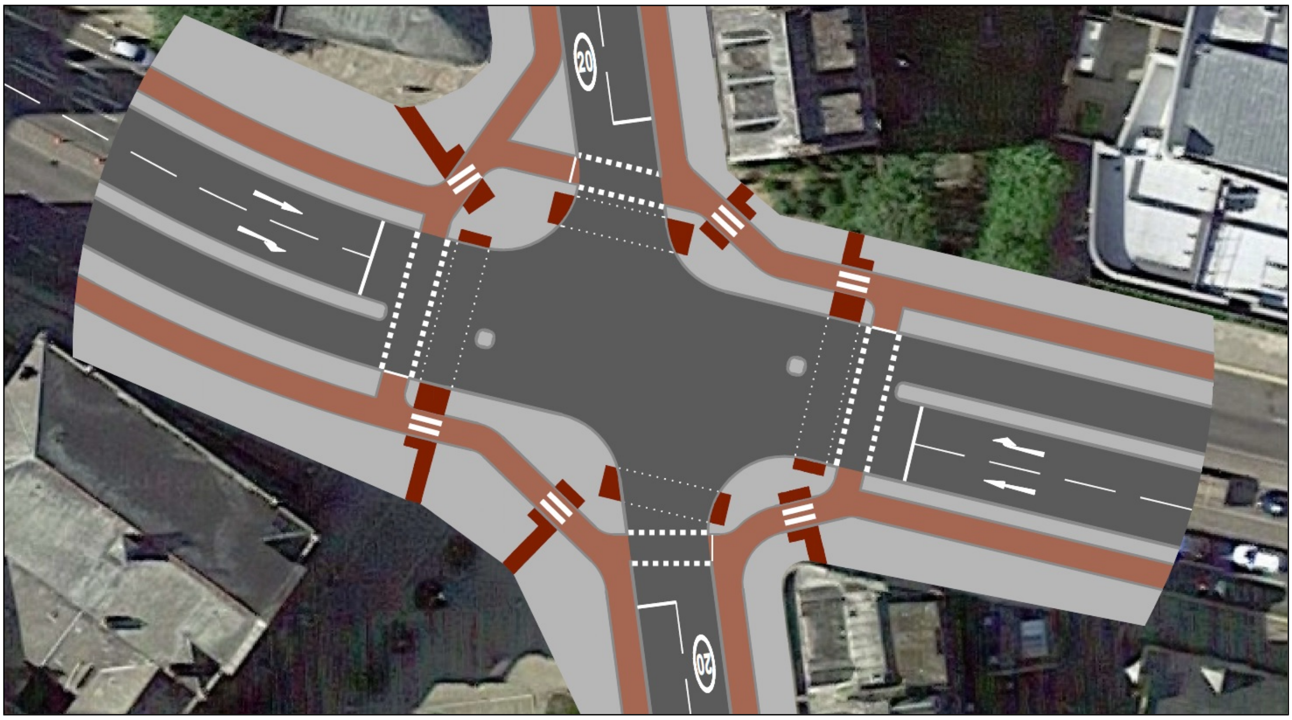
King Street Design Competition

A Fully Protected Cycling Concept



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- Side road entry treatments (from decent dropped kerbs to continuous footways),
- Filtered permeability schemes (close the road – open the street!),
- Access audits for walking and cycling,
- "Barrier bashing" – looking at alternatives to physical barriers,
- Cycle track design,
- Walking and cycling friendly junctions,
- Experimental traffic orders, trialling and interim schemes,
- How travel planning can be used to effect change to streets.

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A Fully Protected Cycling Concept

Version 1.0

20th January 2019

CI/B004

Street sections based on images generated by Streetsketch from Mobycon

Traffic data is taken from the Department for Transport Road Traffic Statistics website

Casualty data is taken from the Cycle Streets Collision Data website

About City Infinity

City Infinity is a micro highway engineering consultancy which can help you design for active urban travel. We specialise in advising on street retrofits and new build layouts which enable walking and cycling, street access audits and advice, plus providing training to people seeking to do the same. We can also provide advice on travel planning and how it can link to infrastructure changes which will enable a mode shift to active means.

City Infinity's founder and chief engineer is Mark Philpotts, a chartered civil engineer with nearly 25 years experience in highway design and construction, much of it in an urban transport context.

Mark is a member of the Institution of Civil Engineers, a fellow of both the Chartered Institution of Highways & Transportation and the Institute of Highway Engineers, a practitioner member of the Institute of Environmental Management & Assessment, a member of the Transport Planning Society and an associate member of the Society of Road Safety Auditors.

Construction (Design & Management) Regulations 2015

The content of this report could be regarded as design work for the purposes of the CDM Regulations 2015. This report should be provided in full to anyone developing designs from the content herein. There are specific duty-holders under CDM 2015 and for clients especially, we draw attention to their duties. CITB have produced information which will be of use to duty-holders, including clients.

https://www.citb.co.uk/health-safety-and-other-topics/health-safety/construction-design-and-management-regulations/

1.0 Introduction

1.1 Through its "King Street Design Competition", the Aberdeen Cycle Forum is *"looking for innovative and functional designs that improve safety for cyclists and enhance the ambience of the street."* The competition brief essentially calls for ideas for a segment of King Street with a segregated cycleway and an indication how motor vehicles, buses, and pedestrians will fit.

1.2 This report sets out our response to the brief which concentrates on a segment of King Street between a point just north of Summerfield Terrace and a point just south of the junction with West North Street and East North Street; including this large signalised junction. We also consider bus stops, side streets and parking bays.

2.0 Our Vision For King Street

2.1 King Street is so typical of places across the UK where there is a tension between the needs of local people to live and work along a street with the desire for movement along that street, especially by those wishing to drive. When we also consider the need to move people by public transport and to service an area, trying to balance the competing demands becomes challenging.

2.2 When we take a street such as King Street and then try and improve it for people walking and especially people cycling, we are often faced with further challenges on how we fit everything in. The mistake all too often made is we compromise too much in favour of motor traffic and we don't realise the potential for active travel.

2.3 Our vision for King Street is one where people can safely walk and cycle along its length which will connect the areas to the north of the city centre (including the university) and reconnect the neighbourhoods on either side. We'll demonstrate how the junction with West North Street and East North Street could be radically improved and to offer a glimpse on how it could be modernised for people. We'll also show how we can continue to accommodate a busy bus corridor and provide for parking/ loading near the shops to the north of the segment.

3.0 Approach

3.1 Our base approach has been to use Google Maps as a base onto which we have overlaid a design model of the segment of Kings Street we have presented in this report. We can never be as accurate as a scheme developed using a detailed survey, but we are confident that the concept fits the space.

3.2 We have assumed that King Street would be retained for two-way traffic (although there are options which are explored); and for the major junction, that all traffic movements are required. We have also assumed that bus traffic will continue to use the Kings Street corridor.

3.3 We have made use of publicly available data in the form of traffic flow information from the Department for Transport and casualty data via the Cycle Streets collision mapping tool. We have made some assumptions on how the major junction currently operates using Google Streetview; we think we have understood the current situation well enough for a concept design.

3.4 All of the features within the concept are compatible with UK design rules and for each element, we provide precedent examples so that people are able to better understand the drawings.

3.5 We’ve also strived to provide a layout which fits within the existing highway boundaries and where possible, provide a concept which shouldn’t impact on buried utilities too much as they are costly items to move.

4.0 Existing Situation

4.1 The highway width of the segment of King Street considered here is around 15m to 16m. The actual width does very with the building line. The highway comprises of a footway on each side which vary in width and a carriageway which also varies in width with different features such as bus lanes, parking bays and bus stops, although in many locations it is around 11m in width.

4.2 In the area to the south of Summerfield Terrace, the existing layout comprises of a parking bay, two general traffic lanes and a southbound bus lane. These fit into a width of around 11m and so usefully, there is a local precedent of narrow traffic lanes which assists with our concept. Figure 1 gives an idea of the crossing section at this point, with the view to the north;

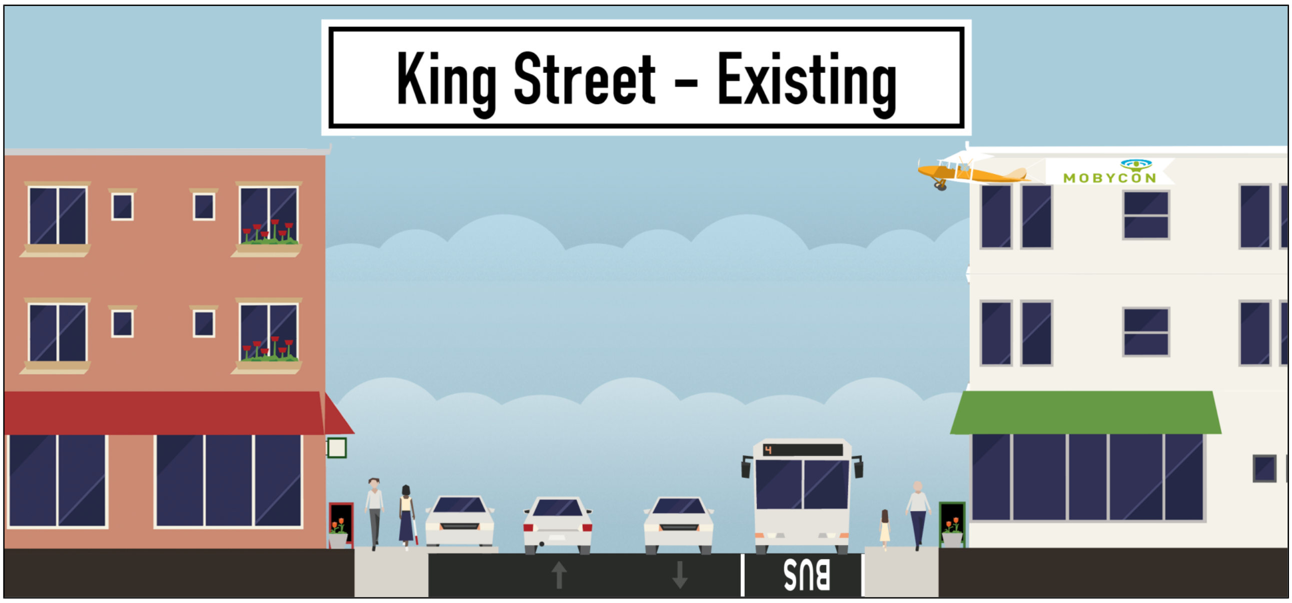

Figure 1 – King Street – existing street layout, looking north

4.3 We have reviewed traffic data for King Street which is available on the Department for Transport website. Count point 40854 is just south of Regent Walk and although it is further north than our study segment, it gives an initial insight into traffic trends. Unfortunately, most of the data years have traffic flow estimates rather than counts, but there is still some general insight to be had.

4.4 There was a general trend of traffic increasing until a peak in 2006, followed by a reduction until 2008. In fact, the drop between 2007 and 2008 was quite large and so may be an indication of the estimates being high. From 2008, there has been a steady increase almost back to 2001 levels.

4.5 Cycle traffic has seen a similar rise and fall, although most recent estimate suggest that it remains far higher that in 2001. Car (and taxi) and HGV traffic has remained fairly constant between 2008 and 2017 with a large drop between 2007 and 2008 which might again be showing estimates have been too high. Bus/ coach traffic and LGV traffic has grown in recent times.

4.6 For King Street, actual data would be useful in taking any scheme forward, however, the count point to the north does give a hint that traffic flows are possibly currently lower than around 10 years ago and that there might be capacity to grab for cycling.

4.7 The levels of cycling in the area are just under 2% (2017) and our view is that this is unlikely to radically increase where people have to share with general traffic, including lorries and buses.

4.8 In terms of casualties along the study segment, we have reviewed the Cycle Streets Collision Mapping website. Between 2006 and 2016 on the segment alone, there were 20 collisions recorded with a total of 25 people injured. 6 out of 20 collisions involved serious injury with the rest being slight. Most injuries were sustained by people on foot (including all of the serious injuries). From a locational point of view, half of the collisions occurred near or within the junction of King Street with West North Street and East North Street.

4.9 From a casualty-reduction point of view, there is certainly value in looking to tackle the levels of collisions involving people walking in the area. From a cycling point of view, just one collision (slight) involved a person cycling. Cycle traffic flows are very low and in terms of wheeled traffic, cycles are perhaps over-represented, at least based on the available data but with acknowledgement that low absolute numbers are notoriously difficult to draw firm conclusions from.

4.10 The traffic flow and casualty data certainly demonstrate conditions whereby King Street is subjectively and actually hostile to active travel and therefore, a street redesign will need to provide protection for people walking and cycling. For the latter, this must lead to the conclusion that protected cycling space is required in order to enable people to cycle. This background review brings us to our concept for King Street.

5.0 King Street Concept

5.1 The core of the concept is the provision of a one-way stepped cycle track on each side of the street. This is a key safety principle for the following reasons;

- Drivers expect to be people cycling in the same direction as they are moving,
- Drivings emerging from side streets often don't see people cycling against the general traffic flow which makes 2-way cycle tracks on one side of the street more challenging from a safety point of view,
- People wishing to cross the road expect to see people cycling in the same direction as general traffic,
- Because of the available width, a two-way cycle track on one side of the street will be difficult to manage with the bus stops.

5.2 A full plan showing the study segment is separately submitted and this report should be read in conjunction with it. The plan makes reference to four cross sections A, B, C and D which are noted on the relevant cross sections below.

5.3 Figure 2 provides a general arrangement which features 2m wide cycle tracks and 3m general traffic lanes. The remaining space is the footway and in most cases, no footway space is reduced.

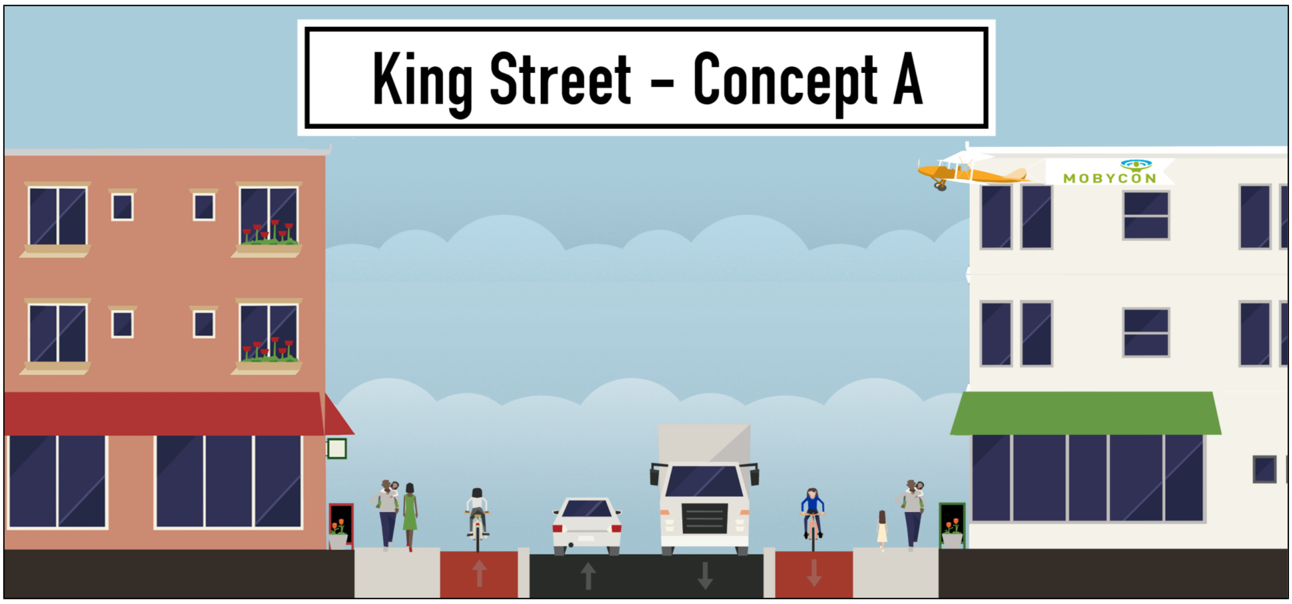

Figure 2 – King Street – general arrangement.

5.4 3m traffic lanes are often used in The Netherlands in order to both maximise space for other modes and to help reinforce lower driver speeds. In this concept, we would expect the speed limit to be set to 20mph and for there to be no centre line markings which is another cue to drivers that they are in a lower speed environment. In fact, there is research to demonstrate that a lack of lane markings can assist with speed reduction.

5.5 Kerb choice is important. We have also looked to use a wide kerb between the carriageway and cycle track in order to provide a slight visual buffer between the two areas and a gently sloping forgiving kerb between the cycle track and the footway. A forgiving kerb can allow people cycling to maximise the width of the cycle track without fear of clipping a kerb upstand.

5.6 A forgiving kerb can also assist people who wish to leave the cycle track (perhaps to park next to a shop) and this is especially helpful to those who use cycles as mobility aids or those who use non-standard and adapted cycles. Photograph 1 shows a wide kerb between a cycle track and a carriageway and Photograph 2 shows a forgiving kerb.

Photograph 1 – wide kerb between cycle track and carriageway, Farringdon Rd, London.

Photograph 2 – forgiving kerb between cycle track and footway, Main Road, Romford.

5.7 There isn’t a standard UK forgiving kerb and so existing types have been used (as depicted in Photograph 2) in creative ways. However, there are manufacturers willing to produce bespoke units where larger schemes make this viable. An ideal forgiving kerb would created a slightly higher difference in level between the cycle track and the footway in order to be more detectable by visually impaired people. Figure 3 gives a suitable detail.

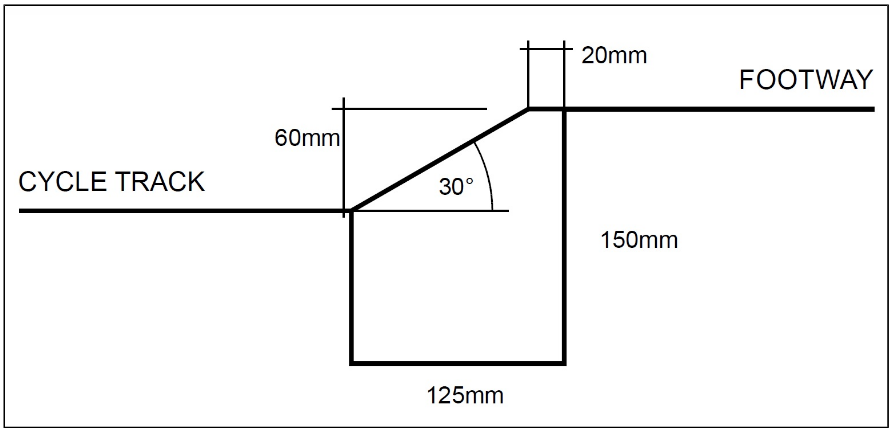

Figure 3 – forgiving kerb detail.

5.8 There will be a desire to maintain some on-street parking and loading. With an overall carriageway width of 6 metres, even on-street parking off-peak will cause localised congestion and so we propose that over a short distance, the footway and cycle track could be reduced in width a little to provide parking/ loading space. This would allow 2-way car traffic to continue, although there might be a need for some ‘give and take’ with larger vehicles. Off-peak operation of the bays would be desirable. Figure 4 shows a general arrangement.

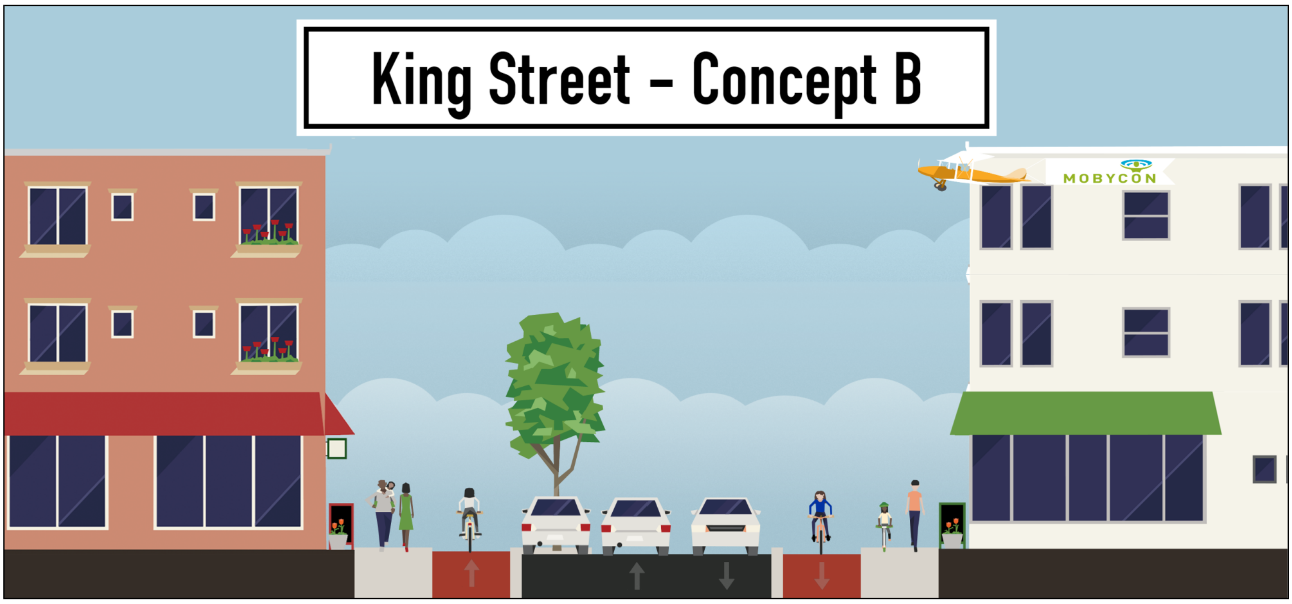

Figure 4 – King Street – general arrangement with parking space.

5.9 Having parking/ loading right next to the cycle track does create a risk of a vehicle door being opened into a someone cycling. Ideally, parking should take place in side streets and so only essential loading remains on King Street where the delivery driver would be leaving the vehicle on the traffic side. This is a compromise and the risks and needs would need to be thought about.

5.10 Buses will undoubtedly remain on King Street and accommodating bus stops with cycle tracks in the available space is a challenge. The ideal solution for cycle tracks and bus stops is to take the cycle track behind the bus stop to create a 'floating' bus stop. However with King Street, this would mean running the cycle track against the building line which simply isn't practical or safe for people walking.

5.11 The compromise is to use a 'boarder' whereby the cycle track becomes shared over a short distance so that people can board and alight from buses. The effectiveness of the arrangement diminishes as the number and frequency of bus routes increases because there is a conflict between passengers and people cycling. Photographs 3 and 4 show a bus stop boarder in operation, although we would advocate a contrasting material and colour finish to further highlight the change of use (mainly to people cycling).

Photograph 3 – bus stop boarder being used for cycling, Royal College Street, London.

Photograph 4 – bus stop boarder being used by passengers.

5.12 Figure 5 gives a general arrangement for the bus stop boarder proposed within the study segment.

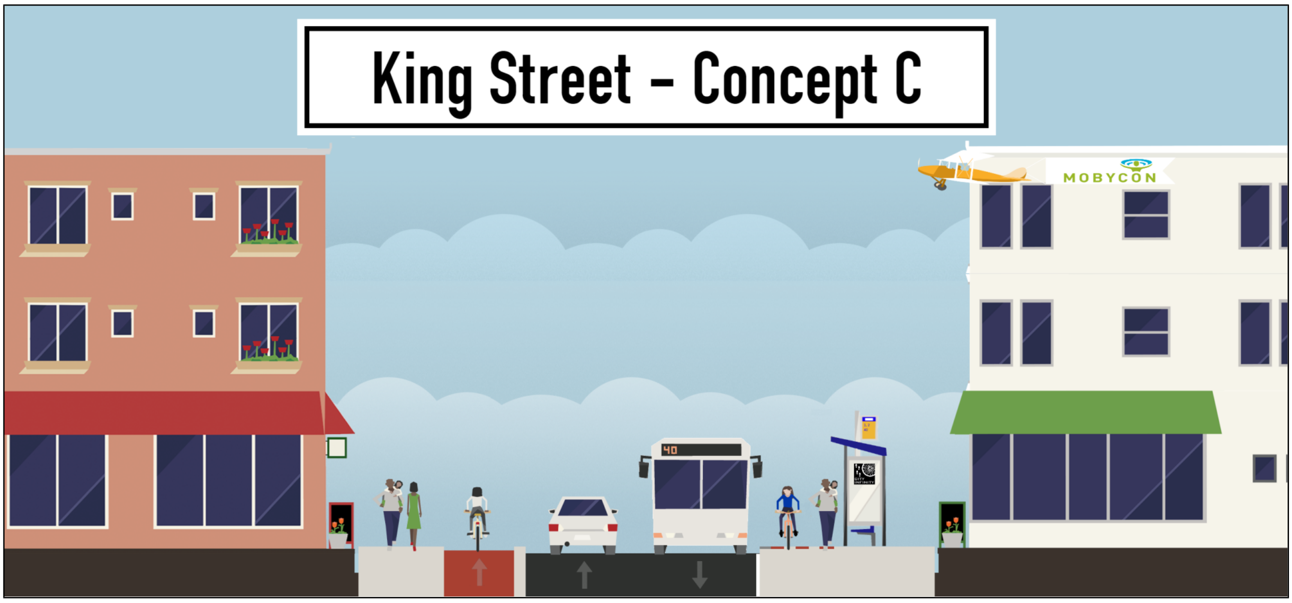

Figure 5 – King Street – general arrangement with bus stop boarder.

5.13 As well as King Street itself, we have to consider the various side streets leading into it. Fortunately, some of these streets are are either closed to traffic or for emergency access only. This means the incidences of drivers joining and leaving King Street are reduced which helps with motor traffic capacity. However, in these locations, some minor changes to layout and surface would help people cycling to access these streets. Emergency access could perhaps be better controlled with collapsible bollards to allow fire access, but discourage drivers trying to cut through. Photograph 5 gives an example.

Photograph 5 – collapsible bollard for fire access.

5.14 Where side streets need to connect to King Street, this is best arranged so that drivers enter from the side road as from a cycling point of view, this avoids ‘hooking’ turns as drivers turn over the cycle track. In other words, there would be ‘no entry’ from King Street. As a driver emerges from the side street, they will need to proceed slowly to watch for people walking and when they reach the cycle track, the one-way arrangement will mean people cycling are coming from right as with the general lane of traffic that is being entered and so helps people cycling be seen by drivers. Frederick Street, for example, already has this arrangement.

5.15 The arrangement also allows the footway to be laid across the side street, a ‘continuous footway’ and this helps reinforce pedestrian priority across side streets. Photograph 6 gives an example.

Photograph 6 – a continuous footway and cycle track, Magee Street, London.

5.16 The use of a continuous footway and cycle track requires some kind of dropped kerb arrangement for drivers to enter or exit the side road. This often leads to a dropped kerb being provided which disrupts the levels for people walking and cycling. In addition, people cycling on the other side of the street may wish to access a side road or leave a side road and cross to the cycle track on the far side.

5.17 The Dutch use ‘inritbanden’ kerbs which require drivers to change level. Again, no UK version exists, but they can in theory be manufactured, especially in natural stone. Figure 6 gives a general arrangement of side street using inritbanden kerbs and forgiving kerbs.

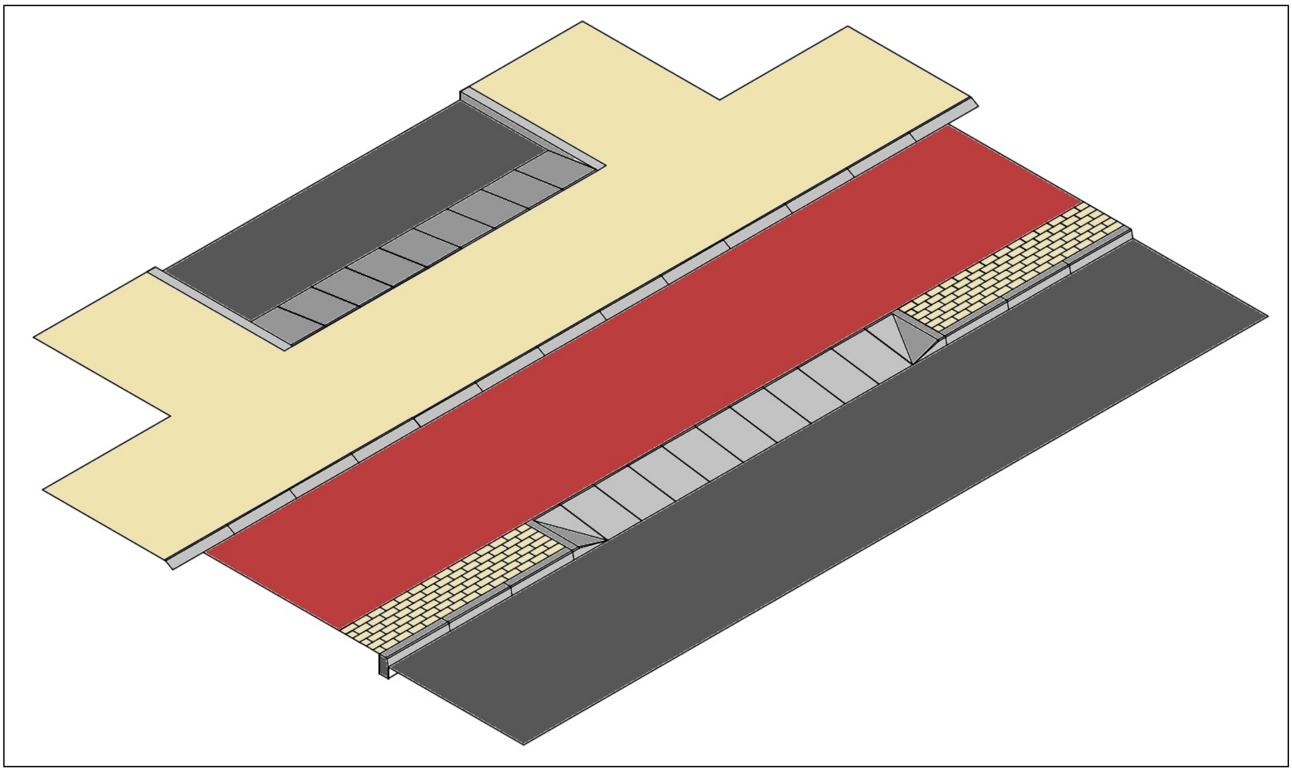

Figure 6 – side road treatment which prioritises walking and cycling.

5.18 King Street is wide enough to provide cycle tracks within, but it requires a change in approach to the management of the street. There may well be objections to the loss of the bus lane by bus operators and any loss of car parking is often the subject of concern by businesses. The bus issue could be dealt with at a network level whereby through traffic is routed elsewhere and the street being bus only at peak times. It is relatively easy to concentrate on one street or route without considering the wider picture.

5.19 Figure 7 shows the central part of the study segment (north to the left of the image). We have shown the end of a parking bay; a humped zebra crossing which helps manage driver speed and gives pedestrians a controlled crossing and a bus stop with a boarder. We have also shown continuous footways/ cycle tracks across side streets. This pattern of treatment could be provided along the whole street.

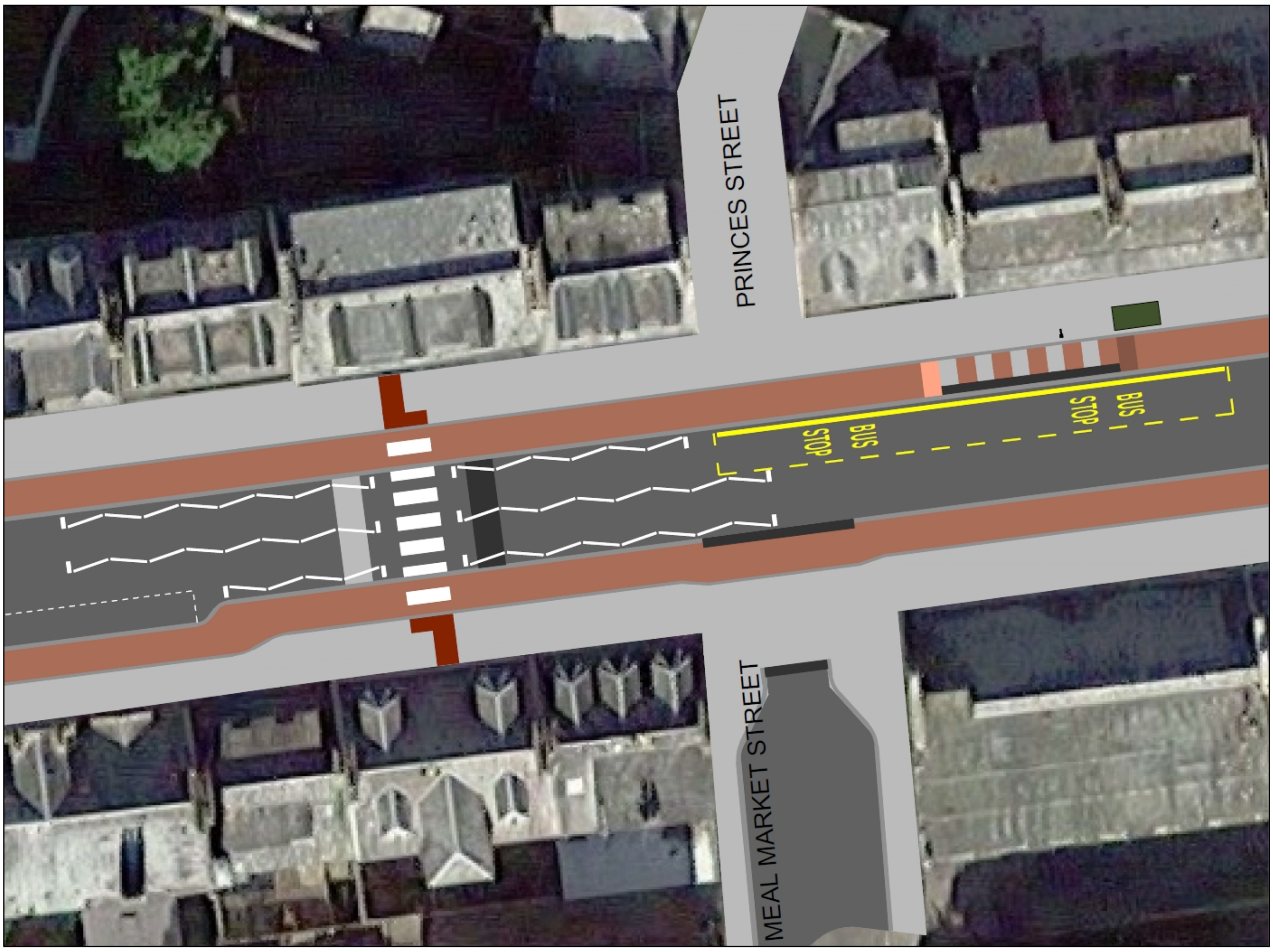

Figure 7 – putting the street elements together

6.0 Tackling West North Street & East North Street

6.1 We have chosen to include this junction in our study segment because it is difficult. It's a large junction which is dominated by traffic. Although there are pedestrian crossing facilities which we believe operate on a single stage across all arms, the main arms are very wide in terms of crossing distance – perhaps 25m in the case of West North Street. This in turn means that the junction probably isn't running very efficiently, pedestrian waits are long and crossing times short. There is not provision for cycling.

6.2 Based on reviewing Google Streetview images, it is likely that the junction operates as shown on the following staging diagram. The main arms run ahead/ left; then the right turns into King Street run; then both arms and King Street and finally an all-round pedestrian stage.

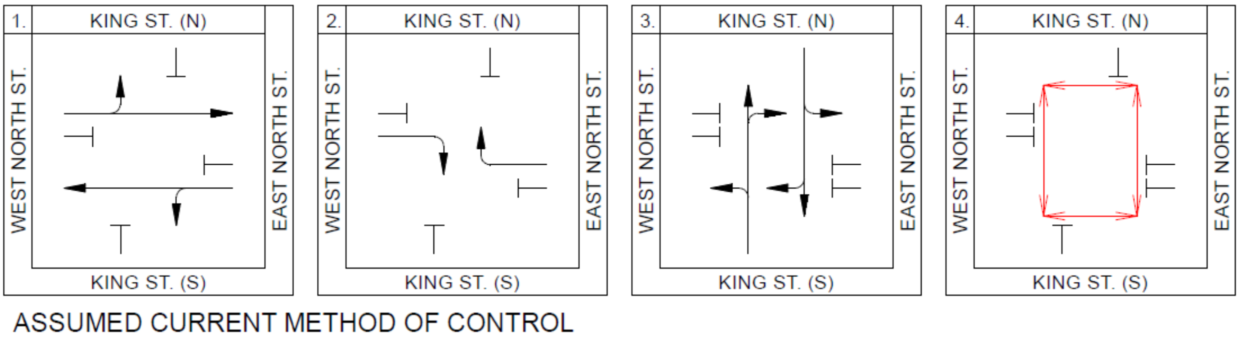

Figure 8 – Assumed method of signal controlled

6.3 To enabling cycling across the main road, protection is required. An often used UK approach is to convert pedestrian crossings to toucan crossings and have people walking and cycling share. This provide a poor level of service to people using both modes and so we have looked at crossing people walking and cycling in parallel. Given that there is also an all-round pedestrian stage now, we have looked at a radical layout which introduces cycle tracks in both West North Street and East North Street which would be required if a network approach were to be taken. This creates a 'protected junction'. Figure 8 shows a view looking west approaching the junction in East North Street,

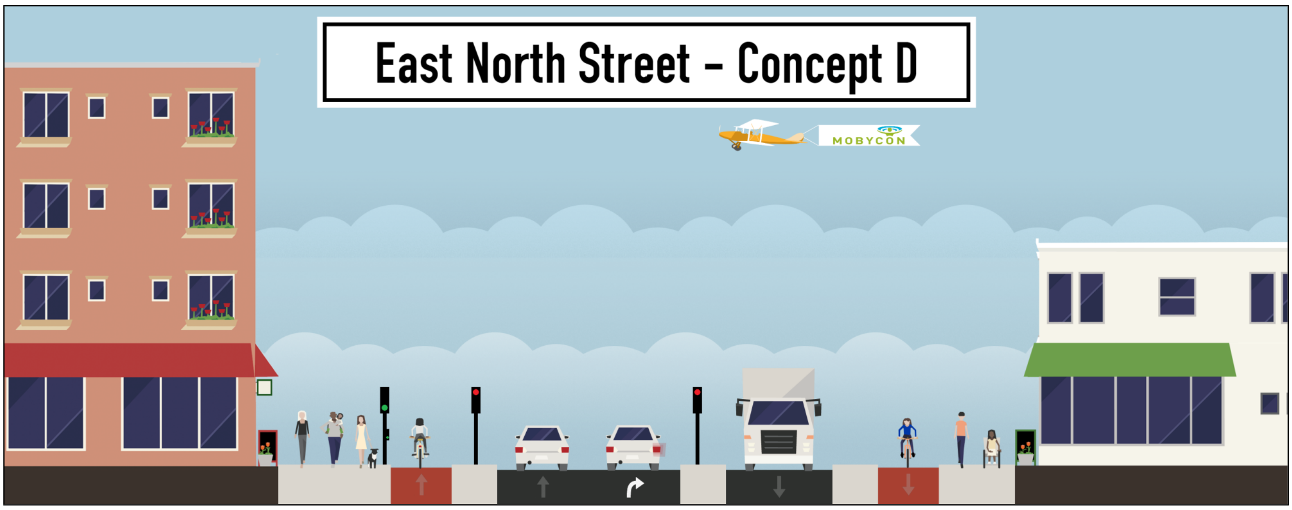

Figure 9 – East North street – general arrangement

6.4 The design provides for fully protected cycling through the junction. For cycling, the concept maintains the use of one-way cycle tracks around the junction. This means that people turning left avoid the traffic signals. People cycling ahead use a crossing which runs in parallel with the pedestrian crossings. Right turns by cycle will be undertaken in two stages, although it would be possibly for someone cycling to cross two arms of the junction during the time pedestrians need to cross one arm. Figure 9 gives a general arrangement.

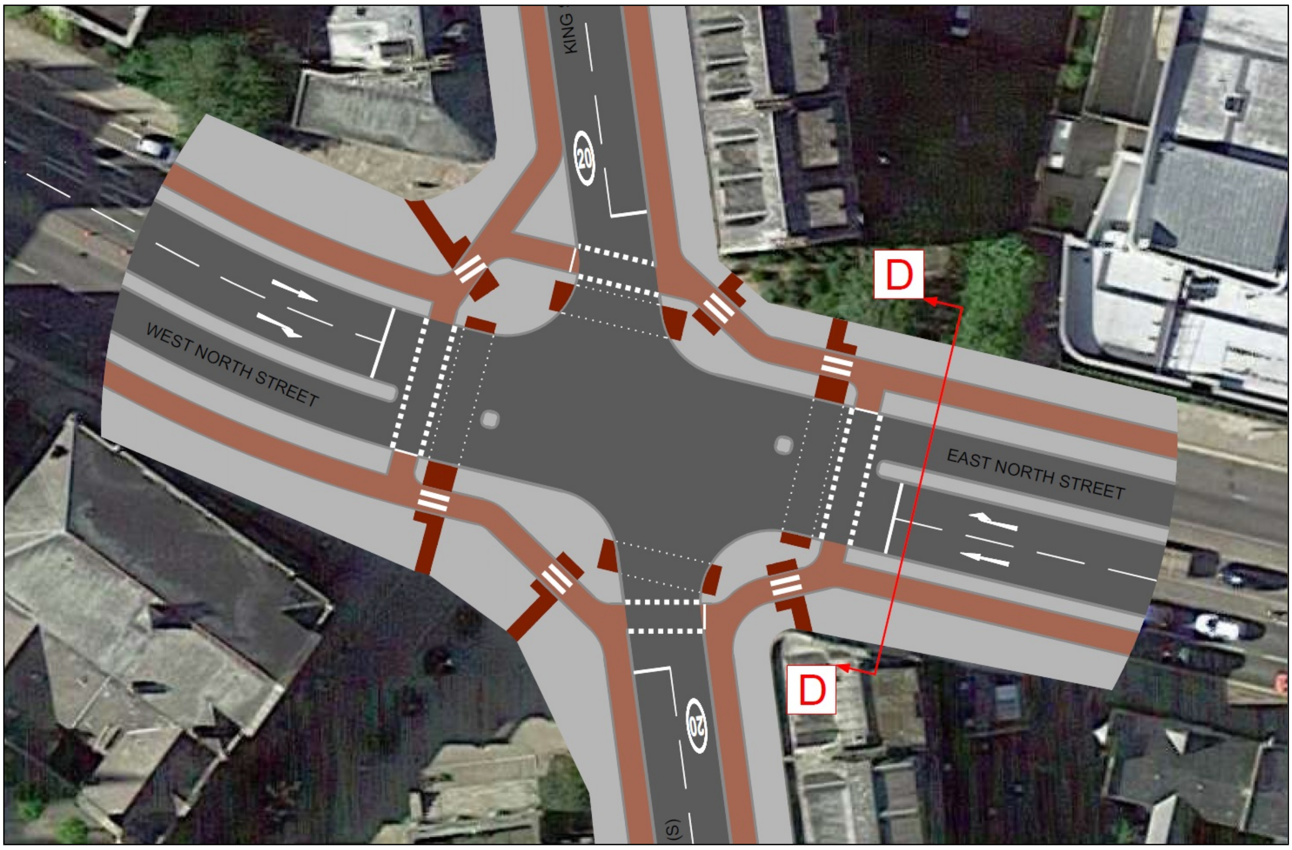

Figure 10 – general arrangement of junction

6.5 Where people on foot cross, they do so from ‘floating’ crossing points. In other words, they cross the cycle tracks with priority given by ‘mini zebra crossings’ over the cycle tracks. They then cross with signals in parallel to people cycling. Figure 11 gives a more detailed view of the floating layout in part of the junction and Photograph 7 gives an example of a mini-zebra crossing.

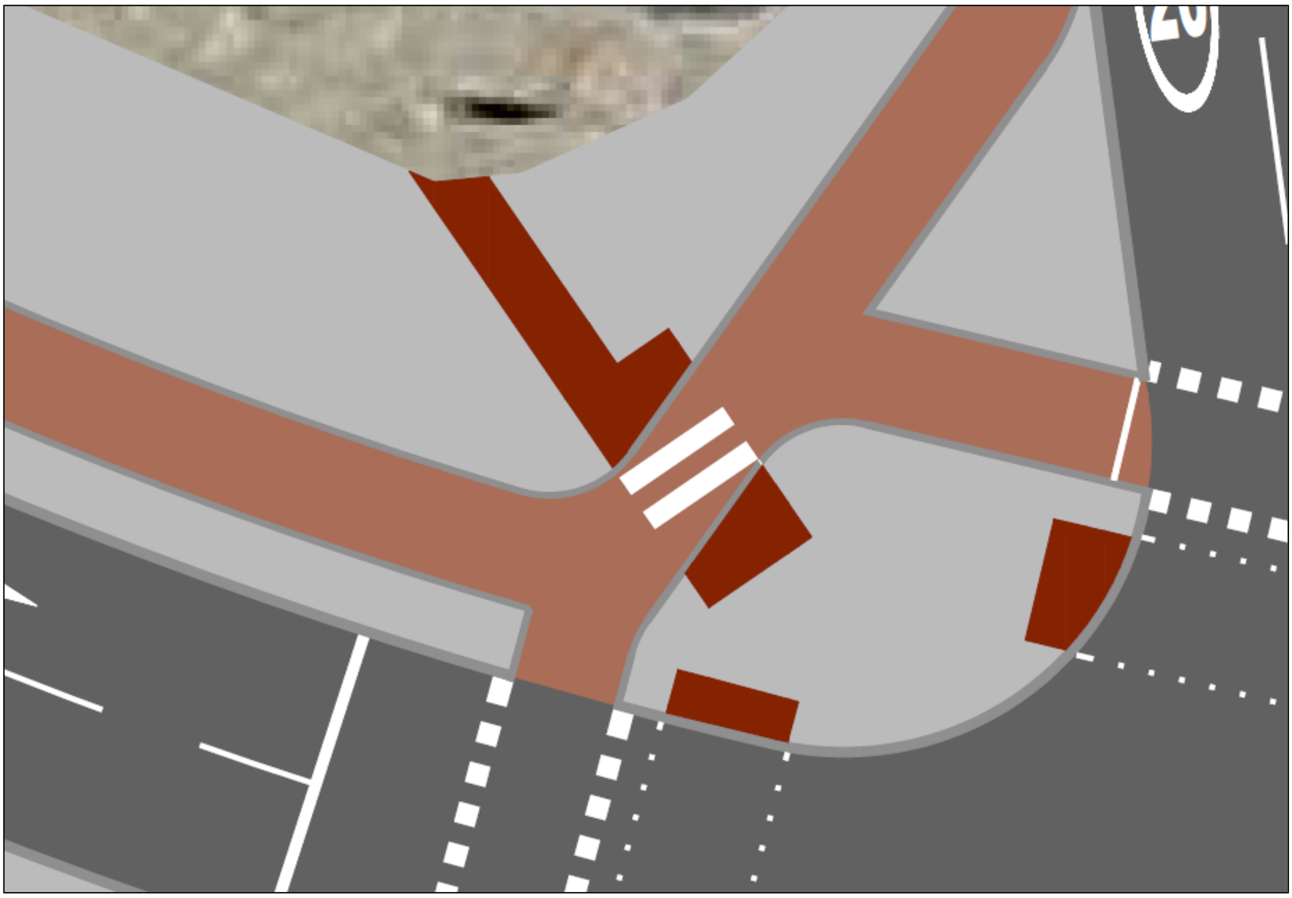

Figure 11 – close view of floating crossing point

Photograph 7 – mini-zebra crossing, Blackfriars Road, London

6.6 It would be usual with Dutch practice to place the pedestrian crossings ‘outside’ of the cycle crossings, but the north-west and south-west corners of the junction makes it very hard to achieve this in terms of the acute angle created by East North Street and King Street and the available space.

6.7 For motor traffic, two 3m traffic lanes are provided on each of the main road approaches with a single exit lane, 3.5m in width. This provides the space released for cycle tracks and the protected junction. The King Street arms have a single exit lane, again by virtue of the space given to walking and cycling.

6.8 The signalised crossing points for walking and cycling significantly reduce the crossing distance and so this would help to reduce the cycle time for the junction as a whole which will go some way to offset the reduction in capacity that this radical layout would lead to. Figure 11 shows alternative methods of signal control for the new layout.

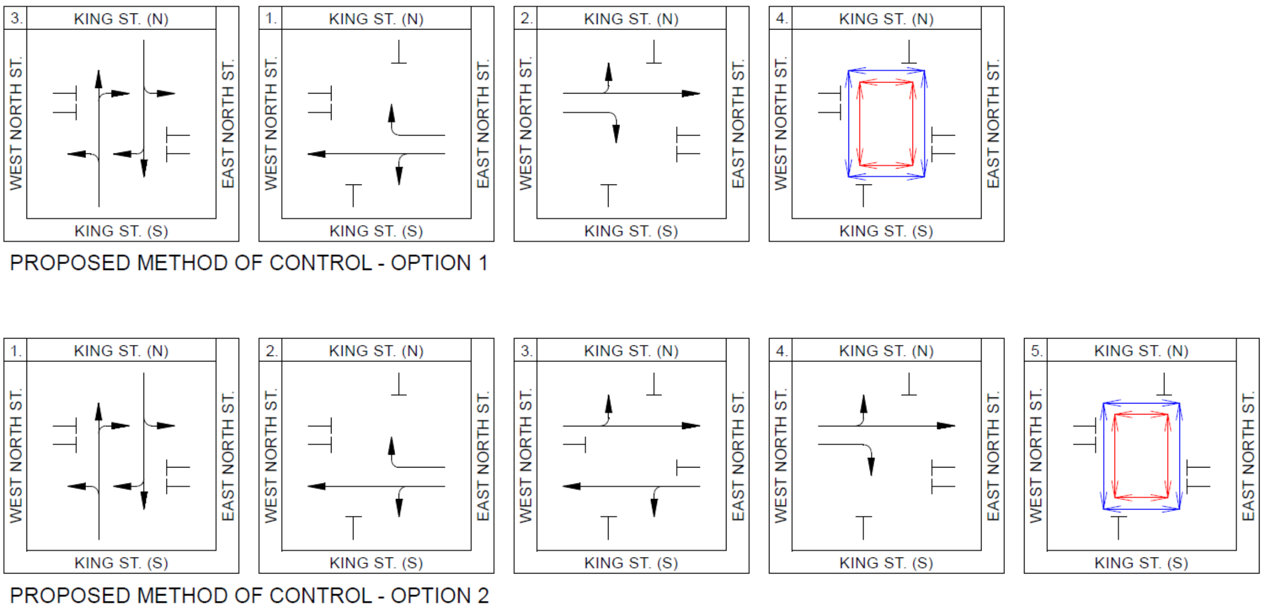

Figure 12 – proposed methods of control

6.9 Clearly, the detail of the actual timings and signal operation is beyond the scope of this concept, but Option 2 is probably going to be more efficient.

7.0 Materials & Features

7.1 As well as the kerb types specified in Section 5, we would also advocate the use of machine-laid red asphalt for the cycle tracks. The red colour helps reinforce visual priority for cycle traffic over the side streets; it reinforces the fact that it is cycling space to drivers; it provides legibility for people cycling through large and complex junctions and it assists people on foot with identifying the cycle track. Photograph 8 gives an example of a stepped cycle track surfaced in red.

Photograph 8 – red asphalt used for a stepped cycle track, Hills Road, Cambridge.

7.2 For the West North Street & East North Street junction, low level cycle signals (LLCS) should be used in combination will full sized cycle signals. The latter allows people cycling to see the signals from a distance whereas the former are easy to see near the stop line which means that people don’t need to turn their head to look up to see the signals. Photograph 9 gives an example.

Photograph 9 – Full sized and low level cycle signals, St. George’s Road, London.

7.3 Finally, we want to make cycling as comfortable and as easy as possible and so if we have a person on a cycle waiting for a green signal, then we can make life that little bit easier with a foot and hand rest as shown in Photograph 10.

Photograph 10 – foot and hand rest, by Blueton Ltd, Main Road, Romford.

8.0 Conclusion

8.1 If we are to enable cycling on busy roads such as King Street, we need to be radical. Anything short of building infrastructure which protects people is not going to enable people of all walks of life, all ages and with varying mobility to choose to cycle. It’s also not just about the bicycle, there is a huge range of non-standard, adapted and cargo cycles available which help people take full advantage of protected cycling space with smooth surfacing and easy to turn corners.

Photograph 11 – protected cycling space enabling the use of a cargo cycle, Stratford.

8.2 Our concept shows what can be done in a relatively constrained space and how other street functions can be accommodated. However, we also have to consider the wider network and so it’s vital that large junctions are dealt with in the same way and this is why we have chosen to tackle one which is rather complex.

Appendix I

Traffic Data Tables

Casualty Data Table

Traffic Data

Northbound

Year	Data Type	Cycles	P2W	Cars/ Taxis	Buses/ Coaches	LGVs	HGVs	All Motors
2017	Estimated	138	41	5584	569	938	819	7950
2016	Estimated	144	40	5625	609	891	811	7977
2015	Estimated	154	41	5539	658	815	814	7867
2014	Estimated	166	39	5507	558	772	808	7685
2013	Estimated	171	40	5405	444	727	880	7495
2012	Estimated	173	38	5404	395	784	870	7491
2011	Estimated	183	38	5485	356	696	850	7425
2010	Estimated	166	38	5399	328	616	815	7196
2009	Estimated	165	42	5437	308	603	811	7201
2008	Counted	165	43	5357	291	573	840	7104
2007	Estimated	69	86	7236	218	1647	785	9972
2006	Estimated	110	84	7530	215	1614	770	10213
2005	Estimated	70	134	7212	216	1354	672	9588
2004	Estimated	83	103	7134	225	1145	653	9260
2003	Estimated	103	87	6946	261	989	645	8928
2002	Estimated	115	68	6660	377	937	625	8667
2001	Counted	111	61	6313	444	839	657	8314

Southbound

Year	Data Type	Cycles	P2W	Cars/ Taxis	Buses/ Coaches	LGVs	HGVs	All Motors
2017	Estimated	169	44	6306	563	1571	588	9072
2016	Estimated	177	44	6353	602	1492	582	9073
2015	Estimated	190	45	6255	650	1366	587	8903
2014	Estimated	204	42	6220	552	1293	571	8678
2013	Estimated	210	43	6104	439	1217	613	8417
2012	Estimated	213	41	6103	390	1314	608	8456
2011	Estimated	225	41	6195	352	1166	607	8361
2010	Estimated	204	41	6097	324	1032	590	8084
2009	Estimated	203	45	6140	304	1010	581	8080
2008	Counted	203	46	6049	287	959	610	7951
2007	Estimated	53	92	8145	224	1750	998	11209
2006	Estimated	85	90	8476	221	1716	978	11481
2005	Estimated	55	144	8119	222	1440	867	10792
2004	Estimated	64	111	8030	232	1217	819	10409
2003	Estimated	79	93	7819	268	1052	805	10037
2002	Estimated	89	73	7497	388	996	780	9734
2001	Counted	86	66	7106	457	892	805	9326

Two-way

Year	Data Type	Cycles	P2W	Cars/ Taxis	Buses/ Coaches	LGVs	HGVs	All Motors
2017	Estimated	307	85	11890	1132	2509	1407	17022
2016	Estimated	321	84	11978	1211	2383	1393	17050
2015	Estimated	344	86	11794	1308	2181	1401	16770
2014	Estimated	370	81	11727	1110	2065	1379	16363
2013	Estimated	381	83	11509	883	1944	1493	15912
2012	Estimated	386	79	11507	785	2098	1478	15947
2011	Estimated	408	79	11680	708	1862	1457	15786
2010	Estimated	370	79	11496	652	1648	1405	15280
2009	Estimated	368	87	11577	612	1613	1392	15281
2008	Counted	368	89	11406	578	1532	1450	15055
2007	Estimated	122	178	15381	442	3397	1783	21181
2006	Estimated	195	174	16006	436	3330	1748	21694
2005	Estimated	125	278	15331	438	2794	1539	20380
2004	Estimated	147	214	15164	457	2362	1472	19669
2003	Estimated	182	180	14765	529	2041	1450	18965
2002	Estimated	204	141	14157	765	1933	1405	18401
2001	Counted	197	127	13419	901	1731	1462	17640

Casualty Data

Year	Casualties	Severity	Number of Vehicles	Number of Casualties	Junction Detail	Junction Control
2016	Pedestrian	Serious	1	1	Crossroads	Auto traffic signal
2016	Pedestrian	Serious	1	1	T or staggered junction	Give way or uncontrolled
2015	Pedestrian	Serious	1	1	Not at junction or within 20 metres	
2012	Pedestrian	Serious	1	1	Crossroads	Auto traffic signal
2011	Pedestrian	Serious	1	1	Crossroads	Auto traffic signal
2005	Pedestrian	Serious	1	1	T or staggered junction	Give way or uncontrolled
2016	Bus/coach/minibus occupant	Slight	1	3	Crossroads	Auto traffic signal
2014	Pedestrian	Slight	1	1	Crossroads	Auto traffic signal
2014	Pedestrian	Slight	1	1	Not at junction or within 20 metres	
2012	Motorcycle rider/passenger	Slight	2	1	Crossroads	Auto traffic signal
2010	Cyclist	Slight	1	1	T or staggered junction	Give way or uncontrolled
2010	Pedestrian	Slight	1	1	T or staggered junction	Give way or uncontrolled
2009	Car occupant	Slight	2	1	Crossroads	Auto traffic signal
2009	Car occupant	Slight	2	2	More than 4 arms (not roundabout)	Auto traffic signal
2008	Pedestrian	Slight	1	1	T or staggered junction	Auto traffic signal
2008	Pedestrian	Slight	1	2	Not at junction or within 20 metres	
2008	Pedestrian	Slight	1	1	Not at junction or within 20 metres	
2007	Motorcycle rider/passenger	Slight	2	2	Other junction	Auto traffic signal
2007	Pedestrian	Slight	1	1	Not at junction or within 20 metres	
2006	Pedestrian	Slight	1	1	Not at junction or within 20 metres	