

MEMORANDUM

To: Billy Fields, Metro Public Works
Chip Knauf, P.E.; Metro Public Works

From: Bob Murphy, P.E., PTOE
Amy Burch, P.E.
Sagar Onta, P.E., PTOE
Kayla Ferguson, E.I.

Date: November 4, 2016

RE: **Slow Moving Vehicle (SMV) Traffic Study**

INTRODUCTION

The Transportation Licensing Commission (TLC) and Metro Public Works (MPW) aim to have a better understanding of the traffic flow and congestion impacts (if any) of the slow moving vehicles (SMVs) currently allowed on downtown Nashville streets. At MPW's request, RPM Transportation Consultants, LLC (RPM) conducted field observations and collected traffic data to aid in quantifying the impacts of these SMV on regular vehicular traffic. In addition, RPM also collected data on the operation of the SMVs, interviewed the operators of the businesses, and reviewed regulations from cities around the country where similar vehicles are in operation. For the purposes of this study, the term "slow moving vehicles" encompasses pedal carriages, pedi-cabs, and horse-drawn carriages, which generally travels at speed below 15 mph. Golf-carts and other for-hire vehicles are not included in this study because of their higher operating speed.

The Metro's Code of Ordinances define "bicycle" as "any vehicle upon which a person may ride which is propelled exclusively or in part by human power using pedals and having two or more wheels". Hence, by definition, pedal carriages and pedi-cabs fall under the definition of a bicycle.

Pedal carriages, as defined in Metro Code, are four-wheeled pedal powered and/or electric motor assisted vehicles that can carry 15 to 16 passengers. Their normal operating speed is approximately 5-10 mph. The electric motor assisted vehicles has a top speed of approximately 25 mph. Currently, pedal carriages can operate on any roadway within the low-speed-vehicle service area, shown in Appendix A.

Pedi-cabs are three-wheeled primarily pedal powered vehicles with electric motor assistance. They can carry up to two passengers and have an operating speed of about 5-10 mph. The electric motor assists the driver during uphill climbs and cuts off at 12 mph. However, pedi-cabs can travel faster

on a downhill or flat roadway depending on driver's strength. Similar to pedal carriages, pedi-cabs can operate on any roadway within the low-speed-vehicle service area.

Horse-drawn carriages can carry 2-9 passengers based on the size and design of the carriage, and usually travel at 3-6 mph. They mainly operate in the lower Broadway area of downtown. However, they are also allowed to operate on any roadway within the low-speed-vehicle service area.

EXISTING OPERATIONS

There are currently three licensed pedal carriage operators, one licensed pedi-cab operator, and five licensed horse-drawn carriage operators. Table 1 shows the number of permits for each type of operator. As shown in the table, the three pedal carriage operators hold a total of 29 vehicle permits, the one pedi-cab operator holds 20 vehicle permits, and the five horse-drawn carriage operators hold a total of 17 vehicle permits. In addition to the operators listed in Table 1, there may be other SMV businesses operating in Nashville without permits.

RPM contacted the operators of the SMV businesses and obtained information on their existing operations. The following section describes their operation based on information obtained in the interviews and data provided by them and the Metro Nashville TLC.

Table 1. Existing Operators

Operators	SMV Type	Number of Vehicle Permits
Nashville Pedal Tavern	Pedal Carriage	10
Sprocket Rocket	Pedal Carriage	8
Music City Crawler	Pedal Carriage	1
Nashville Pedi Cab	Pedi Cab	20
American Melody Carriages	Horse Carriage	1
Cumberland Carriage Tours	Horse Carriage	3
Hat Creek Carriage	Horse Carriage	4
Southern Comfort Carriage	Horse Carriage	4
Sugar Creek Carriage	Horse Carriage	5
TOTAL		56

Nashville Pedal Tavern

The Nashville Pedal Tavern is one of the licensed pedal carriage operators and started operation in 2010. They have permits for 10 vehicles which, are all pedal powered without any engine assist. A total of 15 people can ride on each vehicle, with 12 bike seats on the sides and a bench seat at the back that can seat up to three people.

The vehicles do not operate on a fixed route due to on-going road closures for construction and events. They instead travel to different areas in town, for example, to the entertainment

establishments on Broadway, SoBro and Mid-Town, as well as to different local breweries. However, the majority of the trips are to the lower Broadway area. At any given time, five to seven vehicles may be in the downtown area. All of the vehicles are pre-booked and scheduled to depart every 15-minute interval between 9:30 AM and 9:15 PM. The vehicles may also be rented for special events and for other marketing purposes.

The trips are usually two hours long and start at the Nashville Pedal Tavern’s office on Demonbreun Street and travel to the designated area. The vehicles travel at about 5-10 mph, according to the information provided in the interview. The vehicles stop at two or three establishments where the patrons spend approximately 15 to 20 minutes each.

Nashville Pedal Tavern provided the schedule for the month of August 2016. The data was helpful in understanding the operation during the course of the day. Table 2 shows the breakdown of scheduled bookings for the month. The bookings represent the number of pedal tavern vehicles that will start their tour during the time shown. Not all vehicles are full with passengers. On average, there were approximately 13 passengers per vehicle in August 2016.

There was a total of 570 bookings for the month of August 2016, which is an average of 18.4 vehicles per day for the month. It should be noted that there were 7 days with no bookings generally between Monday and Thursday. The data showed that the majority of the bookings occur between Friday and Sunday. The highest average booking of 35.5 vehicles per day occurred on Saturday, while the lowest average booking of 9.6 vehicles per day occurred Monday through Thursday.

Table 2. Nashville Pedal Tavern Total Booking (Vehicle) for August 2016

Time	Monday-Thursday	Friday	Saturday	Sunday	Total (%)
9:45 AM – 11:45 AM	13	28	28	21	90 (16%)
12:00 PM – 1:45 PM	34	25	25	26	110 (19%)
2:00 PM – 3:45 PM	27	21	22	19	89 (16%)
4:00 PM – 5:45 PM	27	20	23	17	87 (15%)
6:00 PM – 7:45 PM	47	24	24	20	115 (20%)
8:00 PM – 9:45 PM	34	20	20	5	79 (14%)
Total (%)	182 (32%)	138 (24%)	142 (25%)	108 (19%)	570
Average Vehicle / Day	9.6*	34.5	35.5	27.0	18.4

Note: * 7 of the 19 days (Monday – Thursday) had no bookings.

During the course of the day, anywhere between 15-20% of the bookings occur during each two-hour period. The data also showed that the majority of the scheduled rides, approximately 68%, occurred on Friday, Saturday and Sundays. A detailed review of the data also showed that

approximately 8% of the bookings occurred during the weekday PM peak period (i.e., Monday-Friday from 4-6 PM). Of this 8%, nearly half of these bookings occurred on Fridays.

This review also showed that the highest number of bookings in a day (37) occurred on Saturday, August 6 and each Friday and Saturday in August had at least 34 bookings. The lowest number of bookings in a day (4) occurred on Tuesday, August 16. The highest number of bookings during the weekday PM peak hours (4 – 6 PM) occurred on Friday, August 26. There was a total of 11 bookings during the PM peak hour on this day, while every other Friday in August had 10 bookings during the PM peak hour. Thursday bookings during the PM peak hours ranged from 5 to 10, while for Monday through Wednesday the maximum number of bookings during the PM peak hours was 5.

Sprocket Rocket

Sprocket Rocket began operating in Nashville in 2013. They currently have permits for eight vehicles, which are primarily pedal powered. However, electric motors are installed on the vehicles to provide supplemental power. The vehicles have 16 seats in total with six bike seats on each side and up to four seats on the bench at the back. The top speed of the vehicle is 25 mph.

All the rides are pre-booked with no less than five-minute intervals between dispatched vehicles. They operate from 10:00 AM – 11:00 PM. The vehicles do not operate on a fixed route, but instead operate in a zone that includes Lower Broadway and surrounding streets. All rides start at their office near 5th Avenue South and Peabody Street and travel along 5th Avenue towards lower Broadway to the north. The rides lasts for approximately 1 hour 45 minutes with one stop at a local bar.

Sprocket Rocket provided aggregated bookings scheduled from April 2016 to April 2017. Data was not available for all months. The data showed that patrons start booking several months in advance. Table 3 shows the total bookings from May 2016 to September 2016 for different days of the week. The data showed that of the 153 days of data, there were no booking on 32 days. Similar to the Nashville Pedal Tavern, the data showed that the majority of the bookings for Sprocket Rocket occur between Friday and Sunday. The highest average booking of 44.2 vehicles per day occurred on Saturday, while the lowest average booking of 2.5 vehicles per day occurred Monday through Thursday.

Table 3. Sprocket Rocket Total Booking (Vehicle) for May 2016 to September 2016

Month	Monday – Thursday	Friday	Saturday	Sunday	Total
May 2016	62	138	156	124	480
June 2016	50	141	154	39	384
July 2016	62	204	240	33	539
August 2016	29	166	192	28	415
September 2016	20	157	186	55	418
Total	223	806	928	279	2236
(%)	(10%)	(36%)	(42%)	(12%)	
Average Vehicles / day	2.5	36.6	44.2	12.7	14.6

As shown in the table, a total of 2,236 rides were scheduled from May to September. Of these, 90% of the rides were scheduled on Friday, Saturday, or Sunday, and only 10% were scheduled from Monday to Thursday. This data showed that the vast majority of the scheduled rides occurred on Fridays and on weekends. Data was not available with a breakdown of operations during the course of the day.

During the interview, a representative of Sprocket Rocket also raised following concerns:

- Uber/Lyfts/Taxi cab drivers load and unload passengers in the middle of travel lanes, which hampers the flow of traffic.
- Sight-seeing and tour buses also travel slowly on major streets in downtown, impeding the flow of traffic.
- Vehicles making a northbound left-turn at the 4th Avenue South and Broadway intersection block the one northbound lane at the intersection. This creates significant delay and queues for all vehicles on the northbound approach of the intersection.
- The new loading zone on lower Broadway is treated as right-turn lane at the intersections.

Nashville Pedi-Cab

Nashville Pedi-Cab has been in operation since 2013. They currently have licenses to operate 20 vehicles, which are primarily pedal powered. However, they also have a motor that assists when pedaling uphill. The motor cuts off when the driver pedals quickly on flat ground or downhill. The motor does not have a throttle and is cut off at 12 mph. However, the vehicle can travel faster than 12 mph based on the driver's strength.

Based on the response to survey questions, the pedi-cabs operate primarily after the commuter traffic's weekday PM peak hours, and especially during special events like Titans football game, etc. They are not operational during the AM peak hours. The pedi-cabs do not operate on a fixed route, as they are for-hire transportation service for individuals. They operate only within the Low Speed Vehicles (LSV) boundary set by the TLC. This boundary is shown in Appendix A.

Horse Drawn Carriage

There are currently five horse-drawn carriage operators with a total of 17 carriage vehicle permits. The carriages primarily operate in the lower Broadway area from 6 PM to mid-night on weekdays and from 10 AM to mid-night on weekends. There are four carriage stands on 2nd Avenue North, just north of Broadway.

RPM contacted all the horse-drawn carriage operators and was able to get feedback from one operator. Based on the response received, Figure 1 shows the primary routes taken by the horse carriage from their stand on 2nd Avenue North, just north of Broadway. On rare occasions, horse carriages may travel to the Gulch for special events or trips.

The horse-drawn carriages primarily cater to family-oriented tourists and prefer to stay away from bars and large groups. Similarly, they avoid steep hills and thus prefer to stay in the lower Broadway and SoBro areas.

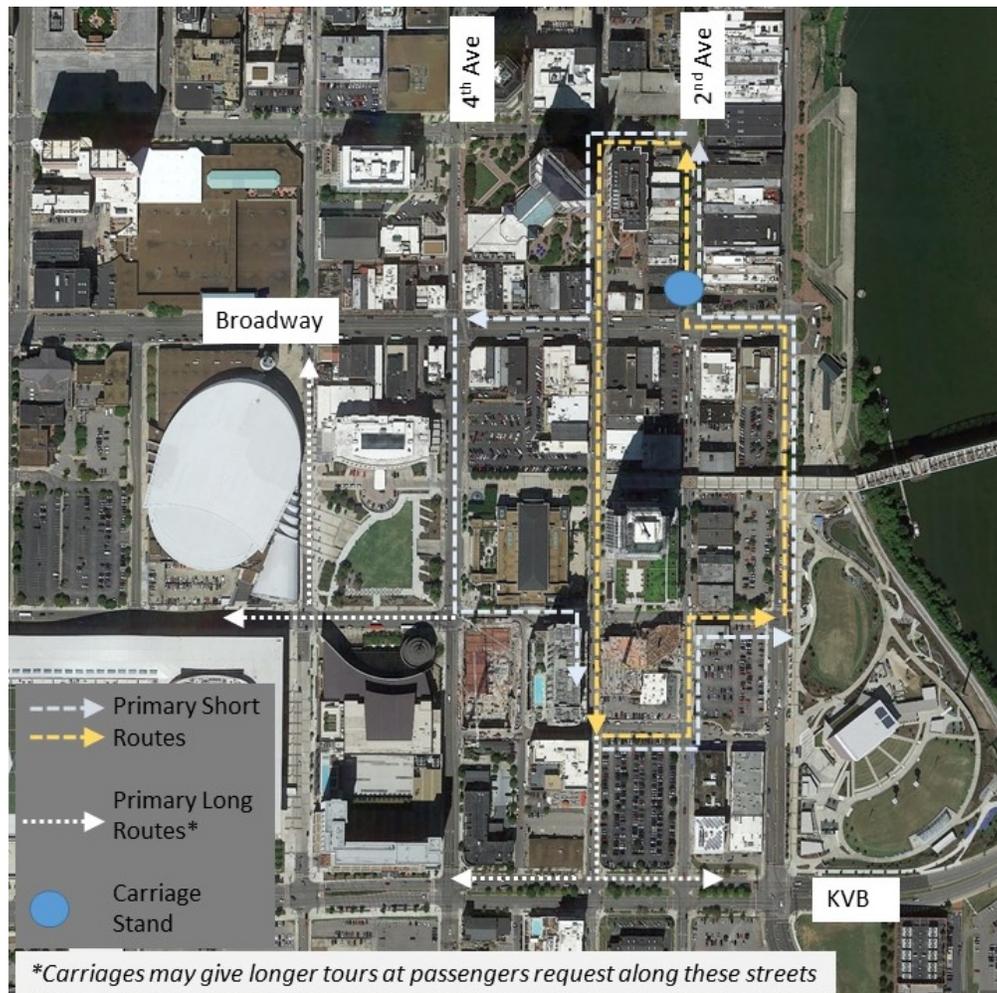


Figure 1. Primary Horse-Drawn Carriage Routes

Comments from Other Users

RPM also received several pages of comments regarding traffic conditions in Downtown from employees of the Baker Donelson law firm on 3rd Avenue North. The primary concerns are the challenges for the employees to exit their parking garage during the peak hours. Some specific concerns that were mentioned are:

- Pedestrians at Broadway cross the street at all times, violating the traffic signal and significantly increasing the delay for vehicles exiting the downtown area.
- SMV and other operators like the sight-seeing tour buses, golf-cart taxis, etc., slow the traffic and add to the frustration of employees leaving downtown during evening peak hours.

RPM also met with Commander John Drake of the Central Precinct and other officers to gather the police department's concerns with SMVs. Their primary concern is related to SMVs impeding traffic flow on major roadways and safety concerns when vehicles behind the SMVs try to overtake them by crossing double yellow lines. There have not been any reported accidents related to SMVs. However, near misses cannot be disregarded according to the police.

The officers at the meeting mentioned that the pedestrian scramble traffic signal feature implemented on the lower Broadway intersections has greatly improved pedestrian flows in the area. However, pedestrians still cross the intersections during vehicular traffic signal phase, which hampers the flow of the traffic through the intersection. The police department does not have adequate manpower to manage traffic at the intersections during the peak hours, as two to four officers are needed at each intersection to control pedestrian and vehicular traffic.

The officers also highlighted that the new loading zone on lower Broadway is used by right-turning vehicles at intersections. At times, this creates a situation where the two right lanes on Broadway are used by vehicles to make right-turns, creating an unsafe situation at the intersection. Commander Drake also mentioned that the police department is seriously concerned with the safety impact of any further increase in SMV vehicle permits in the downtown area.

Data Collection

In order to fully understand the impact that SMVs have on traffic operations, video data was collected at key locations where these vehicles commonly operate. Specifically, video data was collected at the following intersection locations on Friday, September 16, 2016:

- Demonbreun Street and 8th Avenue South
- Demonbreun Street and 5th Avenue South
- Commerce Street and 3rd Avenue North

Once the video data was collected, the operation of these intersections was reviewed between the hours of 3:00 – 7:00 PM in order to capture interactions of SMVs with vehicular traffic on the roadways during PM peak times. The number of SMVs traveling through the intersections during these hours as well as the time it takes them to cross the intersection were reviewed and analyzed in order to understand the actual operation of the slow moving vehicles and how they interact with other vehicles.

To determine how the SMVs operate at intersections, the number of SMVs entering each intersection was recorded for the intersections shown in Table 4. Results are shown below for the data collection period of 3:00 – 7:00 PM. The volumes are totaled for all approaches at each intersection where SMVs were observed. During the hours of data collected, it was determined that the peak hour for SMVs occurs from 6:00 – 7:00 PM. The data also showed that 49 SMVs were observed at the intersection of Demonbreun Street and 5th Avenue South during the four-hour period, which is the highest number of SMV among the intersections observed. However, these SMV accounted for less than 2% of the regular vehicular traffic at the intersection.

Even though the number of SMVs may be relatively low, compared to the amount of regular vehicular traffic on the road, the impact of SMVs on regular traffic can be quantified by calculating the speed of the SMVs versus regular traffic. The impacts of SMVs on vehicular traffic are mostly related to the speeds at which the SMVs can travel. These speeds include both the operating speed (how fast they travel along a stretch of roadway) as well as the start-up speeds (how quickly they can accelerate from a stop at an intersection). In most cases, the operating speeds of SMVs are

lower than that of typical motor vehicles. Additionally, the start-up time needed for SMVs to accelerate through an intersection from a stop is considerably longer than that of typical motor vehicles. Both of these operating characteristics contribute to increased delay for the motor vehicles in their vicinity. Throughout the review of video data, this specific characteristic was examined at individual study intersections where SMVs were observed.

Table 4: Volume of SMVs (Friday, September 16, 2016 from 3:00 – 7:00 PM)

Intersection	Vehicle Type	Number of Vehicles
Demonbreun Street and 8th Avenue	Pedal Carriage	11
	Pedi-Cab	5
	Horse Carriage	-
	Motor Vehicles	2,966
Demonbreun Street and 5th Avenue	Pedal Carriage	35
	Pedi-Cab	10
	Horse Carriage	4
	Motor Vehicles	3,739
Commerce Street and 3rd Avenue	Pedal Carriage	3
	Pedi-Cab	1
	Horse Carriage	17
	Motor Vehicles	3,844

First, the time it took for each vehicle to travel through the intersection was recorded and averaged by vehicle type. The data was collected for both vehicles starting from a stopped position and vehicles moving through the intersection. The volume data collected at Demonbreun Street and 5th Avenue was used to evaluate this metric since it had the highest volume of SMVs compared to other study intersections. Table 5 shows the intersection clearance times for this intersection by movement for each slow moving vehicle classification as well as average clearance times for motor vehicles. Empty cells indicated that the movement was not made during the hours observed.

Additionally, the travel speeds of each vehicle through the intersection were measured. The data collected on Demonbreun Street, between 5th Avenue South and 4th Avenue South, was used to measure average travel speed of all SMVs and vehicles. Results are presented in Table 6.

Table 5: Average Intersection Clearance Times

Movement Type	Vehicle Type	Average Time to Travel Through Intersection
Left Turn at Intersection	Pedal Carriage	22.3 sec
	Pedi-Cab	-
	Horse Carriage	-
	Motor Vehicle	5.3 sec
Through at Intersection	Pedal Carriage	14.0 sec
	Pedi-Cab	10.5 sec
	Horse Carriage	18.0 sec
	Motor Vehicle	4.0 sec
Right Turn at Intersection	Pedal Carriage	12.7 sec
	Pedi-Cab	5.8 sec
	Horse Carriage	5.5 sec
	Motor Vehicle	4.0 sec

Table 6: Average Travel Speeds through Intersections

Vehicle Type	Average Travel Speed Through Intersection
Pedal Carriage	5.7 mph
Pedi-Cab	7.2 mph
Horse Carriage	3.8 mph
Motor Vehicle	16.5 mph

Based on the data collected, the following conclusions can be made:

- Of the slow moving vehicle volumes at the study intersections, pedal carriages comprised approximately 57%, pedi-cabs comprised approximately 19%, and horse carriages comprised approximately 24% of the total SMV volume.
- At the study intersections from 3:00 – 7:00 PM on a Friday, approximately 11% of the SMVs were observed between 3:00 – 4:00 PM, 19% were observed from 4:00 – 5:00 PM, 17% were observed from 5:00 – 6:00 PM, and 53% were observed from 6:00 – 7:00 PM.
- The maximum number of pedal carriages, pedi-cabs, and horse carriages seen in any 15-minute period at the three study intersections was four, five, and six, respectively.
- The maximum hourly volume of SMVs was observed at the intersection of Demonbreun Street and 5th Avenue. A total of 21 SMV were observed at this intersection between 6:00 – 7:00 PM. There were 10 pedal carriages, 10 pedi-cabs, and one horse carriage observed during this hour.

- For all movements, on average, motor vehicles were observed to take approximately 4 to 5 seconds to travel through the intersection.
- Left turning movements by pedal carriages take approximately 4 times as long as an equivalent turning movement made by a motor vehicle.
- For through movements, pedal carriages take more than three times as long, pedi-cabs take more than twice as long, and horse carriages take more than four times as long to travel through an intersection when compared to motor vehicles.
- For right turning movements, travel times through the intersection for horse carriages and pedi-cabs were slightly higher than that of motor vehicles. However, pedal carriages took approximately three times as long to negotiate right turning movements.
- The average travel speeds of SMVs range from 23% - 45% less than the average motor vehicle speed through intersections.

The review of the video data also provided a few notable observations including the following:

- The behavior of the SMVs was generally predictable as they were observed to obey traffic laws the majority of the time.
- However, there was an instance observed where a pedal carriage moved over into an exclusive left turn lane to allow the queue of vehicles to move through the intersection. After the queue had cleared, the pedal carriage traveled through the intersection from the left turn lane.
- Pedi-cabs generally ride on the far right side of the roadway regardless of whether they are surrounded by vehicles or not.
- At times, pedal carriages took longer than the allocated yellow and all-red clearance time of the signal phase to cross the intersection. At these times, vehicles in opposing approaches experienced additional delays and loss time.

Review of City Regulations

To complement the data collected via operator interviews and recorded video observations, a review was undertaken to determine how slow moving vehicles are addressed by other cities. This review was not focused on cities that are necessarily considered peers for Nashville, but rather on cities that allow the aforementioned types of SMVs within the city and have begun the process of regulating them. There are many topics related to SMVs that were reviewed, but they can generally be classified into two categories, licensing and permitting and operating restrictions, which are described in more detail below.

Licensing and Permitting

Since SMVs offer for-hire transportation services and generally operate on public streets, many cities have begun to regulate the operation of these vehicles. Regulation of these services in other cities has also stemmed from complaints by other residents related to the noise, traffic, and safety issues, among others, generated by SMVs.

Business Licenses

Most cities that regulate SMVs have done so by requiring the companies to comply with requirements similar to those imposed on other vehicle-for-hire companies. This generally entails the businesses meeting certain requirements before applying and paying for a business license through the city. After the licensing is approved, they are required to consistently meet a set of regulations outlining business practices. The requirements for applying and maintaining business licenses for SMVs in various cities were found to include many of the following items:

- Specification of principal place of business (often required to be within City)
- Proof of financial ability to render service
- Insurance coverage (oftentimes with the City names as an additional insured party)
- Location of vehicle storage (or stables for horse carriages)
- Number of allowable passengers on vehicles
- Proposed routes or areas of operation
- Zero-Tolerance Drug Policy
- Schedule of regular reporting requirements (list of drivers, vehicles, crashes, trip data etc.)

In comparison, Nashville also require businesses to obtain certificate before they can operate SMV. The permit is required to be affixed to the SMVs. Some of the other requirements for application for the business permit in Nashville include:

- A background check of each applicant
- Proof of US citizenship or legal residency for each applicant
- Procedures for training drivers
- Insurance coverage

Additional requirements can be found in Metro's Code of Ordinances, Chapter 6.75.

Operator Licenses

Some cities elect to regulate the operation of SMVs separately from the business itself. In these instances, the individuals actually responsible for driving the vehicles are sometimes required to have a special license issued by the city. To obtain these permits, drivers are often required to provide information and comply with requirements similar to those imposed on drivers of other vehicles-for-hire. Cities often require some or all of the following items with an application for an operator license:

- Valid driver's license
- Minimum age requirement (oftentimes 18 or 21 depending on whether alcohol is allowed)
- Proof that individual has been designated as healthy enough to operate vehicles
- Proof of completed training courses (driving, horse care tactics, English proficiency, etc.)
- Clean driving record (sometimes specifying number of driving violations within certain time period)
- Criminal record (including checks on the national sex offender public registry)
- Proof that individual is not addicted to alcohol, illegal drugs, controlled substances, etc.

- Proof of citizenship or ability to work in US
- History of residency
- Recent photographs/photo id

In comparison, Nashville also require individuals to obtain drivers permit before operating SMV. Some of the requirements for obtaining drivers permit in Nashville are:

- Valid driver's license
- Social security card of birth certificate
- Criminal background investigation
- Year of experience in the transportation industry
- Educational background of the applicant.
- History of applicant's employment

Additional requirements can be found in Metro's Code of Ordinances, Chapter 6.75.

Vehicle Licenses

Additionally, some cities also issue vehicle permits in addition to operator and business licenses. In these instances, licenses are issued, renewed, and paid for individually for each vehicle in operation. The majority of these requirements relate to the items necessary for safe operation of the vehicles. Such items can include the following:

- Specification of vehicles size
- Lighting and illumination distances (headlights and taillights)
- Brakes or power assist systems
- Reflectors
- Seatbelts for passengers
- Turning signals
- Audible signaling device
- Decals (if applicable)
- Number of passengers allowed
- Vet inspection of horses (for carriages)
- Proof of vehicle inspections and compliance

In comparison, Nashville also require operators to obtain vehicle permits for the SMV. Some of the requirements are:

- Unibody frame construction
- A fully operational horn or bell
- Headlights that have a beam of at least 300 feet
- Flashing tail light that are visible for at least 500 feet
- Hydraulics, mechanical disk or drum brakes

Additional requirements can be found in Metro's Code of Ordinances, Chapter 6.75.

Operating Restrictions

Many of the issues with SMVs in urban areas are related to the impacts that these vehicles have on vehicular traffic and surrounding residents. Impacts to vehicular traffic are most often reported as additional delays incurred by vehicles due to the slower acceleration rates and travel speeds of SMVs compared to motor vehicles. In an effort to mitigate the impacts of SMVs on vehicular traffic, many cities restrict the operations of the businesses.

These aforementioned limitations most often come in the form of limited hours of service and/or route restrictions. When limiting hours of service, other cities most often prohibit SMVs from operating during peak commuter hours, most commonly, the few hours encompassing the PM peak hour. Hours of service were also restricted based on daylight hours in some areas, presumably for safety and reduction of noise impacts on neighboring residents and businesses. These restrictions ultimately allow the SMVs to continue operating within the city and desirable locations, such as the Central Business District or Downtown area, but minimize their impact on neighboring residents as well as vehicular traffic operations given that they are operating outside of peak traffic times.

In addition to the hours of operation, cities have also elected to restrict the roadways on which SMVs are able to operate. This has been done independently or in conjunction with limited hours of service. Roadways can be restricted based on posted speed limits, traffic volume, or availability of multimodal infrastructure where they can operate legally (i.e., bike lanes). These restrictions are most often determined by the city's Public Works Department, sometimes with input from the city's Police Department. In some instances, these restrictions are waived for special events.

Also of note is that in locations where pedal carriages are permitted, many cities institute a policy on alcohol consumption for passengers on board. These may be as simple as prohibiting the driver from partaking, while some restrict the type and quantity of alcohol allowed (e.g., no hard liquor), as well as container material (e.g., no glass).

There are some cities where SMVs operate similar to that of taxis, where passengers can be picked up and dropped off at a variety of locations. In these situations, it was found that cities specified allowable pick up and drop off locations (i.e., designated stands). Additionally, these cities would often regulate how many of each vehicle type were allowed to be waiting at these locations.

A summary of the cities reviewed and their regulations is provided in Appendix B.

In Nashville, there are not currently operational restrictions on SMVs.

Conclusions and Recommendation

The data collected during the course of this study showed that, even though the number of SMVs operating during the PM peak hour is relatively small compared to the total traffic volume on the road, the SMVs operate at considerably lower speeds than general traffic. On such occasions, the SMVs have a negative impact on the flow of traffic, especially for commuters who are leaving downtown.

Options for Mitigating Impacts of SMVs During Peak Traffic Times

Based on the data collected, the analysis conducted and consideration of the actions other cities have taken in regards to SMVs, there are a variety of options that Metro Nashville can employ in

order to improve and/or mitigate the impacts of SMVs on motor vehicle traffic. The following measures represent potential solutions for regulating the SMVs discussed in this study as well as other private vehicles for hire. They are as follows:

- **Restrict Hours of Operation** – While many of the SMVs operate all day, interviews with these companies found that a large majority of their business is reportedly conducted during off peak periods of commuter traffic. Nonetheless, SMVs are operating on the streets during the hours overlapping the PM peak hour of travel for vehicles. This overlap causes conflicts due to the reduced speed and overall travel efficiency of SMVs compared to automobiles. One method of mitigating this conflict is to restrict the operation of SMVs during PM peak hours. Based on the peaking characteristics of Nashville traffic, it could be advantageous to prohibit businesses from dispatching SMVs on weekdays between the hours of 4:00 – 6:00 PM. It should be noted that the focus of this study is on addressing the impact on peak commuter traffic. Therefore, recommendation is not presented for restricting hours of operation during the weekends.
- **Restrict Total Number of Permits Issues by TLC** – Metro Nashville could regulate the number of licenses allotted for SMVs. This would likely entail determining a maximum number of licenses and then enforcing this by capping the number of permitted businesses, operators, or vehicles. This option would allow the existing businesses to continue operating without imposing new restrictions on existing operations and would simply minimize impacts of these businesses by controlling the number of SMVs on Nashville streets.
- **Restrict Number of Vehicles in Operation During Peak Hours** – An alternative to restricting the operating hours is to restrict the number of vehicles allowed to enter the Downtown during peak hours. For instance, companies would be allowed to send vehicles to the Downtown throughout the PM peak hour, but they may only be allowed to send a certain number of vehicles out each hour. This would allow companies to continue offering rides during those times, but would still reduce the impacts to motorists.
- **Restrict Specific Routes** – The restriction of routes on which SMVs can operate can potentially alleviate impacts to peak hour traffic as well as minimize potential safety concerns. Roadway characteristics used to determine these restrictions could include a variety of attributes. For instance, the posted speed limit could be used as a threshold to restrict where SMVs are allowed to operate. Limiting routes to roadways with lower speeds would minimize the impacts of SMVs on vehicles trying to get out of Downtown and would likely result in a safer operating environment. Additionally, the number of lanes on a street could also be used to restrict routes during peak periods. Roadways that only have one lane in each direction could be prohibited for use during peak hours as vehicles would likely be unable to pass SMVs during peak hour congestion. Example of these type roadways include, 3rd Avenue and 1st Avenue, north of Demonbreun Street. MPW could also elect to prohibit peak hour operation on specific roadways and directions in an attempt to separate the SMVs from the major routes leaving the Downtown.

- **Designated Stopping Locations** – SMVs generally have to park to either pick-up or drop-off passengers. The SMV are oftentimes parked on the roadway, when nearby parking is not available, while drivers wait for the passengers to load and unload. In order to minimize impacts to vehicles, it could be advantageous to specify allowable parking and pick-up/drop-off locations for these vehicles.

Based on the options available, it is recommended that a phased implementation approach be undertaken to regulate the SMV operation in lower Broadway. Imposing all of the aforementioned regulations at once could potentially have a negative effect on businesses and traffic in downtown. Therefore; the recommended actions are:

Phase 1 Recommendation:

- Limit the number of SMVs in downtown Nashville from 4:00 – 6:30 PM during the PM peak hour Monday through Friday. Each existing operator will be allowed a maximum of four (4) vehicles in this area during this time period with no less than 15 minutes between each dispatch. New permit holders will not be allowed to operate during this time period, until the impact of Phase 1 recommendations is re-evaluated.
- Restrict SMVs, except for horse carriages, on 3rd Avenue, from Union Street to Peabody Street.
- Evaluate the effectiveness of Phase 1 recommendations after implementation but not before Spring 2017. If it is determined that implementation of the Phase 1 recommendations did not adequately address the concerns of SMV impacts on regular traffic, the Phase 2 recommendation can be implemented.

Phase 2 Recommendation:

- Restrict all operation of SMVs in downtown Nashville from 4:00 – 6:30 PM peak hour Monday – Friday. MPW may modify the peak hour based on changing travel patterns and congestion period in the future.
- Enforce a cap on the number of SMV vehicle permits to minimize additional delays to the traveling public due to SMV operation. The cap may be established such that the percentage of SMV at key intersections, for example, on Demonbreun Street and 5th Avenue South, and on Broadway and 4th Avenue intersections, does not exceed 1% of the motor vehicle traffic at the intersection at any given hour on a weekday.

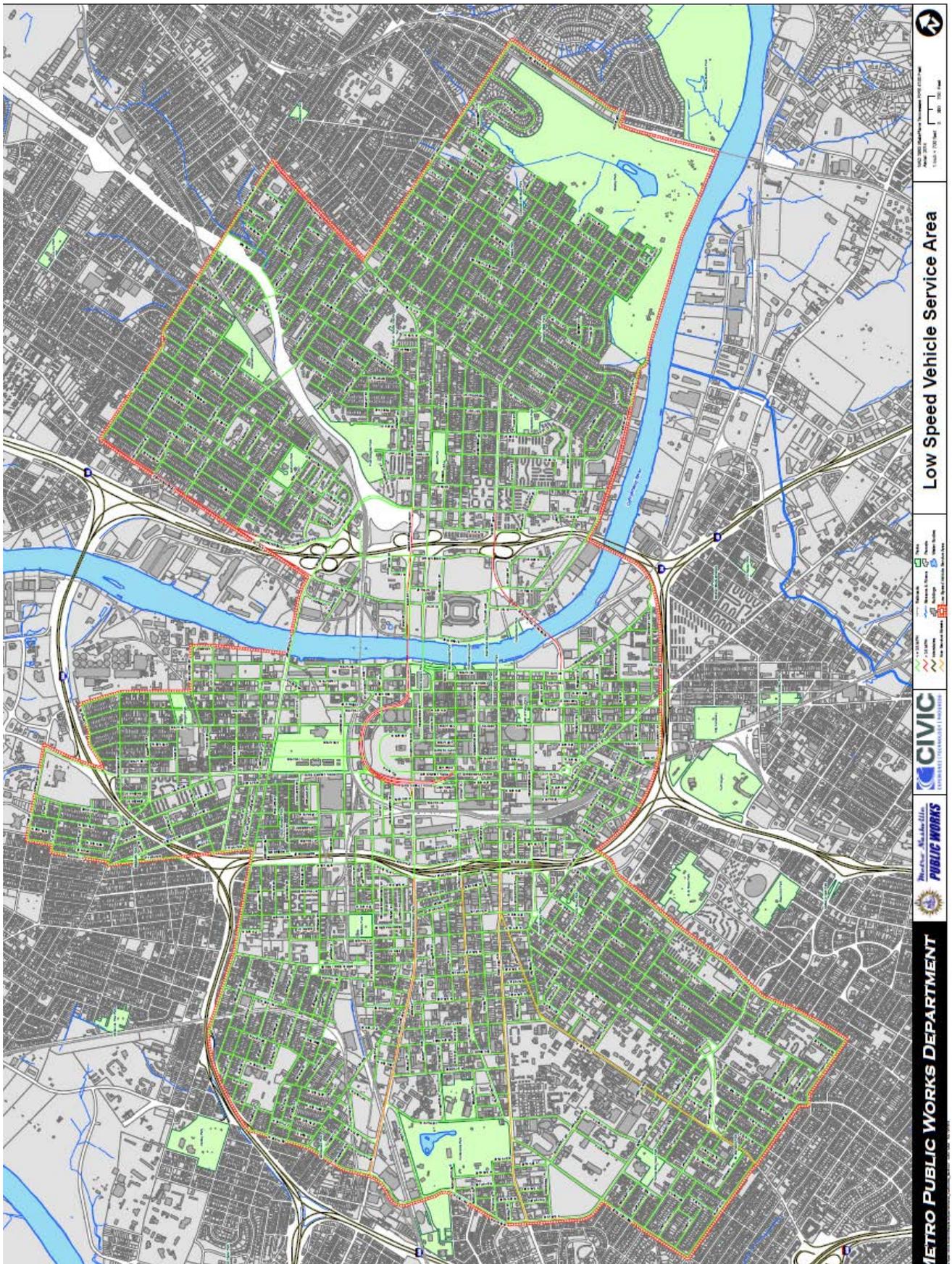
THIS SECTION LEFT INTENTIONALLY BLANK

Appendix A

Low Speed Vehicle Boundary

Date: November 4, 2016

Re: Slow Moving Vehicles Traffic Study



Appendix B

Summary of City Regulations

City	Pedal Carriages					Pedi-cabs					Horse Carriages					
	Licenses/Permits	Alcohol Policy	Route Restrictions	Restricted Hours	Misc.	Licenses/Permits	Alcohol Policy	Route Restrictions	Restricted Hours	Misc.	Licenses/Permits	Alcohol Policy	Route Restrictions	Restricted Hours	Restricted Temp	Misc.
Chicago, IL ¹	Currently do not regulate pedal carriages. Some businesses operate illegally since they are not able to obtain business licenses.					Operator and Vehicular	Not Allowed	Restricted on specific streets	Within downtown on weekdays from 7:00 - 9:00 AM and 4:00 - 6:00 PM		Carriage, Operator, and Horse	Not Allowed	Areas or routes designated by Commission of Transportation and subject to City Council approval Some specific routes have time restrictions as well Designated stops by permit only	Weekdays from 7:00 – 9:30 AM and 4:00 – 6:00 PM (except on some Holidays) Some routes restricted with weekend hours (No use between 6:00 PM – 2:00 AM daily)	> 90 < 15	Maximum of 40 carriage licenses in city Restricted # of passengers No left turns for carriages unless onto one-way street or authorized by permit, ordinance, or route designation
Detroit, MI ²	Business and Operator	Not Allowed	Routes approved by Public Works and Police	Within CBD on weekdays from 7:00 - 9:30 AM and 3:00 - 6:00 PM	Designated pick-up and drop-off locations	Business and Operator	Not Allowed	Routes approved by Public Works and Police	Within CBD on weekdays from 7:00 - 9:30 AM and 3:00 - 6:00 PM	Designated pick-up and drop-off locations	Business and Operator	Not Allowed	Designated stops and routes only	Weekdays from 6:00 - 9:30 AM and 3:00 - 6:00 PM	No	-No more than 2 parked at same stop at any time -Direction to face when parking -no more than 12 licenses issued
Houston, TX ³	No current regulations for pedal carriages as none of the vehicular definitions are accurate. Pedal carriages businesses do operate in the city though.					Business and Operator		Cannot operate where speed limit > 35 mph		Vehicle inspections			Yes (no limited access or controlled access highway within corporate limits except for those designated as service roadways (for all non motor-propelled wheeled vehicles))		No	

¹ [http://library.amlegal.com/nxt/gateway.dll/illinois/chicago_il/municipalcodeofchicago?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:chicago_il](http://library.amlegal.com/nxt/gateway.dll/illinois/chicago_il/municipalcodeofchicago?f=templates$fn=default.htm$3.0$vid=amlegal:chicago_il)

² https://www.municode.com/library/mi/detroit/codes/code_of_ordinances?nodeId=DECO_CH58VEHI_ARTVIIIPEBSRI

³ https://www.municode.com/library/tx/houston/codes/code_of_ordinances?nodeId=COOR_CH46VEHI



City	Licenses/Permits	Alcohol Policy	Route Restrictions Pedal Carriages	Restricted Hours	Misc.	Licenses/Permits	Alcohol Policy	Route Restrictions Pedi-cabs	Restricted Hours	Misc.	Licenses/Permits	Alcohol Policy	Route Restrictions Horse Carriages	Restricted Hours	Restricted Temp	Misc.
Minneapolis, MN ⁴	Business, Operator, and Vehicle	Allowed No hard liquor Alcohol contents <6%		Allowed to operate from 10:00 AM to 10:00 PM (can be waived for special events)	Defined as commercial pedal car Vehicle inspections Noise restrictions	Business and Operator	Not Allowed				Business and Operator Animals must be registered and marked		Routes determined by Public Works and approved by City Council	Weekdays from 6:00 - 10:00 AM and 3:30 - 6:30 PM Can also be restricted for special events	No	Temporary routes (10 days) can be established by MPW Parking/Loading in commercial vehicle loading zones designated by city council
Portland, OR ⁵	This type of service meets the "Private for-hire vehicle" definition, but pedal carriage operations are not specifically identified though they currently operate in the city.					Business, Operator, and Vehicle	Not Allowed	Cannot operate at the Portland International Airport without permission			Business, Operator, and Horse		Cannot operate where speed limit > 35 mph and where light rail and street cars run	Weekdays from 6:00 – 10:00 AM and 3:00 – 6:00 PM	> 90 (When temp between 84 and 90, no ride shall be initiated if forecasted to rise over 90) Driver required to monitor horse's respirator rate, heart rate, and temp every hour when temp is 78-90.	Towing weight restrictions, Horse age minimum, work period maximum per day & week, stable/boarding standards
San Diego, CA ⁶	Business and Operator	Alcohol consumption restricted in	Cannot operate where speed	Yes (Darkness, unless equipped)	Parking & Resting Zones	Business and Operator	Alcohol consumption restricted in	Cannot operate where speed limit > 25 mph	Yes (Darkness, unless equipped with	Parking & Resting Zones	Doesn't appear to meet "for-hire" definition					

⁴ https://www.municode.com/library/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT13LIBURE

⁵ <https://www.portlandoregon.gov/citycode/28180>

⁶ <http://docs.sandiego.gov/municode/MuniCodeChapter08/Ch08Art03Division01.pdf>



City	Licenses/ Permits	Alcohol Policy	Pedal Carriages			Licenses/ Permits	Alcohol Policy	Pedi-cabs			Licenses/ Permits	Alcohol Policy	Horse Carriages			Restricted Temp	Misc.
			Route Restrictions	Restricted Hours	Misc.			Route Restrictions	Restricted Hours	Misc.			Route Restrictions	Restricted Hours	Misc.		
		specific areas of the city, but not by service	limit > 25 mph unless in Class II bike lane; specific street restrictions as well	with proper taillights)	designated by Mayor		specific areas of the city, but not by service	unless in Class II bike lane; specific street restrictions as well	proper taillights)	designated by Mayor Must have seatbelts							
Savannah, GA ⁷	Currently in the process of re-writing the ordinance on 'quadricycles'. Currently, they are allowed to operate in specific areas of the city. Alcohol and noise restrictions are under examination.					Business and Operator		Cannot operate outside specified area.	Restrictions on certain streets from 9:00 AM – 5:00 PM	Prohibited from parking or standing at any bus stop, tour bus stop, tour bus zone, taxicab stand, or horse-drawn carriage stand. Specific language about minimizing impediment to traffic flow	Business and Operator (Vehicle has state license tag)		Cannot operate outside specified area.	Cannot operate from 12:00 AM to 8:30 AM on any day and on weekdays from 4:30 – 6:00 PM		Designated stands established by mayor and aldermen Specific language about minimizing impediment to traffic flow Restrictions on frequency of tours dispatching from carriage stands during weekdays before 6:00 PM	

⁷ https://www.municode.com/library/ga/savannah/codes/code_of_ordinances?nodeId=DIVICOGEOR_PT7MOVETR_CH1GETRRE_ARTFBIMOSK_S7-1133REQU https://www.municode.com/library/ga/savannah/codes/code_of_ordinances?nodeId=DIVICOGEOR_PT6LIRE_ARTCCFE_ARTDDPE_S6-2510PEDRPE



