ACCESSIBLE TRANSPORTATION REFORM: TRANSFORMING THE PUBLIC PARATRANSIT AND PRIVATE FOR-HIRE GROUND TRANSPORTATION SYSTEMS

A New Paradigm Using Technology to Increase Efficiency While Reducing Expenses and the Ecological Footprint

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ABSTRACT

The public paratransit system in the United States is in desperate need of significant reform. Hundreds of millions of taxpayer dollars are wasted on inefficient and unsustainable accessible transportation service, with disjointed agency coordination between multiple public agencies, private businesses and vendors. Accessible transportation is a civil right, and a new service paradigm and model can and should be developed to provide safe, reliable and ecologically sustainable vehicles, using state of the art technology.

Around the country there is a hodgepodge of extensive accessible funding through public transit and social service agencies, as well as for private for-hire transportation. There are numerous government agencies with conflicting policies, mandates and service delivery methods, where silos of service are created with no meaningful communication by and between such agencies, the private transportation sector and the public. There should be a consistent, uniform and coordinated method for delivering subsidized accessible ground transportation service to all disabled passengers.

This study will use the New York City system, problems and proposed solutions as a case study that may be applied in other jurisdictions. Upon successful implementation of a new public/private paradigm, appropriately deploying all for-hire ground transportation sub-modes, further studies should examine all related paratransit services. All service delivery and funding should be integrated and coordinated under a mass transit agency umbrella for one comprehensive, all encompassing system that allows disabled passengers to go from point A to point B seamlessly and affordably like everyone else without the need to research service options.

CHAPTER 1 – ACCESSIBILITY OVERVIEW: THE PROBLEM AND CONTEXT OF STUDY

Many communities in the US and around the world—whether urban, rural, or suburban—are interested in providing effective paratransit services that are also efficient performers from the viewpoint of environmental sustainability. Herein, paratransit will be understood in the general sense of flexible passenger transportation that does not follow fixed routes or schedules, and often serves the transportation needs of people with disabilities or the elderly. Typically, paratransit systems exist because laws and regulations such as the Americans With Disabilities Act (ADA) and 49 CFR 37 require the services to be provided. Public or private operators who deliver paratransit services often do so via fleets of vans or mini-buses. Paratransit ranges widely in terms of the flexibility of the provided services, which can range from relatively inflexible transportation along a more or less defined route, to fully "demand responsive" service that offers on-demand, door-to-door transportation. Given the governmental subsidies needed to support paratransit, policymakers are considering ways to operate paratransit systems more effectively and efficiently. Likewise, they are increasingly interested in the environmental sustainability of paratransit. Service delivery efficiency not only yields environmental benefits, but also goes hand in hand with economic savings.

This study will focus on paratransit services provided by New York City Transit, and in particular on the integration of taxis (and livery and black car services) as service-providing vehicles. The overall focus will be on how such taxi integration will improve: (1) service; (2) economic efficiency; and (3) environmental sustainability of paratransit systems. There are types and degrees of taxi and car service integration that will provide the same levels of paratransit service, for approximately the same cost, but with a measurably smaller ecological footprint.

CHAPTER 2 – THE EVOLUTION AND HISTORY OF ACCESSIBLE GROUND TRANSPORTATION SERVICES IN THE UNITED STATES

A. Paratransit Services

Paratransit systems exist because the United States federal government enacted laws such as Section 504 of the Rehabilitation Act of 1973 (*1*) and the Americans With Disabilities Act ("ADA") which prohibit discrimination on the basis of disability in, among other areas, transportation, and which require government-sponsored/subsidized transportation to provide accessible transportation for all U.S. residents, including for individuals with disabilities. The United States Department of Transportation ("USDOT"), which contributed to the language in the ADA, acknowledges that taxi service is important to the disabled, and encourages taxi fleets to offer accessible cabs, but stopped short of mandating a requirement for taxi fleets to be fully accessible (*2*), as it concluded that it would be unreasonable to enforce such a requirement (*2*).

The ADA, while exempting mandatory accessible taxicab service requirements (*3*), does provide a number of general aspects one must consider when planning for paratransit services, including:

> service provided in a core service must be provided in a corridor that roughly matches the fixed-route transit system, such as bus or rail, and extending three quarters of a mile on either side of the fixed-route corridor (although if service is being provided outside the

core service area for buses and outlying areas for trains, corridors may be designated up to 1 ½ miles from the fixed route);
next-day service should be made available and reservations, up to 14 days in advance, should be permitted;
reservations must be available during at least all normal business hours of the entity's administrative offices, as well as during times, comparable to normal business hours, on a day when the entity's offices are not open before a service day;
the fare charged for paratransit services cannot be more than twice the fare paid by a person without disability on a fixed-route system (although premium charges applicable to a trip of a similar length, at a similar time of day, may be added);
the prioritizing of trips is not permitted;
matching paratransit service must be offered during the same days and hours as the fixed-route system is in operation; and
public entities are prohibited from limiting the amount of paratransit services provided to ADA-eligible persons (*3*).

B. Taxicab Services

There are provisions in the ADA regarding the obligation of public entities that deal specifically with transportation; however, these requirements mostly apply to mass transit (buses, trains, etc). These provisions ensure that those who use wheelchairs are able to board safely and will not be refused service. Mass transportation entities are required to make efforts to purchase or lease wheelchair-accessible vehicles, although this mandate does not apply to private entities providing taxi service (*3*).

However, the ADA is not completely silent on taxicab service, and does, in fact, specifically address the issue of private entities that provide taxi service. In this case, a passenger cannot be discriminated against due to his or her disability and must be provided this service at the same cost and without any refusal by the driver to stow mobility devices (*3*). This is also true for private entities that provide other transportation services, such as limousines and car services (*4*).

Although taxi drivers are not required to purchase wheelchair accessible vehicles, the ADA provides that when a vehicle is purchased for use as a taxicab that is not considered an automobile (i.e. a minivan), the vehicle must be accessible unless the provider can demonstrate that it is providing equivalent service under the "Equivalent Service Standard" (*3*).

The Equivalent Service Standard states that providers of taxi service will be in compliance with the ADA if individuals with disabilities are provided the following service characteristics in an equivalent matter to individuals who are not considered disabled:
Response time;
Fares;
Geographic area of service;
Hours and days of service;
Availability of information;
Reservations capability;
Any constraints on capacity or service availability; and
Restrictions priorities based on trip purpose. (*3*)

There are no current federal regulations that require a minimum number of accessible vehicles that a taxi service provider must maintain in their fleet.

Some municipalities have gone further than the ADA requires, although this can be problematic should the services provided above and beyond ADA requirements fall short of the needs of the individual, in which case the municipality could be liable for violating the Equivalent Service Standard. For example, if a municipality provides the latest in "cutting edge" communications technology for people who: i) are blind; ii) have low vision; iii) are deaf; or iv) are hard of hearing, this could be in violation of the Equivalent Service Standard should the technology not be maintained in a manner that allows disabled individuals to use it (*5*).

Despite this, New York City, as an example, takes a very progressive approach to paratransit services provided within its local jurisdiction.

CHAPTER 3 - NEW YORK CITY'S ACCESSIBLE TRANSPORTATION SYSTEM: A CASE STUDY

A. Access-A-Ride Paratransit Program

New York City, like Chicago (*6*) and San Francisco (*7*) (both of which allow their paratransit customers to utilize taxicabs at reduced rates), has taken a progressive approach in providing accessibility for their taxicab fleets. The New York City metropolitan area contains over 60% of the passenger car service industry in North America and over 30% of the industry worldwide (*8*). The total number of vehicles licensed and regulated by the New York City Taxi & Limousine Commission (TLC), including taxicabs, commuter vans and For Hire Vehicles ("FHVs") is in excess of 60,000 vehicles. According to the TLC, New York City FHVs - defined by the TLC as vehicles not permitted to accept street hails from prospective passengers (*9*) - are the only vehicles permitted to be solicited by a prospective passenger by contacting and pre-arranging or scheduling a pick-up through an affiliated for-hire radio (computer) dispatch service base. However, taxicabs can now be summoned through a smart phone through what has been referred to as an "e-hail." (*10*)

Currently in New York City, a state agency known as the Metropolitan Transportation Authority/New York City Transit ("MTA"), provides paratransit services to the city through its Access-A-Ride (AAR) program. The AAR service area encompasses the city's five boroughs as well as a ¾ mile corridor beyond fixed-route service across the city's borderline into the nearby areas of Nassau and Westchester counties. Services are provided by private carriers who contract with the MTA and use lift-equipped vans or sedans. In addition, service is currently augmented by the use of private taxis, livery and black car services. Attention has been given to the potential financial benefits of such integration, and some have estimated that cost-per-trip can be reduced more than 50% by using these vehicles instead of the more costly AAR vans.

AAR operates 24 hours per day, 7 days per week, and offers the following services:

(i) shared-ride (several customers share a vehicle);
(ii) door to door; and
(iii) feeder service, which is offered by both paratransit and public transit.

Feeder service refers to a trip in which AAR transports the customer for the first leg of the trip, from the starting point to a fixed-route bus/subway stop.

Customers must apply to be qualified to use AAR, and if a fixed-route transit bus can make the entire trip, paratransit service will not be provided. There are fourteen (14) private carriers that provide the service by sedans or lift-equipped vans. Usually, taxi service is allowed when the AAR vehicle is delayed more than 30 minutes after scheduled pick-up time and no other accessible car service is available, although authorization by an AAR agent is required in order to hail a taxi. Should taxi service be necessary and authorized, the customer is reimbursed the cost of the trip less the full AAR paratransit fare. Further, a passenger's maximum ride time varies according to the distance of the trip. For example, a trip with a distance of 0-3 miles may take as long as 50 minutes, while a trip with a distance of 14 miles may take a maximum of more than 2 ½ hours (*11*).

While AAR is a mandated and necessary service, its execution has proven that it could better serve the market it is trying to reach. For example, in order to take advantage of AAR, a passenger must make a reservation one to two days in advance (*12*), which hampers a passenger's ability to be in control of his or her readiness to begin or modify the trip while not being provided with critical information regarding time and distance. Further, although the MTA claims that 95 percent (%) of departures are on time, the MTA's definition of "on time" means "within a half-hour", which can be a long time to wait on the sidewalk for a passenger with a disability or if there is inclement weather (*13*).

B. Taxicab and For-Hire Vehicle Accessibility

As of October 2013, New York City's taxi fleet consisted of 13,237 vehicles (*14*), of which only 231 were wheelchair-accessible (*15*). However, twenty-two (22) months earlier in December 2011, Governor Cuomo signed into law the Street Hail Livery Law ("SHLL", upheld by the New York State Court of Appeals on June 6, 2013), which sought to address two key issues: the lack of accessible vehicles for City residents and non-residents with disabilities, and the lack of availability of yellow cabs in the four (4) boroughs outside Manhattan, as well as the areas of Manhattan outside of its Central Business District ("CBD"). The law authorizes the TLC to auction 2,000 yellow taxicab medallions for accessible taxicabs, which are permitted to pick-up street hails in all boroughs, including the CBD in Manhattan (*16*). In November 2013, the city sold the first 200 of these accessible medallions (*15*).

The SHLL vehicle outer borough permits are to be sold over the course of three (3) years, as follows: 6,000 permits each year to existing livery vehicle owners and/or drivers who have been in good standing with the TLC for one (1) year. Further, the SHLL requires that a minimum of twenty percent (20%) of all outer borough livery vehicles be wheelchair accessible. Whether the percentage of accessible livery vehicles will increase will be determined by a HAIL market analysis to be conducted by the TLC, but the minimum will remain 20%. Further, purchasers of HAIL licenses will be eligible to apply for grants up to $15,000 to either purchase a wheelchair accessible vehicle, or to retrofit their existing vehicle to make it wheelchair accessible (*17*).

On April 30, 2014, the TLC adopted rules that provide that 50% of the city's yellow taxi fleet be wheelchair accessible by 2020 (*18*) pursuant to a settlement brought about from litigation by disability advocates against the city for lack of accessibility in the city's taxi fleet (*19*).

C. NYC Accessible Dispatch Program

To try to alleviate both the problems with AAR and the lack of accessible taxis in the city's fleet, the TLC, in September 2012, launched a program called the Accessible Dispatch Program ("ADP"), an initiative that provides wheelchair-accessible taxi dispatching services to disabled residents of, and visitors to, New York City. The ADP arose from the Accessible Dispatch Pilot Program (the "Pilot Program") that took place from July 2008 through June 2010 (*20*). The Pilot Program attempted to use a central dispatch system through its all-encompassing "311" information line to allow passengers who use wheelchairs to reserve accessible taxis (*21*). The project tested dispatching technology, measured demand for wheelchair accessible vehicles, and helped the city determine how to best provide accessible for-hire service (*21*). Approximately 5,828 trips were taken throughout the duration of the Pilot Program, serving approximately 2,700 customers (*20*). There were an average of 8 trips per day with an average wait time from call to pick-up for "on-demand" trips of 44 minutes, with a median wait time of 29 minutes. The average wait time for "scheduled" trips (a scheduled pick-up for 30 minutes or more in advance) was 23 minutes, with a median wait time of 10 minutes (*20*).

In light of the success of the Pilot Program, the TLC launched the permanent ADP on September 14, 2012 (*22*). A private dispatch company vendor was awarded the city contract to dispatch accessible taxicabs to locations within Manhattan. The ADP is now a centralized service providing on-demand transportation 24/7, 365 days a year. There are multiple ways to book a taxi from the ADP, including calling 311; calling or sending a text message to the dispatch center directly; use the ADP smart phone app; or booking online (*23*). Reservations do not need to be made in advance; however, they can be if the customer wishes to do so, which may lead to a lesser wait time. Passengers pay the normal metered taxi fare in New York City from the point of pick-up to destination, and there are no extra costs to passengers. Further, all accessible taxis are equipped with GPS, so the dispatch center can effectively manage and monitor the entire accessible fleet.

The ADP has made it substantially easier for people with disabilities in New York City to obtain a wheelchair accessible taxicab (*24*). Those who use the ADP find that it provides them with increased flexibility and freedom with respect to transportation options (*24*). Once the request is received by the dispatch center, it will send a notification to the nearest accessible taxi to pick the customer up. If the driver does not accept the request within two (2) minutes, then a notification will be sent to the next nearest accessible taxi. Drivers are compensated for drive time from the point they accept the request until the customer is dropped off, while the ADP covers the fare from the point of acceptance to pick-up. Therefore, it is a win-win situation for both the customer and the driver, as the customer only pays for the time they are in the taxicab while the driver is compensated for the entire time they spend serving the customer (*25*). All drivers of wheelchair accessible vehicles are trained in ADA-compliant responsibilities, service and etiquette, including (but not limited to) how to properly stow and secure wheelchairs and how to properly handle service animals. Drivers are also trained on how to effectively load and unload passengers amidst Manhattan's dense traffic (*26*). As of April 2013, the average wait time, from the minute an order is made to the moment a taxi arrives at the pick-up, was 14 minutes (less than half the average time of the pilot program) (*27*).

CHAPTER 4 – NEW YORK CITY'S ACCESSIBLE ECOLOGICAL FOOTPRINT

A. Ecological Footprint Models

The general term "ecological footprint," refers to a measure of human demand on the Earth's ecosystems. It is a standardized measure of demand for natural capital that may be contrasted with the planet's ecological capacity to regenerate. For purposes of this paper, we use the term "ecological footprint" because the precise measurement methodology will emerge in the course of the study. If greenhouse gas emissions become the sole focus, then in effect the ecological footprint will be a "carbon footprint." If the circumstances merit a more wide-ranging measure of environmental sustainability, then a broader-based measure of ecological footprint will be used. The key will be to perform an inventory of all significant ecological impacts reasonably associated with the MTA's current provision of paratransit services within the area being studied. Inevitably, decisions will need to be made involving any model as to how far to trace life-cycle impacts and what are the appropriate boundaries. The analysis herein does not include life-cycle analysis, but instead focuses solely on vehicle emission reductions based on vehicle type and manner or duration of use.

A preliminary search of studies from around the globe show very little that analyze the ecological footprint of paratransit services. For instance, a study by Diwakar Gupta, Hao-Wei Chen, Lisa Miller, and Fajarrani Surya from the University of Minnesota- Department of Mechanical Engineering, evaluated the efficiency and service quality of paratransit operations (*28*). This study focused on reoptimizing the software used for such purposes and evaluated the selective use of non-dedicated vehicles and service providers (e.g. taxi services) for lowering operational costs (*28*); however, here is no mention of an ecological footprint.

A Chicago-based case study explores the relationship between residential locations on household patterns of vehicle miles traveled, and, by extension, energy consumption and greenhouse gas emissions (*29*). However, paratransit and taxi integration are not mentioned. Further, a study on the city of Indore, India focused mainly on trip characteristics and decreasing vehicle usage (*30*), yet, again, it fails to mention taxi integration or Greenhouse Gas Emissions.

B. Analysis of NYC Access-A-Ride Footprint Data & Reduction

The MTA has provided some information relevant to AAR's ecological footprint, as it is a founding member of The Climate Registry ("TCR"), a nonprofit organization that sets consistent and transparent standards to calculate, verify and publicly report greenhouse gas emissions into a single registry. In 2012, the MTA released a Sustainability Report that contained information regarding AAR emissions. As it states:

> " (AAR) is paid for by the MTA, but operated by contractors. Per TCR's General Reporting Protocol (GRP), this takes it outside the ambit of the MTA's operational emissions. As a result, MTA chooses to report these emissions voluntarily, but they are not subject to the third party verification process. Including Access-A-Ride emissions, MTA's total emissions were 2,193,844 metric tons carbon dioxide equivalent. The paratransit rides, as may be expected, are very carbon intense as they are often personalized for one rider. However, they form only about 4% of the entire emissions of the MTA." (*31*)

Thus, the MTA's unverified numbers bear that AAR is responsible for 84,282 metric tons of carbon dioxide annually.

This is not the end of the story, however. In addition to measuring the amount of metric tons of carbon dioxide that AAR generates, another measurement that is crucial in determining

the difference in the carbon footprint between paratransit and taxicab usage is the "Green House Gas (GHG) Emissions per Passenger Mile Traveled (PMT)" formula. The table below is unpublished data from the MTA and displays a number of components referencing GHG emissions for both AAR and Able-Ride ("LI Bus"), a paratransit program operated in Nassau County, Long Island, New York (which, at the time, was also operated by the MTA), including GHG emissions in pounds per Vehicle Mile, Vehicle Revenue Hour and Unlinked Passenger Trips.

However, the key information provided in the table, as will be further explained below, is the GHG emissions in pounds per PMT in 2011. As shown, the GHG emissions in pounds per PMT ranged from 2.1 lbs/PMT (for AAR) to 3.5 lbs./PMT (for LI Bus).

TABLE 1 MTA Paratransit Vehicle Statistics

2011	Annual Vehicle Miles	Annual Vehicle Revenue Hours	Unlinked Passenger Trips	Passenger Miles	GHG Emissions (tons)	GHG Emissions (lbs)	lbs/VM	lbs/VRH	lbs/UPT	lbs/PMT
DR NYCT	69,603,177	5,310,957	5,905,422	68,075,978	65,953	145,401,014	2.08900	27.37755	24.62161	2.13586
DR LI Bus	3,486,862	209,628	339,799	3,104,678	4,959	10,932,298	3.13528	52.15094	32.17284	3.52123

In October 2008, Transportation Alternatives, a non-profit New York City organization dedicated to improving the city's transportation system, published "Rolling Carbon: Greenhouse Gas Emissions from Commuting in New York City", which reported that the Ford Crown Victoria (the model used for approximately 92% of the city's taxis at the time) generated GHG emissions of 1.5 lbs. per mile (*32*). Further, in 2014, the TLC published the 2014 Taxicab Fact Book, which reported that 600,000 taxicab passengers take 480,000 trips per day, for an average of 1.2 passengers per taxicab trip (*33*). Thus, when taken together, a taxicab produces GHG emissions in the amount of 1.25 lbs./PMT, approximately 60% to 35% the GHG emissions per PMT than a paratransit vehicle.

Another carbon emission analysis can be performed simply by looking at the fuel economy of the vehicles being utilized in paratransit. According to the MTA, the AAR vans currently in use average seven (7) miles per gallon (*34*), while according to the TLC, taxicabs currently in use average twenty (29) miles per gallon (*33*), representing more than a 400% increase in the fuel economy of a taxicab as compared to an AAR van. In fact, on January 23, 2012, the MTA announced the purchase of thirty (30) wheelchair-accessible small vans (which have also been utilized as taxicabs around the country) to add to its AAR fleet, in no small part due to the fact that these vehicles have a fuel economy of 15 miles per gallon (and 13 miles per gallon for its Compressed Natural Gas version) (*34*)

Thus, on its face, it is clear that the utilization of taxicabs in the paratransit system will lead to less pollution and financial costs while enhancing the passenger's quality of life by the avoidance of the long wait times, indirect service and shared rides.

CHAPTER 5 – ACCESSIBLE GROUND TRANSPORTATION REFORM – A NEW PARADIGM

A. On-Demand Accessible Transportation (Taxicabs & Green/Boro Cabs)

While the ADP has been a benefit to all residents of, and visitors to, New York City, and the promise of more accessible taxis and liveries on the street is significant for people with disabilities, problems still remain. For example, drivers of accessible taxis have found it difficult to find space in the middle of heavily congested streets to accommodate wheelchair users; insurance premiums for drivers and vehicle owners are likely to rise; and many disabled riders would far prefer home pick-up to an uncertain wait on a corner in bad weather. Moreover, the high cost of riding a cab is a particular deterrent for people who are on fixed incomes (*35*).

A solution that would be highly beneficial to passengers and drivers alike would be to earmark a small fleet of wheelchair-accessible taxicabs and all accessible green outer-borough taxicabs mandated by the SHLL that disabled passengers could call upon, through a centralized dispatch system, at any time of day or night, as part of the region's mass transit on-demand system. The City could convert the existing AAR program run by the MTA into a combined system of on-demand and pre-arranged services. As it stands now, AAR spends more than $380 million a year with an average cost per ride of $30 to $50, which could be lowered to a range of $12 to $15 if the AAR vans were replaced with accessible cabs. The system would rely on usage patterns to determine the right number of cabs instead of setting them by fiat. Passengers would pay the same cost as a subway trip with a discount for purchasers of certain fare cards (*35*).

The MTA, in fact, has been successfully testing such a program, which will soon become permanent (*36*). It would allow the use of custom-built vehicles instead of retrofitted ones. Further, the MTA or the city would enforce service standards to ensure that wait times were reasonable and drivers properly trained. Over time, as the service became more reliable, demand would rise — after all, door-to-door service for the cost of a subway ride is far cheaper than hailing a retrofitted yellow taxi. This proposal is similar to the program in Chicago, where only 90 wheelchair-accessible cabs (about 1 percent of the total fleet) are, nevertheless, efficiently dispatched through a single toll-free number.

B. Pre-Arranged Accessible Transportation (Brokerage Models)

Currently, there has been an emergence of brokerage models by human resource agencies in the paratransit world, in no small part due to the promulgation of the Medicaid Non-Emergency Medical Transportation (NEMT) program. As pointed out by Paratransit Watch, a popular accessible transportation blog, a number of states have chosen, either in whole or in part, to employ the use of brokers to manage their NEMT programs (*37*). These brokers do not usually provide the actual transportation, but rather enroll and contract providers to perform the service, whether the vehicles are called Ambulettes, Ambucabs, Cabulances, Medi-Buses, Medi-Vans or Medi-Car Services (*37*).

Given the conclusions above regarding the positive impact of integrating taxicabs into the paratransit system to reduce costs and pollution while improving the quality of life of the passenger, it is suggested that these brokers engage in contracting with providers of taxicabs to help promulgate this solution. Further, agencies such as the MTA may designate a fleet of sedans specifically for their utilization by these brokers, which would result in an increase in point to point service for a single passenger or a group of passengers without the long wait times, and further eliminating non-direct, multi-passenger vans that circle and pollute the city.

C. The Future Role of Multi-Passenger Vans (Feeder & Peak Service)

Despite the conclusions called for in this paper regarding increasing taxicab service in paratransit, there will continue to be a need for multi-passenger vans. As stated above, feeder service refers to a trip in which AAR transports the customer for the first leg of the trip, from the starting point to a fixed-route bus/subway stop. For those passengers that choose this service, the multi-passenger van is an ideal option, as the distance traveled by the van is generally shorter than a door-to-door trip, thus having less of a carbon footprint. This can also be a valid solution for disabled passengers, as all of New York City's buses are wheelchair accessible (although not all subway stations are accessible, the MTA provides a detailed list of its accessible subway stations on its website) (*38*).

Further, peak service refers to service being provided during rush hour. Just as carpooling helps to reduce carbon emissions and the number of vehicles on the road, multi-passenger vans in the paratransit system can be efficiently and ideally utilized during peak service hours in order to achieve the same result.

D. Technology (Smartphone Apps, Digital Dispatch Systems & Regulatory Dashboard – Carbon and Emissions Calculators & Monitoring Systems)

As explained above, there are multiple ways to book a taxi from the ADP, including sending a text message to the dispatch center directly, using the ADP smartphone app or booking online. Smartphone apps have become a significant component on the transportation scene; although there is controversy surrounding some of these apps, others have proven to be a valuable tool for commuters and passengers who require use of a wheelchair accessible vehicle. For example, a study of commuters in Boston and San Francisco found that people who gave up their cars for a week did not lose potential autonomy as they were armed with smartphone apps that provide real time information about transit schedules and delays (*39*). Further, on June 26, 2013, Chicago announced a new smartphone application that makes it easier for disabled passengers to locate wheelchair-accessible vehicles as part of its own dispatch program (*40*).

In addition to the proliferation of Smartphone App technology, there is also a movement afoot to provide carbon emission information through the use of technology. In 2008, San Francisco's BART released a first-of-its-kind comprehensive Strategic Plan that emphasized sustainability and reduction of carbon emissions as major goals of its mass transit system in order to improve the quality of life of Bay Area residents, including a plan to develop Transit Sustainability Guidelines. The results of this goal include a present-day "Carbon Calculator" on the BART website that allows users to see the amount of carbon dioxide saved when choosing to travel on BART instead of driving (*41*).

Another significant carbon reduction solution was considered by the San Francisco Municipal Transportation Agency ("SFMTA") with respect to its Electronic Taxi Access System ("ETA") (which would provide taxicab passengers with the ability to electronically hail a taxicab.) (*42*). The SFMTA proposed the use of an On-Board Device ("OBD") that would be able to communicate with the vehicle's engine and produce actual greenhouse gas emission data according to the specific vehicle, the vehicle's company and the fleet the vehicle is a part of. (*42*). Utilization of the OBD model to report carbon emissions would be a significant technological tool to assist in the proliferation of a greener transportation system.

In sum, the utilization of technology in the paratransit and public transportation arenas can help lead to both an increase in the reliable and efficient availability of accessible transportation and a decrease in carbon emissions that will benefit everyone.

CHAPTER 6 – CONCLUSION

The lack of coordinated policymaking, diverse funding streams, and inefficient use of multi-passenger vans over non-fixed routes has, in New York City for example, created government subsidized costs in excess of $60 per passenger. As a solution, point-to-point transportation via taxicab or sedan can be delivered for less than $15 per passenger. Using the Unlinked Passenger Trips information contained in the Table above, this would result in a saving in just one year of approximately $281,000,000. Taxpayer savings like NYC, if applied throughout the United States, would be astronomical, as a 2013 Paratransit Survey conducted by Metro Magazine reported that 24.9 million riders were provided trips in 7,024 vehicles nationwide. (*43*). As the survey also indicates, costs and funding "far outweighed any other challenges" for paratransit operators. (*43*). This is confirmed by a pair of surveys conducted by the United States Government Accountability Office, citing an increase in ridership and a resulting increase in costs (*44*) and reporting that $258,000,000 in fiscal year 2014 is being funded by the Federal Transit Administration's Enhanced Mobility of Seniors and Individuals with Disabilities program for accessible transportation (*45*).

As a result of savings that would be provided by the utilization of point-to-point transportation via taxicab or sedan as an alternative to paratransit, it is proposed that an accessibility "lockbox" be created whereby a small surcharge be added to each taxicab trip to be deposited in a single fund that would be utilized exclusively for accessibility issues, not unlike the model currently being utilized by New York City (*46*).

Further, the oversized carbon footprint created by mostly empty vans crisscrossing urban environments to respond to the diverse geographical and time of day service requests of disabled passengers, can be significantly reduced by replacing multi-passenger non-fixed route vans with point-to–point taxicab or sedan services.

The foregoing should be accomplished not just replacing vans with sedans, but by instituting a complete system overhaul that uses both technology and strategic deployment of different vehicle types and services; a coordinated effort to fill public transportation service gaps as part of the overall transportation mesh or network for disabled passengers. These accessible transportation reforms can be accomplished implementing the following policies and ideas: (1) Replace most demand responsive multi-passenger public paratransit vans with sedans that provide pre-arranged individualized point-to-point service (either using a private contractor or contractors to deliver for-hire ground transportation service through the use of a brokerage model to coordinate dispatch between multiple companies, or outsourcing to one vendor); (2) Utilize multi-passenger vans only for feeder services or routes in areas underserved by mass transit (buses and subways) where there is an established demand for accessible service, and for peak service in central business districts for on-demand service; (3) Utilize not all, but the right number of "hail" or on-demand taxicabs working through a centralized dispatch system that will ideally utilize the latest in technology as the exclusive short-term model until such time as most or all taxicabs become accessible. It is also suggested that a single government app for all such services per jurisdiction be provided by the appropriate agency and that said app should be well known and marketed to the disabled community and able to provide all integrated services,

including on-demand taxicab and for-hire vehicle prearranged services (and to eliminate the need for credit or other cards).

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