Abstract
Rising fuel costs, energy consumption and environmental concerns are directly linked to the built environment and transportation habits. This paper will outline a number of methods, which will examine how these issues can be contained.

Several concepts have been introduced to give city-planners and architects instruments and guidelines of how to address these issues. The Compact city and Walkability are both concepts that introduce counter modernistic guidelines of how the urban environment should be formed. This paper will test how these concepts can be taken down from the abstract level, interpreted and implemented within a case study.

The case study chosen is Belfast Central station because it is situated within a context, which is not coherent with The Compact city and Walkability principle. Where the city of Belfast being one of the most car dependant cities in Europe and the Central station being situated within an area which is undeveloped despite close proximity to the citycentre.

The purpose is to therefore examine the concept of The Compact city and Walkability, their guidelines and abstract recommendations for how a new development should be conducted. First The Compact city has been analysed and discussed with comparison to other researchers with the aim to extract reliable theoretical guidelines. Walkability as an idea is also analysed to explore what urban design guidelines are related to Walkability. These broader guidelines are taken into consideration when the site-analysis is conducted.

Secondly Walkability is further analysed to extract physical elements down to a detailed level of measurements. Which is summarised in the Walkability guide for urban design as it’s function is to serve practical implementation of Walkability in new developments.

To be able to implement the idea of Walkability and The Compact city a current status analysis has been conducted to examine factors, which are important for Walkability, and The Compact city derived from the guideline analysis of the concepts. First a superficial Lynch analysis was conducted to identify important paths, nodes and the area integration within the city centre. This analysis resulted in a view on which buildings and paths are of importance and need to be analysed further.

Transportation networks and building layouts are critical to the concepts of Walkability and The Compact city, pedestrian, bicycle paths and public transport are therefore investigated. The findings were failing within the Walkability and The Compact city guidelines. For example there were severe connectivity issues within the pedestrian and bicycle networks, especially impenetrable boundaries that limited connections to and from the river of Lagan, City centre and The Central station.

I wanted to further test the above-mentioned findings by conducting an observation of movement and compare it to two interviews with key persons within the community. The observation showed that there was less usage of the North-South path, in particular the connection between East Bridge Street and the river of Lagan. The interviews confirmed that the path continuance for pedestrians was limited which further strengthened the observation study. The site analysis is therefore used to point out where and what issues will need to be corrected.

With the analysis and guideline model finished for both concepts a further implementation of them is the last step in this paper. The abstract level of guidelines from the theory chapter is implemented to solve the issues that were found in the site analysis, especially integration issues and pedestrian path networks. The development of the site is set through The Compact city and Walkability principle, with high density, enclosure, path contingency, path context and integration with the surrounding cityscape.

Since East Bridge Street was identified of significant importance for movement within the Lynch analysis, the observation survey and interviews, therefore a more detailed implementation of Walkability indicators was performed. Using the Walkability guide for urban design and implementing the extracted measurements provided. This is revealed on several renderings and sections to scale. The questions of how the concepts can be implemented can therefore be considered answered.
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1.1 Background

The concept of The Compact city is something that has been debated as being one of the solutions for the increased urban sprawl and car dependent modern western cities. (Burton et al. 2004)

Transportation is one of the main issues within modern urban areas especially with the considerable amount of energy it needs and space it requires within a city. The European union and particular european cities have enforced policies to make cities more compact by promoting the use of central located land for development. But also promoting collective transportation, bicycling and pedestrians (Burton et al. 2004).

In particular the United Kingdom has through the Planning policy statement 3 introduced polices regarding density and development of either new or older housing stock. Where for example, a minimum of 60% of new development should be located in previously developed land so called brownfield land. But also to increase development where infrastructure is already existing in particular public transportation. (Government 2011, pp.13-15).

As existing infrastructure and buildings have a long life-cycle it is stated that small-scale change may have a larger impact on adopting a change in transportation habits within a population rather than a large scale change of a whole city. Therefore the central station in Belfast and its surrounding area is interesting to use as an experimentation area because it possesses

A. Brownfield sites
B. Close proximity to the city centre
C. Existing infrastructure, collective as in two bus lines and the central hub for rail transport in northern ireland(Marketing 2006; Department 2012)
D. close proximity to employment

Even if it is stated that close proximity to services may not have an impact on the amount of trips with cars. One can ask how a new development in the area of the central station in Belfast could develop to achieve the ideas of The Compact city.

Since Belfast central station is described as a site of development where the planning agency has stated that it wants to expand the city centre to riverside of Lagan.
1.2 Baseline
This project will examine the concepts of The Compact city and Walkability and how they can be implemented. Within this study I have decided to use Belfast central station as the main subject for this research.
This project will examine if and what urban design elements will make people choose to walk and use public transportation as modes of transportation.
The project will first examine what the concepts are and their guidelines and later be implemented in a case study of Belfast central in Belfast, Northern Ireland.

1.3 Problems and possibilities
Belfast is a divided city with two communities, Catholics/Nationalists, Protestants/Unionists and the city centre is viewed by both communities as a rare neutral area. (Ellis & McKay 2000) The city centre is therefore not even just important as a commercial and economic node but also for the ability of creating space which will help with the integration process. (Ellis & McKay 2000)

Belfast citycentre is located west of the river of Lagan. Belfast citycentre was heavily affected by the civil unrest during the 1970-80s. The unrest resulted in under investment and physical deterioration of the urban structure in the citycentre. (Ellis & McKay 2000) The citycentre was in need of new investment after the peaceprocess of the early 90s. Laganside quarter was a joint project between private investors and the city council of Belfast. The project made the city- centre expand to the Laganside and was the start of the new era which is described in the Belfast Masterplan 2015.
Belfast metropolitan council uses the Belfast Metropolitan area plan to regulate future development within Belfast and Belfast city centre. Within this plan it is stated that pedestrians and bicycles should be promoted and transportation nodes should be enforced as strategical points of development to promote collective transportation.

So far has the Laganside development not been inter grated with public transport. Further it is questionable why Belfast central station area which is a part of the riverside has not yet been developed. (Ellis & McKay 2000).

Belfast is today one of Europe's most car dependant cities. (Ellis & McKay 2000) The city has been sprawling with a lower density in the citycentre as a result since the 1950s. (Ellis & McKay 2000)
This is a common situation in cities throughout Europe and north America where an increase in car dependance results in higher energy consumption and urban fragmentation.

The Compact city is centred around how to address traffic problems which is believed to been caused by modernistic-planning. Car dependence higher energy consumption, social separation and urban fragmentation is some of the main issues. But it is contested weather a compact city will address all of these issues, for example: Pollution is stated as a main problem, but what kind of pollution are we talking about? Sound pollution may actually increase with a higher density in cities due to fewer services and dwellings within less space. Other statements within the concept is that a higher level of local services will lower car usage. But again is it the quantity of trips or length? There is no proof that an increased amount of local services would decrease the amount of journeys by car, but a proven affect has been shown on the distance travelled. (Burton et al. 2004)
Can a city function with a lower level of car ownership? and what spatial physical entities needs to be rethought specially considering promotion of pedestrians, cyclist and collective transportation. There are clear contradictions within this concept and also how and what exactly needs to be done to reach sustainable transportation. Is it really possible to integrate a new development built after the concept of The Compact city and attach it to a car dependant city without losing the benefits?

Density is very important within this concept but what kind of density? Kevin Lynch and other researchers talk about the importance of continuity of the urban landscape for people to navigate through the city. What continuity means is contested in this context but much points towards denser placed buildings which clearly shows boundaries and constraints. An example of this is the classical chessboard city layout where the building facades are direct adjacent to urban paths. A denser urban environment is also said to contribute to a higher customer base for local services. Thus contributing to less transportation needs and encourage social interaction by providing third party environments such as cafés and bars, for unpredicted interaction. A denser urban environment with reduced or none private vehicular transport is stated to reduce environmental impacts. Also people might feel a more security through the
eyes of others. With more people using the streets as pedestrians and cyclists. (Burton et al. 2004)

1.4 Planning conditions
Belfast is one of United Kingdom’s major urban areas and the capital of Northern Ireland. Belfast city has continued to decrease in population since the top of around 400,000 in the 1950s to a turning point in 2006 with around 260,000 inhabitants. (council 2006) After that the population has been rising to 281,000 (2012) (National statistics:2012tb). Thus, the city centre has been decreasing in population particularly because of crime and social unrest. Dereliction is also a major issue in Belfast city where occupancy rate is falling but housing stock increasing, leaving old buildings abandoned. (council 2006). The city centre is also largely abandoned outside of office hours and is almost entirely comprised of office and commercial building apart from some minor residential units. (council 2006).

Therefore the city has proposed to direct new development for residential units to the city centre area and one of those identified sites is Belfast central station (council 2004; council 2006).

But since Belfast has recently had an increase in population and implemented a new policy to use 60% Brownfield land for new development makes the city centre and Belfast central station area especially interesting (Ellis & McKay 2000). Belfast city council has stated that it is essential to get new residential units in the city centre to keep it alive after office hours. Belfast is one of Europe’s most car dependant cities therefore it is essential to emphasise other modes of transportation such as pedestrians, cycling, and public transport.

The Central station in Belfast has a location approximately 1.1 km from the Belfast City hall which is perceived to be the absolute centre of Belfast. The station is perceived as peripheral to the city centre and one of the main buildings on the site is the Mays leisure centre is closed and derelict. Though some new residential development and a boardwalk has been constructed close to the river of Lagan and south of east bridge street.

Belfast city council and the planning department has specifically stated that the connection to the river of Lagan should be a priority and particularly addressed when new development is conducted. The location of the site and key buildings can be viewed on the next page.

1.5 Purpose
The purpose of this paper is to explore the concept of The Compact city and Walkability and how it can be implemented in a new development within the area of Belfast central station. To promote accessibility to the river of Lagan and the city centre for pedestrians mainly but also cyclists.
Belfast citycentre with key buildings and locations

Legend
- Laganside development area
- Belfast Central station site
- East Belfast
- South Belfast
- Western Belfast
- North Belfast
1.6 Question

How can the ideas of The Compact city be implemented on Belfast central station area in a future development?

What physical elements in urban environments makes walking more attractive as a mode of transportation?

How Can Walkability be implemented within a new development of Belfast Central area?

1.7 Delimitation

In this study the physical environment will be examined foremost in terms of transportation. The physical environment includes characteristics of facades, building materials, layout of building volumes, public space, green space and urban fabric. Transportation will include layout of streets, walking paths, cycling paths, parking (bicycle and car) and public transportation.

Belfast central station area will be of main focus but also surrounding adjacent areas. Belfast and Ireland as a whole will be explored to view the full extent of existing public transport and cycling network to and from Belfast central station area. Belfast central station spatial analysis will be focused on the Belfast central station area, as shown on the map on page 8. The project will focus on implementing the concept of The Compact city on the area of which Belfast central station is located. It will especially identify physical properties in the built environment which improves Walkability and imageability, and then implementing these ideas in a theory based development project.

1.8 Method and material

I will here explain why and discuss the use of methods and material within the continued work. This is a case study where I will try to examine how the concept of The Compact city can be implemented locally in a typical environment in Belfast city centre which is partly derelict and fractured since industry left, leaving unused building adjscent to gapsites and demolished sites. Since this type of areas is quite common with plenty of brown-field sites in close proximity or within the city centre it could be replicated in other areas. A case study like this is also viable especially when a certain question is to be studied and tested(Denscombe 2009).

1.8.1 Interviews

For a case-study like this, peoples opinions and thoughts are essential to underpin a proposition for the area. It is essential to understand how people perceive distance by walking and bicycling to Belfast central but also its connection to surrounding areas and the river of Lagan. Therefore I have chosen to use two different key persons within the community, an academic and one within the planning department. Key persons with an official title within the community is especially valued due to the quality of the information they possesses. Key personalities within the community is especially valuable because they can give information with a high level of credibility. (Denscombe 2009, p.267) Interviews is a good choice especially when feelings, thoughts and experience of a area is to be addressed. (Denscombe 2009, p.233) Within my work I have chosen semi-constructed interviews, this with pre-made questions. Semi-constructed interviews gives the responder a chance to continue his/her own reasoning to the full. The questions are not asked in any particular order rather to let the interviewed person to develop his/her own ideas (Denscombe 2009, pp.234-235).

A personal interview is often chosen because of its ease to make a point go through to the interviewed.

The interviewer effect is an aspect which needs to be observed as it can have an effect on the information given. It is described to be our personal ethnic, sex, and heritage features. This can for example give the respondent/recipient a chance to either be reluctant to give answers or fit answers according to what he/she perceives is to be expected (Denscombe 2009, p.245).

There has been one personal face-to-face interview, one by E-mail and one by telephone. The E-mail one had a pre-made question (cHEET) which was answered by the recipient and sent back. The personal and by telephone has been recorded and printed. Both of these interviews have been recorded and printed.

One can control the interview data by comparing solid based questions with simple answers with empirical data. Some of the questions asked has support in empirical data but others that are more related to perception and feelings are harder to validate, this will be discussed later in this work (Denscombe 2009, p. 265)
1.8.2 Observations
I have conducted observations within this project to gather a greater knowledge about how pedestrians move in the area. Observation is a method which gives very little clue of actual intentions and thoughts but more over how they actually traverse the area. The method itself can be deceptive because of the personal flaws of the observer since it is based upon optical perception. Optical perception can be different between people and can be affected by a number of personal flaws and characteristics. This can be our psyche and previous perceptions and experience. Therefore one should not simplify results and generalise it too much. (Denscombe 2009, pp.271-273). This method has the advantage of being within the observed peoples natural habitat. Another point could be the observer affect where the observed people may act differently if they notice the observer. To limit this I have conducted the observations with help of an observation schedule, limiting the amount of time placing myself in a less noticeable position during observations to avoid detection and secure a better result. This is because the longer the observation is conducted the more obvious the observer becomes to his/her surroundings (Denscombe 2009, p.280). Therefore I chose to conduct the observations 30 minutes at a time, at two different locations within the area, at three different times. The time span between observations should be as great as possible that is why I decided to conduct an observation one on the (9/4) and one on the (17/5).

The purpose of the observation is to examine how pedestrians in particular but also cyclists behave in terms of what paths are mainly used. This is because I want to gain knowledge about existing movement to and from key points such as the central station and the river of Lagan so I will be able to access the amount of Walkability in the area and how it may be improved. Since this is a theory based project it is essential to know existing pedestrian patterns in the area (Burton et al. 2004; Southworth 2005).

1.8.3 Site analysis
I have conducted a series of site surveillance to develop a base upon how a future development could be conducted. These are mainly focused on the transportation situation within and adjacent to the site. Particular for pedestrians, cyclists and public transport but also existing building stock. This is because The Compact city, imageability and Walkability is dependant on certain factors such as quality, continuance of the spatial situation.
The survey has been derived from walks within and adjacent to the area of the site. But also through studying maps and external material retrieved from Queens university of Belfast.

1.8.4 Documentation and written data
The data documentations which has been used in my work is a combination of research, governmental, and cooperation articles but also some websites and strictly scientific material. Websites such as BBC News and cooperation articles are used in less serious information regarding historical facts, but also their part in certain aspects of development, in particular Laganside Corp (Denscombe 2009, p.303). Academic articles published either through universities or academic journals are controlled and has a high level of demands set up from the beginning and are controlled before they are published. Older scientific journals are considered more reliable as a source then new ones.(Denscombe 2009, pp.302-303) To validate a resource reliability is by examining why and for what purpose it was written, when it was published and is the material still up to date?

Within the project I have used material to understand what practical entities makes a compact city. For this I have used for example The Compact city published by well renowned and respected Rutledge. Further used The Image of the city by Kevin Lynch which is also a highly recognised book within the architecture/planning profession, in particular the Lynch analysis. The life and death of american cities is another well known book which I have used to understand the history of The Compact city idea.
I have also extensively used planning and architectural articles because they are considered highly reliable for a theory based project like this.
The theory in this work is not to be considered as facts but as foundations in how to address certain spatial problems.
## 2. Theory

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2.1 Definitions

2.1.1 Legibility
Kevin Lynch forwards the Term legibility as of particular importance where he defines it as the ability for citizens to orient themselves within a city. He would set the opposite as being lost and disorientated within the urban fabric of the city.

“The need to recognize and pattern our surroundings is so crucial, and has such long roots in the past, that this image has wide practical and emotional importance to the individual” (Lynch 1960, p.3).

He continues to state that an environment that is visibly easy to perceive and understand will be not only more secure but heighten the human experience of it. Even if it is argued that the human mind is adaptable and learn how to orientate itself it might be at the cost of increased effort. (Lynch 1960)

The Lynch analysis is about legibility as described above, therefore Kevin Lynch has categorised the elements of a city through the concept of legibility. He states that there are other influences such as emotional, function and history that could affect the legibility. (Lynch 1960, p.10)

2.1.2 Walkability
See 2.5 Walkability, (page 13)

2.1.3 Walking conductive
Physical spatial elements which lengthens walking distance and makes more people choose walking as first mode of transportation. (Park 2008) pp73

2.2 The Compact City
The Compact city is a wide concept which uses urban form to address transportation and public space issues in modern western cities. (Burton et al. 2004, p.4)

The concept of The Compact city is about creating a more sustainable urban form. By:

- Planning for mixed use development
- Limiting transportation needs by
- Making the city more compact thus reducing distance between buildings and their uses.
- Remaining transportation needs are to be addressed through an increase in public transportation and bicycling and walking.
- To improve urban form to accommodate walking and bicycling as prioritised modes of transportation.
- Encourage social interaction through a certain degree of compactness (Burton et al. 2004)

The Compact city is about using urban form to achieve a more sustainable society because it is perceived to be a strong linkage between urban form and sustainable development. (Burton et al. 2004)

Sustainable development is by itself a broad term which does not have any certain boundaries. But I will try to explain what it means in relation to the concept of The Compact city.

Sustainable development as a definition was formulated in the United Nations Brundtland report. This report describes Economic, Social and Environmental aspects which has to be considered to achieve a sustainable society as stated to the right.

Further sustainable development in relation to The Compact city is described in the same dividend between economical, environmental and social aspects.

Social
Rest on the assumption that compact cities have a greater potential to greater social interaction, community spirit and cultural vitality. This is said to be the result of close proximity to services such as work, shops, public transportation. But also the opportunity of walking and cycling which is something that compact cities provide. Compact cities are also said to reduce crime and social segregation. (Hofstad 2012).

Environmental
Mixed land use, and densification is said to enable sustainable mobility such as public transportation, walking and cycling. Which reduces the dependance on car travel and emissions. But also a more compact form enables more efficient use of existing infrastructure and energy use. (Hofstad 2012)

Economic
The concept expects a revitalisation of city centres where because the economy is dependent on operation commercial property and housing markets but also its transport infrastructure income and age distribution of citizens in the city. (Hofstad 2012)
To reach sustainable development accordingly to Hofstad the above mentioned categories should be archived. (Hofstad 2012)

2.3 Motivation and debate of the compact city

As mentioned earlier the Brundtland report put sustainable living on the map. But even before that North American and European cities developed in a way that was increasing energy consumption and transportation needs. But also divided the city through transportation infrastructure or just single use development. Where much discussion is about whether traditional single use zoning equals a social, economical and environmental attractive city. When attractive is used here it means the amount of will a human being will have to live or use an area.(Jacobs 1961)

Inefficient use of resources is also one of the main topics. This is due to the fact of single use development, an increase in urban sprawl and therefore induces the need for new infrastructure, further increasing resource consumption. It was a questioning of the ideals of the Garden city where in short urban density should be lowered to address health and environmental issues. (Jacobs 1961).

Other authors have pointed towards climate change and higher fuel costs as one of the reasons which one must adapt to another form of urban planning.(Hofstad 2012) Which is centred around transportation integrated planning for a vision of a city as an integrated whole rather than meeting current demands. This is described in the chart on next page

A higher urban density is not always linked to a increase of walking this is because it depends on the environment as well.(Ståhle 2008)

There are environmental causes such as greenhouse gas emissions and the fear of global warming. But also local environmental issues which today's congested city traffic contributes to. Not to say the least car dependence is one of the main contributors to this. Health concerns are another factor where daily exercise has declined and there is a correlation between health and car dependence. Even the emissions, which are created by traffic, have a negative effect on both the possibility to cycling and walking. Traffic safety is another issue that can affect the choice of cycling and walking. (Hofstad n.d.)

Even if it is widely discussed within the academic society whether the Compact city will contribute to sustainable development there is no doubt on whether the issues should be addressed or not. (Ståhle 2008)

The European Union and a number of European cities have tried to implement the concept of The Compact city (Hofstad n.d.). There is some contradictions within the concept itself since for example a higher density will put greater pressure on existing infrastructure and other utilities. This will for example regarding improved local environment, increase sound pollution. (Burton et al. 2004)

Another aspect is the discussion of whether a compact city will reduce bio-diversity or not. Scientists argue that urban regions facilitate a large amount of bio-diversity especially in suburban low dense areas. Bio diversity is on the decline in urban regions but it is not the amount of space that seems to have an affect on it. Rather it is the connections, or network of green space that determine its richness. It is possible to build dense without losing green connections and path continuity.(Ståhle 2008)

Green space also brings cooling and environmental benefits such as reduction in pollution and heat islands. Also hard surfaces have other environmental effects such as flooding, reduction in groundwater, etc. Therefore it is argued that hard surfaces should be reduced and might be possible, following the principals of The Compact city. (Ståhle 2008)

2.4 Pros and cons with The Compact city

2.4.1 Pros

Reduces transportation needs by improving other modes of transportation. (Burton et al. 2004)

Reduce pollution connected to car dependence and transportation in general at least on a local scale. But also through utilising existing technical infrastructure in such a way as for example heating and cooling of buildings can be done much more efficiently(Ibid. 2004)

Reduced energy consumption through more effective heating of buildings. This will be
achieved through a denser building structure. (Ibid. 2004).

Higher social interaction due to less vehicle traffic and better interlinkages between
neighbourhoods. With less traffic, streets will have more space for social interaction. (Ibid. 2004)

Increased base of customers for local service, commercial and cultural developments. (Ibid. 2004)

Increase in quality in public transport due to an increase in demand (Ibid. 2004)

Security will increase both in traffic due to less vehicular movement at slower speeds. Bu also security in terms of crime due to the increase in people who uses public spaces. Therefore people will be more secure through the eyes of others.

Increased local environmental benefits such as lower emissions from reduction of traffic. Better environment to be a pedestrian.

Better health among the citizens due to connections between car usage and amount of daily exercise conducted through walking and/or bicycling. There is no contest whether daily exercise has a positive effect on human health. Health will also improve due to less emissions and related diseases such as diabetes, obesity, lung cancer etc. Particle pollution is also one of the most potent health risks in cities today, which is mainly caused by traffic in western cities. (Ibid. 2004)

A social mixture will accrue due to that spontaneous meetings will increase. But also integration of meeting between social and ethnic groups when mix-use and different types of tenures.

Virgin land development might decrease or even stop when a denser development is promoted. When development is allocated in brownfield areas or densification of already developed land.

Reviving derelict buildings and neighbourhoods often in city centres. Through vitalisation of old building-stock but also concentrating development to brownfield sites.

2.4.2 Cons

There is no secure connection between that the quantity of car trips would decrees if local services would increase. The only secure about this is that the length of trips decreases with an increase in local services. Hens that it is discussed other things such as the urban design will have a larger effect in the quantity of car trips(Burton et al. 2004).

denser city will bring a greater stress to already built infrastructure in dense urban environments. Therefore it is contested weather a dense urban environment really will result in a decreased amount of traffic, pollution, sound- pollution and so forth, for example the amount of sound pollution even if they are of different (kinds). One can imagine a city full of people in the streets (Burton et al. 2004).
It is not secure whether a compact city will affect the mode of transportation. Freedom of choice tends to favour the car. But many researchers point towards “sticks and carrots”. To give choice of transportation but also limit the usage in some way. For example congestion tolls. (Ellis & McKay 2000)

Urban sprawl generates car usage and increase the dependence on it. Scientist and the community do not contest this. But the scientific community has hardly agreed on the fact that a compact city would address the problems with urban sprawl. (Ståhle 2008)

Green-spaces outside city centres is said to be saved through implementation of The Compact city. But it is much more insecure how green space in city centres are effected. A denser urban environment could lead to greater disturbance between neighbours especially mix-used variations with commercial tenures close to private housing which are one of the main features of the concept.

This could also lead to less green space and with depression of biodiversity as a result.

It could decrease the amount of life quality in cities due to an increase in congestion and traffic. But also through less green and public space for recreation. As green space is said to have a positive affect on wellbeing health issues could follow at-least especially for middle-class and working class citizens (Frey 2004).

Telecommunication has lead to an increase in mobility and ability to carry out work in non fixed places. This contradicts the very foundation of the theory since it directs the cause of problems towards traffic. Therefore if traffic will not be an issue as before, especially since congestion happens mainly during rush-hour when people are travelling to work. (Frey 2004)

2.4.3 Discussion

Even if it is contested whether The Compact city can or cannot address the increasing problems in our cities, one thing is clear, something needs to be done, when the worlds population will live in urban areas in the future (Hofstad n.d.). Especially European cities where the European union implements this strategy with a variety of results. (Hofstad 2012). The problems cities are facing are an increase in pollution, traffic and decline in greens/public space and biodiversity. To understand whether the concept of The Compact city addresses these issues or not one must look at examples to review.

City centre revitalisation and a shift towards a higher use of brownfield sites in the United Kingdom. It has shown to lower the amount of pristine land going to development. But also revitalisation of city-centres and some mixed use development within these. But motives behind these are not always intended to think of environmental, economical and social terms. Often it is centred around commercial incentives and a larger grip on the subject is lost. For example development of central shopping centres in city centres such as Belfast. Victoria square is one of these, which has a high level of commercial development but also some offices and residential developments. The place where it was developed was derelict with multiple buildings adjacent and damaged after the Belfast troubles. Victoria square development demolished every single old building and does not pose any direct public transport linkage other than a Parking facility. This could be an example when economic incentives gets the upper-hand even when Belfast city council want to regenerate the city centre (council 2006; council 2004; Burton et al. 2004). There must be a clear vision for what a city should expect out of a development and implement all three aspects.

There seems also to be a lack of integration between transport planning and development. It becomes much harder to implement transportation when a area is already built especially in economical terms. But also that it seems to induces a will to use the car as a main mode of transportation through the power of path dependence¹ (Burton et al. 2004).

If cars are the issue what is the answer? Would it be possible to create a city free of cars?

Important within the concept of The Compact city is to prioritise pedestrians, cycling and public transport. Therefore it seems to be essential to implement this strategy in urban space. Not only because of making transportation more environmental friendly but

¹ Path dependence is the idea that decisions we are faced with depend on past knowledge trajectory and decisions made, and are thus limited by the current competence base (TIMES n.d.).
also consider transportation links such as roads, something to enjoy. If city streets are boring the city is boring (Jacobs 1961).

It is more about how the space of which they use is formed and merely used for pleasure. There seems to be a deviance between traffic planners and architects, urban planners. Whereas the first account for traffic in a macro scale where pedestrians are considered only as an obstacle to slow down traffic flows. The latter to care for local places and environment. Since the 1930s when a split between these two groups seems to have become reality, new developments have favoured cars as the main mode of transportation and degraded cycling and pedestrianism as something recreational. The neighbourhoods themselves have a grid pattern not optimal for pedestrians and bicycles. (Southworth 2005). For example trip length is obviously relative to each mode of transport. If it is put into consideration when new developments with street layout that offers longer travel length, no short-cuts, no sidewalks and no services, it becomes obvious that vehicle transportation is prioritised (Southworth 2005).

Another important aspects is how High-speed traffic cut through our cities and imposed boundaries on the fine gridded pedestrian network.

Sometimes reasons for cities being sprawled out was the hazardous conditions that existed and posed health threats to its population. But this was a long time ago and many of the health posing hazards has been corrected (Southworth 2005).

Every era has its problems and we have to address our access emission of green house gases and hazardous polluted cities related to traffic problems. Therefore the positive aspects seems to outweigh the negative and I will carry on analysing further physical interventions that can higher the level of Walkability in a neighbourhood.

2.5 Walkability
Walkability is a quality which is not well defined. But it has to do with how the built environment encourages and supports walking through variables such as travel-time and qualities such as visual interest.

"...is the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network." (Southworth 2005)

Most important seems to be the visual quality of the pedestrian network. Where for example street trees is a contributing factor to this quality. Also a variety in the environment but with a continuance parallel to what Kevin Lynch stated for "Strong paths, even if it is hard to generalise. Safety is also important where crossings with other modes of transportation has to be safe for all persons in dependant of age and degree of mobility(Southworth 2005).

The single most important factor whether a person chooses to walk or not is distance. But utilitarian access is not a single factor, the quality of the path network is also a key factor. It is necessary to look at pathways beyond just a transportation network. For a pathway to be considered as walkable it has to possess following(Southworth 2005).

1-Connectivity of path network, both locally and in the larger urban setting;
2-Linkage with other modes: bus, streetcar, subway, train;
3-Fine grained and varied land use patterns, especially for local serving uses;
4-Safety, both from traffic and social crime;

5-Quality of path, including width, paving, landscaping, signing, and lighting; and

6-Path context, including street design, visual interest of the built environment, transparency, spatial definition, landscape, and overall exploitability. (Southworth 2005)

The following chapter will analyse each above stated category to represent physical properties which can be implemented in a new development. This is because Walkability is something which is hard to change once a neighbourhood is already built. (Southworth 2005).

2.5.6 Connectivity

Is determined by the amount of sidewalks but also continuance in the pathways without significant obstacles. Also the design of the grid pattern seems to be important where a small block size and high deity of connecting points in paths can relate to a high level of connectivity. This could be put into relation with measuring distance with “as the crow flies”. The finer the grid and connecting pathways, the closer is the distance between start and destination. Therefore getting closer to “as the crows flies” measurement.

Boundaries which lower connectivity can be dead end streets, cul-de-sacs, busy roads, railroads, right of way rivers and power-lines (Southworth 2005). Even if it is stated that Walkability is something that is to be planned from the beginning of a new development it is possible to retrofit and make areas more walkable. This by overcoming barriers by traffic calming, overpasses, underpasses etc, depending on the barrier. Cul-de-sac can be reconnected to surrounding areas and so forth (Southworth 2005).

2.5.7 Linkage

Linkage can be stated as linking the pathways regularly throughout the city to other modes of transportation such as trams, buses, trains or subway. This is to connect the local area to the larger city and region. Usually a distance of 200-400m and an estimated walk-time of 10-20 minutes is acceptable between these linkage points. It is about creating easy transfers between different modes of transportation. For example a person should be able to go from bus to train to flight without any difficult changes. Important is also that the concept of “pedestrian pockets” has to be taken into account. Where a local area no matter how pedestrian friendly it is, it will not reduce car usage if it is not linked to the city through the above mentioned modes of transport, but also if the area is located and possesses a mix-usage of buildings. (Southworth 2005).

2.5.8 Varied land-use

Walkability is also determined by the accessibility of daily activity and services, serving daily needs. According to these needs this can include shops, bank, cafés, laundries, elementary grammar schools, libraries and fitness centres etc. A high level of accessibility of these services means they can be reached within 10-20 minutes walking time approximately within a distance of 800 meters (Southworth 2005). An elementary school is a good example of a local service that is essential to be reached in walking distance. Especially considering safety which I will continue describing in the next category. For example elementary schools have been identified as a general problem in the USA. Because of locations tend to limit Walkability because of the distance from the pupils homes, therefore favouring car-use. Even if this is not necessarily applicable to European situations it is interesting to note what effect location of services has on the chosen mode of transport. (Southworth 2005).

2.5.9 Safety

Safety is perhaps one of the most developed and accepted factors regarding Walkability (Southworth 2005). In the USA a term called Jaywalking was formed up until the 1930s when private vehicles increased and safety of pedestrians became an issue (Norton 2007). It basically means that pedestrians crossing any road, highway or street on non designated crossings is a Jaywalker. (Norton 2007)

“One who crosses a street without observing the traffic regulations for pedestrians.” (Norton 2007, p. 358)

Since pedestrians runs 23 times more likelihood of getting killed than automobile passengers. This lead to a debate whether it is the pedestrians or vehicles that have the responsibility in traffic situations especially crossings (Southworth 2005; Norton 2007). Jaywalking is illegal in Northern Ireland compared to the UK (Pillappa 2005). It
is also interesting how pedestrians are obliged to act more safely within traffic issues. (ie n.d.).

“Mr Noel Brett, Chief Executive, Road Safety Authority added: “Last year, 28 people or one in five of all people killed on our roads was a pedestrian. While this is a reduction of 40% on the previous year, it is a reminder to us all that we cannot become complacent. Tragically 11 pedestrians have died on the south’s roads in 2013(news n.d.).”

This was in line with traffic separation policy(Norton 2007) much alike the system called SCAF in Sweden

It is also stated that an environment that supports and favours fast and efficient automobile traffic will not be enjoyable, safe or interesting for pedestrians (Southworth 2005).

To address safety issues a number of handbooks has been created regarding standardised crossing times, handicapped needs, traffic speeds and so on. But more recently so called traffic calming has been used to slow down traffic and thus making roads and streets more pedestrian friendly. These methods include narrowed streets, rough paving, chokers, chicanes, speed-bumpers, raised crosswalks, roundabouts, landscaping among others (Southworth 2005).

2.5.10 Path Quality

There are several factors determining the Walkability of paths. Negative factors to path quality may include: polluted air, noisy traffic, few designated crosswalks, frontages of buildings are poorly defined, large parking lots in front of buildings, sidewalks which are constantly interrupted by driveways to parking(Southworth 2005, p.251).

Positive affects may include: continuance in path (less interruption), smooth surface, wide enough for 2-3 people to be able to pass each-other or group walking. But also wider in more urban situations. Terrain is also important for Walkability and needs to be address in certain way for example with hand rails. If the path is able to accommodate less mobile people then it is more walkable. It is also about channeling pedestrians by defining the path for example with trees, flowers and verges. This together with adequate street lighting may improve sense of safety and induce walking even at night (Southworth 2005, p.251).

2.5.11 The Path context

Monotonous paths will not induce Walkability rather prevent it,

“If we wish to encourage walking we need to deal with more than connective- pity, land use patterns, safety, and quality of the path itself. A safe, continuous path network in a monotonous physical setting will not invite pedestrians. The path network must engage the interest of the user. Many aspects of the path context can contribute to a positive walking experience: visual interest of the built environ- meant, design of the street as a whole, transparency of fronting structures, visible activity, street trees and other landscape elements, lighting, and views (Southworth 2005, p.251).

Shopping malls, large parking lots, office clusters and electronic communication has contribute to a less readable and transparent city. Transparency is described as most important for Walkability. Where todays traffic analysis over large areas on a macro scale does not pay attention to characteristics on a smaller scale, which is important to evaluate and create strong Walkability. I high value of path context is dependant upon variation in architectural style, quality of path flooring, greenery such as bushes trees and plantations, small scale services along pathway, higher density of buildings, narrower less trafficked streets, straighter streets with a oversight of where the destination is. Transparency the ability for the pedestrian to have a sense of where it is heading is important (Southworth 2005, pp.251-254).

Even though there is no such thing as applicable theories and templates that can be imposed on a standard basis. The stated physical properties seem to have a positive affect on Walkability to an unstated degree. Social aspects are also important as such people prefer paths where other people are for example sitting on cafes, walking, or couples on benches (Southworth 2005, pp.254-255). But since I will not handle the social aspects in this project more then in relation to physical form I will not discuss this further.

Distance is also important for how walkable a path is, where some researchers argue that some of the stated properties above result in a perception of longer distance even though its not. For example, more variety and features such as building styles, amount of
furniture on path, greenery as such (Southworth 2005, pp.254-255).

Is it possible to accommodate the above stated features without cluttering the space? Pedestrians seem to want to view other people and value these paths higher, but also paths with greenery, direction and interesting features. One must try to create defined space within the paths that can accommodate transportation walking and people who wants to reside. Without compromising interesting features, continuance in characteristics, greenery and other mentioned features.

2.5.12 Sungjin parks Walkability Index
Sungjin Park is an American Doctor in Philosophy in city and regional planning. His Phd project was conducted to test following hypothesis.

**Hypothesis 1:** A higher level of path Walkability will increase transit users’ likelihood of choosing walking over driving to the transit station.

**Hypothesis 2:** A higher level of path Walkability will increase the distance transit users will walk to the transit station. (Park 2008)

He first carried out a literature research about which factors does matter for Walkability. These were then tested within a case study of Mountain View, California. Three surveys were conducted, one of 249 transit users by collecting socioeconomic data, trip origins and transit mode choice. The second was 68 transit users which evaluated their walking route to the station. The route was evaluated through 30 Walkability indicators derived from the literature study and the 249 transit users. In total 370 segments of street was evaluated (Park 2008).

A street segment is defined as:

*Length of Segment:* The surveyor recorded the length between the centre points of the two intersections along the street segment. (Park 2008, pp44)

41 Indicators of Walkability was discovered and proven through a comparative analysis of the conducted surveys. A Walkability Index is later produced in order to Quantify Walkability indicators. A presentation of the 41 indicators will be presented on next page. Maximum and minimum values extracted from street segments within the case study, which scored highest in Walkable conductive indicator will also be presented.

I will first demonstrate the Walkability indicators which he has found had an impact on the choice to walk over other transit options and walking distance, Also in which direction each value should go in order to be Walking conductive. Second I will show a list of max/minimum values that is derived from the 270 observed street segments. Third I will narrow down the amount of indicators which I will use in my proposal.
2.5.13 Walkability indicators from Sungjin parks cases study

The list below shows the Walkability Indicator list. The values is max, minimum and average values of all the 270 observed street segment within the case study. The reason why this is showed is to extract the maximum and minimum values which was observed to be walking conductive street-segments.

---

### Table 2.2: Descriptive Statistics of the Values of Path Walkability Indicators for the 249 Routes

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Average Width of Traffic Lane (ft.)</td>
<td>0.0</td>
<td>7.7</td>
<td>1.7</td>
<td>0.4</td>
</tr>
<tr>
<td>3) Number of Traffic Lane Curb-Cuts / 500 ft. Block Length</td>
<td>0.0</td>
<td>4.6</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>2) Existence of On-street Parking I (both = 1, one or none = 0)*</td>
<td>0%</td>
<td>100%</td>
<td>64%</td>
<td>0.3</td>
</tr>
<tr>
<td>2) Average Number of Driveway Curb-Cuts / 500 ft. Sidewalk</td>
<td>0.3</td>
<td>4.8</td>
<td>2.2</td>
<td>0.8</td>
</tr>
<tr>
<td>1) Average Route Steepness**</td>
<td>0%</td>
<td>100%</td>
<td>30%</td>
<td>0.4</td>
</tr>
</tbody>
</table>

* Binominal dummy variables
** Steepness was calculated only at the route level by using secondary data (DEM).
### 2.5.14 Identified max/minimum values of Walking conductive indicators

Walking conductive maximum and minimum values has been extracted from the segment observation list on page 21. Walking conductive values goes in both direction which is stated below.

#### Below more specific explanation is showed how each indicator is calculated. Further info is needed on 5 indicators. These are marked in the list as FigA-E and can be viewed on page 23-24. To the far right the specific values are shown. They are not to be used fundamentally but are values which indicate walkable street -segments. (Park 2008)

### Table 3.3, 5.2, and 5.4

<table>
<thead>
<tr>
<th>Factor</th>
<th>Path Walkability Indicators</th>
<th>Driving Conductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(22) Average Number of Intersections / 500 ft. Sidewalk</td>
<td>less</td>
<td>more</td>
</tr>
<tr>
<td>(9) Number of Mid-block Crossings / 500 ft. Block Length</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(21) Average Numbers of Street Furniture / 500 ft. Sidewalk</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(38) Average Number of Upper-Level Windows / 500 ft.</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(37) Average Number of Street-Facing Entries / 500 ft.</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(25) Average Ground-Level Luminosity after Sunset (fc.)</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(26) Average Skyline Height (ft.)</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(5) Number of Traffic Calming Elements / 500 ft.</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(48) Percentage of Walking-Conducive Commercial Uses</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(36) Average Pedestrian-Level Facade Transparency</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(15) Average Width of Walking Zone (ft.)</td>
<td>wider</td>
<td>narrower</td>
</tr>
<tr>
<td>(17) Average Building Height (ft.)</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(13) Average Width of on-street Parking (ft.)</td>
<td>wider</td>
<td>narrower</td>
</tr>
<tr>
<td>(34) Percentage of Sidewalk Length with Building Façades</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(18) Percentage of Sidewalk Length with Special Pavement</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(29) Fines Coverage Rate</td>
<td>lower</td>
<td>higher</td>
</tr>
</tbody>
</table>

#### Traffic Impacts

<table>
<thead>
<tr>
<th>Factor</th>
<th>Path Walkability Indicators</th>
<th>Walking Conductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(7) Pedestrian Signal Coverage Rate</td>
<td>lower</td>
<td>higher</td>
</tr>
<tr>
<td>(3) Average Number of Traffic Lanes</td>
<td>lower</td>
<td>higher</td>
</tr>
<tr>
<td>(8) Pedestrian Crossing Facility Design Index</td>
<td>lower</td>
<td>higher</td>
</tr>
<tr>
<td>(33) Average Building Width (ft.)</td>
<td>lower</td>
<td>higher</td>
</tr>
<tr>
<td>(6) Pedestrian Crossing Coverage Rate</td>
<td>lower</td>
<td>higher</td>
</tr>
<tr>
<td>(1) Average Width of Curvo-Curb Boulevards (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(2) Average Width of Traffic Zone (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(41) Percentage of Residential Uses / 1st floor footage</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(24) Percentage of Sidewalk Covered by Tree Canopies (%)</td>
<td>higher</td>
<td>lower</td>
</tr>
<tr>
<td>(12) Average Width of Bike Lane (both sides together) (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
</tbody>
</table>

#### Street

<table>
<thead>
<tr>
<th>Factor</th>
<th>Path Walkability Indicators</th>
<th>Walking Conductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) Average Width of Through Traffic Lanes (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(30) Enclosure Ratio in Cross Section II (BBD from streetline)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(29) Enclosure Ratio in Cross Section I (BBD form Bldg. ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(26) Average Building to Building Distance (ft.)</td>
<td>smaller</td>
<td>larger</td>
</tr>
<tr>
<td>(35) Average Building Setbacks (ft)</td>
<td>narrower</td>
<td>wider</td>
</tr>
</tbody>
</table>

#### Landscaping Elements

<table>
<thead>
<tr>
<th>Factor</th>
<th>Path Walkability Indicators</th>
<th>Walking Conductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(25) Average Number of Street Trees / 500 ft. Sidewalk</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(11) Average Width of Landscape Strip (both sides) (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>(10) Average Width of Buffer Zone (both sides together) (ft.)</td>
<td>narrower</td>
<td>wider</td>
</tr>
</tbody>
</table>

#### Sidewalk Amenities

<table>
<thead>
<tr>
<th>Factor</th>
<th>Path Walkability Indicators</th>
<th>Walking Conductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(23) Average Number of Upper-Level Windows / 500 ft.</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(38) Average Number of Building Width (ft.)</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(8) Pedestrian Crossing Facility Design Index</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(33) Average Building Width (ft.)</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(6) Pedestrian Crossing Coverage Rate</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(15) Average Width of Walking Zone (ft.)</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(17) Average Building Height (ft.)</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(13) Average Width of on-street Parking (ft.)</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(34) Percentage of Sidewalk Length with Building Façades</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(18) Percentage of Sidewalk Length with Special Pavement</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>(29) Fines Coverage Rate</td>
<td>more</td>
<td>less</td>
</tr>
</tbody>
</table>

#### Legend

- Represents indicators which is hard to regulate through spatial planning
- Indicators that can be implemented through spatial planning (motivation on page 25)
(A) Walking conductive comercial services
Number of walking conductive commercial activities / tot number of comercial activities

Appendix 2. List of Walking-Conducive and Non-Walking-Conducive First-Floor Uses

Walking-Conducive Commercial Uses Found in My Study Site
- Retail Offices: (banks, Insurance agencies, travel agencies, law firms, real estate agencies)
- Non-Academic Classes: (aerobics, gymnastics, martial arts, ballet, yoga)
- Beauty & Style: (hair salons, nail shops, skin cares, barbers)
- Home improvement and house wares: (kitchenware, carpet, coin-laundry, furniture)
- Specialty Shops: (quilts, antiques, souvenir, gift shops, cigar shops, pet shops, Jewelers)
- Health Services: (dentistry, acupuncture, fitness, opticians/eye clinics/ vision cares/ glasses, chiropractics)
- Restaurants: (fast foods, cafes, coffee shops, restaurants, pizzas, pubs)
- Food-related Retail: (liquor stores, convenient stores, groceries, supermarkets, bakeries, ice cream stores)
- Other Small Retail Stores: (photo shops, locksmiths, flowers, watch repairs, computer stores, copy shops, book stores, cell phones)

Non-Walking-Conducive Commercial Uses Found in My Study Site
- Construction-Related Businesses: (building materials, construction equipments, paint stores, glass shops, construction consultants)
- Auto-related businesses: (car washes, body shops, auto dealers, rental cars, oil changers, parking structures, gas stations)
- Warehouses and Storage Buildings

(B) Transparancy grading
Each facade is given a value regarding to the picture it most correspond.
A-E is given a value of A=5, B=4 and so forth.
The added value is divided by the total number of facades.

<table>
<thead>
<tr>
<th>Level</th>
<th>Residential</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(C) Sidewalk special paving
Percentage of sidewalk covered in special paving which means all other material then asphalt or solid concreete
(D) **Pedestrian crossing index**
This is a standardised index over different types of pedestrian crossings within a street segment. Each crossing is given a value regarding to the description that fits best with the description. The total value is added up and divided with the total amount of crossings in the street-section.

<table>
<thead>
<tr>
<th>Points</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Crossing with traffic lights for pedestrians</td>
</tr>
<tr>
<td>4</td>
<td>Marked with stop signs</td>
</tr>
<tr>
<td>3</td>
<td>Marked with Zebra stripes</td>
</tr>
<tr>
<td>2</td>
<td>Marked with lines crossing traffic lanes</td>
</tr>
<tr>
<td>1</td>
<td>Stop-sign only</td>
</tr>
</tbody>
</table>

{Park:2008tu, p136-138}

(E) **Enclosure Index 1**
This measures the average of building to building distance/ building height along segment. As shown below, a walking conducive value should be not too low nor high. 3.3 is recommended.

Enclosure Index 2
It is measured in the same way as 1 but instead of building height its the average skyline height.
2.6 Pros and cons of Walkability

2.6.1 Pros
Walkability promotes an urban environment which can accommodate less environmental straining transport.

People will come closer together physically by concentrating them on less space. Thus giving a higher chance of encounters with others.

Promotes a denser urban environment which can accommodate more people on less space. Thus creating a higher level of demand for local services.

Third party meeting point will increase with Walkability. As discussed these can be for example Bars, Cafés or a gym. These places has been shown to be important for integration since they are both formal and informal.

A more walkable urban design can accommodate more greenspace contributing to better air quality.

Daily exercise will be greater due to promotion of non motorised transportation. Thus contributing to better health within the community. People that live in more walkable neighbourhoods tended to conduct significantly more physical activities than car dependant areas. (Eriksson et al. n.d.)

Closer between goals and destinations because of mixed use development. Which means less transportation and less environmental impacts(Park 2008).

More space in the built environment will be left to use for recreational purposes such as parks. This because of less or limited traffic.

A safer traffic environment with lower speeds for motorvehicles or none where it’s possible. Street design will be conducted so that it physically states who has priority. For example heighten crosswalks to the same level as the sidewalks. (Southworth 2005)

2.6.2 Cons
Walkability is hard to measure, there is no universally proven method that can quantify factors. Thus only factors which has more or less importance for Walkability can be presented and implemented.

It has been shown that certain factors of Walkability differ in-between countries and continents. For example vegetation and street trees makes a neighbourhood more walkable. But still some European cities like Bologna has limited vegetation and instead its the life in the streets that promotes Walkability. (Southworth 2005)

Walkability as a construct is wide and un precise and lacks a scientific unified definition. Therefore making it difficult to implement and reproduce.

Since a local area never on its own can be walkable without being a pedestrian Island, It will be hard to change already built environments. (Southworth 2005)

Climate does have an impact on Walkability where a colder climate makes people walk less.
2.6.3 Discussion

Walkability is uncertain as a planning construct to aid in urban planning and design schemes. Since researchers point towards strategic implementation from planning authorities without a definition such strategies may vary over time. Thus creating uncertainty among authorities making it unappealing. A solution could be to quantify data both of peoples perception locally what they perceive what a walking friendly street or area consists of.

Walkability as a construct has its main focus on built design and does not involve much of social factors such as age or income. This gives the concept both its limits and weak side. There might be other opinions on what is a walkable area within different communities locally. Researchers like Sungjin Park has proven that Walkability can be quantified at least locally by comparing local preferences of walkable environments to academic research. By this he created a Walkability index which can quantify the built environment and certain factors. He proved that certain factors is more important than others in terms of physical elements. His research is particular interesting in my project because he examines choice of mode of transportation to and from a station. He found that Walkability indicators will be of significant importance for choice of transportation. Instead of uncertain claims he has proven these factors. Therefore with the same situation given with Belfast Central being a transit node his Walkability indicators is more relevant.

But within a new development some of the indicators as shown on page 24 are harder to implement. Since his Walkability Index is first and foremost a analytic tool of street segments. (Park 2008).

What physical elements in urban environments makes walking more attractive as a mode of transportation?

The indicators of walkable conductive measurements extracted from Sungjin Parks research is proven to affect mode of transport within his Case study. As mentioned walking conductive elements are not universal but factors such as few designated crosswalks, frontages of buildings are poorly defined, large parking lots in front of buildings, sidewalks which are constantly interrupted by driveways to parking, has similarities to his indicators.

Transparency of buildings, speed-bumpers, raised crosswalks is also similarities stated by Southworth regarding element which improves Walkability.

The question is broad which makes it hard to answer but strong similarities between Sungjin Park and Southwood exists. The only difference is that Sungjin Park has quantified the elements whereas Southwood gives a broader direction.

The extracted indicators will therefor be viewed in this paper as physical elements which does make Walkability more attractive as a mode of transportation.
2.7 Imagebility

The image of the city concentrates on how the image of the city is perceived through visual quality. Visual quality is by short perceived as:

"The apparent clarity or "legibility of the cityscape. By this we mean the ease with which its parts can be recognised and can be organised into coherent pattern." (Lynch 1960)

The elements that contribute to Imagebility

As mentioned Kevin Lynch categorises the elements that contributes to imagebility within a city in five convenient categories: Paths, Edges, Districts, Nodes and landmarks. I will try to identify and explain them by giving examples of key features within each category and each role for the imagebility and legibility for the observer as described in The image of the city. Kevin Lynch also states that:

"certain features- open space, vegetation, sense of motion on the paths, visual contrasts- seemed to be of particular importance in the cityscape" (Lynch 1960, p.16)

Paths

Paths is identified as the channels of which the observer moves, potentially, occasionally or customarily.

Examples: Railroads, transit lines, canals, railroads. (Lynch 1960)

Interviewed citizens in The Image of the city showed a differentiated reliant upon paths where people with least knowledge of the city showed more tendency to rely upon broad directional relationships, generalised generalised characteristics, and topography. People Who knew the city better tended to rely on paths and their interrelations. Paths that has a concentration of activity may result in a higher level of prominence in the observers mind.

It is also described that streets that is particular narrow or wide, special facade characteristics of building connection to special features attracts attention and this higher value of imagebility. It is also exemplified that through Kevin Lynch study of Jersey city, paths of major importance that lacked sense of identity and was easily confused with other paths made the whole city image uncertain. Lynch describes that people depend on a continuity and identity of certain paths to be able to achieve a image of the city and orientate themselves. Orientation through the observer perceived strong paths as stronger in identity, help to unify the city and give a sense of layer on which whom you stepped into.

Sense of direction is also forwarded as important for imagebility where the observer can detect a movement forth and reverse. Achievement of sense of direction can be a regular change in one direction through elements such as building height, topographic gradient, a prolong curve, etc.

When a path has a high sense of directional quality it can heighten its importance through scaling, which is described as the ability for the user to be able to sense where it is on the path and how far it is to destination. Examples to achieve this is to have landmarks along the paths and especially between different perceived areas of districts which I will explain further down.

Directional value is discussed to be dependant on the level of alignment to neighbouring streets of less importance. It is argued that by aligning streets the observer is able to locate its final destination easier and not be insecure about outside paths(streets) to the main path. (Lynch 1960)

Edges

Lynch describes edges as

"Edges are the linear elements not considered as paths: they are usually, but not quiet always, the boundaries between two kinds of areas. They act as lateral references." (Lynch 1960, p.62)

Strong edges are described as continues elements which are impenetrable for cross movement of the observer. He describes edges as something that is perceived by the observer. This is described through an example of Boston which is situated on a peninsula along the Charles river edge showed strong edges in terms in the west and east parts due to the accessibility to the edge(river) of the observer. The observer was less common to state the northern part of the peninsula as a edge due to its limited access to the water even though they knew it was physically there. The Northern area of the peninsula was described as the waterfront was obscured by structures such as railroad tacks and abandoned buildings. (Lynch 1960)

Continuance is repeatedly stated as essential for a strong edge and as described above the northern parts lacked waterside paths which gave the observe access to the river and the existing paths of the west and eastern parts was broken therefore lowering the physical edges of the river as perceived edges.
Districts

Lynch describes districts as areas within a larger city where the observer can mentally enter and exit the different areas mentally. This image of a district is described to be dependent on physical characteristics such as texture, space, detail, building type, use, activity, inhabitants, degree of maintenance, topography.

For cities with a tight plan for the city it is argued that characteristics such as facades, modelling, ornament, colour, skyline has increased importance for the observer to identify district area.

A certain reinforcement of clues is needed to produce a strong image. All too often, there are a few distinctive signs but not enough for a full schematic unit (Lynch 1960, p.68)

Kevin Lynch gives an example of Little Tokyo in where the are had little or none physical difference in aesthetics except for some of the signs. Even if the population was of strong ethnic concentration the area was not perceived by observers as a strong distinct district. Though the schematic characteristics are not particularly special from the rest of the city but district names can give identity even to such areas.

Districts can have different kinds of boundaries which is either precise, hard or floating, and soft. There can for example be a district within a district whereas the function may be of another character but with aesthetic similarities to the surrounding district. Sharp distinction can be for example were the aesthetic elements of the environment in the city changes abruptly (Lynch 1960)

Nodes

Nodes are as described by Lynch, strategic focal points of which the observer can enter, typically where path junction or a concentration of a specific characteristics (Lynch 1960)

Kevin Lynch specifies two type of nodes, Transportation nodes, Thematic concentrations which can be either a combination or one of them.

Transportation nodes

These are described as a break in transportation where the observer has to make decisions and increase their attention about physical elements within the node by a heightened attention to make decisions where to continue their journey.

Above is a picture shown from Bunker hill in Los Angeles which Lynch describes as having a distinct character where the picture shows Bunkerhills historical character with sharp contrast to surrounding cityscape. This in terms can also show an edge were the edge is sharp and clear and also describes the edges of the district (Lynch 1960)

Transportation nodes was shown to be key places within the city and particular those which imposed a break or interchange in the observers habitual trips (Lynch 1960).

Lynch describes nodes from the american cities Boston and Jersey city. In Boston the perceived transition where the city ended or began was where for example the first railway station and when the observer passed the Tornelle Avenue circle (Lynch 1960, p.73)

"The junction, or brake in transportation, has compelling importance for the city observer. Because decisions must be made at junctions, people heighten their attentions at such places and perceive nearby elements with more then normal clarity" (Lynch 1960, p.72)

This can be exemplified by key junction traffic transition nodes in Boston with The Charles street rotary, Sollay square and south station. They are described as visually places where transportation networks junction.

"The rotary itself is not a handsome place, but it clearly expresses the transfer between river, bridge, storrow Drive, Charles street, and Cambridge street" (Lynch 1960, p.74)

Moreover the trains popping in and out of the hill-side, the heavy traffic, all can be clearly visualised" (Lynch 1960, p.74)
Major rail stations are described as almost always important nodes. Boston south as a example, because of its function being vital for commuters, subway riders, intercity travellers but also its visual appearance in front of Dewey square. Lynch describes the station as a prominent building which cannot be mistaken for anything other then a transportation node. (Lynch 1960, pp.74-75)

**Thematic concentrations**

Whereas The Jordan- Filence corner and Loisburg square in Boston is forwarded as typical examples. The Jordan Filence corner was perceived by observers in the research as being the centre of the centre of the city. This with also a high level of commercial concentration. Filence corner has a subway stop but that is not why observers found it to be a nodal point. The Loisburg square is a park which is situated in the upperclass neighbourhood and highly recognised fenced park by observers. This is forwarded as an example of a highly thematically node where as it is not a transportation node at all. But where its function as a ark is whats makes it remarkable and therefore memorable for the observer. (Lynch 1960, p.76)

**Importance of physical characteristics**

Physical shape is described as not essential for the recognition of space, But when a node has a strong physical form it will be much more memorable for the observer(Lynch 1960, pp. 176-177)

When Lynch discusses the importance of physical characteristics he uses two nodal point Scollay Square and Copley square in Boston.

Scollay Square is described as lacking spatial clear shape, Kevin Lynch states this as it being on a elevated point within the city with the actual square having unclear boundaries. The square floats of to southern streets and it is surrounded by buildings of non prominent character (Lynch 1960, p.77)

Below is Scollay Square and beside is Kevin Lynch analysis of it.

![Scollay Square Analysis](image)

“Evidently it made no visual impression and connection of various paths to it which is the basis of its functional importance, were very poorly understood”(Lynch 1960, p.77)

Copley square is described as a strong node due to its prominent buildings such as Trinity church, Public library, etc. It has well defined boundaries with visually connecting paths.

“The most successful nodes seemed both to be unique in some way and the same time to intensify some surrounding characteristics”(Lynch 1960, pp. 78-79)

**Landmarks**

Landmarks are hard to define but it can be something recognisable within the city that has a high contrast to its environment. Contrast and simple form seems to be key features which has importance if a landmark is to be chosen by the observers. Contrasts can be many things, as a church spire against the sky, a clean building in a dirty city, or even a modern building in a old city<(Lynch 1960, pp.80-82). A landmark can also be established by spatial dominance as such be visible from several different locations in the city. Landmarks positioned in places where paths link and observer decision about direction has to be done enhances its strength. A specific activity that is associated with a structure can also make it a landmark(Lynch 1960, pp.81-84). Long distant landmarks was only used for very general directional orientation but more important symbolically. Local landmarks which is called so because they are only visible from restricted locations within an area. Observers which had experience of an area tended to reveal more landmarks when interviewed. The local landmarks were often remembered as clusters of features such as building material. When the observer moved these clusters seemed to guide the way. As point-to-point orientation where every point is a landmark(Lynch:1960vn p81-84).
2.8 Summery and usage
I will describe in what way The Compact city, Walkability and Imagebility will be used in the project.

2.8.1 The Compact city
To answer how the concept of The Compact city can be implemented in a new development of Belfast central area with the guidelines presented within chapter 2.3.

- Planning for mixed use development
- Limiting transportation needs by
- Making the city more compact thus reducing distance between buildings and their uses.
- Remaining transportation needs are to be addressed through an increase in public transportation and bicycling and walking.
- To improve urban form to accommodate walking and bicycling as prioritised modes of transportation.
- Encourage social interaction through a certain degree of compactness (Burton et al. 2004)

These guidelines are broad but to improve walking as a mode of transportation can be done through the Walkability guide for urban development.

2.8.2 Walkability
The indicators can be used to quantify street-segment elements to evaluate how walkable conductive it is. This by measuring how close the segment comes to the indicated max/min walkable conductive values. But in a new development from a urban design point of view the indicators will be hard to implement. Especially within the context of Belfast where planning is to give general guidelines of a designated area. (council 2004) Therefore a selection of Walkable conductive indicators has been extracted to build a spatial planning model as shown on page 27. Since spatial planning is not about creating a fixed environment with for example Walkability indicators such as amount of intimidates already set. Indicators which are directly associated with urban design will therefore be presented.

2.8.3 Imagebility
Imagebility will be used in order to better understand the area of which Belfast central is situated. A superficial Lynch analysis will be conducted in order to be able to improve legibility and pathfinding within and to the area.
2.9 Walkability guide for urban design

Legend street element
(above arrangement is just an example)

- A: With of walking path
- B: With of Cycling path
- C: Traffic dividing element
- D: With of Parking
- E: Number of Traffic lanes
- F: With of bufferzone
- G: With of motorvehicle traffic space
- H: Curb to curb traffic zone
- I: Enclosure index 1, With between buildings
- J: Height of buildings
- K: With of building setback
- L: Tot amount of entrances to segment

Related guidelines:

<table>
<thead>
<tr>
<th>A</th>
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</tr>
</thead>
<tbody>
<tr>
<td>B</td>
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<tr>
<td>C</td>
<td>&gt;=2,5m</td>
</tr>
<tr>
<td>D</td>
<td>&gt;=4,5m</td>
</tr>
<tr>
<td>E</td>
<td>=2 traffic lanes</td>
</tr>
<tr>
<td>F</td>
<td>&gt;=2,19m</td>
</tr>
<tr>
<td>G</td>
<td>=6,02m</td>
</tr>
<tr>
<td>H</td>
<td>=8,4m</td>
</tr>
<tr>
<td>I</td>
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</tr>
<tr>
<td>J</td>
<td>67%(See FigE)</td>
</tr>
<tr>
<td>K</td>
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</tr>
<tr>
<td>L</td>
<td>Undefined</td>
</tr>
<tr>
<td>M</td>
<td>(less)</td>
</tr>
<tr>
<td>N</td>
<td>(less)</td>
</tr>
<tr>
<td>O</td>
<td>100% 6/6 crossings/150m</td>
</tr>
<tr>
<td>P</td>
<td>40,7/150m</td>
</tr>
<tr>
<td>Q</td>
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</tr>
</tbody>
</table>

Maximum and minimum values of walking conductive indicators related to street layout.

Drawings are not to scale

Street segment (section of street between the middle of 2 crossings. The sections length is not limited)

- M: With between buildings
- N: With of building fasad. All fasades together divided with section length gives fasad coverage (%).
- O: Pedestrian crossing
- P: Average amount of windows on upper level of buildings along segment
3. The site

3.1 History
  3.1.1 Belfast
  3.1.2 The site

3.2 Site analysis
  3.2.2 Lynch analysis
  3.2.3 Pedestrian
  3.2.4 Bicycle
  3.2.5 Public transport
  3.2.6 Boundaries and existing building volumes

3.3 Activity analysis

3.4 Interviews
3.1 History

3.1.1 Belfast

I will now try to make a short summery of Belfast history with main focus upon history which has relevance for the subject.

Belfast as a settlement dates back to the 12th century when Jon de Curcey invaded Ulster and built his castle in the area to establish his rule. Later in the 16th century the lands and castle was retrieved by Sir Arthur Chichester, Governor of Carrickfergus which shortly after received the rights to send members to Westminster in London. Chichester brought settlers over from Scotland and Devon to Belfast. Up until the middle of the 17th century Belfast was a thriving port town but had only increased by 8000 citizens. The major industrialisation transformed the market town in to a heavy industrial city with production mainly in engineering, ship-building and textile industries. In the 19 century employment within the heavy industries attracted a considerable amount of rural workers mostly catholics. This migration gave Belfast a considerable amount of Catholic citizens where Belfast was mostly a Protestants city before. Up until 1911 the city grew and more then doubled the amount of citizens particular Protestants. (Ellis & McKay 2000)

Meanwhile political violent conflicts contributed to the urban emigration but cannot be held as a single reason. Since other cities in the UK have had similar patterns where as car ownership, Local policies, growth of private housing has to be considered. The pattern of the emigration began in the city centre and spread outwards. By this leaving derelict industries most of them connected to the river of Lagan west of the city centre. The city centre was particularly hit by the IRA The Irish liberation army during their bombing campaign in the 1970-80s. The city centre was considered a economic target, thus damaging existing buildings physically. (Ellis & McKay 2000), (Shepheard & Pertnership 1987), (OECD 2000).

3.1.2 The site

The central station

The central station was opened 1976 following the closure of Great Victoria street station. The station was refurbished 2003 and is located just around the corner from the waterfront hall and St george’s market(Anon n.d). The development was carried out by dividing riverside land into sections and such develop them individually.(OECD 2000) Some sections remain still, in particular the site of which The central station is located which is called Maysfield/ Steward street in the Lagan side corporation. (Laganside Corporation 2007)

Within the area today there is a large derelict building called Mays leisure centre. It opened 1974 and hosted several international events. Even if Mayfield leisure centre was one of Belfast most used public buildings it closed after a vote in Belfast city council mainly because of high maintenance costs. Also the intention of building a new leisure facility in the south of Belfast(NEWS n.d.). Another derelict building is a large office-block close to the central station just on the north side of East bridge street.

Future proposals

he site has been selected as a key point of new development since it is identified as a key entrance point to the city centre (council 2004). The laganside corp identified the site as early as the 1990s as a potential point of development (Shepheard & Pertnership 1987) However today there is no real plans in terms of investors or developers in the designated area.

Modern history

The Belfast Urban Area Plan 2001 was adopted 1990, It included a private-public development plan. To address the most derelict land next to the river of Lagan,(OECD 2000). This partnership was called The Lagan side, established 1989 by the Government, with main goal to achieve regeneration of the inner-city on either side of the river. But also rediscover its waterfront. (Laganside Corporation 2007)
3.2 Site analysis

3.2.2 Lynch analysis

The Lynch analysis will be conducted through my own perception of the area. This is subjective and may not be a universal perception of the area. But with support from Kevin Lynch’s book The image of the city I will motivate every entity and so forth the conclusion.

The main paths by Kevin Lynch definition through the area is the main railroad line and East bridge street. I consider these major paths since they carry a high amount of traffic and has a sense of direction. East bridge street has though a lesser path value since it lacks continuance in adjacent buildings and clear boundaries. In general paths within the area are not continuos either in visible characteristics or in sense of direction which makes them less legible for the observer.

The strong node in the area is the central station because it is a main transportation hub where interchange between different modes of transportations takes place. As Lynch describes nodes are stronger if they have a spatial characteristic such as a prominent facade that cannot be mistaken and symbolises the nodes properties such as transportation. Another more characteristic. A lesser node is more of a thematic node inferior the landmark-building BT-tower. The Square in front of it has a concentration of offices but lacks well defined boundaries because of the space between the building it is hard to defined where the square starts or ends.

Strong edges within the area is particularly the railroad tracks but also East bridge street, some parts of the boardwalk. East bridge street is strong due to its height difference to the rest of the area making it impermeable except for one point next to the central station. But as Lynch describes edges are perceptions of how people think an area ends or begin. With that in mind the northern and southern boardwalks is not perceived as a strong edge because of its lack of accessibility, therefore making the observer unsure where the district ends, this can be interpreted from Lynch's own analysis of Boston's harbour. Other strong visible edges is the south west residential units which possesses a continuous facade towards East bridge street. Strong landmarks in the area is the Waterfront conference centre and BT tower because of there visibility and characteristic post-modernistic style. They are visible from several different views from the city especially BT tower. They symbolise the new era of Belfast and new development.
3.2.3 Pedestrian

The pedestrian network was analysed by a walk through the area and adjacent areas. This is because Walkability as earlier described is dependant on the connection to other paths and such their continuance. The survey showed that their is problematic connections between the main street (East bridge street) and the river of Lagan both north and south. The pedestrian paths south of east bridge street lacked continuance other than being constantly interrupted. The rings on the maps marks particular difficulties for example a sidewalk on the lower level of the station was interrupted by a commercial board placed in the middle of the sidewalk. Also a discontinuation was noticed on the northern boardwalk where it was not accessible just north of east bridge street due to a gated community development. But after the gated community the boardwalk starts abruptly (picture 1) and ends in the wall of the railway bridge. One has to step back and walk down some stairs and then under the bridge where that walkway is marked as a cycle path. Therefore if a pedestrian should obey the signs then the pedestrian has to walk back, cross the street walk under, cross the street again and continue. But the northern boardwalk continues to lack continuance, by this the one west of the rail bridge is more modern but ends up in a heightened plateau with no seating (picture 2).

Within the designated area the southern boardwalk has a fairly high continuance but lacks connectivity to the central station. The only designated path for pedestrians is closed from december to march (picture 3). The paths on the lower level of the station ends abruptly for example a billboard in the sidewalk(picture 4) or just into a wall (picture 5). The lower part of the central station is mainly consistent of a car and taxi park with broad roads mainly prioritising vehicle traffic. Connections to the northern parts is accessible through an arch from the lower level of the central station, or by a pedestrian staircase northeast of the main entrance. The sidewalks is overall narrow and large fences and greenery blocks sight making it less legible for the observer to find its path. The main obstacle within the designated area is the railway-tracks and central station which blocks cross movement for pedestrians other then the southern boardwalk. The southern part has though a small open green space and a paved opened area in connection to the southern boardwalk (picture 6) and central station. The green space was used when I did conduct a survey but the open paved area lacked any activity apart from people heading to and from the community education centre which is located there. The building which the education centre is located in seem to have two closed commercial
Quality of Walkability is connectivity to surrounding areas which exists but it is not finely gridded thus resulting in longer journeys. The quality of paths are essential and in general most paths in the area lack continuance and quality since most of the paths are in poor condition and lacks lighting in certain areas. Land use patterns are divided and not mixed which effects Walkability negatively. The designated area consists of more then half of traffic and car instalments, mainly to accommodate vehicular traffic which affects Walkability negatively. The Walkability to and from the city centre from the central station is mainly on east bridge street and the pedestrian movement tend to cross east bridge street and head west either on the walk bridge or past it. The height difference between East bridge street and the rest of the designated area needs to be solved to improve connectivity.
3.2.4 Bicycle

Bicycle paths in the area is not marked at all within the designated area. Outside the area Victoria street which is the first main street to connect to East bridge street the only designated by-cycle path can be found. Within the site a bicycle path is shared with pedestrians without markings.

East bridge street the bicycle path is actually a Bus lane which is supposed to be shared. The bus land is only in one direction towards city centre (westward) (picture 9).

The boardwalk within the area is also shared space without separation lines between Bicycle and Pedestrians. The southern Boardwalk has a high continuance and connect-ability since it directly intersect with East bridge street in the south and therefore also from East Belfast. The southern boardwalk functions as a southern Eastern link for bicycles but also pedestrians because of its continuance and connection in the south to Ormoe road. Though the bicycle path or bus-lane ends where East bridge start. Which makes cyclist having to compete for space.
3.2.5 Public transport

The Central station is the main hub for the rail services in northern Ireland but also the express train to Dublin. The station is trafficked by 6 lines, Bangor, Larne, Londonderry, Porte down and Dublin. In front of the station one can find a bus stop with two of the main bus lines in the city 6 and 4a,b. This connects the station to eastern Belfast and the city centre, and if one needs to travel to other parts an interchange is needed by the City hall. The Central station also lacks connection to the airport and regional and national bus lines which is located by Great Victoria street station (Marketing 2006; Department 2012). Travel time between the city centre and Central station is approximately 2 minutes. The metro-link bus routes in Belfast terminates within the city centre at city hall thus forcing an interchange rather than having lines that run though the city.
3.2.6 Boundaries and existing building volumes

Boundaries has been identified as elements that is impermeable for pedestrians not including building facades. Boundaries within the site is the viaduct of East bridge street (fig 14) but also a number of fencing around the western and eastern car-park (fig 15). These fencing makes pedestrian movement possible through a small path just south of central station and by the southwestern boardwalk. Thus limiting cross movement for pedestrians and bicyclist to access the river of Lagan. Also for the residential area south west of East bridge street the railway tracks divides the area and is only possible to penetrate at two points, north of East bridge street (fig 16) and East bridge street. The Mayfield’s leisure centre and eastern residential unit is surrounded by fencing and the building structures themselves blocks cross-movement for pedestrians and cyclists.
3.3 Activity analysis

Legend

- Path
- Observation point

A. 9/4 2012, Observation main entrance, Central Station (quantity of pedestrians)

- Morning 0900-0910, 0915-0925
- Lunch 1400-1410, 1415-1425
- Evening 1800-1810, 1815-1825

B. 17/5 Observation southern boardwalk

Observed cross movement not using the designated crossing

Passing point pedestrians (a point where pedestrian passes, they can be counted several times at every passage)
The activity analysis of the area was conducted at two occasions April the 9th and May 17th. A description about how they were conducted can be found in the Introductory part and the observation schedule will be attached. 

The observation was conducted in two areas in the designated area of the site.

Observation A was chosen because I wanted to monitor how people moved to one of the major nodes within the area. As it is a main entrance to the Central station movement was quiet intense and it was hard to keep track of how many people moved about. Therefore I pinpointed passing points which made it possible to count how many people passes that point within given time, ignoring directional value. Therefore i chose to divide the observations to 3 respectively 4 for the later passing points 4,5,6 and 3 again which is the only points that uses the later described times shown in the map legend. The observation time was 10 minutes and since there was a lot of people walking I may have not counted everyone correctly.

The results of the observations at point A was that movements seem to favour both of the sidewalks leading towards city centre in particular the northern one. As observed pedestrians tended to cross East bridge street and walk towards the inner-city. Thus the northern sidewalk was over all the heaviest traffic area, not far after was the crossing. Another observed behaviour was shortcut crossing of East bridge street close to the central stations main entrance as shown on the map.

Observation B took place on a warm spring day approximately 15-22° C which might have affected the outcome. This observation conducted all passing points at once. The boardwalk showed a high amount of pedestrians, but movement between the boardwalk and central station seemed to lack legibility. Even if it is possible to penetrate to the central station from the southern boardwalk, the entrance to the station area is hidden away. Also north south movement through the Mays-fields leisure centre was also limited. This could be a result of fencing around the whole structure which makes the pedestrian insecure whether it is penetrable or not. There is a gate just north of the open space by the river of Lagan but it is randomly open for the public. Another observation which I made in the area was that there was a very few amount of people sitting down or maintaining themselves in the area, both observation points lacked seating.

A conclusion could be that Movement for pedestrians at point A tend to flow towards and from the city centre. Observation B tended to have a strong usage along the boardwalk but north and south movement was limited. These findings suggests that their is a problem in the area with cross-movement for pedestrians.

3.4 Interviews

1. Geraint Ellis, Professor within environmental planning at Queens university of Belfast and Co editor of Environmental planning and Co-editor, Journal of Environmental Policy and Planning.

The laganside development was discussed in the beginning of the interview where he states that the laganside was successful in attracted new commercial development to the waterfront. Though social housing and public transportation is lacking and not incorporated. Ellis describes that Belfast is one of the most car dependant cities and that public transport, pedestrian and cycling is not prioritised.’ No over all strategy for cycling and walking’. The connectivity to the city centre is also describes as not to bad if looked on practicalities such as available bus-lines. Psychologically though he describes the station as being much further away. He also describes the central stations different levels as a problem. Since East bridge street acts as a boundary which is hard to penetrate. His suggestion to this problem was to lower the main entrance to the lower level and let people out there.

He also describes that the central station never has been looked upon as an enclosed area. As how it is knitted in the urban fabric. He mentions that Belfast city centre has been attractive for residential development in the past but is not the case today. But short term its not today viable as a development type but long term and from a planning point of view it is preferable. Due to shorter journeys and less traffic, a more living city centre due to denser living. He mentions though that it would mostly be attractive to a younger group of people without children. Geraint also mentions improvements to the city centre to make it more attractive for a wider group of people. Improvements like pocket parks for children’s, increased green space which he perceives is a desirable/required factor for families with children. He also mentions that the city centre lacks infrastructure such as good schools and says that not even him though he loves cities would bring up his children their because of these reasons.

I go onwards to asking Geraint about the legibility and imageability of the Central station and surrounding area. Geraint makes a point that traffic integrated development is not implemented in Belfast. He especially exemplifies this by traveling to the city centre by bike or as a pedestrian. As you come out of the central station you are confronted by traffic and a barrier
and most people follow East bridge street and the other streets to the city centre. But it had been easier if the central station had an easier connection to the northern river path to the city centre by the Odessy. Because then pedestrians and bicycles would not have to mix with other traffic. He mentions though that the connections are bad to the northern boardwalk and that the boardwalk is not wide enough. He again repeatedly mentions the height difference between East bridge street and the rest of the site to be a problem and limiting Walkability and cycling in the area.

Legibility which Geraint is familiar with is also a problem when pedestrians are to get to the city centre the closest way is the path-bridge to the BT-tower and then down to city centre. Since the bridge is hard to recognise where it leads unexperienced user tend to walk down east bridge street and then into the city centre next to the heavy traffic, having to cross several lanes of traffic to get to May street. He would recommend that a crossing over East bridge street would be placed followed by a pathway on the other side of the street connecting to the northern boardwalk and thus to the city centre with a higher legibility for pedestrians and bicycles. He recommends commercial development in the area and residential development due to the central location and to serve the commercial development with public transport.

Fitzsimmons, Paddy Senior Planning Officer Belfast Metropolitan Area Plan Team perceives the central station as not a part of the city-centre. because of its far off location and already built infrastructure and buildings. He cant see how the central station could be more integrated to the city-centre other than with improved public transportation. Also he describes the newly built office development and hotel north of the central station could be improved because they turn their back on the central station and the river of Lagan. Also the BT-tower and the development around it acts as a barrier where the only access-point from it is a narrow pedestrian bridge which is hard to locate. The scale of the existing new buildings are also something he perceives as to large.

Public transportation in Belfast is also described as very poor. He describes office worker commuters to be the largest amount of users of the central station. Especially given its close proximity to such. Paddy also mentions that car dependance in the city centre could be addressed through a less availability of parking which also can be implemented in the area of the central station. It seems like the Belfast planning commission seems has the same view about the set aside location of the central station. But also that the area needs to improve connections to the city centre and the river of Lagan. Though Geraint gives physical recommendations Paddy gives none on how to be able to achieve this. The interviews indicates that the perception of the distance to Central station is greater then the real distance. But also that its problematic for pedestrians and cyclist to navigate through the area around the central station. Also the dimensions of the buildings are to large and the access to the boardwalk and city centre is limited by several boundaries.
4. Proposal

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4.1 Strategy presentation
This proposal should not be regarded as a final document of how the area should be developed since this project is about generating guidelines of how a future development could be conducted. The proposal will try to answer

How can the ideas of The Compact city be implemented on Belfast central station area in a future development?

This question will be answered by implementation of following guidelines extracted from the theory chapter. Each guideline has its own section.

- Planning for mixed use development
- Limiting transportation needs by
- Making the city more compact thus reducing distance between buildings and their uses.
- Remaining transportation needs are to be addressed through an increase in public transportation and bicycling and walking.
- To improve urban form to accommodate walking and bicycling as prioritised modes of transportation. (A more specific implementation of Walkability factors will be done separate, see below.
- Encourage social interaction through a certain degree of compactness (Burton et al. 2004)

How Can Walkability be implemented within a new development of Belfast Central area?

East bridge street will be examined as an example how the Walkability can be implemented within a new development in the area. The checklist on page 27 will be used. Some Walkability indicators will not be implemented due to lack of time, for example facade features such as Windows and Doors.
4.2 Situation plan

Legend
- Proposed new buildings
- Existing buildings
- Sections
- Walkability implementation area

1:2000  Situation plan, location of section and Walkability factor implementation
4.2.1 Existing buildings, buildings proposed to be demolished

The Mayfield arena is today derelict and is in a state of disrepair. It also uses a considerable amount of space within the site in a 1 storey arrangement making it low density development. That is why the building should be demolished within a new development within the area. Please view page 8 for location in greater Belfast.
4.3 Density/ Land-use

Accordingly to the concept of The Compact city a future proposal should be den and accommodate a mix-age of uses within the area. These buildings are set to be between 3-6 storeys high end lessen the closer to the water they come to increase views of the river of Lagan even for buildings set quiet far up, towards East bridge street and the new Station Square. The with of buildings are not more then 12m except for the new proposed shopping mall west of the central station. I recommend the building plot size to be small as maximum 15x18m to ensure a variety in character and height. But the hight are not to differ to much from surrounding buildings as the same with character. Because this could lower continuance and imagebility for the people moving though and within the neighbourhood. I have proposed a large commercial development west of the central station because of the close proximity to the central station and bus links which could help to reduce external car-dependant commercial developments. No building has any available parking adjacent to them except for short term parking available on the one-way street running though the development south of East bridge street. This is because I have implemented priority in traffic accordingly to Walkability and The Compact city. To accommodate this development the Mayfield arena building will need to be demolished, as shown on next page.
4.4 Directional axis

The ability to walk or use a bicycle more than leisure is dependant upon how connected the path system is to the surrounding areas. This is because a walkable area within the city can be good in itself. But if the adjacent areas is not then it becomes as an island of Walkability. That's why I have chosen to conduct the whole plan upon three directional axes which connect to following places as shown in map.

A problem today is that physical boundaries such as the railway, fences, parking and lack of connection between north south and the city centre contributes to limit freedom and connection to main destinations such as the city centre for pedestrians and bicyclists. Therefore the north southern boulevard is only for pedestrians and bicyclists and will connect north of the site to the northern boardwalk to the city centre. This will direct commuters and passengers to the city centre. The southern directional axis serves to connect the western residential neighbourhood to the river of Lagan, the site, and East Belfast.

Important is to give pedestrians and bicyclist the ability to move freely without loss of time. Since time is an important factor for how walkable a path is.
4.5 Walkability

A new development in the area of the central station if it is to be walkable address physical and psychological boundaries which exists there today. Therefore I have proposed a path system which prioritises pedestrians and bicycles. Every path has a bicycling and path lane located within close proximity or direct access to trees and green space. Continuance as in building style volume, use, etc has been discussed above and will higher the walkability in the area.

Public transport and connections to the region and rest of the city will be through the central station. Walking and bicycling to it is more accessible due to a new southern and western entrance. But also the three main paths through the area is directly connected to it. The central station itself is in the same position which is central in the area. This is essential to promote walkability as public transport has to be as accessible as possible for it to be viable. A public space now meets the commuter, pedestrian and bicyclist when uses the central station. This is important, to create quality even just in the pavement of paths.

Almost every building has a bottom-floor commercial unit which could potentially host a café, bar, shop etc. This is because pedestrians often tend to chose paths with a high amount of people visible. But also a high amount of green space which I propose should be provided in almost every path.

The system of paths are main directional axis paths, local paths, and boardwalk. The difference between them is with and amount of greener. The axis paths are broader lined with trees and is there to connect different districts. Local paths is for local transport and connection to the axis paths. The boardwalks are the paths adjacent to the river of Lagan. These are important for south-east connections and leisure.
4.5.1 Implementing the Walkability guide for urban design

All indicators will be implemented except for Q and P because the model does not have facade details. Page 46 and 47 will show how the indicators are implemented in detail.

Cycle lanes are missing within the proposal for East Bridge street therefore factor B will be ignored. K building setback will not be implemented because every

Legend street element
(above arrangement is just an example)

A- With of walking path
B- With of Cycling path
C- Traffic dividing element
D- With of Parking
E- Number of Traffic lanes
F- With of bufferzone
G- With of motorvehicle traffic space
H- Curb to curb traffic zone
I- Enclosure index 1, With between buildings
J- Height of buildings
K- With of building setback
Q- Total amount of entrances to segment

Related guidelines

<p>| | | | | |</p>
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<tr>
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<tr>
<td>I</td>
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<tr>
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<td>L</td>
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<td>M</td>
<td>(less)</td>
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<td>N</td>
<td>(less)</td>
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<tr>
<td>O</td>
<td>100% 6/6 crossings/150m</td>
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</tr>
<tr>
<td>P</td>
<td>40,7/150m</td>
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<td></td>
</tr>
<tr>
<td>Q</td>
<td>&gt;=15,9/150m</td>
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Maximum and minimum values of Walking conductive indicators related to street layout.

Drawings are not to scale
Legend street element
(above arrangement is just an example)

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<tr>
<td>B- With of Cycling path</td>
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<td>C- Traffic dividing element</td>
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<tr>
<td>E- Number of Traffic lanes</td>
<td>E =2 traffic lanes</td>
<td>✓</td>
</tr>
<tr>
<td>F- With of bufferzone</td>
<td>F &gt;=2,19</td>
<td>✓</td>
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<tr>
<td>G- With of motorvehicle traffic space</td>
<td>G =6,02m</td>
<td>✓</td>
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<tr>
<td>H- Curb to curb traffic zone</td>
<td>H =8,4m</td>
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<tr>
<td>I- Enclosure index 1, With between buildings</td>
<td>I 100%(See FigE)</td>
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</tr>
<tr>
<td>J- Hight of buildings</td>
<td>J 67%(See FigE)</td>
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<tr>
<td>K- With of building setback</td>
<td>K &lt;=0,21m</td>
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</table>

No cycling path
4.5.3 Walkability indicators L-P

Legend street element

- **L** - Street segment (section of street between the middle of 2 crossings. The sections length is not set. However most measurements is within 150m segments which maky this length preferable,
- **M** - With between buildings
- **N** - Average building facade within section (%). Total length of section covered in facade divided with total amount of facades.
- **O** - Pedestrian crossing
- **P** - Average amount of windows on upper level of buildings along segment
- **Q** - Total amount of entrances to segment

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Answer: 12%

Square road lane is heightened. Details of facades are not set within this proposal
Details of facades are not set within this proposal.
4.5.4 Results
All indicators except for B, K, P and Q was used and showed a positive result in achieving the maximum and minimum values of the extracted indicators. This may not make the whole area more walkable but the current proposal shows that it can achieve the indicators. East Bridge Street can therefore together with the broader guidelines be an example of how walking conductive street-sections can be designed. The question how Walkability can be implemented within a new development can therefore be viewed as answered.
4.6 Section
The section shows the height difference within the area especially between East Bridge Street and the riverside of Lagan. The main station entrance and the new open space in front of it will be positioned 7.5m above the river. The height difference will be addressed by gradually sloping paths descending from East Bridge Street. I chose to remain East Bridge Street in its current height because otherwise it would have limit train passage.
4.7 Views

4.7.1 South-north Isometric view
4.7.2 North-South Isometric view
4.7.3 East bridge street, View east.
4.7.4 View of the public square.
4.7.5 East bridge street in detail.
4.7.6 East bridge view west
5. Discussion
The future of car dependent cities like Belfast is all but certain. But what is known is that global warming is a fact and also that transportation is one of the single largest emitters. We also know that western cities continue or have been spreading out since the car became available for common use. This has often left central parts of cities derelict as people move to the suburbs together with commercial development. This are though more prominent in the United States of America then Europe often because of lack of space around European cities. Belfast is by this interesting since it is one of Europe's most car-dependent cities. It is also embossed by past social unrest, which has put the city on hold in its development until the early 1990s.

The reason for car-dependence in Belfast is slightly different from other cities. Since citizens chose cars they're because of security reasons. Belfast has though under latter years had an expanding economy and building boom within the city-center.

But much that has been built so far in Belfast has been car-dependent with strictly land-use separated planning. This has further enhanced car-dependence within the city. The concept of The Compact city and Walkability could be tools to use when planning for new development is to be conducted.

Belfast Central station is an example of modernistic planning and how prioritization for pedestrians, cyclists and public transport. It is not only emissions that are the negative affect of car-dependence. It is also the amount of space it requires within the city. Roads within the city also create boundaries which pedestrians find it harder to cross. Often it is the speed of vehicles that makes it a safety issue as well.

Therefore it would be wise to rethink how we plan our cities especially when traffic is to be addressed. Traffic led development, which turns around and makes pedestrians top priority is interesting and has seldom been tried.

To mix-use in a new development is also important to limit transportation needs, which is the first priority. Second is conducting transport through more sustainable ways such as walking or public transport.

The central station in Belfast has importance for the city but also the whole of Northern Ireland. A new development, which is set to accomplish a high Walkability and mix-use within a context of single-use and car-dependence, can seem far-fetched. But as stated before even though it is just a small area within the city it can stand as an example and hopefully trigger a further more sustainable transport situation.

This work was about identifying key properties of how to address car-dependence in a small-scale perspective. Therefore the proposal is just a directional example of how Walkability, The Compact city and a higher Imagebility can be achieved.

Hopefully this work will create a broad guidance of how to deal with new developments in a car-dependent context.
6. Bibliography

6.1 Web sources  65
6.2 Printed  65-66
6.3 Maps and pictures  66
6. Bibliography

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