# Florida Local Technical Assistance Program

**VOL. 2 ISSUE 5 • JULY 2024**

# Celebrating Excellence in Innovation

Local and tribal agencies are responsible for more than three million miles of roadways and roughly 50 percent of the bridges in the United States. These transportation networks are vitally important to both the economic health of the country and the quality of life for all Americans. These agencies must use limited budgets and resources to serve the needs of their customers. Innovation can be the mission critical factor that helps bridge that gap. Local and tribal road practitioners continually implement incremental changes in their processes, tools, and services to reflect groundbreaking technologies and best practices. Check out the winner of the Florida LTAP Center's Build a Better Mousetrap 2024 Competition and celebrate Florida's state and local transportation practitioners.

Hillsborough County Florida

Hillsborough County – Community and Infrastructure Planning Department is the recipient of the 2024 Florida Build a Better Mousetrap (BABM) Award in the Innovative Project category and the overall winner of the 2024 Florida LTAP Center BABM competition cycle.

This recognition highlights the work of Dr. Lama Alfaseeh, Principal Planner, and John Patrick, Division Director, of Hillsborough County Community and Infrastructure Planning Department, for their exceptional contributions and development of Hillsborough County's User-Friendly Greenhouse Gas (GHG) Emissions Estimation Tools.

# Hillsborough County

## Innovative Project Award

### What was the challenge?

As per the Environmental Protection Agency (EPA), the transportation sector is responsible for over a quarter of all greenhouse gas (GHG) emissions in the U.S. Yet, these emissions often escape notice in transportation and infrastructure decision-making, primarily due to the intricacy and limited expertise in estimating GHG emissions. Considering this, Hillsborough County has taken a significant step by developing two user-friendly GHG emissions estimation tools at different resolution levels. These tools, which estimate GHG emissions based on Vehicle Miles Traveled (VMT), are not only reliable, easy, and cost-effective, but also support decision-making at various levels, thereby playing a crucial role in addressing this environmental challenge.

**Dr. Lama Alfaseeh, Principal Planner of Hillsborough County – Community and Infrastructure Planning Department, holding Florida's 2024 Build A Better Mousetrap award.**

On November 22, 2023, the U.S. Department of Transportation's Federal Highway Administration (FHWA) announced a finalized performance measure that will provide State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) a national framework to track transportation-related GHG emissions along with the flexibility to set their targets for reduction. Having a user-friendly tool to estimate GHG emissions at the regional level will be of great benefit to meet these federal requirements. The county-level tool can be adopted in transportation planning and community planning and used for comparison between jurisdictions and regions in terms of produced GHG emissions, which can go back to the year 2000. Furthermore, the county-level tool can illustrate the impact of different levels of traffic, vehicle distributions, and mode shift strategies due to bike and pedestrian infrastructure improvements at a regional/jurisdictional level.

### Innovative Project

Any solution that addresses any or all phase(s) of the 'project' life cycle – Planning, Design/Engineering, Construction, Operations and Maintenance. This project shall introduce new ideas, is locally relevant, original, and creative in thinking.

Build A Better Mousetrap projects are selected for their originality, innovation, and the long-term value provided to the transportation community.

**Dr. Lama Alfaseeh, Principal Planner, (left), and John Patrick, Division Director, (right), from the Hillsborough County – Community and Infrastructure Planning Department, holding Florida's 2024 Build A Better Mousetrap award.**

# Hillsborough County

**Innovative Project Award (cont.)**

### What was the challenge (cont.)?

Hillsborough County is committed to measuring, tracking, and reducing the produced GHG emissions for a sustainable and equitable transportation system.

With the emergence of new transportation technologies, such as electric vehicles, e-scooters, etc., it is necessary to find an efficient and easy way to estimate the impact of using those new technologies on the environment and human health. In addition, with the increase in travel demand and limited supply, expanding roads and building new roads are not always feasible to mitigate congestion and the associated GHG emissions produced. Therefore, practitioners are looking at more innovative solutions, such as mode shift that promotes active transportation modes, to enhance the performance of a transportation network and reduce the negative impact on human health and the environment. The road-level tool can show the before and after results for up to four scenarios and can illustrate the impact of different Market Penetration Rates (MPRs) of Electric Vehicles (EVs) and e-scooters, different percentages of mode shift, and different percentages of heavy vehicles, etc. This tool can be utilized to conduct a sensitivity analysis and to support grant applications such as RAISE Discretionary Grants, which require information about environmental considerations.

**What was the challenge?**

The transportation sector is responsible for over a quarter of all greenhouse gas (GHG) emissions in the U.S. Yet, these emissions often escape notice in transportation and infrastructure decision-making, primarily due to the intricacy and limited expertise in estimating GHG emissions.

Both tools are utilized in different department projects. The Office of Innovation and Resiliency at Hillsborough County will use both tools to update the Sustainability and Resiliency Action Plan (SRAP), and several MPOs are interested in the county-level tool to help meet the federal mandate mentioned.

### How did you develop and implement your solution?

Hillsborough County staff conducted a comprehensive literature review on common approaches to estimating GHG emissions from transportation and found two main ways to estimate the produced GHG emissions: derived either from speed data or vehicle miles traveled (VMT) data. Estimating GHG emissions at a disaggregated level based on speed is more accurate and accounts for operational changes. Still, it is expensive and time-consuming due to the extensive need for computational power and complex data. The most popular speed-based tool is the Motor Vehicle Emission Simulator (MOVES), which requires expertise to use and specifically formatted data. On the other hand, estimating GHG emissions based on the VMT is easy to use. Still, it is associated with some limitations for high-resolution applications because operational changes, such as speed, acceleration, deceleration, etc., are not captured. While every estimation approach has pros and cons, estimating GHG emissions using VMT is reliable, easy, cheap, and, most importantly, supports the decision-making process at different levels. Therefore, Hillsborough County decided to use the VMT-based approach to build two GHG emission estimation tools at different levels of resolution: county-wide and roadway.

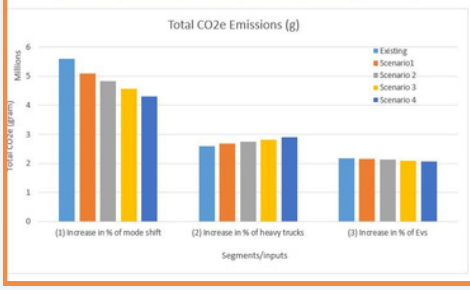
# Hillsborough County

## Innovative Project Award (cont.)

### How did you develop and implement your solution (cont.)?

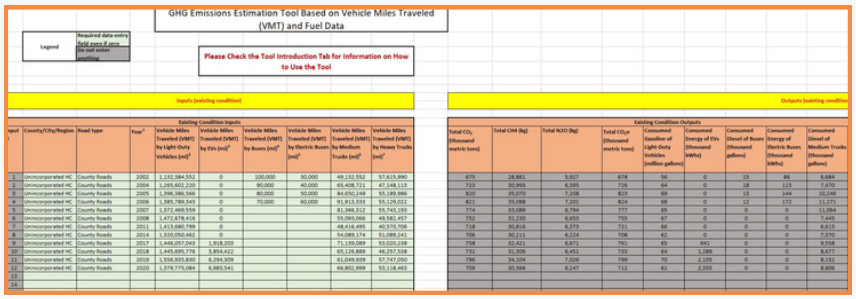
The first step in our methodology was to estimate the consumption of gasoline, diesel fuel, or electricity in the study area. This was based on the VMT of different vehicle categories and fuels, using the appropriate fuel economy rates. Subsequently, we estimated GHG emissions, including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and carbon dioxide equivalent (CO2e). To do this, we relied on the emissions rates from the annual Environmental Protection Agency (EPA) reports, which also accounted for emissions associated with electricity generation.

| Existing Scenario | | | | | |
|---|---|---|---|---|---|
| Segment # | Length (mi) | Total traffic[1] | % of heavy trucks[2] | MPR (%) of EVs[3] | Total CO2e (g) |
| 1 | 3 | 4500 | 2% | 1% | 5,607,535 |
| 2 | 2.5 | 2500 | 2% | 1% | 2,595,655 |
| 3 | 1.5 | 3500 | 2% | 1% | 2,180,812 |




| Proposed Scenarios | | | | |
|---|---|---|---|---|
| Segment # | % of mode shift | % of heavy trucks | MPR (%) of EVs | Total CO2e (g) |
| Scenario 1 | | | | |
| 1 | 10% | 2% | 1% | 5,089,377 |
| 2 | 0% | 3% | 1% | 2,671,206 |
| 3 | 0% | 2% | 3% | 2,153,132 |
| Scenario 2 | | | | |
| 1 | 15% | 2% | 1% | 4,830,533 |
| 2 | 0% | 4% | 1% | 2,746,106 |
| 3 | 0% | 2% | 5% | 2,125,547 |
| Scenario 3 | | | | |
| 1 | 20% | 2% | 1% | 4,572,070 |
| 2 | 0% | 5% | 1% | 2,820,810 |
| 3 | 0% | 2% | 7% | 2,098,293 |
| Scenario 4 | | | | |
| 1 | 25% | 2% | 1% | 4,312,462 |
| 2 | 0% | 6% | 1% | 2,895,710 |
| 3 | 0% | 2% | 9% | 2,070,610 |

**Image of the Hillsborough County GHG Emissions Estimation Tools total CO2e with respect to different road level scenarios.**



GHG Emissions Estimation Tool Based on Vehicle Miles Traveled (VMT) and Fuel Data

Legend: Required data entry; field uses if gave; do not enter anything

Please Check the Tool Introduction Tab for Information on How to Use the Tool

Inputs (existing conditions)

Existing Condition Inputs

| Input | County/City/Region | Road Type | Year[1] | Vehicle Miles Traveled (VMT) by Light-Duty Vehicles (mi)[2] | Vehicle Miles Traveled (VMT) by EVs (mi)[3] | Vehicle Miles Traveled (VMT) by Buses (mi)[4] | Vehicle Miles Traveled (VMT) by Electric Buses (mi)[5] | Vehicle Miles Traveled (VMT) by Medium Trucks (mi)[6] | Vehicle Miles Traveled (VMT) by Heavy Trucks (mi)[7] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Unincorporated HC | County Roads | 2002 | 1,132,384,552 | 0 | 100,000 | 30,000 | 49,132,552 | 57,615,990 |
| 2 | Unincorporated HC | County Roads | 2004 | 1,245,602,220 | 0 | 90,000 | 40,000 | 65,408,721 | 47,148,113 |
| 3 | Unincorporated HC | County Roads | 2005 | 1,396,586,546 | 0 | 80,000 | 50,000 | 84,650,249 | 55,189,986 |
| 4 | Unincorporated HC | County Roads | 2006 | 1,385,789,343 | 0 | 70,000 | 60,000 | 91,913,333 | 55,129,022 |
| 5 | Unincorporated HC | County Roads | 2007 | 1,372,469,559 | 0 | | | 81,366,512 | 55,743,193 |
| 6 | Unincorporated HC | County Roads | 2008 | 1,472,678,416 | 0 | | | 55,093,066 | 49,581,457 |
| 7 | Unincorporated HC | County Roads | 2011 | 1,413,680,799 | 0 | | | 48,418,495 | 40,570,706 |
| 8 | Unincorporated HC | County Roads | 2014 | 1,320,050,461 | 0 | | | 54,089,174 | 51,089,241 |
| 9 | Unincorporated HC | County Roads | 2017 | 1,448,057,043 | 1,818,203 | | | 71,139,089 | 55,020,238 |
| 10 | Unincorporated HC | County Roads | 2018 | 1,449,695,776 | 3,854,422 | | | 85,126,889 | 46,257,538 |
| 11 | Unincorporated HC | County Roads | 2019 | 1,556,935,830 | 6,294,909 | | | 61,049,939 | 57,747,050 |
| 12 | Unincorporated HC | County Roads | 2020 | 1,379,775,084 | 6,983,541 | | | 66,802,999 | 53,118,463 |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |

Outputs (existing condition)

Existing Condition Outputs

| Total $CO_2$ (thousand metric tons) | Total CH4 (kg) | Total N2O (kg) | Total CO2e (thousand metric tons) | Consumed Gasoline of Light-Duty Vehicles (million gallons) | Consumed Energy of EVs (thousand kWhs) | Consumed Diesel of Buses (thousand gallons) | Consumed Energy of Electric Buses (thousand kWhs) | Consumed Diesel of Medium Trucks (thousand gallons) |
|---|---|---|---|---|---|---|---|---|
| 675 | 28,861 | 5,927 | 678 | 56 | 0 | 15 | 86 | 6,684 |
| 723 | 30,993 | 6,395 | 726 | 64 | 0 | 18 | 115 | 7,470 |
| 820 | 35,070 | 7,208 | 823 | 69 | 0 | 13 | 144 | 10,248 |
| 821 | 35,088 | 7,201 | 824 | 68 | 0 | 12 | 172 | 11,271 |
| 774 | 33,089 | 6,794 | 777 | 65 | 0 | 0 | 0 | 11,084 |
| 752 | 32,230 | 6,653 | 755 | 67 | 0 | 0 | 0 | 7,445 |
| 718 | 30,816 | 6,373 | 721 | 66 | 0 | 0 | 0 | 4,615 |
| 706 | 30,211 | 6,224 | 708 | 62 | 0 | 0 | 0 | 7,570 |
| 758 | 32,421 | 6,671 | 761 | 65 | 641 | 0 | 0 | 9,558 |
| 731 | 31,306 | 6,451 | 733 | 64 | 1,289 | 0 | 0 | 8,677 |
| 796 | 34,104 | 7,026 | 799 | 70 | 2,105 | 0 | 0 | 8,152 |
| 709 | 30,366 | 6,247 | 712 | 61 | 2,335 | 0 | 0 | 8,606 |

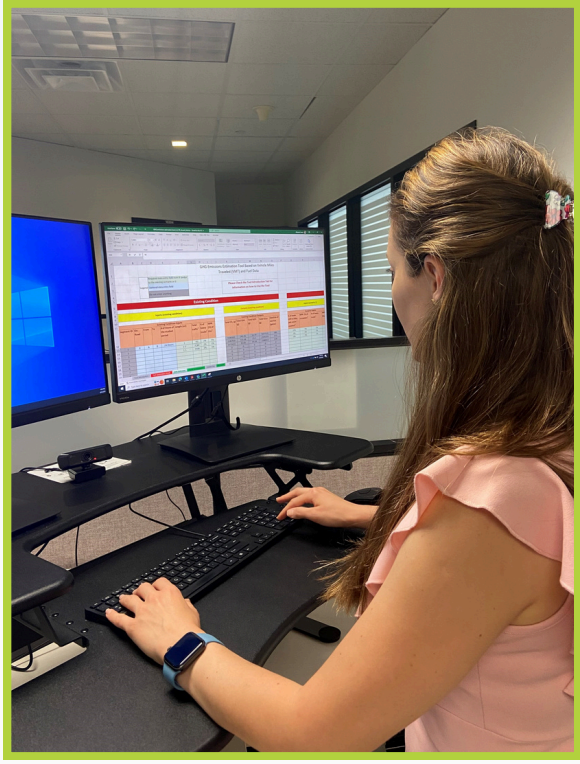
**Image of the Hillsborough County GHG Emissions Estimation Tools based on Vehicle Miles Traveled (VMT) and fuel data.**

To ensure the tools are accessible and practical, we prioritized user-friendliness in their design. They only require straightforward and readily available inputs, providing instant results and trends that inform decision-making at various levels of resolution. It's important to note that both tools adhere to the Federal Highway Administration (FHWA) vehicle categories, encompassing all classes except motorcycles.

### How did you develop and implement your solution?

Hillsborough County decided to use the VMT-based approach to build two GHG emission estimation tools at different levels of resolution: county-wide and roadway.

VMT is reliable, easy, cheap, and, most importantly, supports the decision-making process at different levels.



**Dr. Lama Alfaseeh, Principal Planner of Hillsborough County – Community and Infrastructure Planning Department, using Hillsborough County GHG Emissions Estimation Tools.**

# Hillsborough County

**Innovative Project Award (cont.)**

### How did you develop and implement your solution (cont.)?

They also incorporate electric vehicles (EVs) and electric buses, reflecting the evolving technology and delivering realistic and precise estimations. In a further step towards user convenience, Hillsborough County is developing a user interface to enhance the usability of the county-level tool. To our knowledge, no other GHG estimation tools with such a user-friendly approach have been developed.

### What labor, equipment, plans, or materials did it take to make the solution work?

Both tools were developed in-house in Hillsborough County. A full-time county employee worked on this project: researching, modeling, coding, and gathering data and factors. We collaborated with Dr. Yu Zhang and Dr. Can Cui at the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF) to validate both tools. We coordinated with the Florida Department of Transportation (FDOT) to get data on the percentage of heavy and medium trucks in our study area. Currently, Hillsborough County's Performance, Data, & Analytics Department is helping to convert the tools to an online user interface.

### What was the cost of implementation?

The cost was primarily staff time for existing county employees who worked on developing these tools. Computers with applications such as Excel and ArcGIS were used to model and estimate some inputs (percentage of different vehicle categories). One new specific cost will be acquiring Iron XL software, which will convert the tools from Excel to a web-based user interface, thus allowing broader use of these tools and maximizing their benefit. IronXL is a C#/.NET library that allows for interacting with Excel without COM/Interop. The cost of a perpetual license with five years of support (upgrades) of IronXL is $4,197.

### What was the positive impact, result, or outcome of your efforts?

Being able to estimate GHG emissions in the existing and future scenarios is a significant contribution, which will inform decision-making processes in transportation and infrastructure-related projects and will save governments a lot of money and effort in different ways. Including GHG emissions in the decision-making process will allow for comprehensive decisions that benefit human health, the environment, and ultimately lead to an equitable and sustainable transportation system. When the online interface is operational, the tools will help local governments across the U.S. to preserve and improve the quality of life for residents through effective transportation planning that encompasses innovative approaches, sustainability, and equity. The recognition afforded by sharing the tools in this way will help Hillsborough County attract and retain a talented workforce into the future and will highlight the county's commitment to protecting the quality of life found here for generations to come.

**What was the positive impact, result, or outcome of your efforts?**

The significance of user-friendly tools in estimating adverse impacts to human health and the environment cannot be overstated. These tools, when applied at various levels of resolution, are instrumental in shaping robust and comprehensive transportation planning decisions.

# Hillsborough County

**Innovative Project Award (cont.)**

### What was the positive impact, result, or outcome of your efforts (cont.)?

The GHG estimation tools are not limited to a single department or organization. They will be utilized by various Hillsborough County departments, including the Office of Innovation and Resiliency and the Community and Infrastructure Planning Department, as well as regional partners like the Hillsborough County Transportation Planning Organization (TPO), and other regional and local governments. The Office of Innovation and Resiliency at Hillsborough County, for instance, will use both tools to update the Sustainability and Resiliency Action Plan (SRAP). The county-level tool, on the other hand, will be used by regional and local governments to address the federal mandate of tracking and reducing GHG emissions produced by transportation. The goal is to convert these tools into a user interface and share them with local and regional governments. The beauty of these tools is that they can be used in any community in the U.S. with only minor adjustments to the fuel economy rates of EVs and e-buses, and of course local VMT data. Please view the sample applications supporting document for more discussion of the data and evidence supporting the outcome.

In conclusion, the significance of user-friendly tools in estimating adverse impacts to human health and the environment cannot be overstated. These tools, when applied at various levels of resolution, are instrumental in shaping robust and comprehensive transportation planning decisions. Their potential to revolutionize transportation planning, community planning, and policy making is immense. By saving practitioners time, money, and effort, these tools pave the way for better and more equitable decisions.

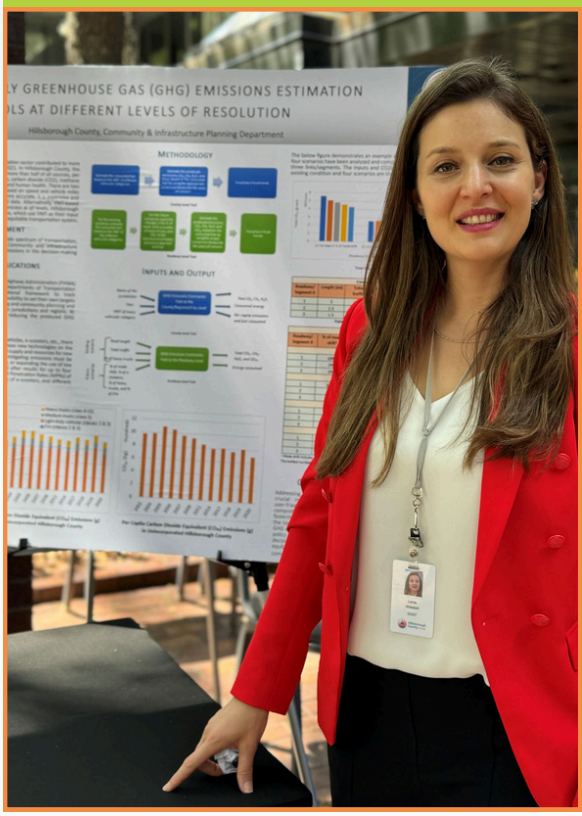
With respect to future projects, creating a dashboard that illustrates the produced GHG emissions at the county/regional and road level over the years could contribute to efficient urban and transportation planning. Hillsborough County is planning to convert the tools to a user interface to maximize the benefit of this project. Developing a regional GHG emissions predictive tool is another potential project to help make strategic decisions and policies. Another important application is to include GHG emissions in the decision-making process toward achieving equity and the proposal of new policies for a sustainable transportation system.

For more information about the Florida LTAP Center, visit **https://floridaltap.org**. For more information about the BABM competition, visit **https://www.fhwa.dot.gov/clas/babm/**.

**Who can I contact about this tool?**

**Contact Information:**

**Dr. Lama Alfaseeh, PMP**
Principal Planner
Hillsborough County – Community and Infrastructure Planning Department
alfaseehl@HCFL.gov




**Dr. Lama Alfaseeh, Principal Planner of Hillsborough County – Community and Infrastructure Planning Department, presented at the May 2024 Environmental Protection Commission of Hillsborough County Clean Air Fair.**