THE BRITISH INTERNATIONAL SCHOOL OF HOUSTON
SCHOOL CODE: ------

AN EXAMINATION OF THE FACTORS AFFECTING THE WALKABILITY OF RESIDENTIAL AREAS ALONG THE I-10 HIGHWAY IN HOUSTON, TX

BY MICHAEL ISAACS

ABSTRACT: 291
WORD COUNT WITHOUT ABSTRACT: 5218

EXTENDED ESSAY IB SUBJECT: GEOGRAPHY

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Contents

Acknowledgements

For transporting me to collect my data, and providing support throughout my essay process, my parents:

- Martin Isaacs
- Manju Isaacs

For helping me focus my research question, providing inspiration for data collection techniques and helping me to develop my essay with detailed feedback whenever I required it, my fantastic tutor:

- Mrs Bennett

Equipment and Software

Primary Data

Photography: Canon G5X Digital Camera
Weather Data: Netatmo WeatherStation + iPhone 6S
Traffic Counts: Dell XPS 15 9550

Secondary Data

Home values: trulia.com
Walk Scores: walkscore.com
Land Use Mapping Underlay: google.com/maps

Data Presentation and Essay Writing Software

Microsoft Word 2016
Microsoft Excel 2016
Google Earth
Adobe Photoshop CC
Google Chrome
Snagit 12
Snagit 12 Editor
Adobe Acrobat Pro DC

SECTION 0: ABSTRACT

WORD COUNT: 291

Abstract

After doing some research into just how important it is that a residential area is walkable, I became interested into whether walkability does have an effect on a given residential area, especially in the diversity of Houston. As a result, I decided to carry out this investigation to try and determine exactly what makes walking a more reasonable means of transport in some areas as opposed to others, in addition to seeing if there are actually any areas in Houston where walking is the transport method of choice.

In order to do so, I split Houston into six key segments that I wanted to investigate, each having completely different characteristics. I then went out to all of these areas to collect traffic data, so I could see which parts of Houston feature walking as the main method of transport, and where other areas favour the car. In addition to this, I collected land-use data, land value data, photographs and pre-existing 'WalkScore' data, to try and determine exactly what it is about some parts of Houston that make them more walkable than others. I also collected weather data in case climate was a reason that people weren't walking at certain points in the day; luckily, it didn't seem to be an affecting factor.

I was able to compile all of this data together and draw the conclusions that diversity of land use and mid value land are key to making an area walkable, along with prevalence of sidewalks, visual appeal and sometimes having a gated community for safety. I also was able to provide evidence that the geographical theory stating the benefits of walkability were indeed correct; the more walkable areas tended to be more economically active, and have lower crime rates.

SECTION 1: INTRODUCTION

WORD COUNT: 1298

List of Figures:

Location and Background Research

Houston is a large city in Texas, USA. Spread across a land area of 599.6 square miles, it is the largest city in the Southern United States. With a population of about 2.2 million people, it is also the most populous city in Texas and the fourth most populous in the United States. The greater Houston metropolitan area is home to over 6 million people, making it the fifth-most populated in the US. Because of its size, it contains a vast array of different types of residential areas; from apartments in downtown, to run down areas towards the East, to ultra-high-end homes. Due to this great diversity of people, economic status and land use throughout the city, Houston is a perfect site with a wide variety of factors affecting walkability which can be analysed.

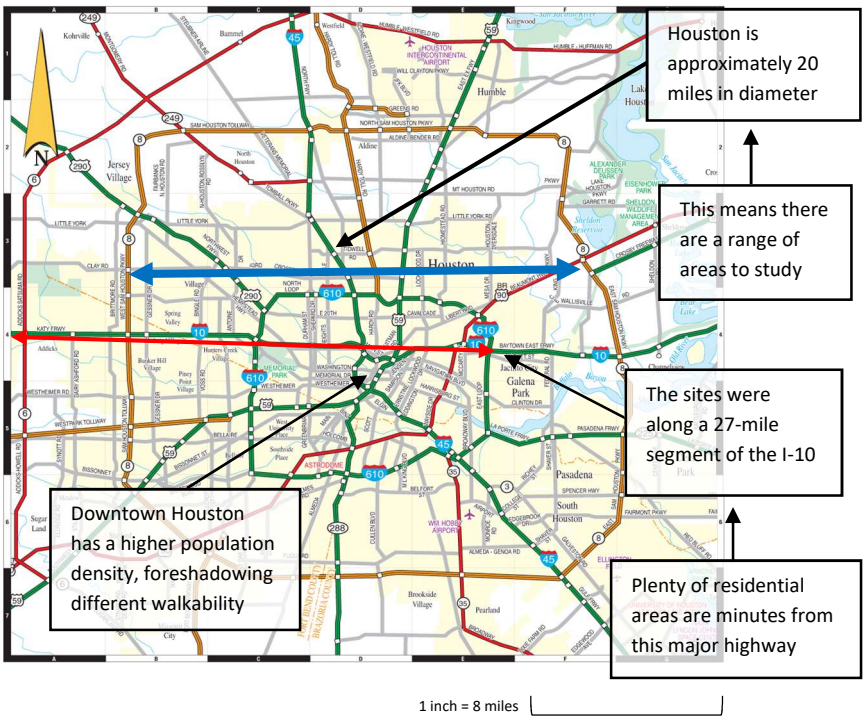


Figure 1.1: A map of Houston, Texas (Houston TX Map, n.d.)

The main secondary source I used for this investigation is Walkscore.com, a website which uses automated technology and algorithms to calculate a 'walk score', as to how reasonable it is to use walking as a primary method of transport for those living in a given area. According to their website, there are 7 key factors that make a neighbourhood walkable: (What Makes a Neighbourhood Walkable?, n.d.)

- **A centre:** Walkable neighbourhoods have a centre, whether it's a main street or a public space.
- **People:** Enough people for businesses to flourish and for public transit to run frequently.
- **Mixed income, mixed use:** Affordable housing located near businesses.
- **Parks and public space:** Plenty of public places to gather and play.
- **Pedestrian design:** Buildings are close to the street, parking lots are relegated to the back.
- **Schools and workplaces:** Close enough that most residents can walk from their homes.
- **Complete streets:** Streets designed for bicyclists, pedestrians, and transit.

My goal was to, through a combination of primary and secondary data, get a far more accurate interpretation of a residential areas than automated software could provide, thus determining the factors that really do make walking a more or less practical method of transport to use in the area.

Why the I-10?

The Interstate-10 is the fourth longest highway in all of America, running from the East Coast to the West. Due to Houston's nucleated structure, the majority of highways tend to be circular; running around downtown at various different distances. However, because the I-10 is used for multi-state driving, it would serve no purpose to run around the city, so it runs straight through it, almost touching the CBD in the heart of downtown. Because it flows directly through the middle of the city, I decided to use this as my basis for selecting sites; keep moving along the I-10 until the area changes in characteristic i.e. land use, land value etc. and then place a site there. I continued this until I felt I had six sites, each dramatically different from the last, which would give me a wide range of factors to analyse as to what really does affect walkability of an area. If all the sites were similar, and say, only land value changed, it wouldn't be as reliable or thorough an investigation, and wouldn't produce data that would meet my satisfaction. I did test other roads such as the 610 loop and 290 freeway, both of which are Houston only roads, but both faced the problem of not having as diverse sites, so I stuck with the I-10 as the basis for forming my sites.

Sub-Focus Questions + Hypotheses

1. How does the land use of the surrounding area affect the walkability of the selected site?
    - I believe that land use will have a dramatic effect on the walkability. If the surrounding area is just other houses, the chances are people are going to have to drive or cycle to get to their desired location. Alternatively, if the residential area has a close proximity to shops, offices, parks, leisure centres and other such services, people are going to be more willing to walk to these locations as they are so close.
2. Does the land value of a residential area affect its walkability?
    - Land value should theoretically have a significant impact on walkability. Wealthy people tend to cluster together in vast estates that are far away from any shops or offices, meaning that they would be more likely to drive to get to their desired location. Ignoring walkability, it would be more likely that wealthier areas would have less people walking anyway, since more people can afford a car
3. Are there any other key aspects of a site that help to improve its walkability?
    - I believe the design of the site will have a significant impact on its walkability. For example, areas with an abundance of sidewalks would be more walkable than one without. Additionally, visual appeal is another aspect to take into consideration. Neighbourhoods with plenty of open, green spaces and water bodies are going to make people want to go outside and enjoy their environment rather than just driving past it.

Why is walkability important throughout global society?

The benefits of walking are relatively well known around the world; we improve our bodies not only physically as we get fitter, but also mentally as walking enables people to enter a calm state. In a city like Houston, people living in the suburbs tend to be located very far away from any services such as shops and restaurants, so it can be difficult to stay active without specifically planning exercise into a schedule.

Despite its high level of importance, health is not the only advantage that makes living a walkable neighbourhood so critical. When urban areas encourage pedestrians to walk as opposed to having to drive/carpool everywhere, those who are not able to drive or don't want to drive have the freedom to not own a car, escaping the high costs that come with one. In addition to this, studies have shown that walkable neighbourhoods improve the average citizen's social behaviour. According to the American Journal of Public Health, pedestrian oriented neighbourhoods also increase social capital. (Social Capital and the Built Environment: The Importance of Walkable Neighborhoods, 2003). Social capital measures aspects such involvement with the local community, trust between neighbours etc. An increased social capital has been linked to better community health, reduced crime rates and sometimes even increased economic activity. In the end, the study found more walkable communities tend to experience a greater social capital. (Do you Walk?: Why Walkability is Important in Urban Areas, 2014).

In communities that have a higher walkability, residents are likely to walk to destinations including corner stores, restaurants, schools, places of worship, public parks and other destinations that are part of their regular routine. While walking about their neighbourhood, these residents can interact with their surroundings more regularly, therefore feeling more connected to and responsible for their community. This will increase the success of any schemes that are intended to support local businesses. Furthermore, by regularly walking in their communities, residents will also interact more frequently with their neighbours, creating a denser community network which can increase individual peace of mind, community trust and in some cases, can decrease crime rates.

What makes an area walkable?

In order to be walkable, a neighbourhood must include the different facilities necessary for regular life relatively near to the residential zones; if a neighbourhood only has housing, then it's not walkable because there's no reason to walk, a concept which is explored throughout this essay by analysing land use. It must also include an array of sidewalks exclusively for pedestrians or cyclists for the residents to be able to safely travel to these locations without a car. Therefore, if a neighbourhood combines housing, restaurants, shops and other local services such as libraries and places of worship, along with a network of sidewalks interlinking them all, residents will be able to meet their everyday needs on foot.

The Sites: Figure 1.2

Distance from the CBD means house prices are significantly lower

Next to popular high-end shopping centre, LaCenterra

WalkScore: 65

A prosperous settlement in Katy; towards the outskirts of Houston

Site 6: Cinco Ranch

Implies plenty of people would walk to this Shopping Centre

Not as affluent or prestigious as River Oaks

WalkScore: 57

A wealthy neighbourhood located next to Memorial City Mall

Site 4: Memorial Estates

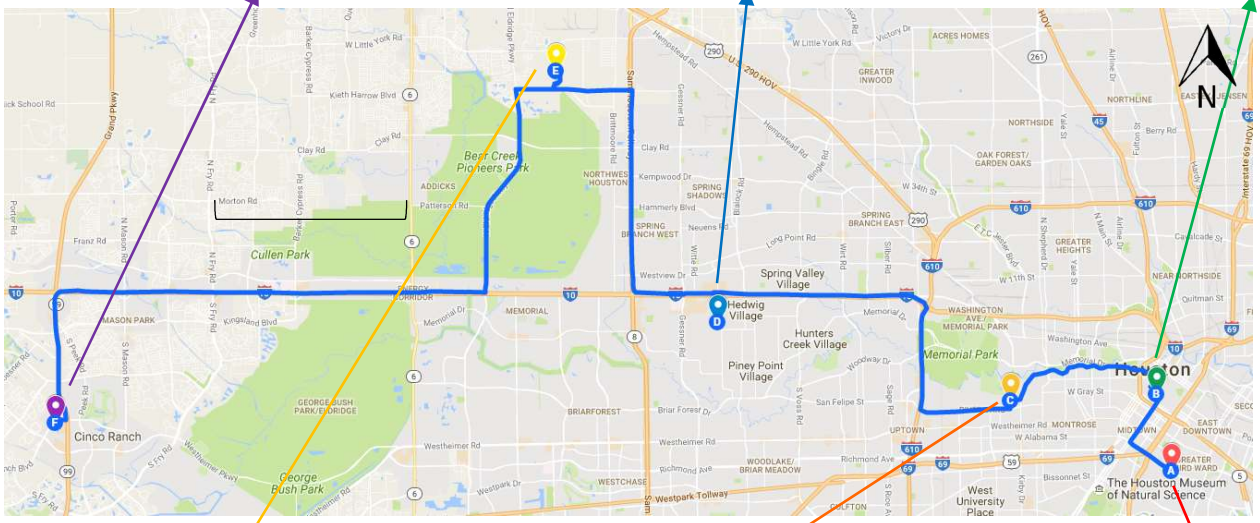
Located along Main St; offices, stores and restaurants minutes away

MetroRail; people take the tram and walk to their destination

WalkScore: 89

A brand new, 25 story residential complex in Downtown Houston

Site 2: SkyHouse Apartments



(Google Maps, n.d.)

WalkScore: 10

Contains several parks, swimming pools, large fountains and artificial lakes

Site 5: Lakes on Eldridge North (LOEN)

A recently constructed gated community near Houston's Energy Corridor

Sidewalks within the neighbourhood, but none once you leave

WalkScore: 66

Due to the abundance of estates, few stores are nearby

Site 3: River Oaks

Houston's most prosperous residential zone; massive, multimillion dollar estates

Estates are seconds away from the River Oaks Country Club

WalkScore: 74

There is a nearby school and plenty of sidewalks

Site 1: The 3rd Ward

One of Houston's most neglected residential areas

Low-rent houses and high crime rates characterise the area

SECTION B: METHODS OF DATA COLLECTION

WORD COUNT: 817

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Methods of Data Collection

How were the sites selected?

Because the I-10 is a straight road that runs through Houston, I used a linear sampling method to ensure I collected data from a wide range of sites along the highway. To achieve this, I split the area I was studying into six main segments, or "regions"; each characterising a completely different type of residential life. I believed having six different regions would allow me to determine a wide range of factors that could determine a site's walkability, as all the sites were so different.

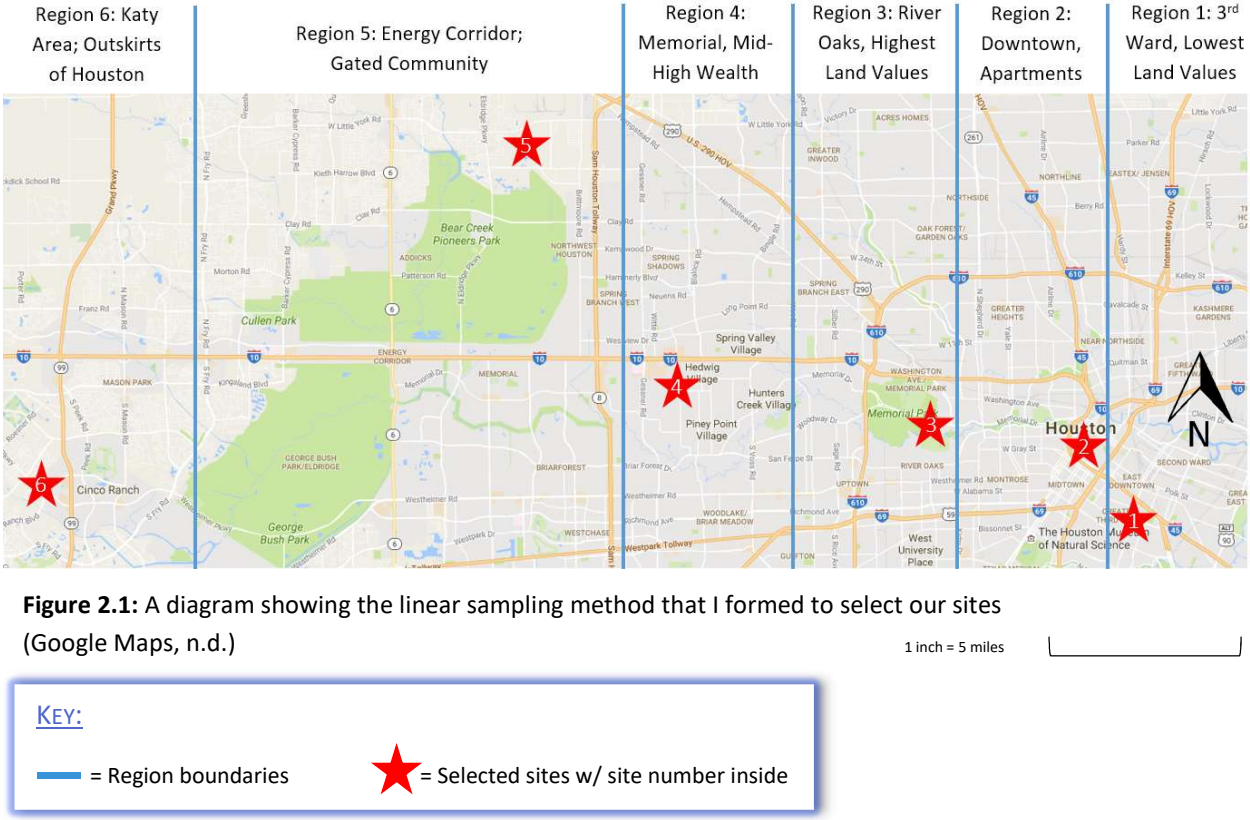


Figure 2.1: A diagram showing the linear sampling method that I formed to select our sites (Google Maps, n.d.)

What Happened?

On both days of data collection, I was driven to each site individually to collect my primary data. I spent about 30 minutes at each of the sites, which was plenty of time to explore, get a feel for the site's characteristics and collect my necessary data. Throughout the investigation, I stayed in the safety of my car to avoid any potential conflict or theft in low-rent areas. Data was collected on two days in case there were any anomalies during the first day of data collection.

Breakdown of Primary Research Tasks

LAND USE MAPPING [TO SUPPORT SUB-FOCUS QUESTION 1]

1. GIS was used to research and select specific sites along the Interstate-10 to create a linear sample.

2. The site was explored to determine the various uses of different pieces of land

3. Blank, overhead maps from google earth were used to annotate the different uses of the land by hand – including different types of residences, offices and shops

4. After the data was collected, a colour coordinated key was formed to create a visual representation of the different land uses in downtown Houston.

5. Photoshop was used to superimpose layers of colours on top of the blank maps which matched the key, to help improve the readability and accuracy of the maps.

Figure 2.2: An example of the raw land use data collected [Site 2, SkyHouse Apartments]
Underlying Map Source: google.com

Traffic Counts [To Support all Sub-Focus Questions]

1. Over a period of 10 minutes, each of the following types of traffic were counted at each site individually:
   - Cars
   - Buses
   - Metros
   - Cyclists
   - Pedestrians (commuters i.e. in business clothing, briefcases etc.)
   - Pedestrians (athletes i.e. in sports clothing, running etc.)

2. This was made accurate via the use of my laptop; directly adding traffic seen directly to the table with just one button, helping prevent miscounts

3. This was then repeated on a second day to obtain the most reliable results, but because they were so similar, I just took an average for each value using the data from both days

Type of Transport	**Number counted**
Car	36
Bus	1
Metro	6
Cycling	6
Walking (commute)	168
Walking/running (exercise)	0

Figure 2.3: The raw data collected for the traffic counts at Site 2 [SkyHouse Apartments] on Day 1

PHOTOGRAPHS [TO SUPPORT ALL SUB-FOCUS QUESTIONS]

At each site, I took a wide variety of photos in order to capture virtually every element of the site imaginable. However, because it would be quite repetitive to analyse every photo, I selected 2 photos of each site; one of the general area, and one of a typical house you might find in the area. This was important, because in areas such as Memorial Estates, the neglected, overgrown surrounding area did not reflect the multi-million dollar houses contained within.

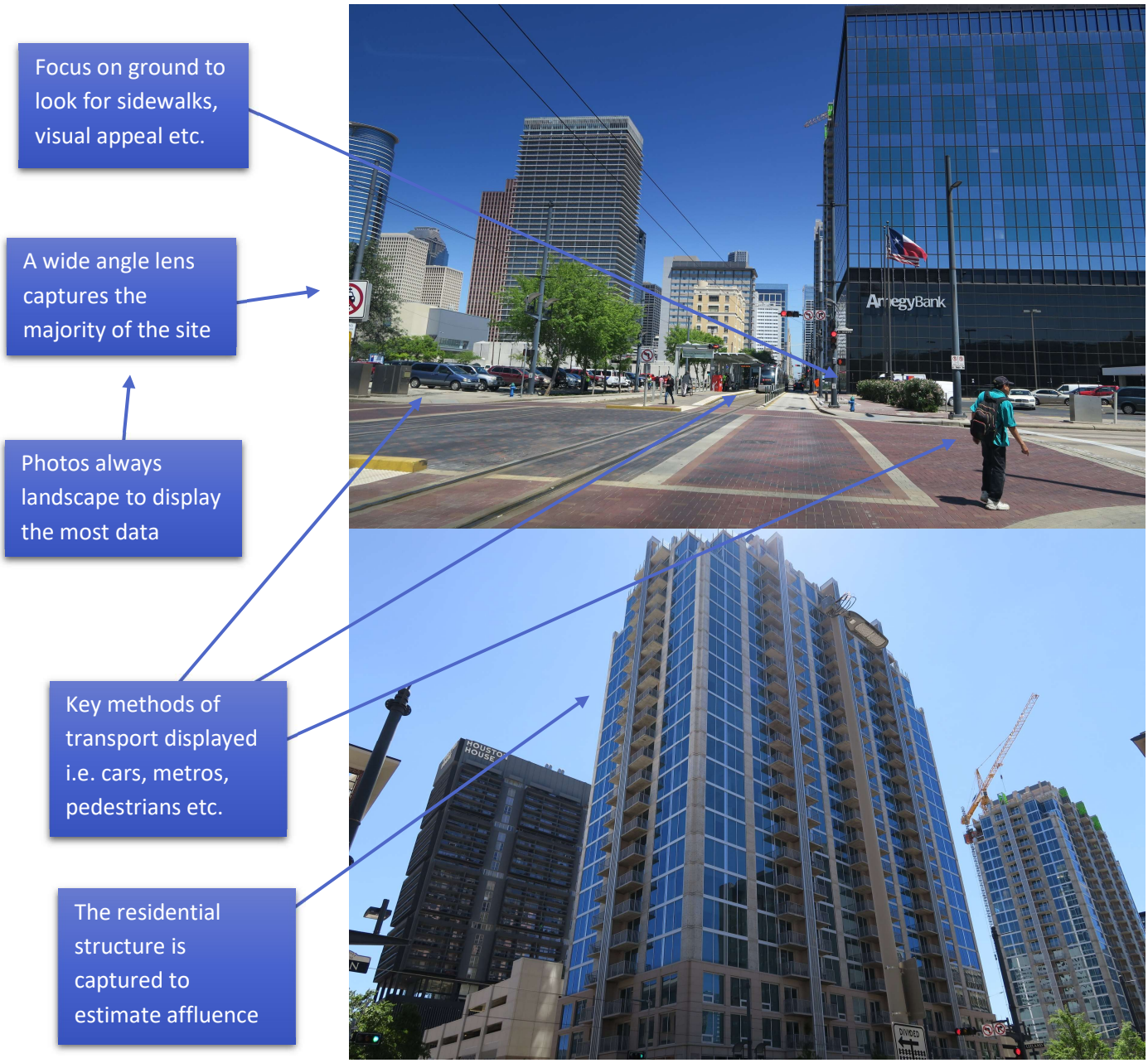


Figure 2.4: How I strategically captured and selected photographs to help analysis

WEATHER DATA [TO SUPPORT SUB-FOCUS QUESTION 3]

I held my weather station outside for 5 minutes, to obtain the most accurate weather data possible; it was being recorded at my exact location and was up to date, as opposed to using old data from weather stations miles away. I then simply recorded this data by typing it into a table on my computer

Figure 2.5: How weather data is obtained by Netatmo (Knightwise, 2015)

Secondary Research

HOUSE PRICES [TO SUPPORT SUB-FOCUS QUESTION 2]

This was a fairly difficult study to carry out, since it would obviously not be ethically correct to go up to various people's homes and ask how much they paid for it. Additionally, unless I went to every property in the site, I would not get an accurate measurement for the average house price; this can vary dramatically by road, swimming pool, house size etc as opposed to just location. Furthermore, we have to take into consideration the year the data is coming from; the price a house sold for in 1990 will not reflect the price it is worth today. To combat all of these issues, I carefully selected my secondary source to be trulia.com. There were three main reasons for this, all of which are features not available on other sites:

1. Trulia only uses actual sold prices, not predicted home values
2. With Trulia, I could set the perimeter for the average house price, so I obtained data exactly within my site, nothing more or less
3. I was also able to choose the time range for the average home sell price; to keep the data the most relevant, I chose only in 2016

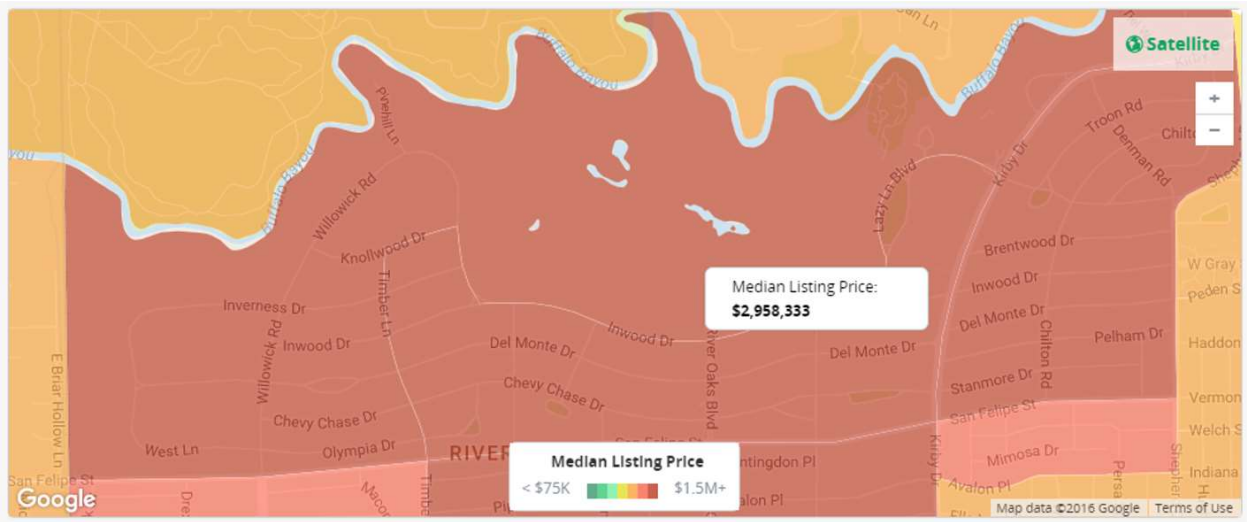


Figure 2.6: A screenshot of trulia.com

WALK SCORES [TO SUPPORT ALL SUB-FOCUS QUESTIONS]

Obtaining the walk scores was a fairly simple process. I simply went to walkscore.com and entered the address of my site, where the score was displayed prominently.

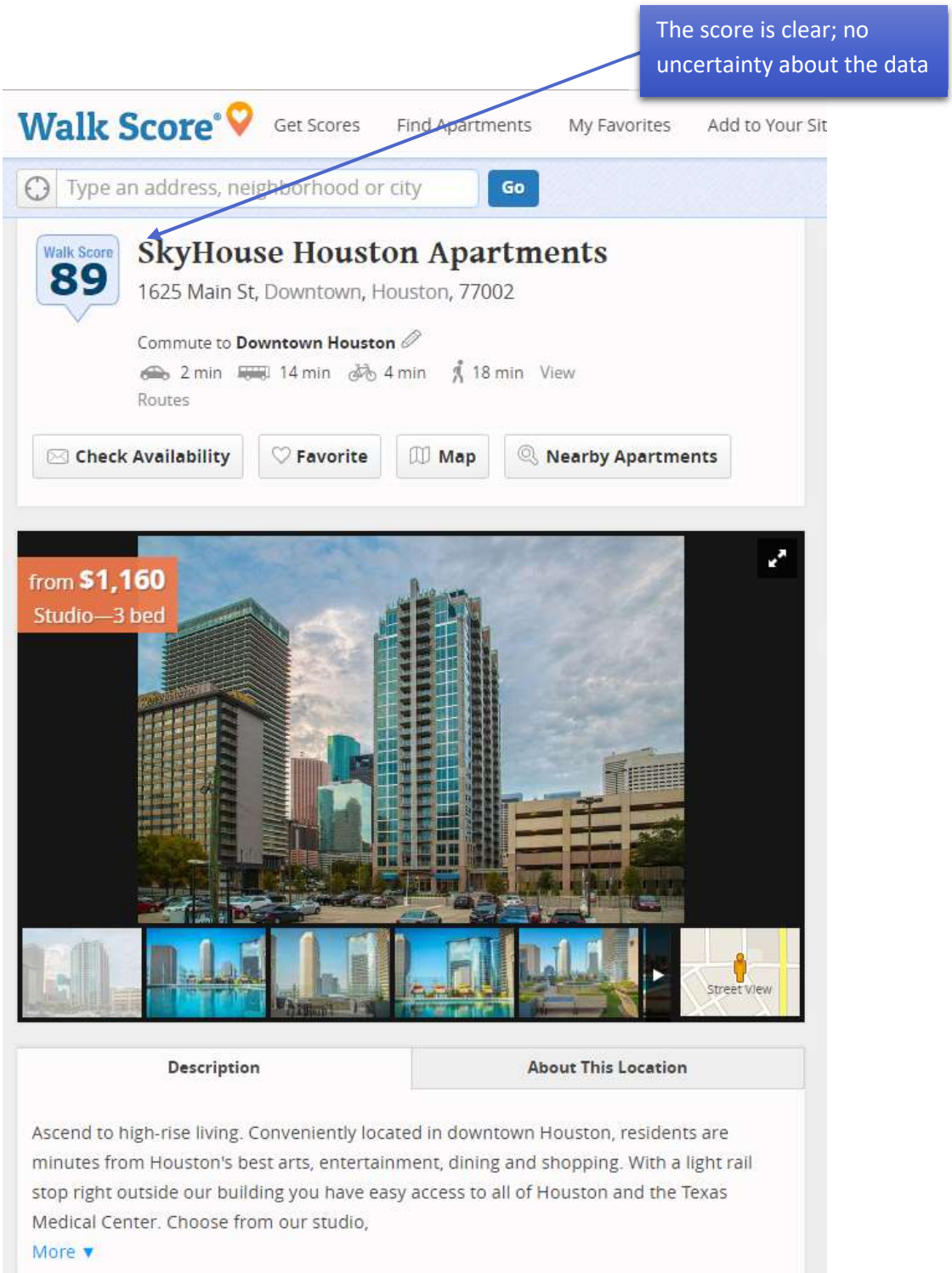
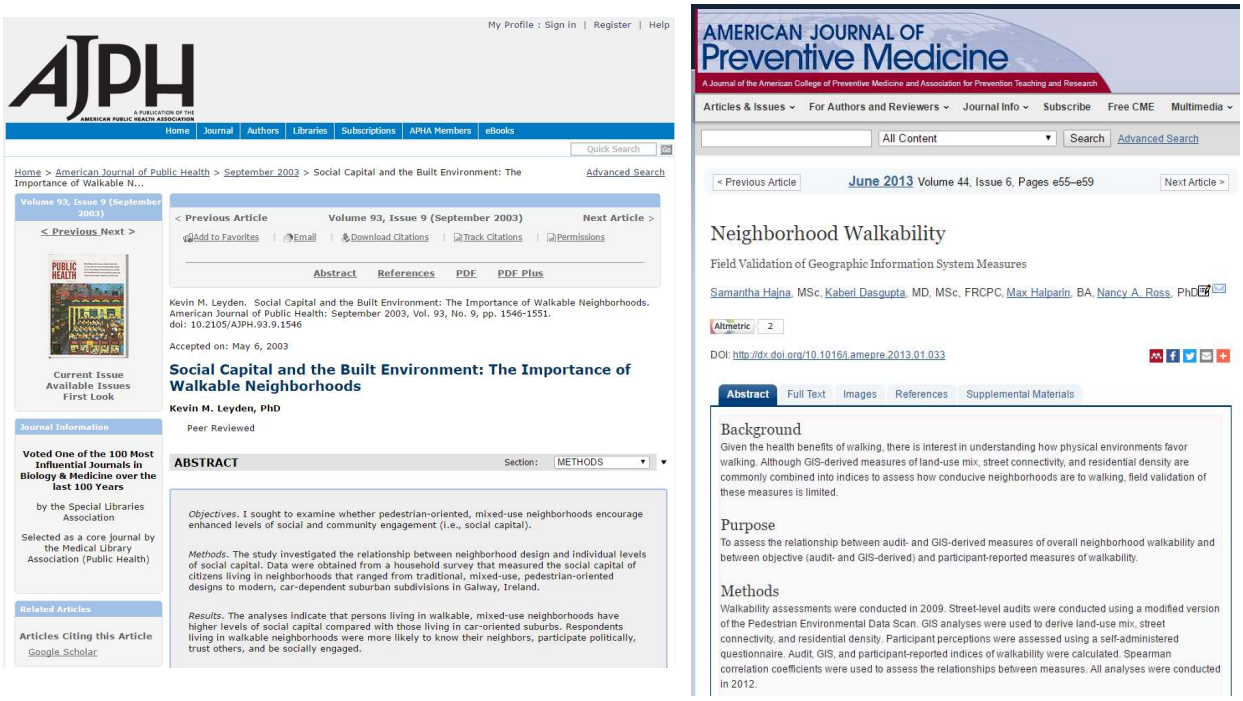


Figure 2.7: A screenshot of walkscore.com

THE IMPORTANCE OF WALKABILITY

Obviously, this study would be meaningless unless there was some kind of geographical theory behind walkability, and why it is important. Since I obtaining this data through primary research would be a whole different investigation, I collected secondary data by searching google scholar and several other search engines, finding several key pieces of information that would demonstrate why walkability is indeed important in our society.



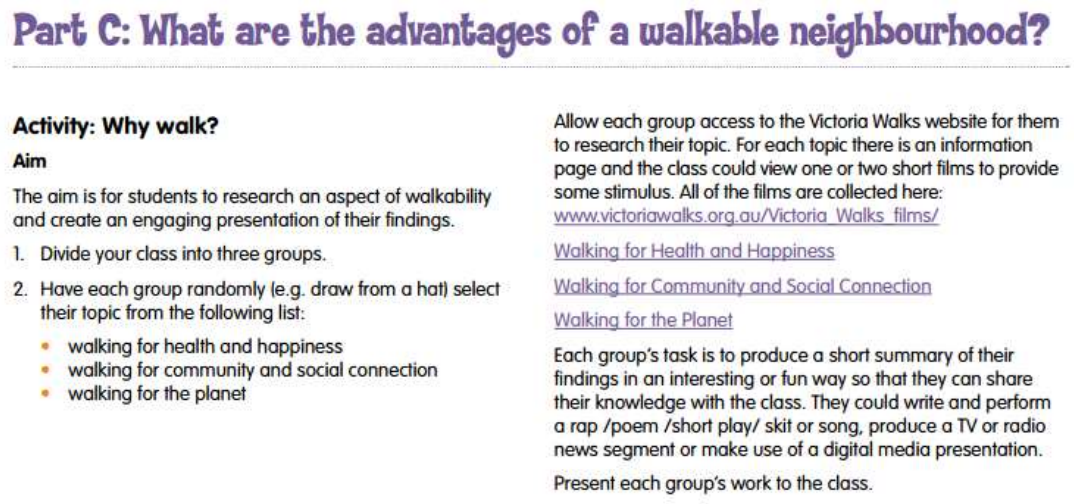


Figure 2.8: Screenshots of several secondary sources used to collect data regarding the importance of walkability

SECTION C: DATA PRESENTATION

WORD COUNT: ---

List of Figures:

FIGURES 3.1.1 TO 3.1.6

Land Use Mapping

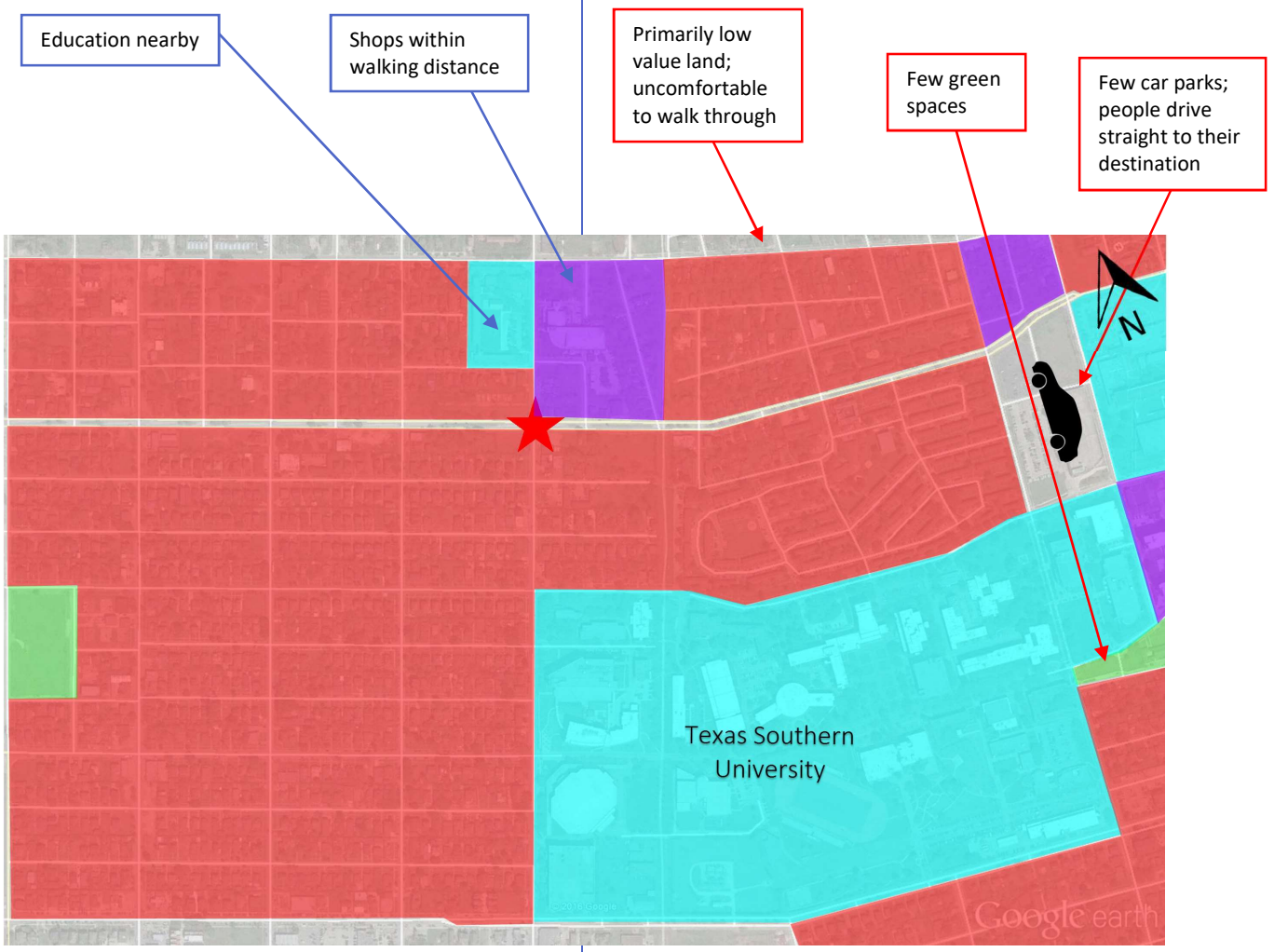
Source for all underlying maps: google.com

Figure 3.1.1: Site 1 – The 3rd Ward

Characteristics that improved walkability

WalkScore: 74

Characteristics that decreased walkability



1 inch = 1000ft

Colour	Category of Area
	Low Value Residential ($100-249k)
	Mid Value Residential ($250-999k)
	High Value Residential (>$1 million)
	Other Residential (Apartments, Condos)
	Parks/Green Spaces
	Leisure (Gyms, Country Clubs)
	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

Figure 3.1.2: Site 2 – SkyHouse Apartments

Characteristics that improved walkability

WalkScore: 89

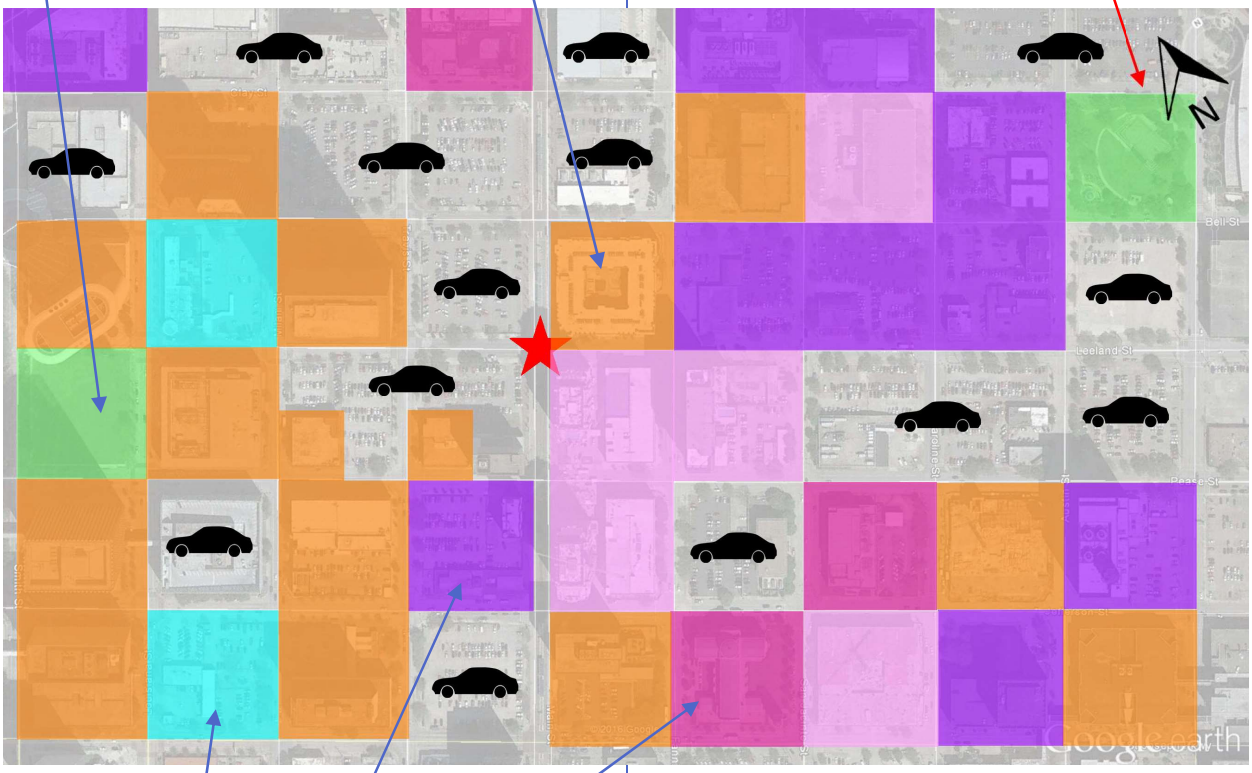
Characteristics that decreased walkability

Several distinct green spaces and parks

Plenty of carparks; people leave their cars behind and walk

Offices next to residences

Few water bodies; could be more visually appealing



Land use diversity; various types of places near each other

Shops near residences

School just two blocks away from apartment towers

Leisure centres within walking distance

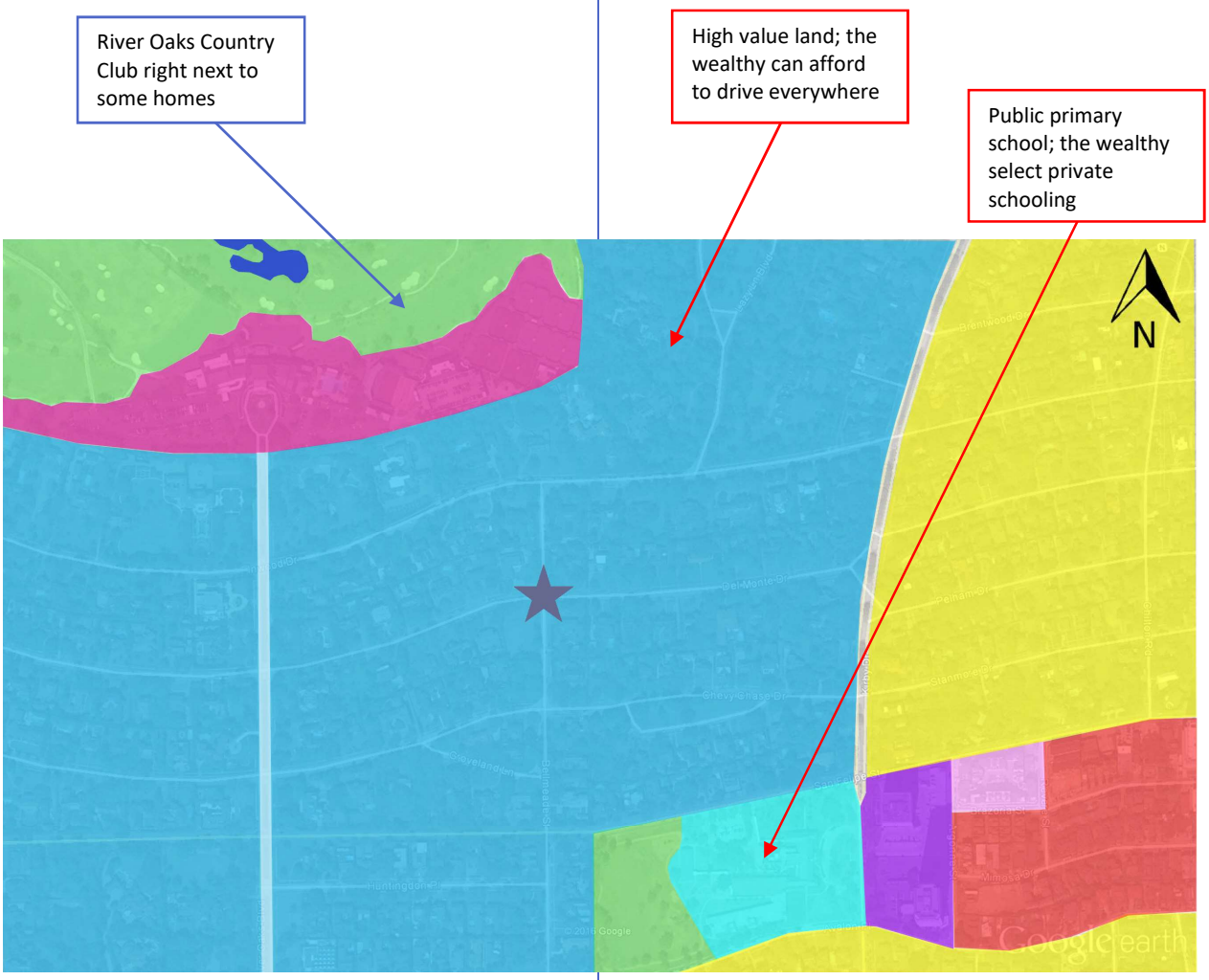
Colour	Category of Area
	Low Value Residential ($100-249k)
	Mid Value Residential ($250-999k)
	High Value Residential (>$1 million)
	Other Residential (Apartments, Condos)
	Parks/Green Spaces
	Leisure (Gyms, Country Clubs)
	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

Figure 3.1.3: Site 3 – River Oaks

Characteristics that improved walkability

WalkScore: 66

Characteristics that decreased walkability



Colour	Category of Area
	Low Value Residential ($100-249k)
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	Parks/Green Spaces
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	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

Figure 3.1.4: Site 4 – Memorial Estates

Characteristics that improved walkability

WalkScore: 57

Characteristics that decreased walkability

Large shopping centre right next to housing

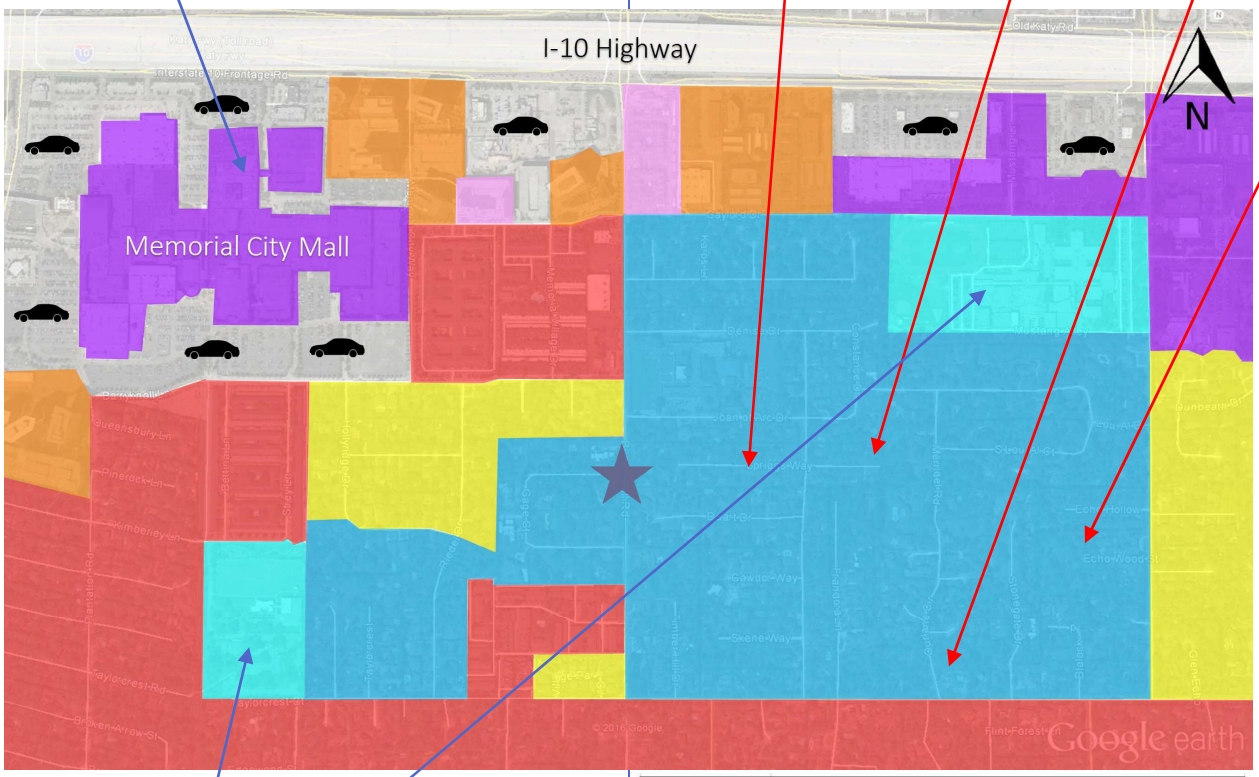
The only path to the mall

The wealthy don't want to walk through low income areas

High income families can afford to drive everywhere

Large areas of low land value; unsettling

No green spaces



Schooling right in the middle of the residential areas

Colour	Category of Area
	Low Value Residential ($100-249k)
	Mid Value Residential ($250-999k)
	High Value Residential (>$1 million)
	Other Residential (Apartments, Condos)
	Parks/Green Spaces
	Leisure (Gyms, Country Clubs)
	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

Figure 3.1.5: Site 5 – Lakes on Eldridge North

Characteristics that improved walkability

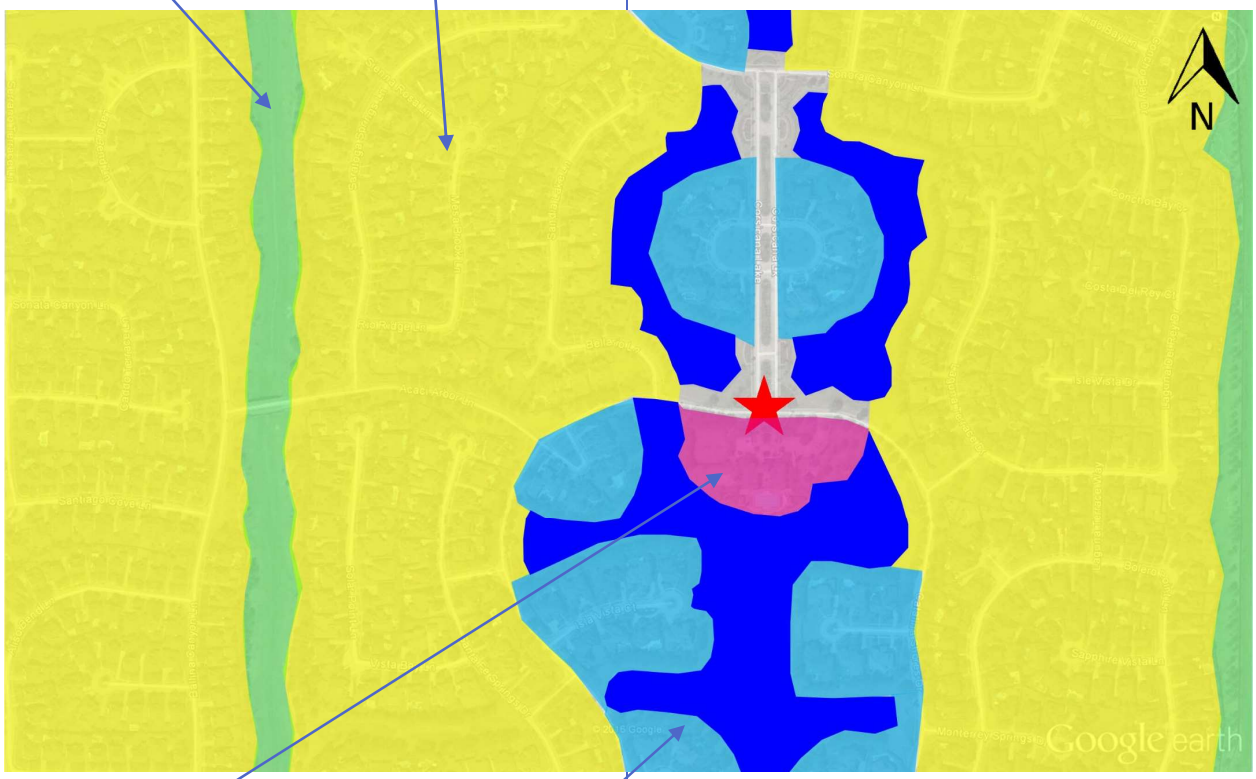
WalkScore: 10

Characteristics that decreased walkability

Green spaces along pavements add visual appeal

Mid wealth land; people enjoy walking with peace of mind

No shops, offices or education nearby



1 inch = 700ft

Private, resident exclusive clubhouse within walking distance

Water bodies add to the beauty of the neighbourhood

Colour	Category of Area
	Low Value Residential ($100-249k)
	Mid Value Residential ($250-999k)
	High Value Residential (>$1 million)
	Other Residential (Apartments, Condos)
	Parks/Green Spaces
	Leisure (Gyms, Country Clubs)
	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

Figure 3.1.6: Site 6 – Cinco Ranch

Characteristics that improved walkability

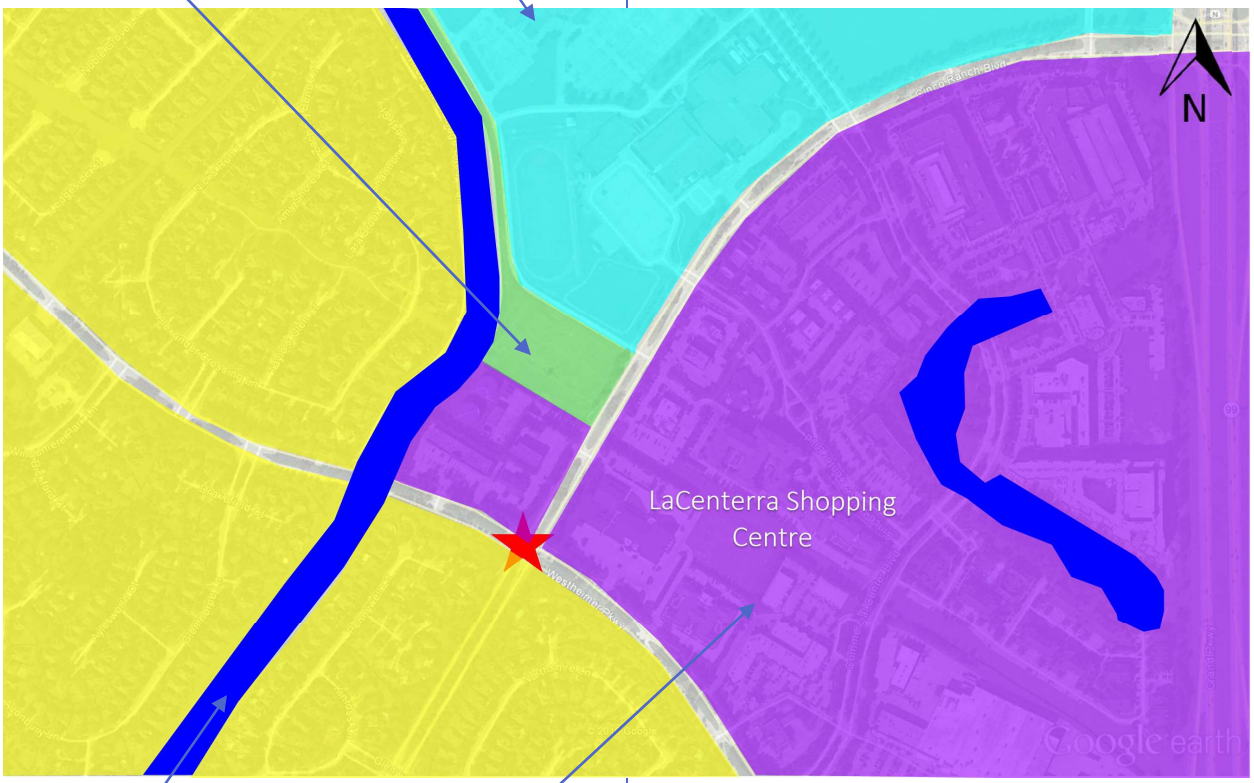
WalkScore: 65

Characteristics that decreased walkability

Green spaces encourage residents to step outside

School just across a bridge from housing

No offices in the area; people have to drive to work



1 inch = 1000ft

River adds visual appeal

Enormous retail centre right next to housing

Colour	Category of Area
	Low Value Residential ($100-249k)
	Mid Value Residential ($250-999k)
	High Value Residential (>$1 million)
	Other Residential (Apartments, Condos)
	Parks/Green Spaces
	Leisure (Gyms, Country Clubs)
	Work (Offices, Banks)
	Water Bodies
	Shops, Restaurants etc
	School/Education
	Car Parks
	Exact Site Location

FIGURES 3.2.1 TO 3.2.6

Photographs

Figure 3.2.1: Site 1 – The 3rd Ward

Characteristics that improved walkability

WalkScore: 74

Characteristics that decreased walkability

Convenience stores just opposite housing

School zone; education within walking distance

Few parking spaces; cars park on the road

Plenty of sidewalks encourage walking

Overgrown shrubbery makes some sidewalks harder to navigate

Quite a lot of litter; discarded, not pleasant to walk around

Low land values suggest high crime rates; unsafe for walking

Few public green spaces or parks

Graffiti; neglected, uncared for

Figure 3.2.2: Site 2 – SkyHouse Apartments

Characteristics that improved walkability

WalkScore: 89

Characteristics that decreased walkability

Major offices and banks metres away from the apartments

Narrow roads; driving is not the ideal method of transport

Incredibly clean, well kept, visually appealing area

Modern, high-rise buildings imply mid wealth residents

Continuous redevelopment; the area plans to stay beautiful

Multi-story car parks encourage people to stop driving and walk

The highly efficient, incredibly popular MetroRail service

The inexpensive trams are convenient; people tend to walk less

Figure 3.2.3: Site 3 – River Oaks

Characteristics that improved walkability

WalkScore: 66

Characteristics that decreased walkability

Plenty of sidewalks; walking is a possibility

Extremely well-manicured area; nice to look at/walk through

The majority of the traffic actually came from estates' staff

They live far away in low rent neighbourhoods

Driving is their only way to reach here

The wealthy like to stay secluded in their vast estates

Driving expensive automobiles is preferable to walking in the heat

Figure 3.2.4: Site 4 – Memorial Estates

Characteristics that improved walkability

WalkScore: 57

Characteristics that decreased walkability

None!

Poorly trimmed trees/shrubs

No sidewalks whatsoever

People never want to leave their state-of-the-art homes

Gated driveways make it clear that car use is common

This path only runs in front of one house

Figure 3.2.5: Site 5 – Lakes on Eldridge North

Characteristics that improved walkability

WalkScore: 10

Characteristics that decreased walkability

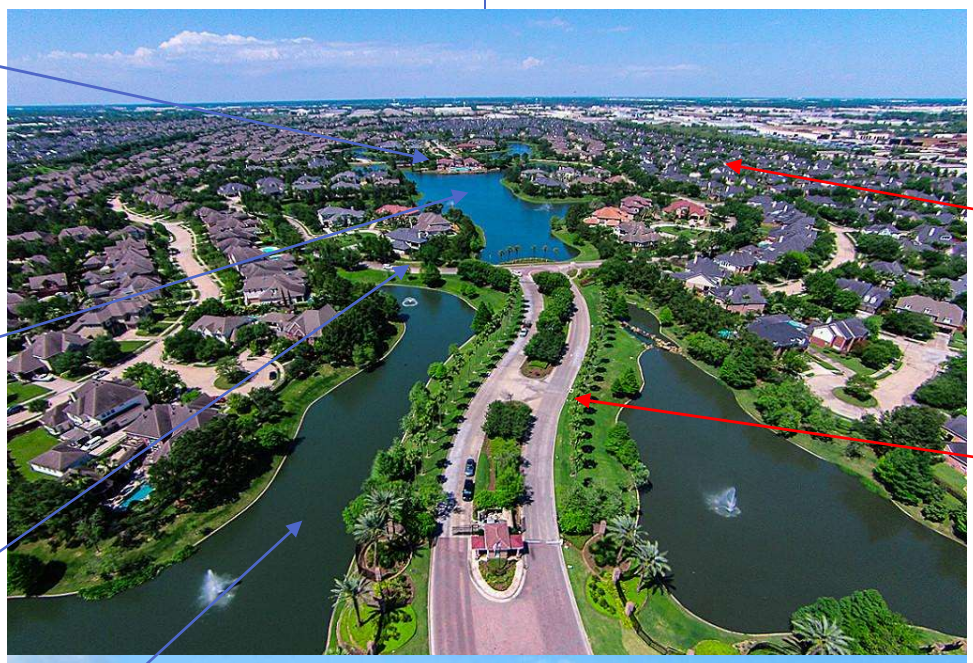
Clubhouse with pool and gym near all the houses

A very aesthetically appealing master planned community

Sidewalks around the lake encourage exercise for the views

Large water bodies with fountains add further visual interest

Tropically landscaped gardens are nice to walk past



Primarily housing; few shops or offices nearby

No sidewalks leading outside; residents are expected to drive

Top Photo: (HAR Images, n.d.)

Figure 3.2.6: Site 6: Cinco Ranch

Characteristics that improved walkability

WalkScore: 65

Characteristics that decreased walkability

Well lit; people are encouraged to walk and enjoy nightlife

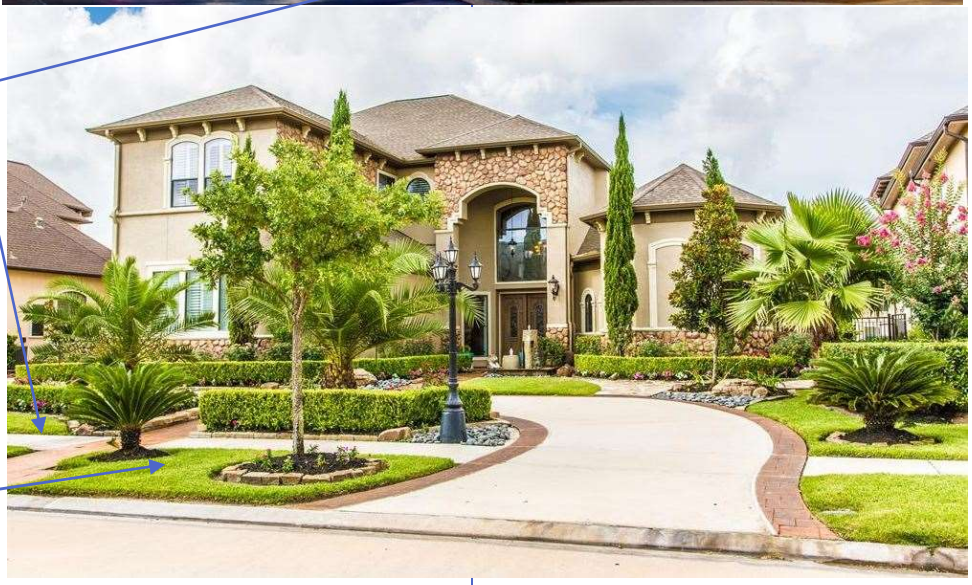
A wide array of shops for pedestrians to explore

Sidewalks throughout LaCenterra and outside homes

Well kept, clean area

Few offices nearby; people have to drive to work

LaCenterra is far away from some homes; people must drive



Top Photo: (LaCenterra, n.d.)

FIGURES 3.3.1 TO 3.3.5

Traffic Counts

Figure 3.3.1: Traffic Counts on Day 1

Site	Pedestrian Commuters	Athletes	Cars	Buses	Metros	Cyclists
3rd Ward	9	1	88	3	0	0
SkyHouse	168	0	36	1	6	6
River Oaks	0	0	15	0	0	0
Memorial	0	0	123	0	0	0
LOEN	17	48	42	0	0	15
Cinco Ranch	76	11	103	1	0	5

Figure 3.3.2: Traffic Counts on Day 2

Site	Pedestrian Commuters	Athletes	Cars	Buses	Metros	Cyclists
3rd Ward	6	0	94	5	0	2
SkyHouse	189	0	34	2	6	9
River Oaks	0	0	6	0	0	0
Memorial	0	0	93	0	0	1
LOEN	11	35	23	0	0	22
Cinco Ranch	86	14	94	1	0	3

Figure 3.3.3: Average Traffic Counts

Site	Pedestrian Commuters	Athletes	Cars	Buses	Metros	Cyclists
3rd Ward	8	1	91	4	0	1
SkyHouse	179	0	35	2	6	8
River Oaks	0	0	11	0	0	0
Memorial	0	0	108	0	0	1
LOEN	14	42	33	0	0	19
Cinco Ranch	81	13	99	1	0	4

Figure 3.3.4: A Graph Displaying the Average Traffic Counts

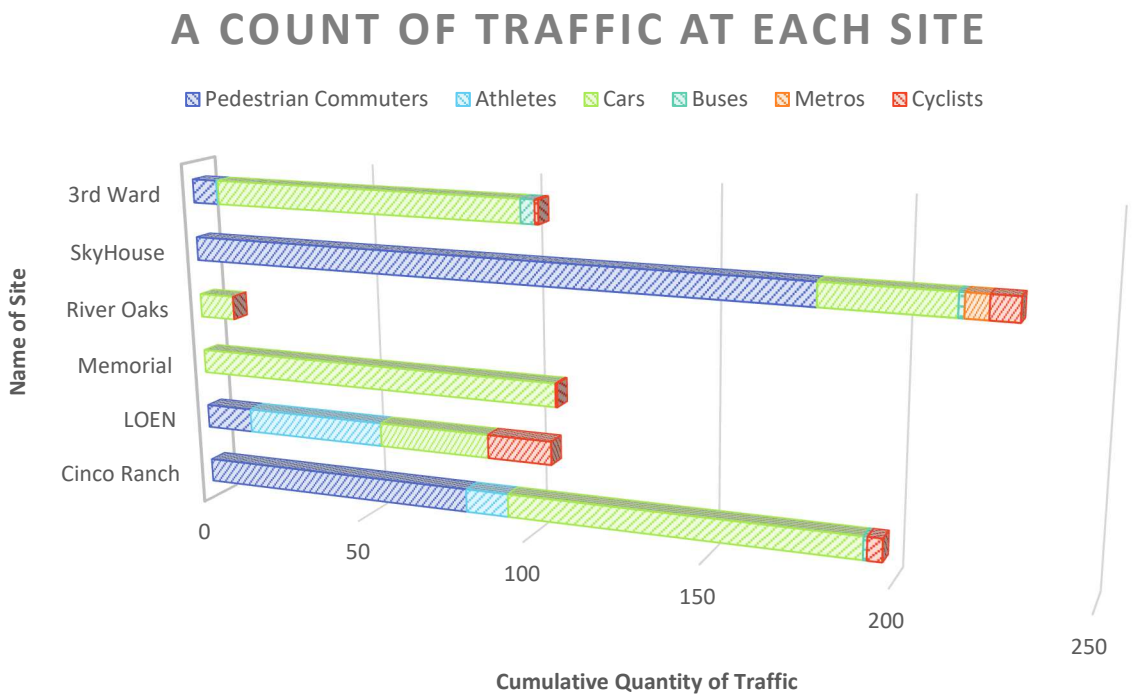
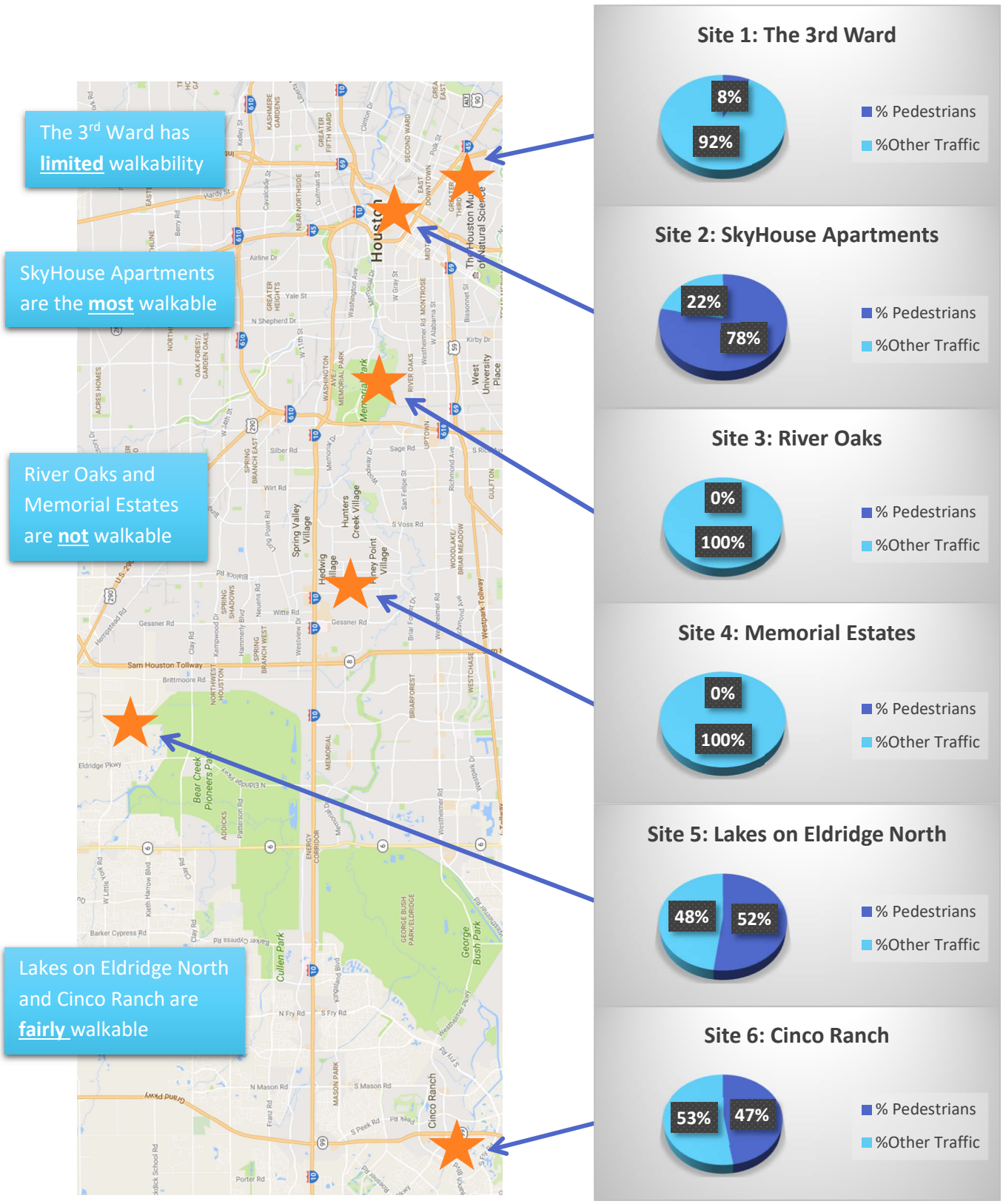


Figure 3.3.5: The % Pedestrians at each site



FIGURES 3.4.1 TO 3.4.4

Weather Data

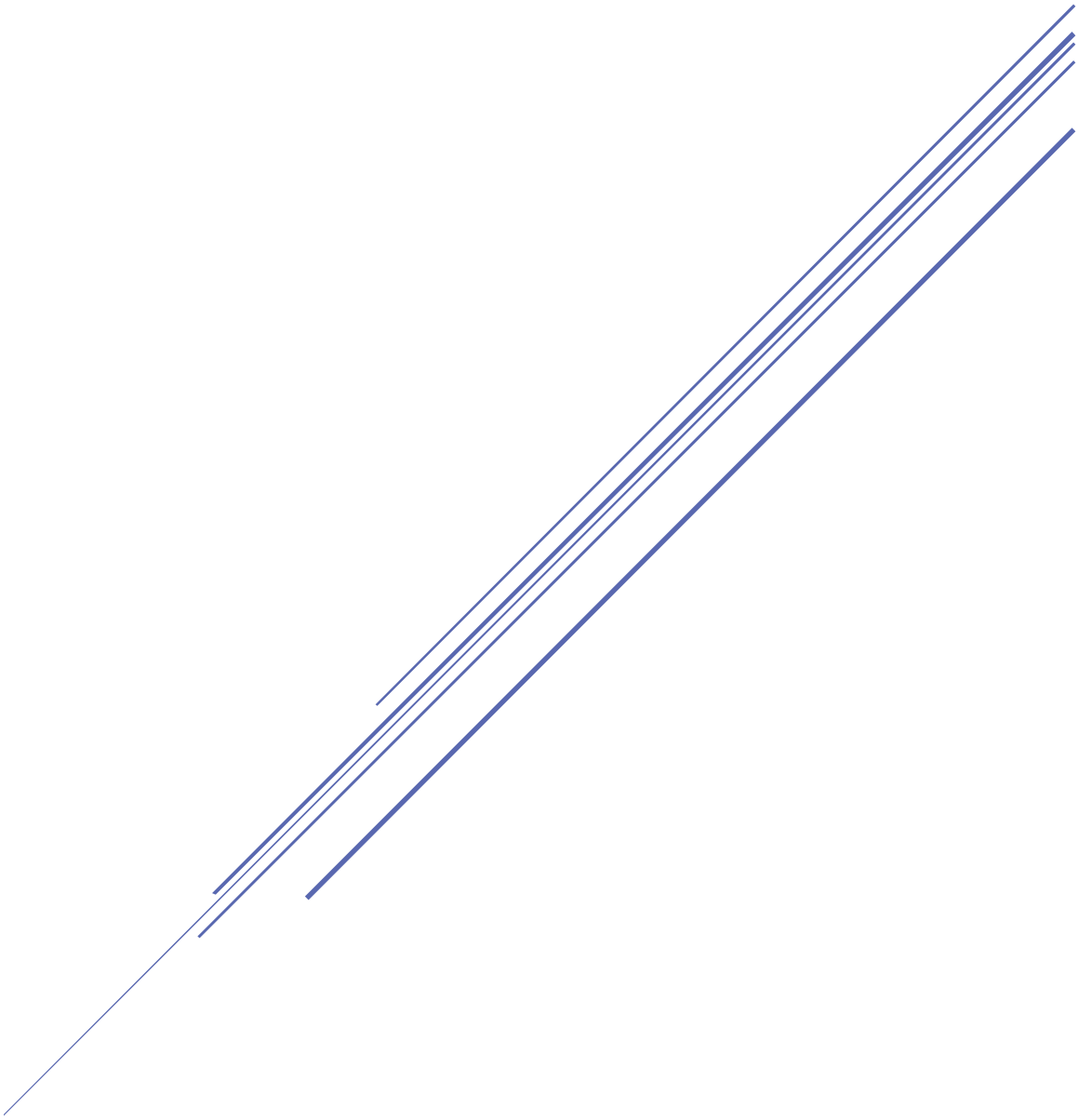


Figure 3.4.1: The Average Climate at each Site

Site	Actual Temperature (°C)	Feels like Temperature (°C)	Precipitation (%)	Humidity (%)	Cloud Coverage (%)
3rd Ward	25	28	0	50	0
SkyHouse	26	33	0	35	0
River Oaks	27	34	0	33	0
Memorial	27	27	0	29	0
LOEN	26	27	0	31	0
Cinco Ranch	25	26	0	27	0

Figure 3.4.2: A Graph Displaying the Average Climate at Each Site

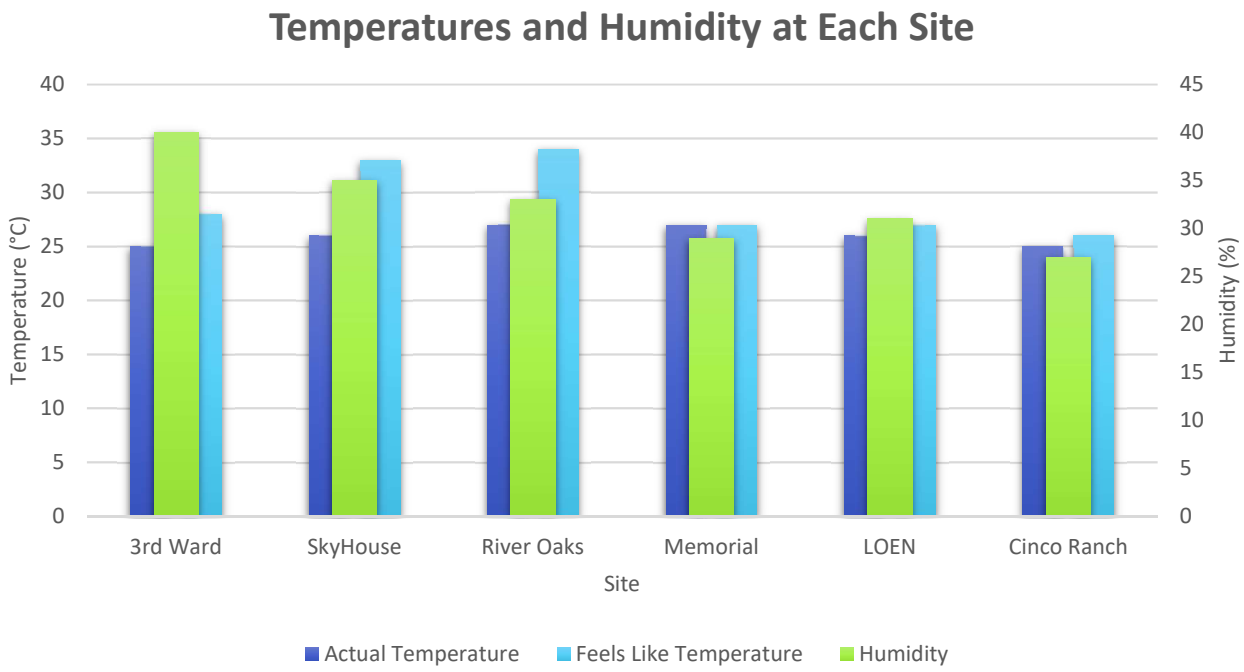
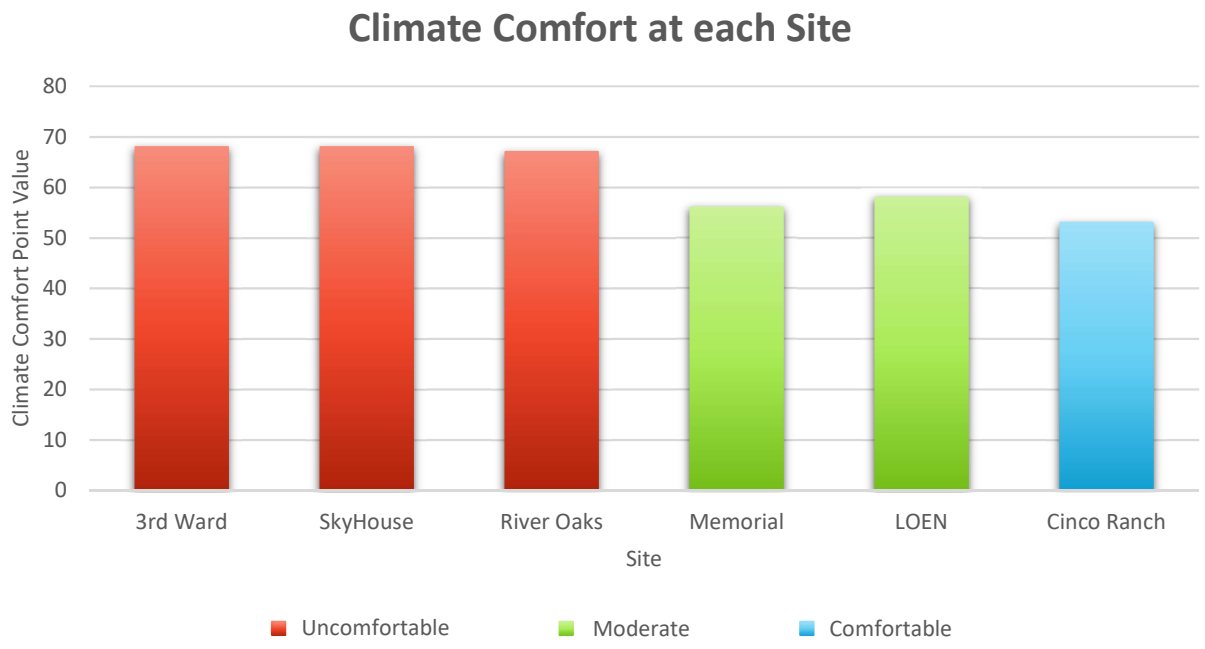


Figure 3.4.3: The Climate Comfort at Each Site

Site	Feels like Temperature (°C)	Humidity (%)	Climate Comfort (Humidity + Temperature, Higher = Less Comfortable)
3rd Ward	28	50	68
SkyHouse	33	35	68
River Oaks	34	33	67
Memorial	27	29	56
LOEN	27	31	58
Cinco Ranch	26	27	53

Figure 3.4.4: A graph of Climate Comfort at Each Site



FIGURES 3.5.1 TO 3.5.2

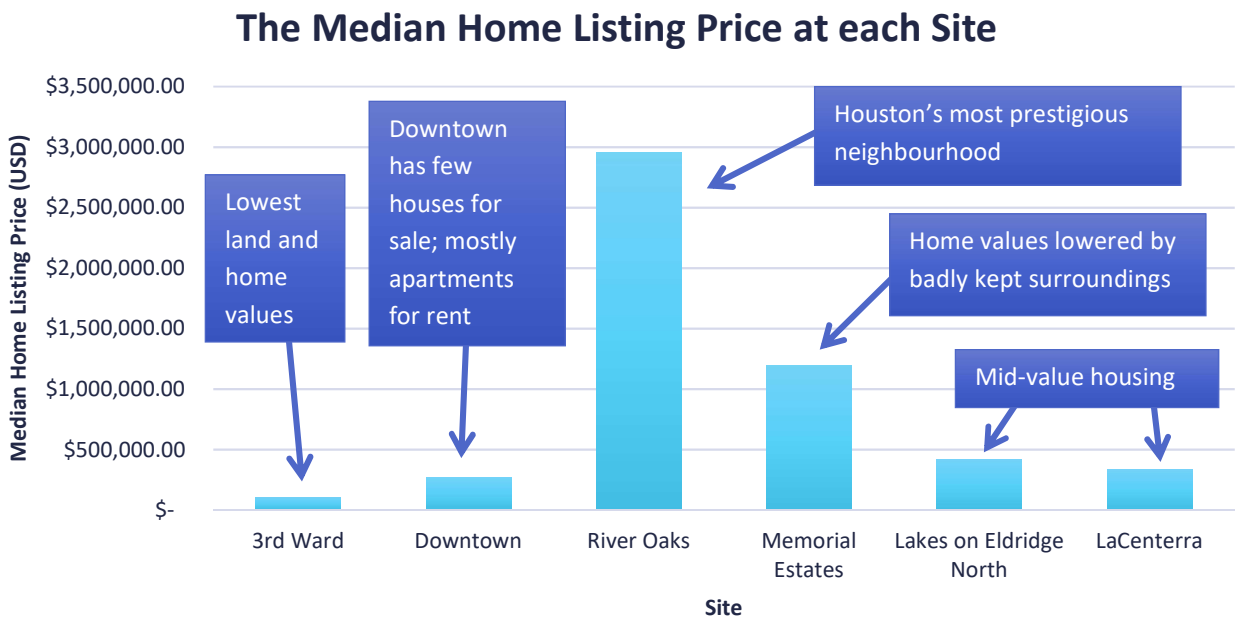
Land Values

Figure 3.5.1: Median Home Sale Prices

Site	**Median Home Sale Price (USD)**
3rd Ward	$106,000.00
SkyHouse	$271,800.00
River Oaks	$2,958,333.00
Memorial	$1,193,750.00
LOEN	$423,450.00
Cinco Ranch	$339,000.00

(Trulia US Home Prices, 2016)

Figure 3.5.2: A graph of Median Home Listing Prices



FIGURES 3.6.1 TO 3.6.2

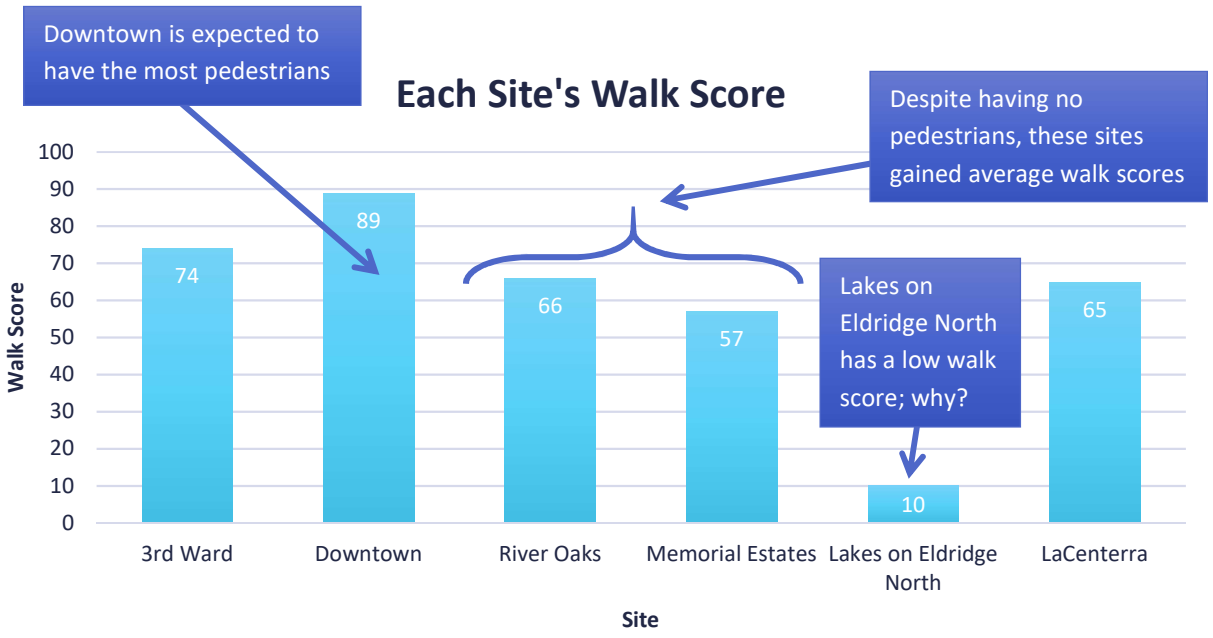
Walk Scores

Figure 3.6.1: Walk Scores

Site	Walk Score
3rd Ward	74
SkyHouse	89
River Oaks	66
Memorial	57
LOEN	10
Cinco Ranch	65

(Walk Score, 2016)

Figure 3.6.2: A graph of Walk Scores



SECTION D: DATA ANALYSIS

WORD COUNT: 1884

Sub Focus Question 1

How does the land use of the surrounding area affect the walkability of the selected site?

Land use does indeed have a major effect on walkability, and there is a key pattern we can identify; for an area to be walkable, it needs to have a great land use diversity. Site 2 is a perfect example of this; not only did it have the highest walk score, but as shown in **Figure 3.3.5**, it had the greatest proportion of foot traffic by a long way, at 78%. Furthermore, we can tell this isn't just an anomalous result produced by a low population density; **Figure 3.3.4** displays that more than 200 counts were made. If we observe **Figure 3.1.2**, we see that the land use around the SkyHouse apartments is by far the most diverse. Almost every grid square has a different purpose, including offices, shops, restaurants, green spaces, schools, leisure centres and more. The key point is that, unlike some sites, the entire surrounding area is not just clustered with houses. While the exact site is a residential area; three apartments clustered together, the fact that the surrounding area is so diverse enables people to be able to walk to most places they would need to visit, thus increasing the site's walkability.

Land use in Site 1, the 3rd Ward, further enhances the effect in can have on walkability. The majority of the area is used for low-rent housing, with a relatively non-prestigious university right in the centre **[Figure 3.1.1]**. With so few things to actually do in the area, it makes sense that people tend to walk quite rarely, and drive to most of their destinations. On the contrary, however, is Site 5: Lakes on Eldridge North. About 85% of the land is used for housing, with a small amount left for a clubhouse, waterbodies and green spaces. It has a WalkScore of just 10 **[Figure 3.6.2]**, which suits these characteristics – there's nowhere to walk! (well, seemingly). Despite the low WalkScore and one-dimensional land use, we find that not only were more than 100 different instances of traffic counted, but more than half of them were people walking. **[Figures 3.3.4 and 3.3.5]** This suggests there is perhaps another factor or a combination of several explored later that are more significant than land-use, which is causing the site with the least diverse residential area to have such high pedestrian counts.

This theory is reinforced at River Oaks and Memorial Estates. The land use is fairly diverse, with schools, shops and leisure in the area. Their WalkScores are average too, at 66 and 57 respectively, meaning one would expect people to walk here frequently **[Figure 3.6.2]**. However, at both of these sites, there were no people counted at all, with the only traffic passing by being cars **[Figure 3.3.4].**

In summary, when land use is incredibly diverse, it does indeed result in a greater number of people walking rather than driving or using public transport. However, for land that is either quite or not diverse at all, it seems that there are other factors determining whether people choose to walk, since the least diverse had far more pedestrians than some of the more diverse sites. Additionally, we can also assume that WalkScores are determined entirely based on land use, and do not take other factors into consideration, as they follow the trend we would expect for land use perfectly. This also matches the geographical theory well; there is no reason to walk anywhere, unless there are useful facilities nearby.

Sub Focus Question 2

Does the land value of a residential area affect its walkability?

As seen across the data, land value certainly has a dramatic effect on the walkability of an area. Let's start with River Oaks and Memorial Estates, with house prices more than quadruple those found anywhere else **[Figure 3.5.2]**. Interestingly, these areas both had land use characteristics that would make them seem fairly walkable; shopping nearby, education and even a country club in the case of River Oaks. So, with all this nearby, why not take full advantage of the beautiful environment and simply walk there? As shown in **Figure 3.3.5,** neither of these wealthy sites actually had any pedestrian traffic at all; **Figure 3.3.4** displays that 100% of the traffic was from cars, but why? It seems to involve the fact that rich people can afford to drive wherever they, so walking a few hundred metres if it means having to potentially suffer the climate and humidity, carry things with them etc. is certainly not worth the effort.

Moving to mid-value land, it does appear that this is the 'sweet-spot' for what can make a residential area truly walkable, and certainly encourage people to do so. If we take a look at **Figure 3.1.5**, it becomes clear that in terms of land use, Lakes on Eldridge North has none of the characteristics that one would expect for it to be walkable. There are no shops nearby, job opportunities or even schools nearby, just a small leisure centre. However, in **Figure 3.3.5**, more than half of the traffic that was counted turned out to be on foot, rather than driving around, and this seems to be due to the land value. Mid-income people occasionally enjoy walking around the neighbourhood with their families, either for exercise or to go to the clubhouse for a swim. If this were an upper class neighbourhood, people would have their own private gyms and swimming pools, so simply wouldn't feel the need to go outside and commute (especially on foot), to these areas. Alternatively, if this were a low value, non-gated community, it would not be as safe for children or families to be out walking on their own, as anything could happen, so they would probably choose to drive instead. We see a similar trend in Site 6: Cinco Ranch. Despite having no offices nearby, **[Figure 3.1.6]** due to the medium-wealth housing **[Figure 3.5.2]**, walking is still a very popular means of getting from place to place **[Figure 3.3.5]**. This is clear evidence that land use is certainly not the deciding factor in an area's walkability, and land value is just as important in determining whether walking is a practical means of transport or not.

Moving onto lower land values, we have Houston's 3rd Ward. This does have some land use characteristics such as nearby education and shops that resulted in its high WalkScore of 74 **[Figure 3.6.2]**, yet going by **Figure 3.3.5**, while walking is definitely possible, very few people choose to do it. The only reasonable explanation for this would be the low land values. Because of the low-income families who reside here, crime rates are incredibly high. In fact, the chance of a resident being a victim of a violent crime (i.e. rape, murder) is 1 in 13 (Two Houston neighborhoods called most dangerous in U.S., 2013). Due to this, the majority of people do not feel comfortable walking out on the streets, so even though useful services are close, people choose to travel in the safety of their cars instead.

Lastly, we have the SkyHouse Apartments in downtown. Here, house values cannot actually be measured, since there are none, but the apartment rental rates fall in line with what a typical mid-wealth family could afford. This means that, once again, people are willing to go out and walk and the area is developed enough for them to be able to do it safely. The medium-wealth population combined with the incredibly diverse land use is what gives this site the highest pedestrian traffic counts and its WalkScore of 89.

In conclusion then, land value certainly does affect a residential area's walkability. Land value that is too low results in higher crime rates and an unsafe walking environment. Land values too high mean that people can afford to drive everywhere in the comfort of their luxury automobiles, afford delivery straight to their homes or just remain in their homes when it comes to leisure activities. Land value somewhere in the middle is required, where people are still willing to go outside and enjoy their environment, and are able to do so in complete safety without the fear someone is going to sneak up behind them and rob them.

Sub Focus Question 3

Are there any other key aspects of a site that help to improve its walkability?

There are a few additional aspects aside from land use and value that determine a site's walkability, the first one being prevalence of sidewalks. As seen in **Figure 3.2.4**, there are no sidewalks at all throughout the Memorial Estates. People prefer not to walk on the roads, so this factor alone is probably a very good explanation as to why there were no pedestrians counted at all at this site. On the contrary, at Site 2 **[Figure 3.2.2]**, there are plenty of sidewalks; one on either side of every road. This encourages people to walk to their destination, as the infrastructure is already in place, and these sidewalks lead to the entrance of every building in downtown, making using walking as a primary method of transport fairly easy.

Another factor to take into consideration is visual appeal. As shown in images **3.2.1 and 3.2.4**, the 3rd Ward and Memorial Estates are very badly kept, with overgrown shrubs, litter on the ground and graffiti on the walls. These two sites, while having decent WalkScores, still had the lowest pedestrian counts that I obtained. The 3rd ward actually had an array of sidewalks, and several areas of diverse land use, but because it was so unappealing to look at or be in, people choose to drive through as quickly as possible, rather than walking and enjoying the atmosphere. Lakes on Eldridge North is a perfect example of how aesthetics can make an area so much more appealing to walk in. With essentially one made land use, housing, you wouldn't expect many people to be walking unless it was to someone else's house. However, because the area is so beautiful, with expanses of lakes, fountains and tropical landscaping **[Figure 3.2.5]**, people like to walk/run around the neighbourhood just to take in the beauty and enjoy their environment. Another important factor to notice is the most walkable residential area, the SkyHouse apartments, was also incredibly well kept and tidy, along with having sleek buildings that are nice to look at **[Figure 3.2.2].**

I collected weather data to try and make sure that this wasn't a determining factor as to whether people were walking in certain sites and not others, and it is clear that this it does not have a significant, if any, impact at all. **Figure 3.4.2 and 3.4.4** show that some of the most uncomfortable conditions with high humidity and temperature were found at Site 2 (SkyHouse), while the climate was far more pleasant while I carried out traffic counts at Site 4 (Memorial). Despite this, Site 2 had the most foot traffic, and Site 4 had the least **[Figure 3.3.3]**, proving that weather does not have a significant impact on the walkability of the given area, at least, in Houston.

In conclusion, aside from the major factors of land use and land value, the aesthetic appeal and prevalence of sidewalks also are significant when calculating just how walkable an area is. A gated community could also be a factor enhancing walkability, as people feel much safer out in the open. We have also proved that people weren't choosing to drive in some areas because it was too hot; the most uncomfortable area had the highest number of pedestrians.

SECTION E: CONCLUSION

WORD COUNT: 558

In conclusion, there are an incredible variety of factors that affect the walkability of any given area, particularly land use and land value. Where land use is diverse, walkability naturally increases, since people are able to access the services they need on a daily basis like work and school by walking there, since they are so nearby, matching what I expected for Sub-Focus Question 1 perfectly.

However, land value has a dramatic effect on walkability when the land use is slightly less diverse. High land values mean people can afford to drive everywhere, and have more in their homes so need to go out less. Low land values mean higher crime rates and an unsafe environment for walking about on your own. Medium wealth land is a happy medium, since people still like to go outside and walk either to commute or just for exercise, and are able to in a safe environment. This differs from what I expected for Sub-Focus Question 2; I thought low wealth communities would have the most pedestrians, since few could afford to drive often, but as it turns out, safety is a higher priority than being economical, which makes perfect sense.

What really adds to medium wealth land increasing walkability is a gated community; a factor I did not take into consideration when making my hypothesis for Sub-Focus Question 3 and shown by Lakes on Eldridge North. Land use diversity was practically zero in LOEN, but because people like going outside and because the environment was so safe, this site had the second highest proportion of foot traffic that I was able to investigate, on both days of data collection.

My other theories for Sub-Focus Question 3 however, were spot on. The visually appealing sites like SkyHouse Apartments, LOEN and Cinco Ranch had significantly more foot traffic than the neglected 3rd Ward and Memorial Estates, as people enjoy stepping outside into a beautiful environment, not an ugly one. The anomaly here was River Oaks, where despite being beautiful, the people living here are so wealthy that they take it for granted, and choose to drive anyway. Sidewalks are also a key factor in making an area walkable; Downtown had the most, and was the most walkable, Memorial had the least, and was not walkable at all. Once again, the anomaly here is River Oaks, where people have too much money to care, and continue driving because it costs them virtually nothing.

Linking to the geographical theory of the importance of walkability, there are some clear points that do indeed reflect the benefits it brings. Downtown Houston was by far the most walkable area, due to the high land use density, variety and prevalence of sidewalks. Being the CBD of Houston, it is also by far the most economically active. This reinforces the theory showing that an increased walkability tends to have economic benefits on an area; this is certainly the case in downtown. Furthermore, we have Lakes on Eldridge North, which despite initial predictions due to land use, turned out to have a very high walkability. Interestingly, this area has some of the lowest crime rates in all of Houston (Lakes On Eldridge North Real Estate Market Overview, n.d.), also implying that due to the number of people out and about walking, crime rates have indeed been reduced, further reinforcing the theory.

SECTION F: EVALUATION

WORD COUNT: 661

How reliable was our investigation, and how could it be improved?

There are several things which were carried out very well in my investigation. Firstly, we have my methods of data collection. The land-use mapping was probably the most accurate and reliable piece of data collected. This is because it was the only raw piece of data that directly combined primary data; where I went and examined the land use in each individual grid segment, but also secondary research to find out exactly what was inside each building, so I could adjust my results accordingly to maximise precision. The photography also incorporated a very good technique; as mentioned before, the photos weren't just randomly taken, but strategically, keeping in mind the points I would need to analyse later, and incorporating two photos into every site for analysis of a wider range of points.

In terms of data presentation, I believe that with the data collected, I was able to expand on my raw data and present all of my findings in a manner as clear and concise as possible. While there is certainly a lot of data that I chose to display, I felt that was necessary to demonstrate absolutely every factor that could possibly be affecting the walkability of some areas; had we just gone by the theories of walkscore.com and land use mapping, there would be no reasonable explanation as to why Sites 3 and 4 had no pedestrians. I believe my land use-maps and photography were annotated to a suitable level of detail, including everything I wished to analyse without incorporating unnecessary data i.e. building heights. For the traffic counts and weather data, I feel like condensed the vast amount of raw data collected effectively, and then used my advanced technology skills to form detail graphs and annotated maps that helped to display factors I would need to analyse later. I am also very happy with the technique I used to collect both of those forms of data, as there was very little room for error. Lastly, I am very happy with the secondary land value data I obtained from trulia.com, as I do not believe there would have been a more accurate way, even with primary data, to obtain such relevant data to my study.

However, there were also some flaws with my method. I don't think I counted the traffic on enough occasions for the data to be truly reliable; at least 5 days, 3 different times a day for every site would have produced more relevant data for me to analyse, and perhaps we would have seen the occasional pedestrian in Sites 3 and 4. In terms of the weather, I feel like I should have perhaps visited the sites during different seasons of the year to see how climate really does affect walkability, rather than just using it as a validity check, but due to time constraints, I wasn't able to do this. Lastly, if I were able to more depth, I would have liked to extend this investigation, turning my secondary data for the geographical theory into primary data; investigating how increased walkability benefits an area, through health data, surveys about social life, studies into economic activity etc.

In conclusion, based on the data that I collected and presented, I feel that the conclusions I was able to draw are very valid, since I did collect enough data to create fairly accurate results. However, I believe that if I had collected traffic on more days, the reliability of my investigation could have been improved, and if I had collected weather data on dramatically different days, perhaps I could have come up with another factor i.e. humidity level, feels like temperature, and at what point that starts to affect walkability. Aside from these minor issues, I am extremely satisfied with the data collected, and I feel that I now have a far more insightful knowledge as to exactly what factors do and don't affect walkability, and why some areas have no pedestrian traffic at all.

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