MITIGATING THE IMPACTS OF SPECIAL EVENTS IN MIDTOWN ATLANTA

Report prepared for:

Dr. Randall Guensler, Dr. Catherine Ross, & Ms. Alice Grossman

Submitted:

December 8th, 2014

By:

Abhilasha Saroj

(Faaiqa) Atiyya Shaw

Xiaodan Xu

Table of Contents

Tables

Figures

Abstract

Special events can provide much needed sources of revenue and economic development for cities and metropolitan regions. Over the last century, Atlanta's beautiful 185 acre Piedmont Park has developed into the location of choice for event organizers hosting large special events in the metro Atlanta region. While these special events have played a significant role in building Atlanta's image as a dynamic urban city of the 21st century, there have been several transportation infrastructure challenges associated with planning and hosting events that often have expected attendances of 50,000 people or more. Both the daily operations and the residents of the surrounding Midtown Atlanta area are affected by increased congestion, road closures, and illegal parking conditions that are caused by large-scale special events in Piedmont Park. The goal of this research was to address these issues from a long-term transportation planning and mitigation viewpoint. The road networks surrounding Piedmont Park were modeled using traffic counts from Music Midtown 2014 in VISSIM 5.2, and a comprehensive literature review and research process was performed to produce detailed recommendations aimed at improving the infrastructure challenges caused by special events in Piedmont Park. One of the primary recommendations that emerged was a need to use portable variable message signs and other forms of real-time information to guide attendees in making parking decisions. The team has also suggested alternate road closures for non-event days, as well as improved information dissemination methods to allow drivers to be aware of the traffic levels. Additionally, there needs to be significant improvements in stakeholder communication between policy makers, engineers, and residents.

1. Introduction

This section will introduce the rich history of Piedmont Park and set the stage for a complete examination of the issues that arise when large special events are held repeatedly in Atlanta's treasured Piedmont Park, located in the center of Midtown Atlanta. As the largest green space in Atlanta, Piedmont Park currently hosts approximately six Class A special events annually. Class A special events are defined by the City of Atlanta as events with expected attendances of greater than 50,000 (City of Atlanta, 2014a). The primary Class A events hosted in Piedmont Park are the Atlanta

Jazz Festival, Gay Pride Festival, Music Midtown, Dogwood Festival, and the Peachtree Road Race. Thus, although Music Midtown is just one of many special events held in Piedmont Park every year, the Georgia Tech team has chosen to focus on the impacts of the Music Midtown festival as one of the largest events in Piedmont Park that appears to have the most significant impact on the Park and surrounding communities. Many of the recommendations in this report are designed exclusively for mitigating the impacts of Music Midtown; however, some of the suggestions will have applicability to the issues caused by the other Class A events that are hosted in Piedmont Park.

1.1 A History of Special Events in Piedmont Park

Piedmont Park has a long history of being the site of large fairs and expositions hosted in Atlanta over the last 150 years. In 1887, the regional Piedmont Exposition was held at Piedmont Park followed by the Cotton States and International Exposition of 1895, a World's Fair that was intended to promote the economies and relations of the Southern states to the international community. The Cotton States and International Exposition was held over a period of 100 days and had a total of 800,000 attendees. Several of the most distinctive features of Piedmont Park can be traced back to the exposition including the Park's active oval and Lake Clara Meer. In the early 20th century, the City of Atlanta officially extended the city limits to include Piedmont Park and its surrounding neighborhoods; this was in part due to the official purchase of the Park by the City in 1904.

By late 20th century (1970s and 1980s), the Park had become the site of large organized events such as the Dogwood Festival, the Arts Festival, the Gay Pride festival, Atlanta Symphony performances, and the Montreux Jazz Festival. This substantial increase in park usage and a lack of maintenance resulted in a deterioration of the Park, which led to the formation of the Piedmont Conservancy in 1989. The Piedmont Conservancy is a public-private partnership established by the citizens in agreement with the City. Its primary goals are to maintain the Park and oversee Park operations. Today Piedmont Park has been almost fully restored, and continues to be the central gathering place and green event space for Atlanta residents (Piedmont Park Conservancy, 2012). In fact, the current popularity of Piedmont Park for being the site of large special events in Atlanta has resulted in tensions between the City and the Park's neighbors. The goal of this project is to assist in alleviating these tensions by providing recommendations for special events planning with respect to transportation problems caused by large special events in Piedmont Park.

1.2 Music Midtown

The first Music Midtown festival was held in 1994 and was organized by Alex Cooley and Peter Conlon. The intent was to create a festival that could compete with the New Orleans Jazz & Heritage Festival. Over the years, Music Midtown has been held at many locations across Atlanta. In 2006, the festival went on hiatus due to a lack of funding, and was restarted in 2011 by Peter Conlon (Atlanta Journal Constitution, 2014). The festival was held at Piedmont Park from 2011-2014, sparking complaints from the surrounding neighborhoods and residents regarding noise pollution, traffic congestion, road closures, illegal parking, and safety and crime issues.

1.3 Piedmont Park & Music Midtown Controversy

An overview of some of the controversy surrounding the Park and Music Midtown will be presented here to set the stage for a thorough and objective engineering examination of the issues faced by the City, event organizers, and surrounding neighborhoods. This section provides some context in the specific problems that have arisen over the festival, especially with regards to 2013 and 2014 Music Midtown festivals.

1.3.1 Neighborhood Associations

Terry Bond, President of the Midtown Neighbors' Association (MNA) composed an opinion piece in the Atlanta Journal constitution blog, *Atlanta Forward*, where he expressed the disapproval of the neighborhoods (primarily Ansley Park and Historic Midtown) regarding the 2014 Music Midtown festival. Bond said,

> *"We continue to have concerns with the increasing scale of these events and the repeated damage to Piedmont Park — particularly the increased stress on Oak Hill, which has been noted by the Piedmont Park Conservancy and Atlanta's Parks*

> *Department. These concerns are exacerbated by the apparent lack of city monitors capable of managing and minimizing the damage inflicted on the park during these massive set-ups and break-downs."*

Bond went on to detail the concerns regarding the impact of traffic and parking on the Historic Midtown neighborhood, as well as significant safety concerns that occur in the hours after the festival. He suggests that while MNA supports the marketing of the event as a green event to which attendees don't drive, the City must accept the fact that a significant portion of attendees will continue to drive and attempt to find parking in the surrounding neighborhoods (Bond, 2014). The neighborhoods illustrated their feelings towards the 2014 concert by voting against the festival permit; following this vote the City released a statement regarding their support of the festival.

1.3.2 City of Atlanta

According to the City of Atlanta's Chief Operating Officer (COO), Michael Geisler, who wrote the corresponding opinion piece (to Terry Bond) on the Atlanta Forward blog,

> *"Atlanta knows how to handle big events… The city is prepared to handle the crowd and ensure inconveniences to surrounding neighborhoods are minimized. We sympathize with the Midtown Neighbors' Association concerns about the festival's impact on Piedmont Park, as well as the traffic, parking and safety issues associated with the event. We will do everything the city can to alleviate any negative impacts Music Midtown might have on our neighbors."*

Geisler also mentioned that the city works to ensure that the costs of clean up and restoration are fully covered by the festival organizers. He notes the large numbers of Atlanta Police Department officers who are on scene to handle safety and illegal parking concerns. He noted that the festival has become part of the fabric of Atlanta and also provides support for Atlanta's Centers of Hope initiative, an after school program to engage the Atlanta's youth in after-school activities. The COO concludes by mentioning that the city greatly values Piedmont Park and its surrounding neighborhoods and will work tirelessly to ensure that these assets are also sufficiently protected during the events (Geisler, 2014).

After the Midtown Neighbors' Association (MNA) and the Neighborhood Planning Unit both voted against the festival permit for Music Midtown 2014, the City of Atlanta released the following statement regarding the festival,

> *"The Department of Parks and Recreation is committed to ensuring that Music Midtown continues to be an integral part of our city's arts and cultural fabric, while minimizing impact to the surrounding communities of Piedmont Park. While we faced extremely challenging weather conditions last year, the park recovered relatively quickly and the Department will continue to work with the festival organizers to remediate the park grounds in a timely fashion. The festival organizer is 100 percent responsible for those costs. Together, the Department of Parks and Recreation, Mayor's Office of Special Events, and the Atlanta Police Department with the support of Piedmont Park Conservancy, will continue to work together to make Music Midtown successful for both patrons and residents"* (Saporta, 2014).

Overall, it is clear to see that the City fully supports the festival for the numerous benefits that it offers to the Atlanta region.

1.3.3 Event Organizer: Live Nation Atlanta

In September 2014, a few weeks before the festival, Peter Conlon, the co-founder of Music Midtown, and current President of Live Nation Atlanta who organizes Music Midtown, also sat down with Maria Saporta for an interview published in the Saporta Report regarding the 2013 and 2014 Music Midtown festival. Conlon has been a resident of the adjacent Virginia Highland neighborhood for several decades and counts himself as an ardent supporter of Piedmont Park.

In 2013, heavy rains on the day of the festival resulted in severe damages to the grass that took several months to completely remediate. Conlon admits that this was a worst-case scenario and expresses his hopes that this will never again occur. Regardless of the weather, he notes a commitment to ensure that the festival organizers always clean up after the event and remediate the park to a state that is better than which they found it. Conlon said that Live Nation Atlanta pays a permit fee of $ 400,000 to the City (Saporta, 2014), which is significantly greater than the usual Class A permit fee of $15,000 (City of Atlanta, 2014). Conlon also mentioned that LiveNation spent $100,000 last year remediating the grass after the rains caused the Park to be left in a muddy condition after the festival.

Conlon put the event in context by noting that Park was always designed for large events noting the history of the Park in hosting the Cotton States Exposition that was attended by $800,000 people. He noted that,

> *"This is a good event for the city. It puts us on the map with other cities and their music festivals. They are economic drivers for cities. During Music Midtown, the hotels, bars and restaurants are full. People are spending money."*

Conlon said that the event was discontinued during the years when it was held at a location that had asphalt grounds ruling out the possibility of moving the event to such a location. He then went on to say that the surrounding neighborhoods' greatest complaints (traffic) is managed by the City, not the festival organizers. Conlon notes that the festival organizers have worked with the neighborhoods extensively to try to minimize the problems that are within their control (Saporta, 2014).

2. Problem Statement

Large-scale special events can result in a wide array of problems that affect those who live and work in areas of close proximity to where the special events are occurring. Over time, the frequency of these events can lead to frustration and decreased quality of life for residents. Atlanta's Piedmont Park hosts approximately 18 events annually that are classified as Class D or larger; these are events that have anticipated attendances ranging from 2000 (Class D) to 50,000 (Class A) attendees. Those living in the neighborhoods around Atlanta's Piedmont Park have begun to express dissatisfaction with the conditions that occur during these events. Their primary areas of concern fall into three categories: (1) congestion; (2) road closures; and (3) parking issues.

The neighborhoods around Piedmont Park (Figure **1**) have noted that the high levels of congestion result in difficulties navigating in Midtown Atlanta during these events. In past years, this has lead to emergencies as well as many of the residents deciding to stay indoors during the affected weekends. The road closures result in new and circuitous routes to and from major destinations such as work, home, school, and shopping.

Additionally, the closures for some events such as Music Midtown, begin approximately 2 weeks prior to the event, and caused significant inconveniences for those navigating in the area. Residents also chronicle issues with event attendees who park illegally in the surrounding neighborhoods during the events. This illegal parking reduces the parking available for those who live in the neighborhoods and increases congestion by keeping residents and attendees on the roads as they look for available parking. Therefore, the goal of this research is to address the issues caused by Piedmont Park special events, and provide recommendations for solutions that could mitigate some of the problems.

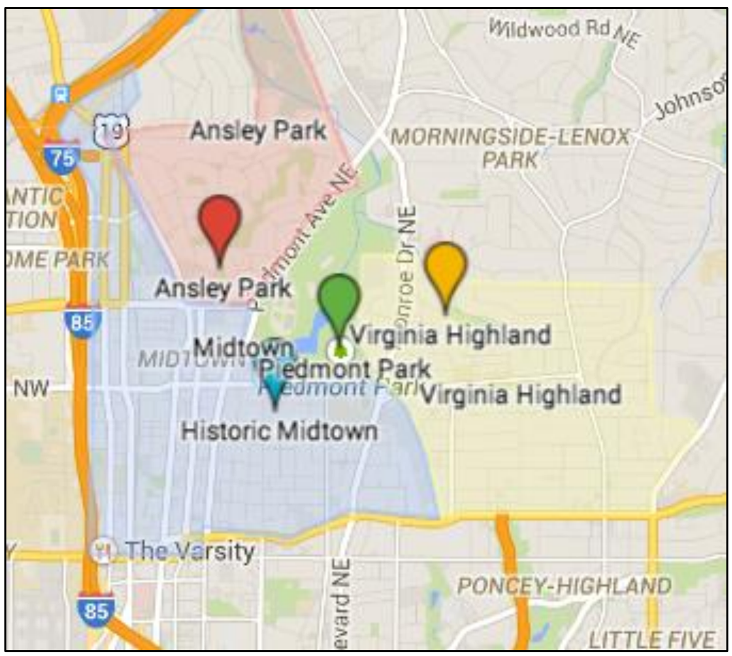

Figure 1. Piedmont Park and surrounding neighborhoods

3. Background

To approach the problems detailed above, a literature review of transportation planning methods for special events was conducted to inform the methodology that would be used for this project. This was accompanied by an intensive research and interview stage that encompassed the majority of the stakeholders involved in the Piedmont Park and Music

Midtown controversy. The literature review and stakeholder findings will be presented in this section.

3.1 Literature Review

As before noted, the goal of this research study is to provide possible solutions aimed at mitigating the impacts of special events in Midtown Atlanta. The three primary impacts as observed by the team and reinforced by the area residents are as follows: (1) unsustainable levels of congestion; (2) inconveniences of road closures; and (3) illegal and obstructive parking practices. To develop a comprehensive methodology that can address these impacts our team has chosen to examine special events planning and administration literature in the three distinct areas of methodological studies, policy reports, and case studies.

3.1.1 Methodological Studies

Many of the primary methodological studies examined include detailed models and algorithms that are aimed at parking optimization and channelization. Although this is somewhat outside of the scope of this project, the team chose to include this information to provide the policy makers and engineers involved with the Music Midtown project with an understanding of the level of engineering and management that can be executed to address this problem over a long term and permanent basis.

The team first examined a 2011 GIS method paper that detailed an attempt to optimize parking for Clemson University football games using an algorithm known as the Hitchcock Transportation Algorithm. The Hitchcock algorithm takes into account network costs for distributions so it is able to produce a realistic solution that minimizes system delay for the network as a whole. This solution was validated using a microscopic simulation model built in Synchro. The results showed that total travel time decreased by approximately 46.9 hours, thus validating the application of the Hitchcock algorithm for situations such as these. While this specific algorithmic approach could not be utilized for Midtown special events due to a lack of specified parking options for attendees in the Midtown area, it did provide insight into possible traffic simulation models that could be used to mitigate the congestion and road closure issues caused by special events in Midtown Atlanta (Sarasua et al., 2011).

The objective of the second research study examined was to perform an analysis for parking lot choice made by attendees of sports events. The research methodologies demonstrated here are focusing on two major areas. The first area is to model the parking lot choice. This was done by using logit model approach, which is also done for travel behavior analysis. The second methodology used the entropy maximization concept for trip distribution. This was used in synchrony with traffic assignment leading to development of a combined parking lot choice and route assignment model. Music Midtown does not have a method for assigning parking lots to the attendees beforehand, although the Gay Pride festival has partnered with an outside parking reservation company to allow attendees to reserve parking beforehand. If the choice of parking lots can be executed using a methodology similar to the one developed here, it has the potential to not only solve the parking issue, but also the congestion problems which are created by attendees searching for available parking (Sattayhatewa and Smith).

The third methodological report examined was the *Wisconsin Traffic Operations Infrastructure Plan* (TOIP) done by the Bureau of Highway Operations at the Wisconsin Department of Transportation. One primary goal of the report lay in developing a methodology and approach for predicting and forecasting the traffic by taking into account city streets, weather data, special events dates and the areas affected by them, and grading them accordingly to find which streets should be given the priority. The approach consists of a grading technique executed using a Visual Basic Graphic User Interface (GUI) on a Microsoft Excel spreadsheet that allows the user to select a specific corridor and give inputs related to weather, average daily traffic etc., execute the methodology, and receive summary statistics of that corridor along with its grade (Low, Medium, High, Baseline). This grade will show the routes or streets that are to be given attention the most and will help prioritize the streets. Based on this approach, the team considered developing an excel based model to grade available parking decks nearby;

such a model would depend on parameters such as occupancy, number of parking lots, distance from Piedmont Park etc. (Cambridge Systematics, 2008).

The final methodological report studied was from the Washington State Department of Transportation and consisted of a methodology to alleviate congestion in Central Puget Sound, Vancouver, and Spokane regions of the state. This study focused mainly on two approaches: "Highway Focus" and "Transit Focus" to solve the problem of congestion in the area. The Highway focus approach primarily consisted of a cost benefit analysis for adding new lanes to the most congested lanes of the highway, while considering the population growth and land use changes for 2025. Additionally, the report examined the contribution of new value pricing strategies in reducing traffic congestion and subsequently evaluated Regional Value Pricing using different tolls decided on the basis of congestion to all freeways and arterials in the region. The Washington congestion analysis gave the team insight on the major parameters to look at in order to develop a methodology for reduction in congestion. When events like Music Midtown takes place it leads to congestion and in order to alleviate this, Atlanta needs to have a balanced and prioritized approach to the problems by either focusing on increasing transit, rerouting, or value pricing. The team used these ideas to develop the methodology for analyzing the congestion impacts on the Midtown Area via different route closures and route assignments (Washington State Department of Transportation, 2006).

2.1.1 Policy Papers

The Georgia Tech team chose to examine two major policy reports done by the Federal Highway Administration and the National Cooperative Highway Research Program regarding special events management because these reports synthesized much of the additional work that has been done in this field and thus, proved to be great resources for the team.

The first policy report studied by the group was the FHWA handbook "Managing Traffic for Special Planned Events". The handbook presents frameworks for traffic planning, operation, management and agency cooperation process during special events. The

FHWA handbook also introduced the data requirements for assessing traffic demand, capacity and event operation. Additionally, the guidance provided sample data on mode split, which the team used in building the VISSIM model of Music Midtown scenarios. The team used this to develop alternative routes and times with respect to the 10^{th} Street closure that occurs during Music Midtown. Finally, the handbook also provided important insight into parking space allocation and parking lots operation that provided a solid knowledge foundation for the team to use going forward (Latowski et al., 2004).

The second policy report studied by the team was a National Cooperative Highway Research Program (NCHRP) Report that provides a comprehensive overview to Special Events planning and management policies and initiatives that have been enacted across the United States. The team used this report as a resource to provide background knowledge and guidance when developing the Midtown special events methodology. It began by acknowledging that the basic definition of a special event is generally accepted to be one that "abnormally increases traffic demand." The overall purpose of the report was to identify all possible transportation related activities that are used to alleviate this increased traffic demand. The goal of special event planning and management is to increase efficiency and safety while decreasing inconveniences caused to users of the system. Key stakeholders are identified as transportation agencies at the federal, state, and local levels, law enforcement agencies, and special event coordinators.

The NCHRP report is based on information from four primary sources: (1) published literature; (2) surveys of stakeholders; (3) in-depth case studies; and (4) informal interviews with special events coordinators. Our team has chosen to highlight a few of the relevant special events planning techniques from the NCHRP report that we believe will prove useful to consider in the Midtown Atlanta Special Events problem. One of the primary methods used to control traffic during special events is portable static signs. Given the nature of the Midtown Atlanta problem, the team believes that this solution has much promise for directing traffic and people to the correct locations/routes, which can alleviate congestion and inconvenience during the event. Another option that can be applied in Midtown Atlanta consists of non-law enforcement service patrols that provide a different level of authority during the events; in the Piedmont Park area some residents have specifically noted feeling uncomfortable by the high level of police presence during special events. Some economic options include incentives for alternate mode use, auto restricted zones, and incentives for alternate travel times. Although it would take some level of coordination, the Georgia Tech team believes that economic incentives will play a role in any special events planning coordination for Midtown or elsewhere. Other solutions discussed in the NCHRP report include alternate routes, parking strategies, and transit accessibility improvements. All of these solutions will be examined with the hope of providing a combination of possible recommendations that will work together to alleviate the issues in Midtown Atlanta (Carson, 2003).

3.1.2 Case Studies

The last set of literature review by team included two case studies of successful special event management strategies and implementations. The first is a case study of Montana State University (MSU) football games. The major objective of this research was to apply traffic management strategies to address the congestion issues as the result of planned special events. Approximately 13,000 people usually attend Montana State University football games. These crowds are presented with ample parking on-site (approximately 2,800 slots), as well as off-site (at private homes, apartments, etc.) in the vicinity of the stadium. Previously, traffic management during football games included road closures, limited traffic control personnel, and static signage to inform motorists of detours. The comparison of game and nongame travel times indicated that pre-game traffic was not heavy enough on any route to make an impact. However, post-game travel times were affected on two corridors in the immediate vicinity of campus: 19th Avenue and 11th Avenue. The Level of Service of the streets around the campus significantly decreased and roadways were inundated with traffic for a long period. The group informed all the stakeholders about the current traffic conditions and raised their concerns about traffic failure after events.

After obtaining the permission from stakeholders and organizing all available resources, the group developed a comprehensive traffic management plan. The plan incorporates real-time traveller information, road closure, traffic signal timing and real-time traffic monitoring. The effectiveness of the strategies is evaluated by a before-after comparison. The establishment of interagency partnerships proved to be the crucial factor which lead the research to success. The congestion was relieved by the combination of the strategies. The effectiveness of real-time information was validated by traffic survey of game attendees. Roadway LOS has been improved by adjusted signal time plan and road closure plan. The real-time traffic monitoring improved the satisfaction of stakeholders to the event. The whole research process validated that the strategies provided by FHWA are effective in treating special events traffic. This research helped the Georgia Tech team to develop a plan that incorporates several strategies simultaneously (Lassacher et al., 2009).

To help develop the parking strategies, the Georgia Tech team investigated the Intelligent Parking System (IPS) in the City of Phoenix. In downtown Phoenix, special events, cultural centers and sports teams attract large numbers of visitors daily. The city estimated that for any given year, the total number of visitors would reach 100,000 in downtown area, which causes great pressure to parking and traffic operation. In this case, they developed a system that is an extension of a previous information dissemination plan. The IPS helps to disseminate the real-time information regarding particular events. This system also incorporates "way finding" at the same time so people do not need previous knowledge/familiarity to make informed parking decisions. The system uses variable message signs (VMS) to disseminate real-time traffic information for both ingress and egress traffic during events. Traffic and parking information is also provided by sensors in parking garages and regional freeways in conjunction with cameras. A traffic management center (TMC) processes the data and calculates the available volume or space. Then the information is sent to the VMS and operators. The system also involves actual operation from individual parties. For example, the barricade provider will employ barricades based on designated traffic routing. From this research, the group was able to understand how real-time information system works for parking system during special events. The Georgia Tech team would like to recommend the application of IPS or VMS for Music Midtown and other festivals occurring in Piedmont Park. The team believes that if support from parking decks and garages around can be obtained, a parking algorithm can be developed to calculate available space in each parking deck/lot and give suggestions regarding parking space allocation. This will help mitigate the side effects caused by road closure and chaotic parking practices (Crowder, 2003).

3.1.3 Conclusion

The varying approaches of managing special events presented in the papers reviewed above have given the team a better understanding of possible solutions and recommendations that can help mitigate the issues caused by special events in Midtown Atlanta. The team intends to integrate these findings into the final methodology for yielding effective solutions to the special event issues at hand.

3.2 Stakeholder Overview

This section details the stakeholders involved in the parking and congestion problems experienced by Midtown Atlanta during special events at Piedmont Park. The stakeholders specific to this project have been grouped into the following categories: government bodies/elected officials, private firms/businesses, public entities, people/community/public interest groups, and the transportation consulting firms involved with solving the issues. To fully understand the plethora of stakeholders involved in this project, the Georgia Tech team undertook an intensive set of interviews and meetings with each of the stakeholders identified below. Much of the information presented was therefore taken from first person interviews conducted with the stakeholders. On occasions where the team could not reach the stakeholders, research and interviews with knowledgeable community residents and officials were conducted.

3.2.1 Government Bodies/Elected Officials

Because Piedmont Park is owned by the City of Atlanta, government officials constitute an important set of stakeholders involved in the special events controversy surrounding Midtown Atlanta, and the Park specifically. The events that occur in Piedmont Park allow the City to obtain valuable revenue through permits. The Mayor is interested in bringing big events to Atlanta to develop public appeal and popularity for the City. However, the

Mayor must also be cognizant of the constituents since he holds an elected position. The important departments that oversee events in Piedmont Park are the Mayor's Office of Special Events (MOSE), Department of Parks and Recreation (DPR) and Atlanta Police Department (APD). The City of Atlanta's Chief Operating Officer (COO) Michael Geisler also plays an important role. The Mayor is part of the group that has the veto power for Permits. The other major governmental departments that have veto powers are listed below (City of Atlanta, 2014b).

3.2.1.1 Mayor's Office of Planning

The Office of Planning is involved in allocating special-use permits, and also responsible for planning and zoning in the City of Atlanta. Thus, this office plays a role in finalizing the rules and permits for special events. The Office of Planning has also been involved in the development of the bicycle lane on 10th Street, an integral corridor for special events in Piedmont Park. The Georgia Tech team believes that this department can play a role in the development of a cycling/biking plan for the special events at Piedmont Park, i.e. a long term solution to solving the parking and congestion issues that arise during special events (City of Atlanta, 2014).

3.2.1.2 Mayor's Office of Special Events (MOSE)

MOSE is responsible for ensuring that all events have proper permits and communicates with the neighborhoods hosting the events for smooth and safe execution of events. Since MOSE is responsible for granting permits, it plays an important role in the events taking place in Piedmont Park (City of Atlanta, 2014).

3.2.1.3 Atlanta Police Department (APD)

APD is responsible for the legal, safe, and crime-free implementation of the event. They are also responsible for the reduction of noise, maintaining smooth traffic flow, and limiting illegal public parking in the neighborhood. APD seems to have the primary power in deciding route closures during events, setting up and enforcing parking rules, and being present during the event to handle traffic and parking. During Music Midtown 2014, APD was responsible for managing and routing traffic as well as managing the illegal parking taking place in the neighborhoods. In a news article published by Springs Publishing LLC, the Chief of APD, George Turner was quoted as saying,

> "*Our officers will be working this weekend to help ensure this is a fun event for attendees and also managing traffic and crowds around Piedmont Park," and also, "The Atlanta Police Department has experience managing these large events and seldom encounter major problems. But we certainly urge event goers to take MARTA, and to take some common sense safety measures"* (Kelley, 2014).

3.2.1.4 Public Works Department of City

The Office of Transportation under the Department of Public Works is responsible for maintaining the street network of the city. It is also responsible for overseeing the traffic movements, street operations, signals, streetlights, and on-street parking management in Atlanta. With these responsibilities, it is clear that Department of Public Works is one of the groups who should be involved in developing the traffic and parking rules in the Midtown Neighborhood during events (City of Atlanta, 2014).

3.2.2 Private Firms/Businesses

The primary firms/businesses involved in the Music Midtown festival are the festival organizers and PARKAtlanta, a private parking firm that works on behalf of the city to enforce parking.

3.2.2.1 Live Nation Atlanta

Live Nation Entertainment is the entertainment company that hosts Music Midtown and thousands of other live events around the world. Their interest in the Midtown Atlanta area is primarily connected to Music Midtown and the profit involved in the successful execution of this concert. They also host many other special events (mostly concerts) in the Atlanta area. Live Nation Atlanta has worked with the Mayor and the Department of Parks and Recreation, as well as other public departments to facilitate the execution of the event. Live Nation also works with the Piedmont Park Conservancy, and last year spent an additional $100,000 to remediate the grass in the park following rainy weather during the concert. Live Nation Atlanta has spoken with MNA in the past in the ongoing attempt to find common ground in the issues that surround Music Midtown. Peter Conlon, President of Live Nation Atlanta, gave an interview in September 2014 in the Saporta Review where he detailed the relationship between Live Nation Atlanta and the City. Live Nation Atlanta pays the City of Atlanta a $400,000 permit fee for using

Piedmont Park, and gives the Piedmont Park Conservancy $100,000 for utilizing the park. Conlon made the point that Atlanta doesn't have any other large spaces that could accommodate an event as big as Piedmont Park. Live Nation Atlanta has much influence with the City of Atlanta, and in the past the Department of Parks and Recreation has publicly issued statements in support of Music Midtown. Live Nation Atlanta and the Mayor's Offices often form an informal coalition in support of the Music Midtown festival (Saporta, 2014).

3.2.2.2 PARKAtlanta

PARKAtlanta is operated by Duncan Solutions, a parking management company that serves many municipal clients. The City's Department of Public Works oversees this relationship which is not popular with many area residents due to proclaimed 'predatory' parking policies. PARKAtlanta helps to regulate parking during Music Midtown, and our group observed their vehicles present in the area during Music Midtown. Their primary stake in the event is the portion of revenue they keep from the parking fees and tickets. PARKAtlanta does not have vested resources such as meters in this area; however, they do invest patrol officers and vehicles for during special events. To the team's knowledge PARKAtlanta has not publicly addressed their role in regulating parking in the Midtown area during Music Midtown. While surveying the streets during the festival, the team saw more occurrences of the Atlanta Police Department maintaining traffic relative to PARKAtlanta enforcement vehicles. PARKAtlanta doesn't have significant impact on their own to make the event a failure/success; they must work with the public offices to make significant changes to parking policy and planning (Lucie, 2013).

3.2.3 Public Entities

3.2.3.1 Atlanta Public Schools (APS): Grady High School (GHS)

GHS is located at the intersection of 10th and Monroe and is across the road from Piedmont Park. Preparations for the festival typically start up to two weeks before, and this can impact the normal day-to-day functioning of the school. GHS has prepared a detailed plan for dealing with these impacts and ensuring that their students are minimally affected. Grady High School issues access permits to faculty and parents who need to access the school for drop off and pick up during events. GHS and the APS has put much effort into coordinating efforts with Live Nation and the Atlanta Police Department to make the experience as easy as possible for students, parents, and teachers. GHS issued a multi-page document detailing the road closures and daily instructions for where parents and teachers should park and drop off/pick up their students respectively. GHS and APS could potentially assist in the success of the event by allowing for the use of their parking facilities during Music Midtown. The team recommends investigating this as a possibility (Grady High School, 2014).

3.2.3.2 MARTA: Metropolitan Atlanta Rapid Transit Authority

MARTA is the largest provider of transit in the metropolitan Atlanta area. Music Midtown is expected to increase MARTA ridership throughout most of the system, although the team is currently still in the process of verifying these numbers. MARTA operates bus service (Route 36) between the Midtown MARTA Station and Piedmont Park. Festivalgoers could also use MARTA trains to access Piedmont Park through the Midtown and Arts Center Station stops. MARTA issued a press release on September 19th informing the public that they could use MARTA to access Music Midtown. In this press release, they advertised free parking at their stations for under 24 hours, and noted that their trains would run every 15 minutes during the Friday of Music Midtown, and every 20 minutes during the Saturday. MARTA has significant power to make the festival more successful by coordinating with organizers and running more frequent bus and train service. Live Nation advised festivalgoers to utilize MARTA when heading to the concert, so both entities appeared to be trying to encourage usage of the MARTA system (MARTA, 2014).

3.2.4 People/Community/Special Interest Groups

3.2.4.1 Midtown Neighbors’ Association

The Midtown Neighbors’ Association (MNA) provides a mechanism by which Midtown concerns can be relayed and addressed between the City, Neighborhood Planning Units (NPU), Board of Education, and organizers of events at Piedmont Park. The Georgia

Tech team worked closely with MNA during this project, and the issues detailed below are some of the problems that MNA expressed as their primary complaints/issues to our team. The MNA provides services to Midtown residents such as the safety light program, and organizes social activities to further neighborhood ties. MNA is very concerned about the impacts of Piedmont Park special events on their neighborhood. The road closures cause significant inconvenience to neighborhoods around. Residents do not receive detailed information about times and locations of road closures and many of them have to detour during events. Some small businesses north of Piedmont Park were affected because drivers couldn't obtain access.

Too much illegal on-street parking also narrows the streets and prevents emergency vehicles from having access. Illegal parked cars have never been towed and the penalty is very small according to neighborhood residents. In order to tackle those situations, the MNA members keep records of traffic problems during the event. They also conduct traffic studies/counts during some special events. Relevant traffic information is provided to residents on their website; this includes maps which have road closures, parking, and other relevant traffic information. The MNA has its own website to publish all the information and maps. Their concerns about Music Midtown have also been reported in other websites like AccessAtlanta.com (Ruggieri, 2014). The MNA voted against the Music Midtown 2014 permit due to the traffic, safety and noise issues caused by this festival. Their actions caught the attention of public officials and made more people aware of the traffic conditions and hazards caused by the festival (Midtown Neighbors' Association, 2014).

3.2.4.2 Midtown Alliance

Midtown Alliance is a partnership of businesses and community residents that constitute a planning and development organization devoted to the "revitalization of Midtown". Events in Piedmont Park bring revenue and visitors to the Midtown area. Midtown Alliance spearheaded the effort to implement Blueprint Midtown, a comprehensive community planning process, which has revitalized Midtown. Midtown Alliance is currently paying for a comprehensive parking study of Midtown Atlanta, and they have done this in the past as well. Midtown Alliance has not made any public statements regarding the festival. Midtown Alliance has significant say in the City as the planning and grassroots organization that is responsible for keeping Midtown Atlanta beautiful. Their support could add money and influence to the citizens' concerns, however; thus far Midtown Alliance seems to have tried to stay outside of the conflicts in an objective manner (Midtown Alliance, 2014).

3.2.4.3 Ansley Park Civic Association (APCA)

The APCA works to maintain and improve the quality of life in Ansley Park, including safety and security through their Security Patrol. The association takes great efforts in anticipating and mitigating the widespread local impacts caused by Music Midtown. The festival leads to an increase in on-street parking in this neighborhood. The APCA is also sponsoring the traffic study of the impacts during large events. The goal of this study is not to prevent the events but to help in better planning and coordinating the festival with local neighborhoods and traffic conditions. There is little information about Music Midtown on APCA's website. However, their concerns about traffic and other issues during Music Midtown have been reported in other website like indiegogo.com and vahi.org. APCA voted down Music Midtown 2014 together with MNA and VHCA. The festival organizers still received their permit and the City did not require them to do anything further to alleviate problems (Ansley Park, 2014).

3.2.4.4 Virginia-Highland Civic Association (VHCA)

The purpose of the Virginia-Highland Civic Association is to advocate for the welfare of neighborhood residents. Currently, through the association, VaHi residents coordinate matters including planning and zoning, safety, parks, communications, preservation and history, community events, traffic, sidewalks, and parking. The road closure during Music Midtown obstructed the traffic from Virginia Highland to entering the Midtown and vice versa. VHCA is now working with MNA, APCA to find solutions to those issues. VHCA also joined the traffic study mentioned above. There is a comprehensive introduction to this study on their website. They put the maps of each day's road closure during Music Midtown on their website and posted important announcements to their Facebook page. They also provide important traffic information for other events like the

Atlanta BeltLine Lantern Parade. VHCA voted down this year's Music Midtown. This measure didn't prevent the deterioration of traffic conditions caused by the festival. But the traffic information and contact lists provided by VHCA reportedly helped residents to solve some of the parking and traffic issues (Virginia-Highland Civic Association).

3.2.4.5 Neighborhood Planning Unit E (NPU-E)

Neighborhood Planning Unit E consists of the following neighborhoods: Ansley Park, Ardmore, Atlantic Station, Brookwood, Brookwood Hills, Georgia Tech, Home Park, Loring Heights, Marietta Street Artery, Midtown, and Sherwood Forest. Neighborhood Planning Units are basically advisory councils composed of citizens. These councils make recommendations to the Mayor and City Council on issues surrounding their neighborhoods. The Saporta Report has several articles about Music Midtown where they mention the vote against the permit, but NPU-E never gave an official statement about their vote. Terry Bond, president of MNA, also serves on the board of NPU-E, and released a statement to the Mayor's office concerning the vote and the citizens' concerns. This can be seen in the second source below. NPU-E joined MNA in voting against Music Midtown 2014 due to traffic concerns (Saporta, 2014). As before mentioned this did not stop the event from moving forward but did catch the attention of the Mayor (Wan, 2014).

3.2.4.6 Neighborhood Planning Unit F (NPU-F)

Neighborhood Planning Unit F consists of the following neighborhoods: Atkins Park, Lindridge/Martin Manor, Morningside/Lenox Park, Piedmont Heights, and Virginia Highland. Neighborhood Planning Units are basically advisory councils composed of citizens. These councils make recommendations to the Mayor and City Council on issues surrounding their neighborhoods. The Saporta Report has an article about the festival where Peter Conlon mentions NPU-F and the fact that they voted for the festival while NPU-E voted against it. NPU-F voted in support of Music Midtown 2014. The votes of the NPUs don't have much power in stopping an event, but they do help in ensuring the Public offices are aware of their stand on issues (Wan, 2014).

3.2.4.7 Piedmont Park Conservancy

The Piedmont Park Conservancy is responsible for preserving historic Piedmont Park. Their primary stake is in maintaining the park and ensuring its security. The Piedmont Park Conservancy has fundraised and spent over $60 million that has been put towards preservation, beautification, and maintenance of the Park. This money has also led to a 53 acres expansion of the Piedmont Park green space. Live Nation Atlanta pays the Conservancy $100,000 as part of their payment when the festival is held in the Park. They have not addressed Music Midtown in public statements. The Park Conservancy doesn't have much power with regards to traffic and parking, but their support and cooperation are necessary for the Music Midtown festival to occur successfully at the Park (Piedmont Park Conservancy, 2014).

3.2.5 Transportation Consultants

3.2.5.1 Joel Mann, *Transportation Engineer*

Joel is an independent consultant working for the Midtown Neighborhood Association (MNA). He is trying to assist them in solving their parking and congestion complaints about Piedmont Park events, and doesn't have much at stake besides his personal relationships with the MNA members and the community. Joel has spent much time mapping the area and coordinating traffic studies and parking counts for MNA. Joel hasn't made any public statements regarding his work with MNA, but has met with us and detailed his work extensively. Currently, as stated above, he is focused on trying to solve the problem from an objective engineering and planning perspective. The Georgia Tech team has worked closely with Joel Mann over the course of this research project.

3.2.5.2 Kimley-Horn and Associates (KHA)

Kimley-Horn Associates is working for Midtown Alliance to conduct a Parking Inventory of Midtown Atlanta. Midtown Alliance is a client of Kimley-Horn, and therefore Kimley-Horn has their business interests at stake. Kimley-Horn does much traffic and transportation engineering work in Atlanta. Kimley-Horn has not made any public statements regarding the festival or their parking study. Kimley-Horn is an objective entity, and has no involvement in the success/failure of Music Midtown. The

Georgia Tech team also worked closely with Kimley-Horn and Associates over the course of this project. KHA provided parking inventory numbers and advice to the team regarding the parking situation.

3.2.6 Conclusion

As is illustrated above, there is a large and complex mix of stakeholders involved in Music Midtown occurring at Piedmont Park in Midtown Atlanta. To solve this problem in the long term, it is important for all stakeholders to communicate clearly and effectively with each other, and make compromises to ensure that all are represented.

4. Methodological Overview

Due to the large number of stakeholders involved in Piedmont Park special events, the problem statement was initially ambiguous and somewhat overwhelming to the team. Thus, with an aim to understand the problem to its depth and in an unbiased way, the team spent the first month meeting and talking with all major stakeholders involved; this was effectively the first step of the methodology. The results of the stakeholder analysis are detailed in Section 3.2 above. During this process the team met with Joel Mann, Transportation Engineer with Nelson Nygaard working for MNA. Mr. Mann is also focused on studying and mitigating the transportation problems associated with festivals in the Park on behalf of MNA. He was able to share traffic data and counts, as well as more comprehensive parking counts that he had organized while working with MNA. Mr. Mann proved an invaluable engineering contact in assisting the team with obtaining data; he also provided much insight into the very complex issues at hand.

Since Music Midtown occurred at the beginning of this project for the team (9th September 2014), it naturally paved the way for the team to focus on this festival in particular. The team inspected the closures and pedestrian and traffic conditions in the area during the Midtown Music festival to obtain a deep understanding of the problems that were discussed during the multiple stakeholder meetings. While meeting with MNA representatives Dana Parsons and Nancy Bowers, the team was able to clearly identify the inconveniences caused to the neighborhood residents as a result of the festivals. The primary grievances that MNA disclosed to the Georgia Tech team are as follows: closure of 10th street, illegal parking, lack of ease of accessibility, security, trespassing and late notification about road closures. The team also worked closely with Kimley Horn Associates who had recently completed a current inventory of on street parking in the Midtown area and who were able to share their insight regarding a fixed parking permit/license system for Midtown. Over the course of the meetings, the team also learnt that the road closure plans are set, authorized and handled by Atlanta Police Department without any major involvement of the neighborhoods.

At this point, the team had a lot of data, information, and contacts but there was still not a clear path for alleviating the numerous issues that had been disclosed. To make the problem approachable, the team classified the problems into the three primary categories of: (1) Road closures; (2) Congestion; and (3) Parking issues. The methodology for addressing these primary problems were then decided based on the data that had and could be obtained within the given time frame. Section 5 contains a detailed overview of the methodology used to examine the road closures and congestion occurring during special events. Section 6 encompasses the results and interpretations of the models and analyses conducted in Section 5. Section 7 details the parking methodology and results obtained by the Georgia Tech team.

5. Road Closures and Congestion Methodology

As per the problems identified after discussions with MNA, the road closure and congestion complaints appeared to be two of the primary problems that our team believed could be improved using varying approaches. This motivated the team to explore these aspects by conducting traffic analyses. Since Music Midtown was the festival of focus, the closures that took place during Music Midtown were studied in great depth. Additionally, the magnitude of the closures during Music Midtown appears to be the most severe out of the Class A special events, according to the neighborhood residents as well as objective observations by the team. Figure 2, Figure 3, and Figure 4 summarizes the road closures that took place during Music Midtown 2014.

Figure 2. Pre-Event Road Closures

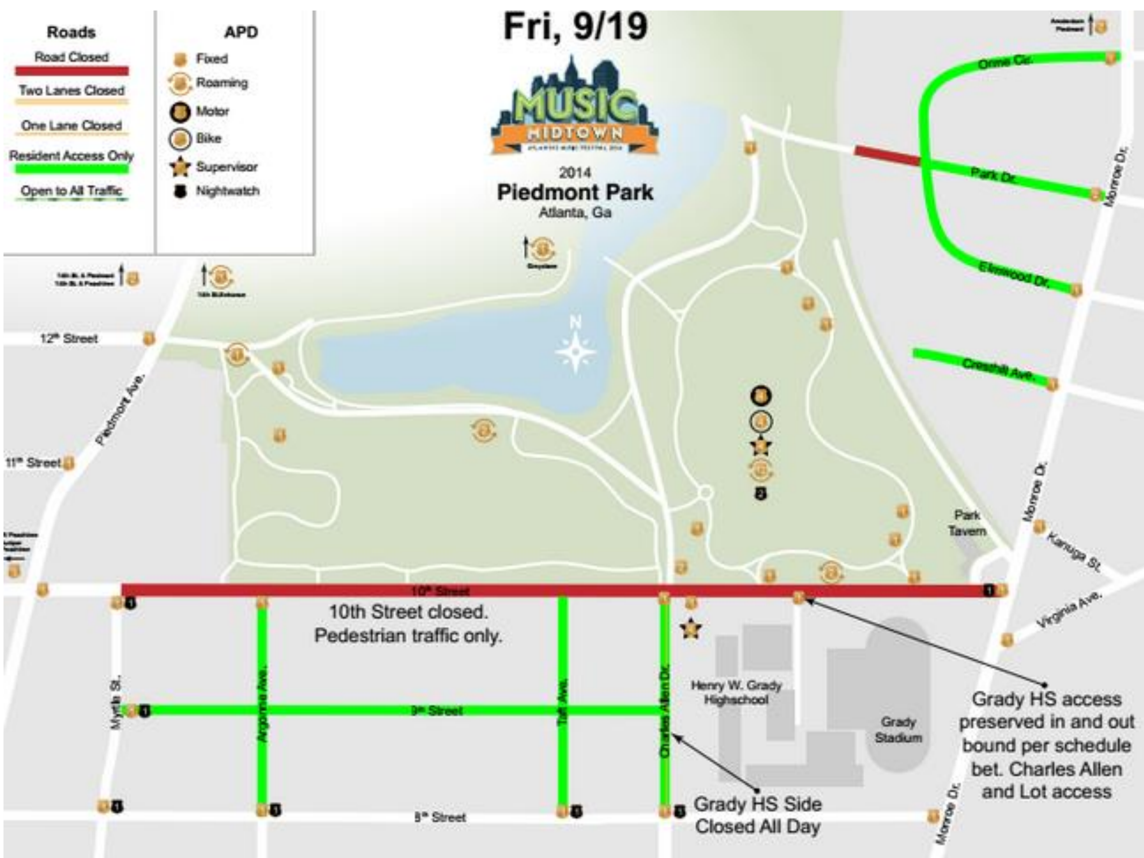

Figure 3. Event day closure

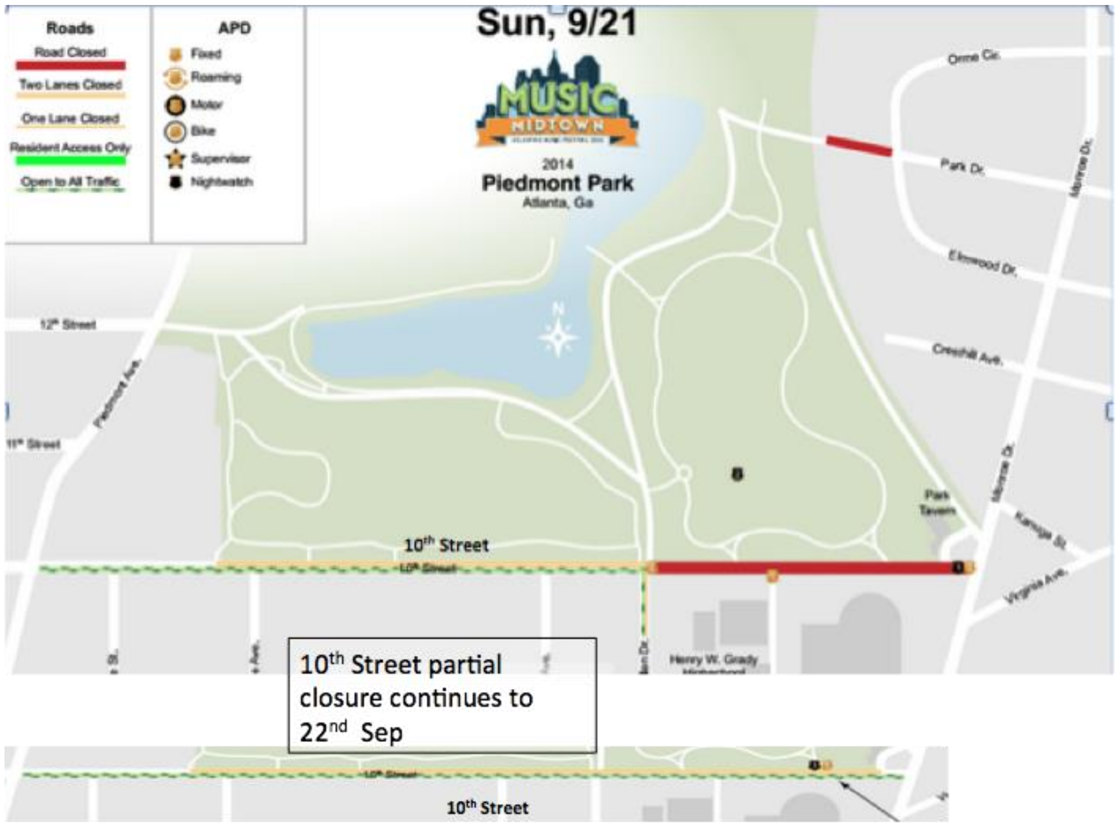

Figure 4. Post-Event closure

5.1 Methodology for Alternate Closure Plan

The team examined the key closures responsible for the inconveniences caused, and noted the following problems:

(a) The partial closure of 10th Street starts on September 11, 2014, eight days prior to event day (19th Sep 2014).

(b) Charles Allen and 10th Street are closed mainly because they lead to entrance of the Piedmont Park making it convenient for the event organizers to work.

Thereafter, the team looked into the possibility of alternate closure plans keeping the following parameters in mind:

(a) Accessibility to the park via a wide entrance for smooth working of event organizers.

(b) Avoid closing 10th Street to keep access to the neighborhoods served along the corridor.

(c) Presence of many other parallel network routes to least affect the residential accessibility for streets that would be closed in lieu of 10th Street.

After a careful inspection of Piedmont Park, it was seen that the most convenient entrances besides the Charles Allen entrance, are located at Park Drive and 14th Street. Since 14th Street is a very busy street with heavy presence of businesses, offices and commercial stores, the team ruled out closing this entrance for the event organizers to use. The entrance at Park Drive is quite wide and the 2014 closures on Park Drive illustrate its feasibility and history of being used by Music Midtown event organizers. The presence of Elmwood Drive, Elkmont Drive, Amsterdam Ave NE parallel to Park Drive continues to ensure that the residents have access to Monroe Drive even when Park Drive is closed. The team therefore considered studying the traffic flow with the alternate closure plan of Monroe and Park drive as shown below in Figure 5.

Figure 5. Alternate Closure Plan

5.2 Traffic Analysis for Three Scenarios

At this point, the three scenarios were built and finalized to be studied using VISSIM analysis:

Scenario A: Non-Event Saturday (No road closures)

Scenario B: Event-Saturday with closures (19th Sep, Music Midtown Saturday)

Scenario C: Alternate closure on Monroe-Park Drive

The methodology for traffic analysis for the three scenarios using VISSIM can be seen in the flowchart below as in Figure **6**. Sections 5.2.1 through Sections 5.2.6 below include the steps of the traffic analysis.

5.2.1 Step 1: Traffic Data Collection

To conduct this analysis with the least amount of assumptions, the team obtained peak traffic data for the Music Midtown event days with the closures that were done for 2014. Peak traffic data was also collected for a typical non-event day. This data was provided by Joel Mann, would hired a traffic consulting firm to collect the counts. The traffic data was available for 10 intersections across both the event and non-event days.

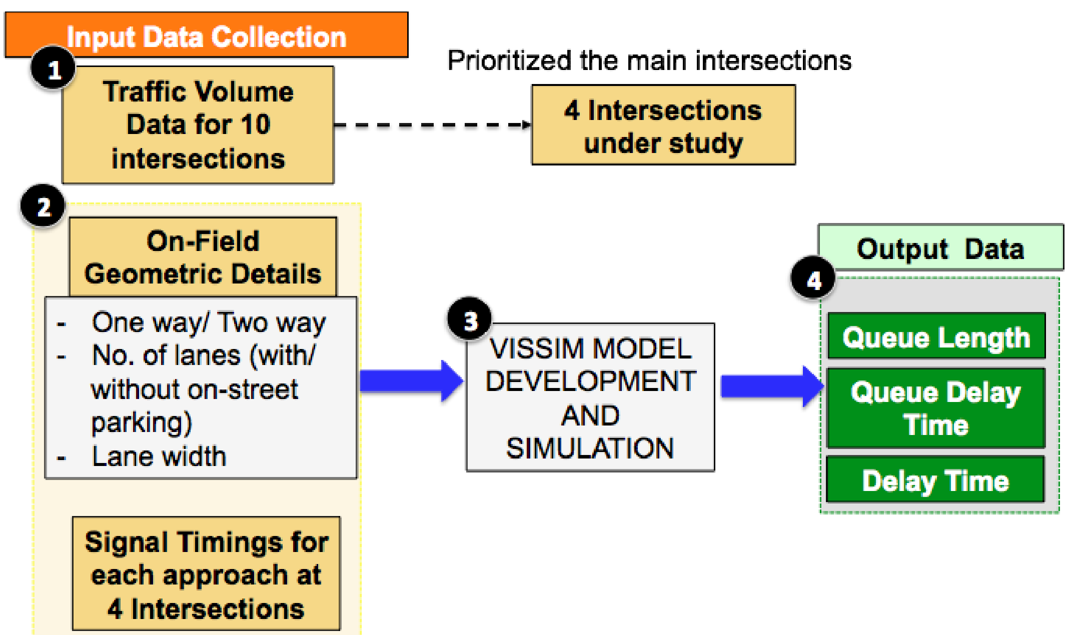

Figure 6. Flowchart describing VISSIM traffic analysis methodology

5.2.2 Step 2: Prioritizing the Main Intersections

The data across all intersections were compared, and the major intersections for the traffic study were finalized. The network finalized for the final VISSIM analysis consists of 4 intersections: Piedmont Avenue and 10th Street, Monroe Drive and 10th Street, Piedmont Avenue and Monroe Drive and lastly Park Drive and Monroe Drive. The following Figure **7** illustrates these locations.

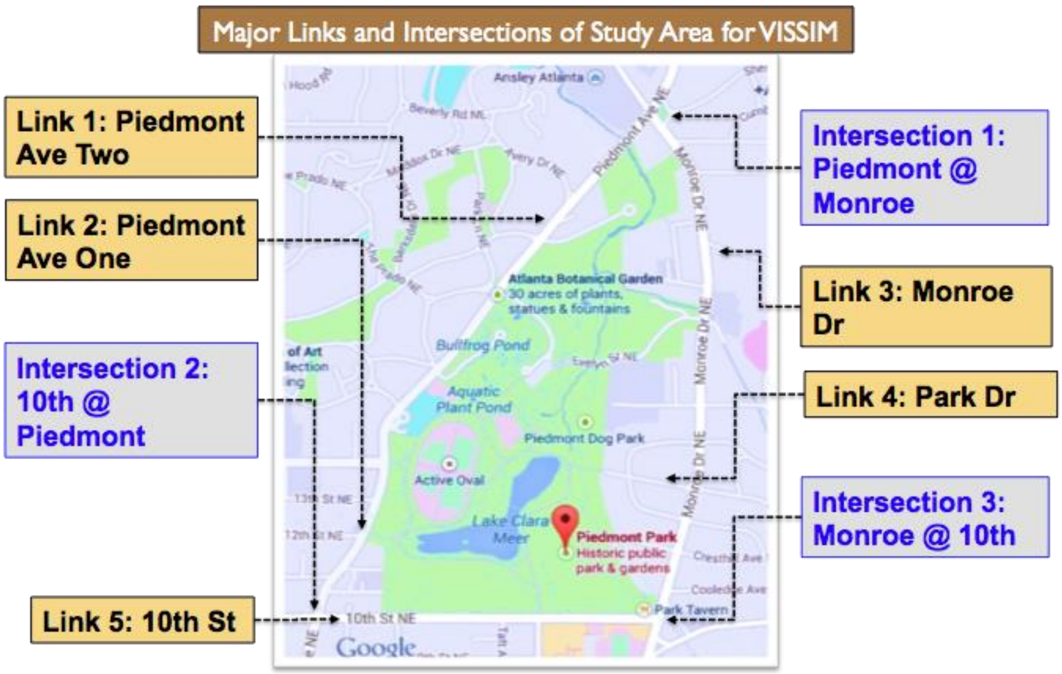

Figure 7. Major intersections for VISSIM study

5.2.3 Step 3: Balancing Traffic Volumes data

Using the available intersection data, the traffic volumes were balanced so that each link had the same volume input and output. The vehicle outflow and inflow to and from small intersections between the major intersections was calculated. For example the differences between the vehicle inflow to Piedmont Ave between the 10th Street and Piedmont Avenue intersection and 10th Street and Monroe Drive intersection was due to the additional vehicles that came from the small intersections in between. All these inflows and outflows were summed up to balance the traffic flow. The team used a simple pencil and paper balancing method to execute this Step.

5.2.4 Step 4: On-field data collection

In order to replicate the real scenario in VISSIM, the input data for VISSIM required accurate geometric details of the links (roads), intersection widths, etc. Using both Google Earth and in-field visits, data was collected for every road under study. The parameters that were collected were one-way/two-way directionality features of the roads, number of lanes in each direction, lane widths, on-street parking, signal positions at intersections, and signal timings for every approach at each intersection.

5.2.5 Step 5: Building and running the VISSIM model

The VISSIM model development can be categorized in four phases as explained below.

(a) **Network Links and Connectors**: Firstly, links are made in the VISSIM model following the geometric details as collected in-field. In VISSIM links can be attached using tool named connectors. The intersections are created in this way.

(b) **Signal Heads**: Once the base network is ready, the signal heads are placed on the basis of the signal timing data collected at each intersection.

(c) **Vehicle Parameters**: The network now is ready to take vehicles, so the next step is to give vehicle volume inputs, define vehicle routings and give ratio of turning movements at each intersection for every approach.

(d) **Data Collection Tools**: The last step is to insert the data collection heads, queue length counters, travel time routes on the network with which the output data requirement is defined and collected. After the simulation parameters are fixed, the mode is ready to be run.

5.2.6 Step 6: Analysis of the results obtained

From the VISSIM analysis for the three scenarios the results for Queue Length, Travel Time and Delay Time were obtained, compared, and discussed. Using these results, recommendations for future closure plans are made for optimum trade offs between traffic congestion, inconvenience to residents, and park accessibility for event organizers.

6. Road Closures and Congestion Model and Results

6.1 VISSIM Model Overview

The VISSIM Simulation model includes the simulation of three major corridors around Piedmont Park; these are 10th Street, Piedmont Avenue, and Monroe Drive. The team also incorporated four major intersections into the model: 10th Street at Piedmont Avenue, Piedmont Avenue at Monroe Drive, Monroe Drive at Park Drive and Monroe Drive at 10th Street. The signal timing plan information was obtained from the observation of real conditions on a normal Saturday. The team obtained the baseline and events traffic counts from Joel Mann who obtained these from a traffic counts firm. The geometric information was obtained from Google Earth measurements.

6.1.1 Traffic Volume

The data included the two-hour traffic volume and the peak hour volume. The group used the peak hour data for critical intersection analysis. The critical intersections are selected based on the absolute value of the traffic counts. The three intersections with the highest volumes are Piedmont at Monroe, Piedmont at 10th and 10th at Monroe. Monroe at Ponce De Leon was not selected because it is not included in the research area. Finally, the Monroe at Park Drive intersection was selected because the road closure directly affects this intersection. The group also picked the research time period based on the peak hour traffic volume analysis. Table **1** below shows the baseline and event traffic counts for the three intersections being studied for the purposes of this analysis.

Table 1. Comparison between Baseline and Event Traffic Counts

Intersection	Time Frame	Normal days		Events		Difference
		9/25(Thursday)	9/27(Saturday)	9/18(Thursday)	9/20(Saturday)	
Piedmont Rd@ Monroe Dr	AM PEAK HOUR VOLUME	3503		3559		1.60%
	PM PEAK HOUR VOLUME	3886		3909		0.59%
	SATURDAY PEAK HOUR		3058		3501	14.49%
Monroe @ 10th St	AM PEAK HOUR VOLUME	2264		2077		-8.26%
	PM PEAK HOUR VOLUME	2685		2293		-14.60%
	SATURDAY PEAK HOUR		2187		3058	39.83%
Monroe @ Park Dr	AM PEAK HOUR VOLUME	2018		1990		-1.39%
	PM PEAK HOUR VOLUME	2236		2074		-7.25%
	SATURDAY PEAK HOUR		1708		1882	10.19%

Based on comparisons above, the team found that Saturdays during events have much higher volumes than baseline data. In this case, the group decided to use the Saturday traffic counts for the simulation because it reflects the significant traffic condition changes during events. However, the traffic counts only cover the major intersections within the area. The group does not have the detailed traffic data for smaller intersections along the major road. Additionally, due to one unplugged count machine during September 20, the traffic data was missing traffic counts at 10th and Piedmont, which is one of the major intersections studied by the team. The team decided to balance the flow for the network and use the virtual ramps to combine small intersections and calculate the inflow/outflow for the missing intersection.

For Scenario C, there is no current traffic data because this scenario has not occurred before, and is a new alternate suggestion by the team. In order to obtain the traffic volume under this scenario, the team decided to use the baseline traffic volume inputs for the overall inputs in Scenario C since the scenario was designed to be implemented on the days without events, but which still require the road closures (for stage set-up, etc.). There are four major assumptions for balancing flow under scenario C, which are listed below.

1. The traffic which enters the road closure portion of the network will be reallocated to other directions or roadways.
2. The baseline traffic which passes Monroe Drive between Park Drive and 10th Street will be allocated to 10th Street and a virtual entrance north to Park Drive.
3. The traffic entering Monroe Drive of Piedmont at Monroe will be reduced because more people use Piedmont Drive to avoid the closures
4. More traffic use 14th Street because there are several parking decks and parking garages.

Based on assumption above, the team relocated the baseline traffic volume and obtained new traffic inputs under Scenario C. The total input traffic volume is shown in Table **2** below.

Table 2. Balanced Input Traffic Volume of the Network

	Scenario A (Sep 27)	**Scenario B (Sep 20)**	**Scenario C**
Input Street	Hourly Volume(vph)	Hourly Volume(vph)	Hourly Volume(vph)
Piedmont Ave NE (10th-8th)	862	1110	862
Charles Allen Dr	152	0	152
Piedmont Ave NE(North to Piedmont@Monroe)	1301	1562	1301
Monroe Dr NE (North to Piedmont@Monroe)	1045	1078	1045
Park Drive (EB)	48	0	0
Park Drive (WB)	211	267	211
14th Street(EB)	328	346	367
Monroe Dr NE(South to Monroe@10th)	1098	1010	655
10th Street (EB)	1095	661	1095
Virtual Entrances	118	0	551
Total	**6258**	**6034**	**6239**

For each major intersection, we calculate the traffic volume of each direction under different scenarios. The summary tables of intersection traffic volumes are shown in Table **3**, Table **4**, and Table **5** below.

Table 3. Balanced Intersection Traffic Volume under Scenario A

Scenario A Sep 27	Direction	10th-Piedmont Volume (vph)	Piedmont-Monroe Volume (vph)	Monroe-Park Volume (vph)	10th-Monroe Volume (vph)	Charles-10th Volume (vph)
Eastbound	Left	227	245	24	326	0
	Through	868	641	9	0	769
	Right	0	159	15	443	184
	Total	**1095**	**1045**	**48**	**769**	**953**
Westbound	Left	0	206	16	0	0
	Through	537	522	7	0	556
	Right	172	65	188	0	0
	Total	**709**	**793**	**211**	**0**	**556**
Northbound	Left	184	171	40	355	152
	Through	593	674	923	743	0
	Right	85	44	25	0	0
	Total	**862**	**889**	**988**	**1098**	**152**
Southbound	Left	0	472	173	0	0
	Through	0	631	919	689	0
	Right	0	198	41	201	0
	Total	**0**	**1301**	**1133**	**890**	**0**
Intersection	**Total**	**2666**	**4028**	**2380**	**2757**	**1661**

Table 4. Balanced Intersection Traffic Volume under Scenario B

Scenario B Sep 20	Direction	10th-Piedmont Volume (vph)	Piedmont-Monroe Volume (vph)	Monroe-Park Volume (vph)	10th-Monroe Volume (vph)	Charles-10th Volume (vph)
Eastbound	Left	654	267	7	1	0
	Through	7	658	7	0	7
	Right	0	153	9	6	0
	Total	**661**	**1078**	**23**	**7**	**7**
Westbound	Left	0	304	23	0	0
	Through	6	529	4	0	6
	Right	0	86	240	0	0
	Total	**6**	**919**	**267**	**0**	**6**
Northbound	Left	263	176	4	5	0
	Through	847	695	955	1005	0
	Right	0	337	44	0	0
	Total	**1110**	**1208**	**1003**	**1010**	**0**
Southbound	Left	0	607	194	0	0
	Through	0	724	981	798	0
	Right	0	231	4	1	0
	Total	**0**	**1562**	**1179**	**799**	**0**
Intersection	**Total**	**1777**	**4767**	**2472**	**1816**	**13**

Table 5. Balanced Intersection Traffic Volume under Scenario C

Scenario C	Direction	10th-Piedmont Volume (vph)	Piedmont-Monroe Volume (vph)	Monroe-Park Volume (vph)	10th-Monroe Volume (vph)	Charles-10th Volume (vph)
Eastbound	Left	227	365.75	0	0	0
	Through	868	418	0	0	769
	Right	0	261.25	0	769	184
	Total	**1095**	**1045**	**0**	**769**	**953**
Westbound	Left	0	167.44	0	0	200
	Through	461.32	425.04	0	0	455
	Right	145.68	51.52	211	0	0
	Total	**607**	**644**	**211**	**0**	**655**
Northbound	Left	184	220.21	0	655	152
	Through	593	880.84	0	0	0
	Right	85	57.95	0	0	0
	Total	**862**	**1159**	**0**	**655**	**152**
Southbound	Left	0	195.15	300	0	0
	Through	0	910.7	0	0	0
	Right	0	195.15	0	0	0
	Total	**0**	**1301**	**300**	**0**	**0**
Intersection	**Total**	**2564**	**4149**	**511**	**1424**	**1760**

Finally, the virtual ramps used for balancing the traffic flow have inflows and outflows which are listed in Table **6** below.

Table 6. Inflow and Outflow of Virtual Ramps

	Scenario A Sep 27		Scenario B Sep 20		Scenario C	
Virtual Ramps	Volume (vph)	Exit/Entrance	Volume (vph)	Exit/Entrance	Volume (vph)	Exit/Entrance
Piedmont Ave (14th to Monroe)	224	Exit	30	Exit	292	Exit
Piedmont Ave (10th to 14th)	118	Entrance	0	Entrance	118	Entrance
Monroe Dr (Piedmont to Park)	24	Exit	423	Exit	371	Exit
Monroe Dr (Park to Piedmont)	342	Exit	283	Exit	433	Entrance
Monroe Dr(park to 10th)	59	Exit	213	Exit	0	Exit
Monroe Dr(10th to park)	80	Exit	0	Exit	0	Exit

6.1.2 Network

In the VISSIM model, each roadway is represented as a link. The geometric parameters of each link were measured in Google Earth. The virtual ramps are one-lane roadways with 12 foot width to ensure the maximum capacity. The geometric design elements are listed in Table **7** below.

Table 7. Geometric Information of Each Link

			Direction	Lane Width		
Link No.	**Link Name**	**Total No. of Lanes**	**One/Two Way**	**each left lane (ft)**	**each right lane(ft)**	**through lanes(ft)**
1	Piedmont Ave NE (10th-8th)	4	One Way	10	10	
2	Piedmont Ave NE (10th-14th)	4	One Way	10	10	
3	Piedmont Ave NE before 14th Street Intersection	3	One Way	12		10
3a	Piedmont Ave NE at 14th Street Intersection	4	Two Way	10	10	
3b	Piedmont Ave NE at Monroe Dr. Intersection	5	Two Way	10	10	
4	Monroe Dr NE	4	Two Way	11	11	
5	Park Dr (Entrance)	3	Two Way	12		10
6	Park Dr NE (Park-Monroe)	3	Two Way	10	10	10
7	Monroe Dr NE (Park Dr-10th)	4	Two Way			10
8	10th (Piedmont-Monroe)	4 (on street parking on south side and one dedicated bike lane)	Two Way			10
9	Monroe (10th-Virginia)	4	Two Way			10
10	Piedmont Ave NE In	4	One Way	10	10	
11	Charles Allen Dr		Two Way	12	12	

The turning movements at the intersection as well as virtual diverge and merge are represented by connectors. For one intersection, four approaches are connected as shown in Figure 8 below.

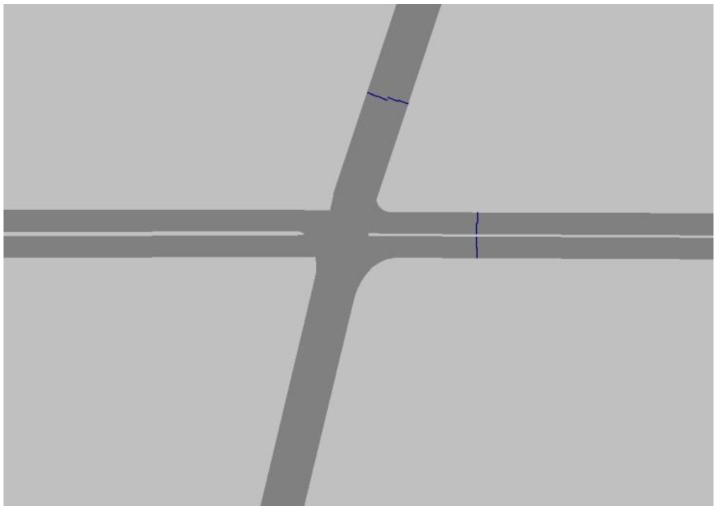
Figure 8. Intersection modeled in VISSIM

6.1.3 Signal Timing Plan

In this project, the team obtained the signal time plans for five intersections within the research area through observation. The signal timing information was collected in the morning of one Saturday, Nov 22. Signal timing plan for each intersection is shown in Table **8** below.

Table 8. Signal Timing Plan of Major Intersections

g-green	**y-yellow**	**r-red**	**rc-red clearance**
Intersection	Approach	Signal Indication	Cycle Length (s)
	10th EBT	r48+g64+y3+rc1	116
	10th EBL	r32+g12+y3+rc1+r68	116
	10th WB	r71+g41+y3+rc1	116
10th at Piedmont	Piedmont	g40+y3+rc1+r72	116
	Charles Allen	g22+y3+rc1+r33	59
10th at Charles Allen	10th	r26+g29+y3+rc1	59
	10th	g20+y3+rc1+r98	122
	Monroe NBT	r54+g64+y3+rc1	122
	Monroe SBT	r83+g35+y3+rc1	122
10th at Monroe	Monroe Left	r24+g8+y3+rc1+r86	122
	Park	r40+g16+y3+rc1	60
	Monroe SB	g36+y3+rc1+r20	60
Monroe at Park	Monroe NB	g20+y3+rc1+r36	60
	Monroe EB	r74+g59+y3+rc1	118
	Monroe WB	r39+g75+y3+rc1	118
	Piedmont Thru	r79+g35+y3+rc1	118
Piedmont at Monroe	Piedmont Left	r67+g12+y3+rc1+r35	118

Based on the signal-timing plan above, the group added signal controller in VISSIM Model for intersections. Signal heads are placed at entrances for different direction of traffic movements. One of the signal-timing programs is shown in Figure 9 below.

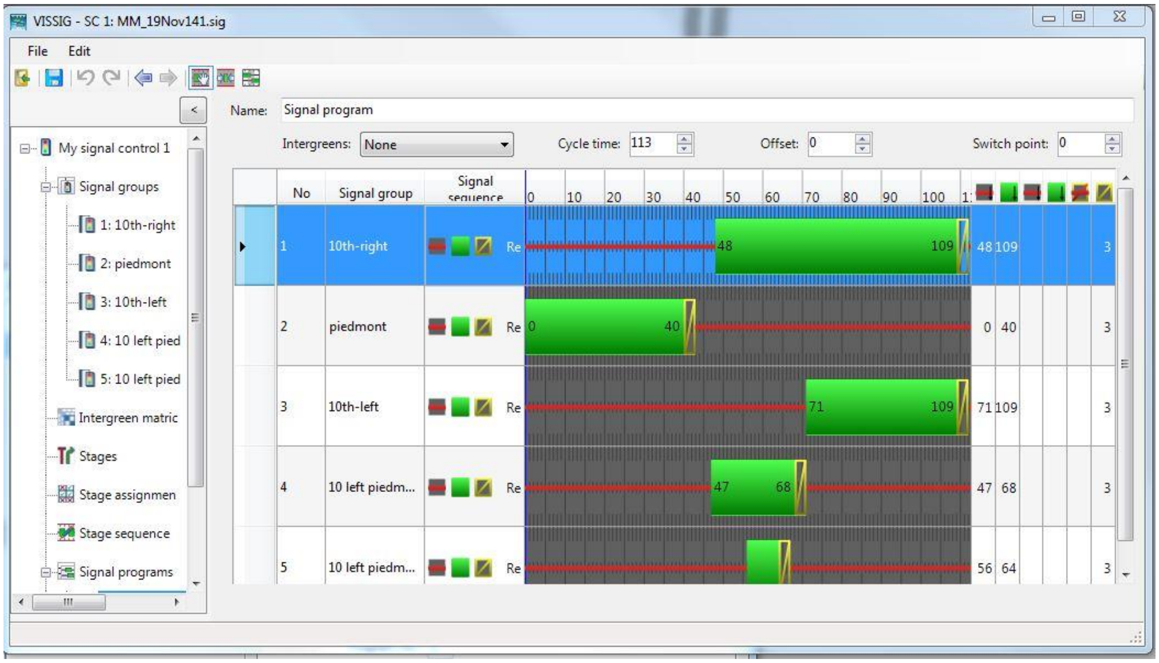

Figure 9. Snapshot of signal timing program window in VISSIM

6.2 VISSIM Model Results

VISSIM model analysis (PTV VISSIM, PTV Group, VISSIM 5.20 User Manual 2009) for Scenario A, B and C provided with mainly three measures of road congestion and closure impact.

6.2.1 Definitions of Result Parameters

6.2.1.1 Queue Length

This parameter is measured using Queue counter tool present in VISSIM. VISSIM simulation provides the queue counter feature, which gives output as

- average queue length
- maximum queue length
- number of vehicle stops within the queue

As per VISSIM manual, queues are counted upstream from the location of the queue counter on the link to the final vehicle in queue condition. In the case, where queue backs up onto multiple different approaches the queue counter records data for all of them and gives output for the longest maximum queue length. The output is in length and not in number of cars. Queue definition can be configured in VISSIM with giving limit values to speed, maximum headway, and maximum length. For the VISSIM models used in the project, the definition of Queue is shown with a snapshot below.

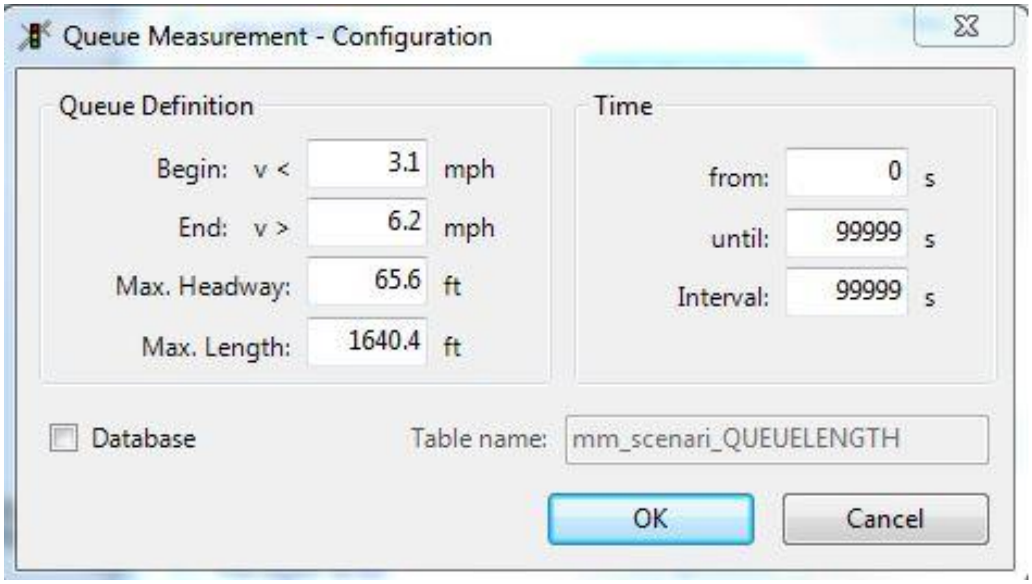

Figure 10. Queue measurement configuration used for the model

6.2.1.2 Queue Delay Time

This is measured using Data Collection tool, which gives queue delay time which indicates delay time by vehicle while queuing up. As part of output, queue delay time and number of vehicles is obtained which has been used to find average queue delay time per vehicle. As per VISSIM, the configuration for Data Collection is set as shown in the snapshot below (Figure 11).

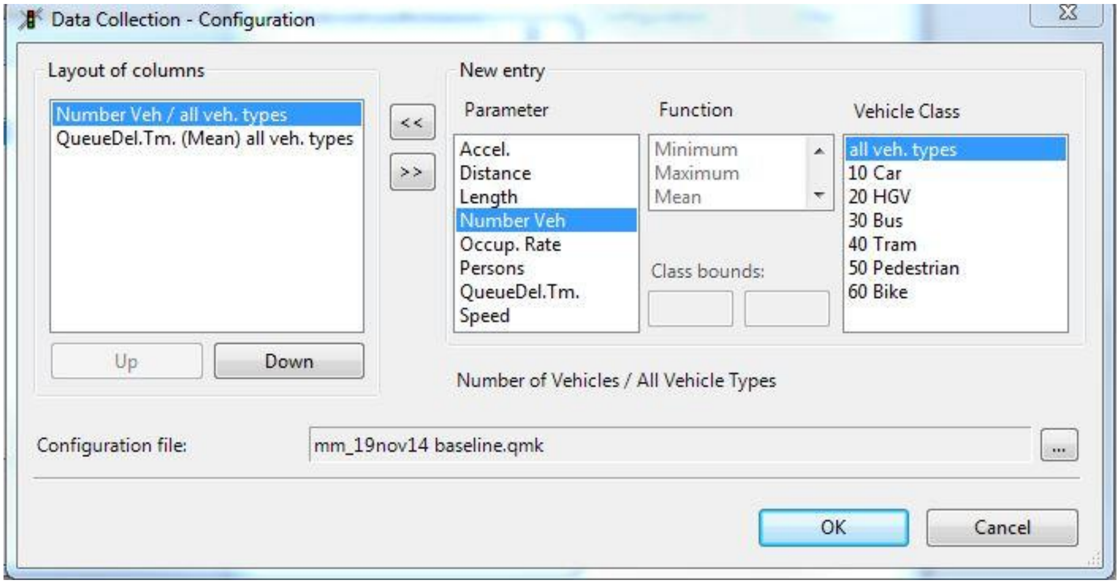

Figure 11. Queue measurement configuration used for the model

6.2.1.3 Delay

Using Travel Time (TT) tool of VISSIM, delay for a section of route can be determined. A delay time measurement determines, compared to ideal travel times (no other vehicle, no signal time) - the mean time delay calculated from all vehicles observed on a single or several link sections. All the vehicles that pass the travel time sections are captured by the delay segment. As part of output, average delay time per vehicle is being shown, which is significantly less compared to average queue delay time per vehicle because delay is calculated for all vehicles. The delay configuration is shown in Figure 12 below. The output given by VISSIM includes following three types:

- Delay: Average total delay per vehicle defined as the total delay time computed for every vehicle that completes the travel time section by subtracting the theoretical (ideal) travel time from the real travel time.
- Stopd: Defined as average standstill time per vehicle
- Stops: Defined as average number of stops per vehicle

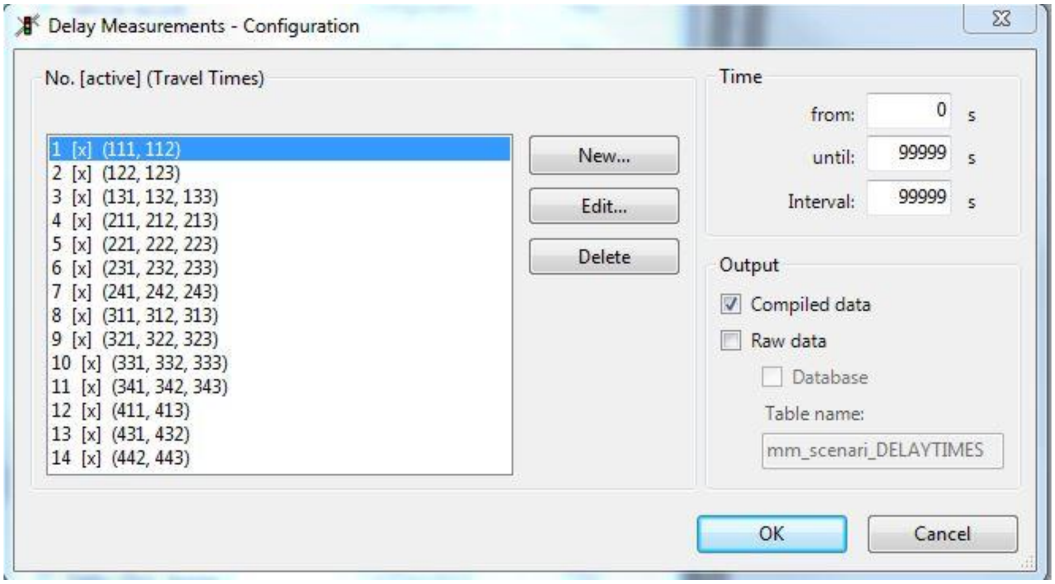

Figure 12. Delay measurement configuration window

6.2.2 Comparison of Queue Length at Intersections

In this part, three queue-related parameters which collected by queue counters have been analyzed. The queue conditions of intersections under different scenarios are compared to evaluate the impact of different scenario on traffic.

6.2.2.1 Average Queue Length

The first parameter for queue length analysis is the average queue length. Following table and graph describes average queue length per vehicle at each intersection for Scenario A, B and C.

Table 9. Comparison Table of Average Queue Length (ft.)

Intersection	Scenario A (Baseline) ft.	Scenario B (Event Day) ft.	Scenario C (Alternate Route Closure) ft.
10th-Piedmont	294	125	299
Piedmont-Monroe	818	1739	680
Monroe-Park	97	107	0
10th-Monroe	1478	309	1

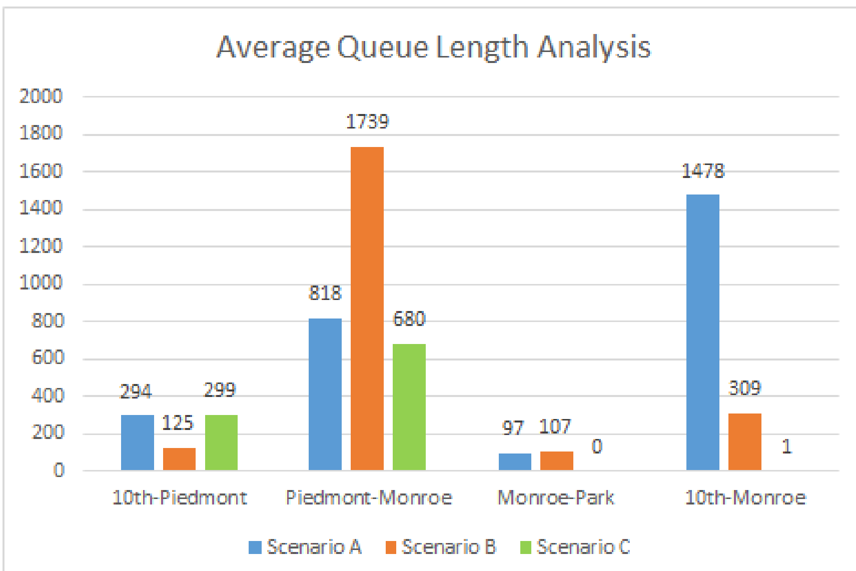

Figure 13. Comparison of Average Queue Length (ft.)

From the graph above, we can see the queue is reduced in Scenario B (Event Day) for 10th at Piedmont and 10th at Monroe due to the road closure on 10th Street. However, the queue on Piedmont at Monroe significantly increase because more traffic diverts to this intersection during Music Midtown with closure of 10th street. And from the simulation, it was seen that the queue tends to accumulate if the entrance is congested forming a bottleneck, which makes the traffic condition even worse. After applying closure at Monroe-Park and simulating Scenario C, the queue length increases at 10th at

Piedmont back to match the baseline Scenario A almost, as 10th Street is open now. However, the average queue length decreases at Piedmont-Monroe. Monroe-Park and 10th-Monroe intersection has almost negligible value for Scenario C for average queue length as Monroe to Park part is closed. And our new road closure scenario use the barriers instead of signal control, which also decrease the queue number of 10th at Monroe and Monroe at Park.

6.2.2.2 Maximum Queue Length

The second parameter is maximum queue length. Follow table and graph describes maximum queue length per vehicle at each intersection for Scenario A, B and C.

Table 10. Comparison Table of Maximum Queue Length (ft.)

Intersection	**Scenario A (Baseline) ft.**	**Scenario B (Event Day) ft.**	**Scenario C (Alternate Route Closure) ft.**
10th-Piedmont	776	564	711
Piedmont-Monroe	1383	2833	1260
Monroe-Park	766	947	0
10th-Monroe	2268	709	93

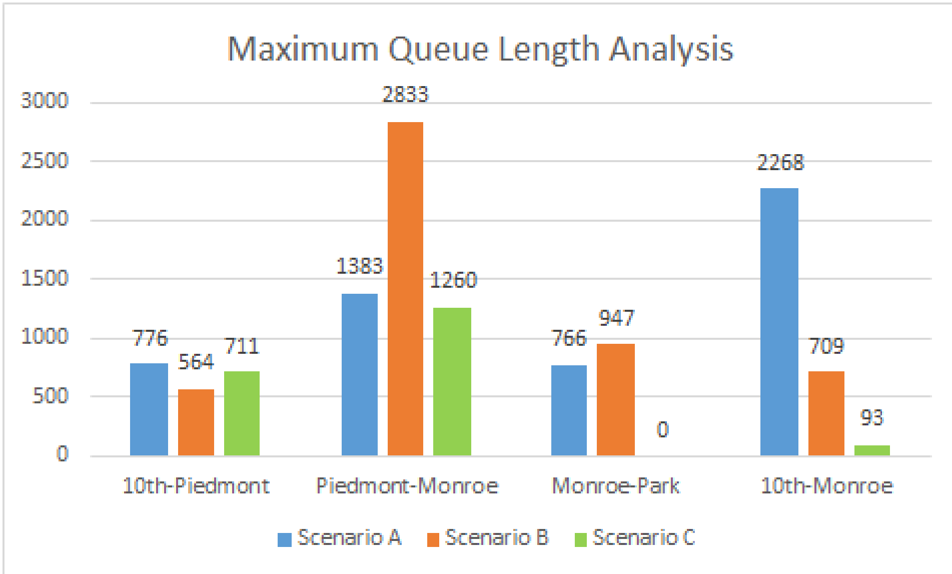

Figure 14. Comparison of Maximum Queue Length (ft.)

From the graph above, we can see the maximum queue basically has the same trend as the average queue length except 10th at Monroe under Scenario C. There is queue at this unsignalized intersection is mostly because high turning volume cause the turning lane congested so the following cars decelerated or stopped. But even there is queue at this intersection, the maximum queue is much less than other two scenarios. In this case, we can conclude that the Scenario C in our model can effectively reduce congestion, we can conclude that the Scenario C in our model can effectively reduce congestion.

6.2.2.3 Number of Vehicles Stop within the Queue

The third parameter is number of vehicles stops within the queue. Follow table and graph describes number of vehicles stop within queue at each intersection for Scenario A, B and C.

Table 11. Comparison Table of Number of Vehicles Stop within Queue (veh)

Intersection	**Scenario A (Baseline)veh**	**Scenario B (Event Day)veh**	**Scenario C (Alternate Route Closure) veh**
10th-Piedmont	1642	1118	1695
Piedmont-Monroe	3427	5353	3109
Monroe-Park	1111	1267	0
10th-Monroe	3814	1417	32

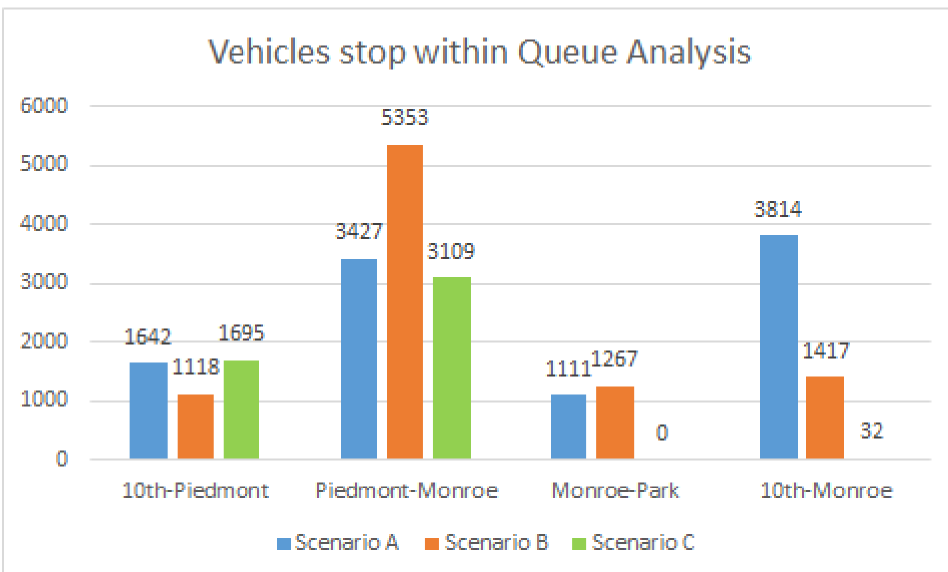

Figure 15. Comparison of Number of Vehicles Stops within Queue (veh)

The number of vehicles stop within queue basically follow the same trend as queue length. The number of vehicle stops exceed the total number of vehicles pass the intersection because vehicles cannot pass the intersection within one signal cycle when intersection is seriously congested. The vehicles at the end of the long queue may have to stop twice or more times to pass. The vehicles pass Piedmont at Monroe suffer from long queue and excessive stops due to events.

6.2.3 Comparison of Average Queue Delay Time per Vehicle at Intersections

The next parameter for traffic evaluation is Average Queue Delay Time per vehicle. Following table describes average queue delay time per vehicle at each intersection for Scenario A, B and C.

Table 12. Comparison Table for Average Queue Delay Time (s) per Vehicle

Intersections	**Scenario A (Baseline) (s)**	**Scenario B (Event Day) (s)**	**Scenario C (Alternate Route Closure) (s)**
Piedmont - 10th	85	50	60
Piedmont - Monroe	318	485	154
Monroe - Park	299	217	59
10th - Monroe	474	209	92

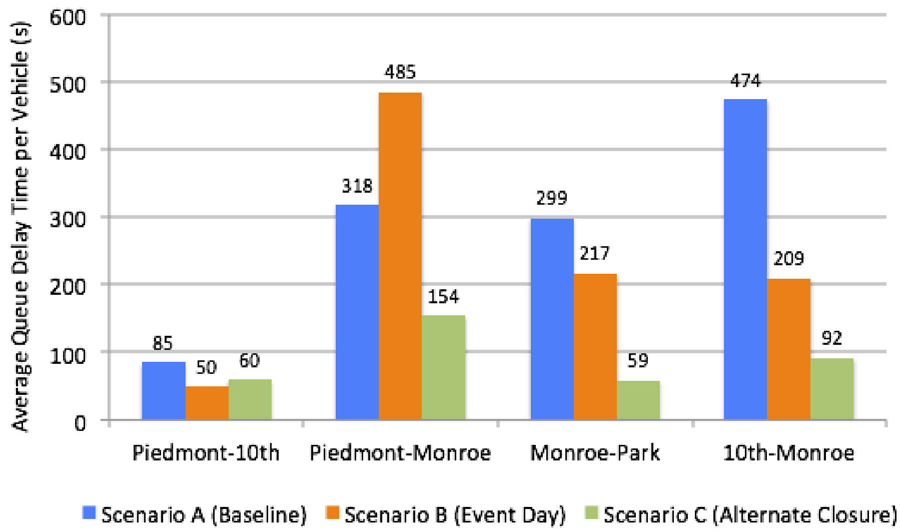

Figure 16. Comparison of Average Queue Delay Time per Vehicle

From the above chart, it can be inferred that the queue delay time per vehicle reduces significantly at Piedmont-Monroe for Scenario C in comparison to the Scenario A (baseline) and Scenario B (Event Day). This is majorly because a lot of traffic entering Monroe towards park now gets diverted away from this network to further North East of Piedmont Park because of closure, mostly the residential traffic still remains to use this route. Since, the queue delay time per vehicle is calculated only for vehicles in the queue, it is much higher than average total delay calculated in the next section.

6.2.4 Comparison of Delay at Intersections

In this part, three delay-related parameters which collected by travel time measurement function in Vissim have been analyzed. The delay conditions of intersections under different scenarios are compared to evaluate the impact of different scenario on traffic.

6.2.4.1 Average Total Delay Per Vehicle

The first parameter for delay comparison is the average total delay per vehicle. Following table describes average total delay per vehicle at each intersection for Scenario A, B and C.

Table 13. Comparison Table of Average Total Delay Per Vehicle (s)

Intersection	**Scenario A (s)**	**Scenario B (s)**	**Scenario C (s)**
10th-Piedmont	42.0	33.4	43.1
Piedmont-Monroe	57.5	79.9	63.0
Monroe-Park	15.7	15.0	0.1
10th-Monroe	71.8	55.7	0.8

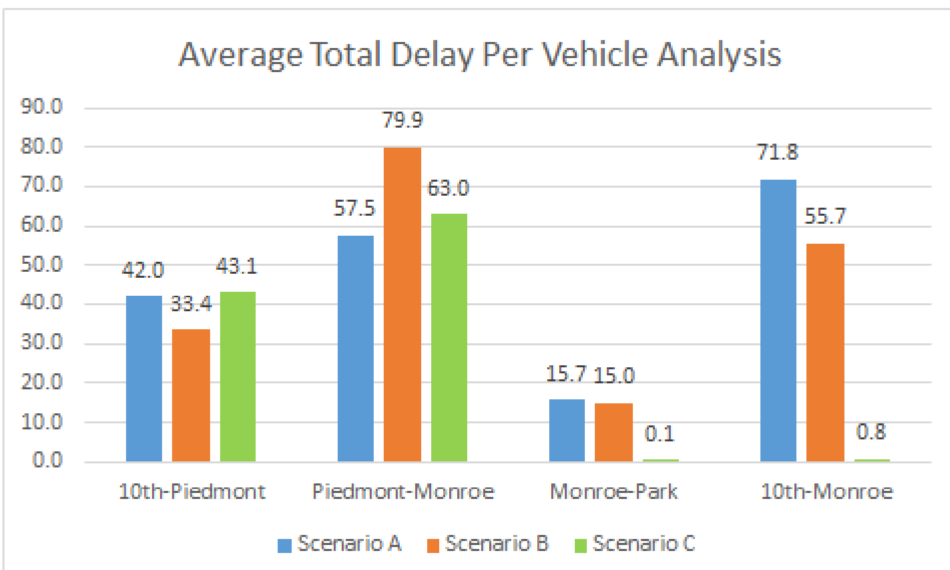

Figure 17. Comparison of Average Total Delay Per Vehicle (s)

From the graph, we can see the average total delay of 10th at Piedmont and 10th at Monroe decreases because 10th Street is closed. The average total delay of Piedmont at Monroe significantly increases because higher intersection traffic volume. After applying scenario C, the average total delay of 10th at Piedmont recovers and slightly exceed the baseline delay due to higher traffic volume passing 10th Street. The average total delay of Piedmont at Monroe is less than delay during events, which is because the reduce volume of westbound approach. But the delay exceed the baseline delay, which might be caused by higher turning volume. The Monroe at Park and 10th at Monroe have low average total delay because signal control is replaced by barriers under Scenario C.

6.2.4.2 Average Standstill Time per Vehicle

The second parameter for delay comparison is the average standstill time per vehicle. Following table describes average standstill time per vehicle at each intersection for Scenario A, B and C.

Table 14. Comparison Table of Average Standstill Time Per Vehicle (s)

Intersection	**Scenario A (s)**	**Scenario B (s)**	**Scenario C (s)**
10th-Piedmont	36.1	28.2	37.0
Piedmont-Monroe	47.7	62.8	51.8
Monroe-Park	10.2	8.7	0.0
10th-Monroe	60.7	46.5	0.1

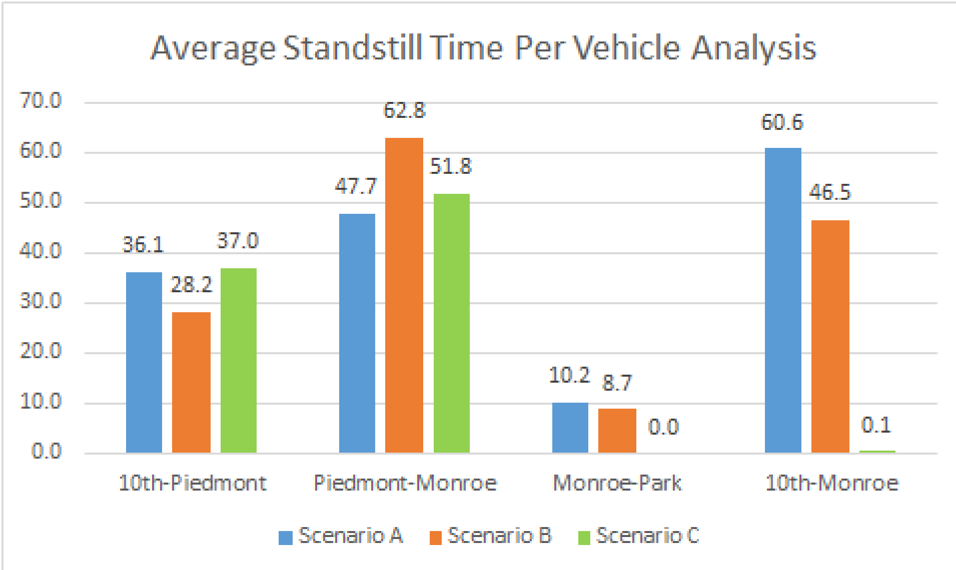

Figure 18. Comparison of Average Standstill Time per Vehicle

From the graph above, we can see the average standstill time generally follow the same trend as average delay time except it is slightly lower. This is because the standstill time do not incorporate delay caused by decelerate.

6.2.4.3 Average Number of Stops per Vehicle

The third parameter is the average number of stops per vehicle. Following table describes average number of stops per vehicle at each intersection for Scenario A, B and C.

Table 15. Comparison Table of Average Number of Stops per Vehicle

Intersection	**Scenario A (s)**	**Scenario B (s)**	**Scenario C (s)**
10th-Piedmont	0.76	0.75	0.79
Piedmont-Monroe	1.04	1.66	1.21
Monroe-Park	0.63	0.63	0
10th-Monroe	1.34	0.99	0.02

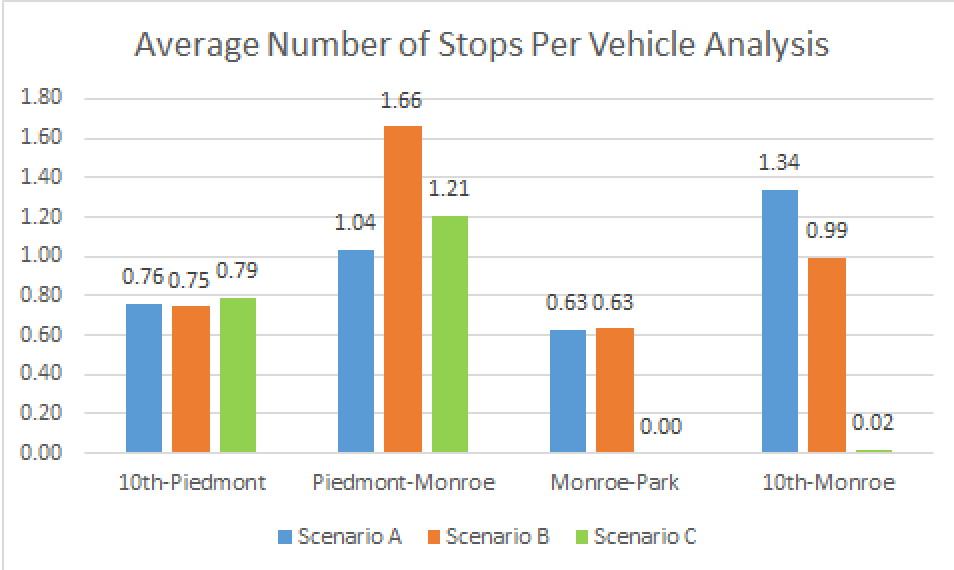

Figure 19. Comparison of Average Number of Stops Per Vehicle

The result of average number of stops per vehicle is close to number of vehicles stop within queue because the former parameter is the average value of the later one. From the graph above, we can see the average number of stops of piedmont at Monroe exceed one under all scenarios. And the Scenario C does not reduce the number of stops compared with baseline number because the higher turning movements are accommodated with unadjusted signal timing. So even Scenario C reduces the overall queue length at the intersection, it pays the price to add extra delay and stops to each driver. This can be mitigated or relieved by adjusting signal timing plan during events.

6.2.5 Limitations of VISSIM Methodology Used

Although the VISSIM model used for the three scenarios gives results that can be used for making comparison and to make an inference about which intersection gets affected most due to change in scenario or due to making a new closure. But the model has some assumptions that may lead to limit it from being followed completely without any change.

- **Traffic signal plans:** The traffic signal plans used for all the scenarios were collected on-field on a normal day. The same traffic plan has been used for Scenario A, Scenario B (event day) and Scenario C (alternate road closure plan).

However, for traffic operation during special events, the improved signal control should be provided to accommodate the traffic volume change and improve the Level of Service.

- **VISSIM link geometry:** Although the on-field dimensions have been used to create VISSIM link geometry, the intersection widths and details do not match exactly to the real intersection. Apart from this, the VISSIM model consists of only roads, signals and vehicles. It does not incorporate pedestrians, crosswalks, sidewalks and on-street parking, which makes it not precisely accurate to the real roads under study.
- **Vehicle behavior:** The group used the default drivers' behavior model in Vissim which is based on previous research under normal condition. The decision process of drivers during special events has not been studied in our research due to requirement of large amount of data and restriction of time and resource.
- **Placement of data collection points:** The data collection points were placed manually in Vissim under different scenario, which may cause the error of results because the difficulty of making the placement exactly same as each other.
- **Desired Speed of Vehicles:** The design speed in Vissim Model under three scenarios is set as 30 km/h for cars and 25 km/h for trucks, which is not realistic enough because the desire speed may change under different scenarios.

7. Parking Methodology and Results

The team utilized several approaches to execute an assessment of parking conditions in Midtown Atlanta during special events. These include an ongoing parking inventory and occupancy study performed by Kimley Horn and Associates during Summer and Fall 2014. The team also performed manual counts in the Virginia Highland, Ansley Park, and Historic Midtown neighborhoods during Music Midtown and Pride. Following this, on street parking capacity calculations for selected streets in the Virginia Highland neighborhood were also calculated using a detailed methodology to allow for comparisons. Finally, the team studied and synthesized recommendations from several local sources as well as literature sources regarding possible solutions for alleviating the parking issues faced during special events in Midtown Atlanta.

7.1 Kimley Horn Parking Inventory of On-Street Parking

The team first obtained on-street parking inventories of the Midtown Atlanta area from Kimley Horn and Associates (KHA) who conducted the occupancy studies as the prime consultant for Midtown Alliance. the Georgia Tech team met with KHA in Fall 2014, KHA was in the process of supplementing the on-street inventories with parking deck inventories, but as of December 2014 (this project completion date) had not yet completed the deck inventories. As a result, the team focused primarily on the on-street parking data that had been completed for the central Midtown area, and were not able to make specific recommendations regarding a rerouting of festival attendees to specific parking decks in the area. The parking occupancies for some of the main streets surrounding Piedmont Park have been summarized below in Table **16**, and a resized sample page from the parking inventory plan is included in Figure **20**. Please see the Appendix for a full overview of the area covered by the Kimley Horn parking inventory plans.

The KHA methodology used to obtain this data is included below; this methodology was obtained from KHA in email correspondence and is as follows:

1. The on street parking was completed via field study of the existing roadways
2. The number of parking meters according to PARKAtlanta was verified in the field.
3. For areas without meters, the number of parked vehicles were counted in the field.
4. For areas where vehicles were not occupying the available parking area, block-face length was considered to be approximately 20’ per vehicle.
5. Parks counts were performed during the following time periods in September 2014: weekday midday (11 am – 1pm) and weekday evening (7pm – 9pm) for on-street parking and weekend evening hours (8 pm -10 pm) for peaks around entertainment districts.

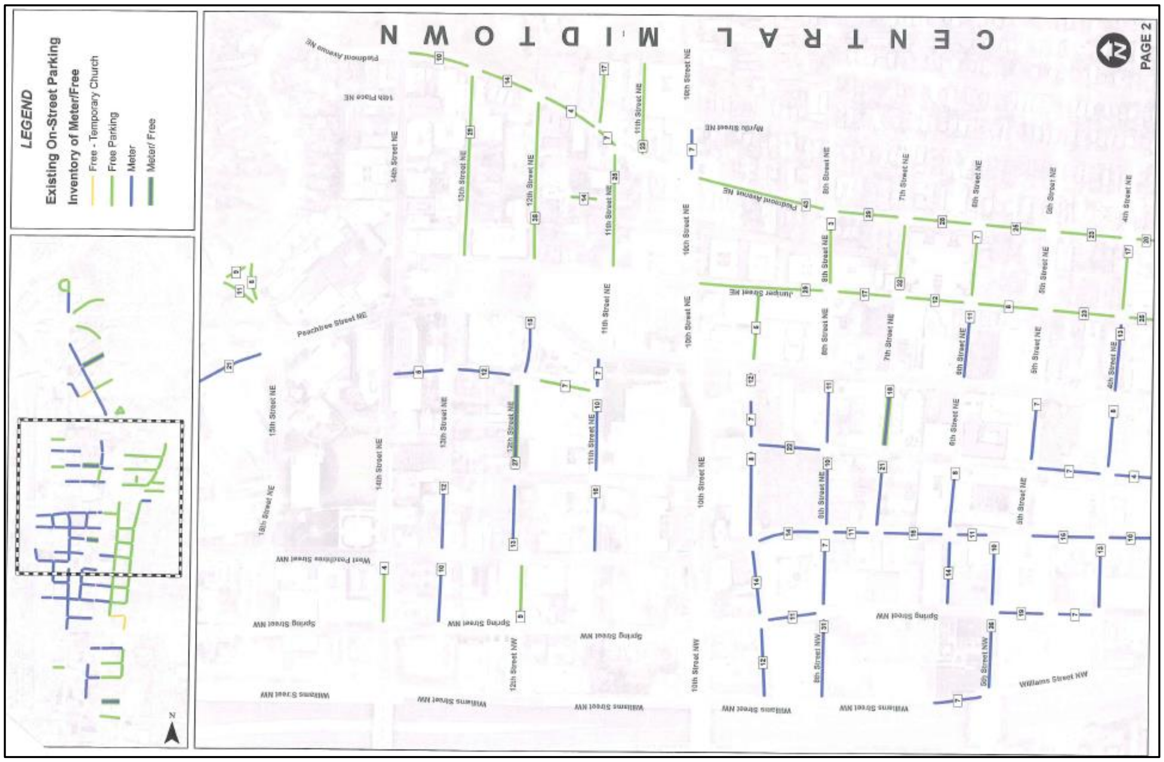

Figure 20. Sample KHA Parking inventory plan sheet (full sized version included in Appendix)

It should also be noted that the parking inventory did not encompass east of Myrtle Street, and thus stopped right before the Piedmont Park boundaries. Therefore, the Virginia Highland neighborhood and a portion of the Historic Midtown neighborhood was not included in the study; because of this, the team manually performed parking counts for these neighborhoods during Music Midtown, as will be discussed in greater detail in the next section. However, the table below includes the streets directly to the West of Piedmont Park, and thus allows for an overview of the parking occupancy of the available on street parking for these streets during normal days in the shown time periods. Greater than 80% parking occupancy is shaded in red, and less than 20% parking occupancy is shaded in green.

Table 16. Kimley Horn On Street Parking Occupancy Summary

Times/ Streets	**Weekday 11 am - 1 pm**	**Weekday 7 pm - 9 pm**	**Friday Evening 8 pm - 10 pm**	**Meter/Free**
Piedmont Avenue NE (8th-10th St.)	40% - 60%	> 80%	> 80%	FREE
Piedmont Avenue NE (7th-8th St.)	< 20 %	20% - 40%	20% - 40%	FREE
Piedmont Avenue NE (6th-7th St.)	60% - 80%	40% - 60%	60% - 80%	FREE
Piedmont Avenue NE (5th-6th St.)	20% - 40%	20% - 40%	40% - 60%	FREE
Piedmont Avenue NE (4th-5th St.)	60% - 80%	40% -60%	40% - 60%	FREE
Piedmont Avenue NE (11th - 14th St. NE)	> 80% (small stretches 40%-60%)	> 80%	Parking Inventory not complete	FREE
Juniper St. (8th-10th St.)	20% - 40%	> 80%	> 80%	FREE
Juniper St. (7th-8th St.)	20% - 40%	> 80%	60% - 80%	FREE
10th Street (Myrtle St. - Piedmont Ave NE)	20% - 40%	< 20%	> 80%	METER
11th Street (Juniper - Piedmont)	60% - 80%	60% - 80%	Parking Inventory not complete	FREE
11th Street (Peachtree St. - West Peachtree St. NE)	60 - >80%	> 80%	> 80%	METER
12th Street (Juniper St. - Piedmont Ave.)	>80%	> 80%	Parking Inventory not complete	FREE
13th Street (Juniper St. - Piedmont Ave.)	> 80%	> 80%	Parking Inventory not	FREE

			complete	
8th Street (Juniper St. - Piedmont Ave.)	> 80%	>80%	> 80%	FREE
7th Street (Juniper St. - Piedmont Ave.)	> 80%	>80%	> 80%	FREE
4th Street (Juniper St. - Piedmont Ave.)	> 80%	60% - 80%	> 80%	FREE
Crescent Ave NE (11th St. - 14th St.)	> 80%	> 80%	> 80%	FREE (11th - 12th) METER (12th - 14th)

As the table above shows, parking occupancy increases significantly in the streets surrounding Piedmont Park on Friday evenings between 8 - 10 pm. This is on usual Friday evenings, not special event days, which indicates the issues that arise between residents and event attendees during the special events.

7.2 Comparison of Virginia Highland Music Midtown counts with total available parking

The team collected parking counts for the Virginia Highland, Historic Midtown, and Ansley Park neighborhoods on Saturday, September 20th, 2014, the final day of the two-day Music Midtown festival. These parking counts were compared with total on street parking capacity for four representative neighborhood streets in the Virginia Highland neighborhood. Due to a lack of time and unforeseen circumstances, the capacity for only four of the neighborhood streets could be calculated; if given more time, the team would ideally complete all streets in all neighborhoods. The methodology that the team developed for calculating on street parking capacity is elaborated on in Section 7.2.1 below.

A map of the streets counted in the neighborhood has also been included in Figure **21**. The numbers of the streets in Figure **21** correspond with the street numbers in Table **17** and Table **18**. Table **17** indicates the total on street parking capacity as well as the total number of parked cars on Music Midtown and Pride festival days (9/20 and 10/12 respectively). The total on street parking capacities for the four chosen streets were calculated using the parking capacity methodology in Section 7.2.1.

7.2.1 Methodology for calculating Parking Capacity

Please read all notes and assumptions included below the formulas before attempting to apply them to obtain/recreate the results. It should also be noted as a caveat that all measurements were conducted in Google Earth, and thus there may be slight differences from existing conditions. The team does not expect that this will greatly impact the comparisons made using this data.

Length of Viable Parking Space on Street:

*Length of Street - [(15' * 2 * # of Fire Hydrants) + (20' * # of Crosswalks) + (30' * # of Stop Signs)]*

Total Parking Capacity on Street if Parking on both sides is available:

[(Length of Viable Parking Space on Street - (16' * No. of Driveways)) * 2] / (22 feet)

Total Parking Capacity on Street if Parking on one side is available:

[(Length of Viable Parking Space on Street - (16' * No. of Driveways))] / (22 feet)

Assumptions and Notes regarding Parking Capacity Methodology:

- Each driveway was considered to be a standard length of 12 feet with 2 feet on both sides that should be kept clear of parked cars for turning movements from driveway and sufficient sight distance. Therefore, each driveway was considered to occupy 16' of space along the street where cars should not park legally. This guidance was taken in part from Joel Mann, transportation engineer working for the Midtown Neighbors' Association and from the Landscaping Network site regarding residential driveway widths.
- If the street was less than 40' wide and residents appeared to only be parking along one side, the street was considered to have on street parking along one side.

- The number of fire hydrants is multiplied by 2 if the hydrant is located such that there is a total of 30’ along the street where cars cannot park. If the hydrant is located at the end of a dead end street, then it is only necessary to consider the 15’ of street prior to the hydrant where cars cannot park.
- Twenty-two feet is considered to be the length of a parallel parking spot since these are the regulations according to the Georgia Department of Driver Services. Although the team acknowledges that drivers may park closer to each other than this, this number is also considered more accurate for future planning and development purposes.
- The final number for total parking capacity is rounded down to allow for a conservative estimate.
- The numbers for the boundaries around signs, hydrants, etc. are from Park Atlanta (Park Atlanta, 2014).

7.2.2 Parking Capacity Results for the Virginia Highland neighborhood

As Table **17** below shows, the Virginia Highland neighborhood streets for which capacity was calculated showed festival (both Music Midtown and Gay Pride) parking numbers that exceeded the parking capacity of the streets, indicating that illegal parking or parking along both sides of the streets were occurring during both Music Midtown and the Gay Pride festival. The team was only able to complete a sample of the neighborhood streets, but strongly recommends that the remainder of the streets be examined further in the future.

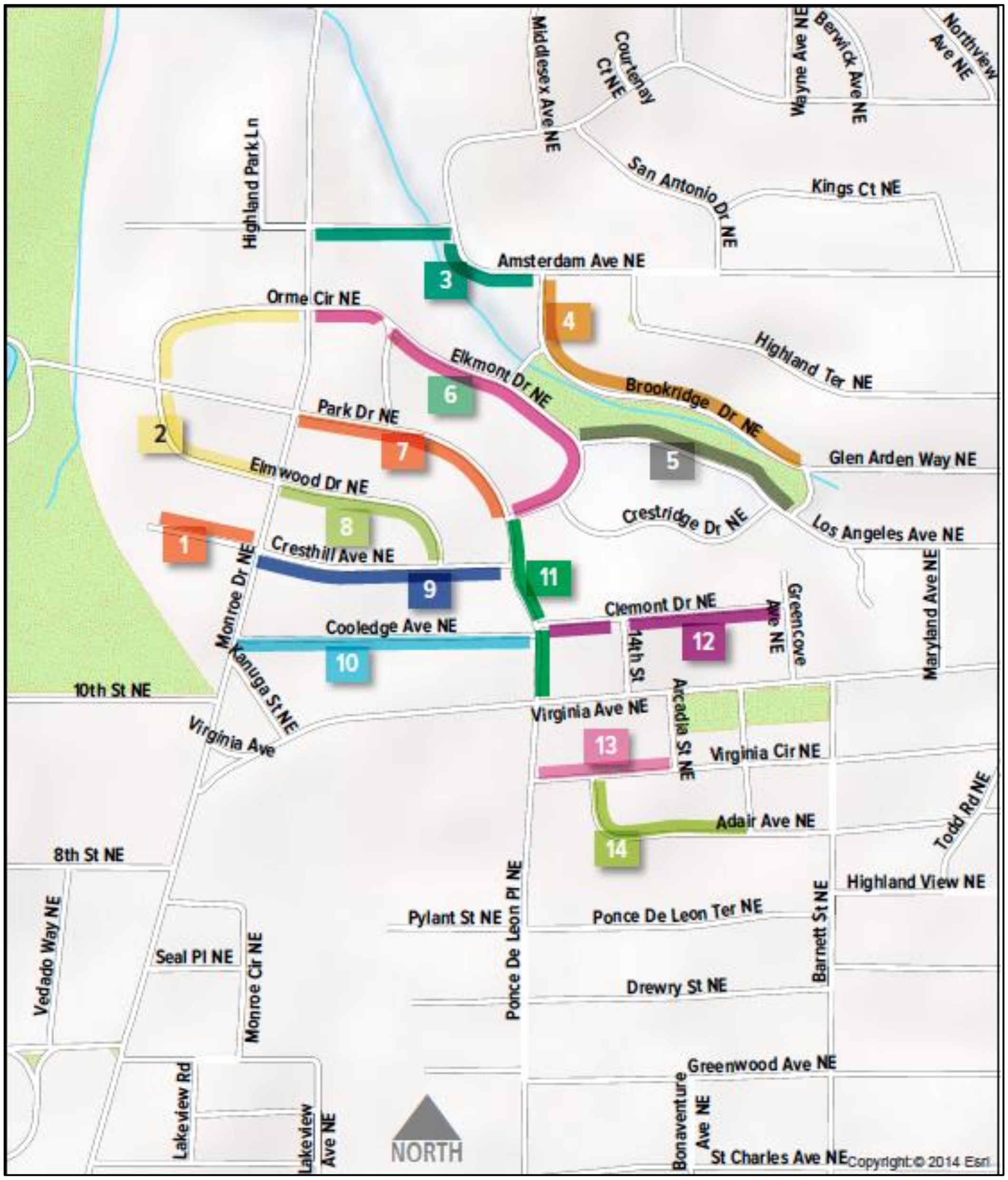

Figure 21. Virginia Highland Streets counted in Parking Study

Sample Calculations:

*1: 500 feet - [(15' * 1 Fire Hydrant) + (30' * 1 Stop Sign)] = 455 feet - (16' * 9)*

= 311 / 22 = 14 parking spaces

*2: 1868 feet - [(15' * 2 Fire Hydrants) + (30' * 4 Stop Signs)] = 1718 feet - (16' * 33)*

= 1190 feet / 22 feet = 54 parking spaces

- *All crosswalks are located near stop signs.*
- *1 Hydrant is located near a stop sign*

*3: 1270 feet = 1270' - (16' * 18) = 982 feet / 22 feet = 44 parking spaces*

*10: 1500 feet - [(15' * 1) + (30' * 2)] = 1425 feet - (16' * 22 Driveways) / 22 feet = 48 parking spaces*

Table 17. Virginia Highland Summary Table with Total Parking Capacity

				Baseline	**9/20/14**	**10/12/14**	**Notes**
Number	**Street Name**	**From**	**To**	**Total Parking Capacity (cars)**	**Total Parked Cars (cars)**	**Total Parked Cars (cars)**	
1	Cresthill Ave	Monroe	Beltline ROW	14	15	22	Barricade (residents only) during Music Midtown
2	Elmwood Dr and Orme Cir	Monroe	Monroe	53	52	76	
3	Amsterdam Ave	Monroe	Brookridge	44	60	55	
10	Cooledge Ave	Monroe	Park Dr	48	57	53	
	TOTAL			159	184	206	

7.2.3 Virginia Highland, Ansley Park, and Historic Midtown Parking Counts

Table **18**, Table **19**, and Table **20** below indicate the Virginia Highland, Ansley Park, and Historic Midtown Parking Counts that were done during the Music Midtown and Gay Pride festivals. As noted before, the team recommends that baseline parking capacities be calculated for each street using the methodology included in Section 7.2.1. This will allow for a full understanding of the extent to which these streets are 'over-parked' during special events.

Table 18. Virginia Highland Total Parking Counts for Music Midtown (9/20) and Pride Festivals (10/12)

				Baseline	9/20/14	10/12/14
Number	**Street Name**	**From**	**To**	**Total Parking Capacity (cars)**	**Total Parked Cars (cars)**	**Total Parked Cars (cars)**
1	Cresthill Ave	Monroe	Beltline ROW	14	15	22
2	Elmwood Dr and Orme Cir	Monroe	Monroe	53	52	76
3	Amsterdam Ave	Monroe	Brookridge	44	60	55
4	Brookridge Dr	Amsterdam	Glen Arden	--	36	10
5	Brookridge Dr	Los Angeles	Elkmont	--	26	14
6a	Elkmont Dr	Orme	Park Dr	--	16	64
6b	Orme Cir	Monroe	Elkmont	--	14	23
6c	Orme Cir	Elkmont	Park Dr	--	21	36
7	Park Dr	Monroe	Elkmont	--	26	34
8	Elmwood Dr	Monroe	Cresthill	--	34	63
9	Cresthill Ave	Monroe	Park Dr	--	41	83
10	Cooledge Ave	Monroe	Park Dr	48	57	53
11	Park Dr	Elkmont	Virginia	--	0	18
12	Clermont Dr	Park Dr	Greencove	--	73	45
13	Virginia Cir	Ponce Pl	Acadia	--	23	21
14	Adair Ave	Virginia Cir	De Leon Ave	--	13	8
	TOTAL			--	**507**	**614**

Table 19. Ansley Park Total Parking Counts for Music Midtown (9/20) and Pride Festivals (10/12)

				9/20/14	10/12/14
Number	**Street Name**	**From**	**To**	**Total Parked Cars**	**Total Parked Cars**
1	Avery Dr	Maddox	Piedmont	28	28
2	E Park Ln	Avery	Westminster	16	6
3	Park Ln	Maddox	Westminster	25	12
4	Westminster Dr	Piedmont	Park Ln	20	9
5	Park Ln	The Prado	Westminster	14	20
6a	The Prado	Piedmont	S Prado	31	28
6b	The Prado	South Prado	Barksdale	20	30
7	Westminster Dr	The Prado	Park Ln	52	46
8	Barksdale Dr	The Prado	Maddox	12	9
9	The Prado	Barksdale	Maddox	42	10
10	South Prado	The Prado	Piedmont	49	52
11	Walker Terrace	South Prado	Lafayette	6	40
12	Westminster Dr	The Prado	Peachtree Cir	5	4
13	Lafayette and 15th St	Yonah Dr	Yonah Dr	32	61
14	Peachtree Cir	15th St	16th St	24	23
15	Peachtree Cir	16th St	17th St	6	3
16	Westminster Dr	The Prado	Lafayette	7	9
	TOTAL			**389**	**390**

Table 20. Historic Midtown Total Parking Counts for Music Midtown (9/20) and Pride Festivals (10/12)

				9/20/14	10/12/14
	Street Name	**From**	**To**	**Total Parked Cars**	**Total Parked Cars**
1	Myrtle St	8th	10th	59	59
2	9th St	Myrtle	Argonne	14	38
3	Argonne Ave	8th	10th	9	22
4	8th St	Piedmont	Argonne	41	41
5	Piedmont Ave	6th	8th	43	64
6	Myrtle St	6th	8th	74	68
7	Penn Ave	6th	8th	53	61
8	7th St	Piedmont	Argonne	70	77
9	6th St	Piedmont	Argonne	52	55
10	Argonne Ave	6th	8th	93	88
11	8th St	Argonne	Durant	26	23
12	7th St	Argonne	Durant	48	53
13	Glendale Terrace	6th	8th	59	63
14	6th St	Argonne	Durant	51	42
15	Durant Pl	5th	8th	75	69
16	6th St	Durant	Charles Allen	55	49
17	8th St	Durant	Charles Allen	18	23
18	Taft	8th	10th	13	16
19	9th St	Argonne	Charles Allen	56	90
20	Charles Allen	8th	10th	50	63
21	Charles Allen	Mentelle	8th	59	53
22	Charles Allen	5th	Mentelle	72	44
23	Greenwood Ave	Monroe	Charles Allen	59	54
24	Vedado Way	Greenwood	8th	65	64
25	8th St	Monroe	Charles Allen	0	0
	TOTAL			**1214**	**1279**

7.3 Comparison of Music Midtown counts with Pride Counts for the Ansley Park, Virginia Highland, and Historic Midtown neighborhoods.

As before noted, the Georgia Tech team performed manual parking counts in the surrounding Ansley Park, Virginia Highland, and Historic Midtown neighborhoods during both the Music Midtown and Gay Pride festivals, which occurred in September and October 2014 respectively. Music Midtown saw crowds of 80,000 on each day, while the Pride festival reportedly had about 200,000 attendees who converged on the area on the day of the festival (Atlanta Pride (a), 2014). This represents a significantly greater number of attendees for the Pride festival, a difference that was not reflected in the percentage differences observed by the team as is shown in Table **21** below.

Table 21. Comparison of Parking Counts between Music Midtown and Pride festival

Neighborhoods	Total Parked Cars (Music Midtown)	Total Parked Cars (Pride festival)	Difference (%)
Virginia Highland	507	614	21.10%
Ansley Park	389	390	0.26%
Historic Midtown	1214	1279	5.35%

The lower than expected increases in parking between the two events illustrates that there was a clearly different parking phenomenon occurring between the two events. While the events had difference of more than double the amount of attendees during Pride, parking only showed small increases. Upon closer examination the team found that another distinct difference between the festivals was that Pride organizers had partnered with Parking Panda, a parking reservation company that allowed attendees to pick from a number of pre-designated parking lots to make a reservation at the same time that they bought their tickets online. A screenshot of the parking lots that were made available for reservation by Pride attendees prior to the event is shown below in Figure **22** (Atlanta Pride (b), 2014). As for Midtown, the Pride event organizers warned attendees to use transit or the paid lots provided by Parking Panda, otherwise they would stand a risk of being towed if they parked in the surrounding residential neighborhoods.

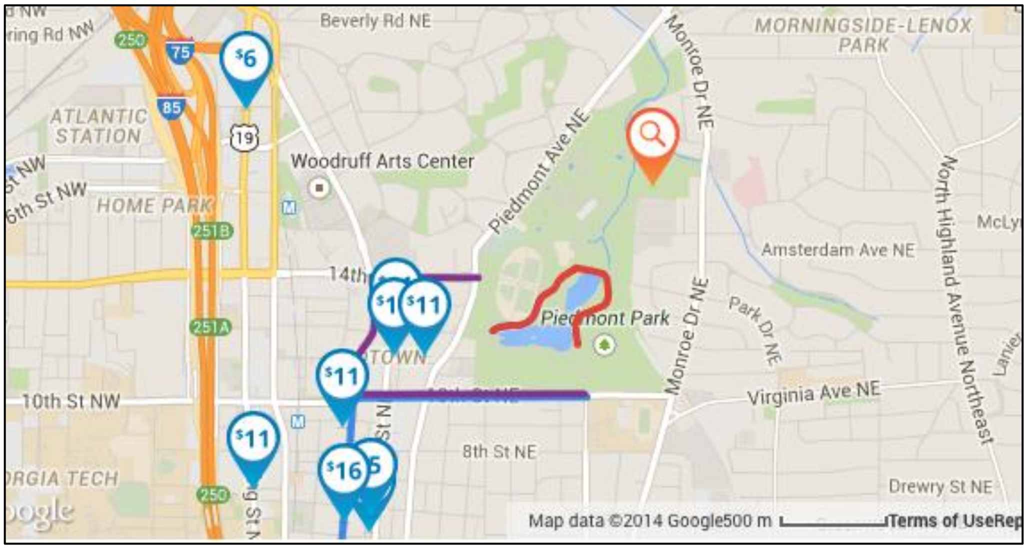

Figure 22. Parking lots and rates for Pride attendees (Parking Panda)

7.4 Recommendations from Literature regarding Parking solutions

As discussed previously, the team investigated the Intelligent Parking System (IPS) in the City of Phoenix, and obtained some ideas that could be applied to special events in Midtown Atlanta. The primary recommendations from Phoenix include the dissemination of real-time information to attendees as well as the use of 'way finding' methods. These include the use of portable variable message signs (VMS) that share real-time information to incoming and exiting traffic before and after the events. These VMS could be used to indicate to event attendees where available parking is located, and it could also be applied to warn attendees to avoid residential neighborhoods. An example of such a variable message sign has been included in Figure **23** below. The ITS system in Phoenix also used barricades to block areas, once parking has been filled. There are parking garage sensors and videos that allow officials to keep track of the parking facilities. The Georgia Tech team would like to recommend the application of IPS or VMS for Music Midtown and other festivals occurring in Piedmont Park. The team believes that if support from parking decks and garages around can be obtained, a parking algorithm can be developed to calculate available space in each parking deck/lot and give suggestions regarding parking space allocation. This will help mitigate the side effects caused by road closure and chaotic parking practices (Crowder, 2003).

Figure 23. Portable Variable Message Sign

Based on the results from the use of Parking Panda, the parking reservation company used by Pride festival organizers, the team also believes that such actions should be mandatory for festival organizers wishing to use Piedmont Park. Informing attendees of the limited parking options available around the Park provides real incentives for them to plan ahead or use a different mode that doesn't require parking. Finally, the team believes that all surrounding neighborhood streets should be blocked from festival traffic, and only resident with parking permits should be allowed to use those streets during the event. This will ensure that the neighborhoods are not significantly affected by these numerous events, and will also lead to a greater and more effective channelization of festival goers to major arterials.

8. Recommendations

8.1 Road Closures and Congestion Recommendations

8.1.1 Road Closures

Instead of close the streets for 13 days and use 10th Street to park the trucks, our group suggests an alternative to closing 10th street, which is to close Park Drive and small portion of Monroe Drive for some of the non-event days. This scenario is expected to raise discomfort for people residing near Park Drive. But this does open 10th street for all neighborhoods. The tradeoff can be done depending on the convenience and utility of the two road closures. The simulation results show that the congestion is eliminated to some extent under the new road closure scenario.

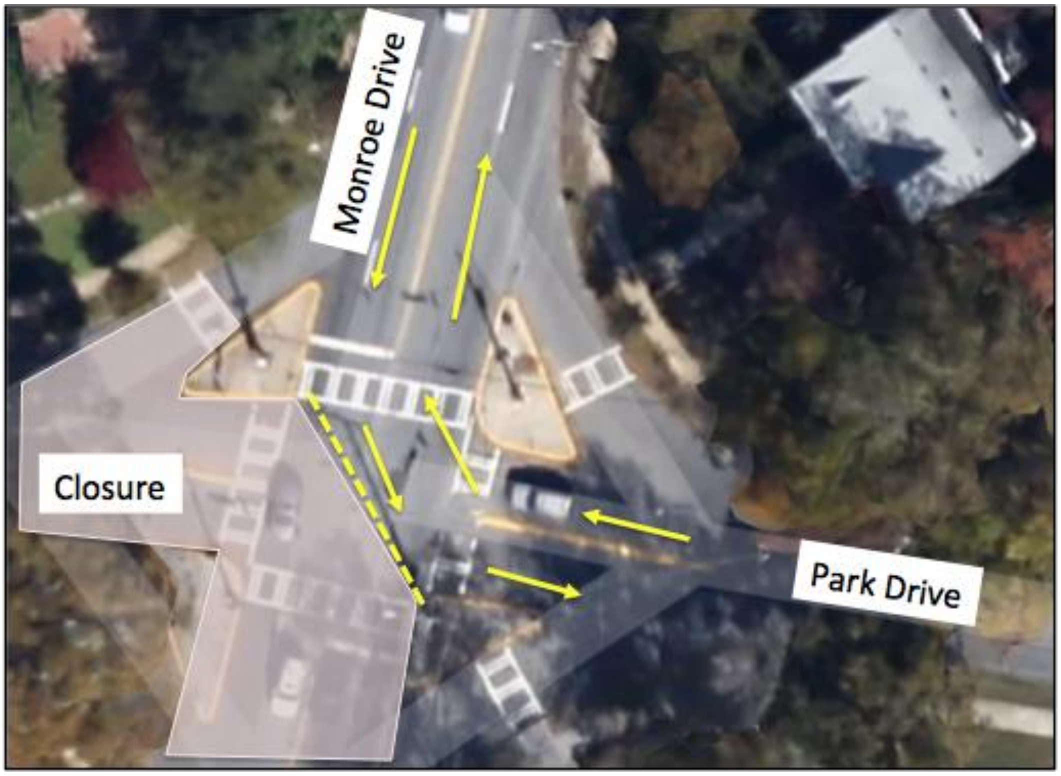

Figure 24. Intersection of alternate road closure

8.1.2 Signal Timing Plan

Currently, there is no special signal timing plans to accommodate traffic during special events. And the baseline signal timing do not provide high level of service according to the baseline result analysis. Traffic during special events should be accommodated with different signal timing plan or other kinds of traffic control at intersections according to the context. For the road closure part, the barriers may have better performance than signal control because it does not stop the traffic.

8.1.3 Information Dissemination

One of the biggest traffic problems during special events is the dissemination of real-time traffic information. Most drivers are not fully aware of the traffic condition during special events and some of them spend extra time making detours or searching parking space. The real-time traffic information should be provided through VMS, temporal signage, radio and websites.

8.1.4 Multimodal Transportation

Currently, MARTA do not provide extra transit service during Music Midtown. The headways between buses are extremely long, which cause low quality of transit service. Most transit riders used Midtown Station during Music Midtown because that station is closest to the Piedmont Park. Our group suggest that shuttle services should be provided during special events to connect Piedmont Park with several major train stations around Piedmont Park. The frequency of bus service should be improved to accommodate large demand. What's more, the bike lane of 10th Street was also occupied by trucks during events. Modest people biked there due to lack of bike facilities and bike storage space. The bike lane should be returned to bicyclists and more parking storage facilities should be provided to bicyclists, which helps reduce parking and congestion problems.

8.2 Parking Recommendations

The team recommends that portable variable message signs be implemented during special events in Piedmont Park to inform attendees of available parking and rules concerning residential parking. Additionally, the use of a parking reservation system such as Parking Panda should be implemented for all special events occurring in Piedmont Park. Finally, the team recommends the use of parking permits for residential neighborhoods that are enforced during the special events.

9. Concluding Remarks

Overall, the team believes that the recommendations provided can help to guide the stakeholders towards some solutions for mitigating the major issues and inconveniences caused by special events in Piedmont Park. This analysis is by no means entirely comprehensive, because the team eventually realized that the scope of the project was too large to be thoroughly completed in one semester. It is our hope that it does provide some useful guidance for the engineers, policy makers, and residents affected by these issues.

10.References

Ansley Park (2014). Accessed from: http://www.ansleypark.org on October 1, 2014.

Atlanta Journal Constitution (2014). "The history of Music Midtown." Accessed from: < http://www.myajc.com/timeline-music-midtown> on December 1, 2014.

Atlanta Pride (2014). "History of Atlanta Pride." Accessed from: < http://atlantapride.org/about/history/> on November 25, 2014.

Atlanta Pride (2014). "Parking." Accessed from: < http://atlantapride.org/pride/parking/> on November 25, 2014.

Bond, Terry (2014). "Festival plans hurt the 'hood." Accessed from: http://atlantaforward.blog.ajc.com/2014/09/18/music-midtown-and-the-neighbors/ on November 25, 2014.

Cambridge Systematics (2008). "WisDOT Traffic Operations Infrastructure Plan." Wisconsin Department of Transportation, Bureau of Highway Operations.

Carson, J.L., and R.G. Bylsma (2003). "Report on Transportation Planning and Management for Special Events." Transportation Research Board of the National Academies, National Cooperative Highway Research Program. Washington, DC. 2003.

City of Atlanta (2014). Accessed from: < http://www.atlantaga.gov> on December 1, 2014.

City of Atlanta (2014a). "Outdoor Festival Permit Application." Accessed from: < http://www.atlantaga.gov/index.aspx?page=146> on December 1, 2014.

City of Atlanta (2014b). "Office of Special Events." Accessed from: http://www.atlantaga.gov/index.aspx?page=134 on December 1, 2014.

Crowder, M., & Walton, C. M. (2003). Developing an Intelligent Parking System for the University of Texas at Austin (No. SWUTC/03/167229-1). Southwest Region University Transportation Center, Center for Transportation Research, University of Texas at Austin.

Grady High School (2014). "Grady High School and Music Midtown 2014." Accessed from:<http://www.atlanta.k12.ga.us/cms/lib/GA01000924/Centricity/Domain/3087/GRADY%20HIGH%20SCHOOL%20AND%20MUSIC%20MIDTOWN%202014%20v1.pdf> on October 1, 2014.

Kelley, C. (2014). "150,000 expected at this weekend's Music Midtown." Accessed from: < http://www.atlantaintownpaper.com/2014/09/150000-expected-weekends-music-midtown/> on October 1, 2014.

Landscaping Network (2014). "Residential Driveway Width." Accessed from: < http://www.landscapingnetwork.com/driveways/width.html> on December 1, 2014.

Lassacher, S., Veneziano, D., Albert, S., & Ye, Z. (2009). Traffic management of special events in small communities. Transportation Research Record: Journal of the Transportation Research Board, 2099(1), 85-93.

Latoski, S., W. Dunn, B. Wagenblast, J. Randall and M. Walker (2004). Managing Traffic for Special Planned Events. Publication FHWA-OP-04-010FHWA, US Department of Transportation, 2004.

Lucie, C. (2013). "Mayor Reed leaning toward not renewing contract with Park Atlanta" Accessed from <http://www.wsbtv.com/news/news/local/mayor-reed-leaning-toward-not-renewing-contract-pa/nbTZj/? __federated=1> on October 1, 2014.

MARTA. (2014). "MARTA is your way to Music Midtown." Accessed from: < http://www.itsmarta.com/music-midtown-2013.aspx> on October 1, 2014.

Midtown Alliance (2014). " Midtown Atlanta." Accessed from: < http://www.midtownatl.com> on October 1, 2014.

Midtown Neighbors Association (2014). "Midtown Neighbors Association." Accessed from: < http://midtownatlanta.org> on October 1, 2014.

Park Atlanta (2014). "How to Avoid Getting a Citation." Accessed from: < http://www.parkatlanta.org/tickets.html> on December 1, 2014.

Piedmont Park Conservancy (2012). "Park History." Accessed from: <http://www.piedmontpark.org/visit/history.html> on December 1, 2014.

Piedmont Park Conservancy (2012). "Mission." Accessed from: < http://www.piedmontpark.org/conservancy/mission.html> on December 1, 2014.

Ruggieri, Melissa (2014). "Midtown Neighbors Association concerned about Music Midtown traffic." Accessed from: <http://www.accessatlanta.com/weblogs/atlanta-music-scene/2014/aug/04/midtown-neighbors-association-concerned-about-musi/#__federated=1> on October 1, 2014.

Saporta, Maria (2014). "Peter Conlon: Music Midtown is good for Atlanta—and Piedmont Park." Accessed from: < http://saportareport.com/blog/2014/09/peter-conlon-music-midtown-is-good-for-atlanta-and-piedmont-park/> on November 25, 2014.

Sarasua, W. A., P. Malisetty, and M. Chowdhury (2011). “Using a GIS-based, Hitchcock algorithm to optimize parking allocations for special events.” *Applied GIS*, Vol. 7, No. 2, 2011, pp. 1-13.

Sattayhatewa and Smith. Development of Parking Choice Models for Special Events. *TRB 2003 Annual Meeting CD-ROM*.

Virginia-Highland Civic Association (2014). “VHCA, Ansley, Midtown, MLPA, City Council Members Join To Study Event Impacts and Process.” Accessed from: < http://vahi.org/vhca-ansley-midtown-mlpa-city-council-members-join-to-study-event-impacts-and-processes/> on October 1, 2014.

Wan, A. (2014). “NPU-E Information.” Accessed from: < http://www.atlantadistrict6.com/npu-e.html> on October 1, 2014.

Wan, A. (2014). “NPU-E Information.” Accessed from: < http://www.atlantadistrict6.com/npu-f.html> on October 1, 2014.

Washington State Department of Transportation (2006). “ Congestion Relief Analysis for the Central Puget Sound, Spokane & Vancouver Urban Areas.”

11. Appendix

1. Road Closure Maps
2. Traffic Counts
3. Parking Maps (provided by Joel Mann)
4. Kimley Horn Parking Inventory Plans
5. Annotated Bibliography, Literature Review, Sources