Business Signage and Placemaking in Streetscapes

Analysis of On-Premise Signage Pre-Attentive Processing in Pedestrian Streetscapes to Inform Placemaking Design Standards in Form-Based Code Development

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PART 1: SIGNAGE, PLACEMAKING AND IMPLICATIONS

Signage in the Urban Streetscape Environment

The rise of cities is a social form that came about from the interwoven developments of agriculture, economic trade, transportation routes, sacred places, secular practices and writing systems (Project for Public Spaces, 2012; Rose, 2016). Within the early cities, business signs were symbols of the goods or craft available at the establishment. As written text became the predominate communication medium, signs changed from hanging perpendicular off the building front to horizontal and attached to the façade or fascia (Treu, 2012).

In the contemporary urban streetscape, commercial on-premise signage is an important and expressive element and can positively influence businesses success (Jourdanet al., 2013). Signage increases the ability of customers to find the location of the business, and for the design of the signs to appeal to pass-by-traffic (Jourdan et al., 2013; Walters, 2011). Placemaking brings a new dimension (or perhaps back an old dimension) into the conversation, to understand the streetscape as a system – of commerce, transportation and places for people - a place to celebrate people and businesses.

With the placemaking approach, the streetscape is a third place, that is, a place people choose to linger, socialize, and patronize. The spatial quality of streets and sidewalks depend immensely on the complexity of elements such as: art, building façade, cars, first floor window transparency, furniture, landscaping, people, road, sidewalk, sky, tree canopies, turf, primary signage, and secondary signage.

Benefits of placemaking elements in the streetscape include:

- **<u>ecological</u>, cleaning the air and providing shade in the urban heat island;**
- **<u>economic</u> as they encourage people to stay longer on the street and patronize businesses;**
- **<u>aesthetic</u> as they support unifying design themes, visual appeal, and freedom of expression;**
- **<u>social</u> as they allow people to gather, relax or socialize.**

(Ewing and Handy, 2009; Faga, 2014; Guest, 2014; Orlando 2013; Portella, 2014; Schneekloth & Shibley, 1995).

***Does the inclusion of placemaking elements in the streetscape affect the ability of people to find the business signs? How much is too much?* This study examines the correlation between streetscape design intensity and the likelihood of finding on-premise signage through photoshop image manipulation and 3M's Visual Attention**

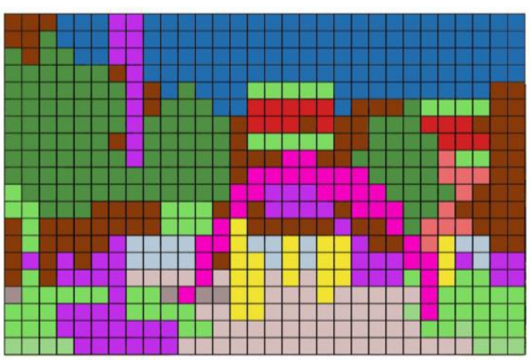
Software (VAS). 3M's Visual Attention Software (VAS) measures the likelihood of a person to find the sign during one's pre-attentive processing. Pre-attentive processing is a universal process demonstrating what a person will see in the first three to five seconds. It does not predict what a person will see once cognition starts.

Streetscape Images, Photoshop and VAS

The study uses photos of 26 existing streetscapes in Lansing, Michigan to explore the effect of adding placemaking elements on the percent 'likehood of finding' the business signage using VAS. Three levels of placemaking intensity were created for each image, for a total of 200 images (Images: 26 original, 58 at level 1, 58 at level 2, 58 at level 3). Each image was raster coded (colored squares) to measure the amount of coverage of each element in the image. The placemaking elements include: art, building façade, cars, first floor window transparency, furniture, landscaping, people, road, sidewalk, sky, tree canopies, turf, primary signage, and secondary signage. The 200 images were imported into VAS to detect the percentage of likelihood of finding on-premise signage. The percentage of detection of signage score from VAS set the stage for identifying the correlation between placemaking making intensity, or streetscape complexity, and on- premise signage.

Original Image

Photoshop Enhancements



Photoshop Enhancements Raster Coding

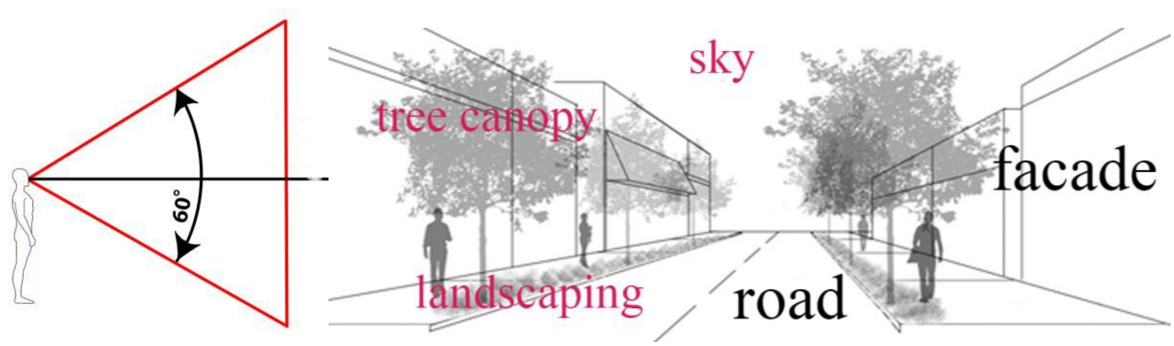
VAS Ouput - 66% likelihood

Images show the methodology used to conduct the study

Relationships between Placemaking Intensity and Signage

Variable Placemaking Intensity

In analyzing all 200 images together (including the original photo and all three levels of placemaking intensity), an increase in building *façade* and *road* in the cone of vision (as typically captured in a photograph) statistically increase the VAS prediction of likelihood to find the sign. An increase in *sky*, *tree canopy* and *landscaping* in the visual field decrease the VAS prediction of likelihood to find the sign.



Cone of vision and elements in the visual field that influence VAS prediction offinding the business signage

Implications

When the level of placemaking for a streetscape is undetermined, an increase in building height for streetfront *façade* area supports the likelihood of finding the commercial signage. This can be an increased single story height or multiple floors on thebusiness street frontage. The study included images of downtown streetscapes and auto-oriented business developments (such as strip malls and business on 5 lane throughfares) and the presence of the *road* supports the likelihood of finding the commercial signage. Pedestrian malls were not included in this study set.

***Sky* and *tree canopy* create a negative effect on the likelihood of finding the commercial signage. Two variables the VAS software measures are intensity and edges. In the streetscape images, this is equated to the sky (intensity) and tree**

canopy (edges). The recommendation is to accept these as part of the outdoor environment. *Landscaping*, included as low plantings in medians and sidewalk strips, also creates a negative effect on the likelihood of finding the signage. If placemaking is not a desired goal, then the costs ofincluding low planting may not be worth the cost and maintenance efforts.

This beg the question – *Are the findings the same when looking at each level of placemaking intensity separately?*

Effects of Placemaking Intensity on Signage

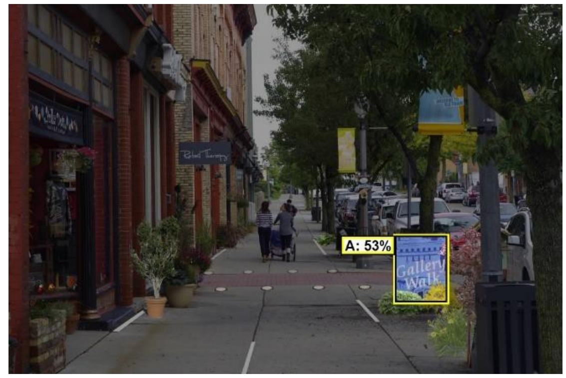
In statistics, mean scores are a helpful tool for understanding the 'average.' Average is the middle, half are above and half are below. For example, the average U.S. mother has 2.4 children. A safe interpretation is most mothers have two or three children. The following mean scores for the VAS output are an average, representing the middle ofthe field.

Placemaking level	# of images	Mean percent likelihood of finding the sign
Level 0 original image	26	70%*
Level 1 placemaking	58	60%
Level 2 placemaking	58	58%
Level 3 Placemaking	58	56%
* statistically significant at .05 level		

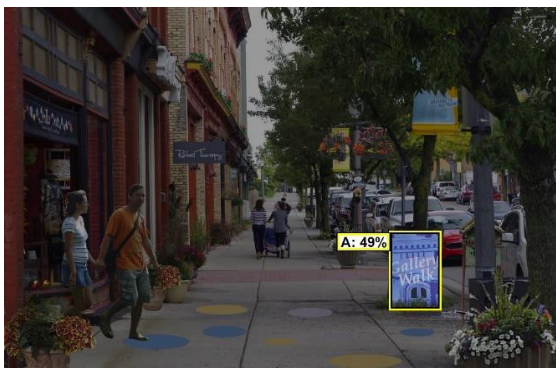
Statistical significance is another important concept for interpreting the findings in this study. The percent likelihood of finding the sign was compared across the different levels of placemaking. At level 0, (with the degree of streetscape development in the original image), the percent likelihood of finding the sign is significantly higher when compared to placemaking levels 1, 2 and 3.

Once placemaking elements are added, there is no significant difference between the levels. In general, increasing placemaking elements (from level 1 to 2 to 3) decreased the VAS score for finding the business sign. In some image scenarios, going to the extreme of level 3 placemaking increased the sign visibility. In these cases, the use of elements such as overhead tensile tarps, table umbrellas and/or the addition of people in the scene negated the negative influences of *sky* and *tree canopy*.

Level 0: visibility percentage 56%



Level 1: visibility percentage 53%



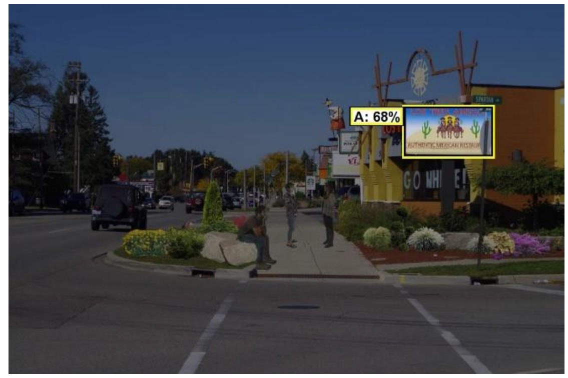
Level 2: visibility percentage 49%

Level 3: visibility percentage 61%

Images illustrate the different pre-attentive visibility percentage using VAS in adowntown streetscape

** VAS output darkens the image to highlight the target sign area*

Level 0: visibility percentage 78%



Level 1: visibility percentage 68%

Level 2: visibility percentage 64%

Level 3: visibility percentage 72%

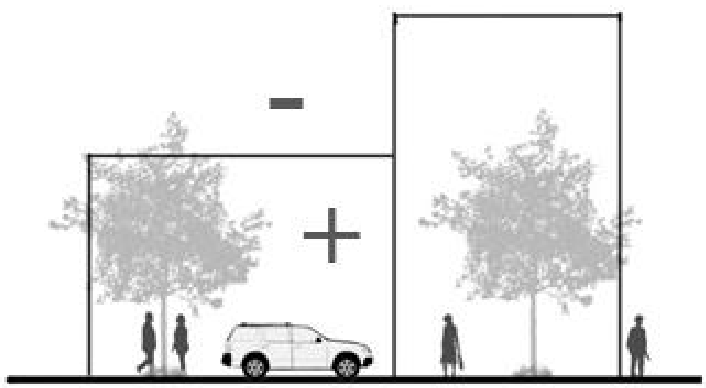
Images illustrate the different pre-attentive visibility percentage using VAS in anauto-oriented streetscape

**** VAS output darkens the image to highlight the target sign area***

Implications

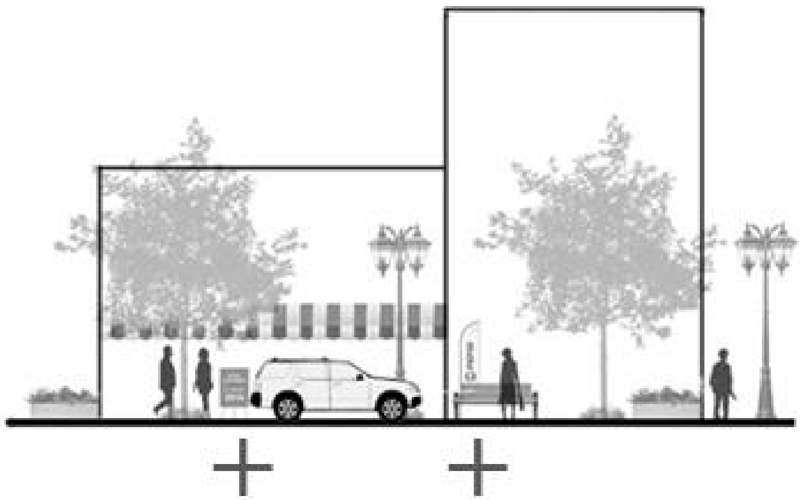
The inclusion of placemaking elements does significantly decrease the VAS likelihood of finding the sign when compared to images without placemaking elements. However, the impacts between placemaking levels 1, 2 or 3 is not significant. Meaning, if placemaking is going to happen, go for it! The decrease in sign perception is low and potentially outweighed by the visual richness gained and increase in people using the spaces along the street. The sky has a continued impact because VAS analyzes an image, in part, for edges and intensity. The lightness of the sky and the edge of the sky to the building and tree lines likely decrease pre-attentive visibility. A highly complex streetscape, though, is able to void the negative impact of the sky.

At level 1 intensity, an increase in the amount of building façade improved the percent likelihood of finding the sign, while an increase in sky decreases the likelihood of finding the sign.



At level 2 the sky continued to decrease the likelihood of finding the sign and the other elements no longer had a statistically significant impact.

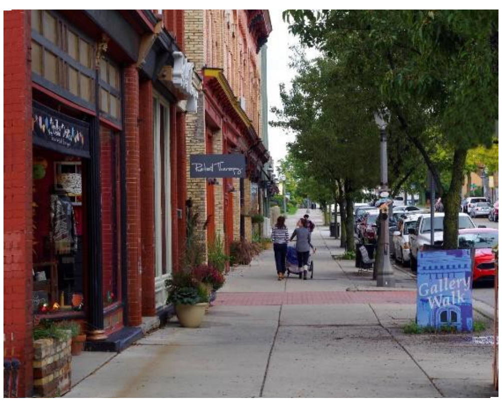
At level 3 the sky no longer affects the percent likelihood of finding the sign. Instead, an increase in *secondary signage* improves primary sign pre-attentive visibility.



Comparison of Downtown and Auto-Oriented Images

Analysis shows that the 100 images in an auto-centered setting have statistically more primary signs in the images than the 100 images in a mid-size, downtown setting. This does not, however, affect the likelihood of finding the sign. In an auto-centered settinglarger on-premise signs do not increase pre-attentive visibility.

Images illustrate diverse sign size in auto-centered streetscapes.



Images illustrate diverse sign size in downtown streetscapes.

Implications

There were no differences in how placemaking elements affected the likelihood of finding the business signs between the downtown streetscape and auto-oriented streetscape environments. Businesses in downtown streetscapes canfunction with smaller signs that than those in auto-oriented settings.

PART 2: SUPPORTING LITERATURE, RESEARCH METHOD, AND DATA ANALYSIS

Introduction

The urban streetscape is a place to celebrate people and businesses. Placemaking is a holistic method to transform spaces into places with the elements necessary to attract and retain people in the environment. This includes healthy partnerships of government, businesses, and residents, comfort for the pedestrian with furniture and shading trees, an abundant access to the intangible qualities like excitement and interactivity, and ease of wayfinding. Such a philosophy and process will become more common as cities grow in population and complexity.

Michigan State University's School of Planning, Design, and Construction, in partnership with the Sign Research Foundation, examined the effects of placemaking design on business signage visibility in the streetscape. 26 original photographs were selected representing a variety of streetscapes, ensuring multiple sign types, sizes and colors. Using Photoshop, each original image was enhanced with placemaking designs. The final data set includes 200 photographs, including the original 26, 58 lightly enhanced streetscapes (level 1), 58 moderately enhanced (level 2), and 58 heavily enhanced (level 3). Each image was then rasterized and coded to 15 core streetscape elements, such as signs, furniture, and landscaping. 3M's VAS software was used to predict the percent likelihood of a pedestrian's eye fixation on the signage during pre-attentive processing.

Regression and ANOVA modeling uncovered how different streetscape elements are affecting the VAS likelihood of finding on-premise signage at different levels of placemaking intensity. A level 0 placemaking intensity (the 26 original images) reported amean 70% likelihood of finding the sign, while a level 1 placemaking intensity reported 60%, level 2 at 58%, and level 3 at 56% (each with 58 images). At the level 1 intensity, an increase in the amount of building façade improved the percent likelihood of finding signage, while an increase in sky decreases the likelihood of finding on-premise signage. At level 2, the sky continued to decrease the likelihood of finding signage. At level 3, the sky no longer affects the percent likelihood of finding signage. Instead, an increase in secondary signage improves primary sign pre-attentive visibility. The sky is a regular detractor for the sign in pre-attentive processing. Once a streetscape becomes a level 3 intensity, the overall complexity in the image successfully dilutes the negative effects of the sky. As streetscapes grow more complex, they were not found to have a significant effect on the VAS of finding the sign.

Literature Foundation

Place matters everywhere and people possess a basic need to belong somewhere (Walters, 2011). Great places are those that are sensitive to aesthetic and functional valuesand display a rich canvas of textures, forms, and details. This complexity and richness is crucial to attract people and to enhance their sense of belonging. The mission of placemaking is to orchestrate the diverse features of the built environment to deliver placesto serve and satisfy people's social, spiritual, and cultural needs. Placemaking has been thenexus of many earlier and emerging urban movements, principles, and theories. The idea of placemaking sparked in mid 1960s, through the works of Jane Jacobs, William Whyte and Kevin Lynch, as a reaction to auto-centeric planning.

Placemaking is defined as an inclusive social agenda that contains key aspects and objectives to enhance and to meet the spatial, social qualities of a place (Fincher et el, 2016; Project for Public Spaces, 2010). The intent of placemaking is to establish ties between the city and its people. Placemaking is a bottom-up approach that empowers people and boosts local leadership and resources (Project for Public Spaces, 2017). With the focus on design, form, and community - placemaking enriches the civic identity and attracts and retains people. Either in a small rural town or in a big urban city, residents and visitors are integral to both economic and cultural development.

Our globalized world favors diverse land uses, physical connectedness, and swift adaptability to economic changes. New Urbanism movement offered design regulations that are place-based to promote public realm as an alternative to auto-centered planning. New urbanism developed urban design guidelines: Form-Based Codes (FBCs). FBCs, unlike traditional Euclidian zoning codes, set policy with an appreciation for flexibility and aesthetics and can save on costs in the master planning process. FBCs's approach is often community-driven, allowing policy to come from the bottom-up rather than top-down. FBCs emphasis on the aesthetic character allow for placemaking – a holistic approach to the planning, design and construction of our communities. FBCs and placemaking focus on form and character of a place while uses and permitting is secondary. (See chapter 2 formore details about New Urbanism, and FBCs).

FBCs may set the design of on-premise signs in communities. They can guide the size, color, shape, and height of signs and can create different design standards in differentneighborhoods. The question remains how planners and designers can use FBCs for placemaking, attracting, retaining and celebrating businesses, residents, and place itself, while supporting on-premise sign visibility. A successful sign not only announces the business but also balances beauty, interest, and order (Crawford, et al., 2015). FBCs are anopportunity to ensure holistic signage success.

Streets and sidewalks could be anywhere, but the streetscape elements can contribute powerfully to a city's sense of place. Sidewalks are more than concrete carpetsthat connect buildings with streets. Sidewalks are places to celebrate people and businesses. A streetscape is a third place, that is, a place people choose to linger, socialize, and patronize. The spatial quality of streets and sidewalks depend immensely on the complexity of placemaking elements such as: art, building façade, cars, first floor window transparency, furniture, landscaping, people, road, sidewalk, sky, tree canopies, turf, primary signage, and secondary signage. Benefits of streetscape elements are ecological, cleaning the air and providing shade in the urban heat island; economic as they encourage people to stay longer on the street and patronize businesses; and social as they allow people to gather or people-watch. Well-designed streets and sidewalks offer stages for dynamic and safe cities. Streets and sidewalks that are rich with layers of streetscapes offer a range of interesting visual assets that create pleasurable experience for people, such as architectural details, surfaces, changing light patterns and signs (Ewing and Handy, 2009).

Form-Based Codes Short History

For the past 60 years, conventional zoning contributed in creating auto-centered places (Walters, 2011). Such auto-centered do not serve today's globalized world that favors overlapping of uses, physical connectedness, and swift adaptability to economic changes (Walters, 2011; Garde, 2017). In the early 1980s, the New Urbanism movement developed urban design guidelines Form-Based Codes (FBCs), as an alternative design tool to conventional zoning codes (Parolek et al., 2008). New urbanism is a movement thatsurfaced between the 1920s and 1930s to promote dense and mixed-use developments in contrast to suburban areas (Inniss, 2007).

Form-Based Codes Institute defines FBCs as: "A land development regulation that fosters predictable built results and a high-quality public realm by using physical form (rather than separation of uses) as the organizing principle for the code." FBCs focus primarily on the physical design characteristics of developments, such as the scale and types of streets and blocks. Simultaneously, they place much value on the inclusion of a wide variety of housing types with emphasis on sustainable design principles (Garde, 2017;Crawford et al., 2015). Conventional zoning places its emphasis on land use. FBCs are place-based regulations that implements form and function of blocks and streets to guide policy with an increased focus on the design of the public realm (Rangwala, 2012).

FBCs' primary goal is to restore the physical decay of suburbs and cities and to strengthen civic life through recreating the active city of the past through creating pedestrian-friendly communities and recreating neighborhoods of the old traditional towns (Woodward, 2013). It is widely known that New Urbanism rekindled the significance of traditional urban forms of public spaces, and neighborhoods, such as alleys, squares, mixed use urban forms, etc. (Walters, 2011) through assigning codes

based on the transect zones, which are 'hierarchical spatial zones of urban and rural character rather than specified uses' (Walters, 2011).

In late 1990s, Duany and Plater-Zyberk developed the 'Transect' methodology based on FBCs, which is also inspired from historical precedents such as Patrick Geddes's valley section (Moga, 2017). The transect methodology is now widely accepted and implemented in urban design and planning practices across the USA (Walters, 2011). According to Duany, the transect is 'an ordering system deploying a geographic gradient to arrange the sequence of natural habitats. This conception proved to be extensible to the human habitat, as every component of urbanism also finds a place within a continuous rural-to-urban gradient (Duany, 2002). The transect is composed of six types of environmental zones with varying physical densities that depicts an array of changing landscapes of a given regional geographic setting from a preserved rural edge to the densest city center (Duany, 2002). New Urbanists also added a seventh transect that is known as a 'specialized district,' which is dedicated for non-urban uses such as airports, etc.

FBCs are the tool planners use to create the transect's continuum. This continuumis defined as 'a method of regulating development to achieve a specific urban form that aims to create a predictable public realm primarily by controlling physical form with a lesser focus on land use, through city or county regulations' (Parolek et al., 2008). The keyprinciple of New Urbanism is to create a traditional town where people can live, work, eat, entertain, and shop to reduce auto dependence and to 're-invigorate the public realm' (Woodward, 2013). Such town planning is with clear center and nodes defined with important buildings, such as city halls, churches, etc. A network of narrow streets radiatesfrom such center, with rich programming and with small compact blocks (Woodward, 2013). This physical setting leads to creating a pedestrian-friendly environment (Woodward, 2013; Walters, 2011).

Although New Urbanism is consistently scrutinized, cities across the country are adopting and replacing their conventional zoning with FBCs to promote creating attractive, walkable urban forms with an enhanced sense of place (Walters, 2011). FBCs are fathomable and easy to use when designing commercial signage (Parolek et al., 2008). Such codes are written using simple text and accompanied by clear drawn diagrams and additional visual aids that are easy to understand and apply by users in both private and public sectors (Crawford et al., 2015).

Placemaking

The idea of place making sparked in mid 1960s, through the works of Jane Jacobs, William Whyte and Kevin Lynch, as a reaction to auto-centered planning. The term 'placemaking' started to be widely used by city designers through mid 1990s, and spurred attempts in creating more livable and walkable cities through urban design. Placemaking is a design technique committed to increasing the connection between people and places, through collaborative coordination among citizens, organizations,

developers, planners and policy makers (Project for Public Spaces, 2009). They further mention that placemaking is context-specific, flexible, and transformative.

According to urban scholars, there is no definitive definition for place-making, but rather place-making is better defined as an inclusive social agenda that has key aspects and objectives to enhance and to meet the spatial, social, spiritual, and cultural qualities andneeds of a place (Fincher et el, 2016; Project for Public Spaces, 2010). A recent MIT study that focuses on the practice of place-making (Silberberg et al, 2013) define place-making: 'At its most basic, the practice aims to improve the quality of a public place and the lives of its community in tandem. Put into practice, place-making seeks to build or improve public space, spark public discourse, create beauty and delight, engender civic pride, connect neighborhoods, support community health and safety, grow social justice, catalyze economic development, promote environmental sustainability, and of course nurture an authentic "sense of place."'

Placemaking is about creating places to improve social and spatial conditions of communities, building places for individuals to enjoy and participate, empowering communities through strengthening their social ties and everyday interactions, and highlighting their unique identity and assets (Schneekloth and Shibley, 1995). As a landscape architect and an architect, Schneekloth and Shibley wrote that the intent of placemaking is to build relationships between the city and its people. This relationship helps the residents to care about their community.

Kevin Lynch, as mentioned earlier, is one of the founders of the idea of sense of place and placemaking. He described five essential urban elements to enhance the legibility of our built environments and consequently trigger its liveliness. The five elements are: districts, paths, nodes, landmarks, and edges (Lynch, 1960). A downtown is a district, while weaving paths of sidewalks and road connect the key nodes. Jane Jacobs wrote that the cityis a reflection of these paths; "if the streets are interesting, then the city will be interesting; if they look dull, the city looks dull" (Jacobs, 1961). Streets and their sidewalks are the main public places of a city, are its most vital organs. She added that good sidewalks offerstages for an "intricate ballet" with diverse "individual dancers." According to Jacobs, all dancers, pedestrians, have their own individual activity on streets, simultaneously; they create together a harmonious and interesting performance on sidewalks (Jacobs, 1961). Such an interesting ballet is only hosted and found on lively streets (Jacobs, 1961). Lively streets are a series of connected destinations (Jacobs, 1961).

Jacobs stressed the importance of diversity of elements create vital and lively built environments (Fishman, 1982). Jacobs identified conditions to generate diversity on city's streets, including: short blocks, buildings with different ages, more than one primary function, and dense concentration of people (Jacobs, 1996). Such elements of physical diversity engender visual diversity, and visual diversity sparks the desirability of any given physical pattern (Turner, et al., 2001). Street design

contributes in improving the quality of the built environment, simultaneously enriching the human experience. William Whyte also identified four key qualities to achieving great public spaces, which are: sociability, uses and activities, access, and comfort (Project for Public Spaces, 2010). Access refers tothe visibility of a place from a distance and its easy circulation (Project for Public Spaces,2010). According to Whyte, great spaces are those that are highly connected to public transportation systems and highly accessible to the physically challenged, for children and the elderly. Comfort refers to the physical arrangement of a space and its diverse provision of sitting choices, uses, and activities (Project for Public Spaces, 2010).

Alex Krieger added that an interesting urban from is the one that provides a rich spectrum of texture, detail, and narrative (Kelbaugh and McCullough, 2008). Wey et al. expands that a well-designed urban street environment offers high quality of both aesthetic and functional values, and such intersectionality is crucial to attract people to participate in urban spaces (Wey et al., 2015). There are five urban design qualities in terms of physical characteristics of streets and their edges: imageability, enclosure, human scale, transparency and complexity (Ewing, et al., 2009). Not only the infrastructural qualities influence the effectiveness of streets, but also their aesthetic values play a crucial role in influencing the effectiveness of streets (Weber, et al., 2008). Aesthetic qualities are judged by factors including: symmetry, novelty, familiarity, artistic style, appeal to social status, individual preference, and complexity (Weber, et al., 2008).

Sidewalks are not only for providing efficient and comfortable mobility for pedestrians, but also the design of sidewalks is integral for defining community character and for creating livable and lively built environments. Sidewalks function as public spaces that allow a direct interaction among people, and between people and businesses. Streetscapes in general, and street furniture in particular, are considered a basic tool to enhance pedestrians' experience on sidewalks and to act as a vehicle for exploring a community's identity. A diverse design complements the existing urban fabric, and promotes walkability. Promoting walkability, through creating desirable and attractive sidewalks, leads to thriving businesses, which consequently nurtures local economy.

Placemaking and Form-Based Codes

FBCs emphasize the idea of placemaking through its design regulations. FBCs regulate urban forms, such as building heights, distances between structures, size and location of windows on facades facing streets, etc. Such design regulations also respect human scale in order to create desirable urban forms physical contexts and spaces. One of the salient advantages of FBCs is that 'they produce predictable outcomes' with an increased focus on controlling design elements to 'shape the public realm' (Rangwala, 2012). For example, the codes require the design of any new buildings, in a certain physical context, to be evolved from the local history, and to be sensitive to local building materials, climate, and landscapes (Rangwala, 2012).

FBCs require community involvement, which usually entails a series of meetings (Inniss, 2008). This charrette process is an opportunity for interested community members or any other interested parties to voice their aspirations and desires for a certain project (Inniss, 2008). FBCs are sensitive to human scale and focus on the needs of the community. In such manner, FBCs are environmentally conscious, whilst producing and preserving sense of place (Rangwala, 2012).

Placemaking, Form-Based Codes, and Signage

In the urban setting, signage includes wayfinding to guide travelers, displays a market brand, and announces a business. Under the influence of Euclidean Zoning, developed to protect health and welfare, signage became a form of land-use and developed segregated patterns (Parolek, et al., 2008). Signage, or the theory and design of signs, however, require flexibility, adaptation, and evolution. FBCs offer such an opportunity by highlighting the aesthetics to guide new, physical developments. Form-based code emphasizes integration, community participation, and walkable environment (CMAP, 2013; Purdy 2006).

As mentioned earlier, physically well-designed streets, with ample seating choices, shading tree canopies and generous sidewalk width, coupled with interesting building facades, produce comfortable, safe, and desirable streets (Ewing, et al., 2016). A dynamicstreet life leads to safer neighborhoods and creates vibrant cities with diverse uses. Streets high in physical complexity provide a range of interesting visual assets that enriches the experience of its people, such as architectural details, signs, surfaces, and changing light patterns and movement. Street furniture delivers complexity of street scenes (Ewing and Handy, 2009).

On-premise signs can take many different forms. (Dawn, 2013). Because of the wide range of signage designs and forms, local governments enacted policies and codes in early 1900s, to regulate signage (Dawn, 2013). Municipal codes and ordinances regulate both wayfinding signage and on-premise commercial signs (Strauss et al., 2014). Such municipal regulations, if executed properly, can greatly enhance the publics' perception and experience in outdoor spaces, as well as the aesthetic quality of public spaces. There are several factors that influence the evolution of signs (Jakle, 2013). For example, in the early 1900's, with the discovery of electricity, business owners started to use electrically lit signs to attract customers and compete with each other. Since then, electric signage has greatly affected American streetscapes. Additionally, the emergence of suburban shopping malls and leapfrog developments along highways induced the creation of automobile oriented signs. In the 1960s, various designs and scales for signs were evolving.

Signage is a major source of complexity in urban and suburban settings. An important function of signage is to enable people to recognize individual stores or locations. A successful sign not only announces the business but also balances beauty, interest, and order (Crawford, et al., 2015). Signage can increase the perception of a place and increase its efficiency. Signs are also key drivers of city brandings and local identities. Signs can be text, shapes, or logos that deliver direct communication and messages to users, such as wayfinding or advertising (Jourdan, 2013). On-premise commercial sign is a signthat promotes and advertises for a business and is located on the same business's premise.There are different types of on-premise commercial signs, such as roof signs, animated signs, pole signs, window signs, etc. (Jourdan, 2013).

FBCs are an opportunity to ensure holistic signage success. Signage is a crucial component for enhancing the public realm and for the success of businesses (Jourdan, 2013). FBCs focus on enhancing signage perception for users by allowing buildingawnings, window signs, and temporary placards that are visually and functionally efficient for pedestrians and moving vehicles (Crawford et al., 2015). FBCs regulate signs in a manner that both supports developments financially and benefits social aspects.

FBCs regulate signage as well as building typologies and the overall urban morphology of new developments through design standards for streets, public spaces, parking spaces, and landscaping (Walters, 2011).

Research Methods

A mixed-methods approach was used to investigate the relationship between streetscape design and signage visibility in pre-attentive processing. In order to explain the different types of urban streetscapes, hundreds of photographs of streets were taken from different perspectives and view-sheds: driving, walking, in an urban setting, or suburban setting, etc. The photographs were taken from the streets of two counties and three municipalities in the Midwest in late summer of 2016. Twenty-six photographs were selected to represent a variety of street types and signage. The selection includes signs in the sidewalk, perpendicular to buildings, flat against buildings, of varying heights on the building, and multiple colors.

With Photoshop, placemaking elements were added to the photographs to develop more complex streetscapes. Fifty-eight images were developed at a level 1 placemaking intensity (a lightly complex streetscape), 58 at level 2, and 58 at level 3 (the most complex streetscape created in this study) for a total of 200 images. One hundred of these images are designed in settings that depict a Midwestern Downtown and 100 depict images of lower density and autocentric settings (Table 1).

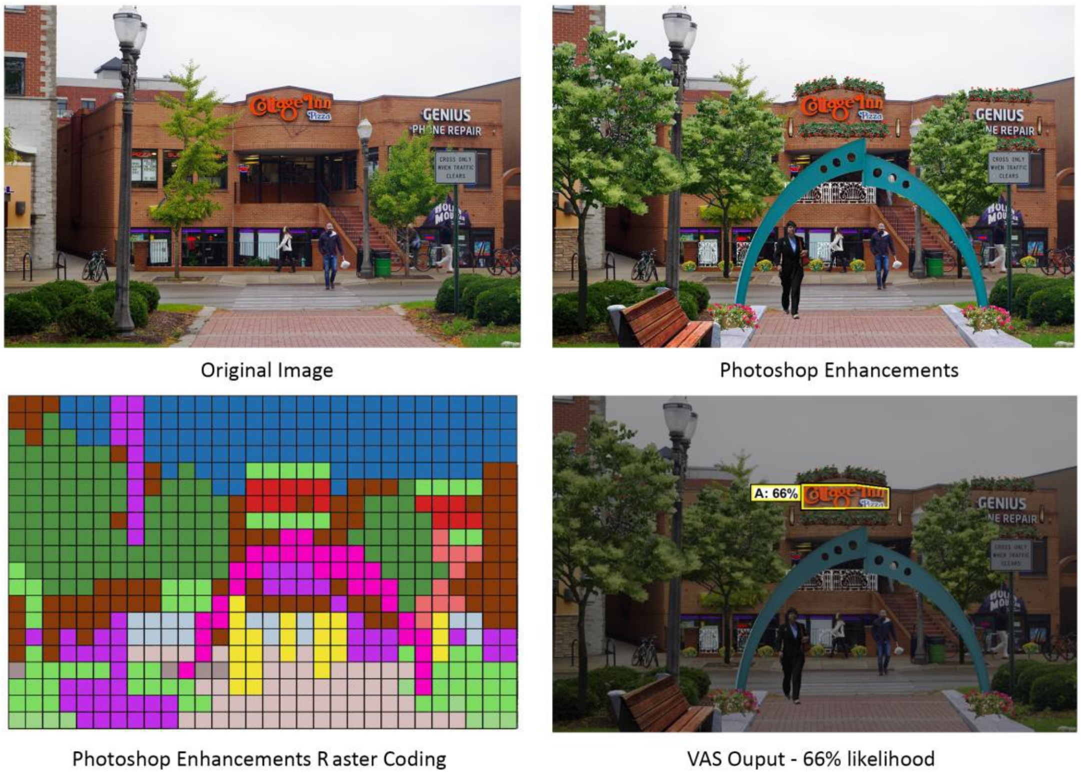
Table 1: Streetscape density and placemaking density

Placemaking Intensity	Original	Level 1	Level 2	Level 3	Total
Lower density	13	29	29	29	100
Midwestern Downtown	13	29	29	29	100
Total	26	58	58	58	200

The streetscape images were analyzed using 3MSM Visual Attention Software (VAS). According to 3M (email communication, 2017): 3M Visual Attention Software (VAS) is a software tool developed by 3Mscientists that simulates human vision during pre-attentive processing, the "first glance" phase. By definition, we are not aware of pre-attentive processing. Pre-attentive processing serves as a foraging mechanism, during which our eyes scan the visual field and select small portions to view consciously. Pre-attentive processing is triggered every time we shift our gaze and can last up to 5 seconds when our vision system is not actively focused on something, or milliseconds when we are actively engaged. This phase of vision can be efficiently modeled because pre-attentive processing works identically in all humans, regardless of demographic, psychographic, or cultural differences. The VAS model is 92% accurate vs. eye tracking studies capturing pre-attentive processing. The VAS software tool gives users the ability to analyze designs or photos, and provides reports that identify the presence and strength of 5 visual elements proven to attract attention: Edges, Intensity (luminance contrast), Red/Green Color Contrast, Blue/Yellow Color Contrast, and Faces. When these elements are strong enough, alone or in combination, there is a high probability that conscious viewing will be triggered.

VAS provides five output types to depict the probability of attracting attention: Heatmap, Regions, Visual Sequence, Markup, and Visual Elements. The findings of this report demonstrate use of the Markup output, which allows a user to draw a marquee around the sign prior to analysis, causing the VAS model to assign a percent likelihood to the area within the marquee.

All the images were placed under a 127 mm x 177.8 mm grid of 600 cells, where each cell is a 6.35 mm x 6.35 mm, square for visual analysis. This coding system uses a raster based method in which the entire cell is coded to predominant streetscape element within. Fifteen streetscape elements identified in the literature (art, building, car, first floorwindows, furniture, landscaping, other, primary sign, road, secondary sign, sidewalk, sky, tree canopy and turf) served as the variables for cell coding. The primary sign is the on-premise, business sign while secondary signage includes enter/exit signs, wayfinding signs, and other signs not announcing the business. Early discussions set a standard of practices to maintain coder reliability, such as consistently coding boulders in gardens to landscaping. A final visual study of all coded images as a collection was used to ensure consistency. Figure 1 helps to illustrate this process.



Images show the process to transform original photographs, code, and put through the VAS software

Data Analysis

Using SPSS 22 for linear regression, each streetscape element cell count serves as the independent variable and the VAS percent likelihood of eye fixation as the dependent. Variables with a statistical relationship to the VAS likelihood are analyzed in a multi-linear regression to improve model predictability. This process was first executed using all 200 images. It was then repeated using only the original images, the level 1, the level 2, and level 3 design intensities.

An Analysis of Variance (ANOVA) was operationalized to compare the VAS percent likelihood for each of these levels of streetscapes. A Scheffe post-hoc test compared the original image (N=26) to each of the other intensity levels as the populationsare not equal. A Tukey post-hoc test allowed levels 1, 2, and 3 to be compared as they each have equal population sizes (each N=58).

An ANOVA also compares the likelihood mean for the Midwestern Downtown images to the lower density images (each N=100) to determine if the setting affects the pre-attentive processing regardless of placemaking intensity.

VAS Analysis Across Placemaking Levels

The VAS likelihood of eye fixation demonstrates a 59.570% mean chance of all images to successfully fixate the eye on the on-premise, primary signage. This mean percent is highest in the original images and gently decreases as the placemaking intensity increases (Table 2). The ANOVA results show a significant difference between the original image and level 1, original and level 2, and original and level 3 placemaking intensities. Once placemaking elements begin to populate the image (level 1), there are no significant differences as the placemaking intensifies (levels 2 and 3) (Tables 3 and 4).

Table 2: Sample Size, mean VAS prediction, and standard deviation by placemaking intensity

Placemaking - Intensity	N	VAS Mean %	Std. Deviation
All Images	200	59.570	14.468
Original	26	70.231	15.089
Level 1	58	59.931	13.671
Level 2	58	57.724	13.864
Level 3	58	56.276	13.615

Table 3: ANOVA comparison of placemaking intensities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3789.518	3	1263.169	6.538	0.000***
Within Groups	37867.512	196	193.202		
Total	41657.020	199			

Table 4: Post-hoc results comparing VAS means of each placemaking intensity

Post-Hoc Test	Image Tested	Comparison Image	Mean Difference	Std. Error	Significance
		Level 1	10.299	3.281	0.022**
Scheffe	Original	Level 2	12.507	3.281	0.003**
		Level 3	13.955	3.281	0.001***
Tukey	Level 1	Level 2	2.207	2.581	0.828
		Level 3	3.655	2.581	0.491
Tukey	Level 2	Level 1	-2.207	2.581	0.828
		Level 3	1.448	2.581	0.943
Tukey	Level 3	Level 1	-3.655	2.581	0.491
		Level 2	-1.448	2.581	0.943

All Case Coding Analysis

Overall, the most common variables coded in the 200 images are building (19.60% mean coverage), road (15.32%), tree canopy (13.91%), and sky (10.23%), together constituting a combined mean 349 cells or 58% of all images (Table 5, Figure 2). Primary, on premise signs account for about 4% coverage of all 200 images (Table 6).

Table 5: Streetscape variables' descriptive statistics

Variable	N	Mean Cell Count	Std. Deviation	Percent Coverage
Art	200.00	4.14	12.60	0.69%
Building	200.00	106.01	59.70	17.67%
Car	200.00	27.26	26.41	4.54%
First Floor Windows	200.00	25.87	20.73	4.31%
Furniture	200.00	45.18	38.73	7.53%
Landscaping	200.00	36.60	25.92	6.10%
Other	200.00	0.55	2.59	0.09%
People	200.00	24.58	20.61	4.10%
Primary Sign	200.00	25.42	37.05	4.24%
Road	200.00	92.25	64.74	15.37%
Secondary Sign	200.00	8.84	11.21	1.47%
Sidewalk	200.00	43.14	33.11	7.19%
Sky	200.00	60.57	45.63	10.09%
Tree Canopy	200.00	90.42	53.53	15.07%
Turf	200.00	9.23	16.99	1.54%

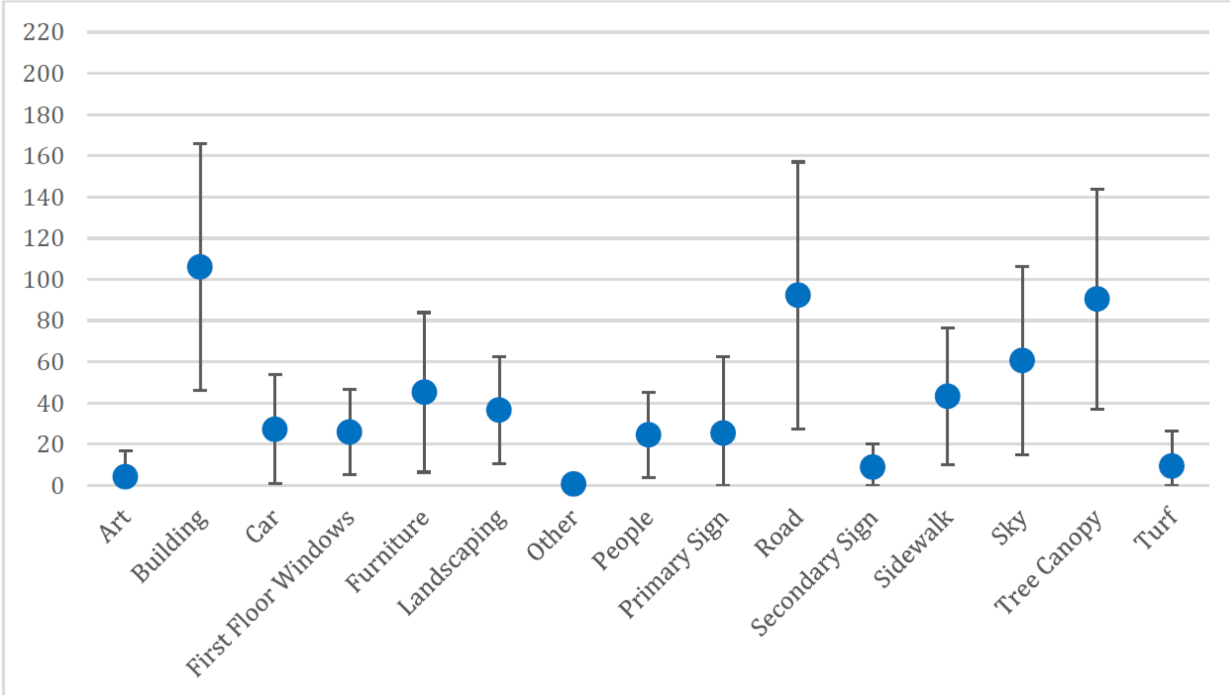


Figure 1: Mean cell count and standard deviation

Table 6: Mean cell count for Primary Sign across the data set

	N	Mean Cell Count	Std. Deviation	Percent Coverage
All 200 Images	200	25.42	37.05	4.24%
Original Images	26	23.19	39.829	3.87%
Level 1 Placemaking Intensity	58	26.12	37.72	4.35%
Level 2 Placemaking Intensity	58	24.41	35.62	4.07%
Level 3 Placemaking Intensity	58	26.71	23.06	5.32%
Midwestern Downtown	100	16.39	12.39	2.73%
Lower Density	100	34.44	49.42	5.74%

With each streetscape element run independently, the building, landscaping, and road significantly correlate with an increase in the VAS likelihood while the tree canopy and sky significantly correlate with a decrease in the VAS likelihood. (Table 7).

A multi linear regression with these five variables yields a significant model and explains 18.9% of the variance (Table 8). The streetscape variables, when modeled together, maintain their respective relationships with the likelihood of eye fixation. The VAS percent chance of successfully fixating the eye can be expressed as:

VAS percent likelihood = 57.178 + (-0.042 Building Cells Count*) + (0.023*Landscaping Cell Count) + (0.063**Road Cells Count*) + (-0.089**SkyCells Count*) + (-0.036**Tree Canopy Cells Count*).**

Table 7: Linear regression results for all cases, each variable run independently

Variable	Constant	B	R Square	Significance
Art	59.902	-0.080	0.005	0.325
Building	53.016	0.062	0.065	0.000***
Car	60.297	-0.027	0.002	0.494
First Floor Windows	57.757	0.070	0.010	0.157
Furniture	58.569	0.022	0.004	0.404
Landscaping	63.388	-0.104	0.035	0.008**
Other	59.826	-0.465	0.007	0.241
People	61.665	-0.085	0.015	0.087
Primary Sign	59.424	0.006	0.000	0.836
Road	55.805	0.041	0.033	0.010**
Secondary Sign	58.304	0.143	0.012	0.118
Sidewalk	60.531	-0.022	0.003	0.474
Sky	65.190	-0.093	0.086	0.000***
Tree Canopy	63.141	-0.040	0.021	0.039*
Turf	59.849	-0.030	0.001	0.618

Table 8: Multi linear regression for all cases results

Variable	B	R Square	Significance
Model		0.189	0.000***
Constant	57.178		
Building	0.042		0.065
Landscaping	0.023		0.598
Road	0.063		0.000
Sky	-0.089		0.000
Tree Canopy	-0.036		0.114

Original Images

In the 26 original images, the building (22.29% mean coverage), road (17.62%) and sky (13.10%) have the highest cell count, accounting for a combined mean of 318.1 cells or 53.02% of each image (Table 9, Figure 3). This is the only image set in which three elements are needed to combine for over 50% of the coverage, indicating a relative lack of complexity compared to the Photoshop, placemaking images.

Table 9: Original images' descriptive statistics

Variable	N	Mean Cell Count	Std. Deviation	Percent Coverage
Art	26	0.769	1.986	0.13%
Building	26	133.769	77.681	22.29%
Car	26	26.808	24.562	4.47%
First Floor Windows	26	27.038	21.523	4.51%
Furniture	26	48.385	38.680	8.06%
Landscaping	26	18.731	19.548	3.12%
Other	26	0.423	1.501	0.07%
People	26	2.038	4.476	0.34%
Primary Sign	26	23.192	39.829	3.87%
Road	26	105.731	62.931	17.62%
Secondary Sign	26	7.923	9.090	1.32%
Sidewalk	26	51.808	37.966	8.63%
Sky	26	78.615	53.066	13.10%
Tree Canopy	26	58.846	48.723	9.81%
Turf	26	15.923	24.625	2.65%

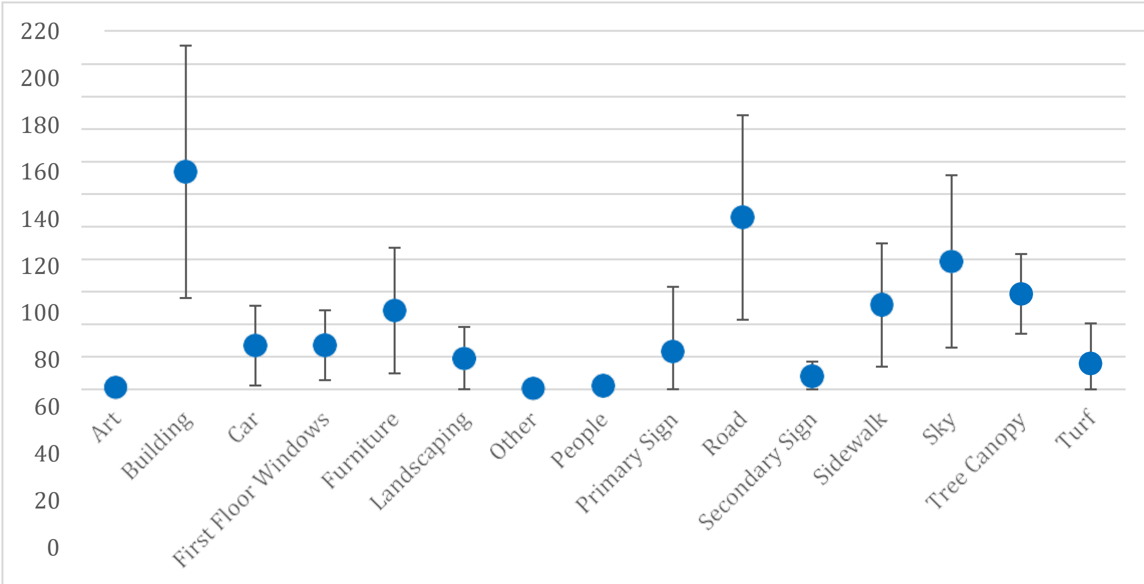


Figure 3: Mean original image streetscape element cell count and standard deviation

For the original images, none of the streetscape variables yielded a statistical relationship to the VAS likelihood (Table 10). People and sky are trending (less than 0.100) to have a negative impact on the likelihood while first floor windows are trending to positively affect the eye fixation.

Table 10: Original photographs linear regression results

Variable	Constant	B	R Square	Significance
Art	71.554	-1.720	0.051	0.266
Building	62.069	0.061	0.099	0.118
Canopy	74.175	-0.067	0.047	0.288
Car	70.209	0.001	0.000	0.995
First Floor Windows	63.276	0.257	0.135	0.065
Furniture	70.192	0.001	0.000	0.992
Landscaping	73.461	-0.172	0.050	0.273
Other	70.753	-1.234	0.015	0.550
People	72.580	-1.152	0.117	0.087
Primary Sign	69.080	0.050	0.017	0.524
Road	67.272	0.028	0.014	0.570
Secondary Sign	72.530	-0.290	0.031	0.393
Sidewalk	72.666	-0.047	0.014	0.565

Sky	77.960	-0.098	0.120	0.084
Tree Canopy	74.175	-0.067	0.047	0.288
Turf	71.603	-0.086	0.020	0.493

Level 1 Intensity

The Level 1 intensity streetscapes are comprised mostly of building (19.60% coverage), road (15.32%), tree canopy (13.91%), and sky (10.23%), constituting a combined mean 354.379 cells or 59.06% of all images (Table 11, Figure 4).

Table 11: Level 1 Streetscape Descriptive Statistics

Variable	N	Mean Cell Count	Std. Deviation	Percent Coverage
Art	58	0.948	3.322	0.16%
Building	58	117.621	56.111	19.60%
Car	58	25.414	26.945	4.24%
First Floor Windows	58	28.483	21.136	4.75%
Furniture	58	46.034	47.419	7.67%
Landscaping	58	29.172	22.700	4.86%
Other	58	0.431	1.535	0.07%
People	58	24.241	16.687	4.04%
Primary Sign	58	26.121	37.719	4.35%
Road	58	91.914	64.573	15.32%
Secondary Sign	58	9.638	11.400	1.61%
Sidewalk	58	45.121	32.490	7.52%
Sky	58	61.379	43.894	10.23%
Tree Canopy	58	83.466	57.986	13.91%
Turf	58	10.017	17.533	1.67%

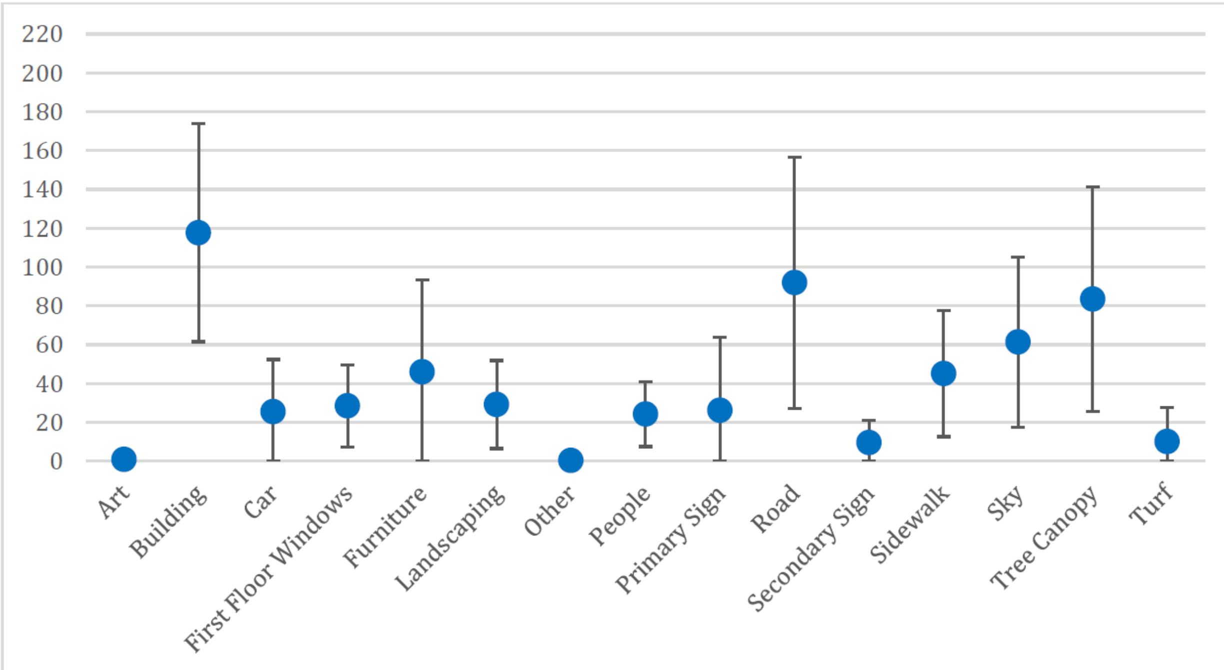


Figure 4: Mean level 1 streetscape element cell count and standard deviation

In the level 1 intensity design, the sky emerges as a significant detractor while the building façade significantly improves the likelihood of eye fixation (Table 12). The multilinear regression with these two streetscapes, independent variables is also a significant model, explaining 25.2% of the variance (Table 13). The VAS percent chance of successfully fixating the eye can be expressed as:

VAS percent likelihood = 67.901 + (-0.011* *Building Cells Count*) +(-0.152* *Sky Cell Count*)

Table 12: Level 1 streetscape linear regression output

Variable	Constant	B	R Square	Significance
Art	59.906	0.027	0.000	0.961
Building	53.016	0.062	0.065	0.000***
Canopy	59.140	0.009	0.002	0.765
Car	61.635	-0.067	0.017	0.323
First Floor Windows	59.223	0.025	0.001	0.775
Furniture	58.262	0.036	0.016	0.347
Landscaping	62.082	-0.074	0.015	0.360
Other	60.128	-0.457	0.003	0.702
People	58.618	0.054	0.004	0.622
Primary Sign	59.514	0.016	0.002	0.743
Road	57.052	0.031	0.022	0.268
Secondary Sign	59.424	0.053	0.002	0.744
Sidewalk	60.096	-0.004	0.000	0.948
Sky	69.483	-0.156	0.250	0.000***
Tree Canopy	59.140	0.009	0.002	0.765
Turf	61.260	-0.133	0.029	0.202

Table 13: Level 1 streetscape multi linear regression output

Variable	B	R Square	Significance
Model		0.252	0.000
Constant	67.901		
Building	0.011		0.698
Sky	-0.152		0.000

Level 2 Intensity

Similar to the other streetscape design intensities, building (17.28% coverage), tree canopy (15.66%), road (14.67%), and sky (9.90%) constitute over 50% of the image with a combined mean of 345.069 cells (or 57.51%) (Table 14, Figure 5).

Table 14: Level 2 intensity descriptive statistics

Variable	N	Mean	Std. Deviation	Percent Coverage
Art	58	3.035	9.138	0.51%
Building	58	103.690	57.656	17.28%
Car	58	28.638	27.294	4.77%
First Floor Windows	58	26.293	21.466	4.38%
Furniture	58	44.276	33.633	7.38%
Landscaping	58	39.655	26.345	6.61%
Other	58	0.707	3.524	0.12%
People	58	27.690	19.187	4.61%
Primary Sign	58	24.414	35.642	4.07%
Road	58	88.000	65.194	14.67%
Secondary Sign	58	8.638	11.886	1.44%
Sidewalk	58	43.052	33.854	7.18%
Sky	58	59.414	44.532	9.90%

Tree Canopy	58	93.966	51.614	15.66%
Turf	58	8.603	15.671	1.43%

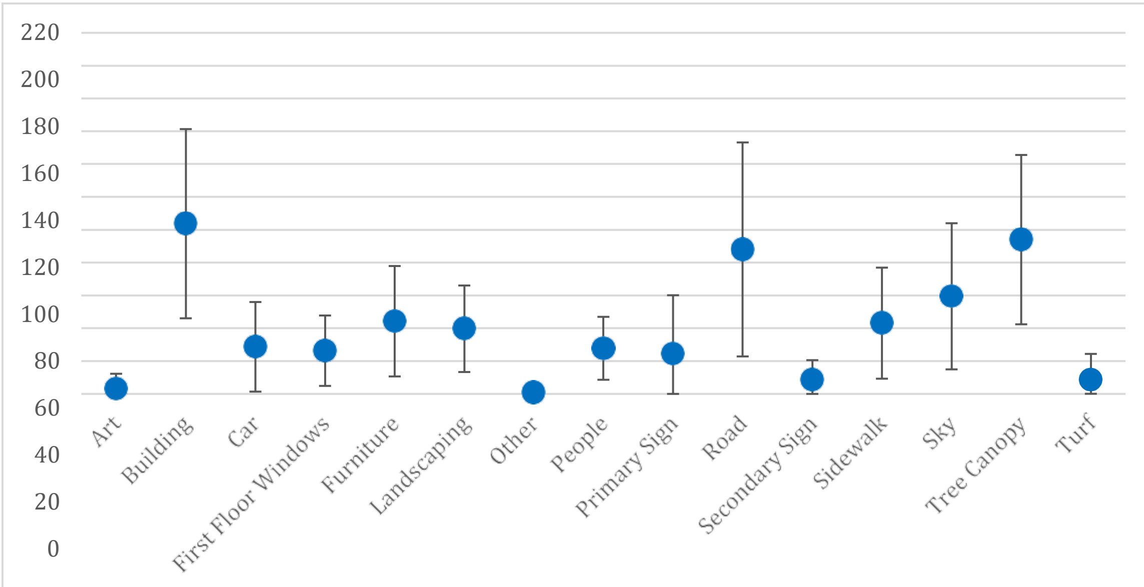


Figure 5: Level 2 design intensity mean cell count and standard deviation

In a level 2 design intensity, linear regression shows only the sky with a significant, and negative, relationship with the VAS likelihood. It alone explains 13.9% of the variance (Table 15).

Table 15: Level 2 streetscape linear regression results

Variable	Constant	B	R Square	Significance
Art	57.390	0.110	0.005	0.588
Building	52.116	0.054	0.051	0.090
Car	57.249	0.017	0.001	0.808
First Floor Windows	54.772	0.112	0.030	0.192
Furniture	57.152	0.013	0.001	0.815
Landscaping	62.059	-0.109	0.043	0.118
Other	58.296	-0.809	0.042	0.121
People	57.894	-0.006	0.000	0.949
Primary Sign	57.524	0.008	0.000	0.875
Road	53.187	0.052	0.059	0.067
Secondary Sign	56.164	0.181	0.024	0.246
Sidewalk	60.322	-0.060	0.022	0.270
Sky	64.626	-0.116	0.139	0.004**
Tree Canopy	61.906	-0.045	0.027	0.214
Turf	58.257	-0.062	0.005	0.601

Level 3 Intensity

While tree canopy was generally increasing in its rank order of streetscape elements with each increase in intensity, it now constitutes the largest percent coverage of the 15 elements with 18% (or 108 cells) (Table 16, Figure 6). When cumulatively added with road (15.13%), building (14.05%), and sky (8.80%), these elements make up about 56% of thephotographs with 336 cells. At level 3 design intensity, secondary signs yield a significant, positive relationship with eye fixation (Table 16).

Table 16: Level 3 intensity streetscape descriptive statistics

Variable	N	Mean Cell Count	Std. Deviation	Percent Coverage
Art	58	9.95	20.16	1.66%
Building	58	84.28	48.47	14.05%
Car	58	27.93	26.32	4.66%
First Floor Windows	58	22.31	19.20	3.72%
Furniture	58	43.78	34.52	7.30%
Landscaping	58	48.98	24.53	8.16%
Other	58	0.57	2.75	0.09%
People	58	31.90	23.06	5.32%
Primary Sign	58	26.71	37.40	4.45%
Road	58	90.78	66.14	15.13%
Secondary Sign	58	8.64	11.41	1.44%
Sidewalk	58	37.34	30.34	6.22%
Sky	58	52.81	43.74	8.80%
Tree Canopy	58	107.97	45.91	17.99%
Turf	58	6.07	12.52	1.01%

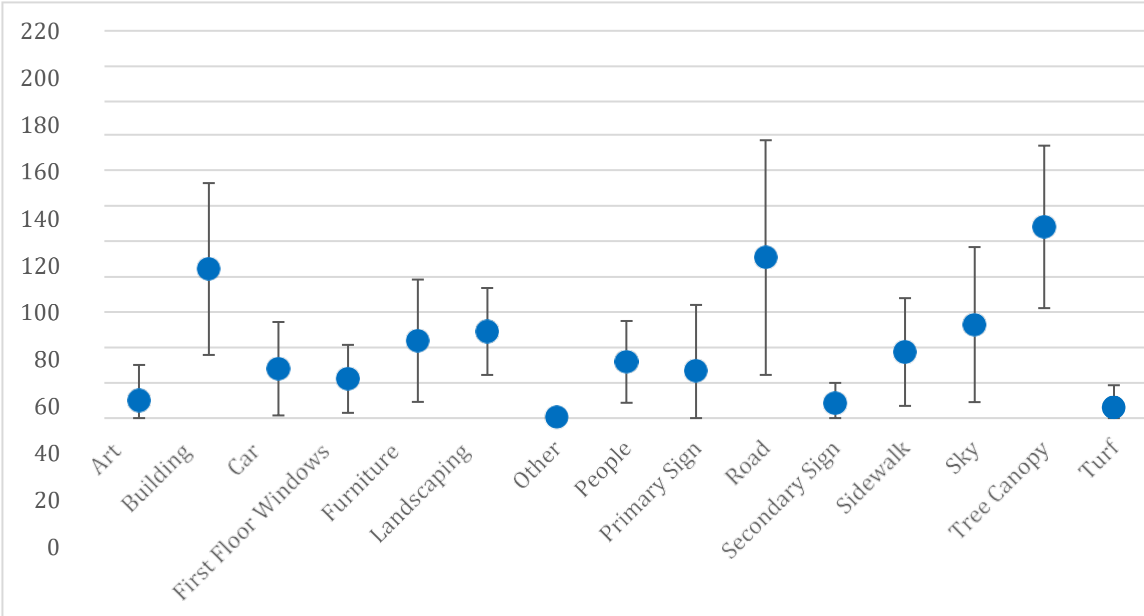


Figure 6: Level 3 intensity mean cell count and standard deviation

Table 17: Level 3 intensity linear regression results

Variable	Constant	B	R Square	Significance
Art	56.668	-0.039	0.003	0.663
Building	53.428	0.034	0.014	0.368
Car	57.125	-0.030	0.003	0.661
First Floor Windows	57.956	-0.075	0.011	0.428
Furniture	56.386	-0.003	0.000	0.962
Landscaping	53.435	0.058	0.011	0.435
Other	56.088	0.330	0.004	0.620
People	55.618	0.021	0.001	0.795
Primary Sign	56.792	-0.019	0.003	0.692
Road	53.775	0.028	0.018	0.317
Secondary Sign	53.345	0.339	0.081	0.031*
Sidewalk	58.100	-0.049	0.012	0.416
Sky	60.120	-0.073	0.055	0.077
Tree Canopy	57.154	-0.008	0.001	0.838
Turf	56.127	0.025	0.001	0.866

Downtown or Lower Density/ Auto-Centered Development

Similar to the 3 levels of intensity, the Midwestern Downtown images are comprised at least half with the building (19.79% coverage), tree canopy (14.75%), road (11.15%), and sky (10.14%). These four elements constitute nearly 56% of the image, or a combined mean of 335 cells (Table 18, Figure 7).

Table 18: Midwestern downtown descriptive statistics

Variable	N	Mean	Std. Deviation	Percent Coverage
Art	100	5.030	13.939	0.84%
Building	100	118.720	58.099	19.79%
Car	100	26.910	22.333	4.49%
First Floor Windows	100	21.090	15.228	3.52%
Furniture	100	58.320	37.586	9.72%
Landscaping	100	38.190	26.796	6.37%
Other	100	0.670	3.411	0.11%
People	100	28.810	21.019	4.80%
Primary Sign	100	16.390	12.385	2.73%
Road	100	66.910	65.681	11.15%
Secondary Sign	100	8.900	8.276	1.48%
Sidewalk	100	51.440	31.038	8.57%
Sky	100	60.860	38.842	10.14%
Tree Canopy	100	88.520	52.289	14.75%
Turf	100	9.270	17.398	1.55%

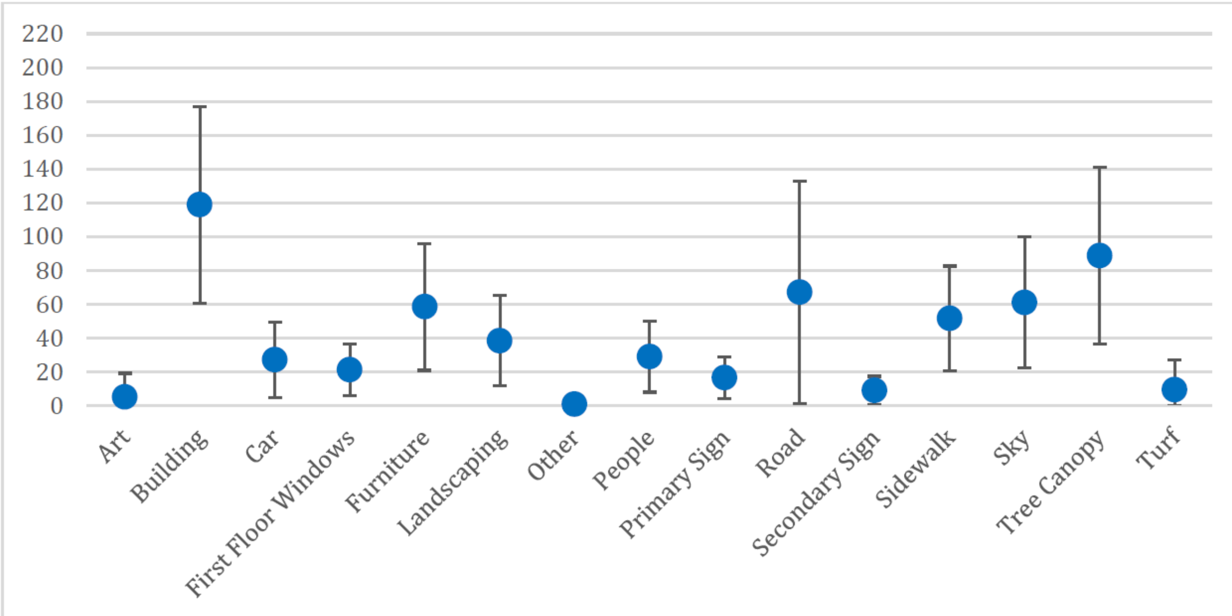


Figure 7: Midwestern Downtown mean cell count and standard deviation

In lower density or auto-centered images, the road (19.60%) occupies the greater proportion of the 15 elements. Joined by the building (15.55%) and tree canopy (15.39%), they comprise 50.53% of the images, or a combined mean of about 303 cells (Table 19, Figure 8).

Table 19: Lower density/ auto-centered descriptive statistics

Variable	N	Mean	Std. Deviation	Percent Coverage
Art	100	3.250	11.091	0.54%
Building	100	93.300	58.843	15.55%
Car	100	27.610	30.042	4.60%
First Floor Windows	100	30.650	24.197	5.11%
Furniture	100	32.030	35.397	5.34%
Landscaping	100	35.010	25.053	5.84%
Other	100	0.430	1.335	0.07%
People	100	20.340	19.390	3.39%
Primary Sign	100	34.440	49.416	5.74%
Road	100	117.580	53.061	19.60%
Secondary Sign	100	8.770	13.568	1.46%
Sidewalk	100	34.830	33.176	5.81%
Sky	100	60.270	51.737	10.05%
Tree Canopy	100	92.310	54.947	15.39%
Turf	100	9.190	16.653	1.53%

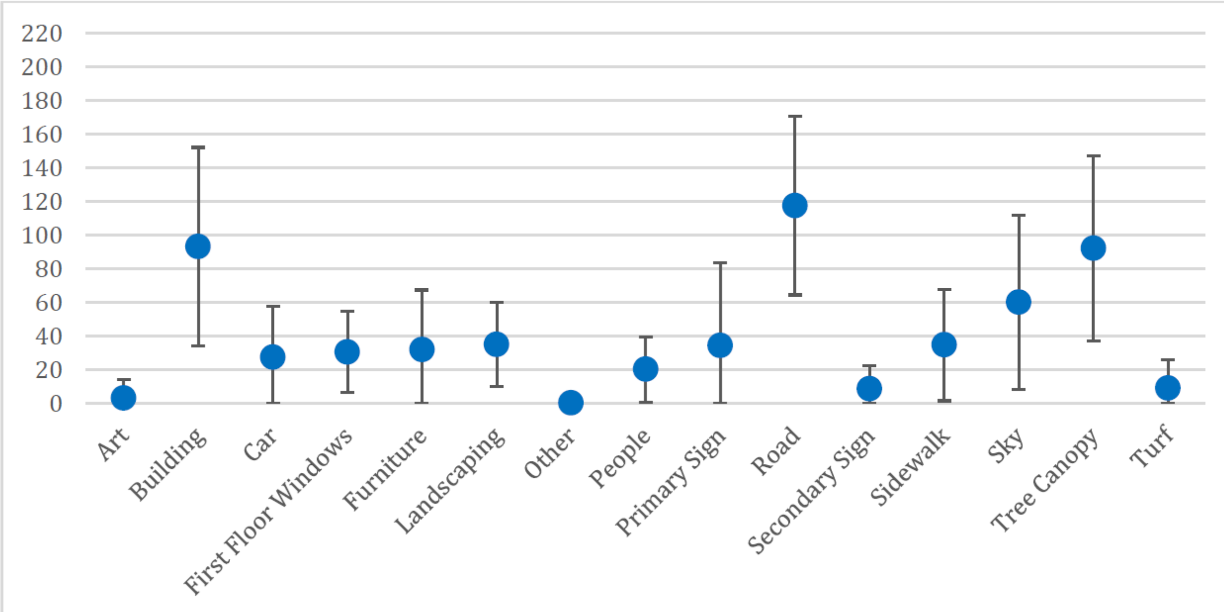


Figure 8: Lower density streetscape element mean cell count

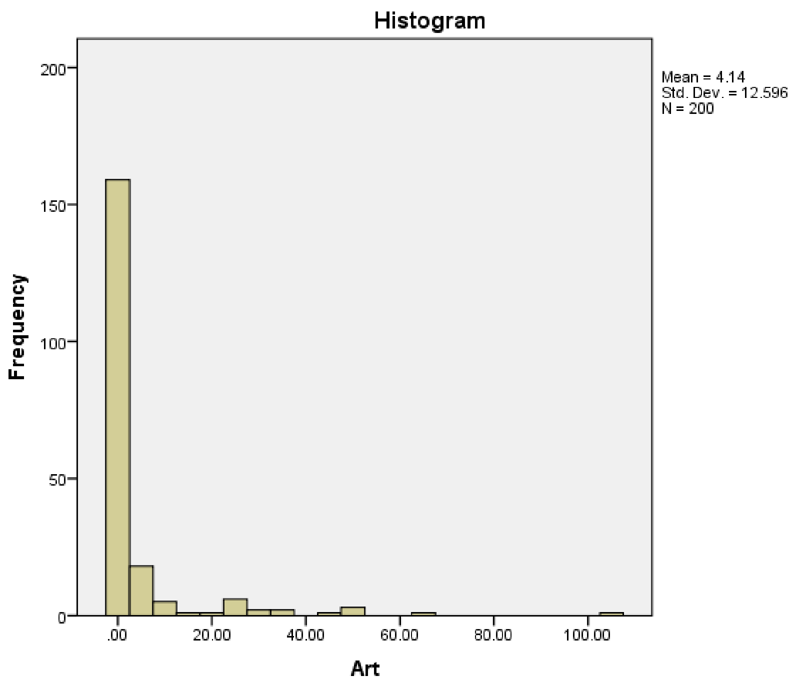
While the two settings of the streetscape highlight different elements, such as the amount of road, these two settings have no significant impact upon the likelihood of eye fixation on the primary sign (Table 20). The lower density images, though, have a significantly higher count of cells coded to primary signage (significance = 0.000). This significance does not occur when comparing levels of placemaking intensity.

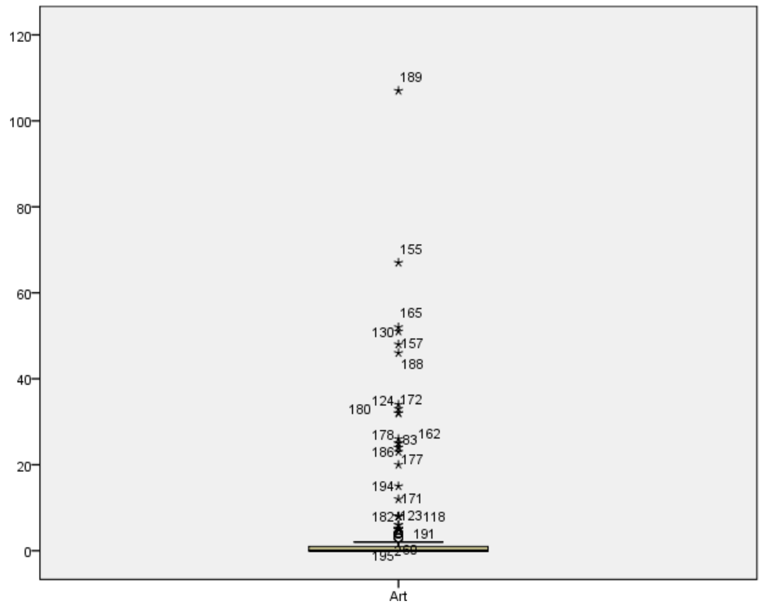
Table 20: Midwestern Downtown / Lower density streetscape ANOVA comparison results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	623.045	1	623.045	0.714	0.399
Within Groups	172845.750	198	872.958		
Total	173468.795	199			

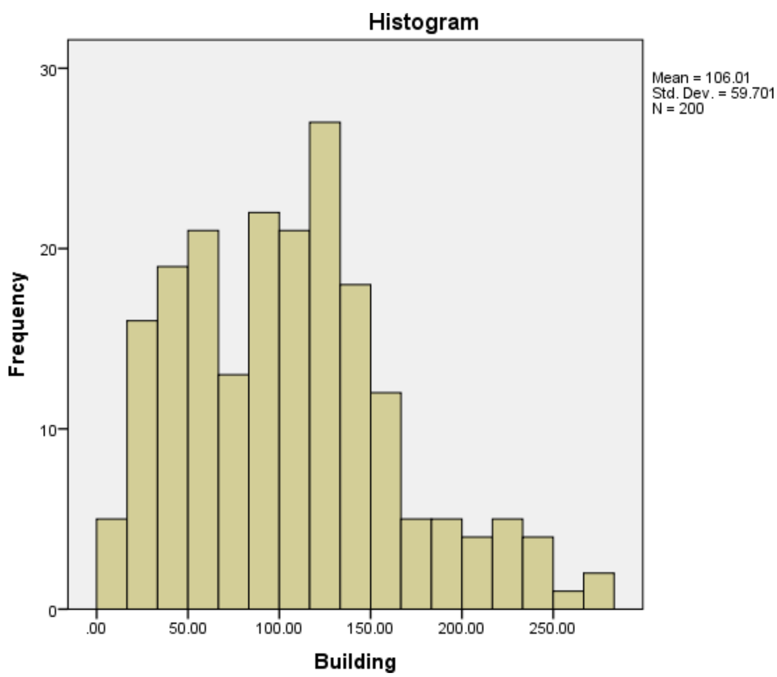
Histograms

The following histograms, created in SPSS 22, demonstrate the variety of coded streetscape elements. The Art Histogram, for example, skews towards a high frequency of images without many cells coded to *art*. The box plots demonstrate the 25-75 percentile of streetscape coded elements. The larger the box, the greater variety of the streetscape element within the photographs and Photoshop images.

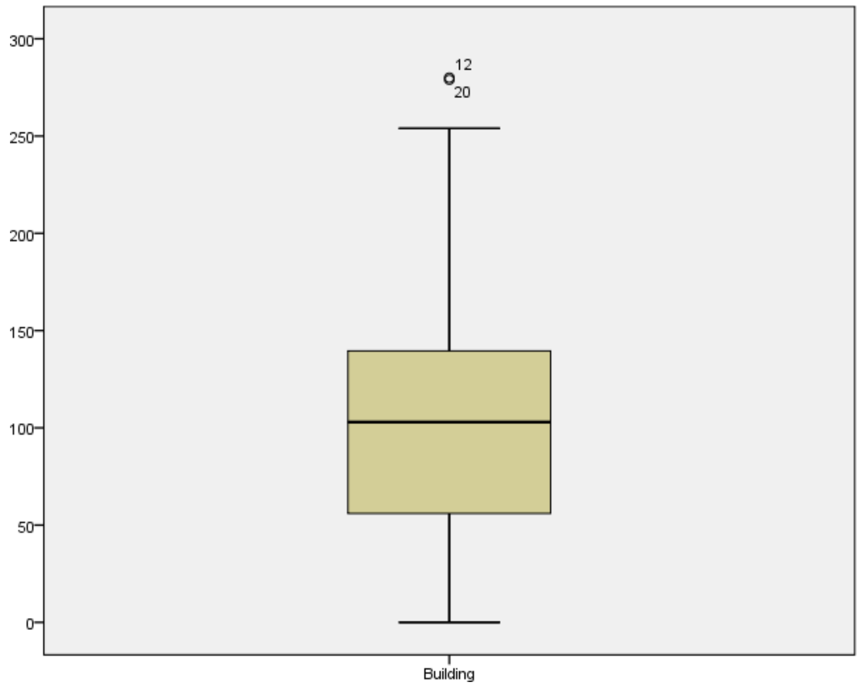


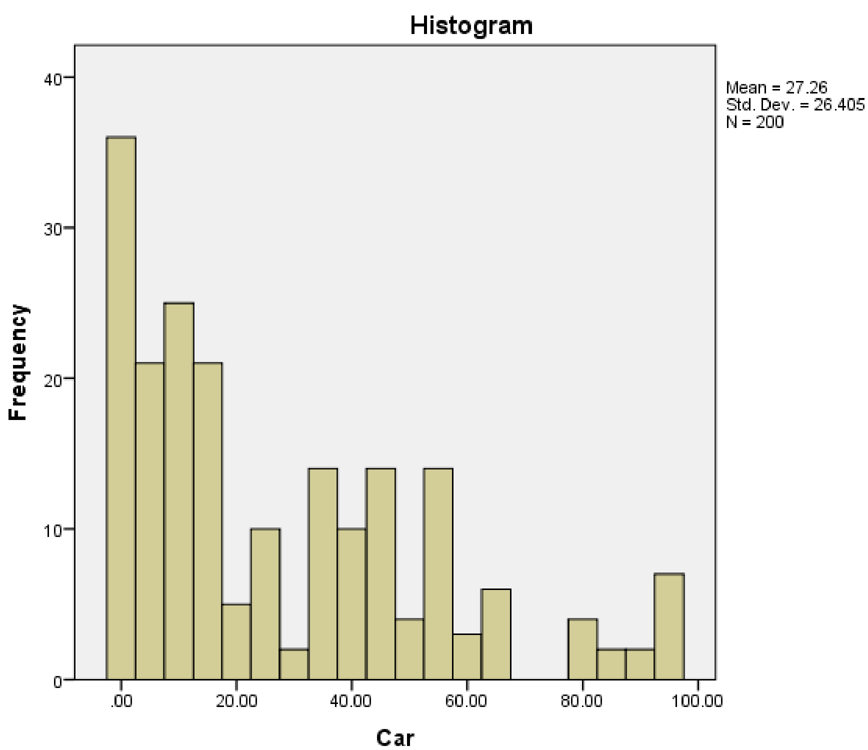


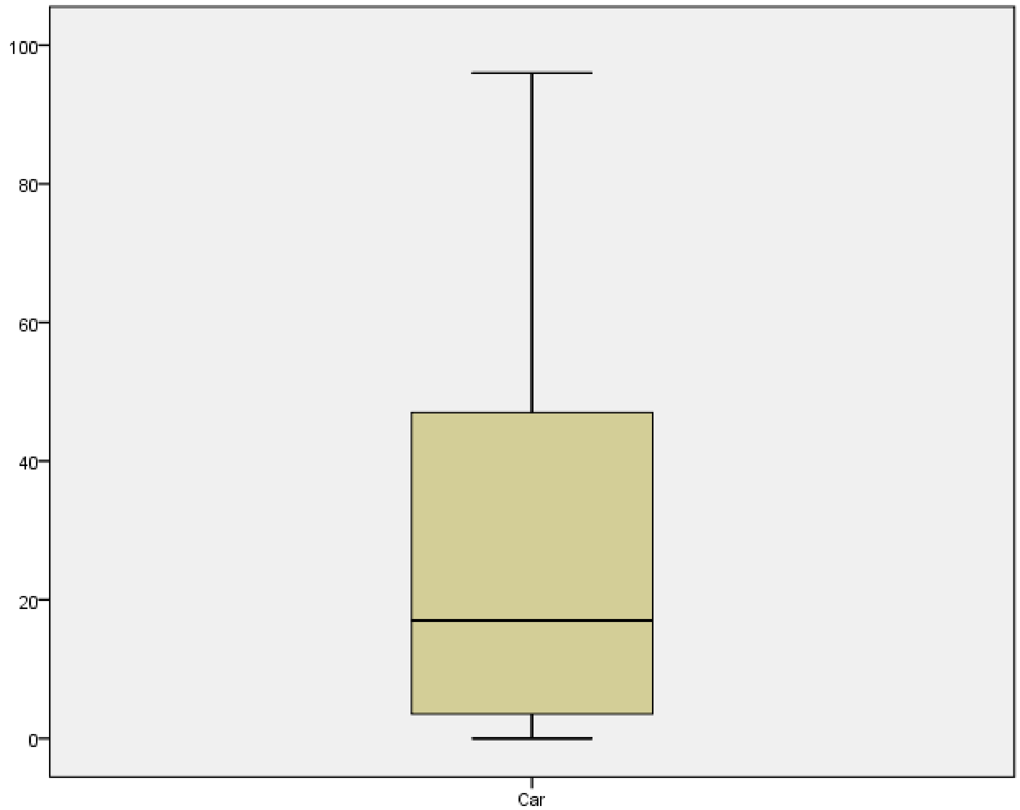
120
100
80
60
40
20
0
189
155
165
130
157
188
124
172
180
178
183
162
186
177
194
171
182
123
118
191
195
200
Art



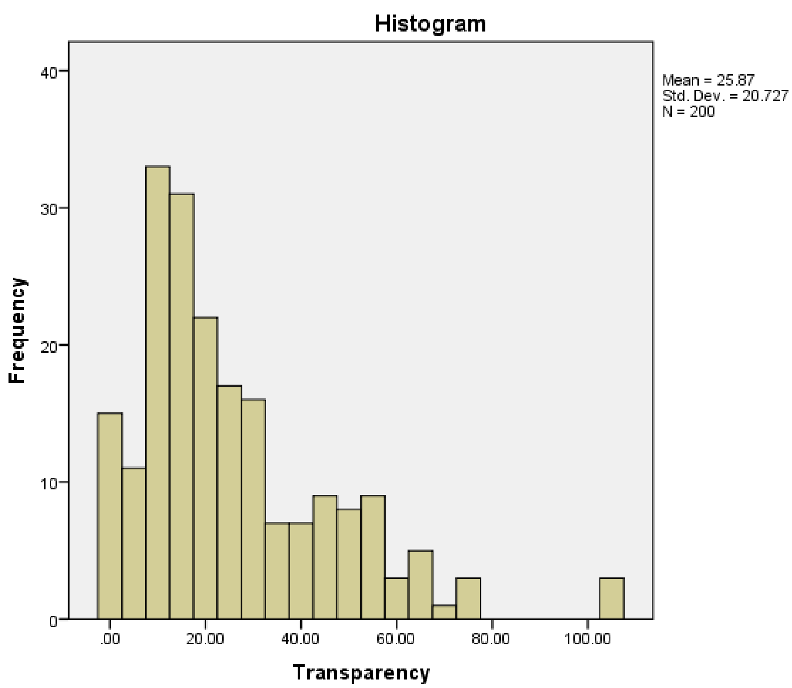
Histogram
Mean = 106.01
Std. Dev. = 59.701
N = 200
Frequency
30
20
10
0
.00
50.00
100.00
150.00
200.00
250.00
Building

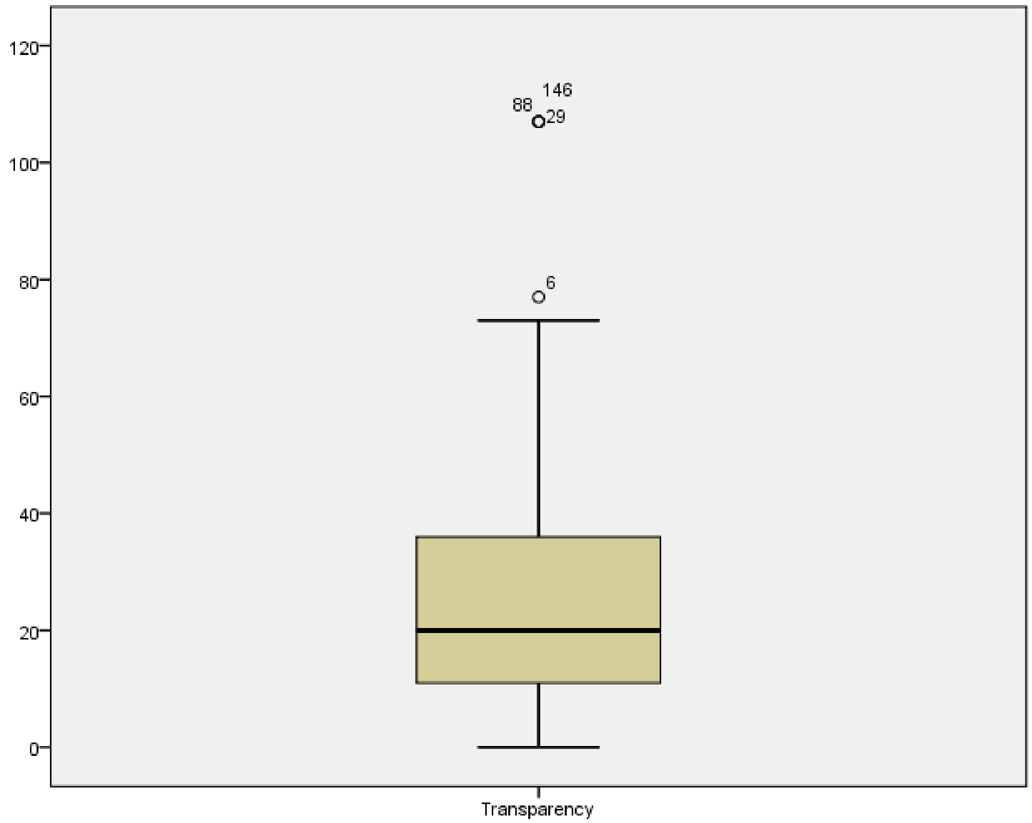

300
250
200
150
100
50
0
12
20
Building


Histogram
Mean = 27.26
Std. Dev. = 26.405
N = 200
Frequency
40
30
20
10
0
.00
20.00
40.00
60.00
80.00
100.00
Car

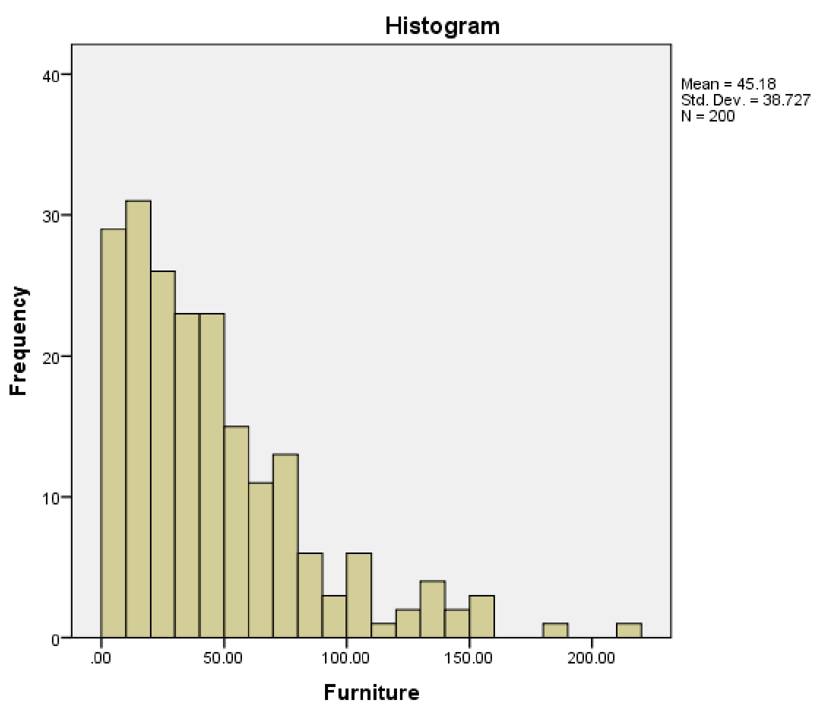


"Transparency" refers to the variable *First Floor Windows.*



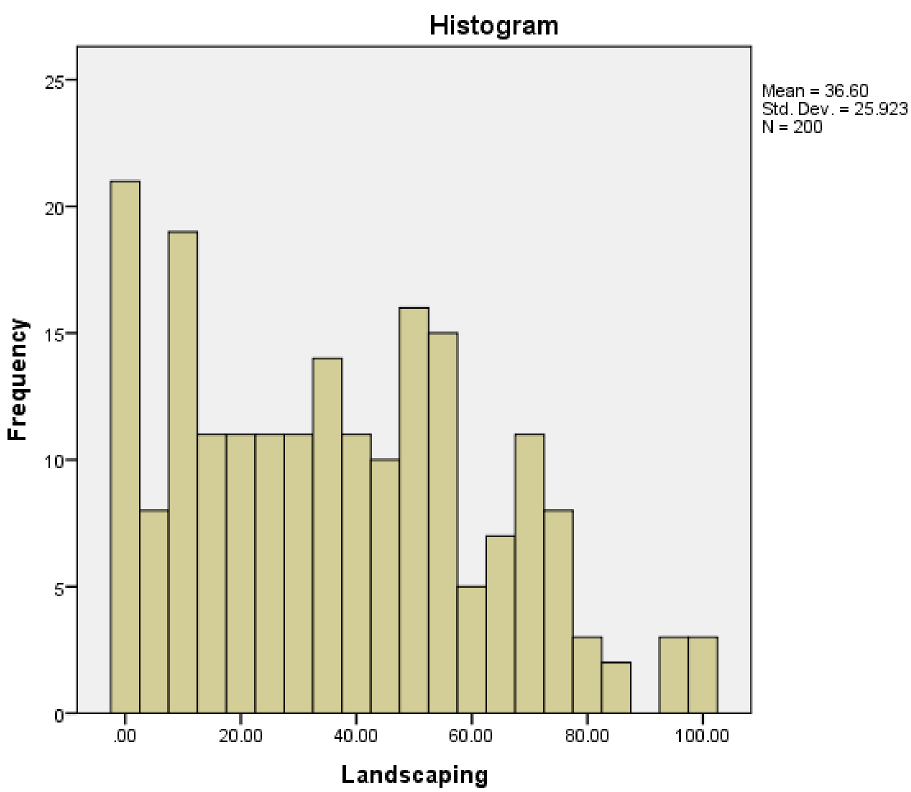


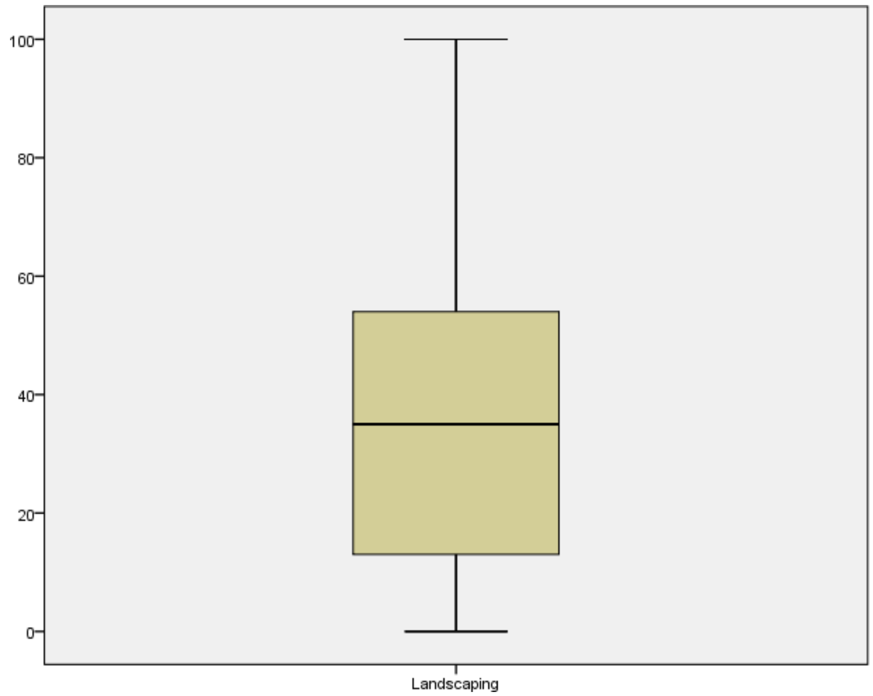
120
100
80
60
40
20
0
146
88
29
6
Transparency

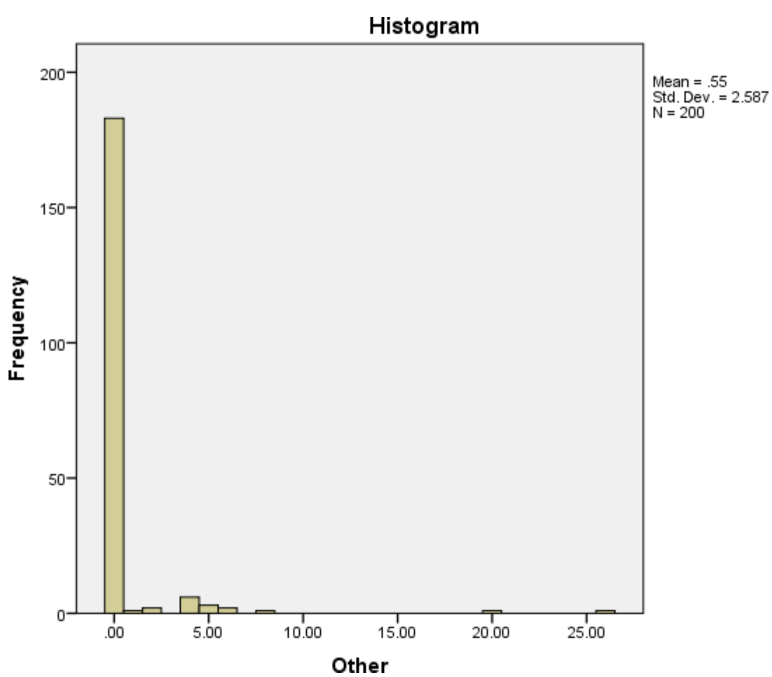


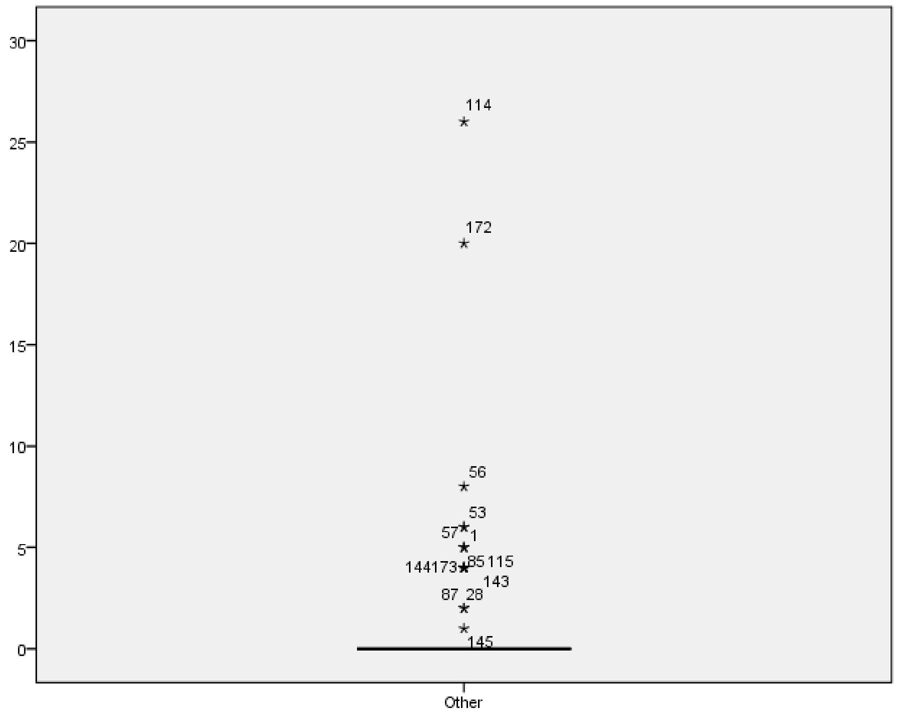
Histogram
Mean = 45.18
Std. Dev. = 38.727
N = 200
Frequency
40
30
20
10
0
.00
50.00
100.00
150.00
200.00
Furniture


250
200
150
100
50
0
49
50
77
65
23
196
16
66
48
136
Furniture

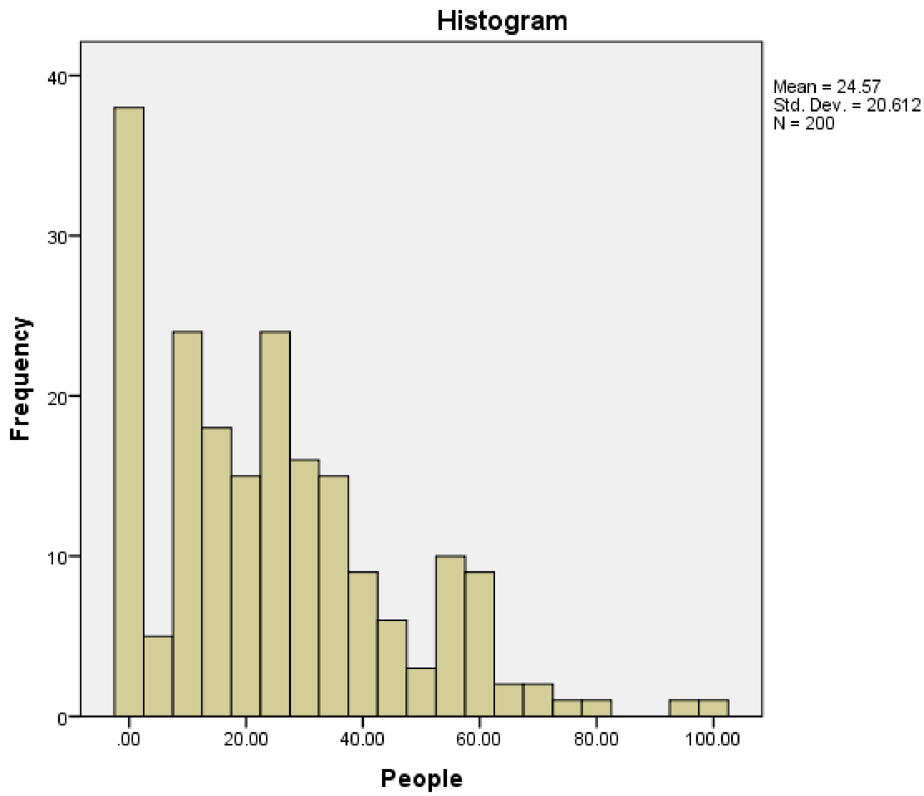

Histogram
Mean = 36.60
Std. Dev. = 25.923
N = 200
Frequency
25
20
15
10
5
0
.00
20.00
40.00
60.00
80.00
100.00
Landscaping

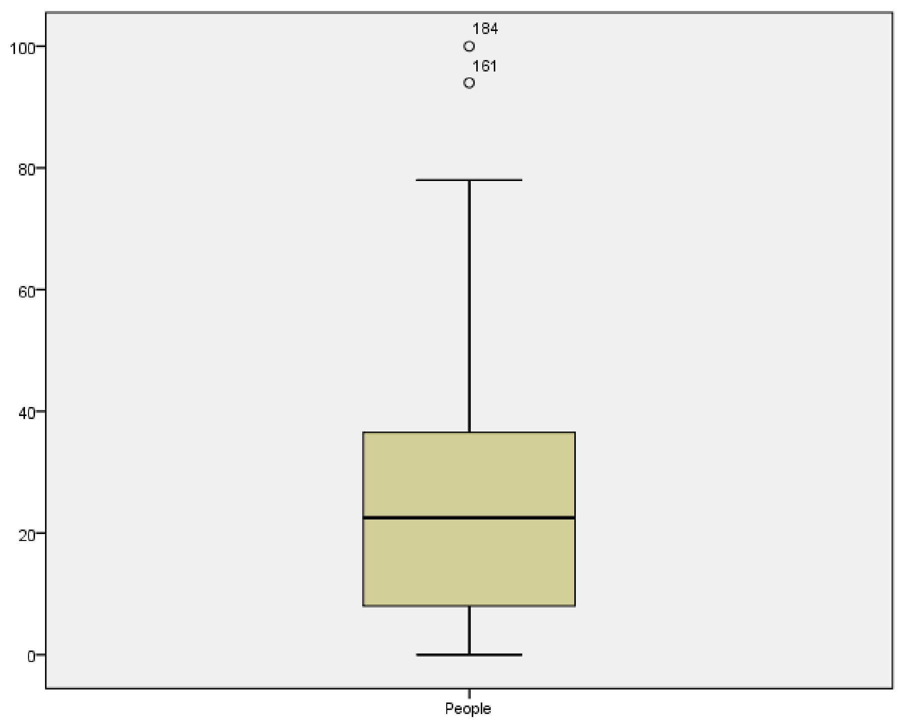

100
80
60
40
20
0
Landscaping

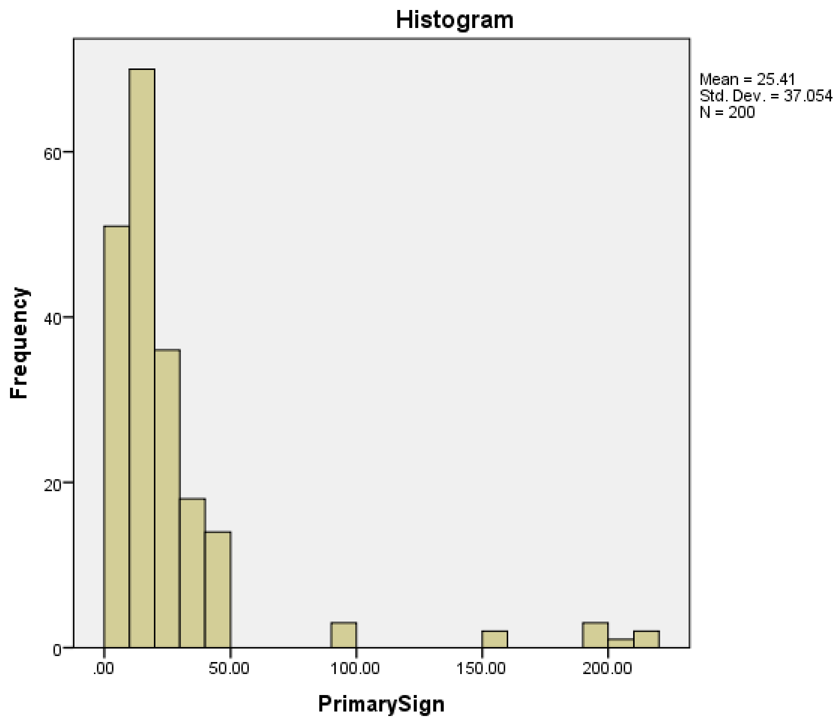

Histogram
Mean = .55
Std. Dev. = 2.587
N = 200
Frequency
200
150
100
50
0
.00
5.00
10.00
15.00
20.00
25.00
Other

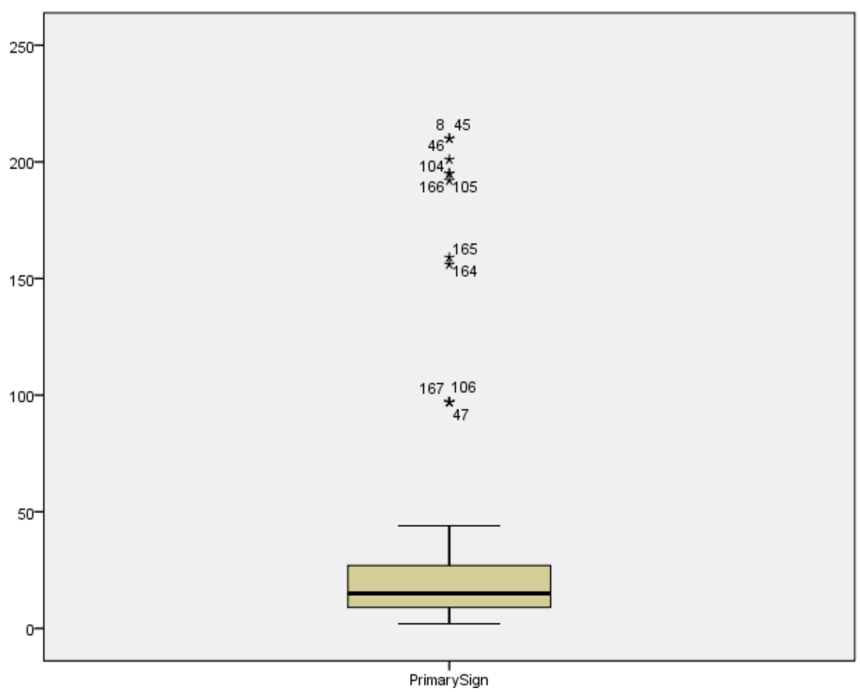


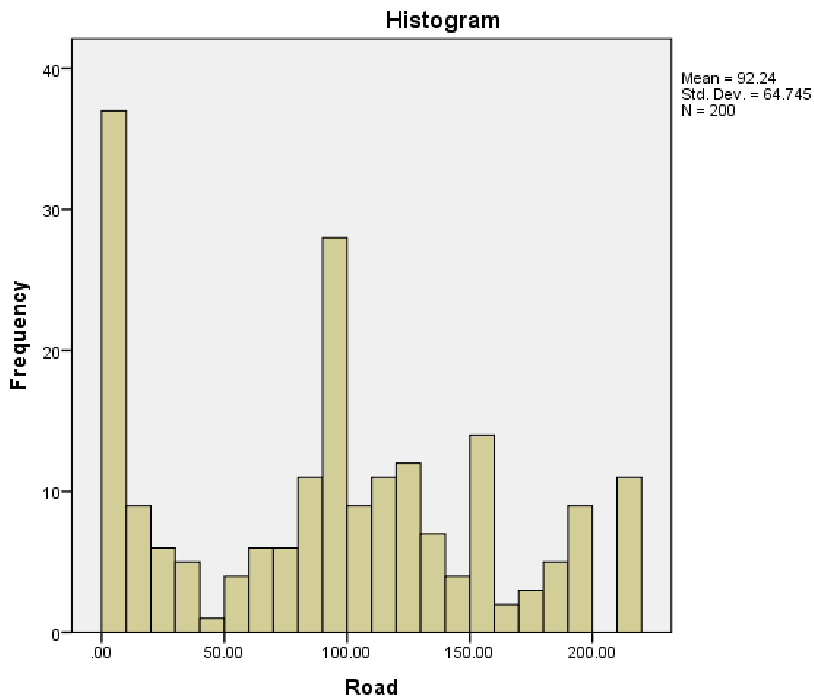
30
25
20
15
10
5
0
114
172
56
53
57
1
144173
85
115
143
87
28
145
Other

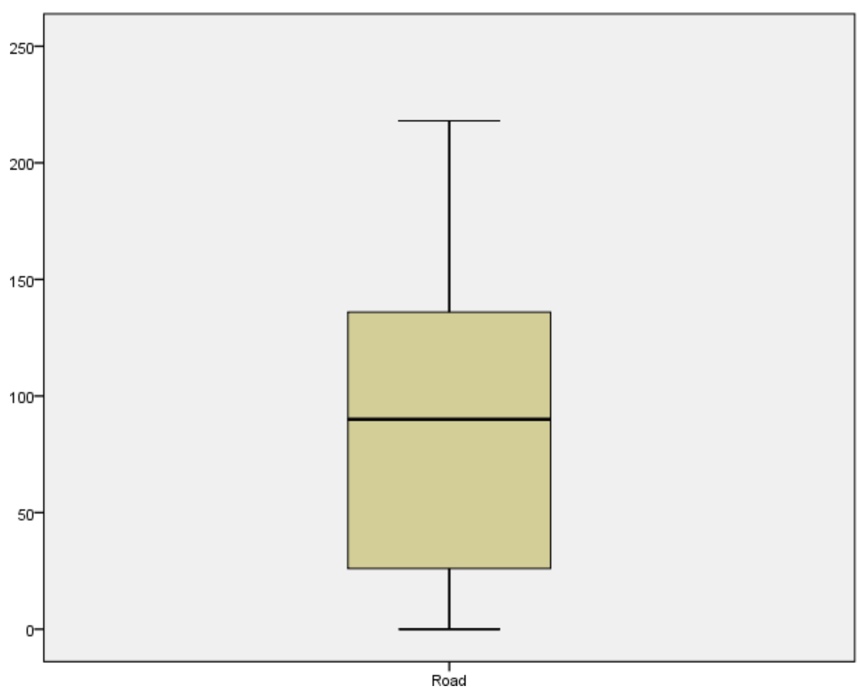

Histogram
Mean = 24.57
Std. Dev. = 20.612
N = 200
Frequency
40
30
20
10
0
.00
20.00
40.00
60.00
80.00
100.00
People

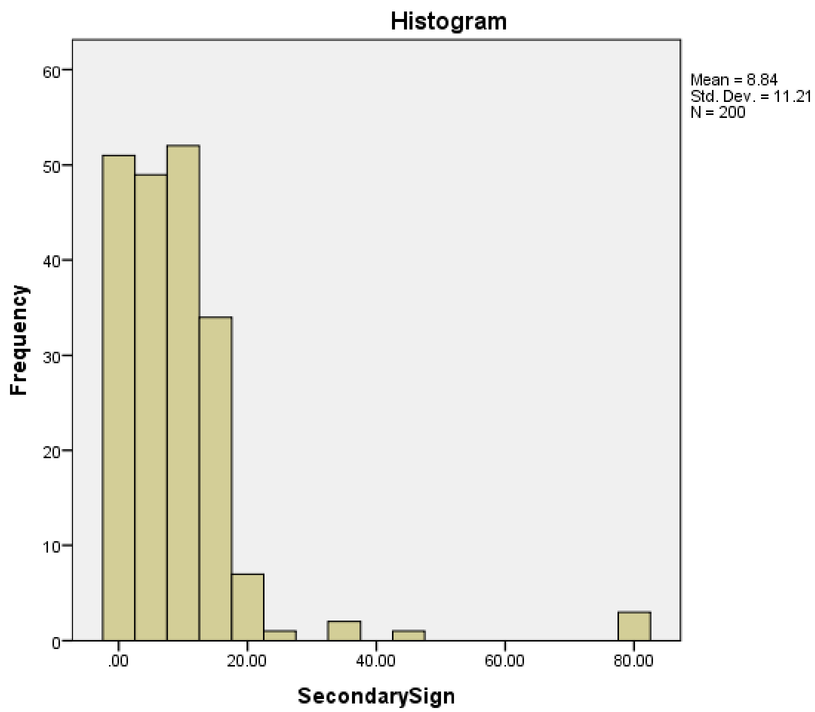

184
161
100
80
60
40
20
0
People

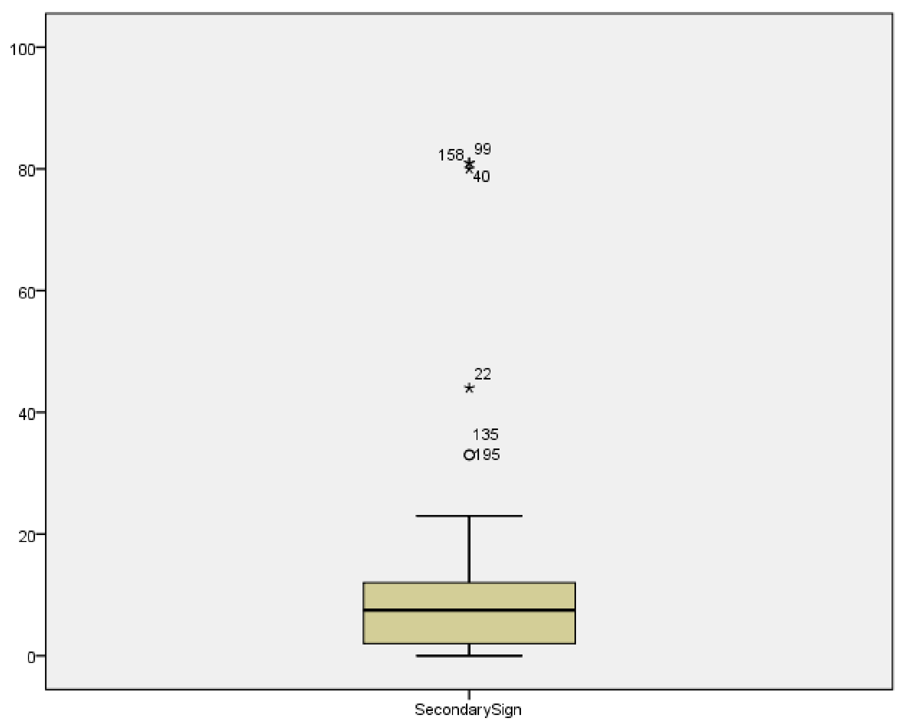

Histogram
Mean = 25.41
Std. Dev. = 37.054
N = 200
Frequency
60
40
20
0
.00
50.00
100.00
150.00
200.00
PrimarySign

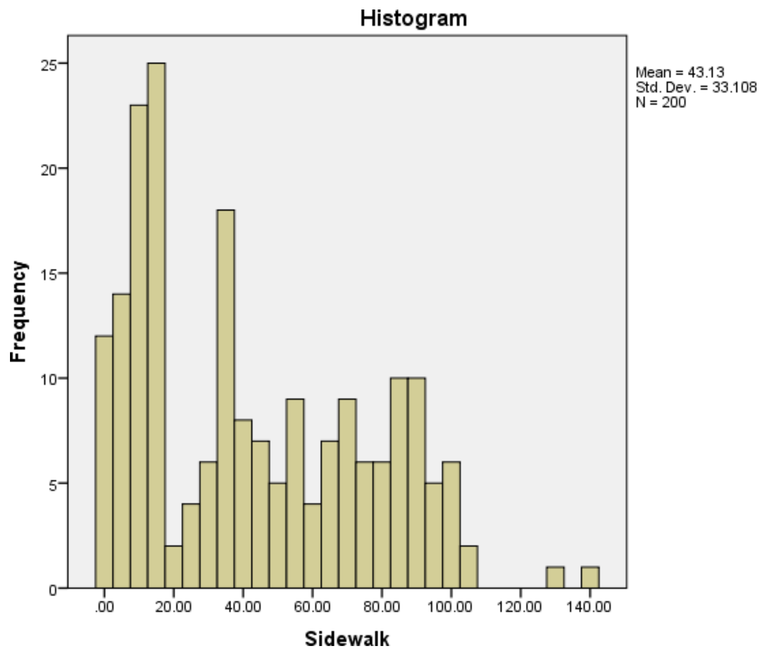

250
200
150
100
50
0
8 45
46
104
166 105
165
164
167 106
47
PrimarySign

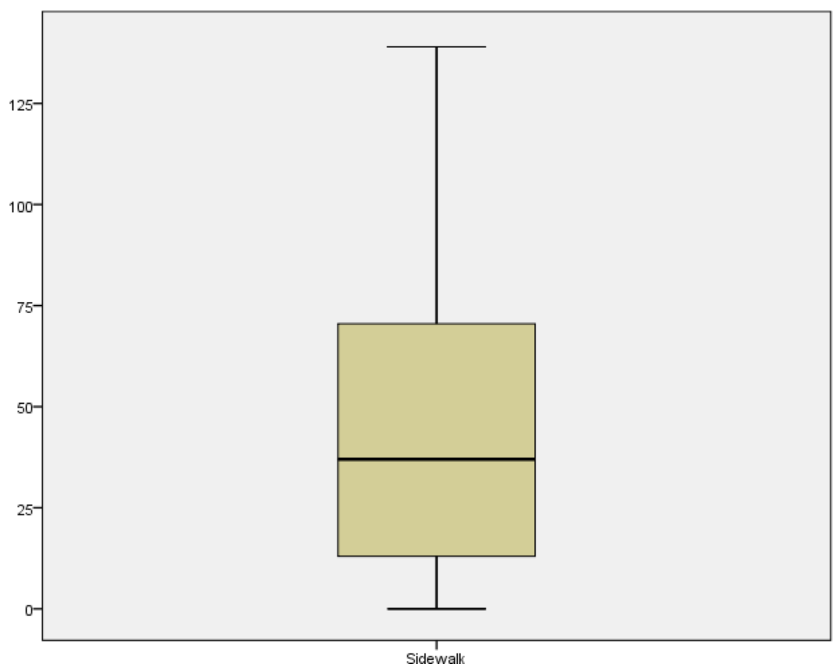

Histogram
Frequency
Road
Mean = 92.24
Std. Dev. = 64.745
N = 200
40
30
20
10
0
.00
50.00
100.00
150.00
200.00

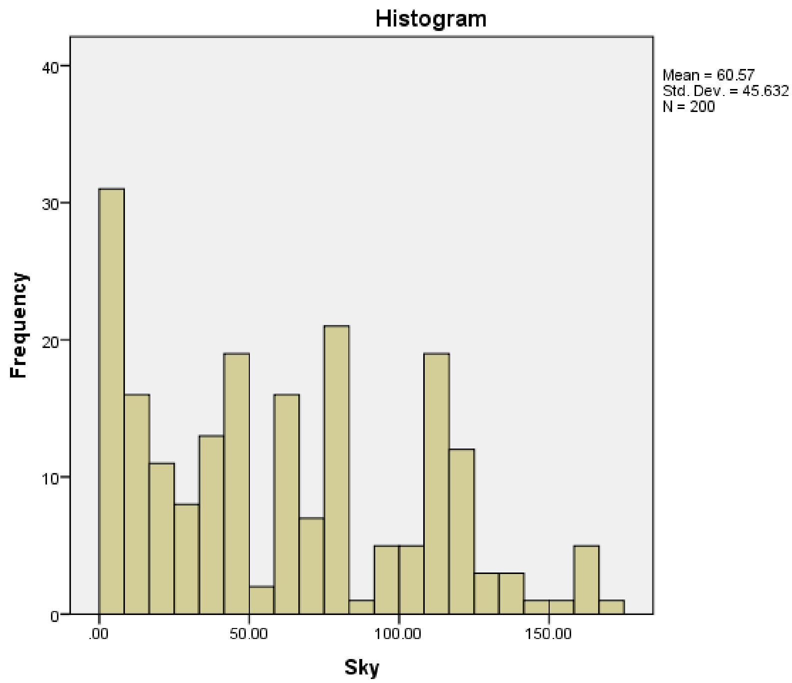

250
200
150
100
50
0
Road

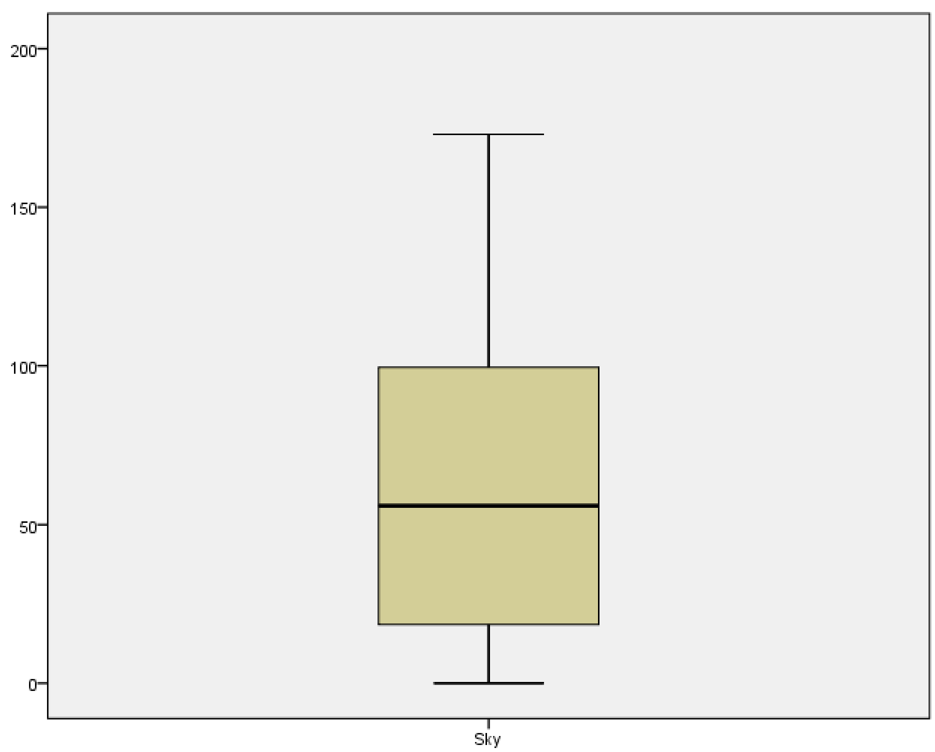

Histogram
Mean = 8.84
Std. Dev. = 11.21
N = 200
Frequency
60
50
40
30
20
10
0
.00
20.00
40.00
60.00
80.00
SecondarySign

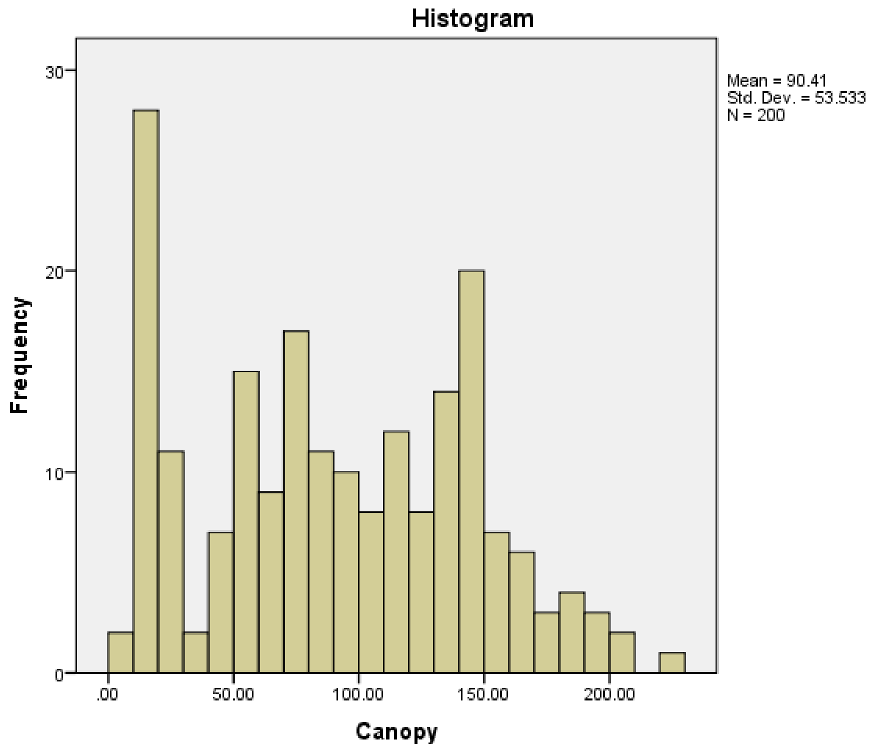

100
80
60
40
20
0
158
99
40
22
135
195
SecondarySign

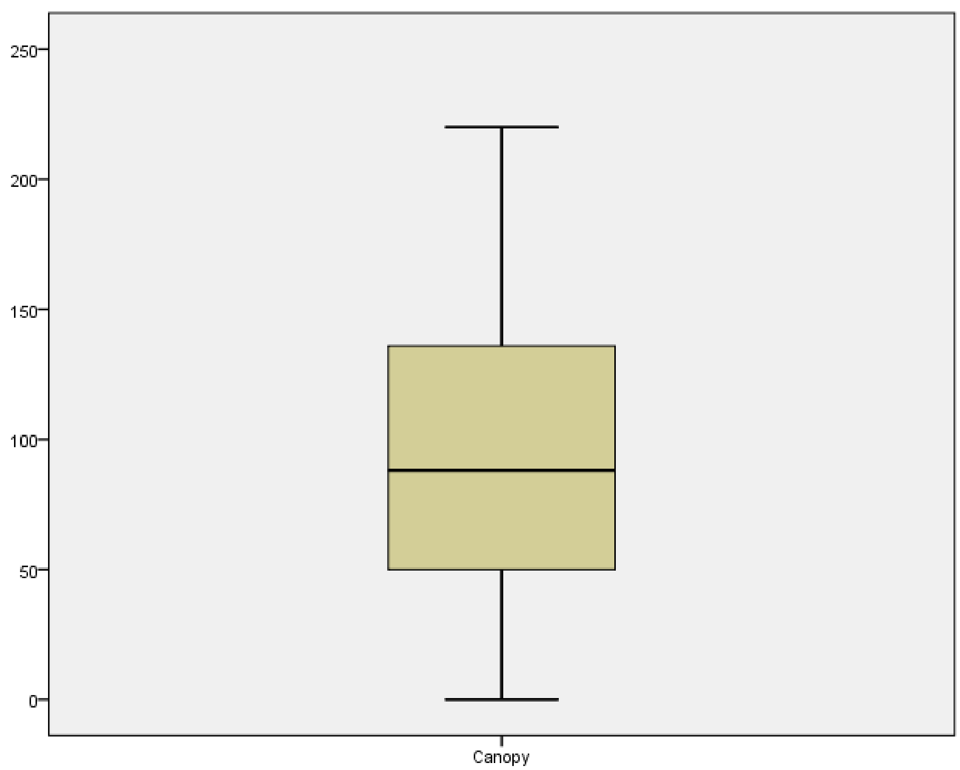

Histogram
Mean = 43.13
Std. Dev. = 33.108
N = 200
Frequency
0
5
10
15
20
25
.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Sidewalk

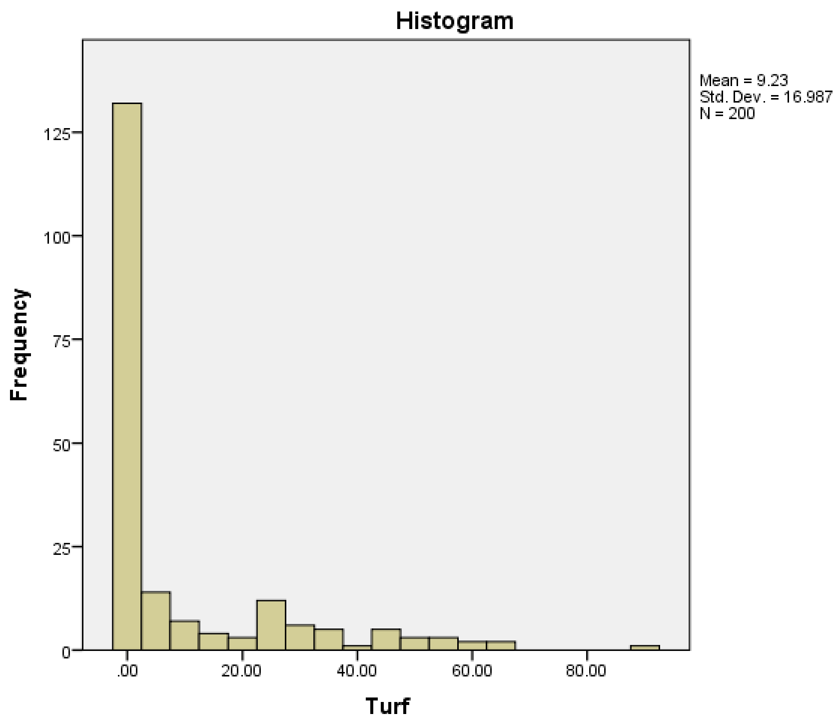

0
25
50
75
100
125
Sidewalk

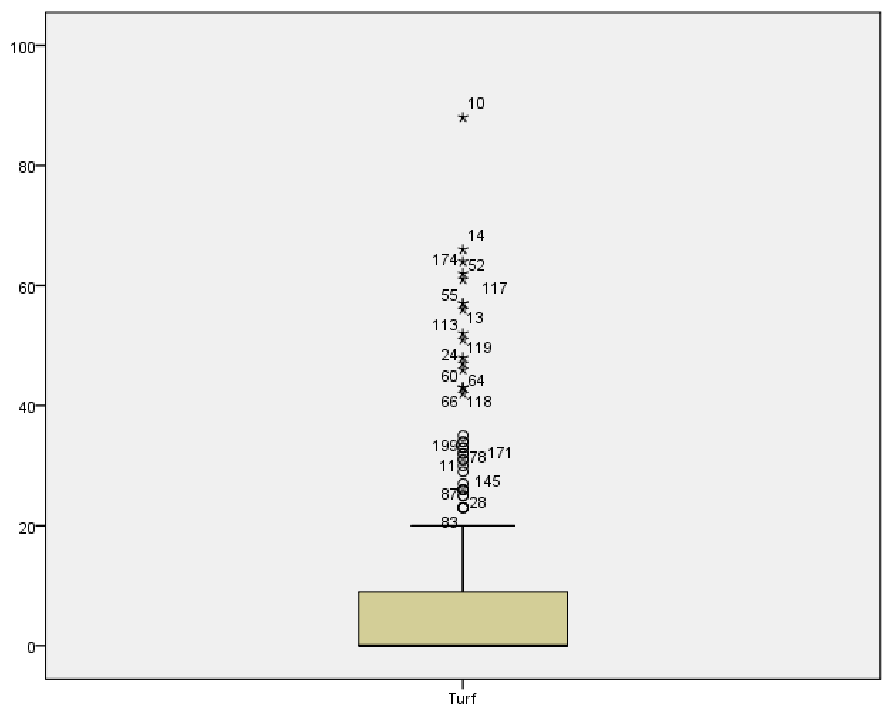

Histogram
Mean = 60.57
Std. Dev. = 45.632
N = 200
Frequency
40
30
20
10
0
.00
50.00
100.00
150.00
Sky


200
150
100
50
0
Sky


Histogram
Mean = 90.41
Std. Dev. = 53.533
N = 200
Frequency
30
20
10
0
.00
50.00
100.00
150.00
200.00
Canopy


250
200
150
100
50
0
Canopy


Histogram
Mean = 9.23
Std. Dev. = 16.987
N = 200
Frequency
Turf


Turf

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