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by Thomas Noble

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Coming Full Circle

Reclaiming space on major urban road junctions by learning from historic street patterns.

Thomas Noble

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UNIVERSITY COLLEGE LONDON

FACULTY OF THE BUILT ENVIRONMENT

BARTLETT SCHOOL OF PLANNING

Major Project:

Coming Full Circle: Reclaiming space on major urban road junctions by learning from historic street patterns.

Thomas Noble (BEng)

Supervisor: Oliver Davey BEng (DIS) MSc MCIHT

Being a major research project submitted to the faculty of The Built Environment as part of the requirements

for the award of the MSc Urban Design & City Planning at University College London:

I declare that this major research project is entirely my own work and that ideas, data and images, as well

as direct quotations, drawn from elsewhere are identified and referenced.

September 2020

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Abstract

Cities are places of exchange, meeting and social gathering which rely on proximity and connectivity to fulfil these functions. Road junctions are where the physical intersection of streets enables the intersection and intensification of these social functions. In this respect, they are essential to the function of the city and should be considered as key nodes in the urban fabric. However, in the 20th Century as cities grew and cars became more prevalent, major interventions were made on road junctions to improve the flow of traffic, often destroying parts of the city to achieve it. While this helped increase mobility overall in doing so it damaged the very fabric and functionality of the city. They are designed to segregate and accelerate traffic flows, thereby removing the opportunity for interaction and exchange, in this respect it is argued that these interventions were anti-urban

As cities start to turn away from the dominance of private vehicles, and towards more sustainable modes of travel such as cycling and walking, many of these road junctions are being re-configured to make them safer for pedestrians and cyclists. It is argued that many of these new improvements repeat a similar mistake; they are primarily highway infrastructure schemes. Is there a missed opportunity to undertake better interventions that repair and strengthen the fabric of the city? Can major road interventions ever create successful places? Can we learn from the historical street layouts in order to undo these anti-urban interventions?

The purpose of this project is to learn from best practices and historic precedents and provide practitioners with a toolkit to deliver holistic urban design on these sites.

Contents

List of Figures

1.Introduction

1.1 The Problem & Context

There is a shortage of land available for development in large metropolises, especially in locations that have good transport connections. Many cities are facing serious housing crises and there is a need to leverage all available land resources.

In the 20th Century as cities grew and cars became more prevalent, major changes were made to road junctions to improve the flow of traffic. To achieve this large areas of the city were given over to cars to the detriment of the fabric and functionality of the city.

The mobility function of cities is important, but should not be at the expense of other functions and destroys the very places it is providing connectivity to. Main roads, and road junctions, are where much of the activity of the city is concentrated. (Hillier, 2007).

Many of these highway schemes were never fully realised . This has left a legacy of over-sized highway infrastructure that is hostile and profoundly anti-urban and does not even fulfil its intended function.

As cities start to turn away from the dominance of private vehicles, and towards more sustainable modes of travel such as cycling and walking, many of these road junctions are being re-configured to make them safer for pedestrians and cyclists (Mayor of London, 2018).

While this is a positive step, it is argued that many of these schemes are a missed opportunity and repeat a similar mistake of focusing on the mobility function, albeit with a different mode. Do these schemes actually improve the city or is there a missed opportunity to provide more than cycling improvements and public realm? Can we look back to the historic street layouts in order to unpick these ruptures in the urban fabric?

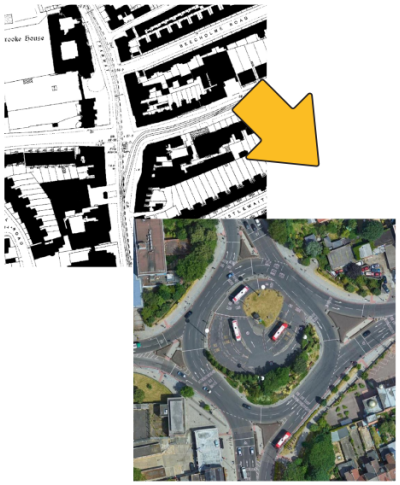


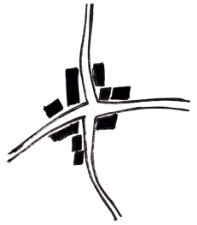
Figure 1
A typical major intervention on a road junction.

1.2 Research Question

Can road junctions be transformed into successful places and become key nodes for urban intensification?

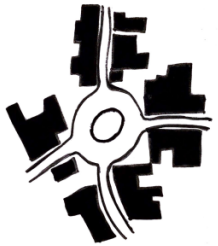
What can we learn from historic street patterns to achieve this?

A
Settlements form around crossroads



B
The city intensifies around the crossroads as it grows.

C
This urban fabric is ruptured by the traffic led intervention



D
The fabric is repaired and intensified

Figure 2
Visual representation how road junctions develop (A-B), the impact of previous interventions (C) and potential future development (D)

1.3 Objectives

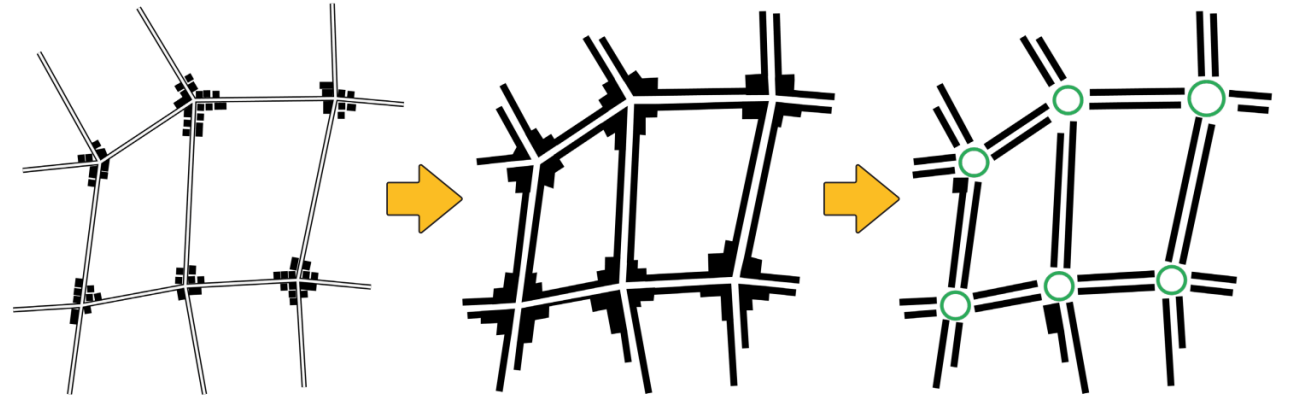
- Understand what 'good urbanism' is terms of road junctions.
- Investigate historic street patterns to see what was different and what lessons, if any, can be learnt and applied.
- Review current design guidance and research and establish what gaps exist.
- Help practitioners identify opportunities for the re-configuration of road junctions to repair the urban fabric and unlock opportunities for development.
- Distil the research into a Design Toolkit to help practitioners deliver good, holistic urban design of these sites.

1.4 Contribution to Practice

The purpose of the research proposal is to provide a framework for a more holistic urban design of urban road junctions. It is hoped that it will be possible to show how major highway interventions can make better places and provide multiple benefits.

The urban problems identified are universal to many cities, many of which are looking to reduce car dominance and improve walking and cycling. There are likely to be many sites where the proposed Design Toolkit could be applied.

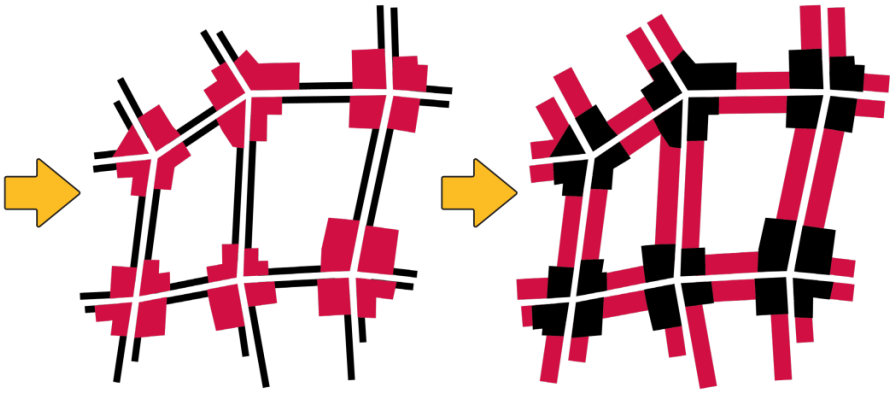
The research could be used by highway departments and planners to identify opportunities for development, intensification and renewal.



A *Settlements grow around crossroads*

B *The city emerges from the network of crossroads which become major nodes*

C *Traffic led interventions damage these nodes and rupture the fabric of the city*

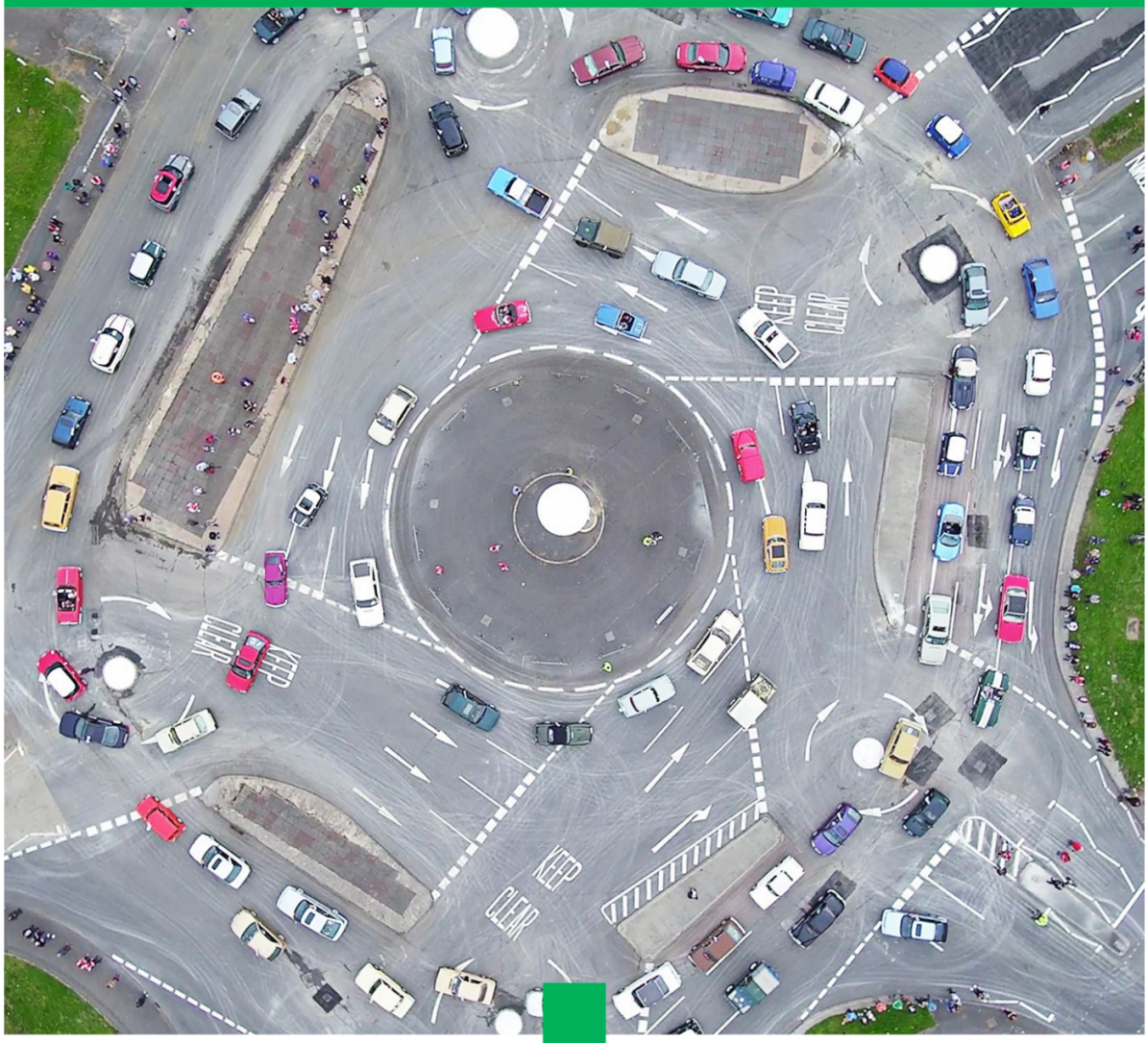


D *Potential repair and intensification*

D *Future intensification spreads out, mirroring the historic development*

Figure 3
Visual representation in a city wide context

2. Methodology



2.1 Stages

The Major Research Project has four separate stages as shown.

However, the process iterative rather than linear, as the tool kit is developed further research is likely required to be required to fill in any gaps. The design stage will initially be experimental in order to test the toolkit, which will need to be adjusted and in turn require additional research.

2.2 Stage 1 - Pre-Research

- Conceptualisation of Problem and Question
- Pre-research reading and site assessments to verify suitability of concept
- Research potential application sites

2.3 Stage 2 - Main Research

- Undertake Literature Review based on sub-topic
- Identify sites for case studies, critiques and potential application sites.
- Undertake review of case study sites, including detailed land use analysis of one or two sites in order to quantify impacts of interventions.

2.4 Stage 3 - Development

- Initial development of toolkit based on literature review and case studies.
- Shortlist potential application sites, based on map search, historic documents.
- Select preferred site
- Undertake outline design on site using toolkit to test applicability
- Review outcomes and adjust toolkit to suit, undertaking further literature review and research if necessary.
- Finalise design.

2.5 Stage 4 - Review and Evaluation

- Undertake final evaluation of design.
- Reflect on suitability and limitations of toolkit and design approach.
- Reflect on transferability of toolkit and contribution to practise.

2.6 Design & Research Tools

As part of the case study analysis some detailed land use analysis will be undertaken using QGIS, a geospatial software package into which land-use data for the UK can easily be imported from the Ordnance Survey. Data is then analysed using PostGIS, a database system. Historical land-use analysis requires more manual input and some detective work. Maps have to be digitised by hand using QGIS and uses assigned manually using a mix of archive photos and web searches.

Design is undertaken using AutoCAD to produce scaled and dimensioned plans and then exported to Sketchup to produce 3D drawings.

It is important not to understate the importance of sketching as a design tool. The first step should always be to sketch several design iterations out first by simply printing out plans of the proposed sites and drawing over them in tracing paper.

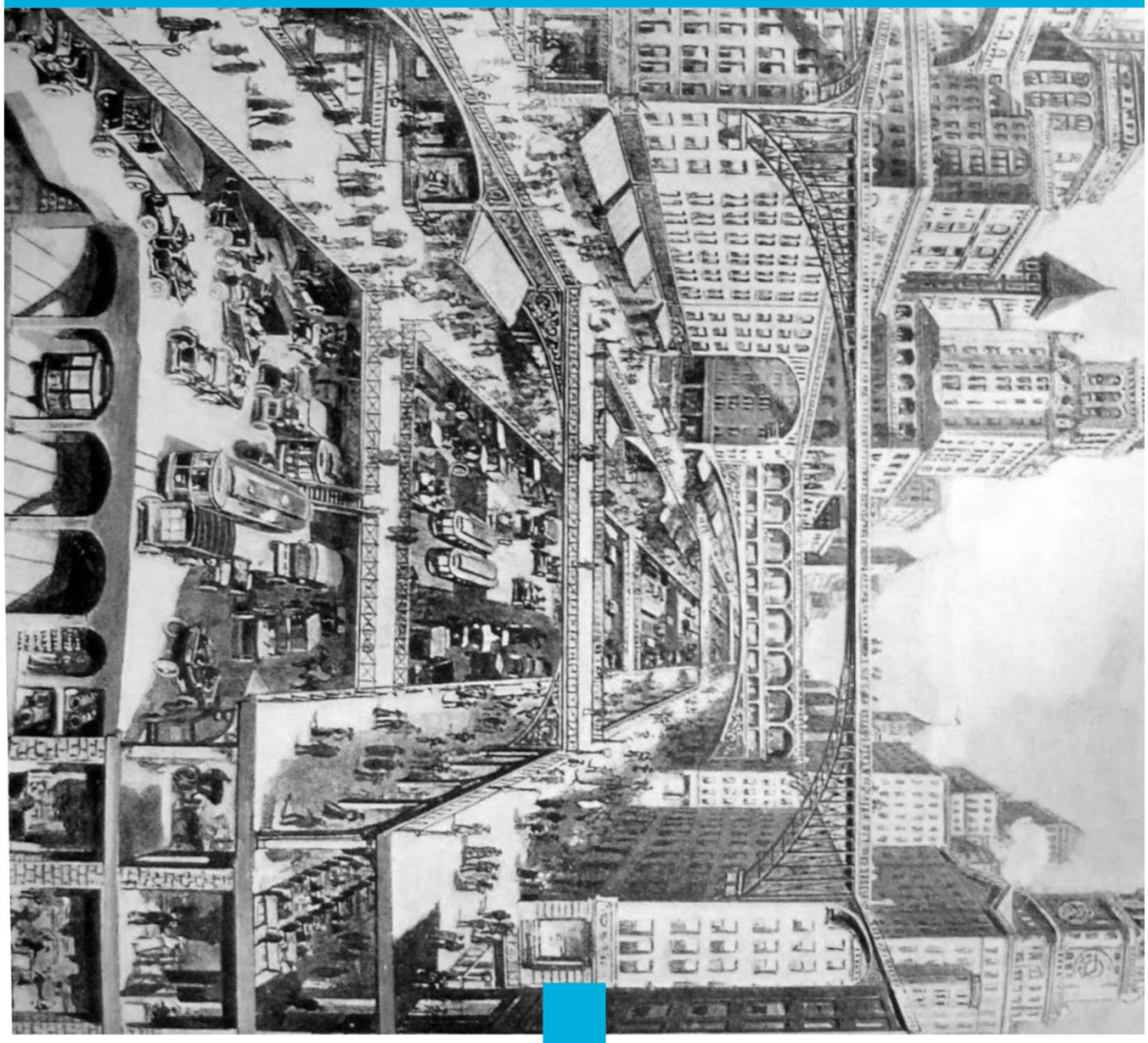
2.7 Ethical Risks

The ethical risk for the proposed research methodology is very limited.

A short interview was conducted with two transportation consultants, who were made fully aware of the nature and purpose of the research and that the final report may become publicly available. The transcript of the interview will not be published and no quotations will be included in this report.

No personal data has been recorded in relation to this interview.

3. Literature Review



This literature review is broken into three topic areas. Firstly, we take a step back and consider the how and why of cities and why streets and junctions matter. Secondly, we look at the rise of car, what impact this had on how we arrange our cities. Finally, we will consider the resulting backlash to this and how that has shaped current thinking and guidance, including an identification of current research gaps.

3.1 Defining The City

3.2 Rise of the Car and Fall of the Street

3.3 Urbanism, Emerging Thinking & Design Guidance

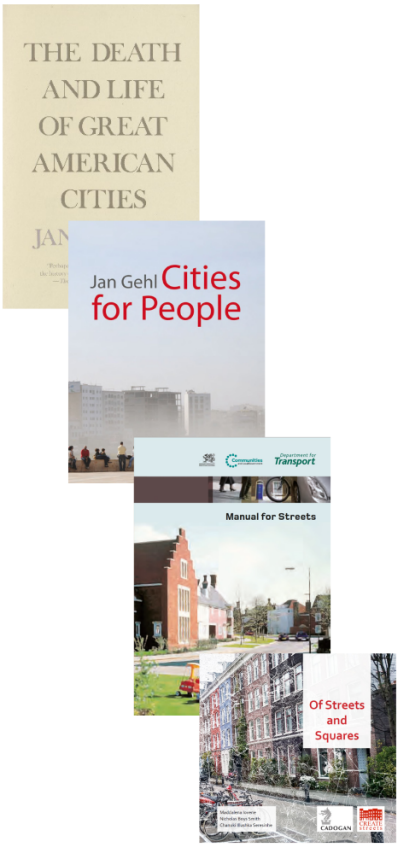


Figure 4

connectivity there is a mixing of people , this brings life and therefore place, and whatever our intentions in design that pattern doesn't change. Space syntax is essentially about how easy it is to move through space, assessed by measuring the number of turns, the angle of terms and distance. Usually crossroads and main roads score highly in these measures, they have a high potential for 'generating contact' and should therefore attract higher density and more uses.

Many of the findings inferred from Space Syntax analysis point towards the conventional street grid as the most effective way of organising a city. Features such as higher concentration and density on main routes, land use by street not block, a logical (not necessarily regular) grid, and narrow plots along main routes (thereby increasing 'contact' along these routes.) In terms of junctions, it should also be noted that main routes tend to branch at shallower angles following the radial structure of the city.

This all emphasises the importance of junctions, or crossroads, as key nodes in the urban fabric. They are where people slow down and gather, they naturally emerge as centres of citywide and local importance and they support vitality due to their high connectivity and centrality.

4.2 Rise of the Car and Fall of the Street

Why was so much of the traditional street grid eradicated? For this it would be useful to look at story of urban road design from the 19th Century to today.

The need to widen city streets to improve traffic flow and mobility is nothing modern, there have been numerous schemes that were successfully implemented in the past. For example; in central London. Northumberland Avenue, Charing Cross Road, Cambridge Circus and Shaftsbury Avenue were all carved out of the city in the 1880s (Figure 7). Kingsway and The Strand were built in the 1900's. A more famous, and much grander example would be Hausmann's boulevards in Paris which, among other reasons such as bourgeois ideals and control of uprisings, were constructed to improve connectivity and mobility. While destructive, none of these interventions were dis-urban in their creation, the fabric of the city was 'stitched' back together new urban forms emerged (Figure 8).

It was towards the end of the 19th Century that anti-urban discourse became prevalent, with the rise of the garden city movement and the desire to cure the problems of the city by essentially destroying it. (Sonne, 2010) (Jacobs, 1961), It is also around this time that motor vehicles started to appear on our streets, and while this might have solved one significant urban problem (horse droppings) it started replacing it with another, congestion and pollution (Glaeser, 2012).

Figure 7 *- Northumberland Avenue, London*

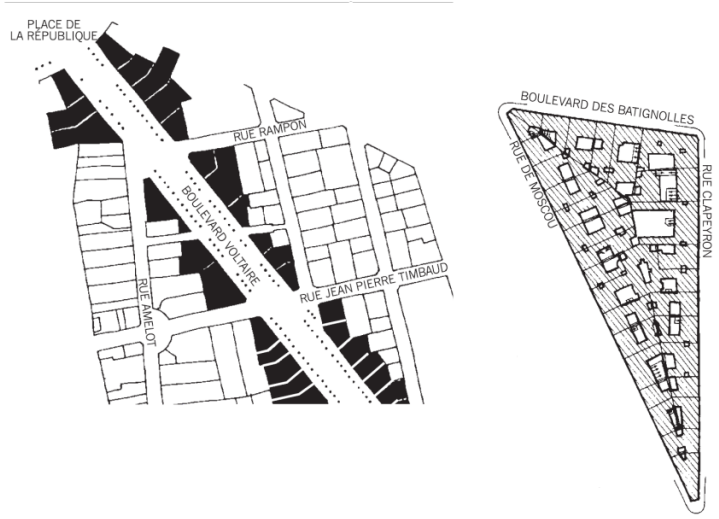


Figure 8 *- Example of how Hausmann's boulevards were stitched back into the urban fabric (right). Resulting new urban forms (left). From Urban Forms (Panerai et al., 2012)*

From the end of the 19th Century we can draw a clear line from the Garden City movement to the modernist city, such as Corbusier's City Radiant, and the suburban sprawl so common today. This story has been well told, notably in The Death and Life of Great American Cities (Jacobs, 1961) and Urban Forms (Panerai et al., 2012). It is interesting to track how urban street design evolved over this period.

The first major city-wide scheme to improve traffic flow in London was the Royal Commission (HMSO, 1906). The centrepieces of the final recommendations were two new 'Main Avenues' on east-west and north-south axes complete with tram lines, railways and utilities. A proposed typical section is shown in Figure 9. These new routes are still very much streets with buses, trams, cars, pedestrians, bikes and good vehicles all visible. Consideration was even given to lay-bys for good vehicles, building form and heights and street trees. The footways were generous at 23' (7m) giving a total width of 42m. The proposals were about providing streets for the mobility of people and goods using all modes, and the proposals seem to show an innate understanding of the other functions of streets.

Around this time Paris was also struggling with increased traffic, despite the completion of most of Hausmann's boulevards only a few years prior (Perhaps an early example of induced demand). In 1903 a city engineer named Eugene Henard published a series of articles on his plans for the improvement of traffic flow in Paris by means of a radical programme of massive new boulevards and ring roads and use of innovative new junction forms; grade separated flyovers and the 'carrefour à gyration' (roundabout). Henard's only real focus was to reduce congestion and improve mobility to allow the economy of the city as a whole to flourish. It could be argued that this was the first real instance of traffic engineering with a view to accommodate the inevitable rise in private car use in cities, as he remarked 'the car has only just been born' (Olson, 2010). While we start to see principles such as separation of traffic, removal of conflict at junctions, bypasses, etc. the proposals are still urban and architectural (Henard was an architect himself). His studies would go on to influence the works of Le Corbusier and others.

By the time London next looked to improve its traffic situation in the 1930's, with the Highway Development Survey (Bressey and Lutyens, 1937), the focus was very much on roads for motor traffic, with large roundabouts or grade separated junctions throughout.

The next development of this was The Greater London Plan (Abercrombie, 1945), which proposed a system of multiple 'Arterial Roads' on radial routes and several ring roads encircling the city. As these plans were developed they became to more closely resemble the modernist utopia of the City Radiant, with elevated and sunken highways and little integration into the urban environment (Figure 11).

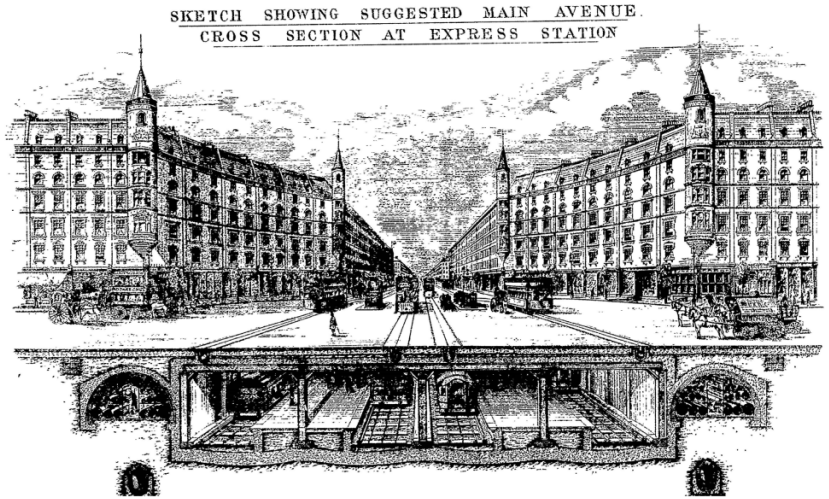


Figure 9 *- Proposals for a trunk road through London, from the Royal Commission on London Traffic 1906*

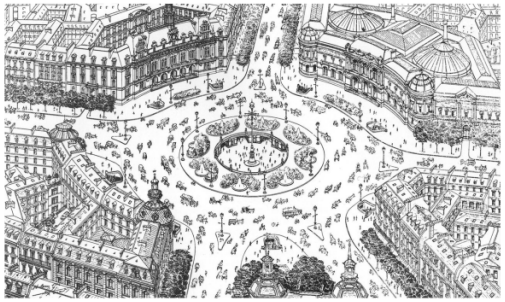


Figure 10 *- Henard's traffic innovations, the roundabout (right) and an early diamond interchange (left). Note how well, despite the scale, this integrates into the urban fabric.*

Perhaps the peak of urban road planning was in the 1960's, this was the decade that the very influential report 'Traffic in Towns' (Buchanan, 1963) was published at also when the final attempt to build major new roads in London got underway. By this time the separation of the movement function of streets from their social functions had reached their zenith, the basic principle of Traffic and Towns was the separation of main roads for traffic and smaller roads for access, very much in line with the modernist principles of inverting the relationship between movement and place. (Marshall, 2004). Taking the proposals to their fullest intent, the city would become cellular with life and activity happening inside neighbourhoods carved out by main roads and buildings turning their back to the street (Figure 12), almost an echo of the Cerda's proposals 100 years before (as discussed above). Figure 12 show the impact such a philosophy would have on the fabric of the city, the complete 'disassembly of the street' (Marshall, 2004). While these proposals were never close to being realised, a few years later the Greater London Council pushed forward plans for 'Ringways', a series of concentric motorways around London based on the previous Abercrombie plans. Some basic elements were built, but fortunately the plans were never fully realised. A typical example is shown in Figure 13 this would have been Dalston, which is now a very vibrant and popular neighbourhood, something unlikely to be achieved if the scheme had gone ahead. This last image is in stark contrast to Figure 9, showing the early proposals for main routes in London or Figure 8 the carefully stitched in boulevards of Paris.

So, what went wrong? Firstly, it is easy to blame civil engineers but probably not that fair. As traffic and vehicle speeds increase the primary drivers for design become traffic flow and safety. It was apparent early on that cars are dangerous, so it was natural to want to separate them from people. Higher flows and speeds meant more complicated junctions and road geometry, better road markings and signage, etc. This is all complicated and specialist, streets were no longer be designed by generalists (Speck, 2013). Engineers were only responding to brief, it was the planning philosophy of the time that movement needed to be prioritised, and the other functions of the street were disregarded. This isolation of disciplines, and dominance of the movement function, is entrenched and hard to change. The schemes discussed earlier were never realised, so large scale damage is not evident, however the principles behind never went away. Many smaller scale, but still damaging, interventions were made. Guidance such as Design Bulletin 32 entrenched this sort of thinking into code, resulting in ongoing 'disurban creation' (Marshall, 2004). A recent study (UDG, 2018) found that most highway authorities in the UK are still using this out of date guidance, only 20% are using the more up to date, and street orientated, Manual for Streets (discussed further below).

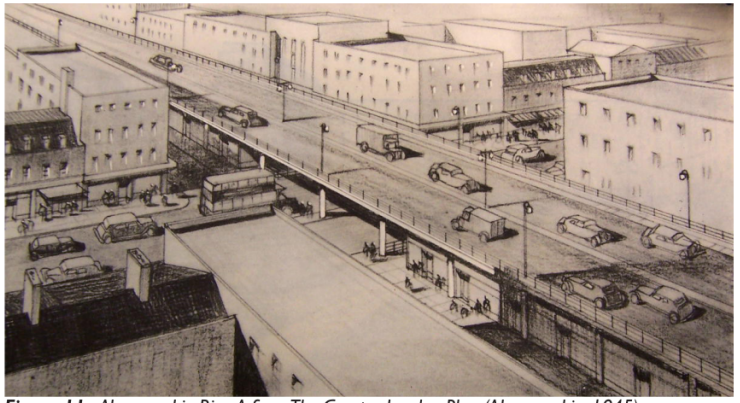


Figure 11 *- Abercrombie Ring A from The Greater London Plan (Abercrombie, 1945)*

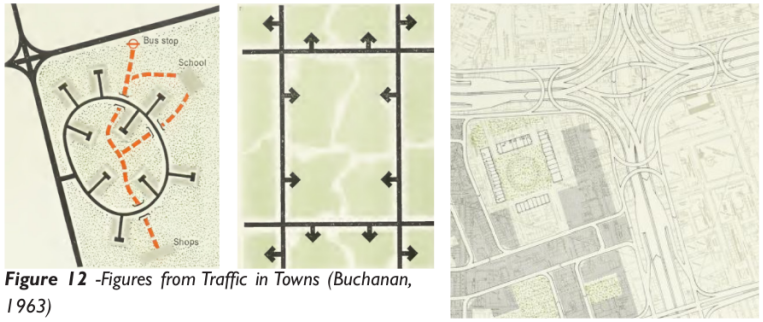


Figure 12 *-Figures from Traffic in Towns (Buchanan, 1963)*

Figure 13 *- Motorway plans for Dalston, east London.*

4.3 Urbanism, Emerging Thinking & Design Guidance

As opposition to urban roads grew, and the negative externalities of traffic became clear to citizens, new ways of thinking emerged

Perhaps the most famous rebuke to modernist town planning and highway engineering came from Jane Jacobs, who made strong arguments for the importance of streets and the complexity of urban economies in Death and Life of Great American Cities (Jacobs, 1961). She railed against the 'pseudo-science' of planning and its practice of reducing the city to segregated functions, reducing complexity and density rather than celebrating and enhancing it. However, she was not the first, in fact in the early 20th Century many planners and architects were strongly making the case for reforming the urban block and railed against what they saw as the anti-urban instincts of the garden city movement. In the words of one report '…to continue the city and to improve it, not to break with its pattern and to destroy it'. This story is well laid out in the paper Dwelling in the metropolis: Reformed urban blocks 1890–1940 as a model for the sustainable compact city (Sonne, 2010), which shows numerous examples of excellent, distinctly urban, developments within many different local contexts. These show how the 'ills' of the city, such as overcrowding, sanitation, lack of light, etc, can be cured without resorting to destroying the city itself.

Two particularly good examples of more recent thinking are Cities for People (Gehl, 2010) and Walkable City (Speck, 2013).

For Jan Gehl, good cities are all about considering the human scale and human speeds, his main argument being that modernist planning has designed cities for a 'modern man' that does not actually exist. We are the same Homo sapiens that walked through the streets of ancient towns and cities and respond in the same way to our environment. This offers us a useful set of rules and principles for designing people friendly places based on psychology and physiology. For example, based on our field of vision public squares need to be less than 100m in any one dimension, for this is the maximum distance we can observe action and any larger the space feels uncomfortable. Most historic squares are smaller than this key dimension, showing that there are underlying principles that work. The 'edge effect' is another important consideration in design, people feel safer and more comfortable against an edge and will generally congregate there. Edges, especially façades, also need to be inviting and interesting. Blank façades actively deter people while rough façades, i.e. those with niches and structure such as colonnades, invite people to stay. Façades need to be interesting and varied over short distances to maintain our visual interest and make streets pleasant to walk on. The book has numerous such examples and useful recommendations that can be applied to any city.

In Walkable City (Speck, 2013) the author provides a well-researched and tested set of design principles that underpin street vitality. This builds on the work of Jacobs, Gehl and others along with the author's practical design experience. While the book is very much rooted in the US context, there are many universally applicable recommendations; small blocks, avoiding multi lane roads, avoiding one-way systems, bringing in trees and providing suitable separation for the pedestrians and other street users from moving traffic. On the latter point, this doesn't mean separating them in the sense of the early modernist visions shown in traffic in towns, but rather simply a permeable physical barrier such as parked cars.

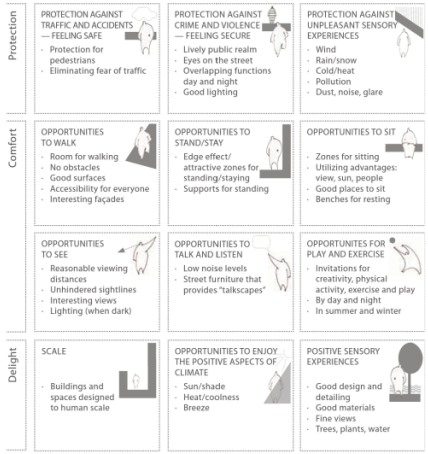


***Figure 14** - From Cities for People (Gehl, 2010)*

One particular observation that is applicable to this study is that better public realm, such as paving or street furniture, cannot make a place great on its own, there is a need to 'pick winners'. The other elements, such as accessibility and the private realm (i.e. buildings) that surround it must also be of high quality for the place to work.

Another recent publication, which is more applicable to the UK context, is Of Streets and Squares (Iovene, Smith and Seresinhe, 2019). This is comprehensive study of what makes places and streets popular, which summaries existing research as well as new primary research undertaken by the authors. One interesting finding, that is relevant to this study, is from a study in New York in the 1970s which found that nearly 60% of meetings on streets happen on corners, in the works of the author, 'corners are crucial' in place making.

The primary research in the study involves a 'visual preference survey' and a novel place analysis using machine learning tools and big data. It is difficult to assess the quality of this primary research and it is not clear if it has been peer reviewed. Some of the survey questions may be leading and show the author's biases towards traditional architecture. However, the findings and recommendations of the report are broadly in line with the other publications that have been reviewed. The study concludes with a ten step guide which includes simple rules relating to use, spatial arrangements and form, with similarities to (Gehl, 2010) and (Speck, 2013)

A lot of this thinking has now found its way into professional guidance. In the UK *Places, Streets & Movement* (DETR, 1998) sought to put the dominant highways design guidance, Design Bulletin 32, in its place and promote the importance of other functions of streets.

This, along with the original DB32 guide, were superseded in 2007 with the introduction of Manual for Streets (DfT, 2007), a far more comprehensive guide which aimed to provide a more holistic set of design principles for streets. The inversion of the street and dendritic road hierarchy, a significant element of DB32, was rejected in favour of permeable, connected street layouts and an emphasis on street frontages. Urban design elements such as enclosure, walkability, surveillance, materials, placemaking, etc. are covered in detail. On junctions the guidance recognises that junctions are important places in terms of accessibility, surveillance, interaction and legibility and that they should not be defined by traffic flow alone. Instead, the form of buildings should determine the junction layout and they should be locations of amenities and other important functions. Roundabouts are singled out as inappropriate for residential areas, mainly due to their impact on pedestrian desire lines, safety and the street scene. This is a recognition that roundabouts are primarily designed for traffic flow and efficiency, other users and uses are secondary considerations. By extension, it could be argued that roundabouts are therefore not suitable for urban areas. Some forms may be acceptable, such as mini roundabouts or 'continental' style roundabouts. These types of junctions are characterised by slower speeds, tighter radii and a smaller radius overall. Consequently the land take is much lower and they are estimated to be safer (DfT, 1997). This is probably closer to Henard's vision than many roundabouts constructed today.

Since Manual for Streets there have been many publications and design guides focussing on stret design streets, as well as walking and cycling specific guidance. In London there is the Streetscape Guidance (Transport for London, 2016), this is very detailed and covers everything from layouts to kerb heights. The guidance introduces a matrix of street types concept, based on a combination of movement function and place function. This cements the idea that streets are never just for traffic, but also recognises that their mobility function is important and that a street can have high movement function (i.e. high traffic) and still be successful as a place. An obvious example of this is a Parisian style boulevard, which has almost motorway dimensions but still hosts a huge array of street life. Many of the early concepts for major highway schemes in London, as discussed above, appeared to have this appreciation and ambition. One recent paper, Creating Boulevards for London (Kieren and Boys Smith, 2016) proposed a London wide intensification and 'beautification' of main streets to transform them in to boulevards. The paper identifies many opportunities and advantages such as increased housing provision and better public transport, things that none of the current design guidance covers. It also discusses the limitations on these ambitions caused by constraints such as utilities; streets serve an important function as conduits for many utility services, from sewers to fibre optics (the City of London has up to 10 separate telecoms providers in its narrow streets)[1], and this makes any significant changes to street layouts challenging and expensive. The paper is only published for discussion, it has not been subject to review, but it is shows that thinking within the industry is changing and that there is a gap in research and design guidance. So far, little has been written about opportunities.

Junctions are inevitably places of conflict and this makes the addition of cycling infrastructure particularly challenging; 75% of bike accidents occur on or near junctions (RoSPA, 2017). There is a myriad of design guidance available for cycling infrastructure, and this is a complicated design topic and outside the scope of this study. However, some simple principles and best practices are required. The London Cycling Design Standards (Transport for London, 2014) is an up to date, very detailed guide which has been developed within the context of an existing large, dense and historic city. The Irish National Cycle Manual (National Transport Authority, 2020) is a comprehensive online guide which provides useful simple design recommendation. One recent interesting innovation in cycling infrastructure, that is very relevant to this study, is the CYCLOPS type junction that is being pioneered in Manchester, UK (TfGM, 2019). This is a new typology that incorporates an external orbital cycle track into the junction, this is design to reduce conflict without impacting on pedestrian convenience or junction traffic capacity. The first junction was only opened in July so it is not possible yet to say how successful it is.

1 City of London - Telecommunications

4.4 Conclusions

The literature substantiates the idea that crossroads and junctions are key parts of the urban structure. This is from the perspective of historical studies, theoretical analysis and empirical data. Crossroads are where the social functions of the city are intensified, where contact and conflict are maximised, and the flows of the city intersect. Successful cities need better junctions as well as better streets.

Throughout the 20th Century the social function of streets was neglected and the movement function prioritised, this was accelerated by the advent of the private car and anti-urban discourse (Jacobs, 1961). Streets became roads, and urban design and highway design branched and became increasingly siloed and disconnected. Interventions and developments in this time were destructive and anti-urban (Marshall, 2004). Junctions are ultimately points of conflict; messy places which are the antithesis of modern highway design which seeks to remove conflict and disorder.

The importance of streets and conventional urban patterns is now much better understood with a wealth of theoretical and empirical studies backing this up.

Guidance has been improved and is being updated all the time, although in practice this isn't necessarily followed, and old methods are entrenched. Most new schemes are still very movement and traffic focussed. A recent survey by the Urban Design Group (UDG, 2018) found that only 20% of highway authorities in the UK were, in reality, using the Manual for Streets, most are still using the outdated Design Bulletin 32 standards, creating road layouts with sweeping bends, large roundabouts, etc. One transport consultant I spoke to confirmed that mobility and flow are still the overriding priorities when looking at improving junctions, pedestrians are low on the agenda and urban design is not considered at all. Projects are judged on the metric of capacity and flow, there is no reward for considering pedestrians. So even despite the decades of changing thinking and new guidance, there is still a long way to go in practice.

The numerous studies and guidelines reviewed offer a wealth of design principles and theories that can be used to build a toolkit for designing great streets and places. However, there is little said on road junctions apart from passing mentions in documents such as Manual for Streets (DfT, 2007), despite the recognition of their importance. Junctions and crossroads are not streets or public squares, they have elements of both along with other specific design considerations. There is a clear gap in the research and guidance which presents a good opportunity for research by design.

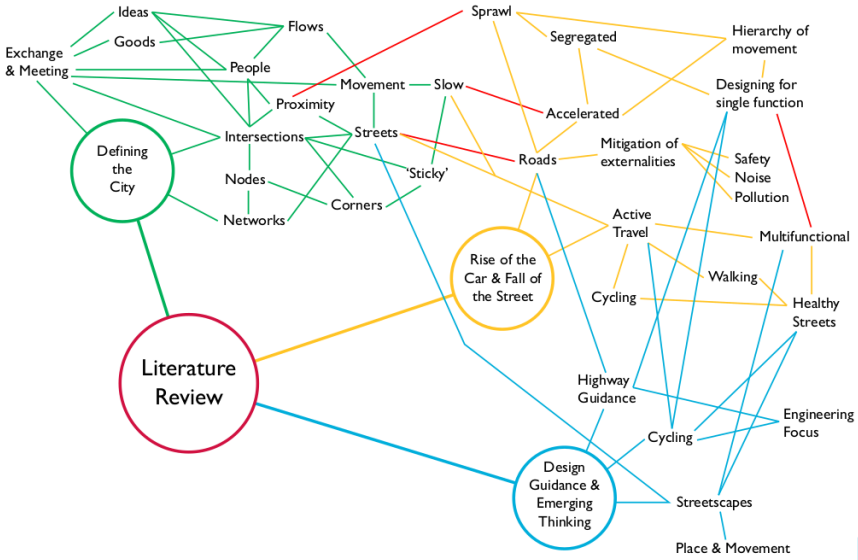
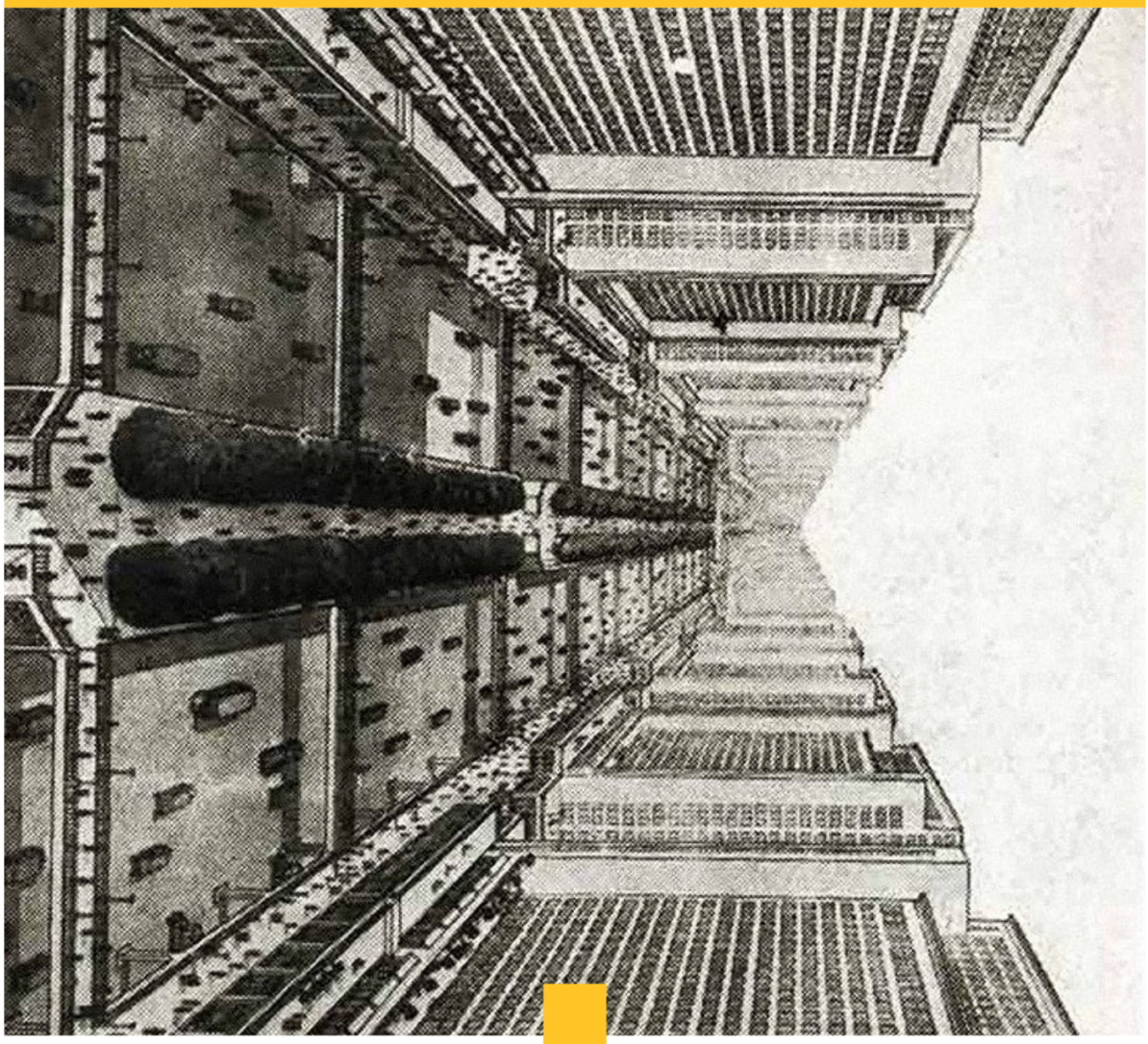


Figure 15 *- Graphical representation of concepts in literature review)*

5. Case Studies



5.1 Selection

A range of sites were investigated, based on the following outline criteria:

- Large junctions on major roads (e.g. roundabouts on 'A' designation roads.
- City centre or inner city location
- Junctions that have recently been, or will be, re-configured to reclaim space back from the highway.

Four sites have been investigated:

1 Old Street Gyratory, Islington, London

2 Elephant & Castle, Southwark, London

3 Lea Bridge Roundabout, Hackney, London

4 Temple Circus, Bristol.

Part of the research question is to establish what can be learnt from 'traditional' street patterns so there are also case studies of major road junctions that haven't been significantly altered.

5 Bank Junction, City of London

6 Place Victor Hugo, Paris

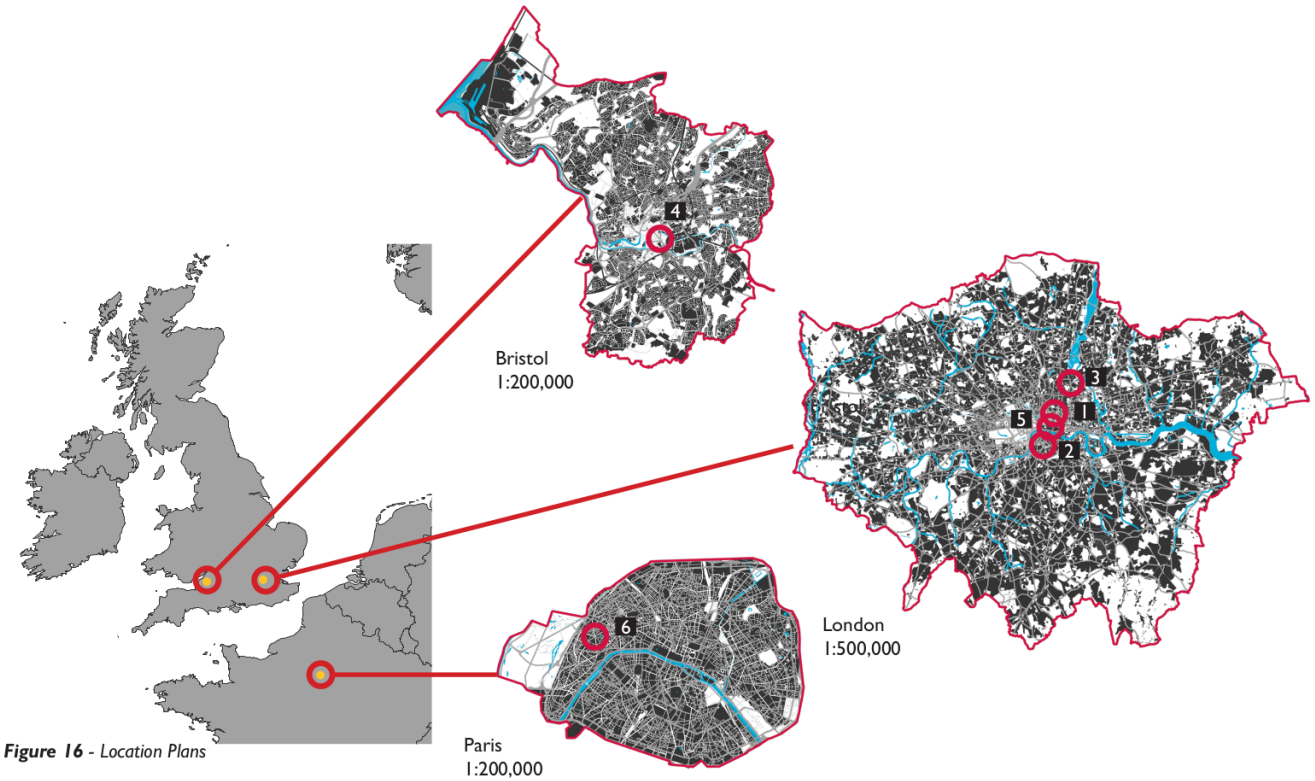


Figure 16 *- Location Plans*

5.2 Analysis

For two sites, Temple Circus (4) and Lea Bridge Roundabout (3), detailed quantitative analysis of land use was undertaken using GIS to compare the historical site with the current layout.

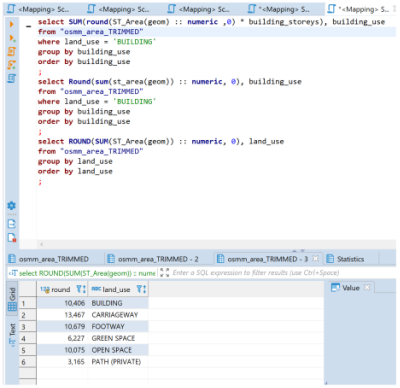


Figure 17 *- SQL Code*

Figure 18 *- Lea Bridge, From LB Hackney*

5.3 Site 1 - Old Street

Key Information

Location: Islington, London, UK

Coordinates: 51° 31' 32.3" N, 0° 5' 15.4" W

Year Built: 1968 (Converted to gyratory)

Type: Signalised gyratory, 4 - 5 lanes, pedestrian underpasses (linked to Underground station)

Characteristics

1918 Layout

- Simple crossroads
- Well defined corner plots
- Unbroken street frontage
- Permeable street network
- Single lane in each direction
- Fine grain, small plot size
- High plot coverage

Figure 21 *- Future Arrangement (under construction)*
Scale: 1:1000

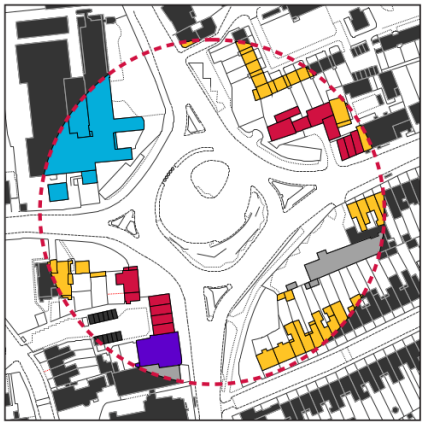
Area Analysis

1938

1938

1938


Present Day


Present Day


Present Day

Land Use

- Building
- Carriageway
- Footway
- Green Space
- Open Space
- Gardens (Private)
- Parking (Private
- Transport (Bus)

Building Use

- Education
- Housing
- Industrial
- Commercial
- Mixed (Housing & Commercial)
- Public House
- Garage
- Religious
- Cinema

Building Heights

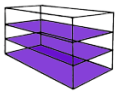
- 1 Storey
- 2 Storey
- 3 Storey
- 4 Storey
- 5 Storey
- 17 Storey

Summary of Land Use

Total Area = 30,524m²

	Buildings	Private Space	Public Space	Carriageway
1938	11142	6638	7372	5371
	37%	22%	24%	18%
2020	6192	7010	10418	6904
	20%	23%	34%	23%
Change	-4950	+372	+3046	+1533
	-26%	2%	16%	8%

Highlights


Floor Space ↓ 26%


Open Space ↑ 16%


Carriageway ↑ 8%

The biggest change by far is the loss of building floor space; an estimated **6634m²** across all storeys. Surprisingly, the biggest gain is in open space, including green space but mostly paved areas of little value, and the amount of carriageway space has only increased 8%.

5.6 Temple Circus

Key Information

Location: Bristol, UK

Coordinates: 51°26'59.5"N 2°35'06.2"W

Year Built: 1950s - 1990s (in stages)

Type: Signalised gyratory, 3- 4 lanes, At grade crossings

Reconfigured: 2019 (ongoing)

Type: Signalised crossroads. 5 - 6 lanes

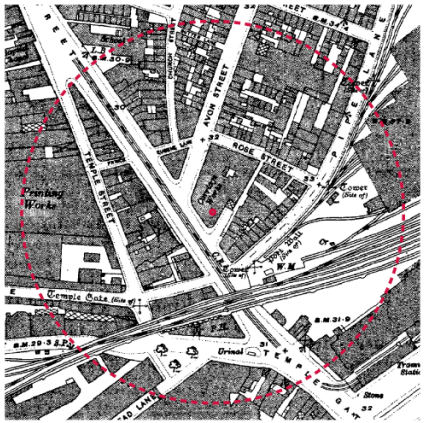


Figure 30 - *1918 Layout*
Scale: 1:3000

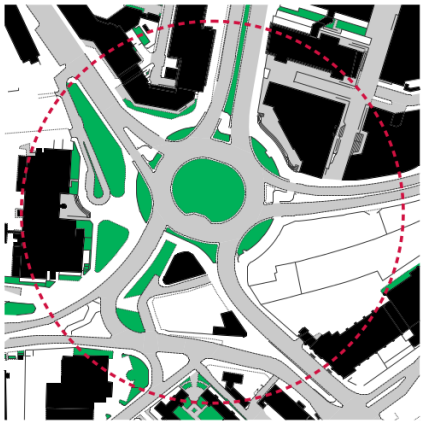


Figure 31 - *2017 Layout*
Scale: 1:3000

Figure 32 - *Future Layout (under construction)*
Scale: 1:3000

Characteristics

1938 Layout

- Multiple interconnected streets, complex layout.
- All streets at junction offset or branching
- Multiple routes in all directions, interlinked with smaller streets.
- High plot coverage
- Fine grain, small plot sizes
- Well defined corners. Buildings are shaped by street geometry.
- Streets widths approximately 15m - 20m
- Unbroken street frontages

2017 Layout

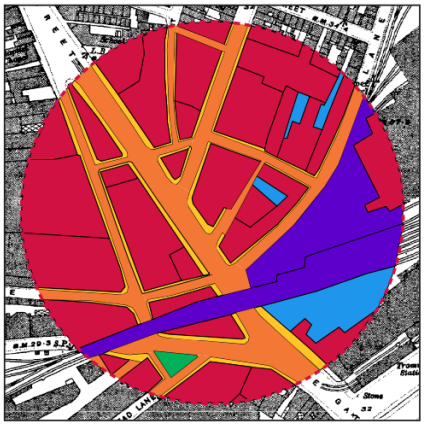
- Large gyratory, signalised, plus one way systems and connected junctions.
- Covers area measuring 200m x 140m.
- High speed road geometry - large radii, flared junctions
- Low plot coverage.
- Little relation to building form and street geometry.
- Large plots and blocks. No active frontages.
- Large amounts of open space, very little of which is accessible and useful.

Future Layout

- Simplified layout, less roads but wider ones. Up to 6 lanes.
- Improved cycle infrastructure, including segregated lanes.
- Large public squares, lacking in edge definition, enclosure and surrounded by traffic.
- Limited improvements in soft landscaping.
- No increase in plot coverage.
- Buildings do not address the street.
- Large scale plots and blocks. Not human scale.

Figure 33 - *Layout pre-2018*

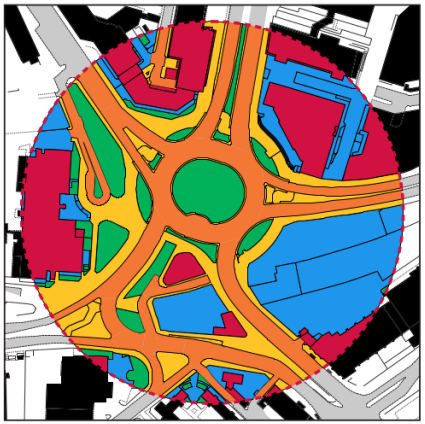
Area Analysis

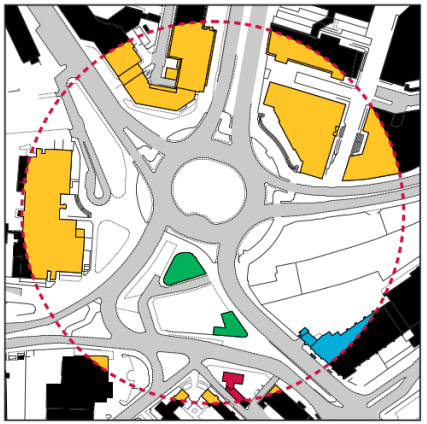


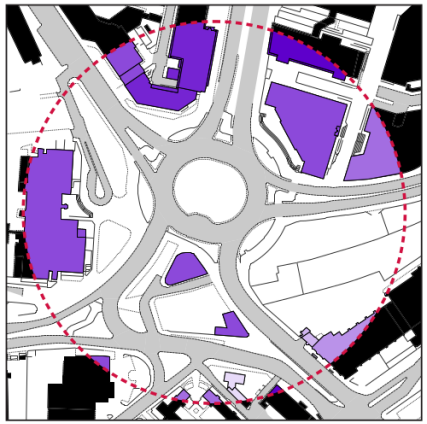
1918

1918

1918


Present Day


Present Day


Present Day

Land Use

- Building
- Carriageway
- Footway
- Green Space
- Open Space
- Transport (Rail)

Building Use

- Commercial (Office)
- Commercial (Other)
- Hotel
- Transport - Rail
- Housing
- Industrial
- Public House
- Education

Building Heights

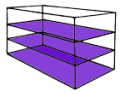
- 1 Storey
- 2 Storey
- 3 Storey
- 4 Storey
- 5 Storey
- 6 Storey
- 7 Storey

Summary of Land Use

Total Area = 54,019m²

	Total Buildings	Total Private	Total Public Space	Total Carriageway
1918	28086	10398	4773	10762
	52%	19%	9%	20%
2018	10406	13240	16906	13467
	19%	25%	31%	25%
Change	-17680	+2842	+12133	+2705
	-68%	+11%	+47%	+10%

Highlights


Floor Space ↓ 11%


Public Space ↑ 47%


Carriageway ↑ 10%

The biggest change is the loss in building footprint; an estimated **17680m²**. However, an increase in building height means that the net change in floor space is **-6553m²** (down 11%), still a significant change. Public open space has massively increased, up **47%,** but carriageway space has only increased **10%.**

5.7 Place Victor Hugo

Key Information

Location: 16th Arrondissement, Paris, France

Coordinates: 48°52'10.8"N, 2°17'07.2"E

Year Built: 1854

Type: Roundabout, not signalised

Figure 34 - *View looking north. From Wikimedia by Mbzt CC BY-SA 3.0*

Characteristics

- Boulevard style streets, approximately 20m wide
- Simple geometry
- Wide gyratory area, approximately 95m in diameter (however no lanes, road markings or other traffic controls.
- High plot coverage
- Fine grain, small to medium plot sizes
- Well defined corners. Buildings are shaped by street geometry.
- Unbroken street frontages
- Many active uses on ground floors
- Central fountain
- High number of street trees

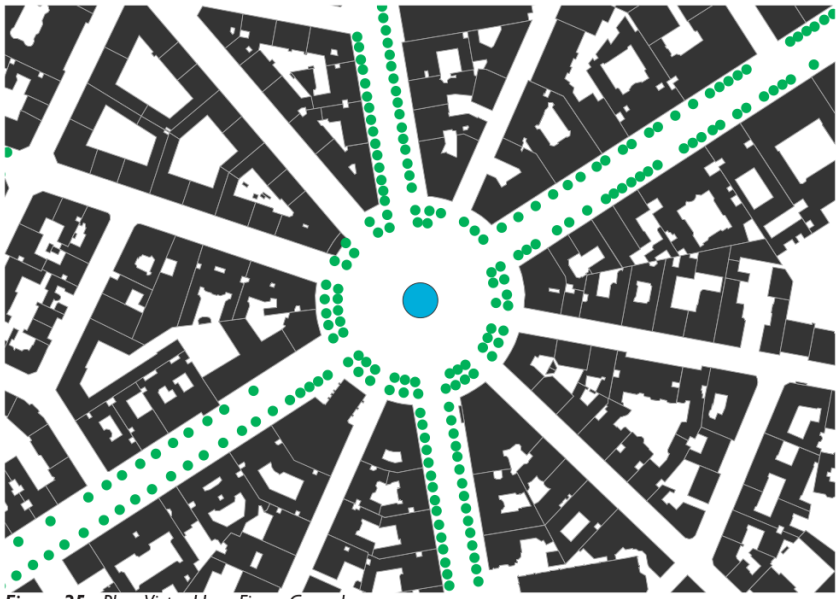


Figure 35 - *Place Victor Hugo Figure Ground*

5.8 Bank Junction

Key Information

Location: City of London, London, UK

Coordinates: 51°30'48.2"N 0°05'19.9"W

Year Built: 1670s - 1840s (Current form)

Type: Signalised Junction, surface crossings with underpasses for tube station

Figure 36 - *Bank Junction View looking east. By Chas Brown CC BY 2.0*

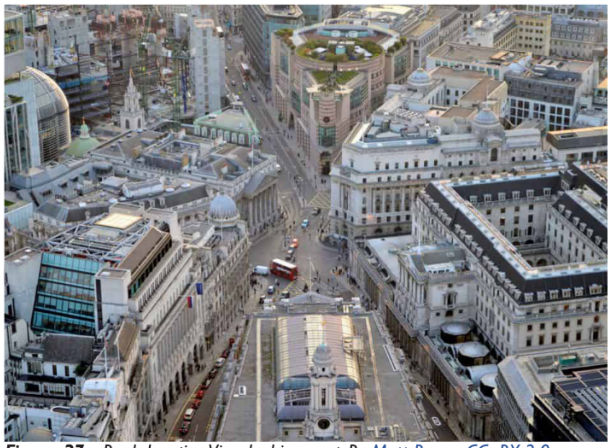


Figure 37 - *Bank Junction View looking west. By Matt Brown CC BY 2.0*

Characteristics

- Complex street layout
- Radiating streets, branching from different points.
- High plot coverage
- Mostly fine grain, small to medium plot sizes
- Well defined corners. Buildings are shaped by street geometry. Multiple landmark buildings on street corners.
- Unbroken street frontages
- Well utilised, small, public space
- Many active uses on ground floors
- High quality street furniture and surface finishes
- Limited soft landscaping.
- Traffic dominated, until road closures in 2018.[3]

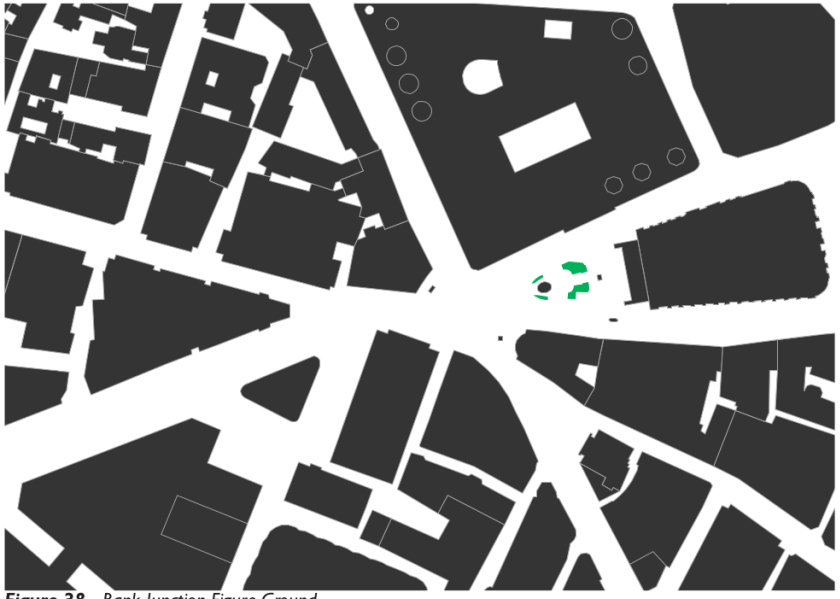


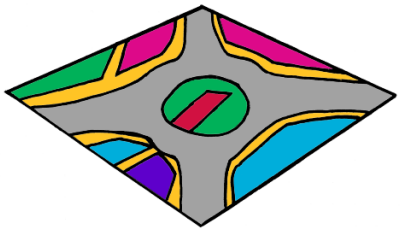
Figure 38 - *Bank Junction Figure Ground*

Figure 39 - *Bank Junction - Public Space*

3 https://news.cityoflondon.gov.uk/city-of-london-corporation-votes-to-make-safety-scheme-at-londons-bank-junction-permanent/

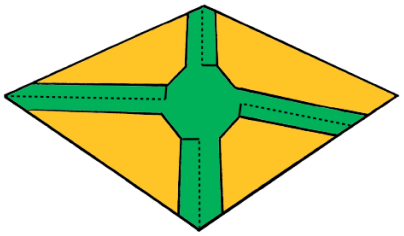
6. Design Toolkit

6.1 Introduction



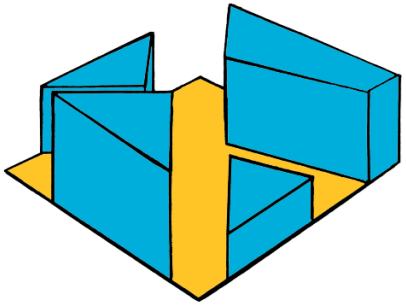
Site Analysis

- Analysis of historic street patterns
- Analysis of surrounding context & determination of Character Area
- Traffic Flows & Transport



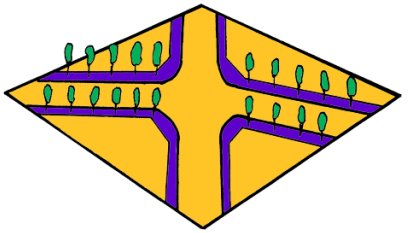
Junction Design

- Modal Balance
- Junction Typology
- Maximum and Minimum Dimensions



Building Typologies

- Context / Character Area dependent
- Density recommendations
- Height to junction size (enclosure)
- Uses
- Typologies



Street Characteristics

- Footway geometry
- Materials
- Street Furniture & Planting

6.2 Site Analysis

It is important to fully understand the character and function of the site and the surrounding context. However, this is not to suggest that the character should be rigidly conserved, this project is after all, about intensification and development. The designer must also consider what the site *could* be.

1. Analyse Historic & Current Mapping

Following the methods used in Section 3, analyse the existing and historical patterns and land use. This is both quantitative and qualitative. Simply overlaying maps, particularly figure grounds, can provide a good sense of the impact of highway interventions.

Figure 40 - *Overlay of current and historical maps*

2. Traffic Levels

Traffic data is useful to determine how busy the junction is. This can be used to compare the site with similarly busy junctions to establish how efficiently the junction is using carriageway space. For the UK, Annual Average Daily Traffic (AADT) figures are freely available.

3. Character Area Designation

To aid development of a site vision the following character designations are suggested:

The designer should make a careful assessment of the existing surrounding character and local context and building vernacular. It is possible to both intensify and respect the local context.

Designation	Characteristics
Neighbourhood Centre	• Small scale • Roads not typically wider that one lane in each direction • Small plot size and narrow frontages • Low to medium rise blocks, such as townhouses
Local Centre	• Medium scale • Roads up to 2 lanes wide, plus segregated cycle lanes • Small plot size and narrow frontages • Medium rise blocks. • One building should be a 'landmark'
Inner City Hub	• Medium to large scale • Roads up to 2 lanes wide, plus segregated cycle lanes. Multiple routes may be required to increase traffic capacity. • Allow for transit (bus / tram) • Medium sized plots. • Medium rise blocks. • At least one building should be a 'landmark'
City Gateway or Hub	• Large scale • Roads up to 2 lanes wide, plus segregated cycle lanes. Multiple routes may be required to increase traffic capacity. • Allow for transit (bus / tram) • Medium blocks • Medium rise blocks with some high rise on corners, hybrid blocks preferable. • Multiple buildings should be 'landmarks'

6.3 Junction Design

The detailed layout of the junction is highly specialised,and will require input from traffic modellers, engineers, safety experts, etc. However, the purpose of this study is to allow urban design to lead the process. Based on the research above a series of junction typologies are proposed.

Any junction design should respect the following hierarchy. This puts pedestrians first, then transport users, as these are the two biggest modes, based on London (Mayor of London, 2018).

Vehicle traffic is still important for the functioning of the city, but private car use is to be discouraged. Commercial vehicles are therefore placed above private cars in the hierarchy.

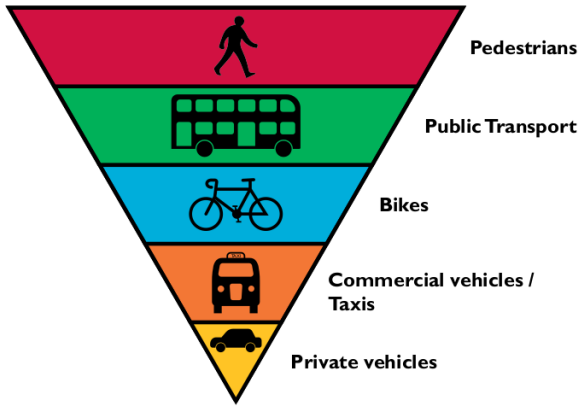
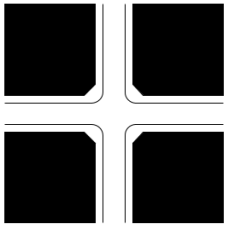
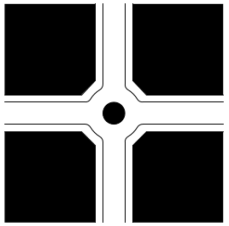


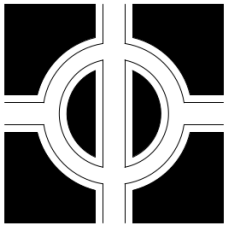
Figure 41 - *User hierarchy*



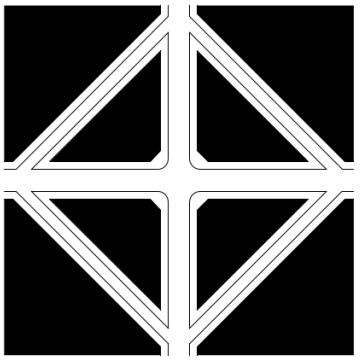
A: Simple Crossroads.



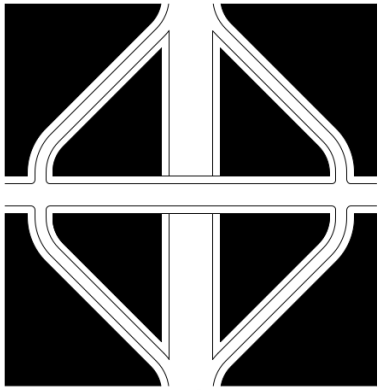
B: Small roundabout, low speed 'Continental' type (DfT, 2007)



C: 'Throughabout' - suitable for medium to large sites where there is a clear dominant through route



D: Crossroads with bypasses. Side roads offer bypass of busy junction. Could be time restricted to ease flow at busy times or restricted to certain modes (e.g buses and bikes).



E: Grade separated with slip roads built into urban fabric, after Eugene Henard. Careful consideration to ground floor of buildings is required.

Figure 42- *Junction Typologies*

6.4 Building Typology

Form

- Respect the street layout, especially if this gives rise to unique forms and typologies.
- Maximise plot coverage. Fill the space, then look to open up space around this.
- The private / semi public spaces serving the buildings should be away from the street

Scale

- Height of buildings should respect the street dimensions and create a sense of enclosure.
- Intensify - building scale should ramp up to junction.
- Buildings should serve as punctuation points, and exclamation, to define the junction as place.

Uses

- Mixed use is preferable, vertically and horizontally.
- Commercial on ground floor and first floors.
- Residential on upper floors, avoid residential on ground floors.
- Internal layout - avoid habitable rooms facing the street.

Frontages

- Active frontages, with growing intensity towards junction.
- Plot frontages should be short to encourage diversity of uses and businesses and create visual interest.
- The ground floors should be defined architecturally to differentiate them from the upper floors and add visual interest.

Figure 43 - *Respect the street layout*

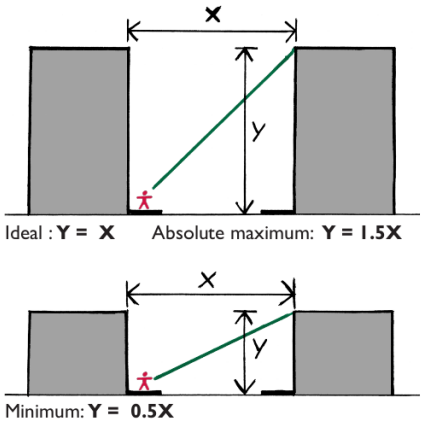


Figure 44 - *Enclosure*

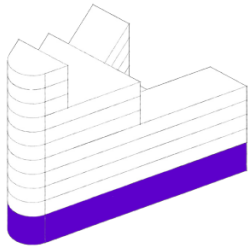


Figure 45 - *Build up to junction*

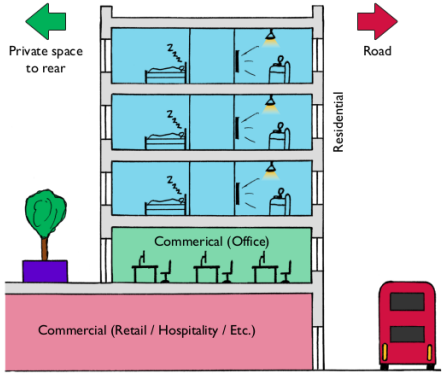


Figure 46 - *Typical Cross Section*

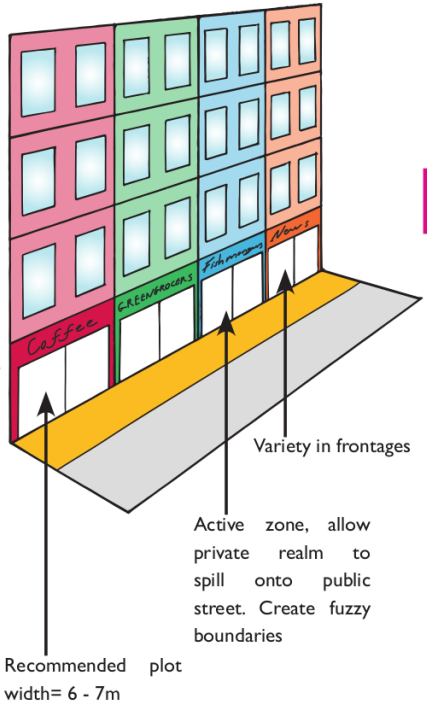
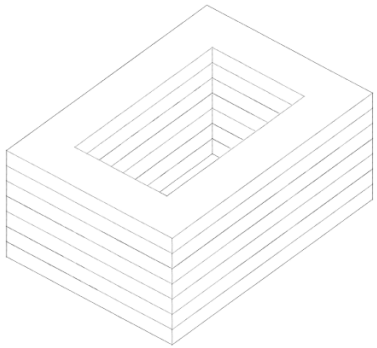
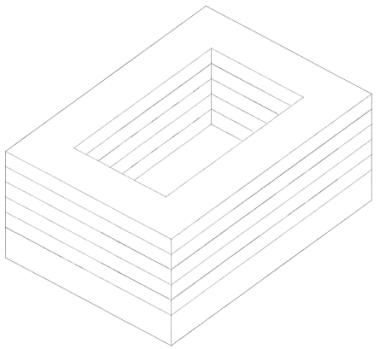


Figure 47 - *Frontages*

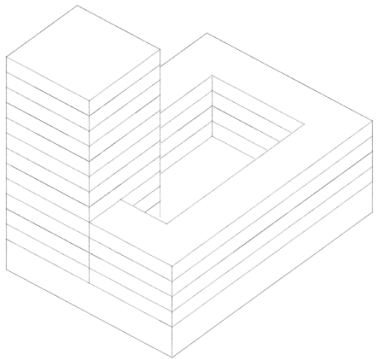
Block Typology



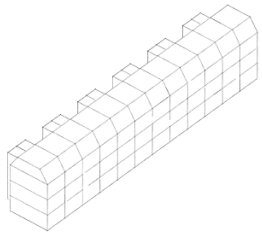
Perimeter Block



Perimeter Block with Podium



Hybrid Block with Podium



Townhouses

Figure 48 - *Building Typologies*

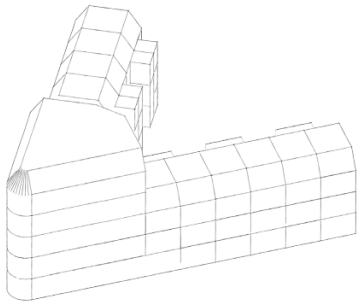


Figure 49 - *Mix and integrate the typologies*

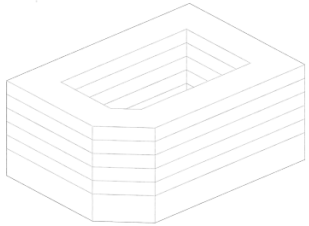


Figure 50 - *Ensure typology respects the corner*

6.5 Street Characteristics

Adapted from the London Streetscape Guidance (Transport for London, 2016)

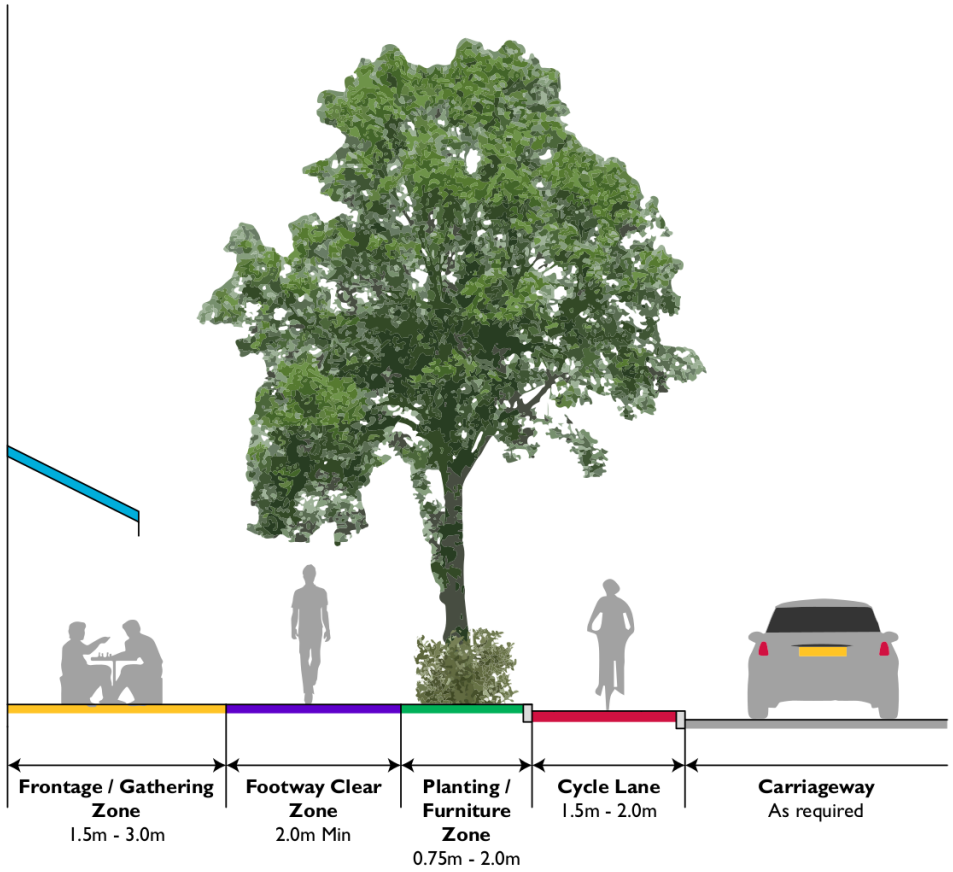
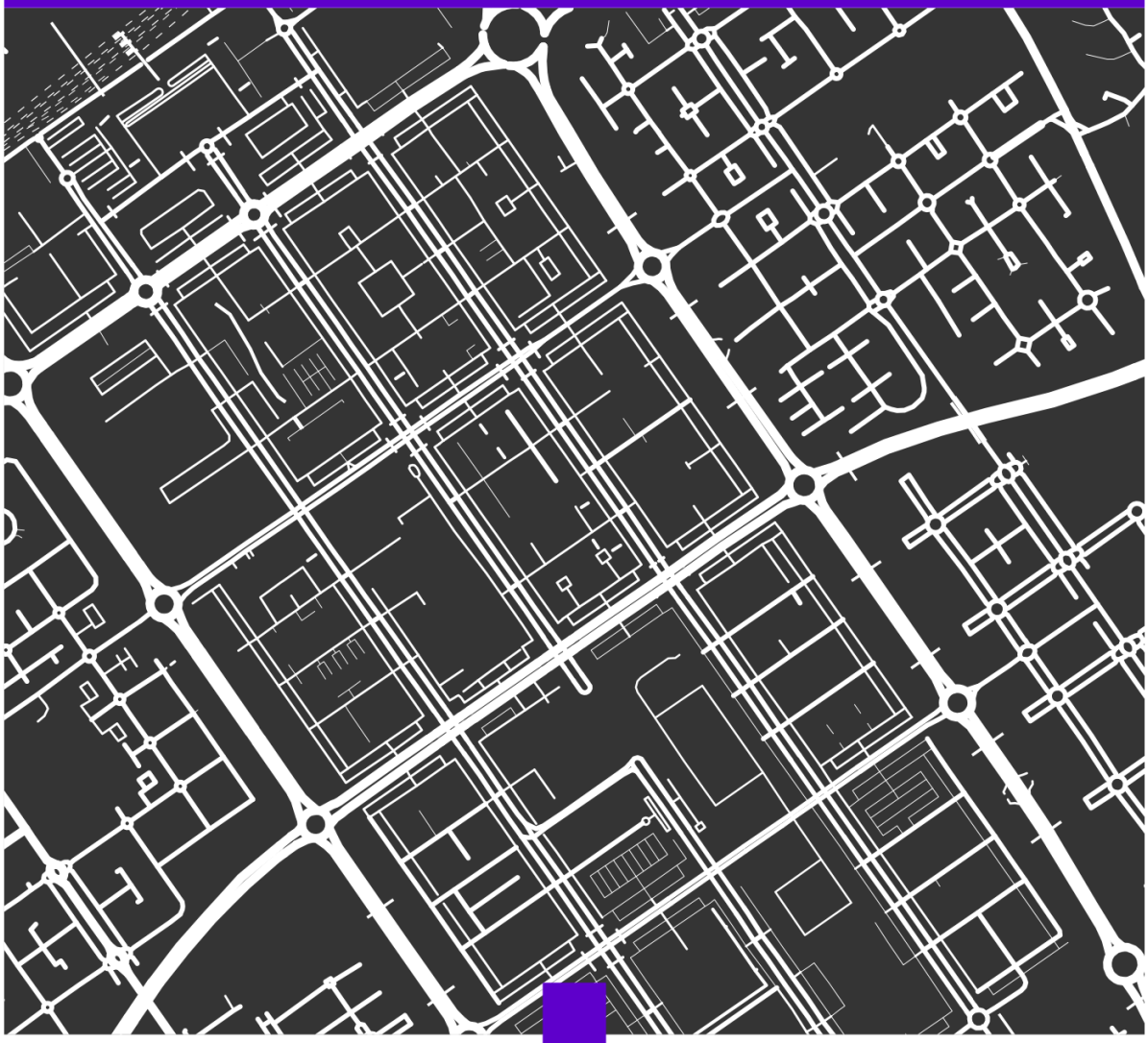


Figure 51 - *Street Cross Section*

7. Application to Site



7.1 Site selection

The proposed site should meet the following criteria:

- Located on major urban road
- Created by clearing a significant area and disrupting the urban fabric
- Large junction with open space
- Have proposals for re-modelling

Several junctions were investigated including:

1. Eastgate Roundabout, Gateshead, UK

54°57'55.3"N 1°36'07.0"W

Large, complicated roundabout labelled. Part of an unrealised urban motorway scheme.

2. Holland Park Interchange, London, UK

51°30'16.7"N 0°12'59.9"W

Large gyratory, 6 lanes wide, in west London next to Overground and Underground station. Originally part of 'West Cross Road' elevated motorway scheme.

3. New Bridge Street Roundabout, Newcastle, UK

54°58'30.5"N 1°36'23.6"W

Grade separated roundabout on urban motorway. Adjacent to Metro Station.

Figure 52 *- Eastgate*

Figure 53*- Holland Park*

Figure 54 - *New Bridge Street*

7.2 Chosen Site

While these sites present a good design challenge and opportunity, it was decided to take advantage of the detailed geospatial analysis undertaken in Section 5 and develop designs for Lea Bridge (Hackney) and Temple Gate (Bristol). This will allow a comprehensive assessment of the effectiveness of the design.

Both sites have been progressed to an outline design stage as a proof of concept. Temple Gate was chosen as the site to be taken forward for final detailed design.

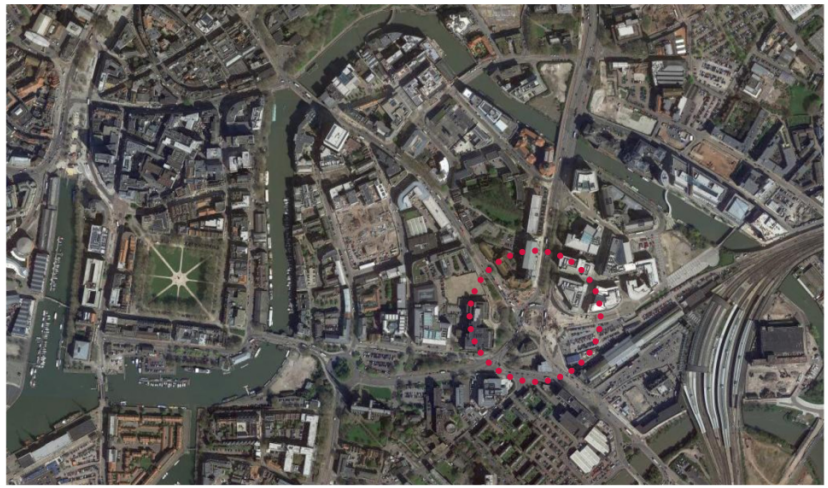
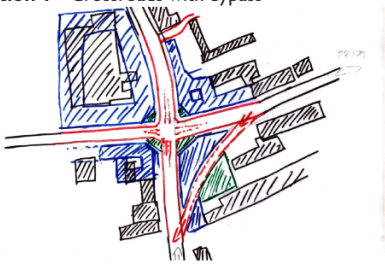


Figure 55 - *Location of Temple Gate, Bristol Aerial photo ©2020 Google CNES / Airbus, Infoterra Ltd & bluesky, ,Maxar Technologies, The Geoinformation Group*

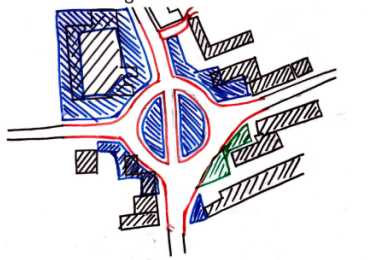
7.3 Test Site - Lea Bridge Roundabout

Sketch Proposals

Option 1 - Crossroads with bypass



Option 2 - 'Throughabout'. Main route N-S



Option 3 -Continental Roundabout

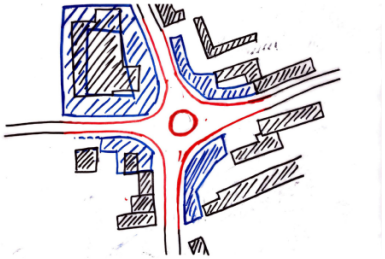


Figure 56 - *Initial Design Options*

Selected Option

Option 1 is taken forward to the next stage of design.

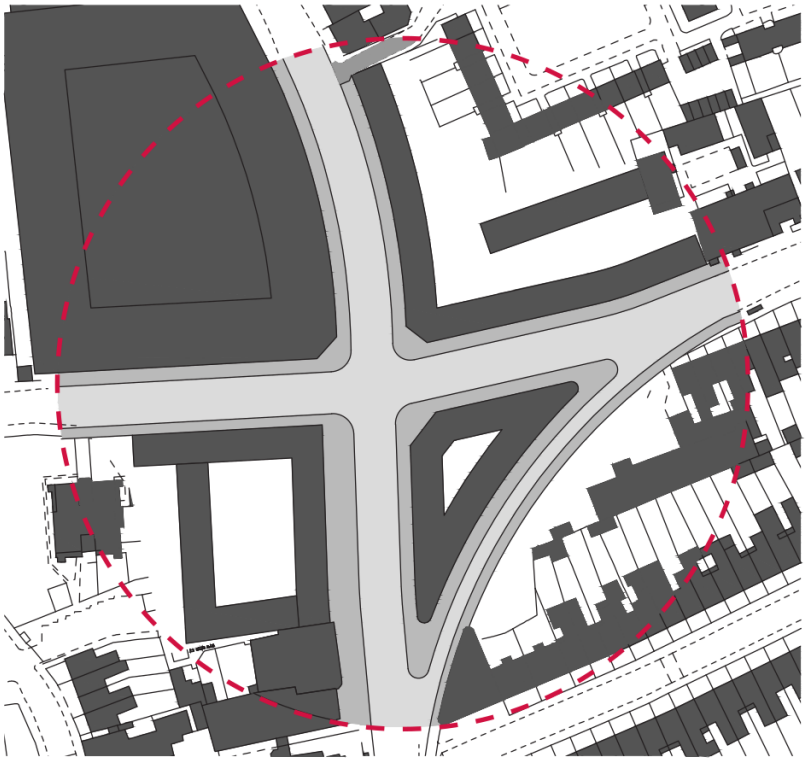


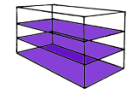
Figure 57 - *Lea Bridge Option 1*

The design incorporates a number of courtyard blocks, a podium block and town houses. The bypass will be for buses and cycles only.

Area Analysis

	Buildings	Private Space	Public Space	Carriageway
Existing	6192	7010	10418	6904
	20%	23%	34%	23%
Option 1	15077	6025	4087	5335
	49%	20%	13%	17%
Change	+8885	-985	-6331	-1569
	+15%	-4%	-26%	-6%

Assuming an average building height of 4 storeys there would be an increase in floor space of 35,540m² which is an increase of 188%.



Floor Space ▲ **188%**

Open Space ▼ **-26%**

Carriageway ▼ **-8%**

Based on a price per square meter of £8,564[4] this would result in an estimated residential property value of **+£304 Million.**

4 Office of National Statistics

7.4 Proposal Site - Temple Gate

The final site is Temple Gate, Bristol. This is discussed further in Section 4 above.

This site is located between the main train station for the city and the city centre. It connects two main roads and has a high degree of traffic.

In accordance with the toolkit the site should be classified as a Urban Gateway.

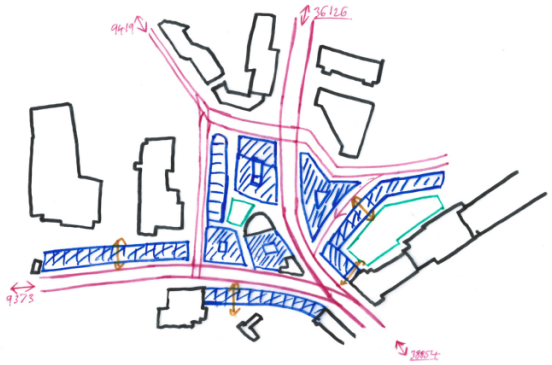
The local character is mixed, with some industrial buildings, a large station which is an important heritage asset, and large modern office buildings. The surrounding area, and Bristol itself, is characterised by low to mid rise Georgian terraced housing often painted in bright colours.

Figure 58 -*Typical Bristol streetscape*

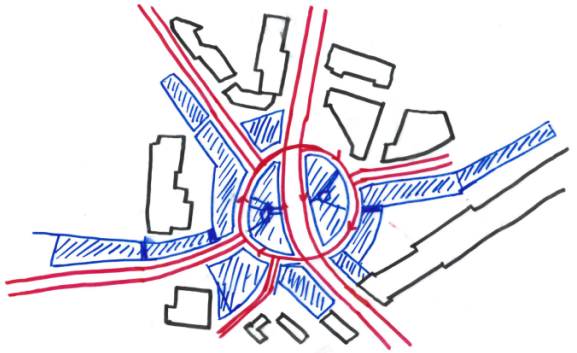
The site should have a mix of typologies, including town-houses, incorporate wide streets and landmark buildings in accordance with its designation as an urban gateway.

7.5 Initial Options

Option 1 - Multiple junctions



Option 2 - 'Throughabout' - respecting main N-S route.



Option 3 - Multiple junctions and central boulevard

Option 4 - Parisian style roundabout

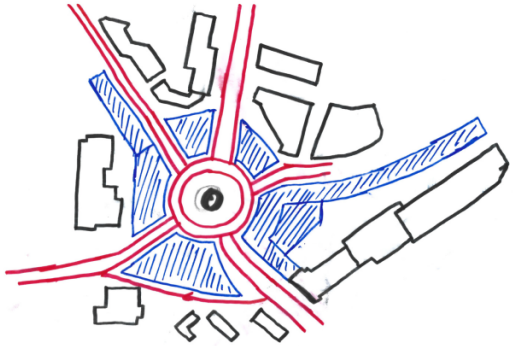


Figure 59 - *Initial Design Options*

7.6 Final Proposals

Option 1 has been developed to detailed design.

The key design aspects are listed below:

- High plot coverage
- Narrower streets, no more than 2 lanes in each direction where existing streets allow.
- Multiple north - south and east - west routes to allow distribution of traffic and resilience
- Cycle lanes throughout, and main junction is optimised for bikes and pedestrians.
- Street trees throughout.
- Mix of typologies, town houses, perimeter blocks and hybrid blocks.
- Public squares on main pedestrian routes and away from traffic with good enclosure.
- Buildings shaped by junction.
- Existing heritage buildings retained.

Figure 60 - *Proposed Design - General Arrangement*

Scale: 1:1000

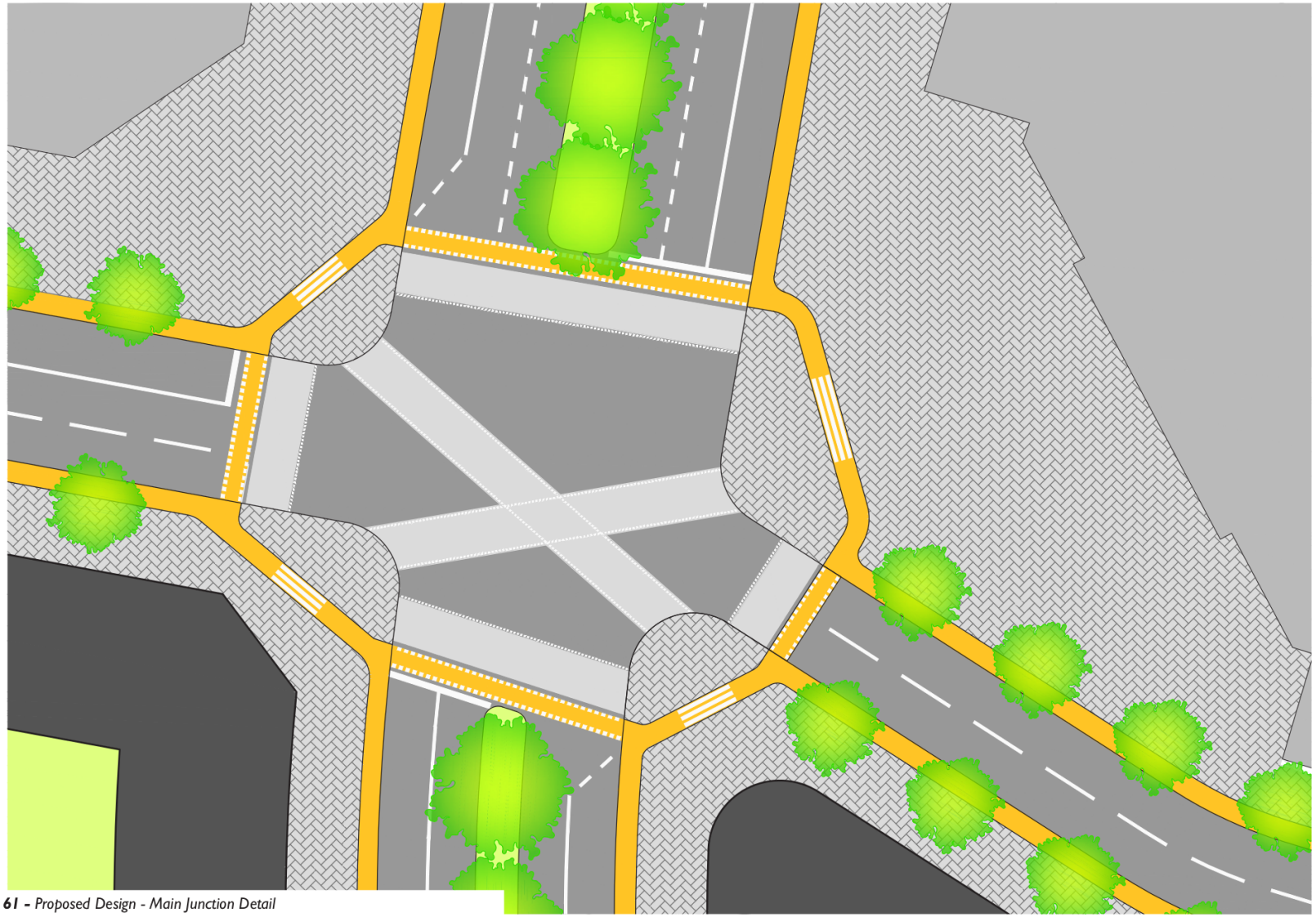


Figure 61 - *Proposed Design - Main Junction Detail*

Scale: 1:250

Figure 62- *Proposed Design - 3D View 1*

Looking east

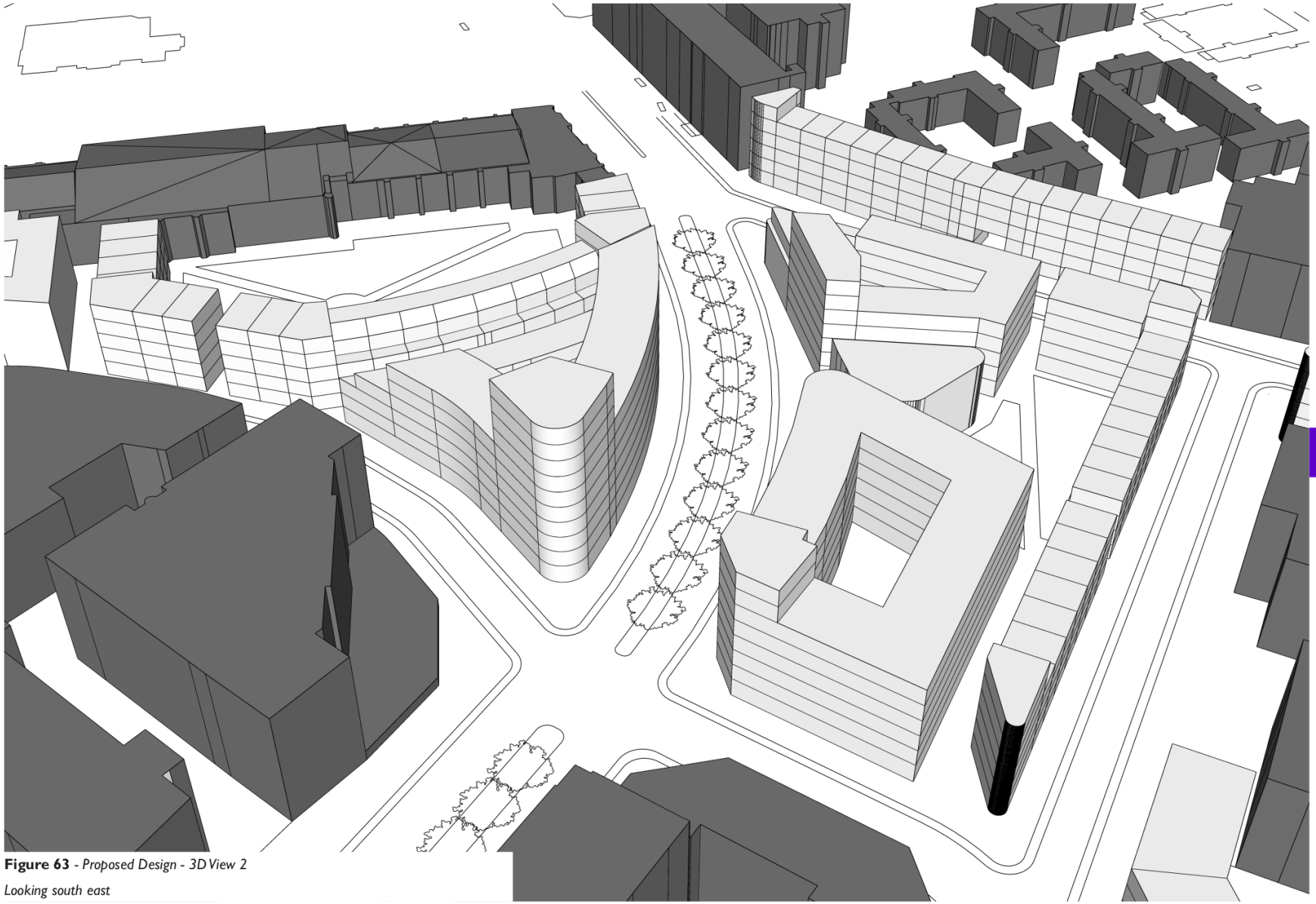


Figure 63 - *Proposed Design - 3D View 2*

Looking south east

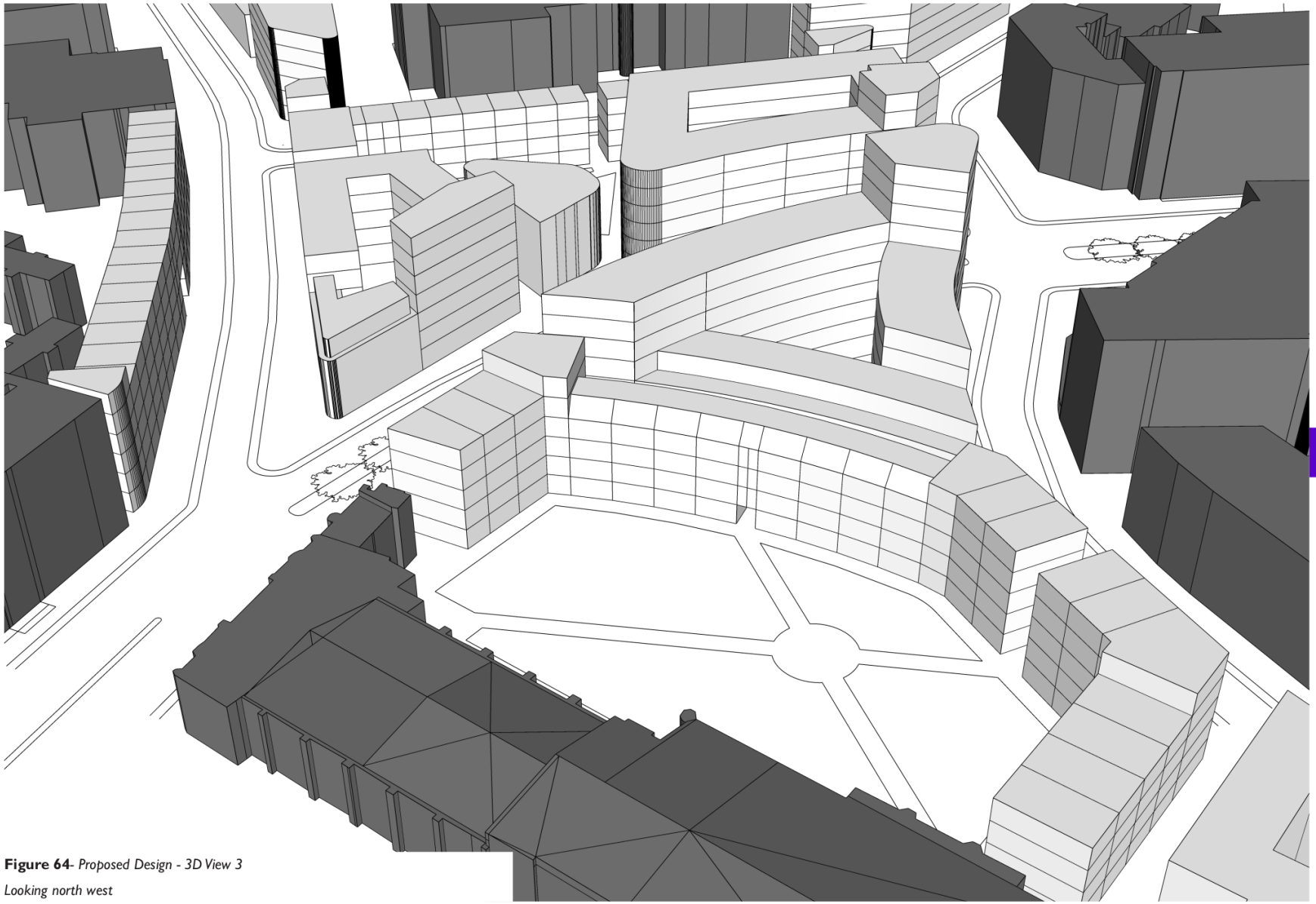


Figure 64- *Proposed Design - 3D View 3*

Looking north west

8. Conclusion

8.1 Conclusion

This research question set out to answer the question:

Can road junctions be transformed into successful places and become key nodes for urban intensification?

Through a comprehensive literature review and analysis of existing sites it was suggested that the answer to this was probably yes, but this is not a satisfactory conclusion. The only way to really test this hypothesis was through using design as a research tool.

The iterative design process allowed continual testing of theories and design principles and the subsequent revision and improvement of these, as well as identifying gaps in the available literature.

The other question asked was:

What can we learn from historic street patterns to achieve this?

The literature and case studies helped identify a set of principles that have been used to shape the design toolkit, such as street widths, frontage widths, enclosure, plot coverage and street connectivity. Some principles were established through analysis of the case studies alone, for example it was noted that large junctions in historical layouts tend not to have a simple main routes, it is more common for there to be multiple routes in each direction with interconnected side streets, almost like tributaries of a river. For example, see Elephant and Castle in Section 5.4. Most historical sites have buildings that are shaped by the street layout, giving rise to unusual and distinct building typologies and creating landmarks.

Further quantitative analysis of the historical and current sites has shown that the biggest loss when these junctions were constructed was the reduction in private space and buildings. The available public space was increased massively but the space devoted to carriageways was increased only slightly. This suggests that an increase in building footprint is important to improving these sites and that there is a potentially a significant opportunity for development. The example of Lea Bridge demonstrated that there is a potential economic gain to be made and that these sites are therefore very commercially viable.

It conclusion, and based on the reviewed literature and case studies and through the use of design as a research tool, it is possible to create great places on the site of large road junctions and historical street patterns can provide valuable design principles to help us achieve this.

8.2 Limitations and Further Research

Urban Design is by its nature multi scalar and multi disciplinary. This project offers a proof of concept, but further detailed analysis by other disciplines would be needed to progress it further, particularly transport modellers and highway engineers.

It is recommended that the next stage of research would be to develop the designs to a more detailed stage with assistance from these disciplines.

There is a clear gap in the design guidance research and literature in regard to junctions, so the output of any further research could be a comprehensive design guide.

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