HOW NASHVILLE CAN CREATE A MULTIMODAL FREEWAY SYSTEM WITHIN FIVE YEARS

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In Nashville's low-density suburbs and surrounding counties, those who can't drive have limited access to job opportunities and services and are poorly served by public transit. Those who can drive face significant travel delays, commuting long distances to job sites during peak periods on congested freeways. This paper presents a systemwide management approach to implement and finance attractive new mobility options for both of these commuter groups throughout Nashville's seven-county regional area. The approach synergistically combines three innovations:

1. Flexible Choice lanes (also known as "Flexi-Choice" lanes) are created by using existing HOV or regular lanes with variable tolls *only* during peak periods (therefore "flexible")
2. Cash rewards for commuters who choose to share rides in carpools or transit. Net toll revenues are leveraged to finance investment and incentive costs.
3. Active management of freeway traffic with part-time shoulder travel lanes that operate *only* during peak periods, thus expanding highway capacity and providing faster travel for those who cannot afford tolls

INTRODUCTION

Not only is freeway expansion too costly (as high as $95 million per lane-mile[1]) and too slow; but research shows that it doesn't work long-term: A few years after a highway is widened, traffic increases to fill the new supply. The key to Nashville's congestion relief is to activate multimodal travel options that are practical and attractive. This paper shows how Nashville could deploy three innovations — (1) Flexi-Choice lanes, (2) cash rewards, and (3) active traffic management with part-time shoulder travel lanes — synergistically to expand multimodal travel options and relieve congestion throughout the region within 5 years. We call the combination a "Multimodal Flexi-Choice System," and argue it would be faster, cheaper, and more equitable and sustainable than expanding motorways.

FLEXI-CHOICE LANES

Under the Multimodal Flexi-Choice System, Flexi-Choice lanes would be created from existing left lanes (either high occupancy vehicles [HOV] or regular lanes) with new tolls imposed only during peak hours that vary with demand to keep them free-flowing. During peak periods of congestion, these Flexi-Choice lanes would be used by drivers paying tolls and transit buses and carpools using them free of charge. During off-peak periods when there is no congestion, Flexi-Choice Lanes would be open to all drivers with no tolls or other restrictions.

Flexi-Choice lanes entail smarter operation and management of existing lanes within the freeway footprint, thereby avoiding the need to build new road capacity, minimizing environmental impacts, and requiring far less time to implement than adding new lanes.

Flexi-Choice lanes with rewards and traffic management expand travel choices for all – not just for those who can afford to drive and pay tolls. That makes it highly likely this strategy bundle, unlike road expansion alone, would increase regional and local accessibility of all commuters to jobs and other opportunities, yielding net gains for equity.

[1] Based on Federal Highway Administration (FHWA), *Appendix A: Highway Investment Analysis Methodology* at: https://www.fhwa.dot.gov/policy/23cpr/appendixa.cfm#hers-improvement-costs. Costs in 2024 dollars calculated using U.S. Bureau of Labor Statistics *Inflation Calculator* at: https://www.bls.gov/data/inflation_calculator.htm

CASH REWARDS

Research shows a single car entering a congested freeway at the beginning of a 3-hour peak period delays all other vehicles that are behind it in that lane over the entire peak period. The total delay to all vehicles typically amounts to 3.3 hours,[2] valued at $56 in economic cost.[3]

Incentivizing the driver of that vehicle to ride as a passenger with another commuter is thus worth as much as $56. Under the Multimodal Flexi-Choice System, cash rewards would be cost-effective in inducing commuters to switch travel modes to reduce congestion as well as in increasing carpool and transit use if they are combined with free-flowing Flexi-Choice lanes that transit and carpool vehicles can use for free. Any surplus revenue from tolls on the Flexi-Choice lanes would provide a sustainable source of funding for the rewards program. Thus, Flexi-Choice lanes and cash rewards would work together synergistically to maximize person throughput on freeways without needing public financial support for cash rewards.

ACTIVE TRAFFIC MANAGEMENT WITH PART-TIME SHOULDER TRAVEL LANES

Active traffic management helps relieve traffic congestion at a much lower cost, much faster, and with fewer environmental impacts by smoothing the flow of traffic through less expensive infrastructure improvements such as ramp metering, variable speed limits, and part-time use of shoulders as travel lanes created for use during peak periods. An example of inexpensive infrastructure improvements is the restriping of existing pavement to create narrower regular lanes to make additional pavement width available for the shoulder lane.[4]

As part of the Multimodal Flexi-Choice System, active traffic management would include conversion of the right shoulder on freeways to a part-time travel lane (called a "Smart Lane" or "Flex" lane in some states) that is open to traffic only during congested periods when Flexi-Choice lanes charge tolls. This additional shoulder travel lane would reduce congestion to drivers in the free lanes during peak periods and would be reverted to a safety shoulder during non-peak periods when Flexi-Choice lanes are free, as shown in **Figure 1**.

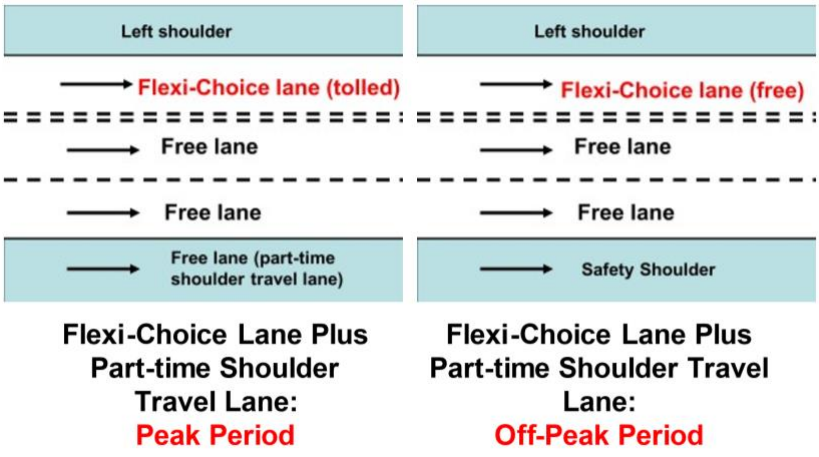

Figure 1. Flexi-Choice Configurations during Peak and Off-Peak Periods

[2] 6,000 vehicles are delayed for 2 seconds each amounting to a total of 3.3 hours for all 6,000 vehicles delayed over the peak period of 3 hours.
[3] The value of personal travel time is $16.74 per hour, based on USDOT's *Revised Departmental Guidance on Valuation of Travel Time for Economic Analysis* at: (https://www.transportation.gov/sites/dot.gov/files/docs/USDOT%20VOT%20Guidance%202014.pdf)
and US Bureau of Labor Statistics *Inflation Calculator* (https://www.bls.gov/data/inflation_calculator.htm
[4] Hunt, Jim, Pete Jenior, and Greg Jones. Providing A Shoulder to Drive On. Public Roads. Federal Highway Administration. March/April 2017. https://highways.dot.gov/public-roads/marchapril-2017/providing-shoulder-drive

Extra freeway lane capacity would thus become available at times of the day when it is most needed, and the same number of lanes would be available for use free of charge by motorists during periods when Flexi-Choice lanes charge tolls. This additional freeway capacity would also counter-arguments against the "take-away" of an existing free lane to create an HOV or toll lane. By providing an additional travel lane for use during periods when travel on Flexi-Choice lanes is restricted to HOVs and toll-payers, a part-time shoulder travel lane can work synergistically with a Flexi-Choice lane to increase both technical and political feasibility. Shoulder travel lanes have been implemented in 16 states in the US to provide inexpensive extra road capacity.

Figure 2 below shows one such lane in Hawaii. **Figure 3** shows how the lanes operate to ensure safety, using overhead speed signs to control speeds in all lanes and to indicate when the shoulder lane is open for traffic (with a green arrow) and when it is operating as a safety shoulder (with a red "X"). Figure 3 shows how part-time shoulder lanes operate to ensure safety in Cincinnati, Ohio, where the part-time shoulder lane is on the left, whereas the part-time shoulder lane would be on the right and the Flexi-Choice lane would be on the left in the case of a Flexi-Choice system in Nashville.

Figure 2. Shoulder Travel Lane in Honolulu, HI
(Source: Kittelson & Associates and FHWA's *Public Roads*)

It should be noted that the shoulders operate as travel lanes only during times of congestion. The shoulder lane (or any of the other lanes) may be shut down using overhead or side-mounted lane controls, as shown in Figure 3 if an incident warrants closing any of the lanes.

To assist state and local agencies in considering and adopting the part-time shoulder lane strategy, the Federal Highway Administration (FHWA) published a guide [5] that highlights more than 30 shoulder-use installations covering a range of design and operational approaches in 16 States.

Figure 3. Overhead Signage on I-275, Cincinnati, OH
(Source: Ohio Department of Transportation)

[5] FHWA. Use of Freeway Shoulders for Travel — Guide for Planning, Evaluating, and Designing Part-Time Shoulder Use as a Traffic Management Strategy. Publication #: FHWA-HOP-15-023. https://ops.fhwa.dot.gov/Publications/fhwahop15023/index.htm

MULTIMODAL FLEXI-CHOICE SYSTEM HELPS ACHIEVE OTHER KEY GOALS

This three-pronged Multimodal Flexi-Choice System would reduce congestion, provide choices for motorists, and generate revenue to fund cash rewards to incentivize the use of carpooling and transit. It would also assist in achieving other key Nashville metro transit goals. Flexi-Choice lane networks would:

- provide a congestion-free travel way for transit, improving transit service and access for those who can't drive or cannot afford to drive
- support fast, high-quality express bus service to and from suburban activity centers, emulating rail service that is typically viable only to and from the Central Business District
- help increase the attractiveness of alternative modes as more and more travelers get access to transit and carpooling on the Flexi-Choice network
- increase the pool of potential transit riders, allowing more frequent transit service
- increase the pool of potential carpoolers, resulting in more and better carpool matches
- create a virtuous cycle – more transit riders and carpoolers, leading to more frequent transit service and better carpool matches, leading to better mobility for all.

Flexi-Choice networks offer an opportunity to support Nashville's *Choose How You Move* initiative that is currently on the ballot. The initiative seeks to create a more stable funding stream to support transit services, walking, and bicycling. Flexi-Choice networks could help transform Nashville's existing auto-centric freeway system into a more efficient, sustainable, and equitable multimodal freeway system that serves all residents with high-quality transit service, mobility hubs, and first-mile/last-mile services to and from mobility hubs.

In the long run, a truly multimodal managed freeway system could influence residential and employment location choices, leading to development patterns that are more transit-friendly, equitable, and sustainable, helping Nashville and the state of Tennessee to achieve pollution reduction, carbon emission reduction, and economic development goals.

IMPLEMENTING A MULTIMODAL FLEXI-CHOICE FREEWAY NETWORK WITHIN 5 YEARS

Since Flexi-Choice lanes require little or no expansion of the freeway footprint, lengthy impact review, and permitting processes can be avoided, and construction delays and costs can be minimized. Nashville could implement a Flexi-Choice system throughout the region within 5 years, as suggested below:

Year 1 – Scenario Planning, Enforcement of HOV lane restrictions, and Cash Rewards Implementation:

Scenario Planning: The Greater Nashville Regional Council (GNRC) could incorporate an analysis of the impacts of a regionwide implementation of a Multimodal Flexi-Choice System into its scenario planning process to educate stakeholders and the public on the costs and benefits of the concept and to incorporate their feedback into GNRC's metropolitan transportation plan.

Enforcement of HOV lane restrictions: The Governor of Tennessee can direct the TN Department of Highway Safety, working in collaboration with any city or county executive to deploy metro, city, and county police agencies (all currently authorized to enforce state highway traffic laws) to begin enforcement of vehicle occupancy requirements for the legal use of HOV lanes. The routine practice of manual enforcement was abandoned over a decade ago, but enforcement can immediately and safely be reimplemented with a focus on education. The practice of "platoon enforcement" action at low traffic speeds in existing enforcement zones was designed for efficiency and established for this exact purpose. While this could worsen traffic congestion in the HOV lane in the short term, restoration of enforcement in the long term will discourage violators and allow legitimate HOVs and bus services to benefit from faster travel once violations are reduced. Tennessee DOT could at the same time proceed with procurement of well-proven automated technology to reduce the need for police operations. Single Occupancy Vehicle ("drive-alone") commuter habits will rapidly adjust to coordinated incentives, enforcement, and education.

Cash Rewards Implementation: GNRC can provide matching grants to employers who adopt Transportation Demand Management solutions readily available and cash rewards[6] for carpoolers, vanpoolers, and transit riders who use the HOV corridor and transit service by WeGo to accommodate the mode shifts to transit. Rewards could be set at a level high enough to ensure that HOV cheaters who are forced to move to the regular lanes will not increase congestion on the regular lanes because an equal number of drivers in the regular lanes will be incentivized to shift to riding as a passenger in a carpool or transit vehicle. Tennessee DOT has already funded a rewards program that is currently operating in Nashville using Federal grant support. The program can target commuters in corridors that have HOV facilities.

Year 2 – Project Development and Procurement for HOV Corridors:

Project development and procurement could begin for construction activities needed to implement Flexi-Choice lanes, part-time shoulder travel lanes, and active traffic management on those freeway segments where HOV lanes exist. Discretionary grant funding could be sought from FHWA's Congestion Relief Program under which Federal grant funding is available for both planning and implementation.

Years 3-5 – Construction in HOV Corridors, Project Development and Procurement for Remaining Corridors:

Construction could begin for Flexi-Choice lanes and part-time shoulder travel lanes with active traffic management implemented on freeway segments where HOV lanes exist. Funding support could be obtained through a public-private partnership (P3) concession that leverages the toll revenue stream, as discussed in the next section. Concurrently, the project development and procurement process could begin for implementation of the Flexi-Choice system on all other freeways (where HOV lanes do not exist), with the leftmost regular lane serving as a Flexi-Choice Lane.

Within 5 years, part-time shoulder travel lanes and active traffic management could be operational on the remaining freeway segments (where HOV lanes do not exist), again using a P3. At the end of the fifth year, Nashville would have in place a complete multimodal freeway network, complementing the new Choice lanes being constructed on I-24.

[6] GNRC has partnered with Hytch Rewards - a locally based technology company - to incentivize employers to help address regional traffic congestion by encouraging their employees to reduce the number of cars on the road by carpooling, vanpooling, or using public transportation for their commute or other work-related travel. Through the program, GNRC will share in the cost of providing cash incentives to qualifying employees of participating companies and organizations.

SCOPING/STRUCTURING FOR PUBLIC-PRIVATE PARTNERSHIP APPROACH

While implementing a Flexi-Choice system will not need construction on new rights-of-way, significant construction will still be needed. Shoulders will need to be hardened so they are capable of supporting increased traffic loads. At locations where there is inadequate shoulder width, such as at bridges, significant construction work might be needed to implement a continuous shoulder lane if the lane cannot be accommodated by narrowing the left shoulder and regular travel lanes. Active traffic management technology will need to be installed. The implementing agency can leverage P3 to finance these capital investments and avail itself of the specialized private sector expertise in tolling and active traffic management services.

To ensure interest from concessionaires, each proposed Flexi-Choice project will need to be scoped so that it requires a significant investment. The project could be scoped to include the construction of several freeway segments bundled into a single P3 procurement to ensure an adequate investment size. Special consideration will be needed in structuring the P3 agreement. Due to the active traffic management component, the normal revenue risk P3 structure will need to be modified. In a normal revenue risk concession, the concessionaire benefits when congestion increases on free lanes because it can raise toll rates without losing toll-paying customers. On the other hand, with Flexi-Choice lanes, the concessionaire will need to be incentivized to optimize the flow of all freeway traffic, and of person throughput on the entire freeway if the concessionaire is also responsible for providing transit service.

P3 Program Manager at the Federal Highway Administration Patrick DeCorla-Souza notes that the P3 structure will need to ensure that private and public objectives are aligned. He recommends that the P3 agreement be set up to compensate the concessionaire based on the total volume of traffic or persons carried on the facility during peak periods, rather than directly from toll revenue. The concessionaire would thus be incentivized to maximize vehicle or person throughput not only on Flexi-Choice lanes but also on the free lanes. While the concessionaire would have the freedom to set toll rates on Flexi-Choice Lanes at levels to ensure congestion-free travel at 55 mph, which is a performance standard in the P3 agreement, all toll revenue would be retained by the public agency. The public agency would then use the revenue to pay the concessionaire with shadow toll payments, that is, payments based on a number of vehicle miles or person-miles served during peak periods when traffic is required to be actively managed, with payment deductions for each vehicle in the Flexi-Choice lane that is not served at the required 55-mph performance standard.

LOOKING TO THE FUTURE

The state of Tennessee has identified about 30 potential projects on congested freeways where it proposes to consider building new Choice lanes. Studies to add lanes involve extensive effort over several years to complete before construction can begin, and only one study is underway currently. Implementing this **Multimodal Flexi-Choice System** in all congested freeway corridors using P3s now, and having them in operation while completing the studies needed to add new lanes, will give Tennessee's commuters traffic relief now.

About the Authors

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