Troy, OH, Parking Study & System Optimization

– 2019 –

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Introduction

On November 15, 2018, the City of Troy, Ohio, enacted a temporary change to the parking policy that mandated that all city operated, downtown parking spaces be used for no more than two hours at a time by a single vehicle. The change completely removed this mandate, allowing for persons to park for an unlimited amount of time in any of the previously governed spaces, with the expectation that the change in mandate would be evaluated in early 2019 to determine whether or not the City should reinstate the previous law, modify it, or keep the change in place. The City of Troy wanted to ensure that the evaluation was impartial, thus they have engaged with a consultant to evaluate the impacts of the changes and explore possible solutions to problems of technology, permits, and customer-focused initiatives. This report addresses all of these areas and more in the following sections

I. Evaluation of Changes in Parking Behavior After the 11/15/2018 Change
II. Analysis of Parking Space Usage When Time Restrictions Are Removed
III. Recommendations for Customer Programs
    a. Placard Program for Businesses and Residents
    b. Communications-Based Customer Initiatives for Parking Allocation
IV. Recommended Technologies for Parking Monitoring
V. Comparison of Troy, OH, Demographics to State and National Averages
VI. Potential Customer Draws to Troy, OH

For this study, the following data was provided by the city:

- Monthly 2 Hour Violation Counts from November 2016 to Present
- Dollars Collected from Parking Related Violations by Month from November 2016 to Present
- Study Considered Spaces Geospatial File
- Parking Space Database with License Plate Parked and Reading Timestamp (11/29/2018 – 1/31/2019)
- Downtown Area Apartment Addresses
- Woolpert 2017 Parking & Traffic Assessment

Additionally, this study covers the following 650 spaces, though 50 of those were either Police Only spaces (35) or did not have a number and could not be matched to plate data:

Figure 0.1. Map of Downtown Troy, Ohio, spaces included in this study

I. Evaluation of Changes in Parking Behavior After the 11/15/2018 Change

Prior to November 15, 2018, most of the parking spaces in the downtown area of Troy, Ohio, were either metered or restricted to at most two hours of continuous use by a single parker. For the time restricted spaces, parkers could relocate their vehicles to another spot to avoid penalty, but would face a citation if recorded in the same spot for more than two hours. These citations started out as $20, but if they were not paid within 72 hours the fine would escalate to $50. Moreover, the Troy Police Department could elect to file a misdemeanor in Municipal Court for any persons not paying after two months (with a postcard reminder mailed approximately one month after the citation was issued), which could result in the offender not being able to renew their license or registration until paid.

In the two years leading up to the 2018 change, the average number of 2+ Hour citations was 52.8 per month, with a slightly higher trailing twelve month (ttm) average of 62.5 per month (for November 2017 – October 2018). In the 46 days following the institution of the moratorium of the 2 hour limit, a significant shift in behavior was observed.

The table below shows the number of license plates (not unique) that were observed to have stayed in a single spot for 2, 4, or 6 hours (inclusive). For comparison, there were almost as many instances of persons staying in a single spot for 6 or more hours between 11/15/2018 and 12/31/2018, 746, as there were in all of the 2+ Hour violations written from November 2017 to October 2018, 750. There were 91 more 6+ Hour stays in January 2019 as there were in the first 46 days of the moratorium; parking behavior demonstrated a significant change from before.

	2+ Hour Stays			4+ Hour Stays			6+ Hour Stays			
	Count	# of People	% of Total	Count	# of People	% of Total	Count	# of People	% of Total	Total # of People
November*	934	x		468	x		223	x		351
December	2,502	743	11.8%	1,377	421	6.7%	523	204	3.2%	6,284
January	3,889	949	13.1%	2,147	547	7.5%	837	253	3.5%	7,258

** November data based on manually entered totals from Troy PD, no plate data available*

When considering the two years leading up to the moratorium, the average number of 2+ Hour citations written per month was 52.8 and the standard deviation was 30.7. Given these measures of historic central tendency, we can observe that the number of 2+ Hour stays observed in December would be located almost 80 standard deviations from the mean, which would be considered a 0% probability event. In other words, the likelihood of these levels of 2+ Hour stays ever having been recorded before the moratorium is 0. The value for January is an even farther outlier, further indicating that there is significant demand for the ability to park for longer than two hours in a single space.

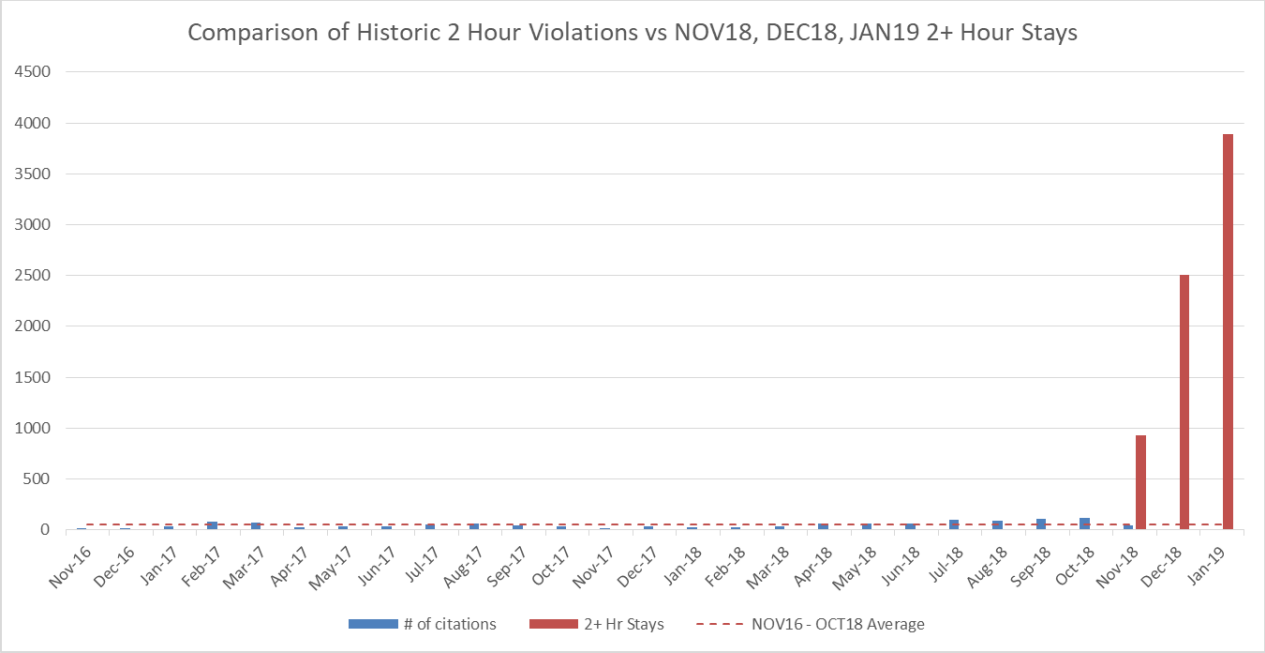


Figure 1.1. Comparison of Historic Monthly 2 Hour Violations Written vs. NOV/DEC/JAN 2+ Hour Stays

While there is not an adequate amount of space level data prior to the moratorium to complete additional analyses aimed at the individual parkers and how their geographic central point shifted before and after 11/15/2018, it is highly likely that at least some persons who are not able to have guaranteed parking are now parking closer to their residence or workplace and staying longer. This can have the negative effect of limiting retail parking, or at the very least dislocating it to points farther away than desired, and also give the impression to visitors that convenient, proximate parking is non-existent in the downtown area.

Another way to compare the parking utilization before and after the moratorium is to consider the difference in estimated percent occupancy across the system. While not a direct comparison as the size of the study areas are not the same, we can look to the Woolpert 2017 study for a glimpse at what occupancy levels were in March, 2016, and at the daily parking space records maintained by the Troy Police Department for 12/1/2018 – 1/31/2019 to consider the difference in estimated hourly occupancy.

The Woolpert study considered 397 spaces in the downtown area, while the parking space database and related geospatial file have 600 spaces. Moreover, the Woolpert study made use of manual counts of the studied areas, but this analysis of the parking space database made use of counts of distinct space number and license plate combinations during 3.5 hour windows (on average, it took 205 minutes for the parking enforcement officer to cycle back to repeat his reading of the same space). One drawback to this analytical windowing method is that the parking enforcement officer will naturally have reasons for delay during the day, whether it be lunch, assisting motorists, or performing other duties, thus it is not surprising that we see fluctuations in the 2018 numbers that were not present in 2016.

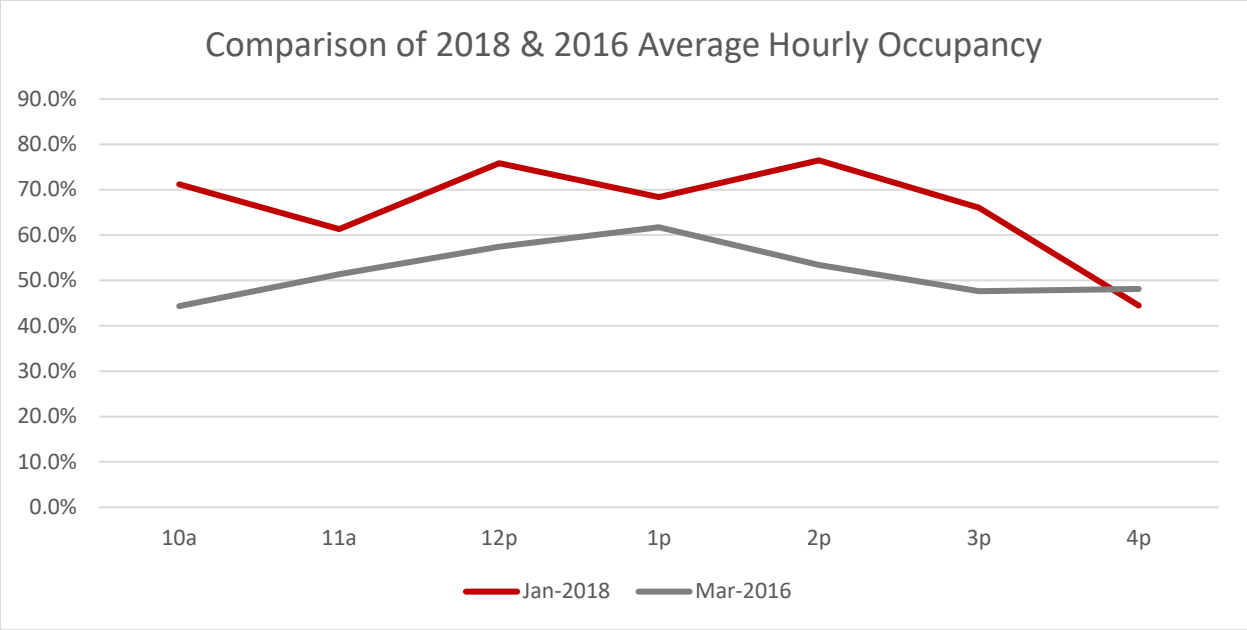


Figure 1.2: Comparison of Average Hourly Occupancy, 2018 vs 2016

In general, the percent of spaces in the downtown Troy area that were occupied during the peak usage hours of the day (10a to 2p) was up, on average, 17 percentage points, even with the up-and-down motion present in the 2018 average hourly occupancy.

II. Analysis of Parking Space Usage When Time Restrictions Are Removed

Even without the pre and post moratorium comparisons, the daily parking space database that has been created by the GIS Department and populated by the parking enforcement officer provides a wealth of information about the post-moratorium usage of the spaces in the downtown area.

First, let us examine the amount of unique license plates that each space saw over the two month observation window, which serves as an analogue for the frequency with which a space turns over. As can be seen in Figure 1, the spaces west of the courthouse, on the southwest corner of the traffic circle, and Main St east of the circle turn most often. Given the 37 days that spaces were observed, the most frequently turned spaces averaged nearly 3 vehicles per day, while the least turned spaces averaged a new vehicle only once every 4 days or less.

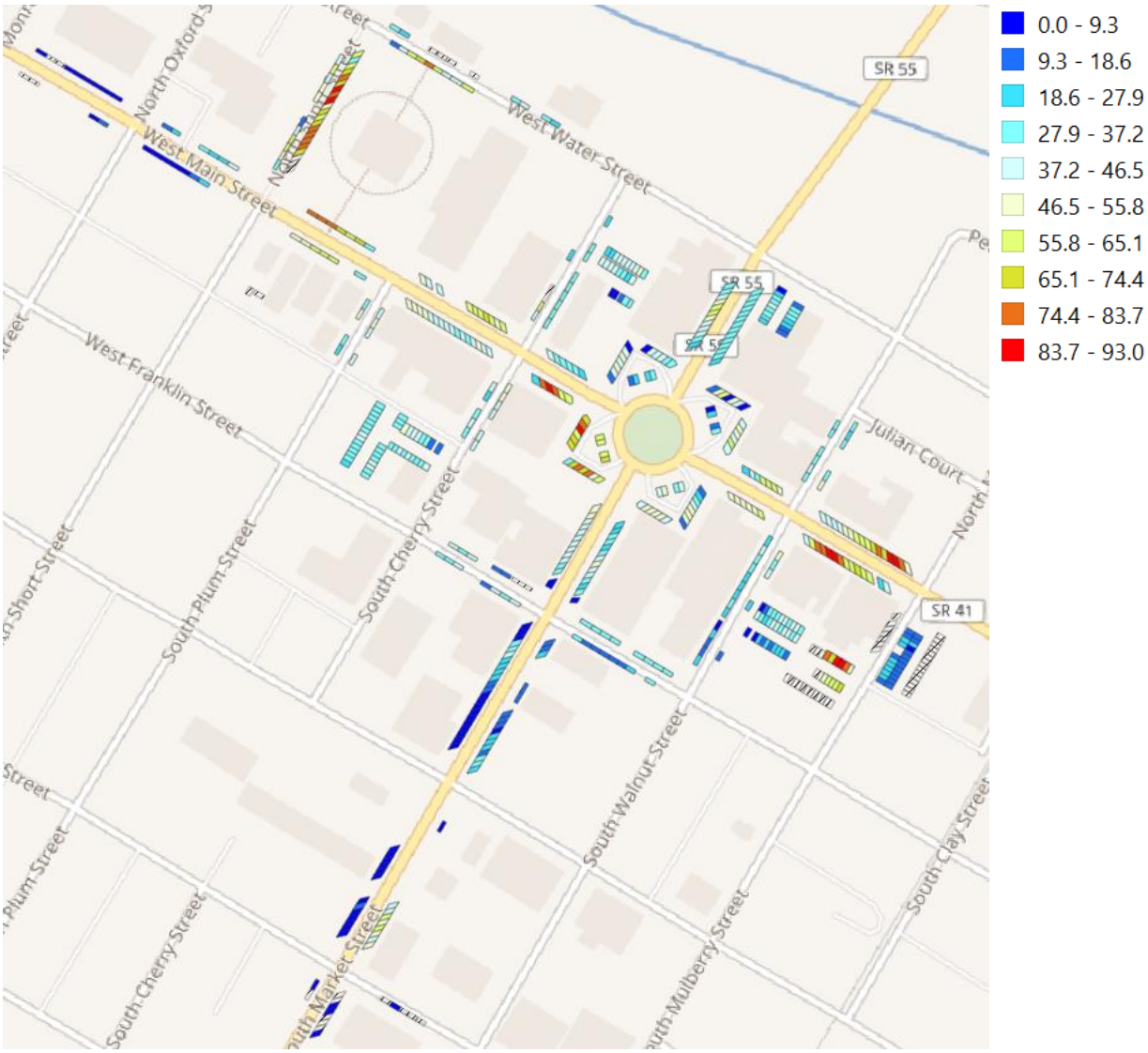


Figure 2.1: Heat map of number of unique license plates seen per space 12/1/2018 – 1/31/2019

Still, just looking at the number of unique plates is not enough to fully characterize or describe the areas which, when all restrictions are removed, are used most for the longest continual stretches. To examine

this, we consider a similarly designed heat map for 2+ Hour stays, 4+ Hour stays, and 6+ Hour stays and observe how specific areas remain *warm* as the length of stay threshold is increased.

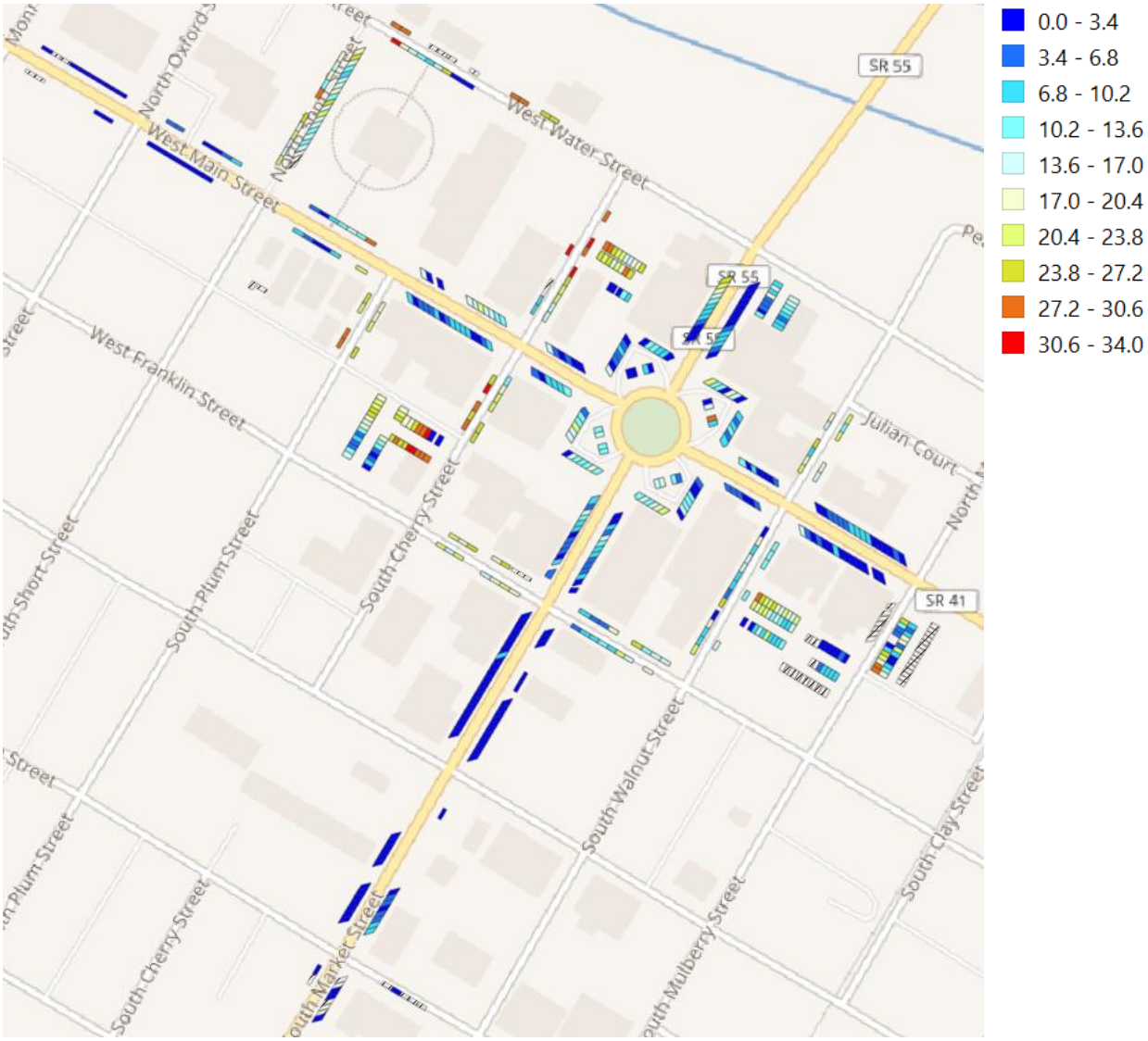


Figure 2.2: Heat map of 2+ Hour Stays per Space for 12/1/2018 – 1/31/2019

As can be seen in the heat map for the 2+ Hour stays over the two month period, much of the system saw a 2+ Hour stay at least once every three days, except for the on-street spaces along Market St. and Main St. which, with the exception of the traffic circle and in front of the court house. The distribution of these 2+ Hour stays provides insight into how the parking system segments based on use—the courthouse region has the overwhelming share of long term parks while the restaurant and retail sector to the east has very few.

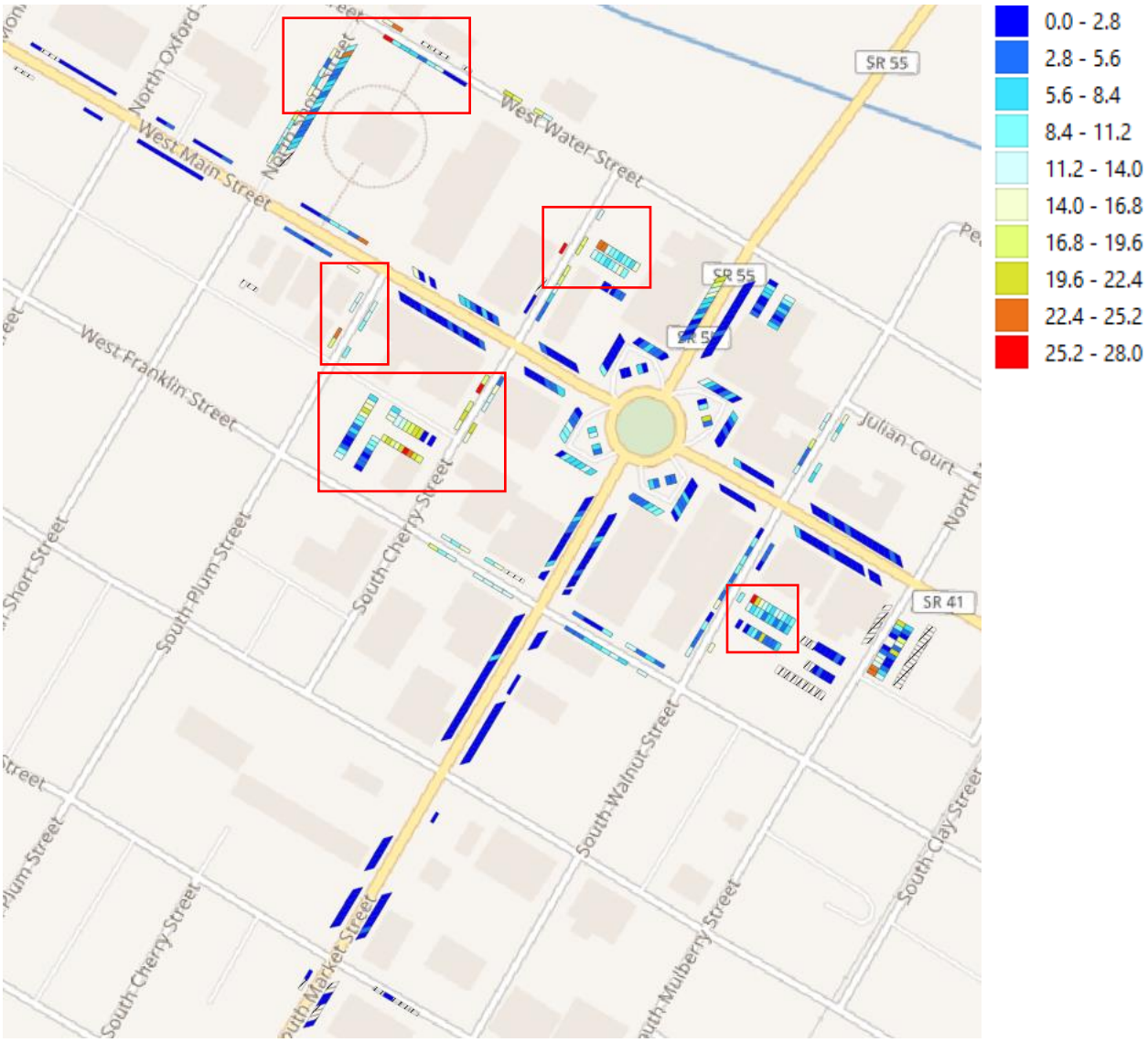


Figure 2.3: Heat Map of 4+ Hour Stays per Space for 12/1/2018 – 1/31/2019

As we increase the length of stay threshold to four hours or more, we can begin to see clear geospatial clusters that indicate which parts of the parking system are most used for lengthy stays. The paid lot on Cherry and Franklin is an especially popular destination for longer term parking, as are many of the spaces within a block of the courthouse, except for those along Main St. Interestingly, the majority of on-street spaces that are immediately proximate to area businesses are the least likely to have 4+ Hour stays—this does not eliminate the possibility that persons parking in these on-street spaces are moving their vehicles periodically, but given the moratorium there is little benefit or reason for persons to do so currently.

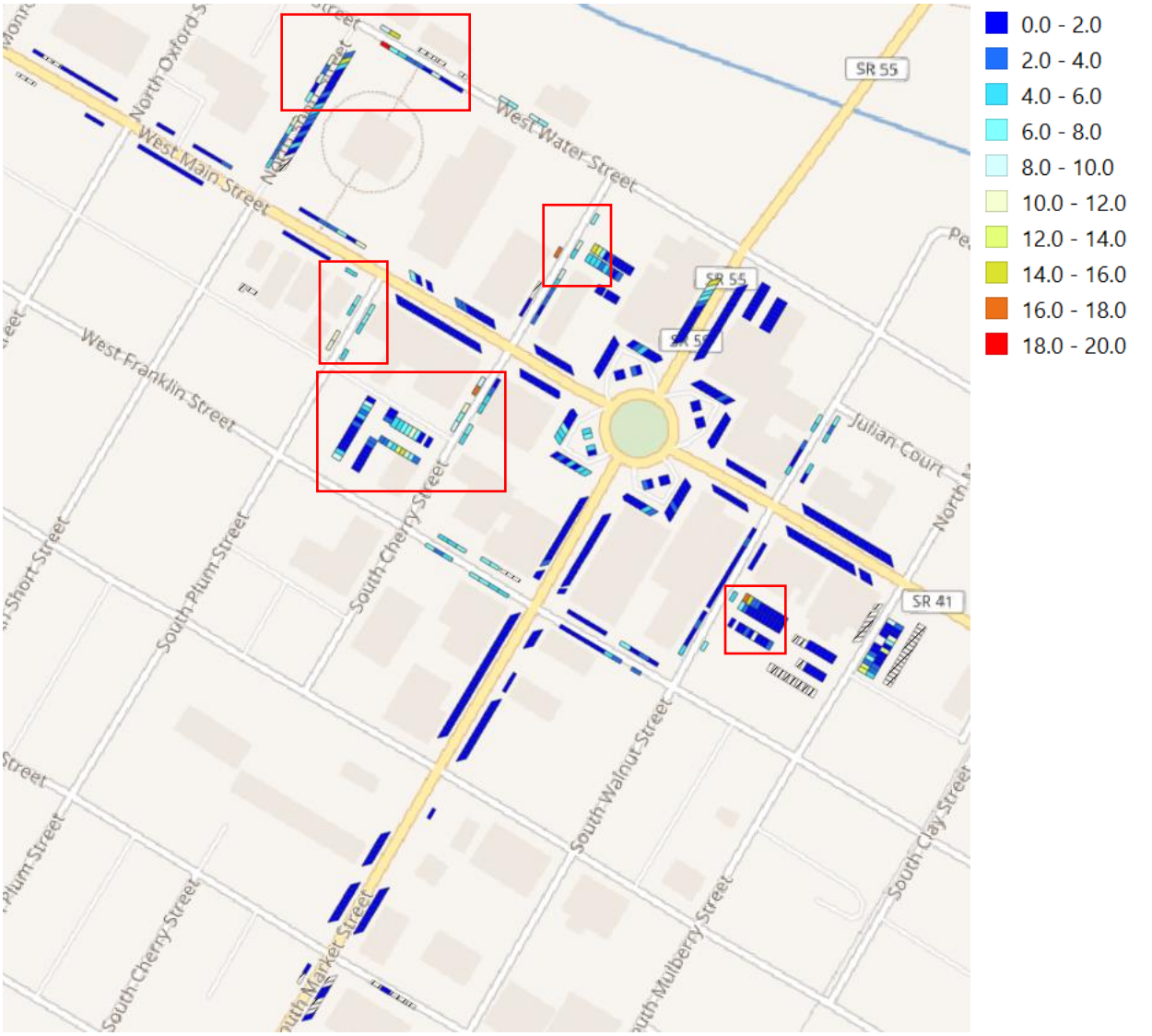


Figure 2.4: Heat Map of 6+ Hour Stays per Space for 12/1/2018 – 1/31/2019

The final threshold to consider is for those parking 6 hours or longer, which would be those that certainly stayed for almost the entire day, or almost that long. The geospatial hot spots are still the same as with the 4+ Hour stays, but the clusters have cooled off as the length of stay criteria was strengthened. Interestingly enough, when viewed in this manner, it appears that, with the exception of some of the spaces on the north corner of the courthouse block, persons that are intending to park for six hours or more are parking off of the main roads or at least to the for periphery of these areas.

If we look at the rate of six plus hour parkers, which would be those most likely working or living near one of the downtown spaces, we see a fairly consistent trend for most days that parkers were tracked at the parking space level: an average 7.2% of plates (54.4 persons) recorded on a given day were parked for more than 6 hours. While not every one of these 50 to 60 people would elect to purchase a daytime pass guaranteeing them a space in a block of parking spots, this could be a prime group to target for a future guaranteed parking program.

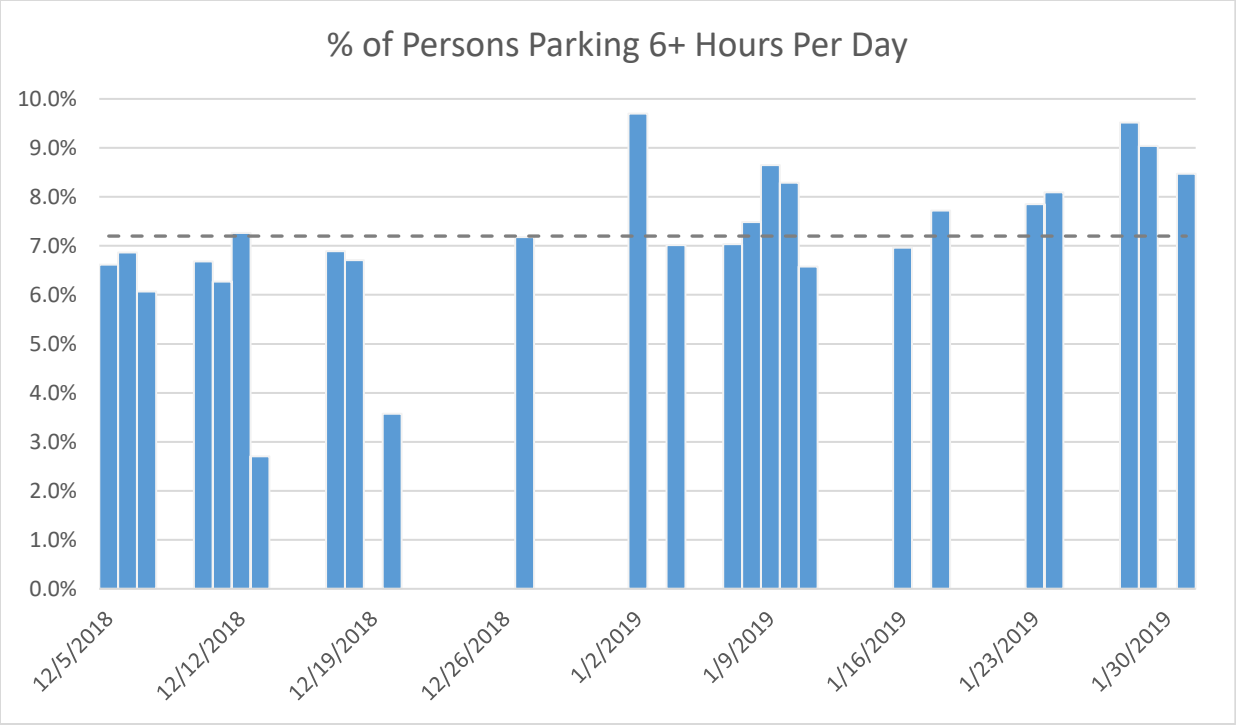


Figure 2.5: % of Persons Parking 6+ Hours Per Day

III. Recommendations for Optimizing Utilization of the Downtown Troy Parking System

As mentioned in the Woolpert Study (p. 56), a necessary step for optimizing parking allocation for the City of Troy is to create a program aimed at ensuring proximate spaces are available near the most common visitor destinations by allocating space for employees and residents on the periphery of the downtown system. Additionally, given the volume of employees and apartment residents that are estimated to work or live in the study area (and likely using the study spaces), it is easy for many of the high-demand spaces in front of retail, restaurant, and municipal buildings to be occupied for most of the day by persons who are not being served by the establishment.

In discussions with several persons who work for the City of Troy, it was abundantly clear that there are not only multiple groups with differing expectations of the parking system, but also changes that will have to be made in order to keep the parking system viable and optimized. The main demands that were heard during these conversations were:

1) Short Time Limit for the Downtown Square
2) Short Time Limit for the Courthouse Area Proximate Spaces
3) A way to move employees and residents away from the Main St and Market St on-street spaces

When optimizing a parking system, we must evaluate current and future usage in order to determine zoning allocations, permit or placard definitions, pricing, and enforcement. While there are vacancies in some of the large buildings around the downtown circle, it is unlikely those vacancies will persist for more than a few months and there are plans to bring in additional retailers along Main and Market, including a prominent brewpub in the former Lutheran Church on West Main Street near the courthouse. For this reason, it is best to design the system with these developments in mind rather than the current landscape.
The map below provides an outline of our recommendation for the downtown Troy parking spaces. There are four categories of spaces in the proposed system: 2 hour limit (red), 4 hour limit (blue), Placard/Reserved (green), and Unlimited (no color).

One key aspect that will drive the effectiveness of this proposed system is the concept of a *continuous block*, which means that after parking in one of the Red or Blue zones for the posted amount of time, the vehicle must either be relocated to an unlimited space, a lot space, or the parker must pay for the additional time they will park. This restriction eliminates the spot/block hopping behavior undertaken by downtown employees before the moratorium that was a drag on productivity and facilitated the lack of availability of proximate spaces for patrons.

The off street lots are prime locations for a new placard program which allows residents and businesses/employees the ability to purchase a reserved spot so that they know precisely where they will park and that they will not be impacted by the time limits present in the new system. In terms of placard offerings, we recommend both offering a 24 Hour for $30/month and 20 hour option (6a – 2a) for $25/month, with the primary audience of the 24 Hour placard being the residents and the 20 Hour option for the employees/businesses. The primary purpose of the 20 Hour Placard is to prohibit overnight parking, making it really only viable for non-residents. Additionally, we recommend a first round of 50 placards being offered (with no more than half of any lot being reserved in the first round of

offering) first to the apartment residents and then any remaining being offered to businesses/employees.

Based on the 45 downtown apartments, assuming a 92.5% occupancy rate (see: https://ycharts.com/indicators/us_rental_vacancy_rate) and a national average of 1.6 adults per rental unit, we believe there to be approximately 70 potentials buyers of resident placards alone. It is unclear at the moment given available data what the expected buying rate will be, but it is possible that the entire first wave of placards are purchased by residents or resident owners who split the cost with tenants or incorporate it into monthly rent.

Long term, the city should work towards utilizing all 155 of the spaces in the GREEN sections for placards so that the majority of the on street spaces are available for customers and municipal visitors. This, however, presents a problem in that there are only 110 spaces left in these lots if the average space reserved per apartment is held to 1.0, which works out to only 2.2 spaces per business given the estimated 50 downtown Troy businesses. Thus, it is likely that at least one additional lot will need to be developed in the coming years, or that spaces on the edges of the system (e.g. those farthest south on Market St. or farthest west on Main St.) will need to be rezoned as Placard.

In order to encourage persons to opt for the placard when available, the city should institute an hourly price mechanism that kicks in once a person has stayed for the maximum amount of allowable hours (2 if choosing the Courthouse or Square spaces, 4 elsewise). Aside from installing additional Pay-by-Plate machines, the city should also explore partnering with an hourly space payment app such as Parkmobile, Passport, SpotHero, or Parking Panda, which will allow persons to easily pay for the additional time they plan to use the system. An added benefit of using payment apps or the Pay-by-Plate machines is that the parker can move around the system and know that they will be covered as they have paid for their additional time.

Pricing for the hourly rate should be set so that the average employee will pay 50% or more above the placard option if they choose to park for free for four hours and then need to pay the hourly rate for the remaining 4 hours of an 8 hour workday. Assuming an average of 21 workdays per month, and an overstay rate of 4 hours per day, the hourly rate would need to be at least $0.43 per hour. As this would be a strange hourly rate, we recommend pricing parking at $0.50 per hour after using up the free parking allotment. At this price, an employee would pay more than the $25/month placard option if they averaged more than 2.38 hours of overstay per workday per month, which should have the desired impact of encouraging employees and businesses to opt for the placard program versus paying on demand.

To summarize the recommendation for the parking system:

- Create 2 Hour Max zones around the downtown circle and the Courthouse
- Create 4 Hour Max zones for the remainder of the spaces on Main St and Market St
- Implement a “Continuous Block” rule that prohibits space hopping in any of the 2 or 4 Hour Max zones by considering any space in these zones to be a continuation of the time limit
- Use the Off-Street Lots for implementation of a placard program, with the remainder of the lot spaces being 4 Hour Max (or, possibly, no time limit)
- Offer an initial round of 50 Placards for use in the lots, with
    - No more than 20 reserved spaces in any single lot, initially

    - A 20 Hour (6a – 2p) Option for $25 per month (geared toward employees) and a 24 Hour Option for $30/month (geared toward residents
- Charge persons staying longer than the 2 or 4 Hour Max limit at a rate of $0.50/hour, which is designed specifically to cost employees who work an 8 hour shift and stay in a 2/4 Hour space at least 50% above the placard program price

This recommendation has specifically been designed to not only satisfy the majority of the priorities heard during talks with persons from the city of Troy but also to be conservative in its approach to providing proximate access to businesses and municipal buildings for visitors first and foremost.

IV. Recommended Technologies for Parking

The ability to know how a parking system is being utilized and the ability to provide customers with real-time information about their desired or already purchased parking (in the case of reserved or permit parking) are two uses of technology that are quickly becoming not only essential but also expected. Thankfully, numerous technologies exist in the current market which facilitate both of these desires.

One approach is to use License Plate Recognition (LPR) cameras to create zones which are monitored in real time to provide a general level of occupancy by tracking which vehicles enter and exit the zone. Vehicles which enter but do not leave within a pre-determined amount of time are deemed to be parked in the zone. Potential vendors in the LPR camera space include Genetec, TIBA, and Nupark. This approach has both benefits and drawbacks:

Benefits:

- Allows for individualized reporting and tracking by utilizing the license plate as a unique customer identifier
- Enables law enforcement to receive live updates on vehicles of interest
- Can provide near real-time occupancy levels of any zone monitored, which can be passed along to customers via a website or mobile application
- Can be used to automate dispatching of parking enforcement personnel when time limit or zone restrictions are believed to have been violated, or when scofflaws have been seen entering an area and not having left

Drawbacks

- Requires two cameras for each path in (though alleyways and rarely used paths in and out can often be skipped provided the amount of vehicles entering/exiting via these paths is occasionally monitored and used to create a buffer in the live data)
- Can be expensive—each camera costs a minimum of $10,000 with most models costing more and most often requiring licensing cost for the software
- Can create public concerns over privacy and the use of the data that cameras like these capture (license plate, video and photo records, etc.)
- Does not provide an occupancy tracking mechanism for individual spaces

Another approach is to leverage spot tracking technology, which is often done via a camera and automated software, but can also be done using LiDAR. These technologies do not enable the individualized tracking which is present with LPR, but do allow for individualized, real-time spot availability tracking and reporting. This presents a great opportunity to let parkers know where they should head to have a better chance of finding spots, provide businesses and residents the ability to see if their spots are in use or not, and provide reporting capabilities up to and including predictive analytics to recommend parking locations ahead in the future. Potential vendors in the spot tracking arena include MiStall, Falcon, and Cleverciti. Benefits and drawbacks of spot tracking technology include:

Benefits

- Provide real-time space availability information
- Can be relatively inexpensive to implement, costing as little as $1 per space per month, though additional development costs may be needed for data storage and customer facing websites or applications

- Allows personalized tracking and notifications, such as the ability to set alerts when certain spaces are used during certain timeframes or a space has been occupied for too long
- Can be used to create predictive models that allow for future parking recommendations which allow visitors to better plan their trips

Drawbacks

- No LPR functionality which results in no ability to use for access control or individualized reporting
- Often requires customers to develop their own applications to communicate space availability with users
- Most require user provided and maintained databases to store data long term for historical reporting and analysis
- Because most cameras are only allocating a couple dozen pixels at most to a parking space, dirt, debris, direct sunlight, and dense shade can lead to less accurate readings which can indicate a space is open when it is not

While both of these categories of parking technology have their drawbacks, they can be combined to create incredibly useful parking management systems that provide great benefit to parkers. Such use cases include using parking spot tracking cameras to provide potential parkers a quick way to see lot/zone occupancy (including individual spot availability) and LPR cameras for specific lots or zones where permit parkers need to be able to know that there will be a parking spot available to them due to access controls.

V. Comparison of Troy, OH, Demographics to State and National Averages

Troy, OH, is a small town of approximately 25,000 people, located approximately twenty miles north of Dayton. Troy has historically been a traditional, industrial Midwestern town, which has been the home of the headquarters for the Hobart Corporation, a manufacturer of industrial kitchen equipment known throughout the world. Troy is located on the Great Miami River, and was once a frequently visited stop on the canal system that flowed through there. Like many Midwestern towns, Troy has suffered from a slow population growth in the last decade, a relatively low rate of diversity, and, while having an above national average rate of high school graduates, has a rate of persons with a bachelor's degree or higher that is almost 25% below the national average.

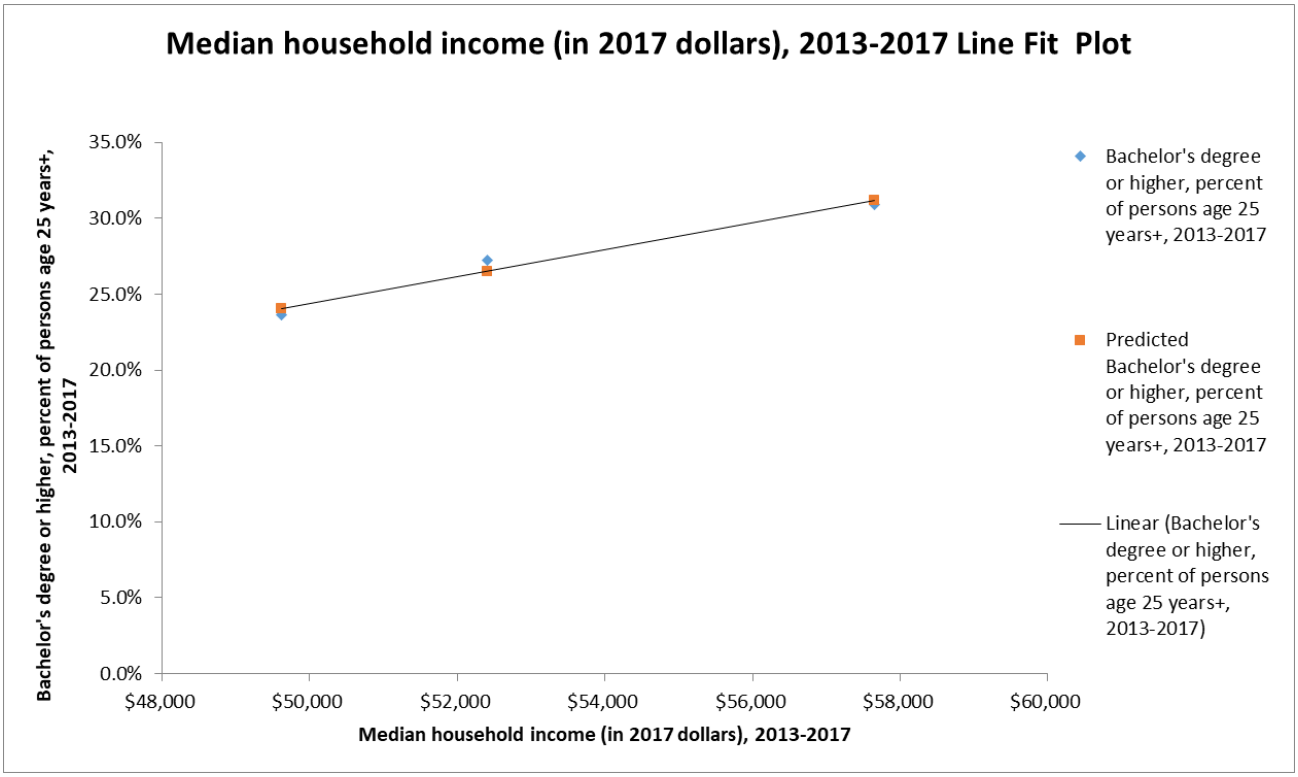
Fact	Troy, Ohio	Ohio	US
POPULATION CHANGE AND MAKEUP			
Population, percent change - April 1, 2010 (estimates base) to July 1, 2017, (V2017)	2.6%	1.1%	5.5%
Percent Under 18 Years Old	22.6%	22.3%	22.6%
Percent 65 Years or Older	15.9%	16.7%	15.6%
Percent 18 - 64 Years Old	61.5%	61.0%	61.8%
DIVERSITY			
Female persons, percent	50.4%	51.0%	50.8%
Percent White	89.5%	82.2%	76.6%
Percent Black or African-American	4.5%	12.9%	13.4%
Percent Asian	2.6%	2.3%	5.8%
Percent Other Race	3.4%	2.6%	4.2%
COST OF LIVING			
Median value of owner-occupied housing units, 2013-2017	$125,900	$135,100	$193,500
Median gross rent, 2013-2017	$770	$764	$982
Persons per household, 2013-2017	2.41	2.44	2.63
Persons in poverty, percent	11.1%	14.0%	12.3%
SOCIOECONOMIC			
High school graduate or higher, percent of persons age 25 years+, 2013-2017	89.6%	89.8%	87.3%
Bachelor's degree or higher, percent of persons age 25 years+, 2013-2017	23.6%	27.2%	30.9%
Median household income (in 2017 dollars), 2013-2017	$49,618	$52,407	$57,652
Percent Male Owned Firms, 2012	55.3%	56.4%	53.7%

Key Observations of Demographic Comparison

As can be seen in the table above, the City of Troy is much less diverse than both the state of Ohio and the US as a whole. Diversity does not change quickly, but it can be influenced steadily over time and studies by the Urban Institute and Metropolitan Planning Council show that an environment of integrated racial and economic diversity boosts the economy and provides more access to educational

and economic mobility (https://www.curbed.com/2017/3/30/15124922/chicago-segregation-costs-2017).

Another key takeaway is the disparity of persons with a bachelor's degree when compared with a state and national average. This metric has a strong tie to the socioeconomic health of a community, as evidenced not only by the above correlation to Median Household Income but also its correlation to similar economic variables in other demographic and socioeconomic analyses. These two metrics are highly correlated, and the graph below demonstrates the linear forecast we can use to make conclusions about the value of increasing this figure:



Using Census estimates for the number of households in the City of Troy, which is 10,461, and the current income tax rate for Troy, 1.75%, if the percentage of persons with a bachelor's degree or higher increased from the current level to the state average, it would be worth more than $500K in additional tax income to the city. Attracting persons with a bachelor's degree (or higher) can be done in a number of ways, some of which are listed below in the Recommended Marketing section, including targeted messaging of real estate and apartment listings on social media platforms which highlight the small town appeal, relatively low cost of living, and the proximity to Dayton.

Recommended Marketing

Attracting new and returning visitors to Troy is a great way to boost the local economy, increase the popularity and awareness of the offerings of the City of Troy, and make additional use of the existing parking spaces. The below ideas range from simple social media campaigns to organized events, but are popular ways to increase the notoriety and draw of the city.

- Engage with photographers in Troy to create more tourism focused pieces for Instagram, Facebook, and Twitter (similar to photos like this for Granville, OH: https://www.instagram.com/p/BMbsOu5lvXJ/?utm_source=ig_embed)
- Use music events (like the Tipp City Canal Music Fest), art festivals, and, once the brewery opens, brewery events to attract persons from regional cities such as Columbus, Dayton, and Cincinnati
- Host local themed events highlighting the libraries, area industries, or local businesses that specialize in hand-made food, furniture, or apparel
- Host haunted history tours with a pre-dusk starting point at an area restaurant or bar that gives visitors a chance to explore downtown Troy before the tours start

These are just a few ideas that could be tried out and measured for appeal, but one of the main aspects of these types of programs is to continue to find ways to measure their appeal, tweak them to drive more reach, and continue to brainstorm new initiatives to follow on after rolling out different marketing campaigns and programs.