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16. Abstract This report summarizes the technical work performed developing and incorporating Metropolitan Planning Organization sub-models into the existing Texas Revenue Estimator and Needs Determination System (TRENDS) model. Additionally, this report explains the maintenance and monthly updates performed on the TRENDS model. The TRENDS model is designed to provide transportation planners, policy makers, and the public with a tool to forecast revenues and expenses for the Texas Department of Transportation for the period 2010 through 2035 based on a user-defined level of transportation investment. The user, through interactive windows, can control a number of variables related to assumptions regarding statewide transportation needs, population growth rates, fuel efficiency, federal reimbursement rates, inflation rates, taxes, fees, and other elements. The output is a set of tables and graphs showing a forecast of revenues, expenditures, and fund balances for each year of the analysis period based on the user-defined assumptions.					
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**DEVELOPMENT OF THE TRANSPORTATION REVENUE ESTIMATOR
AND NEEDS DETERMINATION SYSTEM (TRENDS) FORECASTING
MODEL: MPO SUB-MODELS AND MAINTENANCE**

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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TECHNICAL REPORT ON THE DEVELOPMENT OF THE TRANSPORTATION REVENUE ESTIMATOR AND NEEDS DETERMINATION SYSTEM (TRENDS) FORECASTING MODEL: MPO SUB-MODELS AND MAINTENANCE

OVERVIEW

This report summarizes the technical work performed developing and incorporating Metropolitan Planning Organization (MPO) sub-models into the existing Texas Revenue Estimator and Needs Determination System (TRENDS) model. Additionally, this report explains the maintenance and monthly updates performed on the TRENDS model.

The TRENDS model is designed to provide transportation planners, policy makers, and the public with a tool to forecast revenues and expenses for the Texas Department of Transportation (TxDOT) for the period 2010 through 2035 based on a user-defined level of transportation investment. The user, through interactive windows, can control a number of variables related to assumptions regarding statewide transportation needs, population growth rates, fuel efficiency, federal reimbursement rates, inflation rates, taxes, fees, and other elements. The output is a set of tables and graphs showing a forecast of revenues, expenditures, and fund balances for each year of the analysis period based on the user-defined assumptions.

Under the latest contract, a new local option revenue model was added for use by each of the state's 25 MPOs. In addition, a substantially revised user's guide was developed and made available. The model is maintained and updated on a monthly basis to include the latest cash forecasts and letting schedules provided by TxDOT. The web-based model is available at: <http://trends-tti.tamu.edu/>.

TASK 1: DEVELOP METROPOLITAN PLANNING ORGANIZATION (MPO) SUB-MODELS

The following steps were used to develop the Local Option Sub-Models:

1. The Roadway-Highway Inventory (RHiNo) file provides data of commercial and total vehicle miles traveled by county by year. The years 2000 through 2007 were used.
2. For each year of RHiNo file data, the commercial truck vehicle miles travelled (VMT) was subtracted from total VMT to derive personal vehicle VMT.
3. The respective percentages of personal and commercial VMT were calculated for each county for each year.
4. Total VMT by county as shown in RHiNo file data was divided by total statewide as shown in the RHiNo file data to calculate a share of total statewide VMT by county.
5. The statewide VMT totals calculated by the TRENDS model for years 2000 through 2007 were used as control totals and then multiplied by the county VMT share calculated in Step 4 to arrive at an adjusted total VMT by county.

6. The percentage of personal and commercial VMT by county was calculated from the data produced in Step 3.
7. The percentage of personal and commercial VMT by county calculated in Step 6 was multiplied by the adjusted total VMT for each county as calculated in Step 5 to produce adjusted personal and commercial VMT for each county for the years 2000 through 2007.
8. Population estimates by county obtained from the State Data Center for the years 2000 through 2007.
9. Per capita personal and commercial VMT was derived by dividing the adjusted personal and commercial VMT calculated in Step 7 by the estimated population.
10. The average annual rate of change in per capita personal and commercial VMT was calculated for the period 2000 through 2007.
11. Population projections for the period 2008 through 2035 for each county were obtained from the State Data Center.
12. The average annual rate of change in personal and commercial per capita VMT was then used to calculate per capita personal and commercial VMT for each year through 2035.
13. The projections of personal and commercial per capita VMT by county calculated in Step 12 were then multiplied by county population projections from the State Date Center.
14. The projections of personal and commercial VMT by county derived in Step 13 were then adjusted using the total statewide commercial and personal VMT calculated in the TRENDS model as a control total.
15. The projected commercial and personal VMT calculated in Step 14 become the basis for calculating projected VMT fees.
16. The projected commercial and personal VMT calculated in Step 14 when divided by the personal and commercial vehicle fuel efficiencies used in the TRENDS to provide the number of gallons of gasoline (personal) and diesel fuel (commercial) consumed.
17. The number of gallons of gasoline and diesel fuel consumed multiplied by the tax rate provide the projected fuel tax revenue.
18. The number of registered vehicles by vehicle class (motorcycles, passenger cars < 6,000 lb, passenger cars > 6,000 lb, trucks < 6,000 lb, trucks > 6,000 lb) for the period 2000 through 2008 was obtained from the Department of Motor Vehicles.

19. The average number of vehicles per capita by county by vehicle class was calculated by multiplying the data described in Step 18 by the estimated population for the same period.
20. The projected number of vehicles by vehicle class by county was derived by multiplying the per capita data derived in Step 19 by the projected population described in Step 11.
21. The projected number of vehicles by class by county became the basis of calculating vehicle registration fees.
22. The procedures described above were repeated for each of the four population growth scenarios produced by the State Data Center.
23. Counties were aggregated by MPO to produce local option revenue estimates.

After the sub-models were developed, they were incorporated into the web-based user interface of the TRENDS model. [Figures 1 through 7](#) illustrate the new portion of the model added in FY2010 related to local revenue options. In this section of the model, the first question asked is whether the user wishes to perform a local option revenue analysis. The default answer is “No.” (See [Figure 1.](#))

LOCAL OPTIONS

Local Revenue Options

Do you want to do a local option revenue analysis? Yes/No No

Local Fuel Tax

Do you want to change local fuel tax rate? Yes/No No

Local VMT

Do you want to change local VMT? Yes/No No

Local Vehicle Registration Fee

Do you want to change local Vehicle Registration Fee? Yes/No No

Local Fuel Efficiency

Do you want to change local fuel efficiency? Yes/No No

Figure 1. Local Revenue Options.

If the answer in the dropdown menu is changed to “Yes,” a list of all 25 of the state’s MPOs appear. The user can then select the particular MPO (or multiple MPOs) in which to levy a local option fee or tax by clicking on the box adjacent to the MPO name. (See [Figure 2.](#))

LOCAL OPTIONS

Local Revenue Options

Do you want to do a local option revenue analysis? Yes/No Yes

Select the Metropolitan Planning Organization to be included in the analysis: Check here to select ALL

Ablene <input type="checkbox"/>	Hidalgo <input type="checkbox"/>	San Angelo <input type="checkbox"/>
Amarillo <input type="checkbox"/>	Houston/Galveston <input type="checkbox"/>	San Antonio <input type="checkbox"/>
Beaumont <input type="checkbox"/>	Killeen/Temple <input type="checkbox"/>	Sherman/Denison <input type="checkbox"/>
Brownsville/Harlingen <input type="checkbox"/>	Laredo <input type="checkbox"/>	Texarkana <input type="checkbox"/>
Bryan/College Station <input type="checkbox"/>	Longview <input type="checkbox"/>	Tyler <input type="checkbox"/>
Capital Area <input type="checkbox"/>	Lubbock <input type="checkbox"/>	Victoria <input type="checkbox"/>
Corpus Christi <input type="checkbox"/>	Midland/Odessa <input type="checkbox"/>	Waco <input type="checkbox"/>
El Paso <input type="checkbox"/>	NCTCOG <input type="checkbox"/>	Wichita Falls <input type="checkbox"/>

Local Fuel Tax

Do you want to change local fuel tax rate? Yes/No No

Local VMT

Do you want to change local VMT? Yes/No No

Local Vehicle Registration Fee

Do you want to change local Vehicle Registration Fee? Yes/No No

Local Fuel Efficiency

Do you want to change local fuel efficiency? Yes/No No

Figure 2. MPO Area Selection.

Below the list of MPOs, the user is then asked “Do you want to change the local gasoline tax rate?” The default answer is “No.” If the answer is changed to “Yes” in the drop-down menu to the right, the user is then asked the rate of the tax in cents per gallon and the fiscal year in which the user wants the increase to become effective. Next, the user is asked if he/she would like to increase the diesel fuel tax. Again, the default answer is “No.” If the answer is changed to “Yes” in the drop-down menu to the right, the user is then asked the rate of the tax in cents per gallon and the fiscal year in which the user wants the increase to become effective. (See [Figure 3](#) below.)

LOCAL OPTIONS	
Local Revenue Options	
Do you want to do a local option revenue analysis? Yes/No	No ▾
Local Fuel Tax	
Do you want to change local fuel tax rate? Yes/No	Yes ▾
How much would you increase the local gasoline tax? (Enter increase in cents per gallon.)	0 cents
In which year would you like the increase to become effective? (Enter the year.)	2012 yyyy
How much would you increase the local diesel tax? (Enter increase in cents per gallon.)	0 cents
In which year would you like the increase to become effective? (Enter the year.)	2012 yyyy
Local VMT	
Do you want to change local VMT? Yes/No	No ▾
Local Vehicle Registration Fee	
Do you want to change local Vehicle Registration Fee? Yes/No	No ▾
Local Fuel Efficiency	
Do you want to change local fuel efficiency? Yes/No	No ▾

Figure 3. Detailed Local Fuel Tax Options.

Figure 4 allows the user to impose a vehicle miles traveled tax. Similar to the local fuel tax option, the user is asked “Do you want to change the local VMT tax rate?” The default answer is “No.” If the answer is changed to “Yes” in the drop-down menu to the right two additional questions year. First, the user is asked the rate of the tax in cents per gallon that is imposed on personal vehicles. Next, the user is asked the rate of the tax in cents per gallon that is imposed on commercial vehicles. Finally, the user is asked to enter the fiscal year in which the tax(es) is(are) to become effective. (See Figure 4 below.)

LOCAL OPTIONS	
Local Revenue Options	
Do you want to do a local option revenue analysis? Yes/No	No
Local Fuel Tax	
Do you want to change local fuel tax rate? Yes/No	No
Local VMT	
Do you want to change local VMT? Yes/No	Yes
How much would you want to change the local personal VMT?	0 cents
How much would you want to change the local commercial VMT?	0 cents
In which year would you like the increase to become effective? (Enter the year.)	2012 yyyy
Local Vehicle Registration Fee	
Do you want to change local Vehicle Registration Fee? Yes/No	No
Local Fuel Efficiency	
Do you want to change local fuel efficiency? Yes/No	No

Figure 4. Detailed Local VMT Options.

Figure 5 allows the user to increase the local vehicle registration fee. Similar to the VMT tax option, the user is asked “Do you want to change the local vehicle registration fee rate?” Again, the default answer is “No.” If the answer is changed to “Yes” in the drop-down menu to the right four additional questions appear. These four questions allow the user to set the annual vehicle registration fee for several different classifications of vehicles: a personal vehicle with a gross vehicle weight less than 6,000 lb, a personal vehicle with a gross vehicle weight greater than 6,000 lb, a truck less with a carrying capacity of less than one ton, and a truck with greater than a one ton carrying capacity, and set the local vehicle registration fee for a motorcycle. Finally, the user is asked in which fiscal year the increase is to take place. (See Figure 5 below.)

LOCAL OPTIONS	
Local Revenue Options	
Do you want to do a local option revenue analysis? Yes/No	No
Local Fuel Tax	
Do you want to change local fuel tax rate? Yes/No	No
Local VMT	
Do you want to change local VMT? Yes/No	No
Local Vehicle Registration Fee	
Do you want to change local Vehicle Registration Fee? Yes/No	Yes
How much would you want to change the local passenger vehicle fee? (<6000LBS)	0 \$
How much would you want to change the local passenger vehicle fee? (>6000LBS)	0 \$
How much would you want to change the local truck fee? (<1Ton)	0 \$
How much would you want to change the local truck fee? (>1Ton)	0 \$
How much would you want to change the local motorcycle fee?	0 \$
In which year would you like the increase to become effective? (Enter the year.)	2012 yyyy
Local Fuel Efficiency	
Do you want to change local fuel efficiency? Yes/No	No

Figure 5. Detailed Local Vehicle Registration Fee Options.

The final user-controlled variable in the local option sub-model relates to the local fuel efficiency in which the user is asked if they wish to change the fuel efficiency for the local area as opposed to the state as a whole. Again, the default answer is “No.” However, if the user feels the mix of vehicles in the local fleet is different than that assumed for the state as a whole, a different fuel efficiency selection can be made by selecting “Yes” in the drop-down menu and a new set of variables appears. The user then can change the fuel efficiency scenario for commercial vehicles, personal vehicles, or both types of vehicles. (See [Figure 6](#) below.)

LOCAL OPTIONS

Local Revenue Options

Do you want to do a local option revenue analysis? Yes/No No

Local Fuel Tax

Do you want to change local fuel tax rate? Yes/No No

Local VMT

Do you want to change local VMT? Yes/No No

Local Vehicle Registration Fee

Do you want to change local Vehicle Registration Fee? Yes/No No

Local Fuel Efficiency

Do you want to change local fuel efficiency? Yes/No Yes

Select the fuel efficiency assumption for local commercial vehicles.

Average
 Low
 High

Select the fuel efficiency assumption for local personal vehicles.

Average
 Low
 High

Figure 6. Local Fuel Efficiency Options.

Once all desired variable values are entered, the user can then select the reports that are desired. There are nine different reports that can be selected ([Figure 7](#)). Among them:

- Chosen variables.
- Revenue and expense summary by year.
- Annual revenue and expense graph.
- Cumulative revenue and expense graph.
- Detailed annual revenue and expense statement.
- Revenue statement for local option taxes and fees.

The graphs and tables are also available in PDF format and can be saved to disk or other media for printing. Additionally, the TRENDS model user’s guide was updated to include instructions for the MPO local option sub-models.

OUTPUT OPTIONS

Report Formatting
In my report, show me (check all that apply):

Check here to select ALL

The variables I've chosen for this analysis	<input type="checkbox"/>
A summary of revenues and expenses by year	<input type="checkbox"/>
A graph of revenues minus expenses by year	<input type="checkbox"/>
A graph of cumulative revenues minus expenses	<input type="checkbox"/>
A revenue and expense statement for the period 2010 through 2030	<input type="checkbox"/>
A revenue and expense statement for each year from 2010 through 2030	<input type="checkbox"/>
A revenue and expense statement for the period 2010 through 2035	<input type="checkbox"/>
A statement of revenue for the local options selected for the period 2010 through 2030	<input type="checkbox"/>
A statement of revenue for the local options selected for the period 2010 through 2035	<input type="checkbox"/>

Figure 7. Expanded Format Options.

TASK 2: MAINTENANCE OF THE TRENDS MODEL AND MPO SUB-MODEL

The TRENDS Model, along with the integrated MPO sub-models, is housed on a TTI website available at: <http://trends-tti.tamu.edu/>. As new data becomes available the TRENDS model is updated to reflect the new information. Variables that are maintained and updated on a regular basis include:

- TxDOT cash flow forecasts.
- Inter- and intra-agency fund transfers.
- Letting volume information.
- Bond sales and debt service.
- Population.
- Fuel economy.
- Vehicle registrations.
- Construction cost inflation.
- Vehicle miles traveled.
- Other critical variables as necessary.

Any changes made by the state legislature regarding transportation funding were also incorporated into the model (e.g., new vehicle registration fee structure effective September 1, 2011). Additionally, federal transportation legislation was closely monitored for any changes that would affect the model.

