Keynote Address by Michael Replogle

Nashville's Drive to Work Symposium

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Introduction

I will be talking this morning about how integrated congestion and multimodal management strategies can make metropolitan transportation work better, with more choices and lower costs. We'll start by considering some lessons from my experience in New York City. We'll talk next about managed lanes and how they're working in different places, with different options, considering traffic science and its paradoxes. I will discuss how integrated multimodal mobility strategies might be bundled as Integrated Congestion and Multimodal Mobility Management, or IC4M. I will close by summarizing a few key ideas that could constitute an effective short-term action framework for Nashville and Middle Tennessee.

New York City Experience

From 2015 to 2021 I served as Deputy Commissioner for Policy at the New York City Department of Transportation. Our agency has a $17 billion, ten-year capital program and a $1 billion annual operating budget, with about 5500 employees. We manage all of the surface streets, most highways, free bridges and tunnels, the Staten Island Ferry, street lights, 13,000 interconnected and computer-controlled traffic signals, lane markings, bike lanes, and bus stops. We work closely with other agencies in the city, like the Taxi and Limousine Commission Port Authority, and the Metropolitan Transportation Authority, which operate most public transportation. Our agency is guided by a strategic planning framework that sets goals to reduce greenhouse emissions, improve traffic safety, improve asset management, electrify our transportation, and improve transportation equity.

Much of New York City's progress has come through reallocating and better managing street space to expand travel choices, access, and safety. Twenty-five years ago, 60% of trips in the city were by walking, cycling, and transit. Today, 68% of trips are on those sustainable modes and the city has set a goal of getting to 80% sustainable mode share by 2050 through integrated mobility strategies as the city continues to grow.

We've reduced the amount of car use in the city while growing the city by a million jobs and a million population over the last several decades. Vision Zero traffic safety has been at the core of our transportation initiative, recognizing that the only acceptable number of people killed in the traffic system should be zero. By designing and engineering safe systems and taking into account what leads people to get injured or killed, we can prevent serious deaths and injuries in time.

Through our Vision Zero initiative's variety of approaches, we were able to cut pedestrian deaths by 40% over five years. This entailed safety education, redesigning our streets, and stronger conventional police enforcement and automated enforcement.

We reduced our citywide speed limit from 30 miles an hour to 25 miles an hour and adopted the largest automated speed enforcement camera program in the Western Hemisphere, with over 2200 cameras in 750 school zones. You only get a ticket if you go more than ten miles an hour over the speed limit, so there's no doubt as to whether you were speeding or not. The driver doesn't get points; rather the vehicle owner gets a $50 citation. These cameras change behavior. Seventy percent of all people who get a ticket don't get another one within a year. There's been a 14% decline in injuries thanks to the cameras and 70% less speeding in the corridors with cameras.

New York City complements cameras with the use of an engineering toolbox that includes such things as leading pedestrian intervals, which give pedestrians a head-start when the traffic signal changes to get positioned in the street so that drivers better see pedestrians and avoid hitting them. We extend sidewalks, install pedestrian refuges, and re-engineer conventionally auto-oriented streets into more pedestrian-friendly, complete streets. We concentrate these strategies in priority corridors where we see the most safety problems. Pedestrian fatalities fall by half in priority corridors after concentrated use of these tools.

An example of this is Queen's Boulevard, which in the late 1990s was called the "Boulevard of Death" because as many as 18 people a year would die in this six-mile stretch of roadway. We cut the speed limit. We redesigned the street. As before and after pictures show, we created bus lanes, bike lanes, and wider sidewalks. After that transformation, we went five years without a single fatality on Queens Boulevard, where once there were 18 fatalities a year.

New York City has used these kinds of approaches on streets all over the city, on both suburban and urban roads. The lessons are relevant to solving traffic safety problems across America. In New York City, we were often able to help overcome opposition to traffic management and street space reallocation by working with communities, working with community boards, working with advocacy groups, and working around the issues that people care about that touch their lives the most. Traffic safety was our core value.

In New York City, 259 people were killed in the traffic system in 2023, some 12 percent lower than in 2013. We cut pedestrian deaths by 45 percent, in part by reducing the dedication of free parking street space and reallocating that to bus lanes, and bike lanes, and improved pedestrian visibility at intersections. There were more than a few times when the fighting got tough, and City Hall backed down. But often we were able to prevail through political leadership and demonstration of results. Tactical urbanism has been a leading approach. Instead of making a ten-year plan for projects and doing a bunch of computer modeling, we often said, let's put some pylons on the street and see how it works. Let's use paint. Let's bring in some big rocks that we can use to reallocate the street space and create new temporary plazas. If people don't like it, we can take it out. We tried it, and most people liked it. Occasionally we adjusted or took it out. But more often what we put in through some consultation with communities in fact stuck.

To advance safety, efficiency, equity, and environmental goals, New York City has also started to manage curb space differently, working to strengthen a culture of compliance with traffic laws. We introduced and are expanding pay-by-license-plate-parking, toll collection, and traffic enforcement, which makes it much more efficient to administer curb restrictions and parking rules. If a city fails to enforce its traffic rules, it's almost worse than not setting any rules at all because it creates a culture of impunity. A culture of respect for traffic law can bring orderly, safer, and more efficient use of streets and highways.

New York City has dramatically improved conditions for cycling in the city over the last decade; biking has more than doubled. Since 2014, over 479 miles of bike lanes have been built including 180 miles of protected bike lanes. We grew our bike share network from 6,000 in 2015 to 40,000 public bikes by the end of 2024. We began specifically promoting the use of e-bikes for people and freight in 2020. Today over 65,000 e-bikes and 450 e-cargo bikes are cutting traffic and replacing trucks with more efficient cargo bikes, getting goods delivered faster and at lower cost.

New York City has also given more priority to buses and trucks in traffic, with signal priority, reserved lanes, and other strategies that speed priority traffic to support equity and efficient economic activity. We created an Open Restaurants Program that was designed for rapid scaling during the COVID-19 pandemic. Within a matter of weeks, 6,000 empowered restaurants converted sidewalks and parking spaces to set up outdoor tables and chairs. Converting over 10,000 parking spaces to restaurant uses brought life back to most parts of the city and saved 100,000 jobs.

New York City has learned from cities around the world. We noted how in Seoul in 2005, a major motorway was converted to a linear park and it improved traffic flow. This was another validation of something called Braess' paradox, which is when you take a road out of a network, often it makes the traffic move better on the whole network. On Broadway in New York City, when we converted many blocks of streets from motor traffic to create plazas, walking, and cycling space, we saw Midtown Manhattan traffic flow improve. The New York City DOT is continuing to extend the Broadway pedestrianization and bike lanes to more and more of Manhattan.

That said, we've also struggled with managing the motorways that are part of the New York City road network. Many of these are under the control of the State Department of Transportation (DOT).

New York City DOT helped foster the conversion of the Sheridan Expressway to a surface boulevard, working with the New York State DOT to make it safer. With a federal grant, New York City is now reimagining the Cross Bronx Expressway, maybe healing that scar across the Bronx by covering it and better managing the traffic. New York City continues to examine the future of the Brooklyn Queens Expressway.

Congestion pricing in New York City remains poised for implementation, with all systems in place to go live after years of challenges. Designed following the requirements of 2019 New York State Legislation, it would manage all the lanes entering Midtown and lower Manhattan, imposing a once-a-day congestion charge sufficient to fund $15 billion in capital expenditures by the Metropolitan Transportation Authority (MTA) for better regional bus and train service. Though the project had won final federal approvals and defeated legal challenges, New York State Governor Kathy Hochul – a formerly vocal supporter of the initiative - put implementation on indefinite hold a mere three weeks before its scheduled start-up in June 2024. In response, business, environmental, transit groups, and other supporters of the project in July 2024 filed litigation to overturn the Governor's move, which appears driven by polling concerns in several suburban swing congressional districts. MTA has had to cancel billions of dollars in contracts and transit services have become less reliable. Hundreds of millions have been spent to set up and win approval for congestion pricing which will be recovered only by activating the system. The Governor is now under attack for harming the region's economic and environmental health, worsening congestion, and impairing equity of access. Perhaps after the November election, the system will be put back on track.

In Stockholm, two weeks before implementation of a central area congestion pricing system like New York's was about to be implemented, popular support for the system was at its lowest, with less than 1/3 in support. But in a matter of weeks following implementation people came to love it. Drivers loved it because they got better reliability and time savings. Transit riders liked it because they got better service. And transport authorities and elected officials – even those who had opposed it - came to love it because it brought in revenue that financed improved regional transportation investments, which was good for the economy and at the ballot box. The Stockholm system was implemented from the start as a 6-month trial. When the trial ended the congestion charge was removed for 6 weeks leading up to a referendum. Traffic congestion had returned. A majority voted in favor of restoring the congestion charge and soon thereafter, the government restored congestion pricing, which retains strong popular support. Similar stories are found in many other cities where such systems have been put into place to manage traffic.

Managed Lanes

With that as context, let's talk about managed lanes.

So what should we do about congested freeways? This is something that's a big challenge across America. Many states, including Tennessee, are still adding more general-purpose lanes to roads in trying to solve congestion, which works as well as addressing an obesity problem by buying bigger pants and a bigger belt.

The reality is that induced demand cancels any gain. For every 100% increase in road capacity in a corridor, we can expect 50% to 120% increase in traffic within a few years, with 80% being typical.

In addition to general-purpose lanes, many states have been introducing managed lanes. Let's talk about their typology.

First, there are high occupancy vehicle ("HOV") lanes, restricted to carpools.

Second, there are high occupancy toll ("HOT") lanes, called choice lanes here in Tennessee, where solo drivers can pay a price to ride in the managed lane, which otherwise is free for carpools. But these new lanes are costly and induce new traffic and sprawl.

Third, there are HOTTER lanes and "Flexi-HOT", which Patrick DeCorla Souza of the Federal Highway Administration spoke of in a prior panel. "HOTTER" stands for "High Occupancy Transit and Tolls on Existing Lanes with Rewards." The "Flexi-HOT" lane concept would create a HOT lane without taking away any existing capacity, by creating peak-period-only shoulder lanes and tolling the managed lane only during times when there is corridor congestion. The HOTTER approach would give drivers and passengers app-based cash incentives to share rides and use managed lanes, with solo drivers paying only if they want to save time by using the managed lanes.

These strategies provide a spectrum of approaches to traffic management, some carrot, and some stick, providing various supply and demand incentives. Patrick DeCorla Souza has been doing some good related research which merits a closer look. Patrick's research on the Capitol Beltway, in Maryland, near where I live today, looks at what would happen if the state Department of Transportation were to convert two of the

existing free lanes into toll-managed HOTTER lanes, and then use the revenues to pay people to get into carpools and buses. He found that giving the right incentives could induce 1200 people who previously drove alone on this road to shift into carpools or buses. That could improve the travel speeds for everyone on the whole network, in both the free lanes and managed lanes, boosting the speed from 41 miles per hour now to 44 miles an hour for motorists in the free lanes, and from 41 miles per hour now to 55 miles an hour in the HOTTER managed lanes. This could be a big win for everyone but would be possible only with good operations, communications, and political leadership.

Should states add managed lanes and general-purpose lanes? Those may be politically easier because they satisfy special interests. But such new capacity increases traffic, is costly, takes a long time to put in place, and ultimately just makes traffic problems bigger over time, driving our communities apart rather than bringing them together.

Managed lanes can work well, as we heard on the previous panel, but only if they're enforced and only if most drivers comply with the rules. There are different ways to achieve that. However the most effective is to use automated toll management and enforcement techniques.

There are some lessons from Virginia, where we see a lot of high occupancy toll lanes. One of them is that the worst thing about express lanes is that when they end, you often see bottleneck congestion backups. This is another reason why it's valuable to price all the expressway lanes, rather than just adding more new HOT lane capacity where the current HOT system ends. Managing all the lanes on a motorway or entering a central area is the most effective outcome, as Stockholm, Singapore, Oslo, and other places have shown. This also makes it easier to integrate managed lane networks with free streets to avoid creating new bottlenecks.

Traffic Science

Now let's walk through some traffic science and illustrate the typical operation of a motorway, considering how average traffic speed varies with the number of vehicles through a typical daily cycle. I'll illustrate this using data from an inbound peak-direction 4-lane segment of I-66 motorway in Northern Virginia on a typical day a few years ago, shown in Figure 1.

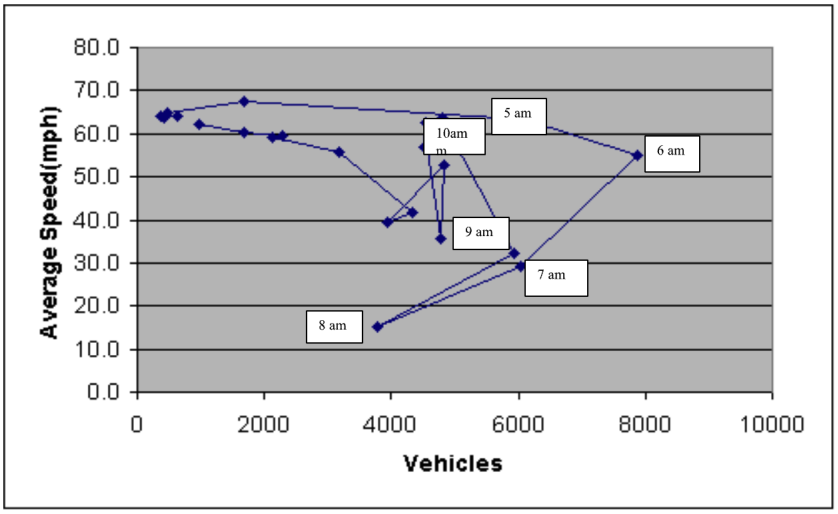

FIGURE 1: Typical Road Traffic Speed and Flow on I-66E in Northern Virginia

Early in the morning, between 5 am and 6 am everything's fine. People are going 60 miles an hour, even as almost 2000 vehicles per hour per lane use the roadway. But speeds rapidly degrade once you exceed the capacity of the road and pass from laminar to turbulent flow. The number of motor vehicles that can get past the peak load point falls as the speed falls. The road's capacity is being severely degraded because it is not managed for efficient flow.

By 7 am speed has fallen to 30 mph and throughput is down by 25 percent. By 8 am the speed had dropped to 12 miles an hour, and only 4000 vehicles, rather than 8000 vehicles moving past the peak load point.

Failure to manage the load has degraded the capacity, functionally equivalent to a brown-out in an electrical power grid. Finally, by 9 am, as the excess traffic entering the link begins to diminish, the backups shorten, and the freeway capacity and speed begin to recover. By 10 am the facility is back to efficient free flow conditions. This same pattern occurs across thousands of motorways around the world that experience unmanaged demand exceeding their practical capacity.

We wouldn't tolerate it if our electricity providers managed power grids so badly as this, causing brownouts or blackouts routinely. Why do we casually accept such conditions in our roadway networks? Electric utilities have developed more expensive backup power resources they can bring on to meet peak demands and they are empowered to adjust prices and incentives to shed heavy power users during peak hours. Roadway network operators – mostly state Departments of Transportation and toll authorities -- have recently started to realize that they might do the same. However many governments and populist citizens have remained distrustful of such ideas, preferring to pursue costly and failed highway capacity expansion rather than integrated demand and supply management strategies to address congestion.

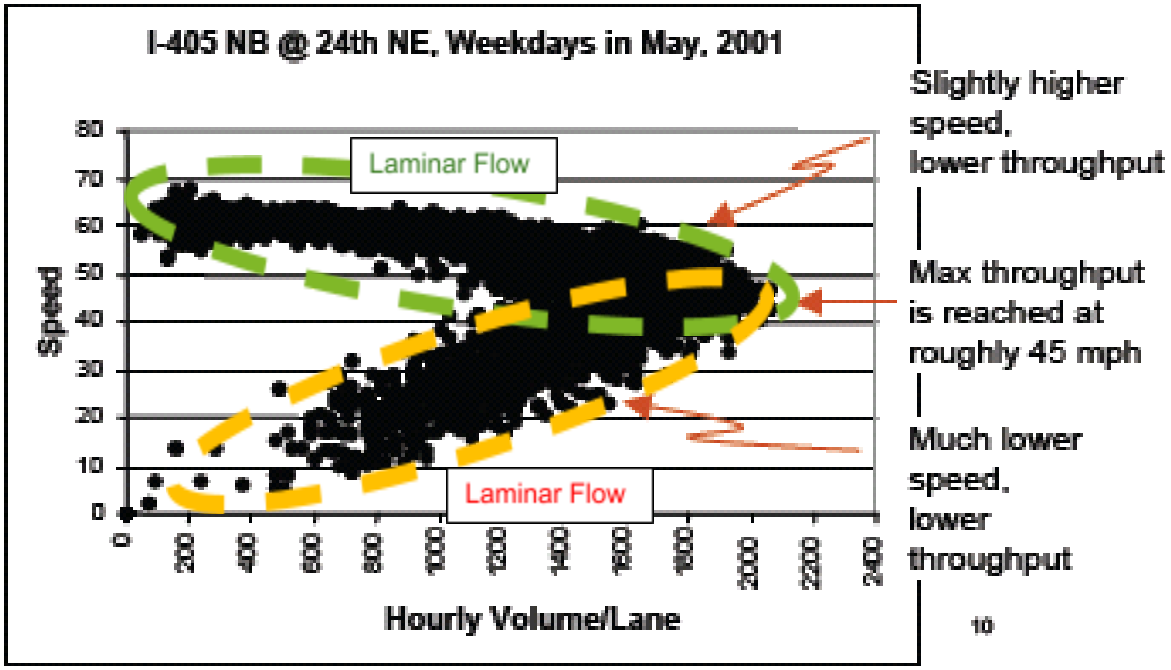

FIGURE 2: Typical Road Traffic Speed and Flow on Seattle's I-405 Northbound

This traffic science is just as applicable to Nashville as it is to Seattle or Washington DC. We see this transition over the course of a peak period. In Figure 2, with data from Seattle's I-405 NB, we can see the top part of that curve is the region of laminar flow, as it's called in fluid dynamics. When a facility goes from laminar flow to turbulent flow the speeds fall and the efficiency falls, as in the graph's lower part.

We can illustrate this by pouring two cups of rice through two identical funnels. In the first funnel, we dump the rice quickly into the funnel; a backup quickly forms, slowing the pace at which the rice falls through. In the second funnel, the rice is poured gradually into the top at a pace that keeps it from backing up. In a short time, all the rice has poured through the second managed-flow funnel; the first unmanaged-flow funnel remains backed up, moving slowly.

This is the same thing we see in photos of parallel managed lanes and unmanaged lanes on highways. For example, Figure 3 shows State Road 91 in southern California with two managed lanes in the center that are priced to remain free-flowing during the peak period, and four general purpose lanes in each direction that lose half their capacity during times of peak demand because they go into turbulent flow.

FIGURE 3: State Road 91, Orange/Riverside Counties, California, 2011.

Studies show the two managed lanes typically carry just as much traffic in the peak period as the four unmanaged general-purpose lanes. The vehicles in the managed lanes are traveling at three times the speed of the vehicles in the unmanaged lanes during the peak hour, 60 miles an hour versus 28 miles an hour.

So what future do you want to see? Do you want to wait eight or ten years to get HOT lanes that only serve some people and leave the majority stuck in a jam? Or do you want to consider how you might manage many peak-hour motorway lanes in ways that expand travel choices for all and protect your existing highway capacity for everyone to use even during hours of peak demand, saving billions of dollars that it would cost to widen highways?

Looking five years or eight years into the future, it's possible to manage many or all the lanes on congested expressways. Such managed lanes could operate at 50 miles an hour or more even during the most congested periods while offering more choices —incentives, more practical carpooling, and better transit options. If all the lanes are priced and managed like some cities are doing, like New York City may soon start to do, then the tolls can be much lower while fully protecting peak road capacity, and the travel speeds and the infrastructure costs are also a lot lower than building new lanes.

That said, a mix of unpriced lanes and managed lanes can operate and fit in most rights-of-way and can operate in existing lanes or new lanes. But adding access lanes, with grade separation for access ramps, is also very expensive and limits the number of people who can make use of them because you have to space entry and exit points along the facility. At-grade access for managed lanes is much cheaper if following the example of many states. On Minnesota's I-35, near-continuous access to the managed lanes is featured along 70% of the facility. In Salt Lake City, Utah, the I-15 managed lane shown in Figure 4 has 19 access points along a 42-mile stretch of managed lane HOT lanes. This works well and it gives people more travel choices.

FIGURE 4: I-15 Near-Continuous Access to Managed Lanes

Integrated Congestion and Multimodal Mobility Management

Might there be a practical strategy offering quick traffic relief without building a costly, parallel managed and choice lane network? I think the answer is yes and I call it "Integrated Congestion and Multimodal Mobility Management," or "IC4M" -- there are four guiding principles to IC4M:

1. Add no new road space when adopting a managed lane regime.
2. Toll the existing lanes (or as Patrick DeCorla Souza has suggested, consider using some of the shoulders creatively during the peak when first piloting the strategy in a region).
3. Use behavioral approaches to achieve the desired user outcomes.
4. Advance social and economic equity by reducing car dependence, expanding travel choices, and boosting efficiency.

The key elements include:

1. Some blend of HOTTER managed lanes, and general-purpose lanes,
2. Links to the surrounding streets and neighborhoods,
3. Corridor transit that better connects to nearby locations,
4. A personal digital interface and exchange -- better apps that help connect consumers to mobility services and keep consumers engaged as they're carpooling or biking or taking transit.

Many important elements of mobility management will be part of emerging IC4M apps:

a. Mobility-as-a-service (MAAS) apps so that people can find out in real-time about travel options and make connections if things get squirrely, or their plans change.
b. Mobility benefits management, like what Hytch and the GNRC are doing in Middle Tennessee.
c. Administering travel benefits and user charges, incentives, and tolls through apps.
d. Developing strategies to help people buy into things like pay-per-mile-insurance, which can help people save money if they drive less
e. Implement "Individualized ability marketing" programs, which is a very effective way of helping people understand their options,
f. Administrative support and dashboards to help the managers of the system see what's going on and fine-tune the strategies.

The IC4M approach is a way to build on our prior investment in freeways and expand travel choices with smarter incentives, information, and operations.

An Action Agenda for Middle Tennessee

What does this mean for Middle Tennessee? And how could this be translated into some key actionable items for next year? My recommendations are:

1. Build a strong regional coalition to advance the Choose How You Move initiative and the WeGo Essentials in Nashville. Both are sound packages for thinking about how to advance smarter mobility in the region and across Middle Tennessee.

2. Harness political will and leadership to create a culture of compliance with traffic laws, including enforcement of HOV restrictions on the 128-lane miles of HOV network in Middle Tennessee to reduce violation rates and ensure these lanes work effectively.

3. Expand and increase regional ride-sharing and transit incentives while increasing the fine for violating HOV lanes or choice lanes. Learn from practice in regions like Georgia, Virginia, and California where higher fines and greater enforcement foster compliance with HOV rules.

4. Seek federal grants to develop a HOTTER lane network by converting existing HOV lanes to choice lanes, following the HOTTER lane or Flexi-HOT lane approach.

5. After demonstrating success and acceptance, convert additional general-purpose lanes to Choice lanes, following the HOTTER lane approach, to help expand the overall effectiveness of network administration.

6. Win automated enforcement authority for safety and traffic enforcement in Middle Tennessee, including managed lane rules. Mobilize a political coalition of those concerned about workforce access, Vision Zero supporters who want to reduce the number of people killed and injured in the traffic system, and citizens frustrated with time wasted in traffic and lack of good travel choices in Middle Tennessee.

These things are practical and achievable. The folks here in this room are the nucleus of a coalition that can help lead change and move it forward in the next year.

Thank you very much for your attention. I wish you great success.