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Ensuring Federal Transportation Policy Achieves Decarbonization, Clean Air and Environmental Justice

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Four federal agencies (DOT, EPA, DOE and HUD) have signed a joint MOU committed to achieving seven goals, including the decarbonization of the transport sector, protecting exposed communities by reducing air pollution from transport, and achieving an equitable transition that includes assuring mobility for traditionally underserved communities. But the MOU does not identify the scope or kind of policies that will be needed to implement the three goals of our primary focus (i.e., de-carbonization, protecting at-risk communities from air pollution, and enhancing mobility for underserved communities).

For example, the MOU does not identify the need for the Federal Highway Administration (FHWA) adopt nationally consistent traffic modeling criteria to assure accurate projections of regional emissions of both GHGs and air pollutants to support reducing those emissions during each planning cycle to decarbonize surface transport as soon as possible, but not later than 2050.

To ensure that federal transportation investments are designed to achieve the Goals and Objectives described in the MOU, the USDOT must:

1. identify and quantify the magnitude of both GHG emissions and traffic-generated health hazards, and the benefits that would be achieved by adopting mitigation strategies designed to reduce emissions, improve community health, and enhance mobility for non-drivers and underserved communities –
    a. traffic and emissions modeling must be required for all projects requiring a NEPA review.
    b. life-cycle CO_2 emissions associated with infrastructure materials and construction must be accounted for and mitigated.
2. require criteria for performing traffic modeling to account for induced travel demand, changes in multi-modal accessibility when comparing alternatives, and recognize capacity limitations when forecasting future traffic, emissions, community exposures, and estimating the benefits of mitigation measures.

Current Approaches to Transportation Modeling Will Undercut Efforts to Reduce Emissions Funding

The Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA) both boost funding to transform the transport system towards zero emissions by 2050 and to remediate disparate adverse impacts of transportation systems. However, many states are poised to quickly lock-in decades of GHG emissions growth by spending hundreds of billions of dollars on wider and more extensive high-speed motorways that spur sprawl and traffic growth.

A December 2021 Issue Brief by the Georgetown Climate Center concerning the impacts of alternative approaches to invest the $600 billion in IIJA funding between 2022-2026 found that *investments to add more lane miles will increase emissions because building more roads adds more traffic — known as "induced demand."* Traffic expands to fill new lanes, adding more pollution. If 27% of IIJA transportation spending goes to highway expansion, CO_2 pollution could be 0.2% lower in 2026 but 1.6% higher by 2032, as the road expansions induces more traffic demand.

Transportation Models Used to Justify These New and Expanded Roadways are Erroneous and Obsolete

The transportation modeling methods used to justify these wasteful projects were developed in the 1980s when the computers employed were less powerful than today's baseline smart phones. Due to computer limitations of the past, traffic is modeled as if every road segment is independent using a Static Traffic Assignment (STA) algorithm which cannot properly:

- account for bottlenecks,
- constrain forecast traffic volumes to roadway capacity, or
- match actual speeds.

Since the 1980s, new features have been grafted on top of the STA the process including more complex mode choice models, activity-based models (ABM) and links to microsimulation. However, the underlying modeling STA DNA is unchanged. These limited, antiquated models are not reviewed or tested for accuracy after a project is built; but they are accepted by the federal government as an acceptable basis for developing projections of the climate and health-damaging emissions that will come from transportation projects.

The STA models in use routinely forecast future traffic volumes above roadway capacity and used to declare the immediate need for more capacity. To elected officials, community members and local businesses, this sounds like impending disaster. In reality, however, they are simply model errors. No roadway will ever carry a traffic volume over capacity, except perhaps for a few minutes before traffic breaks down.

An accurate model would not allow these over-capacity assignments. Instead, the model would adjust travel demand through changes in mode, destination, routes route and/or time of day, which is exactly how people make travel choices in response to congested conditions. In a scenario where population and jobs are added to a congested region without additional roadway capacity, an accurate model would forecast *reduced demand* when measured on a per capita basis. No modeled roadways would have traffic volumes exceeding capacity in either the base year or the future year.

Adding new roadway capacity in this hypothetical example releases constraints on traffic growth and causes *induced demand*. STA models fail to properly account for induced demand because that traffic volume is included in the no build alternatives as grossly overestimated over-capacity assignments and often explained away as "latent demand." Then, the STA models forecast similar traffic volumes for both no build and build alternatives. The traffic analysis falsely concludes that the build alternative can correct the impossible over-capacity situation while also denying that the project would induce demand. This framing has been repeated throughout the U.S. but is fundamentally wrong. It is never born out in reality, but FHWA does not require an analysis of the performance of the models after the project is built in order to see this error, much less correct it.

Induced demand has been researched extensively and is accepted by most researchers. Because the obsolete transportation models fail to accurately account for induced demand, the University of California Davis and the Rocky Mountain Institute have created induced demand calculators to help fill the void. However, these calculators cannot correct the errors in the traffic analyses in alternatives analyses. Better models are required that produce realistic and credible estimates of the impacts of transportation alternatives.

Beyond the problems listed above, the models are not set up in a way to account for economic changes in a corridor, telecommuting, the land use forms, the walkability of the community and other relatively common issues that impact travel demand.

Reforms Needed to Accurately Model Congestion and Emissions Results of Highway Projects
Existing US DOT modeling rules apply solely for purposes of regional conformity analysis in serious, severe, and extreme nonattainment areas (NAAs) – the South Coast and San Joaquin Valley, New York City, Houston, Atlanta, Phoenix, and Denver. Further rule changes could be made to expand the scope of the rule to apply to other nonattainment areas (for example, to ensure a project or plan would not put the area into nonattainment), to NEPA analysis, and GHG evaluation. 40 CRF 93.122 Procedures for Determining Regional Transportation-related Emissions says, "By January 1, 1997, estimated of regional transportation related emissions used to support conformity determinations must be made at a minimum using network-based travel models according to procedures and methods that are available and in practice and supported by current and available documentation. These procedures, methods, and practices are available from DOT *and will be updated periodically*." (italics added)

To comply with established regulations, this rule should be updated to –

1) *Disallow the use of any model in alternatives analyses where the volume-to-capacity ratio exceeds 110% for any time period in either direction for any important roadway in the region in either the base year or future years.* Over-capacity assignments are model errors, and a 110% cutoff is a reasonable point where the errors become serious enough to exclude the model from application.

2) *Model travel time and non-auto trips based on destination access measurers prior to the destination choice step.* In current practice, increases in travel speeds are assumed to translate into travel time savings, even if the travel speed increases are realized through lengthening trip distances by blocking turn movements and corridor crossings. Travel time is determined by considering speed and distance; and today distance can be easily considered for all potential trips in a region using GIS and cloud computing to measure how many more destinations can be reached within a reasonable period of time. Additionally, modeling non-motorized trips is done post destination choice. In this formulation, non-motorized trips in the model can substitute only for very short auto trips. The decision to make a non-motorized trip generally is made prior to or simultaneously with destination choice, and these trips can substitute for longer auto trips. Modeling non-motorized trips should be moved ahead of destination choice and should be based on the land use variables that have been shown to significantly correlate with non-motorized trips including density, diversity, and design. Using destinations access, as Virginia DOT has since 2015, can accomplish this because travel between destinations can be measured for any mode of travel as opposed to our current travel demand models.

3) *Require agencies to routinely compare and report on how regional travel forecasts from 5 and 10 years ago compare with realized travel patterns and how current forecasts are being adjusted to better account for factors that reduce forecast accuracy in light of this.* The past accuracy of models and the projections they produce should be utilized by FHWA to inform how they update their rules, procedures, guidance and tools going forward. That accuracy should also be included in any environmental documents so that resource agencies and the public know the extent of the margin of error to give the project sponsor's projections and needed mitigation.

4) *Update the model calibration process to emphasize travel times and speeds including matching recurring bottlenecks by time of day.* Travel demand models are calibrated to traffic counts even though the most important performance metrics extracted from the models are travel times and speeds. Until recently, travel time and speed data were either unavailable or very expensive to collect. Today accurate travel time and speed data are available 24/7 for every major roadway in the U.S. and these data are made available to state DOTs and MPOs. While it will be useful to continue checking model traffic volumes against counts, the primary calibration focus should be travel speed because these data are more accurate and comprehensive than traffic count data, and because the most critical model outputs in planning studies are travel speeds.