

INTRODUCTION

The Grapevine Parking Study offers a comprehensive analysis and set of recommendations for the City of Grapevine’s parking operation and future parking projections. The City will use this document as a guide for future decision making, resource allocation, and parking investment choices. This study focuses on the assessment of current parking conditions, future parking projections and operational procedural enhancements within the study area.

OVERVIEW

In the fall of 2018, the City of Grapevine selected WGI to assess the City’s future parking needs for their newly designated Dallas Road Transit District, with a secondary task of evaluating parking conditions in the Downtown/CBD area and making recommendations for parking management in that area. The purpose of the study was to develop a comprehensive parking study for the City of Grapevine focused on balancing the demand and availability of parking within the study area and transit corridor. This study is intended to serve as a planning tool based on a proactive approach to future parking demands, while ensuring that visiting patrons have convenient access to parking spaces before, after, and during future development along Dallas Road, and to provide suggestions for parking solutions in the Downtown area.

Downtown Grapevine attracts many visitors on a daily basis with a year round event calendar tailored to everyone. Founded in 1844, Grapevine has evolved tremendously, but strives to keep true to its small town roots. Surrounded by attractions such as Great Wolf Lodge and Gaylord Texan, Downtown Grapevine has become a destination for business and pleasure.

With the recent expansion of the Trinity Metro commuter rail system at the south end of the core downtown area, the city has proactively taken action to plan for projected growth. Utilizing previous parking studies conducted, and in conjunction with the recent Mesa/ArchiTexas Transit District Overlay Document, our team was tasked to develop a plan for future parking needs based on the potential of much higher density growth along the Dallas Road Transit Corridor that currently exists, and assess the current state of parking in Downtown Grapevine using real-time data to project parking demands. Further, based on these projections we were tasked to provide parking and transportation solutions to aid in the continued growth of the city while also improving visitor experience.

PROJECT APPROACH & METHODOLOGY

In general, Northwest Highway defines the project study boundary to the north, Vine Street to the south, Ball Street to the west and S. Dooley Street to the east.

WGI conducted extensive data collection on existing conditions, including three days of parking occupancy

counts. In addition to performing field observations and statistical analyses of existing conditions, our information gathering relied on outreach and direct communication with key staff and other downtown stakeholders. We conducted one-on-one meetings with City leadership, senior staff members, representatives of private sector employers and business owners to gain a broader understanding of the attitudes and perceptions of the community at large.

The primary focus area for this study was the Transit Corridor, as defined by the Mesa/ArchiTexas Transit District Corridor Study along Dallas Road and bisected by Main Street. However, our parking analysis also includes observations of private and public parking facilities and pedestrian activity patterns in Downtown Grapevine as well.

The first step in our process was to document the existing parking inventory. This inventory included marked and unmarked on-street parking supply and public and private off-street parking facilities. Once parking supply was confirmed, parking occupancy surveys were performed during three pre-determined times in an effort to document parking activity during normal daytime conditions, as well as downtown special events.

Using projected development patterns within the Transit District, building usage downtown and potential future garage locations suggested by City, the WGI team built a scenario matrix highlighting the pros and cons of potential garage locations. In addition to the locations provided by the city, our team also took into consideration other locations brought to our attention through stakeholder meetings and site tours.

Throughout the development of the project we took into consideration User Comfort Factor as well. The User Comfort Factor (UCF) approach is applicable to a number of design considerations in parking including vehicular circulation, site dimensions, parking geometrics, flow capacity, and entry/exit design. Acceptable user comfort factors for parking, which are defined below, range from 1 to 4.

UCF 1 – Poor: less than 50% of patrons will be satisfied

UCF 2 – Acceptable: 50% of patrons will be satisfied

UCF 3 – Good: 75% of patrons will be satisfied

UCF 4 – Excellent 90% of patrons will be satisfied

Finally, using the information and feedback gathered, actionable and comprehensive recommendations will be presented to the City.

CURRENT CONDITIONS

The first task in developing a comprehensive parking study is to assess the current parking conditions within the study boundary.

This Existing Parking Conditions Report provides a summary of parking conditions at the time of study. This first step will provide City of Grapevine with an understanding of their current parking supply and the utilization of the supply. This will serve as a benchmark for prioritizing parking future planning decisions.

CURRENT PARKING INVENTORY

A parking inventory survey was conducted within the study area, including off-street parking and marked and unmarked on-street parking. This efforts goal was to create a baseline of the current state of parking. The table below provides a summary of the parking inventory for the entire study area. **Note that all numbers represent data within the Study Area as of October of 2018.**

Parking supply types are defined below:

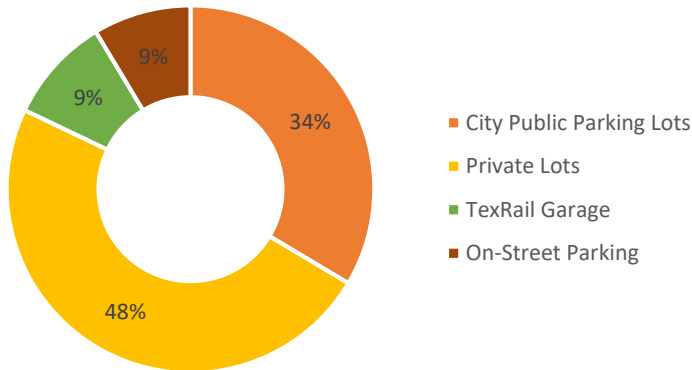
- **On-street Parking** – Marked striped public parking and unmarked public parking
- **Private Off-street Parking** – parking spaces available off street that are for private uses or facilities.
- **Public Off-street Parking** – parking spaces available off-street located in a lot or garage that are open and available for public parking for a fee.

There are an estimated 5,931 total parking spaces within the study area. This number includes all the supply types listed above. It does not include parking spaces associated with single-family driveways or garages.

In general in the study area there are:

1,990	City Public Surface Lots		2,878	Private Surface Lots		552	TexRail Garage
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Overall Parking Inventory



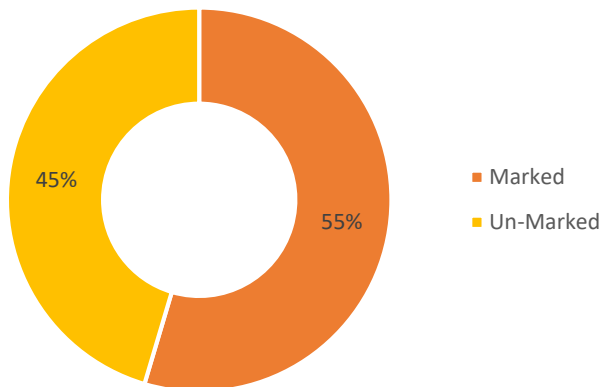
Overall Parking Inventory	Spaces
City Public Parking Lots	1,990
Private Lots	2,878
TexRail Garage	552
<i>Total Off Street Subtotal</i>	<i>5,420</i>
<i>Total On-Street Subtotal</i>	<i>511</i>
TOTAL STUDY AREA	5,931

The parking inventory within the Parking Study Boundary is heavily skewed with 91% off-street inventory representing the majority of the 5,931 parking spaces. While off-street inventory makes up most of the available inventory, there is a balance within the inventory between private and public parking. All of the on-street and off-street public parking surrounding Main Street and vicinity is currently free to the public and unrestricted by time limit.

ON-STREET PARKING INVENTORY

On-street parking on Main Street consists of parallel parking and angled, head-in parking spaces. Based on the inventory counts, there were 511 on-street parking spaces within the parking study area. This was comprised of marked (public) and unmarked on-street parking. Unmarked parking refers to vehicles parking in “No Parking” zones or spaces unstriped, not marked. It should be noted that parking inventory in areas under construction during our data collection and field observations were not noted. For the purpose of this study, we focused on parking available as public parking. As shown in the table below, there are 279 public on-street parking spaces within the study focus area that are marked public parking.

On-Street Parking



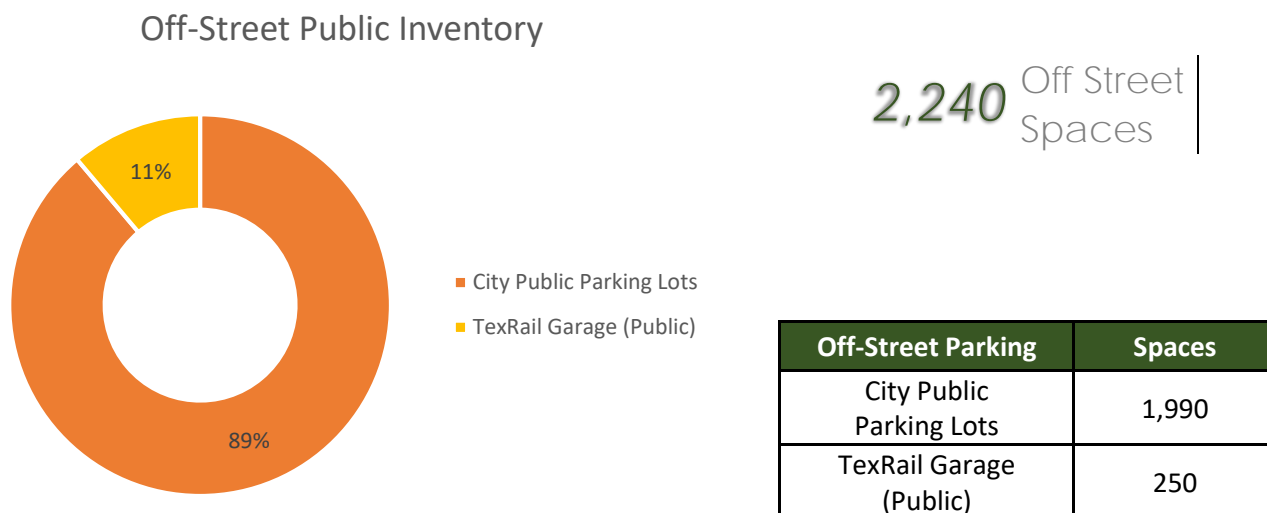
511 On Street Spaces

On-Street Parking	Spaces
Marked	279
Un-Marked	232

OFF-STREET PARKING INVENTORY

Off-street parking within the study boundary area includes public surface lots owned and controlled by the City of Grapevine and privately owned lots serving individual land uses and not controlled by the City. Additionally, the garage affiliated with the TexRail development will provide 552 parking spaces, of which 250 will be available for public parking.

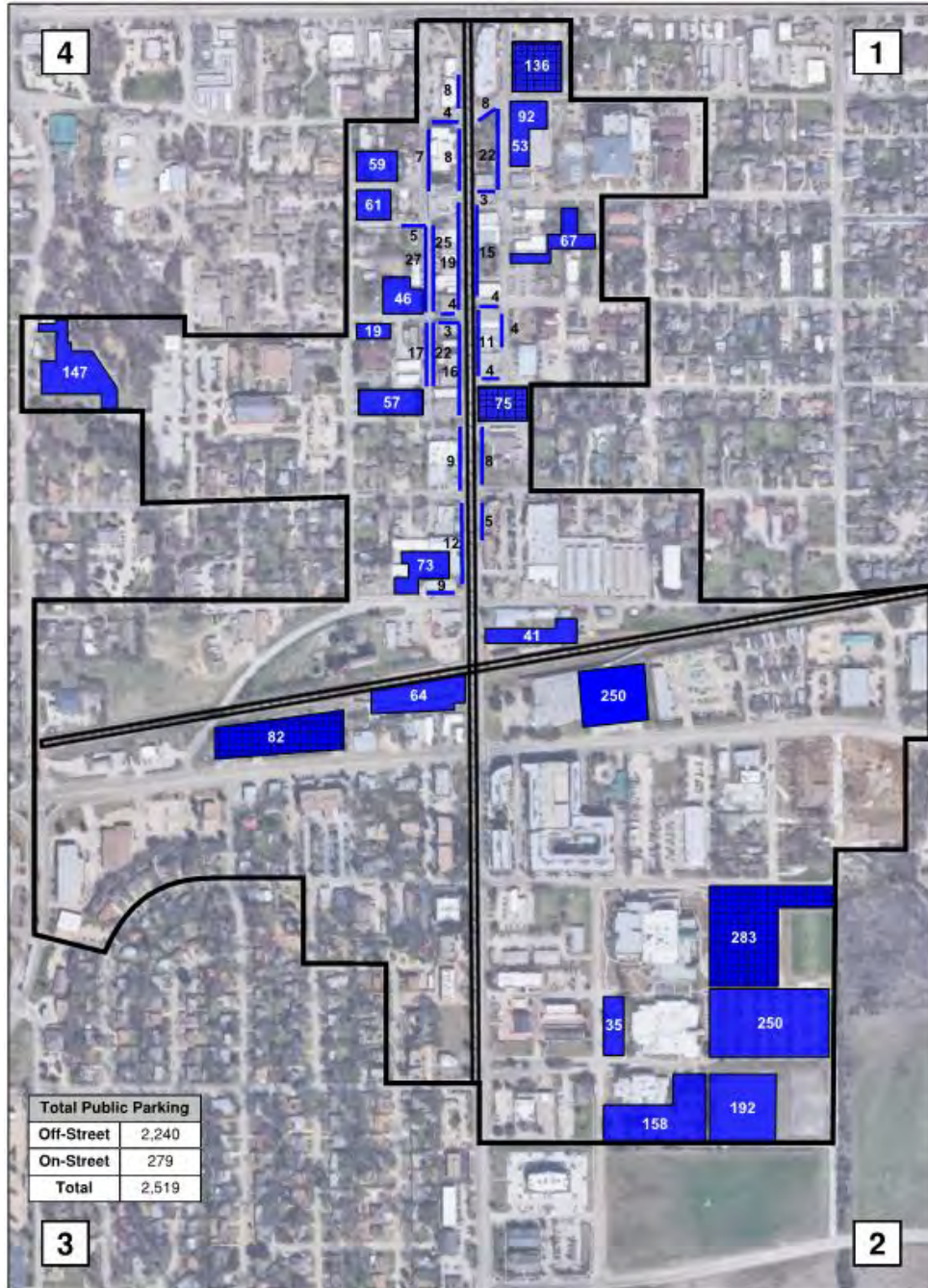
Based on our inventory counts, there were a total of 5,420 off-street parking spaces available within the parking study area. For the purpose of this study, we focused on public parking which we defined as those owned and controlled by the City. As shown below there are a total of **2,240** off-street public parking spaces in the study area.



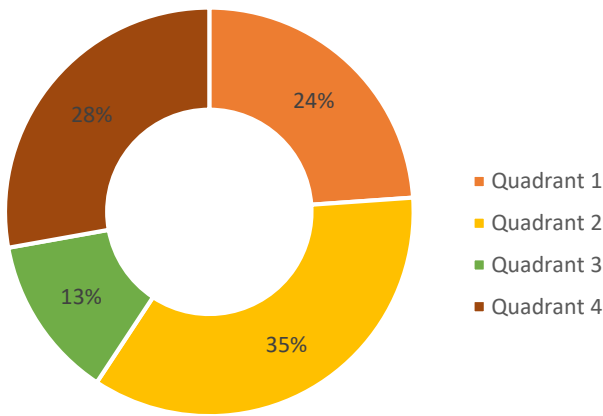
Moving forward we are only considering marked on-street parking and public off-street parking for our calculations and future parking projects as these are spaces within the control of the City of Grapevine and therefore part of the long-term inventory.

STUDY BOUNDARY QUADRANTS

Given the study area is 4,403 feet north/south and 2,450 feet east/west the consultant team felt it was prudent to break the area into four quadrants as shown below. These quadrants allow for the analysis of the data to be organized and adequately determine parking generators and impacts to the inventory. In general, the study area was cut along Main Street north and south and Dallas Street east and west.



The breakdown of the parking inventory by quadrant is as follows:



Parking Inventory by Quadrant			
	Off-Street	On-Street	Total
Public & Private	4,868	511	5,379
Quadrant 1	1,128	157	1,285
Quadrant 2	1,841	63	1,904
Quadrant 3	694	0	694
Quadrant 4	1,205	291	1,496

WALKING DISTANCE ANALYSIS

Pedestrian comfort and safety factor is a critical factor in creating an area where people are willing to park away from demand generators. Walking distance is an industry standard that serves as a tool to aid in promoting walkability for parkers.

The goal of the walking distance analysis is to determine the number of parking spaces available within a reasonable walking distance from a demand generator. In other words, how many parking spaces are available from a venue within a distance pedestrians are willing to walk.

The User Comfort Factor (UCF) approach is used in Walking Distance Analysis and is applicable to a number of design considerations in parking including vehicular circulation, site dimensions, parking geometrics, flow capacity, and entry/exit design. Acceptable user comfort factors for parking, which are defined below, range from 1 to 4.

UCF 1 – Poor: less than 50% of patrons will be satisfied

UCF 2 – Acceptable: 50% of patrons will be satisfied

UCF 3 – Good: 75% of patrons will be satisfied

UCF 4 – Excellent 90% of patrons will be satisfied

The distance defined by the UCF is governed by multiple parking facility variable available such as structured, surface lot or indoors/outdoors.

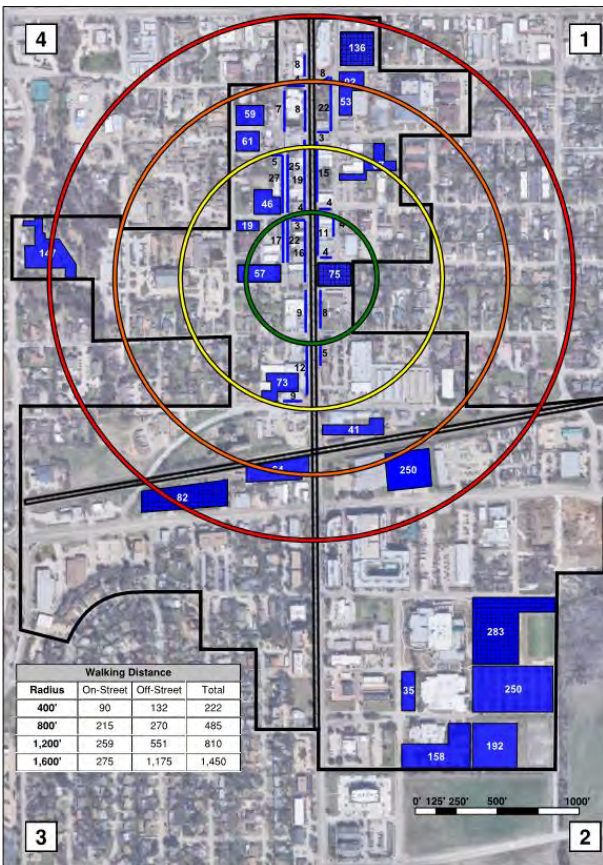
When these factors are taken into consideration, it allows one parking space to serve multiple downtown destinations.

See chart below defining User Comfort Factor for walking distances:

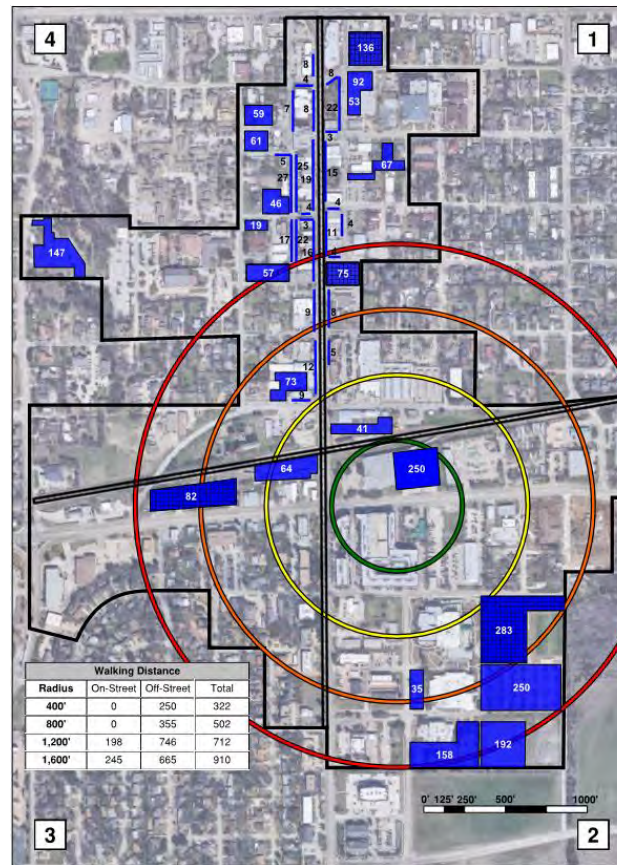
UCF Walking Distance Design Standard

Design Standard For:	UCF 1	UC F 2	UCF 3	UCF 4
Nearest parking to destination				
Climate controlled	5,200'	3,800'	2,400'	1,000'
Outdoors, covered	2,000'	1,500'	1,000'	500'
Outdoors, uncovered	1,600'	1,200'	800'	400'

WGI performed a walking distance analysis for two distinct parking generators The Main Street shopping area and Dallas Road Transit Corridor.



In the Main Street shopping area there are 810 parking spaces available; 259 on-street parking spaces and 551 off-street spaces within a comfortable walking radius.



In the Dallas Road Corridor area, there are 712 parking spaces available; 198 on-street parking spaces and 746 off-street spaces within a comfortable walking radius.

Focusing primarily on the walking distance along Main Street, the analysis shows limitation in the connectivity of Main Street and Dallas Road. However, taking into consideration the walking distance closer to intersection of Main Street and Dallas Road, there is an increase in user comfort throughout the entire transit corridor as well as a large portion of Main Street. This increase in user comfort would aid in the development of Dallas Road, while also ensuring that there is walkable connectivity to Main Street.

As development continues this connectivity and pedestrian access will be critical in user comfort and maintaining the walkability currently enjoyed by Main Street. This connectivity will not only benefit pedestrians but will also provide opportunities for vehicular circulation improvements. With this connectivity in place opportunities to begin a shared parking program could be further explored as pedestrians would be willing to park once and access the Dallas Road Transit and Main Street corridors from a centralized parking facility. Coupled with a parking wayfinding program, centralized parking facilities could increase access and help reduce parking congestion in general. This would allow City of Grapevine to better manage their parking assets and optimize parking operations. Further this would reduce the dependence of off-street parking throughout the corridors.

SUPPLY AND DEMAND FOR OVERALL STUDY AREA

In addition to the on-site visual observations discussed earlier, a parking supply and demand study was conducted for the study area, as well. In general, a parking supply and demand study subtracts the projected number of spaces required within a defined area based on programmed uses from the number of available parking supply to determine if a surplus or deficit exists. The parking ratios for the parking supply and demand study are based off the City of Grapevine's Zoning Ordinance Section 56, Off-Street Parking Requirements.

Off-street parking was the only parking supply considered as part of our supply and demand analysis. While on-street parking does provide supply, a parking space is shared for various uses for a specific period of time and can vary based on being regulated by City Engineering. In addition, the inventory of on-street parking varies widely and therefore not part of the long term parking supply.

WGI utilized the land use information provided by the City of Grapevine to determine square footages for the existing buildings within the project area. Any land use information that was not included was generated by use of a land use square footage take-off exercise performed by WGI. At this time of the study, the existing building program mix was as follows:

City of Grapevine Land Use Square Footages		
Building Use	Size	Units
Retail/Commercial	417,000	SF
Office	327,000	SF
Restaurant	23,000	SF
Church	2,306	Seats
Storage/Warehouse	32,000	SF
Senior Center	13,000	SF
Theatre	610	Seats
Funeral Home	13,000	SF
Museum	22,000	SF
Community Center	5,353	Seats

WGI utilized City of Grapevine’s parking ratio requirements to determine the parking demand per land use. Parking ratios are the number of parking spaces that should be provided per unit of land use. The average parking ratios utilized were based on general land use or significant land use. For example, Office can apply to medical office, data center office, administration office, etc. All of these uses are office but their parking ratio differs slightly.

Assumptions were made for building square footages as some land uses require an additional parking per building. In order to determine a more realistic parking demand number for these uses the following assumptions were made:

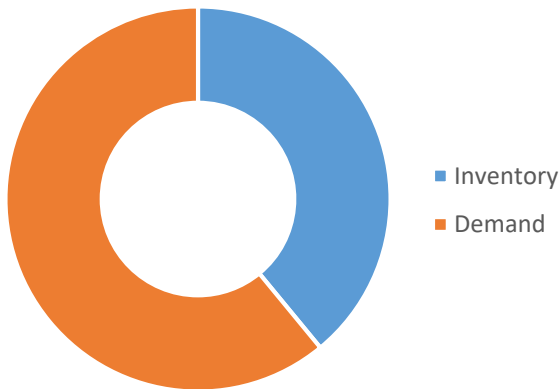
Retail/Commercial: 1,500 SF per building – this accounts for small boutique style retail centers which are currently part of the Main St. corridor and expected to be part of the future development of the Transit Corridor.

Office: 3,000 SF per building – average building size from available office leases in Grapevine, TX on Main St and Dallas St)

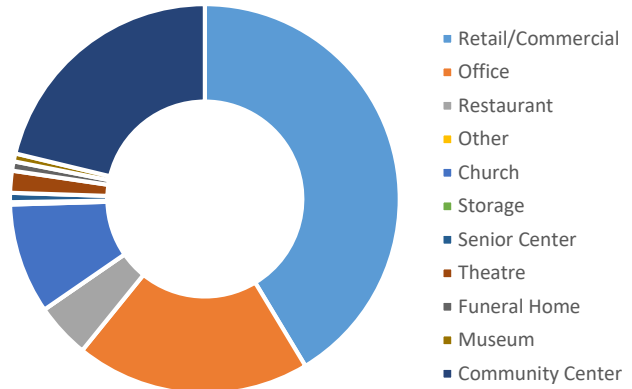
Restaurant: Code specifies 1 parking space per 3 seats, to determine seats based on square footage provided 20 SF per person was assumed for these uses – typically 15 SF is allowed, however this allows for required parking in back of house areas to be included.

Building Use	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus / (Deficit)
Retail/Commercial	417,000	SF	3475		
Office	327,000	SF	1635		
Restaurant	23,000	SF	383		
Church	2,300	Seats	769		
Storage	32,000	SF	16		
Senior Center	13,000	SF	65		
Theatre	610	Seat	153		
Funeral Home	13,000	SF	65		
Museum	22,000	SF	55		
Community Center	5,353	Seats	1,784		
Total Parking Required			8,400		

Inventory vs Demand



Study Area Parking Demand



The inventory reflected on this chart does not reflect the parking spaces (552) that the TexRail Garage will provide. This is due to construction of the parking facility at the time of the study. Based on the minimum parking required per land use versus the inventory of parking spaces gathered by WGI, a deficit of 3,201 spaces is projected. Any changes to land use programming will require an update to the required parking calculations based on additional or removed buildings from the study area.

The projection of a 3,201 deficit is something that needs to be looked at with additional factors. This base calculation assumes that every single programmed land use in the study area is being 100% utilized, typical parking operations state this is not accurate. The main categories that need to be taken into consideration are time weekday, time of day use and modal split.

Parking Reduction Factors

Weekday Use

For example, the supply and demand model above shows that Church and Community Center will require 769 and 1,784 spaces, respectively. These uses combined make up 30% of the overall parking demand

and do not operate during typical peak times or days for Office and Retail/Commercial uses. By removing the parking demand of these two land uses, a typical weekday demand can be projected be 5,847, a 468 parking space deficit.

Time of Day

Now that we have addressed weekday use, we need to understand how parkers utilize the same parking stall throughout the day and take part in utilizing different land uses. The most common land use relationship that is influenced by time of day is Office and Restaurant land uses. This is because an office typically operates from 8 AM to 5 PM, while a restaurant operates more heavily in the evening. What we need to look at is when these two uses overlap. The most common time that these two land uses overlap is from 11 AM to 2 PM. During this time period, it is very common for someone who works in an office space to walk over to a restaurant for lunch, all while utilizing the same parking stall. Essentially, this is a shared use scenario which is common when multiple land uses are in proximity of each other.

This parking reduction requires a shared use model to accurately project the parking reduction calculated for time of day use.

Modal Split

Modal split is the percentage of patrons that drive their own vehicle to a destination. With the growth of Transportation Network Companies (TNCs) the modal split has been decreasing slowly for specific uses. The most common observation of this is during evening restaurant use – leaving your car at home and taking an Uber/Lyft takes off the responsibility about finding a parking stall or paying for a valet to park your car for you during peak operating times.

Aside from TNCs, multi-family residential developments attribute to parking reductions as well. Typically, these developments are centered within many amenities such as restaurants, office space, gyms, shops, etc. Since most residential developments provide their own parking availability for their patrons at a 100% rate – the need to move a parked car to travel to a destination within an acceptable walking distance can be reduced to almost none.

This parking reduction requires a shared use model to accurately project the parking reduction calculated for modal split.

Based on baseline supply and demand calculations comparing parking supply and land use parking requirements, there is not ample parking for each land use to operate at 100% occupancy at the same time. Based on Parking Reduction Factors a final projection cannot be determined, however the deficit of parking supply will certainly decrease or potentially be completely removed. A shared use model is recommended to be utilized for this area to more accurately understand how parking operations influence parking demand.

SUPPLY AND DEMAND FOR TRANSIT DISTRICT CORRIDOR

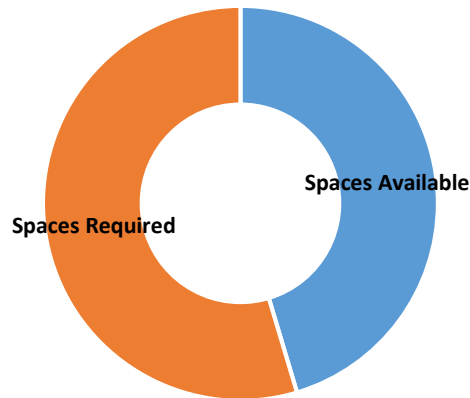
As mentioned above, there are several factors that have to be taken into consideration to understand true parking demand based on weekday/time of day use and modal split. However, WGI has represented a breakdown of parking demand for the Transit District Corridor on Dallas Road. The Transit District Corridor on Dallas Road is that as defined by the Mesa Planning Project. This will aid in understanding the

current land use parking demand and the projections for future parking demand based on assumptions of increased land use programming.

Current Parking Supply vs Demand

Transit Corridor

The Transit District Corridor on Dallas Road is that as defined by the Mesa Planning Project. Based on current land use sizes within the Transit District Corridor and minimum parking requirement ratios, a 349 parking deficit is projected. That is when all program spaces experience maximum utilization a parking deficit of 349 parking spaces can be expected.



349 Transit Corridor
Deficit

Building Use	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	136,600	SF	1,138		
Office	182,000	SF	910		
Storage	32,000	SF	16		
Total Parking Required			2,064	1,715	-349

Future Parking Supply vs Demand

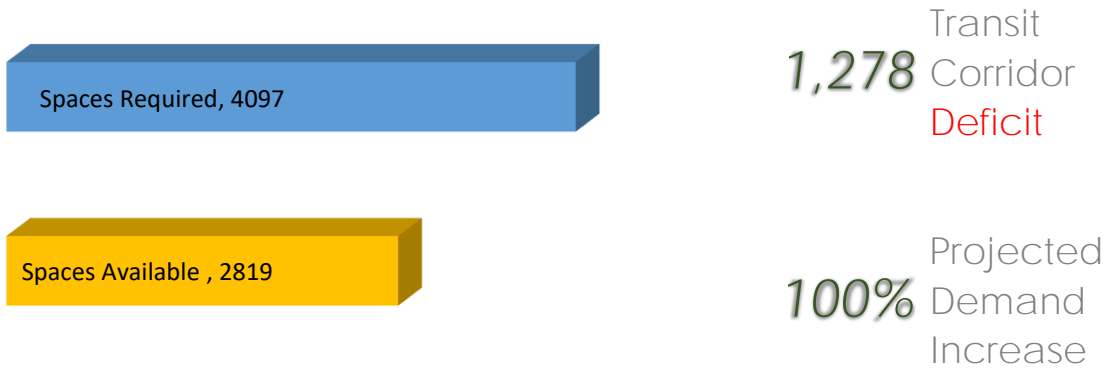
WGI utilized the existing land use program within the study area and made assumptions on future land use growth projections. For the parking demand projections, we assumed the following:

- 100% increase in retail/commercial development
- 100% increase in office development
- Parking inventory provided by TexRail garage – assumes fully operational

The assumptions above are based on the understanding that the current land uses available in the Transit District Corridor are expected to be demolished and replaced with multilevel Transit Oriented Developments which allows the opportunity for such growth in land use programming.

Based on projected land use sizes within the Transit District Corridor and minimum parking requirement ratios, a 1,278 parking deficit is projected. The large increase in deficit is also attributed to parking supply remaining stagnant post opening the TexRail Garage.

Building Use	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	273,600	SF	2,277		
Office	364,000	SF	1,820		
Total Parking Required			4,097	2,819	-1,278



The Transit Corridor could potentially see a deficit of 1,278 spaces depending on the final proposed future programming. While developers could provide on-site parking for each development to accommodate this increase, this would result in less efficient land use, and not be consistent with the type of development patterns typical of a successful transit district. This would encourage the City to look into the potential of additional parking inventory supply to meet parking demand. Specifically, the addition of parking supply could act as shared parking for future developments, allowing developers to reduce their on-site parking.

SUPPLY AND DEMAND BY QUADRANTS

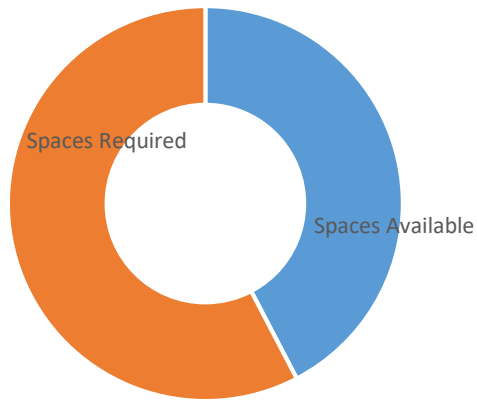
As mentioned previously, Walking Distance is a key variable when evaluating parking assets within a parking area. The question is not simply, “are there enough spaces”, but also “are they in the correct location?”

The overall study area demand model generated a deficit of 3,201 spaces. To understand how each quadrant was operating and to determine if there were pockets of parking deficits, the parking quadrants were evaluated individually. WGI utilized the same land use information from the overall study to determine supply and demand by quadrants and the Dallas Road Transit Corridor. As stated previously, there are several factors that have to be taken into consideration to understand true parking demand based on weekday/time of day use and modal split, the following calculations do not reflect these parking reduction factors.

Quadrant 1

Quadrant 1 is the northeast corner of the study area.

Building Use (estimated)	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	141,000	SF	1,175		
Office	62,000	SF	310		
Restaurant	12,000	SF	200		
Funeral Home	13,000	SF	65		
Total Parking Required			1,750	1285	-465

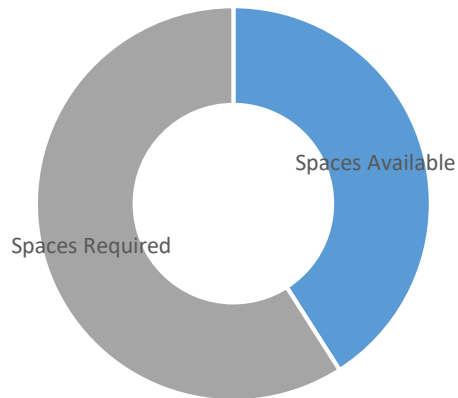


465 Quad #1
Deficit

Quadrant 2

Quadrant 2 is the southeast corner of the study area.

Building Use (estimated)	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	43,000	SF	359		
Office	104,000	SF	521		
Storage	32,000	SF	16		
Senior Center	13000	SF	65		
Community Center	5,353	Seats	1,784		
Total Parking Required			2,745	1904	-841

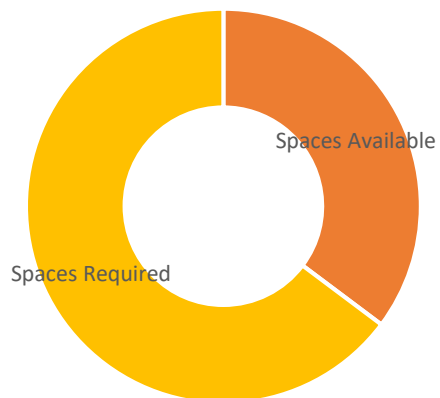


841 Quad #2
Deficit

Quadrant 3

Quadrant 3 is the southwest corner of the study area.

Building Use (estimated)	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	93,500	SF	779		
Office	99,300	SF	497		
Total Parking Required			1,276	694	-582

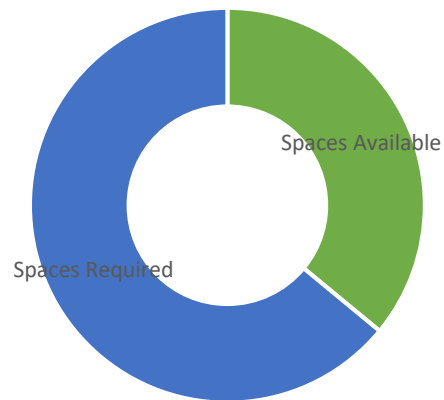


582 Quad #3
Deficit

Quadrant 4

Quadrant 4 is the northwest corner of the study area.

Building Use	Size	Unit	Parking Req. Per Zoning Ord.	Inventory	Surplus/Deficit
Retail/Commercial	141,000	SF	1,175		
Office	62,000	SF	310		
Restaurant	12,000	SF	200		
Church	2,300	Seats	769		
Theatre	610	Seat	153		
Museum	22,000	SF	55		
Total Parking Required			2,661	1496	-1,165



-1,165 Quad #4
Deficit

As mentioned previously, Parking Reduction Factors need to be taken into consideration to accurately determine parking demand based on parking operations. A supply and demand calculation assuming 100% occupancy for all uses in a downtown area such as this one, does not accurately represent parking patterns observed. A shared used model is recommended to be utilized for this area to more accurately understand how parking operations influence parking demand.

PARKING PLANNING

This section of the study explores the future parking conditions one could expect given the current conditions of the parking demand and applying the projected parking demand.

FUTURE SUPPLY AND DEMAND PROJECTIONS

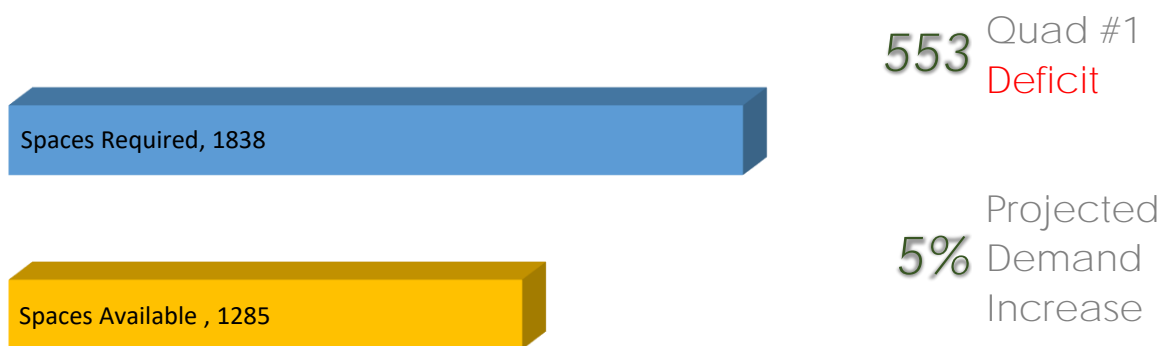
Part of our future parking planning exercise is to project the future demand within the parking study area.

WGI utilized the existing land use program within the study area and made assumptions on future land use growth projections. For the parking demand projections, we assumed the following:

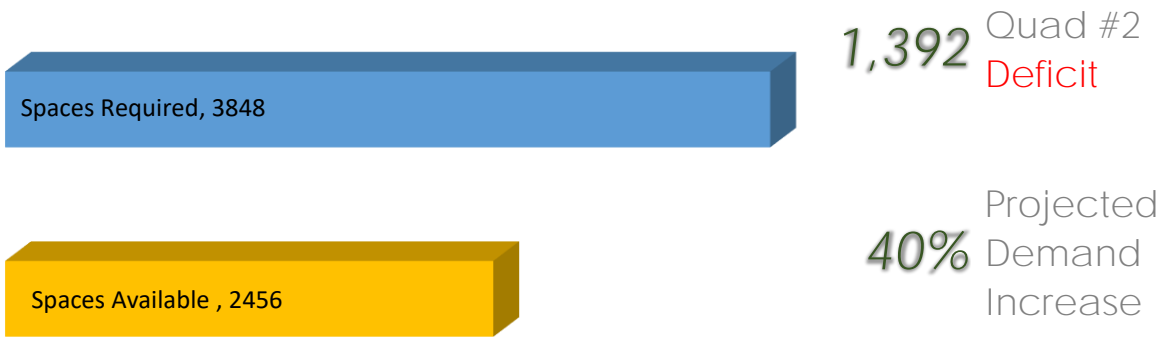
- Quadrant 1 & 4
 - 5% increase in development
 - Most land use is already optimized with little/no room for growth
- Quadrant 2 & 3
 - 100% increase for current land uses in Transit District Corridor
 - Assuming demolition of current program and redeveloping in multi-level land uses
 - Q3 will be the larger area of redevelopment based on newer developments in Q2

These increases are WGI’s assumptions based on current development trends and information received from Mesa/ArchiTexas Transit District Overlay Document. The following data presents the potential impacts.

Quadrant #1



Quadrant #2



Quadrant #3



Quadrant #4



Based on our analysis of sub areas, all quadrants could be expected to be pressured by parking demand in the near future based on pure minimum parking requirement calculations. As mentioned previously, Parking Reduction Factors need to be taken into consideration to accurately determine parking demand based on parking operations.

PARKING SCENARIO PLANNING

Given the need for future parking demand, and given input from City officials and stakeholders, WGI analyzed four (4) areas for potential parking structure development.

Analyzed from a parking scenario-planning point of view for the purposes of this study, each site location requires further investigation, studies and surveys to determine the appropriateness of each site for Garage Development. The concepts and analysis within this study are for planning purposes only.

Assumptions for each potential garage location

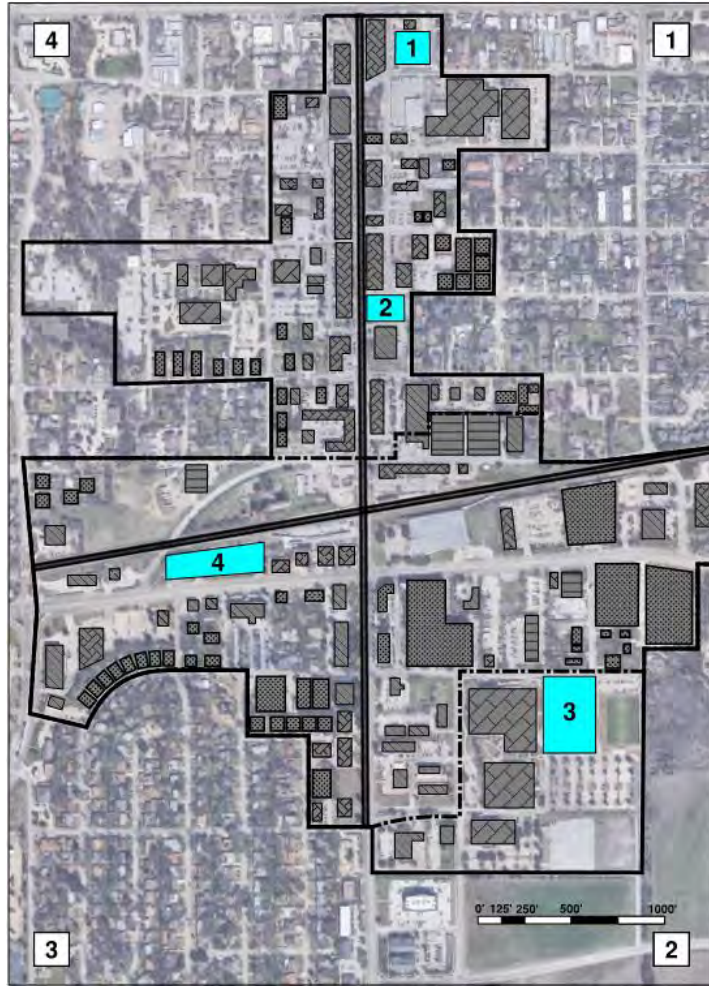
In general structured parking facilities tend to provide less parking spaces per level than parking surface lots. This is due to the ramping system, building setbacks and other architectural factors that are not applicable to parking surface lots.

At this level of parking planning, it is necessary to apply general assumptions to move the study forward. These general assumptions apply to each potential Garage site for the purposes of this study:

- Site square footages based off scalable available mapping at the time of the study
- Maximum of six levels for the potential garage, while also aligning with the Mesa/ArchiTexas Transit District Overlay Document
- Average of 325 SF/car for the potential garage – parking industry standard

For our study of each potential Garage site, our focus was on variables of garage design criteria, pedestrian walkability, and user comfort factors. These variables included but were not limited to the following:

- Number of potential parking spaces
- Walking distances from major demand generators
- Garage efficiency
- Use of ground floor for occupied space/active utilization
- Location within Transit Corridor
- Number of garage levels



One of the first steps of potential garage site analysis is to determine the number of spaces each site can yield within six levels of structure, which is the maximum number of levels recommended by industry standards. For this study, we identified the number of target spaces for a potential garage, ranging from 300 parking spaces to 1,500 spaces, and compared those target spaces to the number of garage levels required. See chart below:

Potential Garages	Location #1	Location #2	Location #3	Location #4
Target Spaces	Number of Levels Required			
300	4	5	1	2
500	N/A	N/A	2	4
750	N/A	N/A	3	5
1000	N/A	N/A	4	N/A
1250	N/A	N/A	5	N/A
1500	N/A	N/A	5	N/A

With the analysis of the maximum number of potential parking spaces calculated, we then continued to investigate each site based on criteria below:

- Street frontage available – This is the potential amount of street frontage the site will allow. This frontage is available for occupied spaces (retail, offices) and promotion of ground level activity for each site. Frontage area typically does not include areas for ramping or garage access and relevant on the sites most likely utilized by pedestrians to access other adjacent demand generators.



- Located within Transit Corridor – We confirmed whether the potential site location was within the Transit Corridor as identified within the concurrent (at time of the study) project managed by Mesa Planning. Location within the Transit Corridor suggests higher density future development and therefore a large need for parking supply. Garages in this area could potentially have higher utilization and serve a larger number of demand generators.
- User Comfort Factor – The User Comfort Factor (UCF) approach is applicable to a number of design considerations in parking including vehicular circulation, site dimensions, parking geometrics, flow capacity, and entry/exit design. Acceptable user comfort factors for parking, which are defined below, range from 1 to 4.

UCF 1 – Poor: less than 50% of patrons will be satisfied

UCF 2 – Acceptable: 50% of patrons will be satisfied

UCF 3 – Good: 75% of patrons will be satisfied

UCF 4 – Excellent 90% of patrons will be satisfied

Walking Distance UCF: Potential Garage Locations Parking Space Summary					
UCF	Radius	#1	#2	#3	#4
4	400'	322	132	283	82
3	800'	502	458	568	146
2	1,200'	712	745	1,168	234
1	1,600'	910	1,370	1,273	610

- Maximum Net Parking Spaces Gained – This is the maximum number of net parking spaces gained after a deducting the current number of spaces available on site.

- Opinion of Probable Cost – This is an opinion of probable cost based on garage pricing at time of analysis (February 2019). Costs are subject to vary widely based on time of year, garage dimensions, ground floor use and other construction related factors. Costs including hard and soft costs become more accurate as the design documents are advanced

Based on the above assumptions and variables we looked at each potential site. Below are charts summarizing our findings:

Garage Site Location	#1	#2	#3	#4	
Variable Criteria					Units
Avg. # of spaces per level	80	73	301	157	Spaces
Maximum spaces achievable	300	300	1500	750	Spaces
Street frontage length	159	119	238	348	Feet
Located within Transit Corridor	N	N	Y	Y	
Level of Service	C	D	A	B	
Max net parking spaces gained	220	227	1199	593	Spaces
Opinion cost per parking space	\$24,000	23,000	\$20,000	\$22,000	\$/spaces

Based on our study analysis Location #3 ranked highest potential for successful garage development and utilization with Location #2 ranked lowest. See Chart below:

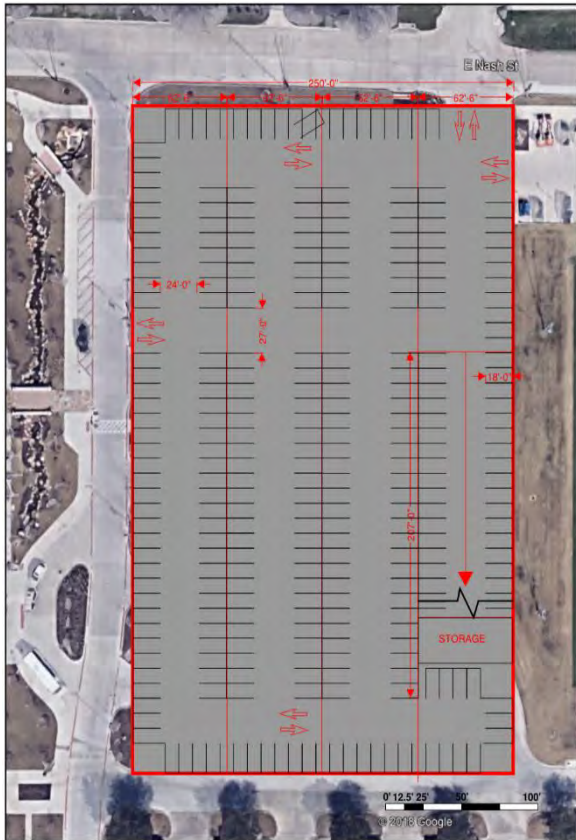
Garage Site	Site Ranking
Location #1	3
Location #2	4
Location #3	1
Location #4	2

The location of Site #3 also falls within the Dallas Road Transit Corridor, therefore not only making it the highest ranked location, but also the location to provide the greatest impact to help support future development in the Transit District.

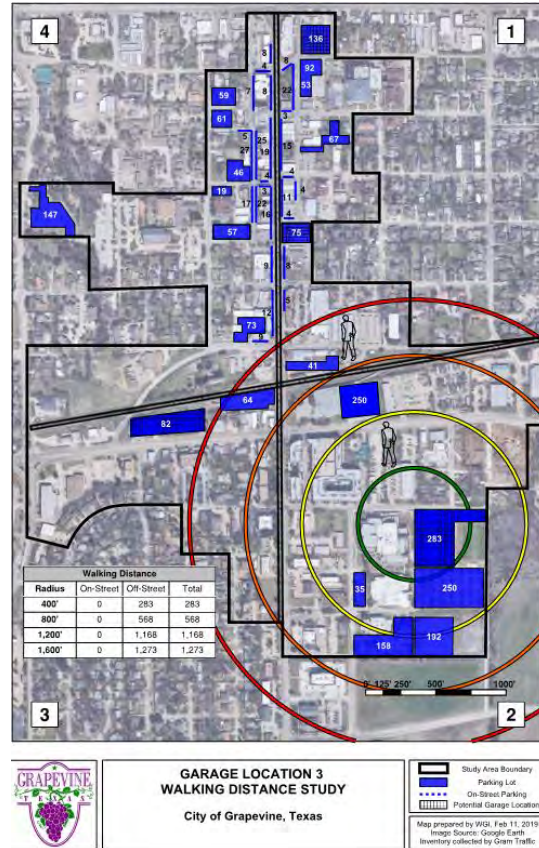
It should also be noted that while location 2 was ranked the lowest, its location makes it ideal for providing parking spaces in the heart of the Central Business District, adding much-needed convenient parking to

the area. Furthermore, a well-designed, historically appropriate structure would be much more visually appealing than the current surface parking.

With Location #3 identified as the highest ranked site meeting our study criteria, we developed preliminary conceptual garage plans for the ground floor, typical floor and roof level. These conceptual drawings below are for planning purposes. Site survey required to confirm dimensions, building lines and easements, etc.



Location #3 Concept Garage Layout



Location #3 Walking Distance



The following are typical characteristics of a garage serving multiple developments within a municipality:

- Ground floor retail
- Easy pedestrian access and walkability
- Wayfinding signage consistent with City branding
- Wide spaces with ample turning radius
- Lighting levels exceeding code required standards
- Open staircases
- Minimized pedestrian/vehicular conflicts
- Park on slopes not exceeding 6.0%

PARKING OCCUPANCY

As part of the study, WGI gathered occupancy data within the study boundary area. We completed this observation on three separate dates. Each of these dates were aimed to capture different parking scenarios to understand the parking trends and hotspots within the parking study area.

As described above only observations in marked on-street spaces and public off-street spaces were considered.

Parking occupancy is the percentage of available spaces that are occupied or utilized at a specific time.

Parking Study Observation Event	<p>Observation Date and Event Type: <i>Nov. 8, 2018 – Weekday</i></p> <p>Observation Characteristic: Determines typical occupancy during regular business hours from 8 am to 5 pm.</p> <p>WGI gathered occupancy information every two hours during this exercise.</p>
	<p>Observation Date and Event Type: <i>Nov. 10, 2018 – Weekend Evening</i></p> <p>Observation Characteristic: Determines typical evening occupancy during weekend hours from 4 pm to 10 pm.</p> <p>WGI gathered occupancy information every two hours during this exercise.</p>
	<p>Observation Date and Event Type: <i>Dec. 6, 2018 – Event (Grapevine Parade of Lights)</i></p> <p>Observation Characteristic: Determines a worst-case scenario occupancy for the study area during a large event.</p> <p>Event occupancy data hours ranged from 3:30 pm – 10:30 pm.</p> <p>WGI gathered occupancy information every hour during this exercise.</p>

For this study, we applied the following occupancy parameters:

- 0%-24% Occupied – empty by parking industry standards
- 25%-49% Occupied – low occupancy by parking industry standards
- 50%-74% Occupied – medium/high occupancy by parking industry standards
- 75%-100% Occupied – high/fully occupied by parking industry standards

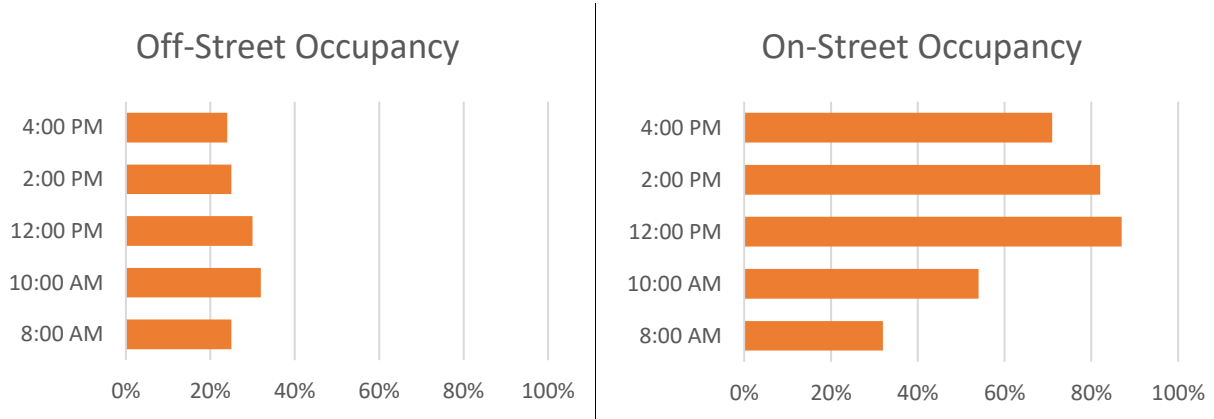
The parameters above are used to determine if parking related policies or practices need to be adjusted to manage the demand and balance availability throughout the study area.

As the following series of heat maps visually demonstrate, public parking demand is medium to low within parking study area at the time of our observation. Industry standards consider parking facilities effectively full when operating above 85% to 90% of true parking capacity. This is due to parker’s frustration in

circulating a facility looking for limited, remaining open spaces. Parking facilities are considered to be operating at maximum efficiency when peak demand remains at or below 85% of true capacity. This consideration is based on the parker’s perception of parking availability.

Weekday May 31, 2018 Observation

The consultant team collected parking occupancy on Thursday November 8, 2019. Occupancy data was collected every 2 hours between 8:00AM-5:00PM hours.

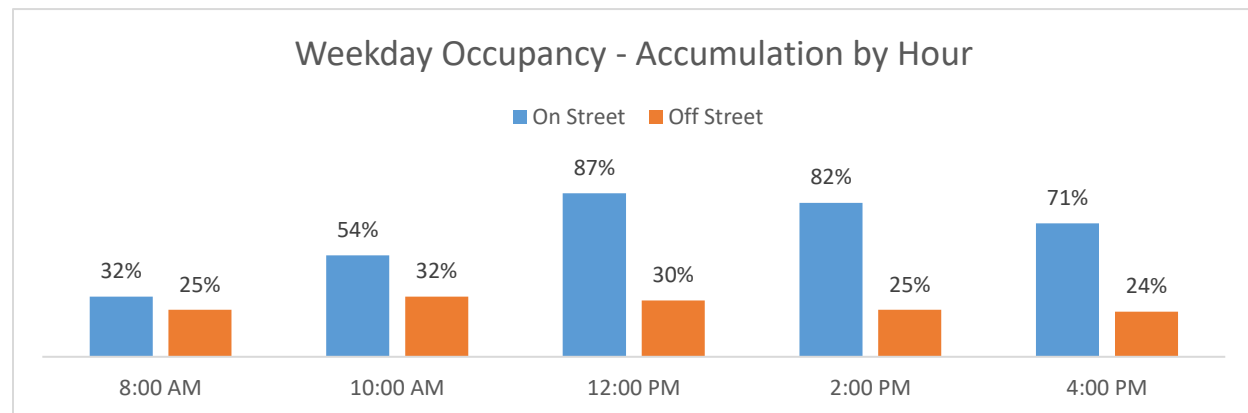


May 31st	8:00 AM	10:00 AM	12:00 PM	2:00 PM	4:00 PM
On-Street	32%	54%	87%	82%	71%
Off-Street	25%	32%	30%	25%	24%

641 spaces Off street Peak @10 AM
32% Occupied

243 spaces On street Peak @12 PM
87% Occupied

The table and chart below describe the accumulation of parking occupancy by hour for the times data was collected.

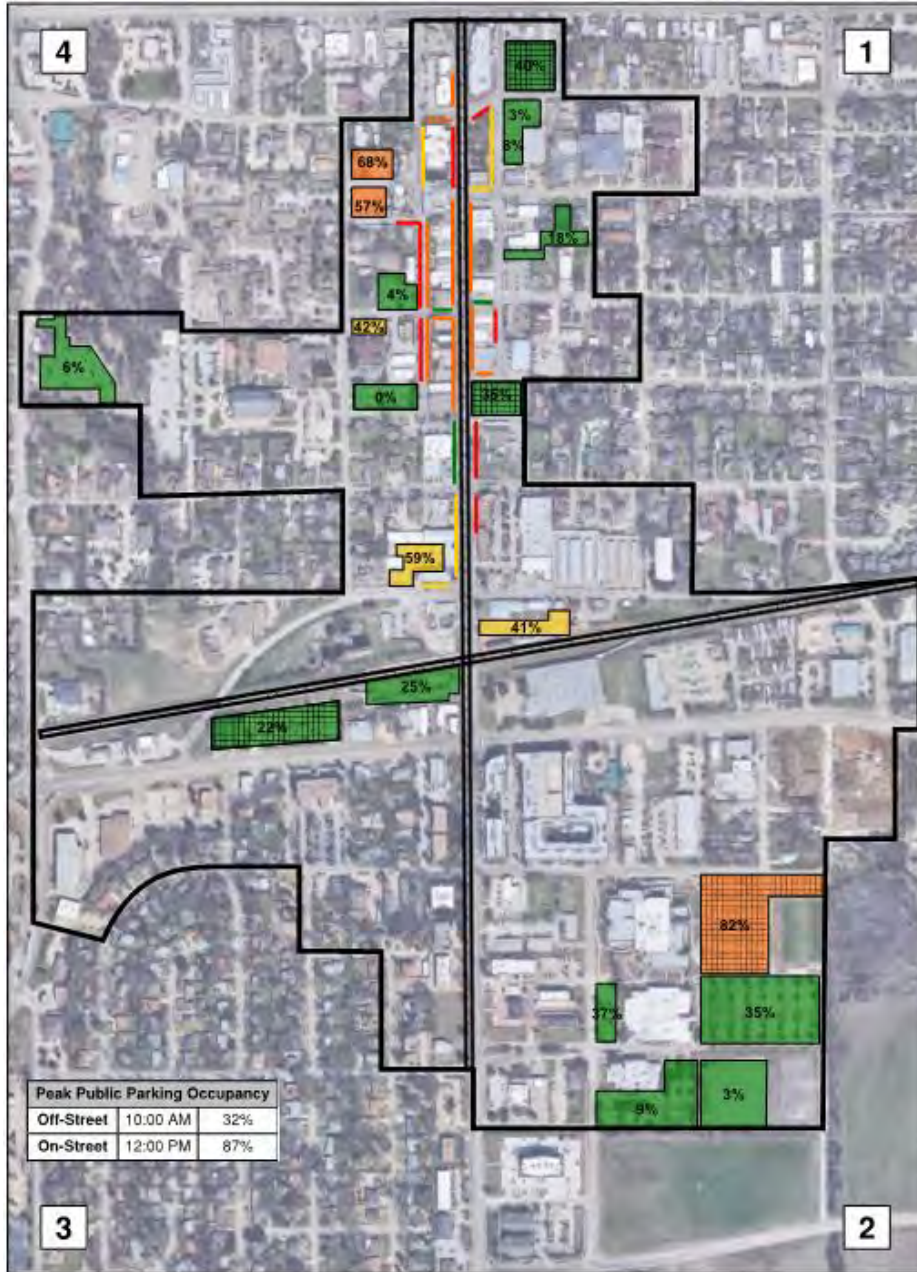


Based on the observation data, it can be determined that overall on-street parking demand is greater than off-street parking demand. The higher parking demand for on-street parking spaces is attributed to the following:

- The peak parking period was observed at Noon on Thursday November 8, 2018 and showed off-street parking within the parking study area effectively empty at 30% occupancy, with nearly all of the public on-street parking operating at 87% utilization.
- The off-street lots considered to be effectively full were the Grapevine REC lot and the parking lots located to the west of the Grapevine City Hall.
- Currently on-street parking spaces are not time restricted. This lack of time management decreases the amount of parking space turnover, thus increasing the occupancy of the on-street spaces as fewer vehicles have incentives to vacate the space.
- Although off-street spaces outnumber on-street spaces, their distance from parking demand generators is greater. There are more convenient on-street parking spaces than off-street parking spaces. Our study shows that the majority of off-street parking spaces are further than 1,200 feet from the demand generators. This distance equates to a User Comfort Factor (UCF) 2, which is not ideal.

Design Standard For:	UCF 1	UC F 2	UCF 3	UCF 4
Maximum walking distance				
Surface lot	1,400'	1,050'	700'	350'

- Parking wayfinding throughout the study area does not promote the use of off-street parking facilities. Patrons should be encouraged to utilize off-street parking spaces for long-term use and on-street parking for short-term use.



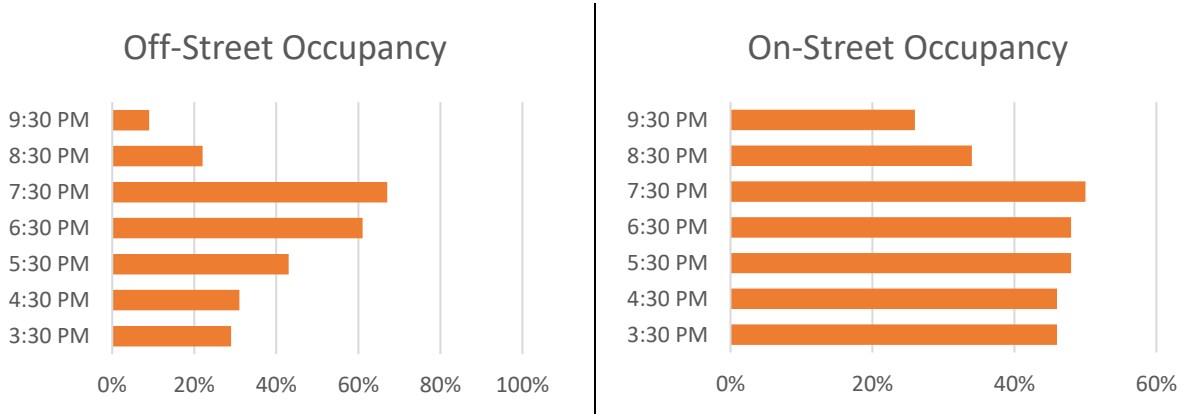
PUBLIC PARKING WEEKDAY OCCUPANCY
Peak Off-Street Occupancy: 10:00 AM
Peak On-Street Occupancy: 12:00 PM
City of Grapevine, Texas
Collection Date: November 8, 2018 - Thursday

Study Area Boundary	0-40%
Parking Lot	40-60%
	60-80%
	80-100%

Map prepared by WGI, Feb 11, 2019
 Image Source: Google Earth
 Inventory collected by Gram Traffic

Weekend Evening November 10 2018 Observation

The consultant team collected parking occupancy on Saturday November 10, 2018. Occupancy data was collected every 2 hours between 4:00PM-10:00PM. The goal of this observation was to determine the effect of evening visitors on the parking system.



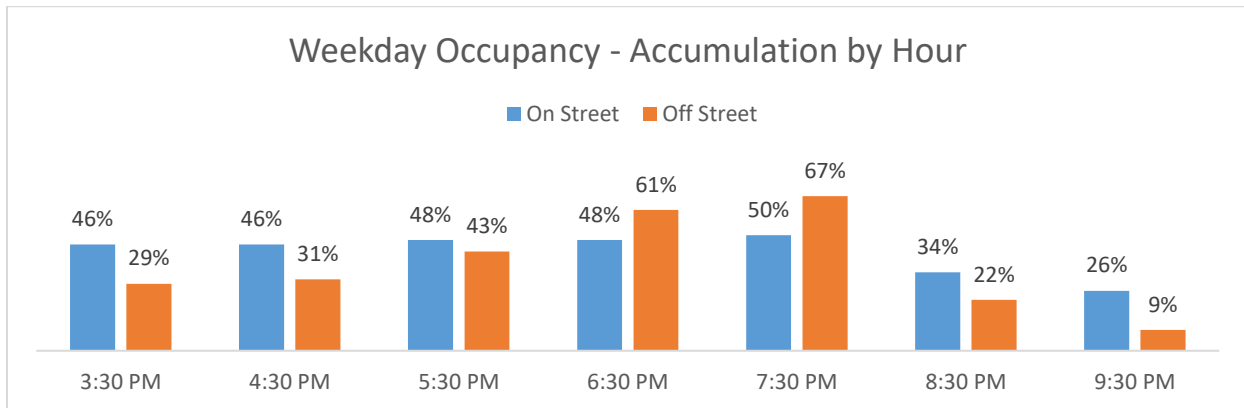
Weekend Evening	4:00 PM	6:00 PM	8:00 PM	10:00 PM
On-Street	85%	90%	92%	63%
Off-Street	30%	18%	20%	12%

606 spaces
30% Occupied

Off street
Peak
@ 4 PM

257 spaces
92% Occupied

On street
Peak
@ 8 PM

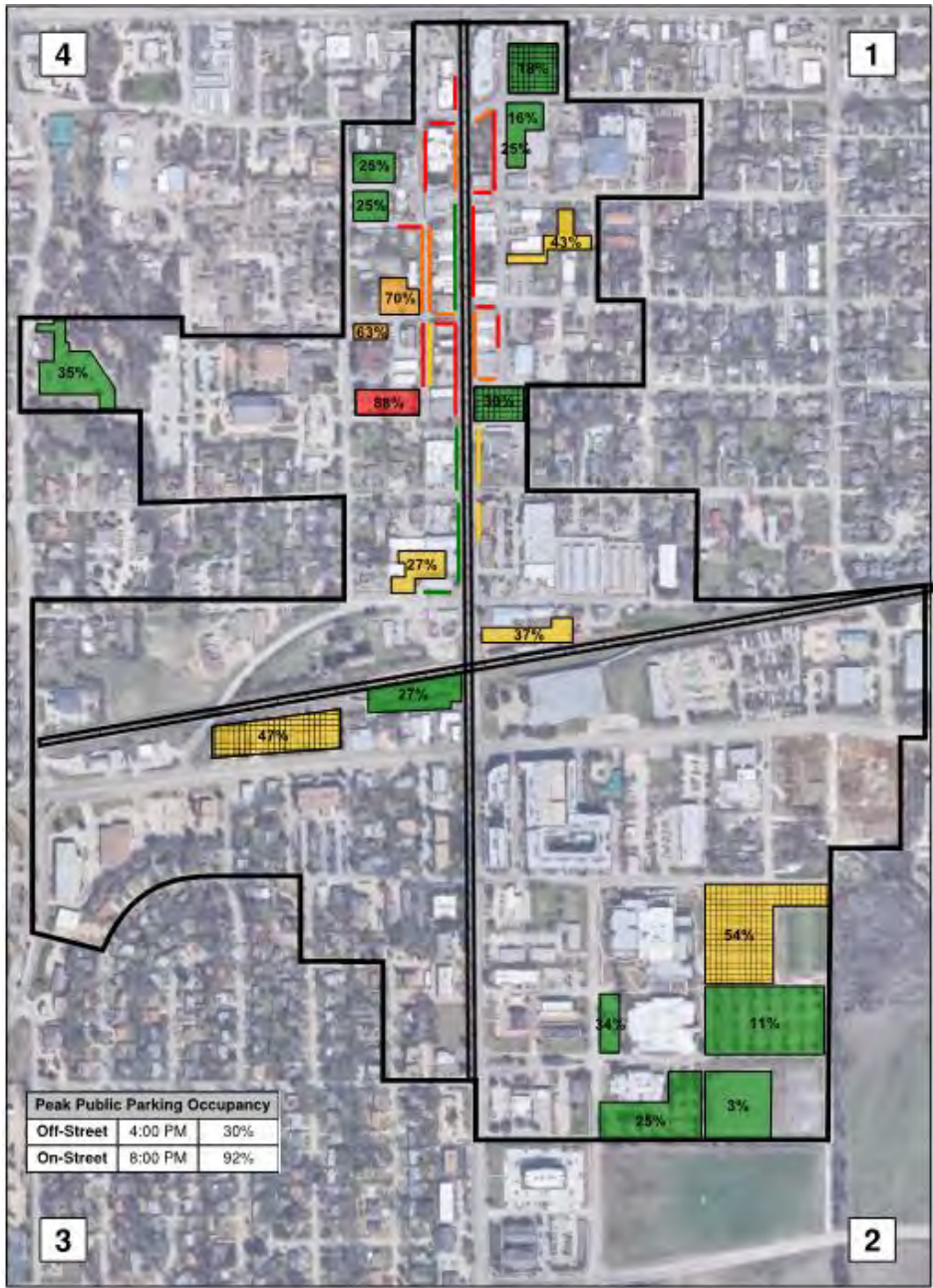


Based on the observation data, it can be determined that on-street parking demand is greater than off-street parking demand. The higher parking demand for on-street parking spaces may be a result of the following:

- The retail/commercial zone of the study, which includes restaurants, is located mainly along the Main Street corridor. This results in a higher demand for parking in the northern Main Street corridor versus the central and southern areas.
- There is off-street public parking available within a UCF 4 (400') walking distance from the Main Street Corridor, however the utilization observed was 70% and considered underutilized by industry standards. This may be due to certain establishments having private parking they provide to their patrons.

Design Standard For:	UCF 1	UC F 2	UCF 3	UCF 4
Maximum walking distance				
Surface lot	1,400'	1,050'	700'	350'

- The overall peak parking period was observed at 4 pm on Saturday November 10, 2018 and showed that off-street parking within the parking study area was effectively empty at 30% occupied, with nearly all of the public on-street parking operating at 85% utilization.
- Off-street lots considered effectively full were the parking lot on the northeast corner of the West Franklin Street and Church Street (Wilhoite's) intersection.
- On-street parking spaces are not regulated by time constraints. The lack of time management decreases the amount of parking space turnover, thus increasing the occupancy of the on-street spaces as fewer vehicles have incentives to vacate the space.
- Although off-street spaces outnumber on-street spaces, their distance from parking demand generators is greater. This assumes that there is more convenient on-street parking spaces than off-street parking spaces. Our study shows that the majority of off-street parking spaces are further than 1,200 feet from demand generators. This distance equates to a User Comfort Factor (UCF) 2, which is less than ideal.
- Parking wayfinding throughout the study area does not promote the use of off-street parking facilities. Patrons should be encouraged to utilize off-street parking spaces for long-term use and on-street parking for short-term use.



PUBLIC PARKING EVENING OCCUPANCY
Peak Off-Street Occupancy: 4:00 PM
Peak On-Street Occupancy: 8:00 PM
 City of Grapevine, Texas
 Collection Date: November 10, 2018 - Saturday

Study Area Boundary	0-40%
Parking Lot	40-60%
	60-80%
	85-100%

Map prepared by WGL Feb 11, 2019
 Image Source: Google Earth
 Inventory collected by Gram Traffic

December 5, 2019 Observation

The WGI team attended the Parade of Lights event held on December 5, 2018. The event was scheduled at 7:30pm. Despite inclement and cold weather, the event began as scheduled and was well attended. Along several areas of Main Street there were approximately five rows of people standing at curbside watching the parade.



Prior to the parade event, temporary “No Parking” signs were installed along the parade route, Main Street, and the adjacent cross streets. Street barricades including oversized trucks and fire apparatus vehicles were stationed at intersections one block east and west of Main Street. In addition to the physical street barriers, Department of Public Works and police staff were also placed at each street closure.



Available close-in surface parking lots near Main Street were well utilized by the public. The remote city owned surface lots for the Library, Conference and Civic Center, Fitness Center, and Arboretum were underutilized.

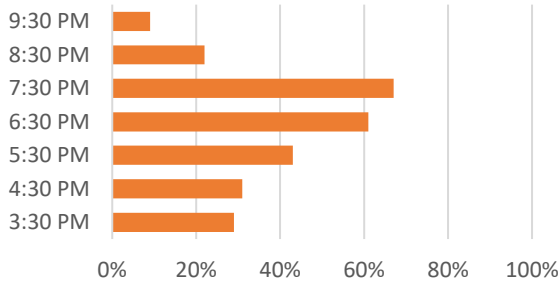


The city owned surface parking lot at the intersection of East Wall and Jenkins was used temporarily to store school buses for parade participants. Approximately half of the surface lot was being utilized for this bus staging area.

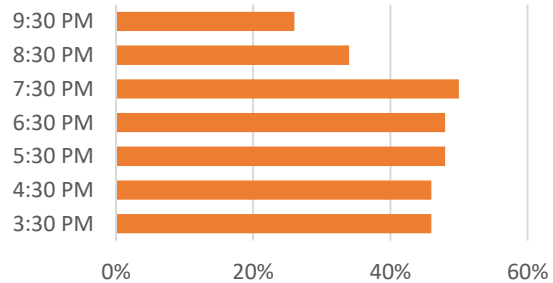


The city owned surface parking lot at the intersection of East Wall and Jenkins was used temporarily to store school buses for parade participants. Approximately half of the surface lot was being utilized for this bus staging area.

Off-Street Occupancy



On-Street Occupancy



Parade Of Lights	3:30 PM	4:30 PM	5:30 PM	6:30 PM	7:30 PM	8:30 PM	9:30 PM
On-Street	46%	46%	48%	48%	50%	34%	26%
Off-Street	29%	31%	43%	61%	67%	22%	9%

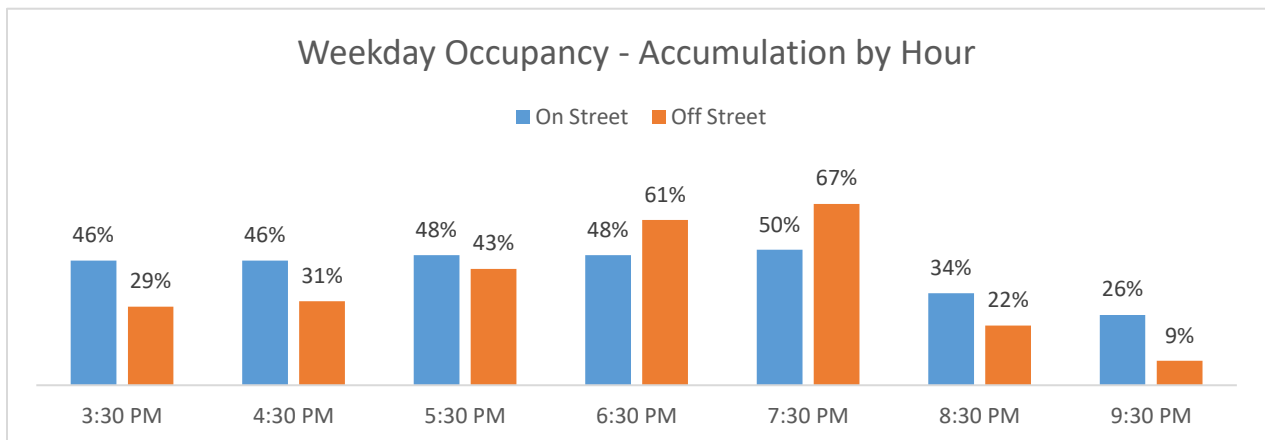
1,327 spaces
67% Occupied

Off street
Peak
@7:30 PM

140 spaces
50% Occupied

On street
Peak
@7:30 PM

Weekday Occupancy - Accumulation by Hour

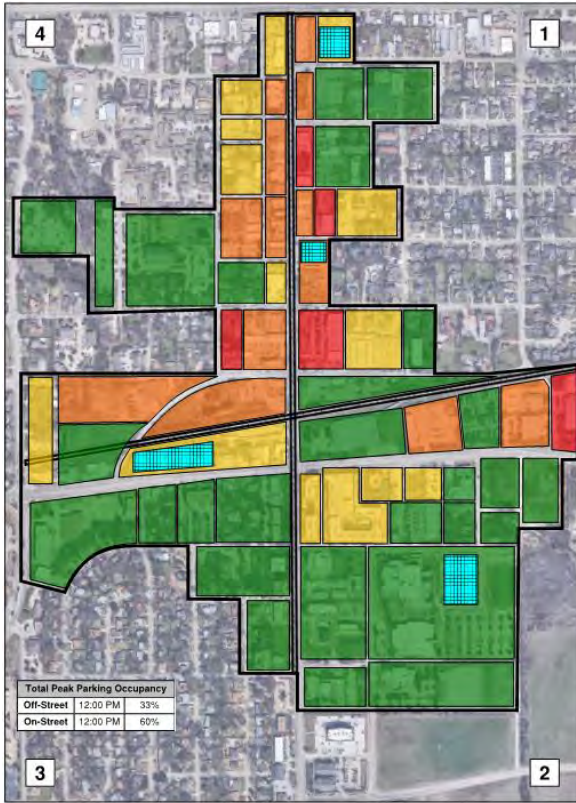


The results from this final occupancy data gathering show a closer relationship between the occupancy of on-street and off-street public parking. Given the event conditions, a medium to high occupancy was observed in the study area. The higher parking demand for off-street parking spaces could be contributed to the following:

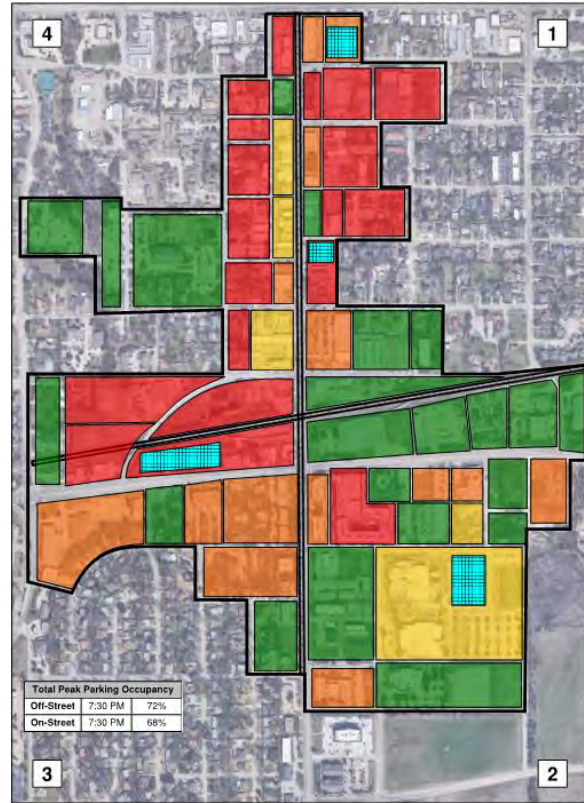
- Christmas parade route is along Main Street, making public on-street parking unavailable and parkers to utilize off-street lots.
- Utilizing public parking lots, unmarked on-street parking several blocks away, and private parking lots during this event.
- The overall peak parking period was observed at 7:30 pm on Thursday December 6, 2018 showed that off-street parking within the parking study area was operating at 61% occupancy, with nearly all of the public on-street parking operating at 48% utilization.
- Off-street lots considered to be effectively full were located closer to the Main Street corridor on the northern and central zone of the parking study. The Lone Star Hi-Railers Model Train Association parking lot was the southernmost parking lot that was full and was actually over parked based on the occupancy being over 100%.
- On-street parking spaces are not regulated by time constraints. This lack of time management decreases the amount of parking space turnover, thus increasing the occupancy of the on-street spaces as fewer vehicles have incentives to vacate the space.

Overall Parking Occupancy

In order to holistically understand parking occupancy throughout the entire parking system (on-street and off-street), a series of heat maps were created. The purpose of these maps was to show the parking occupancy generated during the same weekday and event observations by block throughout the parking system. These heat maps combine the occupancy of the on-street and off-street available parking. For example, the occupancy of off-street parking and on-street parking were averaged and combined to represent an occupancy for the entire block.



TOTAL WEEKDAY OCCUPANCY
Peak Off/On-Street Occupancy 12:00 PM
 City of Grapevine, Texas
 Collection Date: November 8, 2018 - Thursday



TOTAL EVENT OCCUPANCY
Peak Off/On-Street Occupancy 7:30 PM
 City of Grapevine, Texas
 Collection Date: December 6, 2018 - Thursday

Peak Weekday occupancy occurred at Noon. Off-street parking was 33% occupied and On-street parking was 60% utilized.

Peak Event occupancy occurred at 7:30 PM. Off-street parking was 72% occupied and On-street parking was 68% utilized.

Summary of Parking Occupancy

We conducted three days of occupancy counts to measure the parking demand and determine if the supply is adequate to meet the parking demand on the specific observation dates. The occupancy counts indicate that there was not an area where overall parking demand exceeded supply. The City of Grapevine should explore enhancing parking focused wayfinding through the downtown study area to direct patrons to available parking facilities.

Designing a parking system to ensure that every space is occupied during peak hours will result in perception that the parking supply is inadequate. Many argue that on 85th percentile of occupancy should be achieved but this does not take into consideration search times of a taxed parking system.

When making pro-active policy decisions, the most important factor is having good data on which to base those decisions. While the Downtown core/CBD is very close or at full development, as the Transit Corridor continues to develop, it is likely that a portion of the existing parking facilities will be utilized for

buildings and uses other than parking. In developing these lots, there will be an accelerated increase in parking demand. An example of this can be outlined as follows:

1. First, there is the loss of parking spaces on the lot
2. Second, there is an increase in parking demand from the new development.

As future development occurs, the City of Grapevine should continue to monitor parking supply and demand to determine when the City reaches a point of needing to create additional parking.

RECOMMENDATIONS

The following recommendations are broken down into Short-term, Mid-term, and Long-term recommendations in order of priority, with the understanding that some issues overlap. A number of the recommendations will require the cooperation of both public and private organizations and individuals. In particular, we believe the short-term recommendations articulated below can help improve existing parking resources until such time that structured parking capacity is feasible.

Specific Short-Term Recommendations

1 *TexRail Coordination*

The City should continue to monitor TexRail ridership reports, specifically taking into consideration those traveling to downtown Grapevine. This data will provide information and allow the city to take into consideration those traveling to Grapevine using other means of transportation than an automobile, and could help in parking planning as development of the Transit District progresses.

2 Marketing & Communication

Create a branding and marketing program for the public parking system. The city makes a wonderful effort in communicating with the public currently. It is recommended to take this one-step further to include parking by creating of a more informative web-based and hard copy-parking map. These efforts should extend to include private parking lots that offer parking to the public. In addition to a dedicated web landing page, leveraging social media outlets has proven to be successful for many parking organizations. An effective marketing plan will foster customer credibility and confidence in the parking system.

Below are examples of successful parking branding and marketing links in Texas:

<http://www.houstontx.gov/parking/>

<https://www.fortworthparking.com/>

<https://www.sanantonio.gov/ccdo/parking>



Develop a parking management plan detailing the parking goals both operationally and functionally for future planned developments. The plan would include all items that include parking to ensure that the city is proactive and aligned across all departments-Mayor, City Council, Planning, Visitors Bureau, etc. This plan would encompass all of the above recommendations and be used as a tool to ensure that communications and planning are consistent. In addition, this plan should also serve as a tool to measure the success of the city's parking planning and initiatives.

The City of San Antonio website is a great example of how to communicate with parkers on a day to day basis and event related parkings. It provides all relevant parking and transportation resources in one location, with easy identifiable buttons

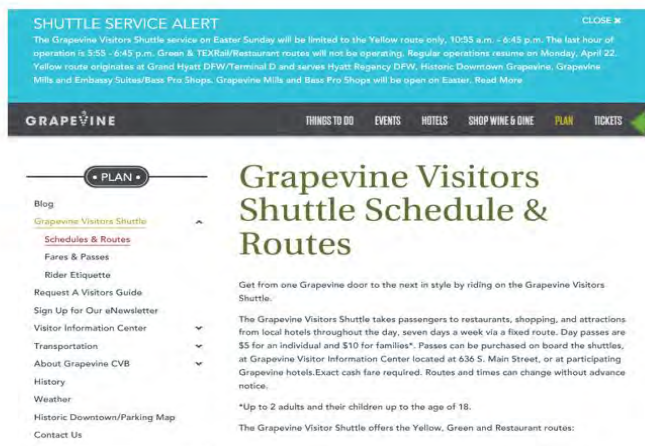


← Interactive parking map for visitors

← Links to parking tools for residents

3 Circulator

The city currently does a great job in marketing the visitor shuttle, making the expansion of the current system simple. The city should further explore the feasibility and cost of providing a shuttle circulator to gain increased walkability and utilization of parking along Dallas Road and other outlying areas. Utilizing the shuttle at a higher capacity will decrease traffic congestion during high volume events. In addition, this will allow parkers to consider more remote spaces while also giving them the option of transportation options within downtown. The development of a Grapevine Shuttle mobile app could also be very beneficial and put parking information in the hands of visitors.



← Add: Getting Around Grapevine

Map Routes →

The City should plan, develop and implement a parking wayfinding project aimed at informing and directing patrons to available parking facilities. Throughout our occupancy data observations it was noted that at times on-street parking was full while off-street parking had ample capacity. In addition to marketing, the City could also aid in managing this situation by providing signage that directs patrons to available parking. This would help alleviate the traffic circulation and reduce search times for parking. This wayfinding should be implemented throughout the study area and applied to both on-street and off-street parking. Consistent wayfinding will enhance the downtown experience.

4 *Parking Wayfinding Program*



5 *Develop Shared Parking Policy*

The City of Grapevine could require developers to provide on-site parking in accordance with current Zoning Ordinance requirements, while still having an attractive and functional Transit District. The Dallas Road Transit District Standards have very effective parking lot design standards to ensure that parking would be behind buildings, screened, and/or located in architecturally compatible parking structures. However, this would prevent the most efficient land use, which is vital to any successful transit district.

Furthermore, the Dallas Road Transit District Standards heavily encourage pedestrian amenities and accommodations. The creation of shared public parking locations/structures would further encourage and benefit pedestrian activity in the Transit District, and could provide much needed relief in the form of conveniently located parking in the Central Business District.

Allowing a reduction in on-site parking for projects within the Transit District, and allowing a further reduction of parking if there are shared parking facilities within a reasonable distance of a given development would be consistent with the practices of other cities with highly successful transit oriented developments. Typically a reduction of 10-15% of zoning required parking could be achieved. To fully realize these reductions a parking district should be created whose role is to manage and track parking inventory assets within the district. This will ensure a checks and balance approach to ensure there is adequate parking available. The parking district's goal would also be to inform City when additional parking facilities will need to be constructed.

7 Leverage Parking Technology

Explore parking technology such as mobile apps that allow visitors to navigate their trip to Downtown Grapevine from a device. Technology can improve the communication with day-to-day visitors and event attendees.



App based parking availability



Dynamic Wayfinding Kiosk



Event Parking App

9 *Parking Ordinance Updates*

Consider a revision to the current ordinances to incorporate any changes that are made as a result of this study, such as shared parking, parking assessment fees, and/or reduction of parking requirements in the Transit District

Specific Mid-Term Recommendations

1 *Expand Residential Parking Program*

Expand and formalize the Residential Parking Permit Program currently offered on Worth Street and offer to downtown residents impacted by parkers utilizing neighborhood on-street parking.

2 *Future Parking Concepts*

Begin efforts for site selection analysis and preliminary design concept plans for a public parking structure(s). Finalize ordinance updates and modifications to reflect the city's current and future goals within the Transit District and downtown. Right sizing future parking and placing it in the most cost effective and strategic location possible will maximize investment and optimize rate of returns.

The City should also consider the opportunities for Public / Private Partnerships to add parking to downtown when development opportunities arise. This will allow the city to partner with developers to ensure that parking is incorporated to potential benefit the city and the development, while not over compensating for the perception of a lack of inventory.

3 *Parking Assessment Fees*

Explore the feasibility of an assessment fee in regards to shared parking and implementation process for downtown businesses and/or Transit District Corridor development.

The supply and demand study results shown in this study are based on significant land uses located by themselves in an area with little or nor transit and weak pedestrian connections. For a downtown area supply and demand study this is not typical and can skew the study results. Additional considerations need to be taken into account when analyzing an urban downtown area. These considerations are known as parking reduction factors:

- **Modal Split** – the percentage of persons arriving at a destination in different modes of transportation. Examples include riding transit, drop-offs and walking from residential areas.
- **Mixed-Use Split** – the percentage of parkers at a land use or district who are not already counted as being parked at another land use or programmed space. An example would be parking in a space for work (office space) and walking over to a restaurant during lunch. The parker would be included in the office space demand not the restaurant space.
- **Seasonal/Time of Day** – the percentage of parkers that are present at a specific season/month/time of day. Examples include a movie theatre during the day on a Wednesday (low percentage) versus during a Friday night (high percentage).

Specific Long-Term Recommendations

1 *Implement Structured Parking*

It would be wise to finalize a location where a parking structure(s) will be located and work to keep those options available if needed. Finalize design documents and construct public parking garage, preferably as a public/private partnership as part of a mixed-use development project or part of a large parking generator development.

2 *Active Parking Management*

Continue to monitor the parking system over time to ensure that parking strategies are effective for existing conditions, and are adequate to support future development.