by mixing these two sets of data is the truth revealed. It hurts my scientific sensibility to say it but, goddamn it, it is true.

For high level targets such as increasing the number of trips by a certain percentage, then monitoring is straightforward although costly to be accurate. You would need to know how many people are walking and cycling across the network. City-wide this can be quite a task.

London does a nifty trick by placing counters at strategic points, connecting them, and then running an algorithm on the data, based on likely route choice. This helps match cycle flows to every single street in central London without actually putting down induction loops, screenlines, Bluetooth registers or lasers everywhere. I would not expect champions to take on this kind of approach personally, but you should be asking for the data or at the very least undertaking a few spot counts yourself.

Trips

Slide 68 cynemon

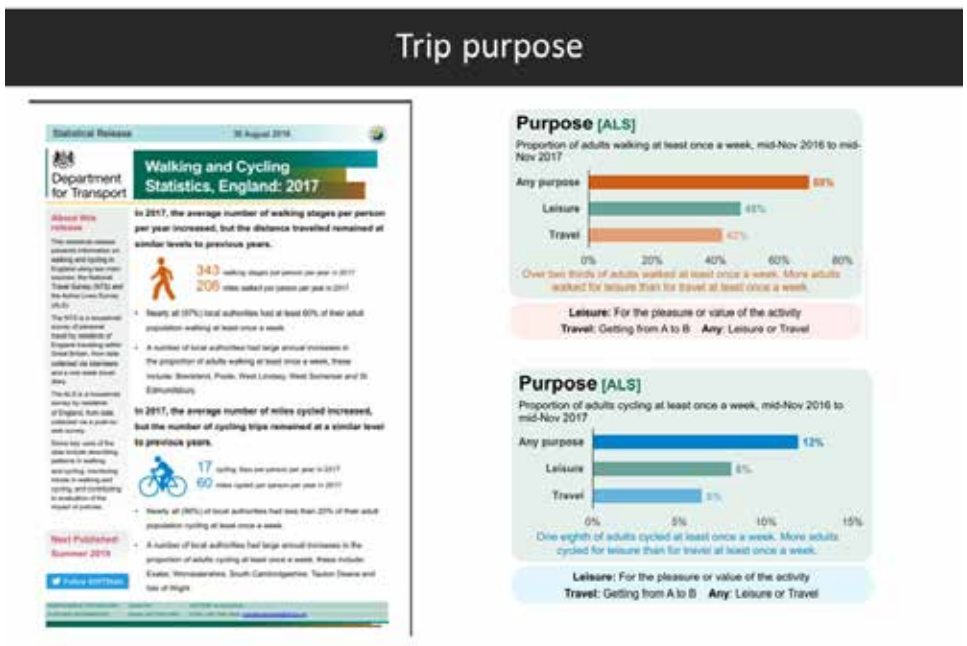


Total numbers are great, but you may want to fine tune your data to look at the distance of trips, or how volumes change in certain areas or on certain routes. This might give you an idea as to where the infrastructure works best, or perhaps where there is more propensity for people to walk or cycle. The best way of getting this data is either to make deals with mobile phone app companies who track people's journeys, or stop people and hand them a survey asking for their trip details. To fine tune this even further, you could set up a web-based map and ask people to plot their journeys. All these datasets will be tuned towards the willing or enthusiastic. This is especially true in the case of people who use phone apps to plot journeys. They are obviously keen, and may even have sporting aspirations, and so this may give you a distorted view of the trips made by the majority of people or even those considering walking and cycling.

Slide 69 using app data locally

Whilst surveying people for their origin, destination and trip length, you might also want to ask them for their trip purpose. A high percentage of commuter trips may be beneficial for peak time traffic, but may also indicate that elderly people or children are not making many trips, so maybe your infrastructure is not enticing enough. On the other hand, a high percentage of leisure trips may indicate that walking and cycling is not being viewed as a legitimate transportation option for commuters. Either way, it is better to know and plan your strategy accordingly.

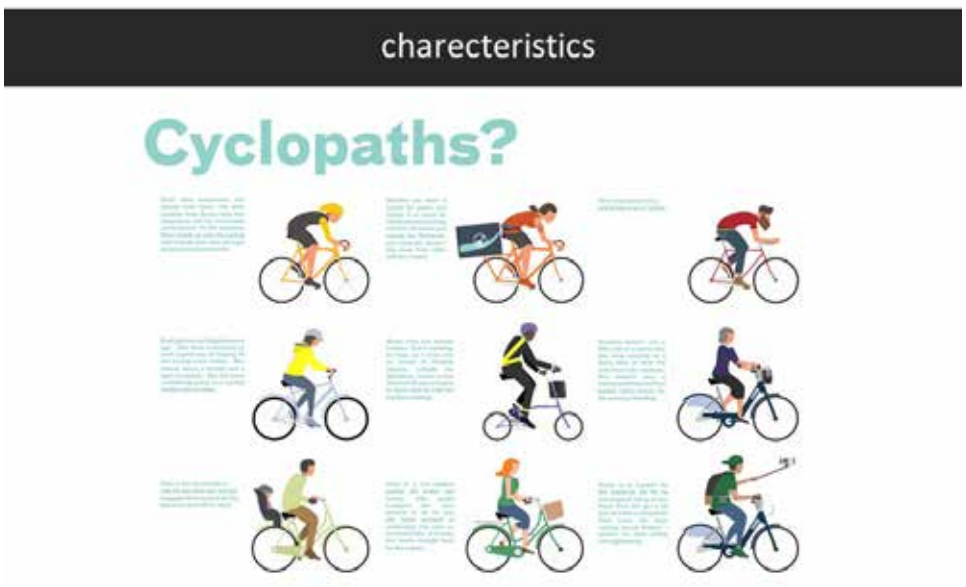
Slide 70 trip purpose is useful



You may also want to know the characteristics of your people, are they: Old or young? Rich or poor? Male or female? What is their ethnic group? This can be found again via surveys or you could closely analyse a video survey to get an indication. In London, most cyclists are young, white, high-earning males making peak time commuter trips. London would love more walking and cycling activity during the day, and would love many more different groups to partake in the activity, which is why they have been investing so strongly in infrastructure that they think will entice them.

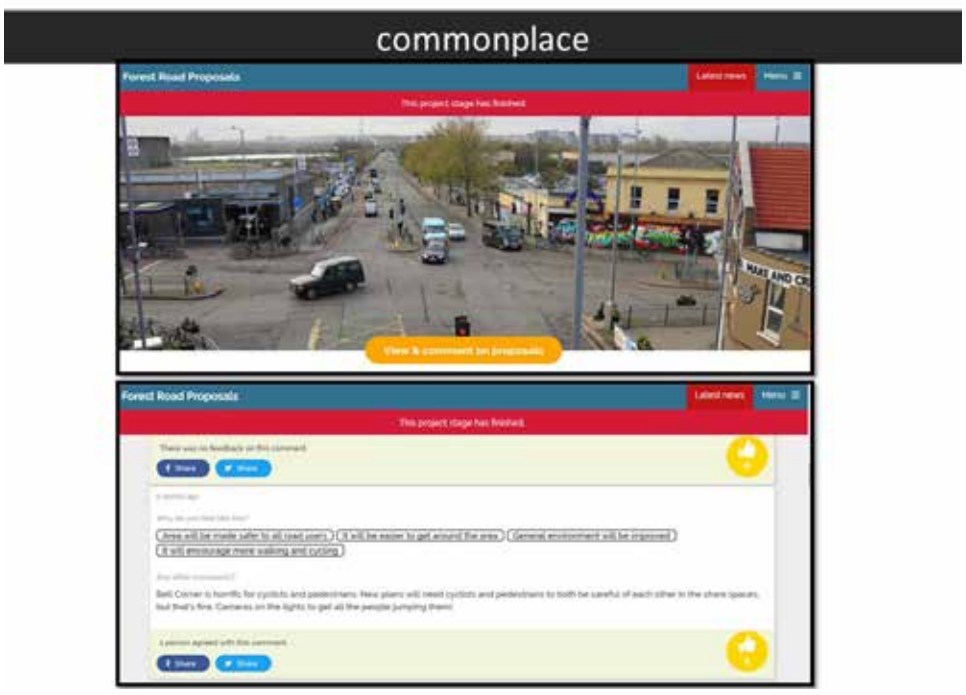
Disbenefits

Slide 71 characteristics



If there is reluctance to walk or cycle in your area you may want to investigate this in a structured way, perhaps to form a behaviour change campaign. What are people's motivations or attitudes to walking and cycling? You could even do a life mapping exercise and look at whether people ever walked or cycled and what made them stop. If you want to know the wider public's view, then I recommend adding comments board to consultations. If civic authorities have this function, then it gives an excellent glimpse as to what local feelings are, and how you might approach people to convince them of the benefits.

Slide 72 commonplace



Putting the surveys aside for a moment, collision data is a key source of information, as it can highlight faults with infrastructure approaches, or help justify an approach you want to try. In the next section, we will cover how to undertake a crash investigation. Walking and cycling can have positive and negative effects on other modes, whether it is on the road network and manifested as congestion or mode shift, or on bus and train networks in terms of patronage. Walking and cycling does not take place in a vacuum, so if walking and cycling figures go up then who will that affect? Could it mean that a bus route is no longer economically feasible to run and so people who relied on the service but cannot ride due to ill health will suffer?

Monitoring should cover benefits as well as disbenefits, which is another civil servant word putting a positive slant on the removal of utility. Do not be a wide eyed lunatic, acknowledge the negative aspects of what you are doing and try to mitigate them. Otherwise, well, you are just being blindly unreasonable, and people will stop listening. Put values to ups and downs, and let the evidence speak for itself.

Slide 73 mitigate disbenefits

If you want more people to walk and cycle, and I am hoping you do, my fellow champions, then guess what: you are in the marketing business. Marketers have developed a language and approach that champions need to understand. Are you after the near market low hanging fruit for example? The deeper into market penetration you go, the more expensive it becomes, and the smaller the returns. Do you really want everyone to walk and cycle? If so, great, but your life will be unfulfilled. If you have an idea of the people who could and should, then you may find it easier to visualise approaching them.

How do you measure and monitor market penetration? Well, aim at a group, apply the message, and then ask a representative sample how they felt or whether they noticed. You also need to think about whether you want to monitor the impact of specific interventions

Balance

or the overall impact of many interventions. The first one obviously helps you see what worked or not, but is time-consuming and expensive. The second just lets you know that something in the collection is working – or not. The general rule is to test new things and then roll them out if successful. There are, however, hundreds of variables and so the perfect monitoring system does not exist. We cannot give up though, as without an evidence-based monitoring framework, you are metaphorically urinating in the wind.

Slide 74 marketing techniques

This is the big one. Which one is more important to society: Health, Safety or Congestion? Or is it all three, or is it a little bit of health and safety without affecting congestion? I think we should start by making the case for health, and showing how to turn health into monetary values. We will then do the same for the other two, and then look at how these values change on specific schemes.

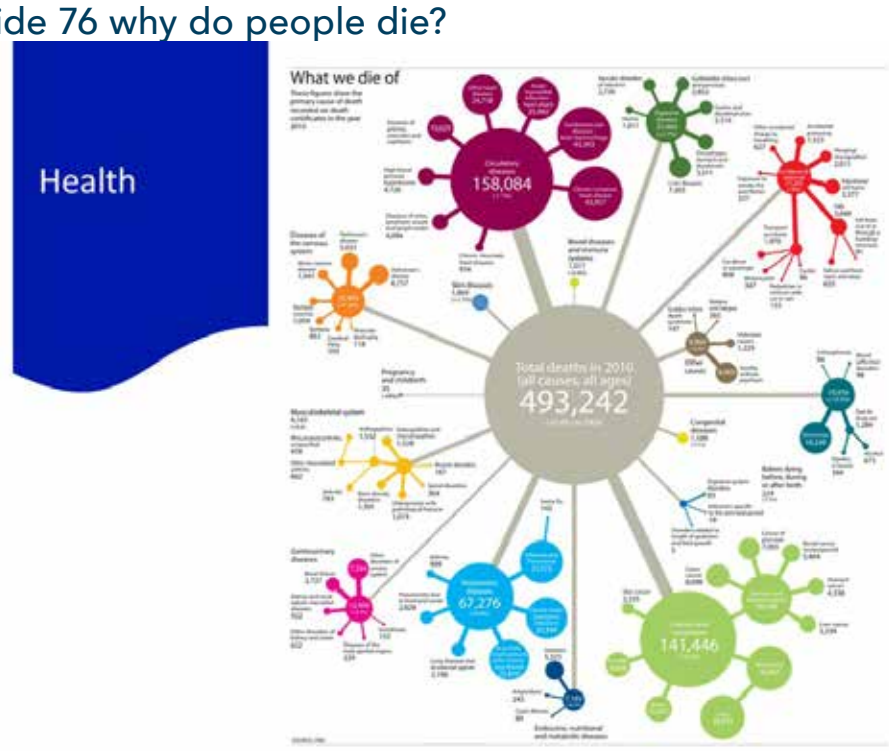
This section assumes that money is the bottom line, and so all those who may have found a higher purpose might want to look away. Champions, on the other hand, need to put figures to anything and this section will show you how. For many years, people assumed that supporting private car use was good for the economy. There is an ocean of evidence contradicting this commonly perceived nonsense, and so cycle champions should not be worried about the bottom line.

The bottom line is that walking and cycling puts money in people's pockets and unburdens society. Nowhere is this more acutely obvious than when discussing the health of citizens.

Slide 75 monetising

Why do people die? It is a big question but unlike other big questions it has a measurable and objective answer. In the UK in 2010 there were 493,242 deaths. 141,446 of these deaths were the result of cancer, 158,084 were the result of circulatory diseases such as blood pressure and heart disease. 67,276 were the result of respiratory diseases and 17,201 were accidents. So 3% of all deaths are accidents. 96 of these accidents were cyclists, and 153 were pedestrians, so less than 0.02% of deaths are due to cycling and 0.03% due to walking. It is therefore very unlikely to get killed walking and cycling. But why take the risk, you could argue, even if it is a low risk? Well, because physical activity reduces your chance of getting most of these big killers by up to 30%. Most people would take the odds that doing something with a 0.02% chance of killing you reduces the chances by 30% of things happening that have a 74% chance of killing you.

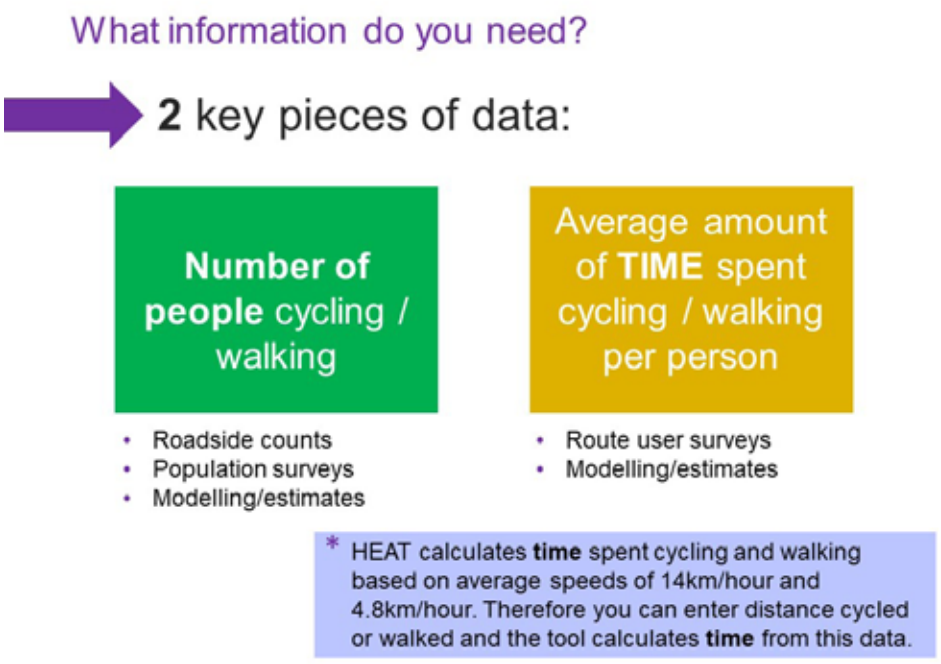
Slide 76 why do people die?



Health

Put simply, if you cycle regularly, you are 10% less likely to die in a given year. Like I say, the evidence is in our favour. This 10% figure is the basis of the World Health Organisation's (WHO) Health Economic Assessment Tool (HEAT) and is based on rock solid evidence. Famously, there was a 14.5 years study in Copenhagen which followed cyclists and non-cyclists and used the ultimate health evidence of checking who was alive and who was dead after the full time period. If you divide the number who died by the number who lived then you get what is less dramatically known as the relative risk.

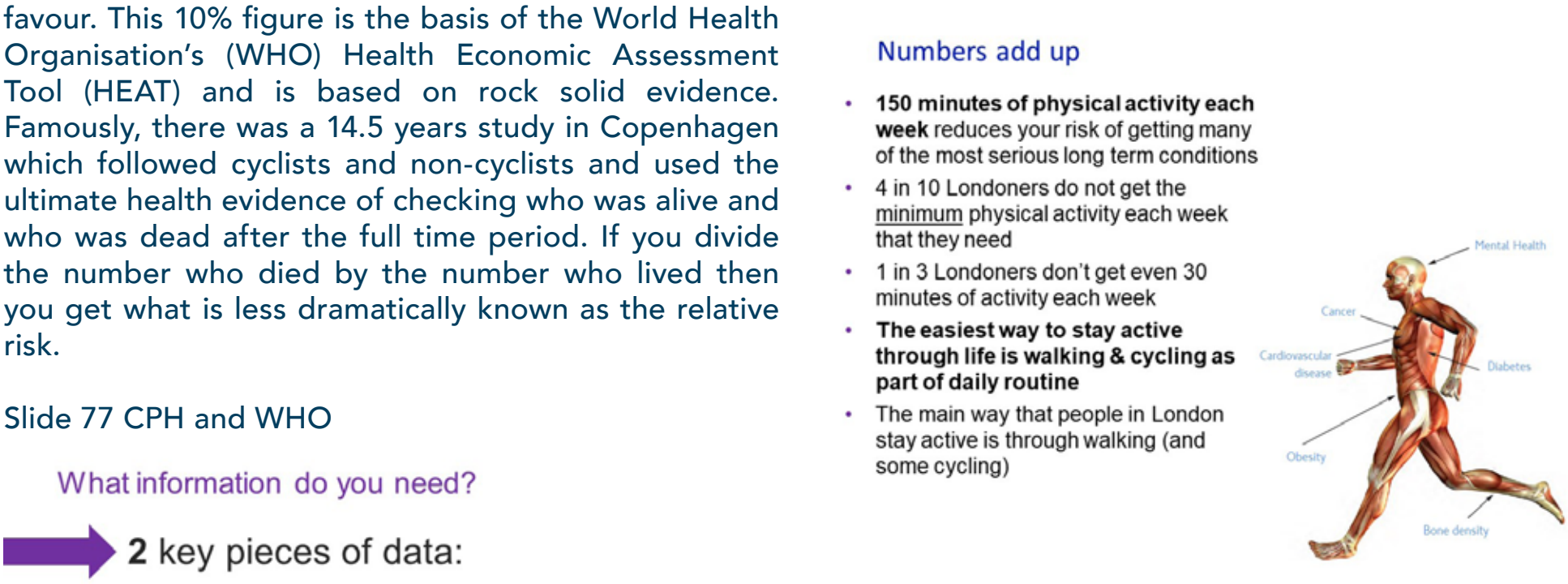
Slide 77 CPH and WHO



How much would you pay to be 10% less likely to die? How much is your life worth to you? Economists have invented a term called the value of statistical life, which quantifies how much a death costs society. You could even think of it as how much a person would be willing to pay not to die. It sounds strange as I am sure we would all pay everything we had and a bit more besides if we were held at gunpoint, but values are needed, if only to quantify relative risk. The figure is approximately 2.5 million euros.

So if I can save your life then I am saving 2.5 million euros and if I can design something that makes you cycle regularly then I am saving 250,000 euros. Please note that that value is per person. So if I build a new super duper cycle track which makes 1000 people buy a bike and jump off the sofa, then I am saving society 250 million euros. The numbers stack up to considerable amounts, as poor health is such a considerable issue, and physical activity is the magic bullet – walking and cycling are a surefire way of programming physical activity into your daily routine if you use them to get to work.

Slide 78 numbers add up

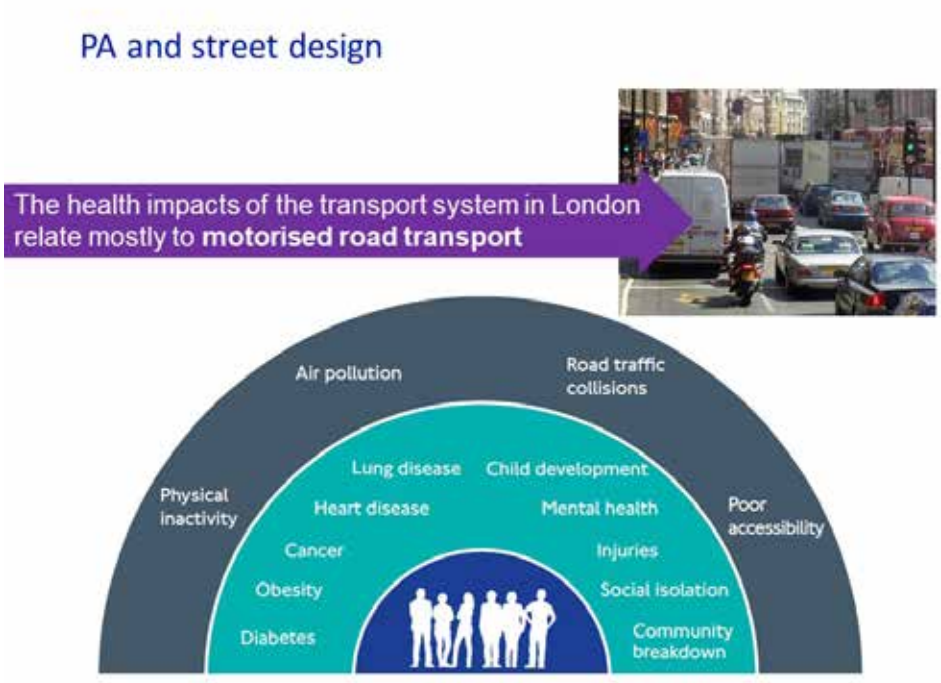


150 minutes a week of physical activity is recommended in the UK to gain all the health benefits. That would equate to three hour-long trips to the gym, which many people do not have the time or the inclination to do. But it also equates to a 15 minute bike ride to work and back 5 days a week, which sounds a lot more in scope and not much effort at all. 1 in 3 people do not even achieve 30 minutes of physical activity a week, and so a health epidemic is brewing. Only those citizens who fit in walking and cycling as part of their daily routine seem to be getting enough physical activity to remain healthy.

I hope you have concluded by now that the answer to our health problems is to design streets that encourage people to walk and cycle. This conclusion does not seem to be very evident in the design of our streets, which are built around the principles of moving motor cars. This approach means that the streets are responsible for reducing the amount of physical activity people undertake, and when you add the air pollution, traffic collisions and poor accessibility that road infrastructure is associated with, then the picture is clear. The thing that should and could be keeping us healthy is making us sick. Champions are needed to address this tragedy!

HEAT

Slide 79 physical activity and streets role



Ok, back to the money: the HEAT tool works by putting figures to the amount of walking and cycling that is occurring or is planned. There is a lot of documentation out there on how to use it, but if you want to get the job done quickly, take some counts and make an estimate on the uplift as a result of what you propose, then run the figures through the tool. In London, the average trip length is 22 minutes so you can just use this figure if you do not know any better; you also need to know how many days they cycle. As in all things, if you are not sure, be conservative and then your results will stand up to scrutiny.

The WHO example shows a conservative 124 days based on a Swedish study. After a few mouse clicks, money comes out of the other end. 1 new trip is roughly equivalent to 1000 euros annual benefit, so do the maths and compare it to your scheme costs. Ok, these figures are lower than the lifesaving promises of millions at the start of the chapter, as we put all sorts of corrections in based on average trips and a limited number of days, but these amounts still stack up to build strong cases.

The more people you benefit, the larger your scheme can be, and the quicker the return. A million-euro scheme would only have to get 100 people walking and cycling to redeem its costs in 10 years. A 10% yield on a million-euro investment would catch any investor's eye. Now you know, so off you go.

Slide 80 HEAT tool

What does this all mean on the ground? Well, let's use a scheme I worked on with the London Borough of Camden as an example: In 2012, there were 824 trips a day on the route, and, following the implementation of light segregation in the form of planters and armadillos, this went up to 1700 trips per day. When processed through the HEAT tool, this equates to an average annual benefit of £220,000, and this scheme prevents 0.11 deaths per year. Over ten years, the benefit to cost ratio for this £470,000 scheme is 4.6:1. The scheme basically paid for itself in two years from health benefits alone. Why are we not building thousands of roads like it?

Slide 81 HEAT RCS

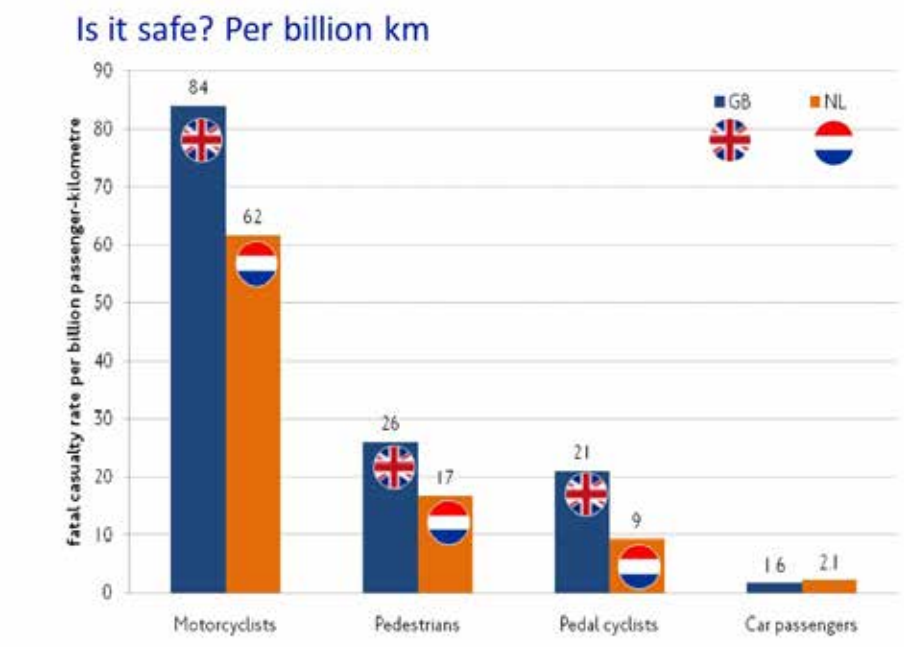
The World Health Organisation, those people again, estimate that by 2030 road traffic injuries will be the fifth most common cause of death. These are not deaths that creep up on you over time and gradually wear you out, these are deaths that end your life

Safety

prematurely with a full stop. The UK has always had a proud record of having one of the lowest rates of road deaths in the world and this gives our politicians the sense that we have no real problem. The United States, for example, has rates that are three times higher and even the bloody Dutch have more than the UK so we must be doing something right. However, in London, the highest risk of injury is to those walking, cycling or riding motorbikes. 127 people were killed in 2014 on London's streets, and more than their fair share were from these three groups.

Is the UK safe because everyone is too scared to undertake healthier, more active travel? In all three of these modes, the fatality rate per distance travelled is higher in the UK than in the Netherlands, with cyclists more than twice as likely to be killed on their journey. The actual figures are 21 cyclist deaths per billion passenger kilometres compared to 9 in the Netherlands. Suddenly the record of the UK looks a bit shakier.

Slide 82 per billion km



There is an acronym in road safety terminology called KSI, which stands for Killed or Seriously Injured. It helps those of us trained in it to keep from talking about death all day, but the definitions are alarming. Obviously killed is just being killed, but seriously injured in the UK means a hospital visit due to fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts and general shock requiring medical treatment, and injuries causing death thirty or more days after the accident. There has to be a cut off,

I suppose, but if you die on the 31st day after a crash you might curse your statistical misrepresentation from beyond the grave. At this stage you will have to forgive my gallows humour, as it is hard trying to undertake safety analysis in a logical manner if you keep bringing forth the human horror of the stories underneath.

Slide 83 KSI

KSI

Casualty Definitions

Fatal collision: At least one person is killed.

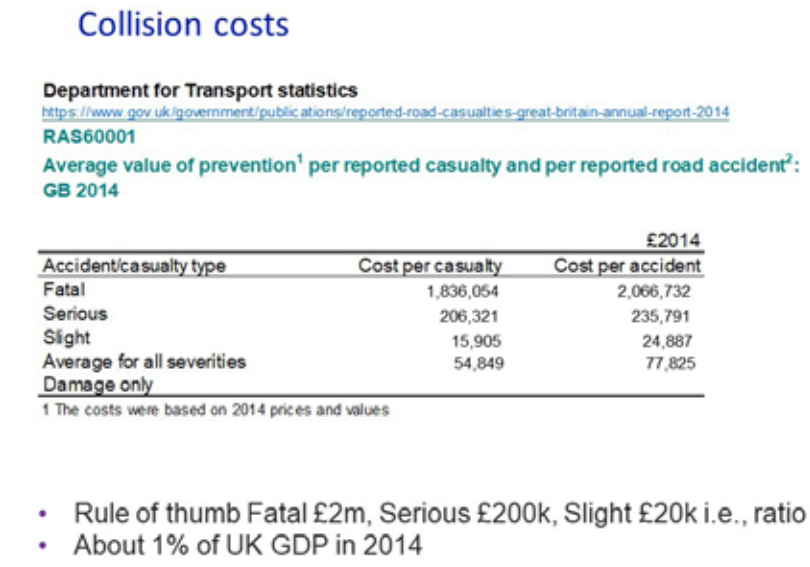
Serious injury: An injury for which a person is detained in hospital as an "in-patient", or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident.

This is an emotive subject and, as such, it always seems immoral assigning monetary values to these tragedies, but that is what we are about to do. In 2014 in the UK, according to our Department for Transport, a fatal accident costs just over two million pounds, whereas a serious accident costs over two hundred thousand pounds, and a slight accident costs over twenty thousand pounds. These figures give us the easy-to-remember ratio of 100:10:1. All the accidents add up to approximately one percent of the UK's gross domestic product, so these are not unsubstantial sums.

As we can put a monetary value to them, based on loss of earnings and other factors, then we should be able to reverse this trick and apply monetary values to those we prevent. If ten people a year die from crossing a treacherous river and we then put a bridge up, that bridge is saving society forty million pounds annually. If the bridge costs twenty million to build, then it has paid for itself in six months. Perversely if you have an accident-prone site, then this can help justify a big spending transformation scheme. Many civic authorities adopt this principle of following these accidents and matching schemes to them.

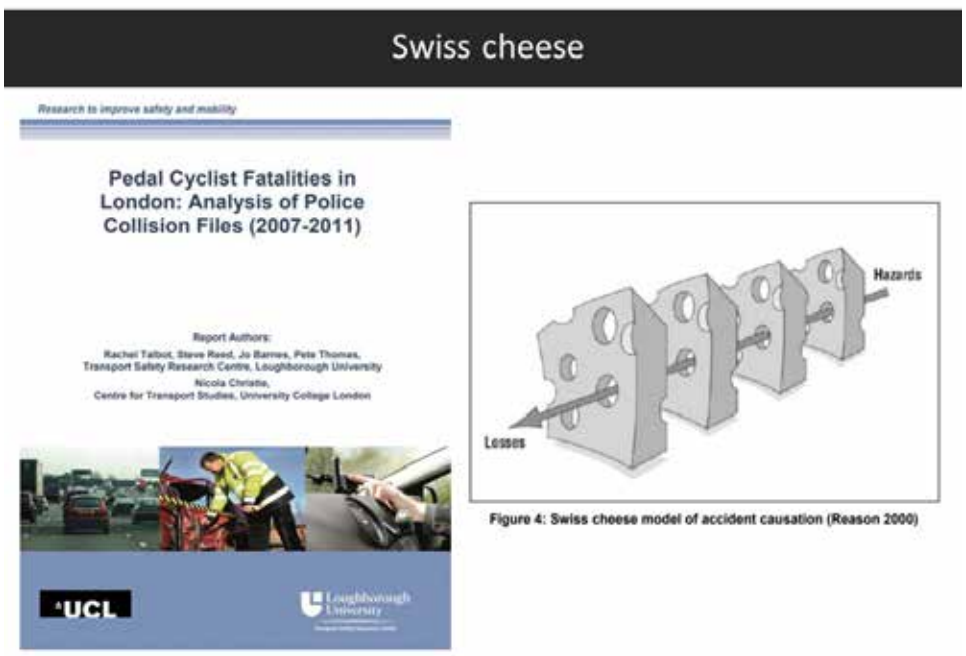
Collisions

Slide 84 collision costs



What causes collisions? Any system that does not allow for mistakes has the potential for collisions. Road safety theory has the Swiss cheese theory: that all the holes need to line up from a collection of mistakes and circumstances for a collision to occur. Personally, it seems obvious to me, but perhaps not to the automotive industry, that drivers are the cause of collisions. In London, driver error is responsible for 85% of the collisions. These errors can arise from drivers travelling too fast, becoming distracted, undertaking risky manoeuvres, taking drink and drugs or by failing to comply with the laws of the road. Drivers are the danger and if they all behaved well, walking and cycling would be a joyous experience. Sadly, however, they do not, and so that is where infrastructure comes in.

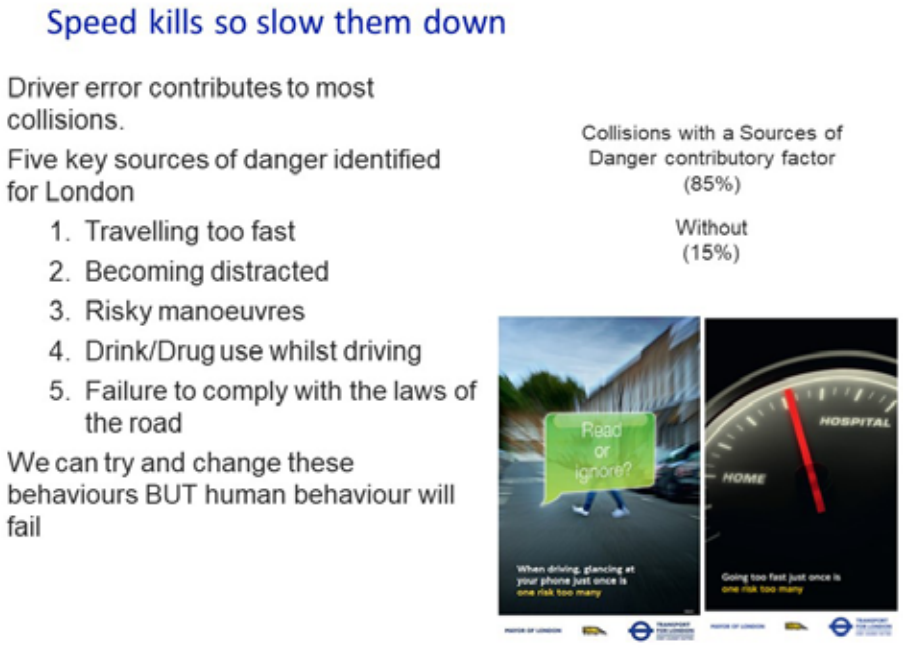
Slide 85 swiss cheese



Speed is the biggest killer on the roads and the statistics speak for themselves: if a driver hits you at 40mph then you have a 15% chance of survival, whereas if they hit you at 20mph then you have a 95% chance of survival. Each 1mph reduction in speed reduces the severity of collisions by 6%. There is a reason that most civic authorities try so desperately to slow general traffic down, but this perception of speed is often lost to those behind the wheel. In the UK, the social norm is to use the speed limit as a lower base rather than an upper threshold.

That is just the way it is, and we just have to wait for the people and the campaigns to evolve to correct this. Personally, I gave up on waiting for driver enlightenment a long time ago when protecting pedestrians and cyclists, but it is nice to dream. I noticed from travels to America that speed compliance is much better, and so it may be other factors where you are. The message here is that you cannot keep cyclists and pedestrians safe without understanding the cause of their danger. Nobody would accept a workplace where twelve tonne objects come hurtling past you without warning at 30mph with only 10% visibility, so why do we accept it on our streets. Enough philosophy, let's get back to the stats.

Slide 86 speed kills so slow them down



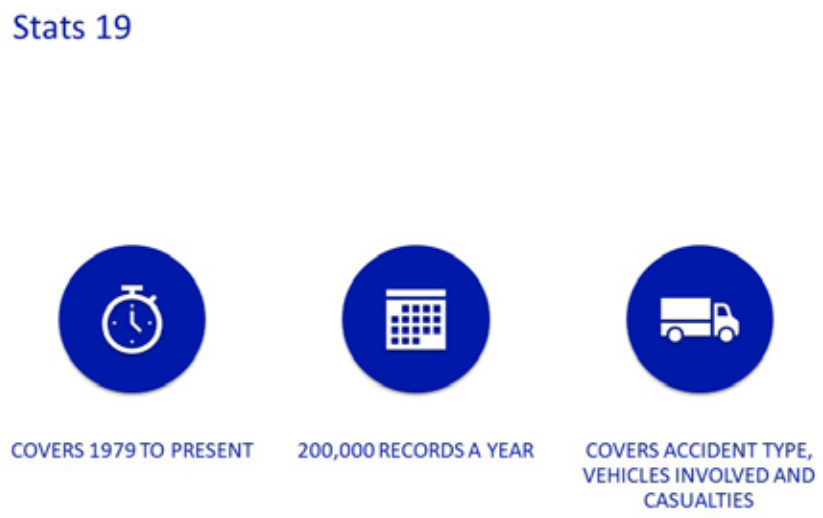
In the UK, we keep a record of all collisions which stretches back to 1979 and is a great source of data if your aim is to prevent accidents. There are over two hundred thousand records a year which are produced by police officers and written onto a Stats 19 form. This form covers the collision type, who was involved, what direction and manoeuvre they were undertaking, and the severity of the incident to all the casualties. I always find it useful to look at the last three years of collisions and draw them out so that I can look for patterns and highlight potential causes on site through observation. A collision analysis is the detective part of transport

Exercise: collision analysis

and, like in all detective work, testimonies are not always accurate.

There is therefore an art to interpreting this information, but at a basic level you should be able to spot clusters or recurring manoeuvres. These may suggest a layout issue which potentially could be resolved. Patterns relating to road conditions could lead to an underlying maintenance issue, or collisions at certain times of the day could suggest a visibility issue or issues related to the school run. It may seem macabre picking through the remnants of accidents past and seeing if you can solve their causes to draw down money to justify a scheme, but this is the game.

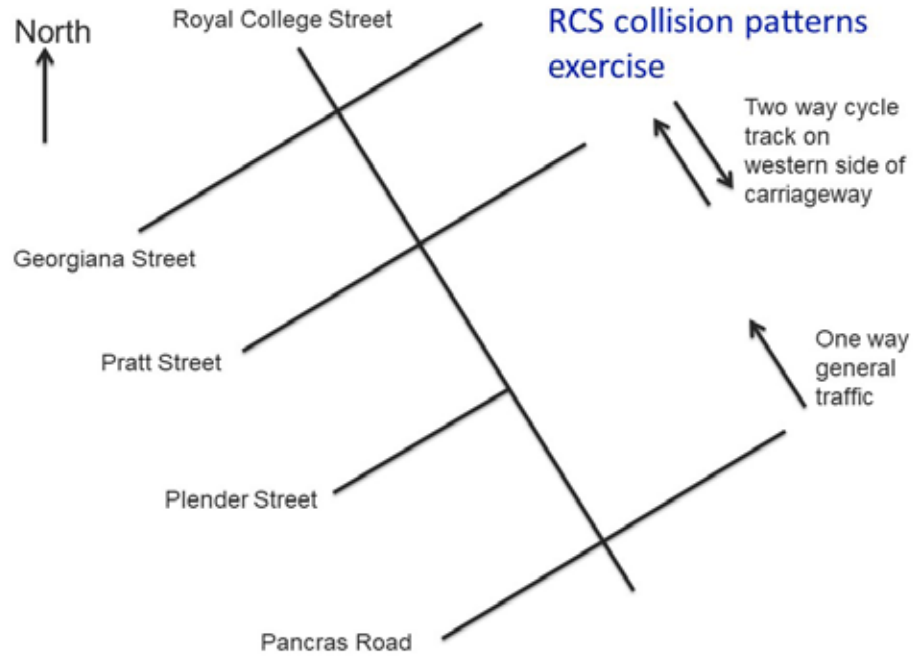
Slide 87 stats 19



Let's return to our Royal College Street example to see how collision figures are generated. From analysing the collision statistics, it was clear that most of the collisions involved cyclists and they were clustered at the side roads. The serious collisions all involved cyclists heading south.

When examining the on-street conditions I noticed that the majority of drivers were only looking south when entering the road as the street was one way northbound. Drivers did not seem to notice the presence of a nearside two-way cycle track with southbound cyclists. The question then was that if there was a way of making drivers look both ways before exiting, then these collisions could be prevented from happening.

Slide 88 RCS collision patterns



Efforts were made to increase the conspicuity of the cycle lane and install flashing warning lights, but these methods proved ineffective. A decision was made to split the two-way track and put southbound cyclists onto the expected side of the road and acknowledge that most drivers could not be taught to look out in this context. The source of the danger was therefore removed. Over a three years period, this could potentially prevent up to 7 collisions. A further 2 were potentially preventable at the signalised junction. In the year following the scheme's implementation, there were 2 slight collisions, and it is worthwhile noting that no system is perfect.

Slide 89 potential collision savings by design

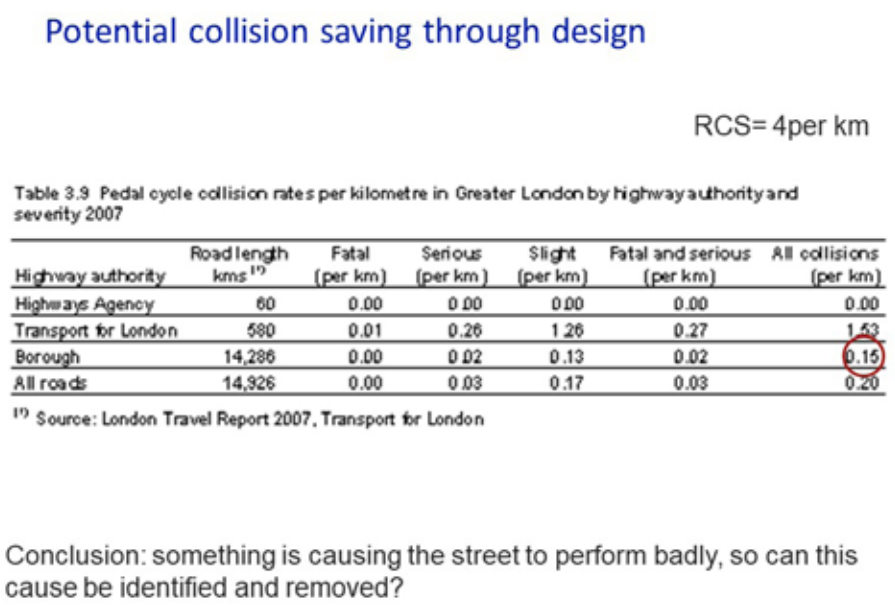


Table 3.9 Pedal cycle collision rates per kilometre in Greater London by highway authority and severity 2007

Highway authority	Road length kms [1)]	Fatal (per km)	Serious (per km)	Slight (per km)	Fatal and serious (per km)	All collisions (per km)
Highways Agency	60	0.00	0.00	0.00	0.00	0.00
Transport for London	580	0.01	0.26	1.26	0.27	1.53
Borough	14,286	0.00	0.02	0.13	0.02	0.15
All roads	14,926	0.00	0.03	0.17	0.03	0.20

[1)] Source: London Travel Report 2007, Transport for London

Conclusion: something is causing the street to perform badly, so can this cause be identified and removed?

It is always worth comparing junctions and links to average values and looking for anomalies; sometimes just giving a route an average rate of collisions can be a big success. The three-year average on Royal College Street prior to the scheme being delivered was 4.3

Congestion

slights and 1.3 serious per km per year. Therefore 2.3 slights and 1.3 serious collisions were prevented and this equated to an annual saving of £334,277. When you add this to the health benefits, then the scheme has practically paid for itself in one year. However, there is a third factor to balance when making scheme decisions and that is delay associated with congestion. Here be dragons!

Slide 90 collision savings

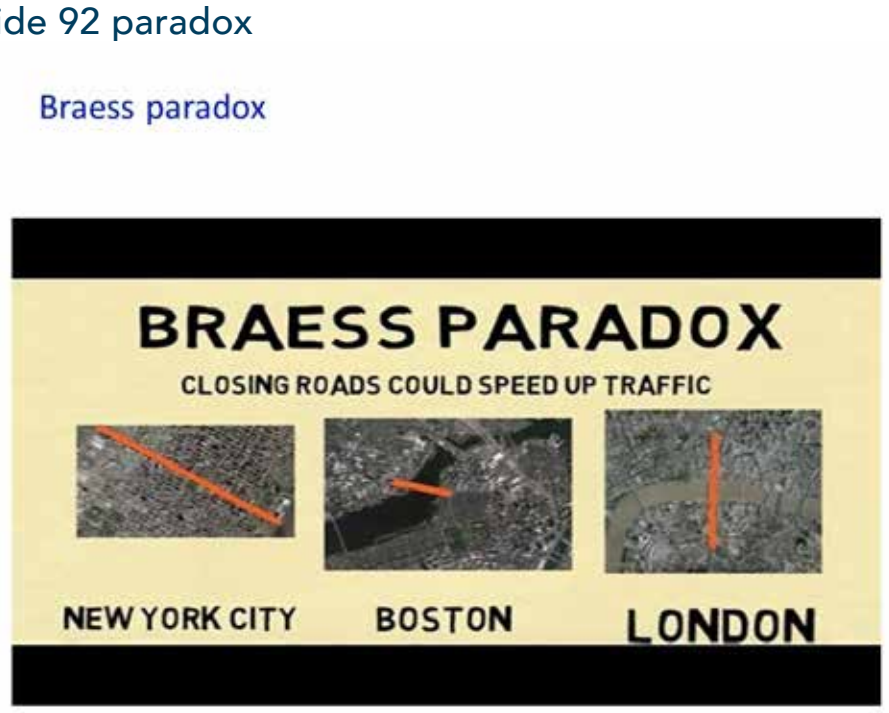
75% of London's congestion is recurrent. The average speed of traffic in London is 7 mph, but this has pretty much always been the case since the carriageway actually did contain horse-drawn carriages. Like most cities, every new road built brought with it new traffic, which quickly filled it up and created more people arguing about journey time and congestion, leading to more road construction and an ever-growing unsatisfied supply and demand issue.

Congestion leads to delay, and delay costs money. It is such a negative word. Delay in the UK is defined as the difference between free-flowing, usually overnight, speeds and the studied conditions. Overnight, pedestrians and cyclists are few and far between, as are other delay-inducing factors, such as other cars. All this adds up to mean that everywhere has delays if it is any anywhere near where people live.

Slide 91 congestion

It is remarkably easy to put monetary values to delay, and so for years it has been used to generate figures for business cases. Health and safety are slightly more involved, and so have been used less in the past. Put simply, if you get free flow situations, then you reduce delay and improve journey time and can generate a monetary value. The fact that more cars will rush in to fill up the space you have created to relieve the congestion has – staggeringly – never been factored in to business case appraisals, and so more roads get built and more cars come. The UK is currently embarked on a huge road building programme to reduce congestion, but the assumption is always that people will only use cars.

Slide 92 paradox



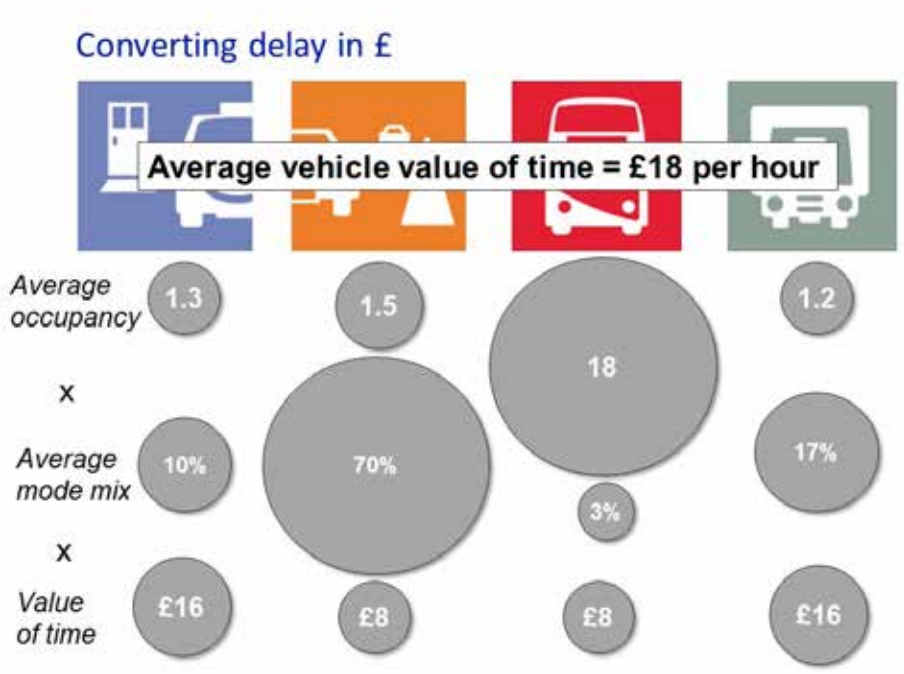
Monetary values are derived from the Department for Transport's willingness-to-pay surveys in the UK. It is an involved method, but in a nutshell it asks how much you would pay to get somewhere quicker. The average value

Value of time

given is about £8 an hour. For example, if a journey was taking someone 2 hours, and following an intervention took them 1 hour, that would save, on average, £8 per hour. If the trip was related to work, then that is a direct cost to the employer and so then the trip would save £30. In London, only 3% of trips are work-related, 20% are commuter-related and a whopping 77% are other trips.

These figures may not seem that high, but let's annualise them. If a street has 10,000 vehicles a day and each one is saving 1 hour thanks to this amazing intervention (let's pretend it's a bridge as they are easy to visualise) then the annual benefits are 1(hr) times 8(£) times 10,000(traffic volume) times 340(Annualisation factor not 365 as nobody drives every day – even Mancs!) = £27.2 million. Wow, that's a big figure and that's how they win, as the maths is the easiest. Our new theoretical bridge could cost £270 million and still be worthwhile as a business case.

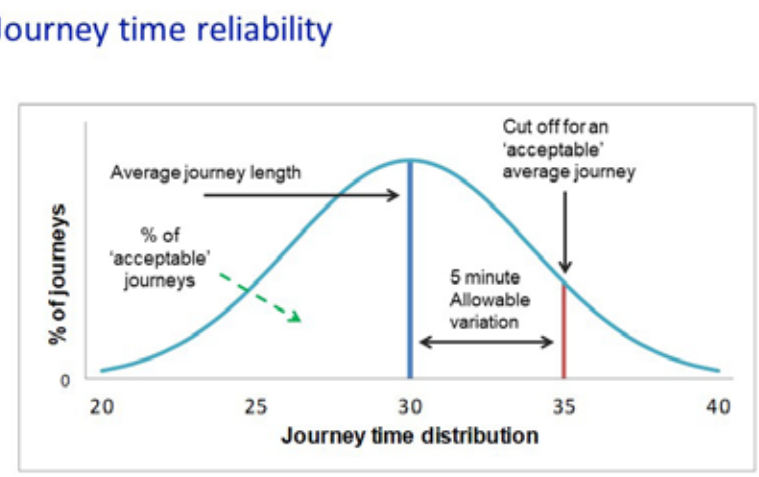
Slide 93 converting delay in £



In London, delay is no longer the key metric. Instead they use journey time reliability. This does seem fairer, as it is not the speed but the reliability that people truly treasure. The journey time reliability metric states that journeys of an average length of 30 mins should not take more than 35 minutes or less than 25 minutes to be reliable. Arriving early for a meeting can be quite annoying, maybe not as annoying as arriving late, but still annoying nonetheless.

This issue is particularly acute if you are trying to run a surface-based transit system to a regular timetable. If buses are supposed to be every half an hour and one takes 40 minutes and the other takes 20 minutes, then even if they set off from the depot half an hour apart they will arrive 10 minutes apart and not maximise their patronage. Journey time reliability is the key to making sure that the old adage of waiting ages for a bus and then three turn up at once is not realised.

Slide 94 journey time reliability



The measure is defined as: *'The Percentage of nominal 30 minute average length journeys completed within 5 minutes of this time'*

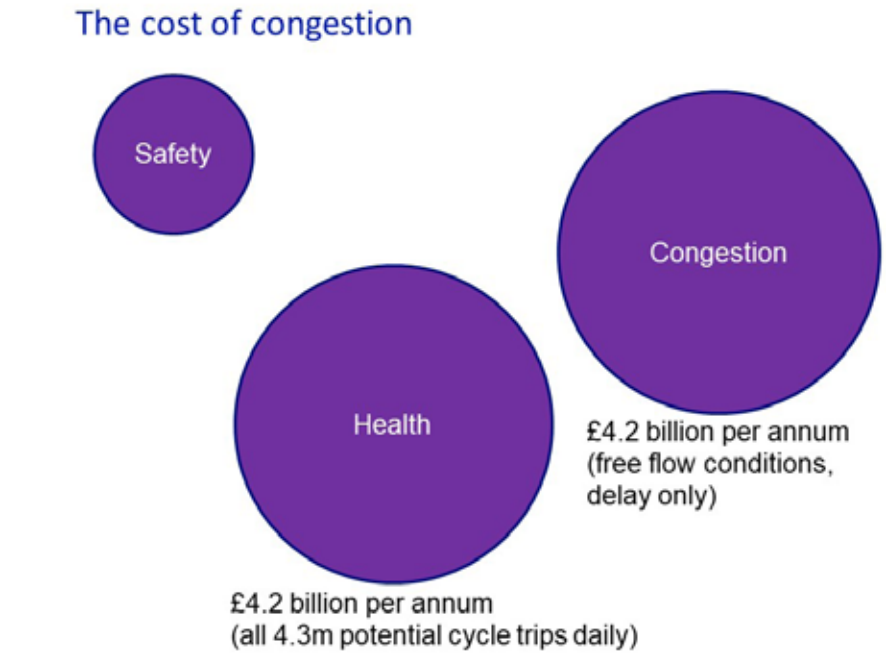
I sense that you are still not convinced about the damage congestion causes, and so you might want to look at the size of the problem. In London alone, using the method shown above, congestion costs society £4.2 billion per annum. That is a bitter pill to swallow and so it is easy to understand why politicians hit the panic button and demand that more roads are built. They only want to save the economy after all.

But wait: champions, you should now be thinking about potential health benefits from walking and cycling and if you are, top marks, as in London they have calculated that if all of London's potentially cyclable trips were actually cycled (that's 4.3 million trips compared to London's current level of close to 800,000), then that would deliver an annual health benefit of £4.2 Billion.

It is an exact balance and as I write this London is teetering on the precipice of deciding which way to go. This is before we figure out how to count pedestrians to truly swamp the numbers. Although in London 50% of walking trips are related to public transport. If we go back to safety, then if we had no collisions whatsoever, then society would save £1.2 Billion and so in economic, if not emotional, terms, the future cities are a battle between health and delay.

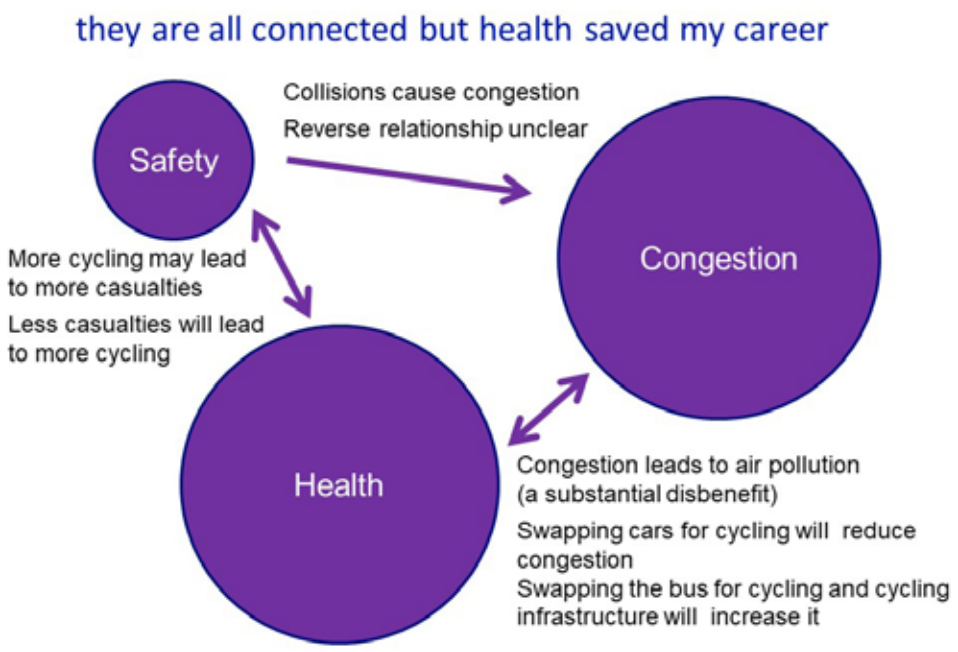
Cost of congestion

Slide 95 the cost of congestion



Obviously, all three of these are related, but balancing their economic representations seems like a sensible way to make a decision to me. The worst form of health is clearly being a casualty, and collisions inevitably delay traffic. But, more virtuously, swapping your car for a bicycle will relieve congestion and at least make you robust enough to have a greater chance of surviving a collision. If this last point seems weak to you, well it is because it is. I was forced to acknowledge midway through my career that I had probably caused more collisions than I had saved by designing schemes that encouraged walking and cycling when surrounding road conditions were not up to scratch. The health professionals helped restore my sleepless nights by showing me how many lives I had prolonged and improved the quality of life. Health has saved my life.

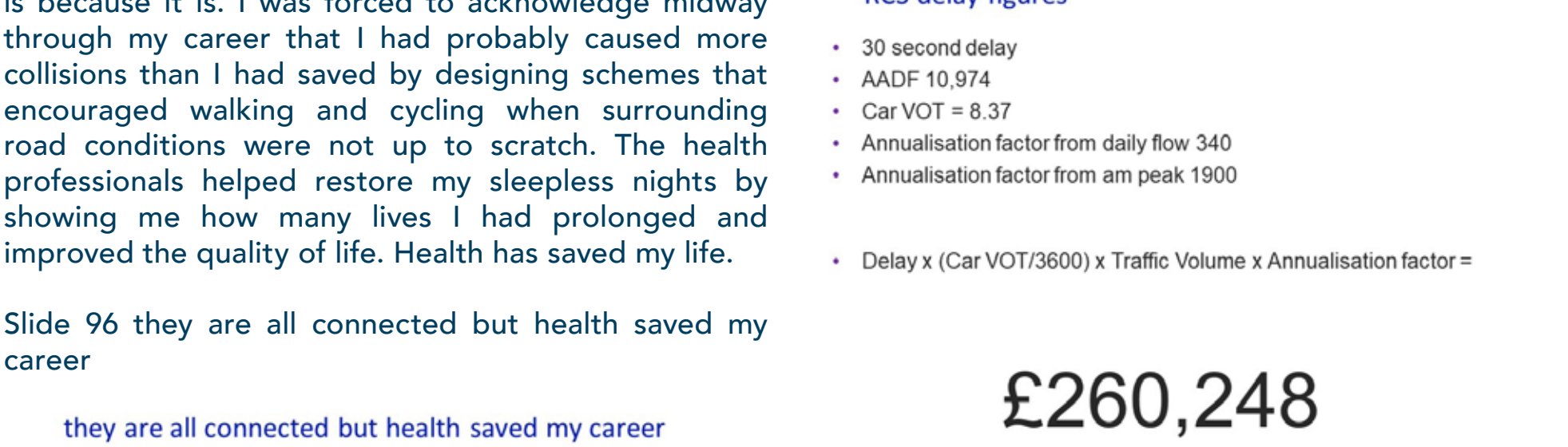
Slide 96 they are all connected but health saved my career



Back to our example then, Royal College Street caused a 30 second delay to 10,974 motor vehicles. I used a value of time of £8.37 per hour at the time and with the annualisation factor of 340 this all equated to a delay cost of £260,248 per year. This scheme was looking good and still has a reasonable benefit cost ratio if you balance all three out, but in standard practice, this scheme would not be justifiable as standard practice the world over is to only consider the value of time of motorists.

However, this is a distorted view, as the delay on Royal College Street came from slowing the speed of general traffic down to its actual limit of 20mph, as before the scheme these speeds were being routinely exceeded. I used this example to show how practice can distort policy. We want people to drive slowly and safely, and yet we base our economic appraisal on solutions that achieve the exact opposite. A six lane 60mph highway through the centre of a city would provide a rock-solid economic case, but would destroy the surroundings, meaning that nobody would want to go to that city centre.

Slide 97 RCS figures delay

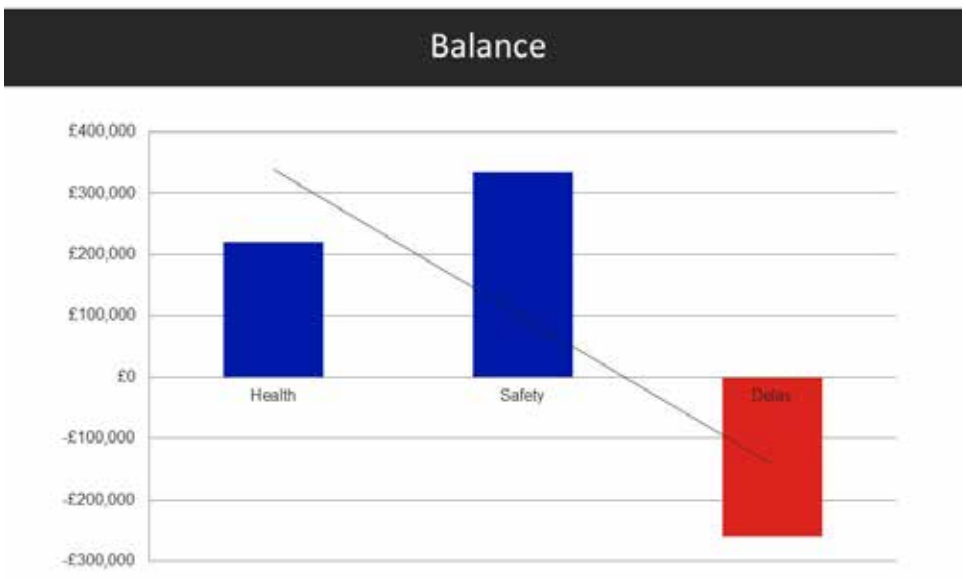


So, what did you decide was the most important? Honestly it does not matter as walking and cycling can help improve all three, but secretly I would be disappointed if you do not go with health, as poor health because of inactivity is reaching epidemic levels, and walking and cycling is one of the easiest cures.

The choice is yours, and everyone that you meet and try to sell your walking and cycling scheme ideas to will have different priorities. It will be difficult making them adopt a balanced view, but that is what champions must do.

Finding balance

Slide 98 Balance

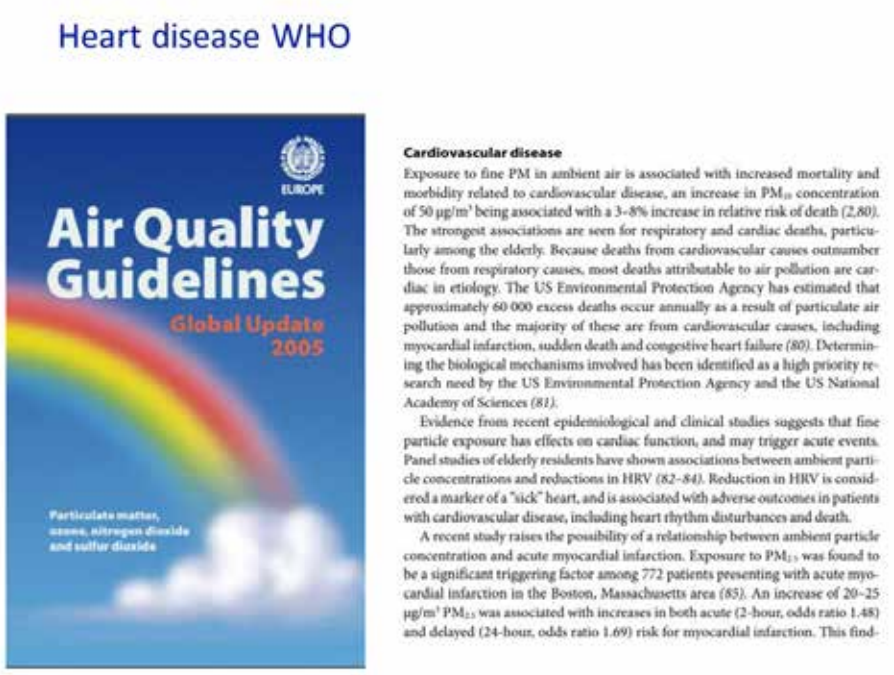


The news as this course is being given is that the world has 12 years to address climate change before the effects are irreversible. The status quo is being defended on the grounds that British jobs are at stake. Alternatives to fossil fuel taxation as a means of income are not being sought, as so many powerful political influencers are benefitting. Champions must recognize the connection between global events and local politics. Some people choose to stand by as events unfold, whereas champions must affect change locally as an example to others.

Slide 99 12 years and counting

This course links transport and street design with air quality. This is one area where local authorities can effect change. Look at the evidence: poor air quality is the 5th major cause of disease and death in England. This might make you think that there are four more things we need to prioritise, but this is a reference to direct causes. Links between the top four causes of death and air quality have already been made. For example, the World Health Organisation has stated that poor air quality is a major cause of heart disease and death. Arteries can become inflamed from small particulates generated by car exhausts and brake dust, and repeated exposure can cause strokes within as little as 6 months. The question is not how much we can put up with, but how little can directly affect us. Parallels with radioactivity concerns from the 1970s and 1980s are obvious. Back then, action was taken to limit exposure to radioactivity so that now, deaths are rare. Exposure to poor air quality has remained relatively unchecked.

Slide 100 heart disease WHO



The World Health Organisation has also shown a proven link between poor air quality incidents and an increase in hospital emissions. Toxic metals breathed deep into the human system can have devastating effects, such as causing lung cancer and asthma. We are in the middle of a public health emergency directly costing 40,000 lives a year. The treatment of asthma alone costs the NHS over a billion pounds a year.

And yet the populist view is that cycling causes air pollution; it's too small-scale to improve air quality. It causes congestion. It exposes pedestrians to more pollution. It is bad for your health. It slows cars down which is bad for air quality. Filtered permeability is bad for air quality. These statements are myths with no citable evidence to support them.

Myths

Slide 101 populist myths

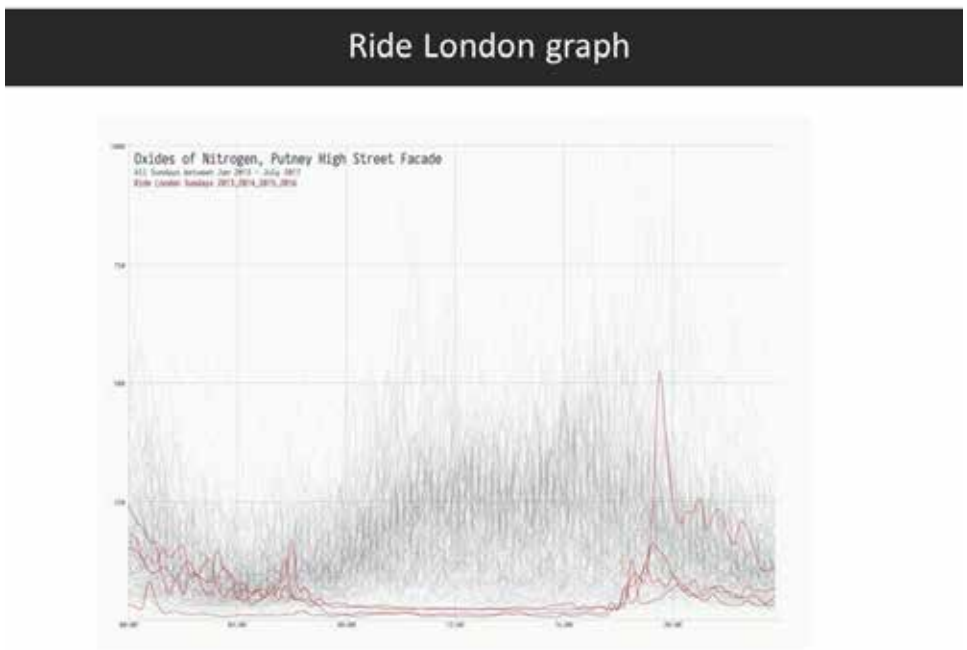
The evidence is that, on street, cycling is a zero-emission activity. Road traffic contributes 60% of harmful particulates in the atmosphere. 47% of nitrogen oxides and 17% of carbon dioxide. Diesel vehicles emit 22 times as much particulate matter and 4 times as much nitrogen oxides. Bicycle production and maintenance is not carbon neutral, but the European Cycling Federation calculated that cycling accounts for 5 grams of C02 per kilometre, compared to car production and maintenance which accounts for 42 grams of C02 per kilometre.

Increases in C02 directly affect every man woman and child on planet earth. If we are not carbon neutral by 2050, then the Paris climate agreement will not be met and the future of our species will be at threat. Each individual decision we all make affects this cumulative total. Champions must decide to play their part. If a resident is encouraged to drive rather than walk or cycle, then the result is not a random chaotic butterfly effect, but a direct contribution to a known upcoming catastrophe. Be passionate about this as the stakes are so high. We simply cannot wait.

Slide 102 ECF CO2

Simply put, cycling does not cause pollution. The graph above shows the effect of Ride London on Putney High Street on nitrogen oxides. When the event is on, there are negligible amounts, as cycling is emission free. For every unverified assumption that cycling has made an area worse, there are thousands of directly verifiable accounts of cycling having a positive effect. This is an obvious point which sometimes gets lost in hyperbolic rhetoric.

Slide 103 Ride London graph



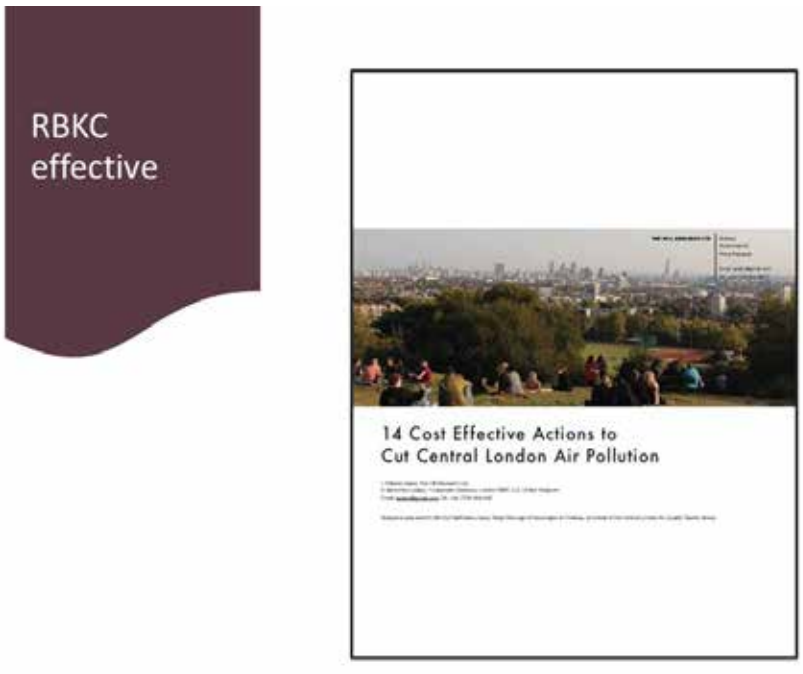
The Quality Directive 2008/50/EC has a limit of 40 micro grams per cubic metre cubed. The London average in 2012 was 48, with Marylebone Road having an average of 94.

Air quality

Slide 104 Quality directive and London

The Royal Borough of Kensington and Chelsea commissioned a report into cost-effective actions to cut central London air pollution. It found that if an effective, London-wide cycle network was introduced, and an extra 360,000 journeys were made by bike, then 453 tonnes of nitrogen oxides would be taken out of the atmosphere every year. This also equates to 33.8 tonnes of particulate matter. Given that a micro gram can bring on a stroke in any given individual, this reduction could have a great health impact. These solutions are in line with Greater Manchester policies. We may not be able to show the exact life we have saved by reducing particulates, but lives are being saved by policies which curb the choice to use private cars.

Slide 105 RBKC effective



Cycling is not too small in scale to have an impact. It is a major mover of people in London. There are over 670,000 cycle trips a day in London; this equates to one fifth of all tube journeys. The aim is to reach 1.5 million trips by 2026 with the Mayor's Transport Strategy aiming for 80% of all trips to be taken using active travel, such as walking, cycling and public transport. This regional strategy can only be achieved through local change and champions should be leading the way. Small local changes can make a big difference.

Slide 106 Small change big impact

Cycling does not cause congestion. More people cycling means our roads get more efficient. One person on a bike takes up a fifth of the place of one person in a car. Given the growing population, we need to switch modes or risk gridlock. The new superhighway routes in London are moving 46% of the people using the road in only 30% of the available space. Within two weeks of opening, these roads were moving 5% more people than before the routes were built. The remaining vehicles may feel more congested, but they are the congestion. Private motor car use is the least efficient use of space in a city. This space is precious and so do not simply give it away.

Exposure

Slide 107 cycling and congestion

Cycle lanes do not expose pedestrians to more pollution but instead provide a buffer, as high concentrations of poor air quality reduce rapidly with distance. The back of the footway is less polluted than the front of the footway, and so the presence of a cycle lane provides more space for pollutants to dissipate. Pollution levels are at their worst at exhaust level and affect young developing lungs, so it is clear to see that babies in push chairs are the worst affected as they are breathing at this level. On a busier road, a buffer is essential and cycling provision can provide this buffer. Cycle tracks can therefore vicariously prevent ill health in pedestrians. The City of London reported that 'Anything that increases the distance between the most intense local sources of the most harmful pollution (usually traffic) and the people who breathe it in will dilute the pollution'. A few metres can reduce exposure by 20 to 50%.

Slide 108 city of London report

The scientific truth is that exposure to pollution is lower for pedestrians and cyclists than it is for those inside motor cars. Given that air quality is much worse inside motor vehicles, there is a public health duty to drive people out of their cars. We need to do this by providing safe and pleasant walking and cycling conditions, so that the cleanest way is also the most advantageous way. A 2016 medical study found that the physical activity benefits of cycling and walking far outweigh the risk from air pollution. A virtuous circle can be created, as physical activity benefits outweigh up to 10 hours of exposure for those walking. Those walking are also not driving, and so the air pollution exposure risk is reduced. People need to be able to walk, work and play outside without risking ill health. This is the right of every resident, so our policies must create cleaner streets where more activity is possible.

Slide 109 exposure PA and air quality

Slow-moving cars are not bad for air quality. Cars are bad for air quality, full stop. The City of London did an evaluation of the impacts on vehicle emissions because of speed restriction and showed that slower vehicles gave off fewer particulates. There were some slight increases in petrol vehicles for CO2 and nitrogen oxides, but for diesel vehicles the slower the better. As diesel vehicles are by far the biggest pollutants on street, then the slower their movements are managed, then the lower the emissions.

The assumption cannot be: given that cars are going through here in numbers they must not be slowed, as this will have a small negative impact on emissions. Instead the policy should be: given that cars are pollutants carrying a significant public health risk then their movements should be managed and they should be removed from sensitive areas. The City of London

Exercise: visulisation

report concluded that it was 'incorrect to assume that a 20 mph speed restriction would be detrimental to ambient air quality'.

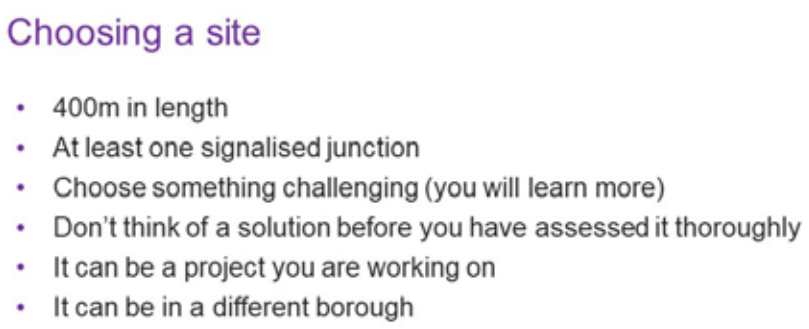
Slide 110 COL report

Filtered permeability seeks to send passing motor traffic to major roads, where the proximity risk is reduced. It has a proven record of encouraging people to walk and cycle. People who walk and cycle do not create emissions. This is a simple fact which can be lost in discussion. The message is simple: fewer cars equals better air. No opinion can change this. Greater Manchester residents deserve clean healthy streets. Champions: you need to make this happen.

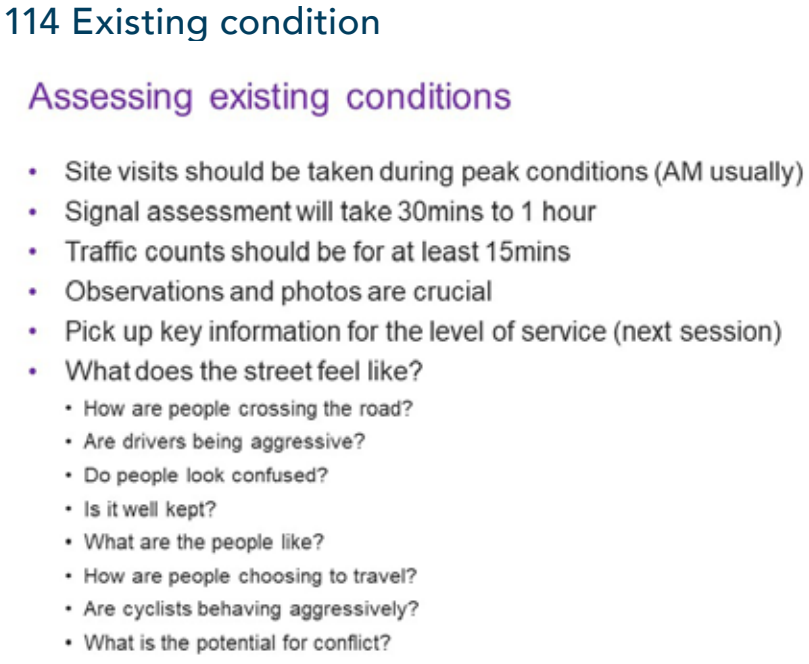
Slide 111 the message

Slide 112 Visualisations exercise

113 choosing a site



114 Existing condition



Project work

115 On site data collection

Gathering data

- Traffic counts for all modes in all directions at your chosen signal junction (on site 15minute count, x4 for hourly count x10 for approximation of AADTF)
- Signal timings (from on site observation or timing sheets)
- Pedestrian counts (pen and paper, tally in 5's or 10's if busy)
- Pedestrian comfort (pedestrians per metre per minute)
- Collision data 3 years within 50m buffer of your link and junction (London Collision Map)
- Traffic speed data (set a distance get a stopwatch)
- Air Quality (clean air London website or app)
- Noise (generated from traffic data)
- Degree of saturation (pen, paper and stopwatch)
- Gradient (smartphone and calculator)

- All the data you need is either easy to get on site or freely available

116 Plan drawing

Plan view of signalised junction

- Clearly show new kerb lines, old kerb lines and infill (tip: its generally easier going out into carriageway than in to the footway because of services)
- Clearly show existing parking and relocated parking (tip: only a few people ever get to remove parking so reposition it)
- Show final line markings
- Text boxes and arrows should be used to reference any change to the existing layout (if something is moved say how much in metres)

117 Layout

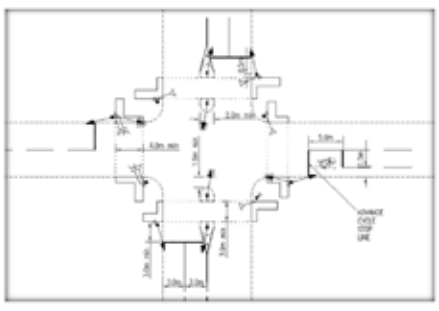
Key layout points

- Need to find space for a primary and secondary signal post (tip: if more than 2 lanes a splitter island is recommended)
- Show pedestrian signal direction (can be far side or near side)
- Every stop line needs a closely associated signal
- Pedestrian crossings need studs and L shaped tactile paving

118 Dimensions

Key dimensions

- ASL minimum 5m maximum 7.5m
- Gates 18m between stop lines
- 450mm clearance for any vertical object (post, sign, bollard etc)
- Lane widths vary from c2.4m to c5m. Standard UK lane width 3.65m (12feet)
- Crossing width 4m min
- Studs to stop line distance = 3m
- Can be 1.7m if ASL present
- Island with post min width=1.3m
- If cyclists on one side min= 1m
- Side mounted 1.6m



119 Kerbs

Kerb lines

- Match to link visualisation
- Show new
- Show cut and fill

120 Islands

Draw islands

- 450mm clearance for any vertical object
- Island with post min width=1.3m
- If cyclists on one side min= 1m
- Side mounted 1.6m
- If more than one approach lane need island

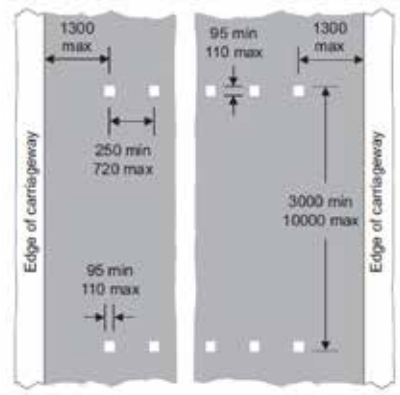
Figure 11: A variety of arrangement at traffic signals

Drawings

121 Studs

Draw pedestrian studs

55 Diagram 1055.1
(a) a place suitable for pedestrians to cross a road at which traffic is subject to control by a constable in uniform or by a traffic warden, being control which is normally in operation during periods amounting in aggregate to not less than 20 hours in any week;
(b) the most suitable place for pedestrians to cross a carriageway within 10 metres of the traffic signals provided for at item 1;
(c) place suitable for cyclists to cross a road at which cyclists are controlled by traffic light signals of the kind provided for at item 3 or 4, and other vehicular traffic is controlled by traffic signals of the kind provided for at item 1;



1. The square marks may be varied to circular marks with a diameter between 95 mm and 110 mm
2. The square marks, or the circular marks referred to at 1, may be varied to square or circular non-depressible studs of the same size and shape which are coloured white, silver or light grey provided the studs are not fitted with reflectors, retroreflecting material or a light source
3. The number of marks may be varied according to the width of the road
4. The minimum width of the crossing, other than a Toucan crossing, may be reduced from 3000 mm to 2400 mm

Pedestrian desire lines

122 Stop lines

Draw stop lines

- Studs to stop line distance = 3m
- Can be 1.7m if 7.5m ASL present
- Think about intergreen and tracking

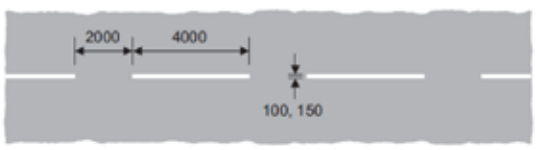
46 Diagram 1001
Vehicular traffic must not proceed beyond the line when required to stop by light signals, by a constable in uniform or by a traffic warden

123 Lanes

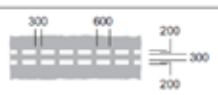
Draw lane markings

- Lane widths vary from c2.4m to c5m. Standard UK lane width 3.65m (12feet)

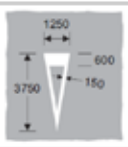
2 Diagram 1004
Vehicular traffic should not cross or straddle the line unless it is safe to do so and when the line is used to indicate a cycle lane, motor vehicles should not enter that lane unless it is clear of pedal cycles
(Longitudinal marking)



3 Diagram 1003A
Vehicular traffic must give way in accordance with the requirements in paragraph 7 of Part 7

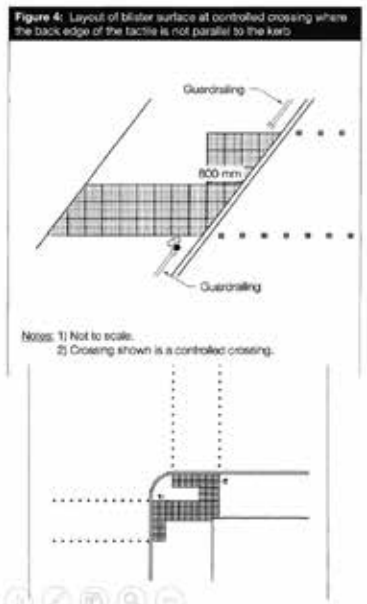


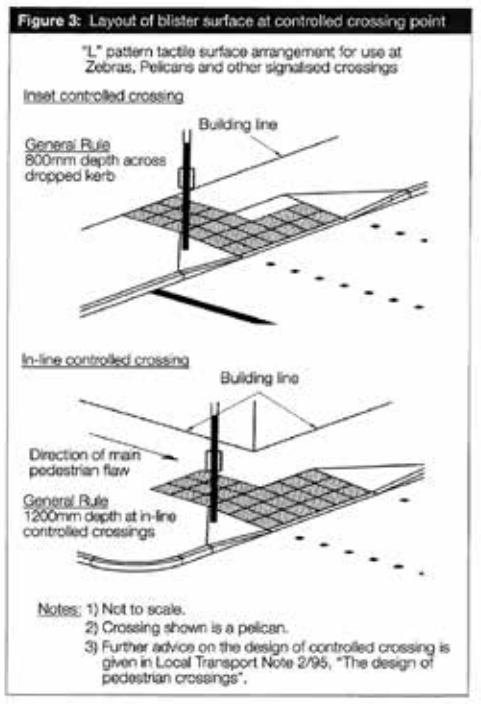
4 Diagram 1023A
Approach to a road junction, level crossing or road narrowing at or near which is placed the marking in item 3 or 6 of this table



124 Tactile

Draw tactile

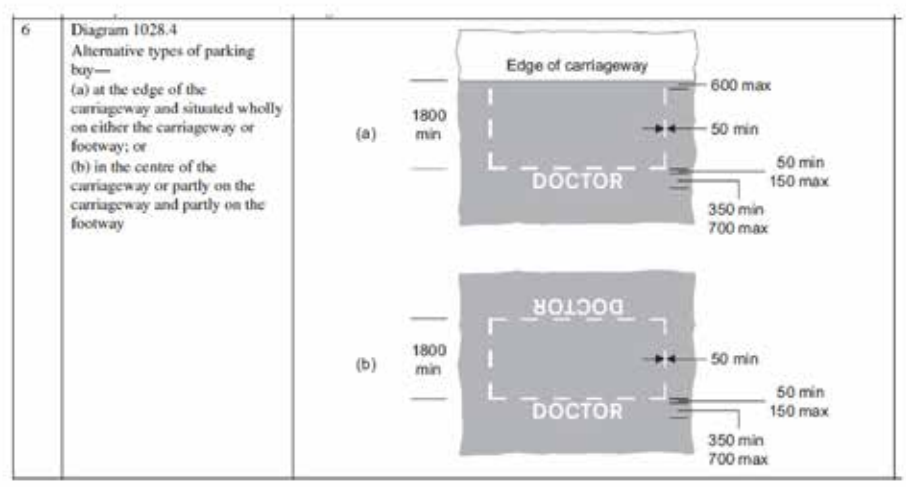




125 Bays

Draw parking bays

6 Diagram 1028.4
Alternative types of parking bay—
(a) at the edge of the carriageway and situated wholly on either the carriageway or footway; or
(b) in the centre of the carriageway or partly on the carriageway and partly on the footway

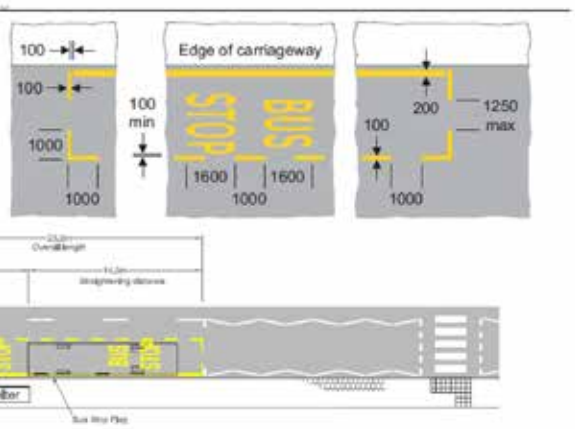


126 Bus stops

Draw bus stops

- How many buses stop there?
- This determines length

9 Diagram 1025.1
Clearway at which, as described in paragraph 1 of Part 6, vehicles must not stop (exceptions apply for buses and taxis)

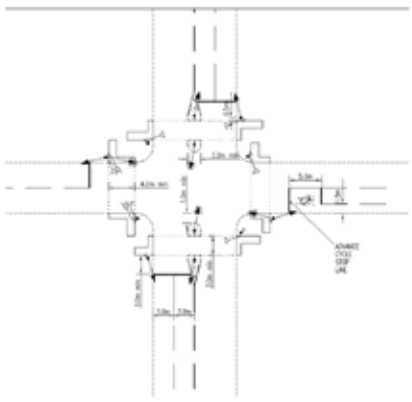


Report writing

127 Poles

Position signal poles

- Primary
- Secondary
- pedestrian



128 text

Add text

- Anything that has changed
- Optional to reassure things that have not changed
- Be clear and positive
- Think what people would want to know

129 style

Writing Style

- Feasibility study
  - Assess existing condition
  - Come up up with options
  - Assess impact
- What does your street need?
- What impact will this have?
- You decide the layout
- Cover all elements from course
- Evidence is better than opinion
- BE
  - Accurate
  - Concise
  - Clear
  - Well Structured

130 style

Writing Style

- 3rd person, present tense
- Reference any statement
- If you state your opinion make sure it is based on site observation and not assumption
- Every decision has a positive and negative impact. Make the case for the positive and mitigate for the negative.
  - Make a balanced case for your scheme
  - Design an option that meets your objectives
  - Estimate your option cost
  - Make a business case for it based on health impact, collision savings and potential journey time savings
  - Come up with a funding strategy
  - Justify the expenditure!

134 example

Writing Style

"There is a risk of collision from alongside involving cyclists and general traffic on the northbound approach to the junction of Marlborough Road and Constantine Hill. This is due to the pinch point caused by the pedestrian island which narrows the carriageway to 3.4m"

"I feel cyclists are in danger of being hit by lorries as the situation is unsafe. Lorries came over the crest of the hill not looking out for anybody."

135 structure

Suggested Structure

1. Context – Location, geography, street type, link profile
2. Outcomes – Policy context (local), key scheme objectives
3. Existing condition – On site observations, junction type, signal operation, observed conflicts, interaction with other modes
4. Data and analysis – collision record and patterns, traffic flow, degree of saturation, signal timing, SFA check and JAT
5. Option sketch – Plan drawing of junction, isometric sketch of link
6. Option costs – quick estimation of main elements, highlight funding
7. Business case – balance health, safety and congestion
8. First year rate of return

(estimated report length 10 pages)

urban
movement

RESEARCH | PLANNING | STRATEGY | DESIGN