Texas A&M Transportation Institute

Task 4.3 Activity Forecasting - FY18 Summary of Work Completed

TECHNICAL MEMORANDUM

Prepared for the Texas Department of Transportation

October 2018

Environment and Air Quality Division

TECHNICAL MEMORANDUM

Inter-Agency Contract (Contract No: IAC 0000015198)

Task 4.3 Activity Forecasting

DATE: October 30, 2018

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INTRODUCTION

This document describes work performed by Texas A&M Transportation Institute (TTI) during FY2018 on Activity Forecasting (Task 4.3 of Inter-Agency Contract No: IAC 0000015198). The task involves analysis and organization of traffic activity data to support transportation conformity. Traffic activity data are a vital component of emission inventories used to assess the impacts of on-road transportation on air quality. The following sections describe this project, a summary of traffic activity modeling and data types, and the specific goals and work performed during FY2018.

SUBTASK 4.3 MAINTAIN, UPDATE AND ENHANCE TRAFFIC ACTIVITY ESTIMATION AND FORECASTING METHODS AS NEEDED

The Performing Agency shall provide activity estimation and forecasts for critical inventory analyses used for conformity demonstrations. The Performing Agency shall provide on-going review of existing procedures and incorporate the appropriate improvements into the emissions analysis process.

The Performing Agency shall provide updated and refined methods and associated documentation of activity estimation and forecasting methods performed under this contract.

SUMMARY AND BACKGROUND

This task ensures that activity estimates and forecasts are available for demonstrating conformity and other transportation planning activities across the state of Texas.

Data Sources

Four data sources are used in conjunction with TTI developed utilities and Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator (MOVES) model to develop activity inputs for conformity demonstration (inventories of on-road mobile source emissions to demonstrate conformity). These are:

- Automatic Traffic Recorder (ATR) counts,
- Highway Performance Monitoring System (HPMS) data,

- Vehicle classification counts (used to estimate vehicle miles traveled [VMT] mix, known as source use types (SUTs) in MOVES), and
- Vehicle registration data.

Traffic data are collected by the Texas Department of Transportation (TxDOT) on a formal and on-going basis as part of the larger federally mandated HPMS data collection program. Vehicle Registration data were collected and curated by TxDOT until 2013, after which it became the responsibility of the Texas Department of Motor Vehicles (TxDMV). A brief description of each data set, and how they relate to the regulatory mandate to demonstrate conformity follows.

ATR Vehicle Counts

ATR vehicle counts are collected by TxDOT at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and weekday, as well as on an average annual daily basis (i.e., average annual daily traffic [AADT]). Since they are continuous, they are especially well-suited for making seasonal, day-of-week, and time-of-day comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area. These adjustment factors are essential for translating emission estimates calculated for a specific day type (e.g., weekday versus weekend) and time of year (summer versus winter), to estimates representative of other day types or seasons.

HPMS VMT Data

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHWA) designed to estimate VMT (as well as lane miles and centerline miles). A wide range of traffic data is collected under the HPMS program. The focus for this application is specifically the VMT, centerline miles, and lane miles estimates made as part of the HPMS program. The HPMS VMT is categorized by seven roadway functional classifications and three area types.

Vehicle Classification Counts

Vehicle classification counts are collected at representative locations throughout Texas on a regular, but periodic basis. Roadway functional classification is included as part of the data collected. Vehicle classification counts are used to estimate the relative

proportion of VMT to be assigned to each type of vehicle. (The VMT mix/SUT estimation procedure is described in detail in a separate report.)

Vehicle Registration Data

Vehicle registration data are essentially county summaries of motor vehicles registered in a county, by model year and vehicle gross vehicle weight rating (GVWR). The vehicle registration data are used in conjunction with the classification count data and are an integral part of estimating the VMT mix (source-use type) on different road types.

Data Acquisition and Availability

While all four data sets are collected by state agencies (three by TxDOT, one by TxDMV), they are very different in the way they are collected, and consequently different in the way they are incorporated them into TTI's and other stakeholder's analyses.

Spatial Availability

HPMS VMT estimates and DMV registration data are available for all counties in Texas. ATR and vehicle classification data (VMT mix, referred to as SUT under MOVES) are available for most but not all counties (in some counties, data may be available but sparse and therefore unrepresentative of actual vehicle types using a road). Consequently, these data sources are typically aggregated (e.g., to TxDOT Districts) to provide adequate accuracy and spatial coverage.

Temporal Availability

ATR data are typically available within six months of the close of the calendar year. Historically, ATR data have been the most reliable data to obtain and incorporate into emission inventories. Typically, newly received ATR data is uploaded without modification. Basic verification checks are performed, but problems are very rare.

HPMS VMT data are also typically available within six months of the close of the calendar year. Until recently, HPMS data were as reliable to obtain and incorporate as the ATR data. However, recent changes in format have complicated the incorporation of the HPMS VMT data into our emissions estimation/conformity demonstration process. Specifically, upon receipt, we extract the data from the TxDOT report and reformat it for use by our analysis procedures.

The availability of classification count data is more unpredictable. They are complicated to collect and rely heavily on contractor provided field collection. Consequently, they typically take longer to receive (due to post collection assembly, verification, and cleaning). Recent changes in the definition of functional classification and area-type, have complicated the incorporation of the classification count data into our emissions estimation/conformity demonstration process.

The vehicle registration data are unique in that they have been extracted specifically for TTI for the purposes of regulatory emissions inventories. The extraction (i.e., queries from operational databases) was originally handled by TxDOT, and then, following organizational changes by TxDMV. This organizational change, along with concomitant budget cuts, staff retirements, and a change in computing platforms, has caused a hiatus in the availability of the vehicle registration summary data. Currently, the last statewide update of registration data used for conformity occurred in 2014. These activity data sets are used for regulatory mandated emissions estimation in Texas.[1]

Data Use

Estimates are only as good as the data they are based on. The primary use of the various activity data sets described in this document is to provide the emissions estimations used for conformity with the best available basis for consistent, accurate, and defensible demonstrations of regulatory compliance.

Regulatory Emission Inventories begin with an analysis of travel demand model (TDM) outputs, typically provided by the metropolitan planning organization requiring the emission inventory. However, the TDM usually only provides an estimate of traffic volumes on each link of the network, for one or two periods (e.g., peak, off-peak) of a specific day (typically an average non-summer weekday [ANSWT]).

Since the VMT outputs of TDMs usually differ somewhat from HPMS data for the region (i.e., estimates of total VMT provided by measured HPMS data). For this reason, one role of HPMS data is to provide:

[1] Mid-year 2014 registration data are used for generating MOVES emissions factors. Year-end 2013 registration data are used for VMT Mix/Source Use Type estimates. This situation is being actively pursued and is a focus of this document. (See the appendix for more detail.)

1) An HPMS factor that adjusts the TDM VMT to official HPMS VMT estimates.

Other vehicle activity data assembled and analyzed by TTI are used to disaggregate the HPMS adjusted outputs of the TDM to estimate:

2) Episode adjustment factors to make seasonal and day-of-week adjustments to VMT on each link (e.g., non-summer versus summer, Monday–Friday).

3) The hourly distribution of VMT across the network.

4) The VMT mix (MOVES SUTs) on different roadway functional classifications (i.e., road types, such as interstates or arterials).

5) The age distribution of vehicles using the network (usually applied during the emission estimation process via an age distribution adjusted emission factor).

These data sets provide an important statewide resource for consistent, accurate, and defensible emissions estimation and inventory preparation. In the absence of exhaustive enumeration of the types and ages of vehicles using the network, we use a statistical modeling approach that combines information and data from various sources to provide a detailed and robust estimate of vehicle activity.

FY18 Goals and Activities

Our primary goal for FY18 is to maintain TTI's proactive role in obtaining and incorporating vehicle activity data into the regulatory emissions analyses for the state of Texas. In FY17, TTI made a substantive update to the VMT mix procedure as currently used for conformity analyses throughout Texas. The report *MOVES Source Use Types and VMT Mix for Conformity Analysis* documents the current procedure.

Under this task, in FY18 we:

- Completed a full review of all activity and forecast estimation methods.
- Obtained and fully incorporated the 2016 ATR data for the entire state.
- Obtained, reformatted, and made available for use the 2016 HPMS VMT data.

- Obtained 2016 classification count data and are developing procedures to address the changes in roadway functional classification and area-type.
- Worked proactively with the stakeholder agencies to obtain the necessary vehicle registration data and are currently pursuing a promising solution. (See the appendix for background on our acquisition of vehicle registration data.)

Additional detail is provided in four appendices:

- Appendix A: MOVES Source Use Type and VMT Mix Procedure.
- Appendix B: Developing VMT Forecasts for Conformity.
- Appendix C: 18 December 2017 Internal TTI Memo "History and Status of Vehicle Registration Data."
- Appendix D: 3 May 2018 TWG Presentation on Vehicle Registration Data.

Appendix A provides an overview of our current procedure for estimating MOVES SUTs and VMT mix used for conformity demonstrations. This procedure uses the registration data discussed above and the classification counts (also discussed above). In addition to being a valuable reference, this overview provides critical background and context for the discussion of registration data. While some of this information was provided to TxDOT previously, it is included here for convenience and completeness.

Appendix B provides and overview of our VMT forecasting procedure as used for conformity planning and demonstrations for areas and subareas without TDMs. This procedure uses the HPMS VMT data described above, along with the ATR data (also described above). In addition to being a reference, this overview highlights the power of the HPMS VMT data and the critical role the ATR data plays in generating seasonal and episode VMT estimates.

Appendices C and D focus on the TDMV registration data and the situation on its acquisition. Appendix C is an internal memo summarizing the registration data situation as of December 2017. It provides background and context, of course, but it also illustrates the level of effort both TxDOT and TTI have put into obtaining this critical data. Appendix D is the May 2018 presentation given to Technical Working Group (TWG) on the registration data issue, including presentation notes (annotations). It illustrates the nature of the registration data, its importance of the registration data to the conformity process, and the status of the acquisition effort as of that date.

APPENDIX A—MOVES SOURCE USE TYPE AND VMT MIX PROCEDURE

INTRODUCTION

The mix of VMT is a critical element in the estimation of on-road mobile source emissions and a major input to the MOVES link-based emissions estimation process. MOVES categorizes the fleet into nine different fuel types and 13 different SUTs. VMT mix is an estimation of the fraction of the on-road fleet VMT attributable to each SUT by fuel type. It is used to allocate total VMT into VMT by vehicle type for each link in the roadway network by time-of-day (i.e., time period). In practice, time period VMT mix is estimated by MOVES roadway type and vehicle type, and typically consists of four time periods: morning rush hour (AM peak), mid-day, evening rush hour (PM peak), and overnight.

BACKGROUND

VMT mix estimation relies upon the TxDOT collected FHWA axle-based classification counts and TxDMV registration data extracts. The collection and use of these data is well established.

TxDOT classification counts separate vehicles into the standard FHWA/HPMS vehicle classifications (based on vehicle length/number of axles) using best practice vehicle classification count methods:

C	Passenger vehicles;
P	Two-axle, four-tire single-unit trucks;
B	Buses;
SU2	Six-tire, two-axle single-unit vehicles;
SU3	Three-axle single-unit vehicles;
SU4	Four or more axle single-unit vehicles;
SE4	Three or four axle single-trailer vehicles;
SE5	Five-axle single-trailer vehicles;
SE6	Six or more axle single-trailer vehicles;

SD5 Five or less axle multitrailer vehicles;

SD6 Six-axle multitrailer vehicles; and

SD7 Seven or more axle multitrailer vehicles.

VMT mix is estimated using the latest available multiyear TxDOT vehicle classification count data from the study area, and analysis-year-specific year-end TxDMV county registration data. Registration data are used to separate vehicle categories by fuel type, supplemented with national defaults, consistent with the analysis year, as appropriate. No seasonal changes are assumed.

The primary concern for emissions estimation is not the actual vehicle counts (number of vehicles), but the proportions of vehicle types by area type and roadway functional classification. For estimating VMT mix, it is critical that the data represent the various roadway functional classifications in a given area. We believe this requirement is met by the TxDOT data. However, we recognize the value of additional data, in terms of more days, different days, and more stations (locations). Consequently, we continue to work with TxDOT to develop a program for including additional days and stations in TxDOT's on-going vehicle classification data collection program.

Additionally, we realize many urban areas have a very refined roadway functional classification typology in their TDMs, well beyond those contained in the vehicle classification data. Our response is to aggregate the TxDOT vehicle classification data into a robust configuration that fits the needs of all applications, consistent with the limitations of the data itself (primarily sample size/cell size). For example, we aggregate multiple years of classification counts into functional classification groups and combine adjacent counties into regional estimates (based on TxDOT Districts). While computationally possible, hourly estimates are not generated, though as noted above, multihour time period aggregations are.

VMT Mix in MOVES

With MOVES, fleet and activity data are critical elements of the emissions estimation process. MOVES can estimate energy consumption and emissions for all on-road sources from calendar years 1999 through 2050, for every county in the United States. Fleet data refer to information characterizing the vehicle fleet such as population estimates, age distributions, survival rates, sales growth rates, and distribution across source bins used to estimate energy and emissions. Activity data refer to information

characterizing how the fleet operates, such as VMT, VMT growth, average speed distributions, and driving patterns.

MOVES is designed to support multiscale analysis and to reconcile fundamental differences between how activity data are collected and characterized, and how emissions data are collected and characterized. With regard to multiscale analysis, MOVES uses a modal approach to estimating energy and emissions based on discrete vehicle power bins, and characterizes energy rates on a time basis (e.g., grams per hour) instead of the traditional mile basis (e.g., grams per mile). This approach requires the assignment of activity data into modal bins and for conversions of mile-based activity data (VMT) to time-based activity data (e.g., source hours operating).

With regard to reconciling differences between activity and emissions data, a long-standing challenge in producing on-road mobile source emissions inventories is the difference between how vehicle activity data characterize vehicles and how emissions or fuel economy regulations characterize vehicles. An example of this is how vehicles are characterized by the HPMS data (based on vehicle length/number of axles), as opposed to the MOVES weight and activity-based classifications.

Reconciling activity and emissions data generally requires mapping between the two categories. MOVES performs this mapping internally, so that the casual MOVES user will not have to deal with external mapping. This internal mapping, however, introduces complexity in the category definitions. Vehicles are characterized both according to activity patterns and energy/emissions performance. Thus, the model uses data for both the activity and energy/emissions methods of characterization. On the activity side, vehicles are grouped into SUTs, or use types, defined as groups expected to have unique activity patterns. Because HPMS data are a fundamental source of activity, the MOVES SUTs are defined as subsets of HPMS vehicles classifications. The majority of MOVES-related activity data are based on these classifications.

To characterize factors important for energy consumption and emissions, MOVES uses the concept of source bins. Unique source bins are defined by those characteristics with the largest influence on fuel (energy) consumption and emissions. Source bins are defined completely separate from use types but are mapped to SUTs internal to MOVES by the Source Bin Distribution Generator. Table 1 summarizes the MOVES Fuel Types. Table 2 shows the MOVES SUTs.

Table 1. MOVES Fuel Type Definitions.

Code	Fuel Type
1	Gasoline
2	Diesel
3	Compressed Natural Gas (CNG)
4	Liquid Propane Gas (LPG)
5	Ethanol (E85 or E95)
6	Methanol (M85 or M95)
7	Gaseous Hydrogen
8	Liquid Hydrogen
9	Electricity

TTI's objective is, to the extent possible, to define MOVES SUT parameters that are unique to regional conditions. There are activity parameters and fuel type parameters. Table 3 and Table 4 summarize the activity and fuel type parameters, followed by Table 5 that summarizes the road type equivalents.

Table 2. MOVES Source Use Type Definitions.

HPMS Class	MOVES Source Use Type	Description
Passenger Cars	21 Passenger Car	All.
Other 2 Axle / 4 Tire Vehicles	31 Passenger Truck	Mini-van, pick-up, etc., used primarily for personal transportation.
	32 Light Commercial Truck	Mini-van, pick-up, etc., used primarily for commercial applications. Different annual mileage and hours of operation.
Single Unit Trucks	51 Refuse truck	Garbage and recycling trucks. Different schedule, roadway, and hours of operation.
	52 Single-Unit Short-Haul	Single-unit trucks with the majority of operation within 200 miles of home base.
	53 Single-Unit Long-Haul	Single-unit trucks with the majority of operation outside of 200 miles of home base.
	54 Motor Home	All.
Buses	41 Intercity Bus	City-to-city buses. Not transit or school buses.
	42 Transit Bus	Buses used for public transit.
	43 School Bus	School and church buses.
Combination Trucks	61 Combination Short-Haul	Combination trucks with the majority of operation within 200 miles of home base.
	62 Combination Long-Haul	Combination trucks with the majority of operation outside of 200 miles of home base.
Motorcycles	11 Motorcycle	All.

Table 3. Summary of Critical MOVES Source Use Type Activity Parameters.

MOVES Activity Parameter	Method
Passenger Truck versus Light Commercial	MOVES Default
Single-Unit Short-Haul versus Long-Haul	Registration versus Observed
Refuse Truck and Motor Home	MOVES Default within Observed
Combination Short-Haul versus Long-Haul	Registration versus Observed
Motorcycles	Nominal

Table 4. Summary of Critical MOVES Source Use Type Fuel Parameters.

MOVES Fuel Parameter	Method
Passenger Vehicle and Light-Duty Truck	Registration and MOVES Default
Single-Unit and Combination Truck	Registration
Refuse Truck, Motor Home, and Bus	MOVES Default

Table 5. Summary of MOVES Road Type Equivalents.

MOVES Road Type	HPMS Roadway Functional Classification
1 Off Network	9 – Rural Local 19 – Urban Local
2 Rural Restricted Access	1 – Rural Interstate
3 Rural Unrestricted Access	2 – Rural Principal Arterial (Other) 6 – Rural Minor Arterial 7 – Rural Major Collector 8 – Rural Minor Collector
4 Urban Restricted Access	11 – Urban Principal Arterial (Interstate)
5 Urban Unrestricted Access	12 – Urban Principal Arterial (Other Freeway) 14 – Urban Principal Arterial (Other) 16 – Urban Minor Arterial 17 – Urban Collector

DISCUSSION

Latest available Texas registration data from the TxDMV are the basis for assessing the short-haul versus long-haul aspects of fleet activity and fuel. For short-haul versus long-haul, the proportion of VMT attributable to a category of vehicles registered in a given area (e.g., TxDOT District) is compared with the proportion of vehicles in that category observed (i.e., reflected in the classification counts). The locally registered VMT is assumed to approximate short-haul activity, while the remainder is assumed to approximate long-haul activity (i.e., from outside the area). This calculation is performed for the two subfleets of interest (single units and combination trucks). Validation was achieved by comparing the Texas statewide allocations with the MOVES defaults.

For these vehicle categories (i.e., those that distinguish between short-haul and long-haul), fuel type is taken directly from the TxDMV registration data by TxDOT District and applied directly. However, for the passenger vehicle group (passenger vehicles and passenger trucks), a combination of model year distribution for TxDMV registration data and MOVES fuel fraction by model year is used, creating a Texas area-specific application of national passenger vehicle fuel type. No explicit validation is possible or necessary, since this is a direct application of MOVES default values by model year.

Future fleet age distribution is not available (the latest age distribution is carried forward, consistent with U.S. EPA guidance), but future fuel fractions are. These are applied to reflect the analysis year. At this time, only gasoline and diesel fuels are included. Others are implicitly treated as *de minimus*. However, the procedure can incorporate additional fuel types (using either national defaults or local data) once a significant number of alternatively fueled vehicles enter the fleet. This includes the various configurations of electric power train vehicles.

The remaining vehicle categories either have no currently available regional data or are negligible in magnitude. Refuse trucks and motor homes are included as separate vehicle categories in MOVES, along with a distinction between passenger trucks and light commercial vehicles. The former two categories, refuse trucks and motor homes, have limited local data and are only loosely related to the area of registration. The latter two categories, passenger trucks and light commercial vehicles, are usage based and have no direct analog in the regional data (TxDMV registration data). Consequently, MOVES national defaults are used for both groups. Refuse trucks and motor homes are taken from the combined single-unit truck category. Passenger trucks and light

commercial trucks are allocated based on national defaults taken from the combined TxDMV defined light truck category. Motorcycles are allocated a nominal value taken from passenger vehicles.

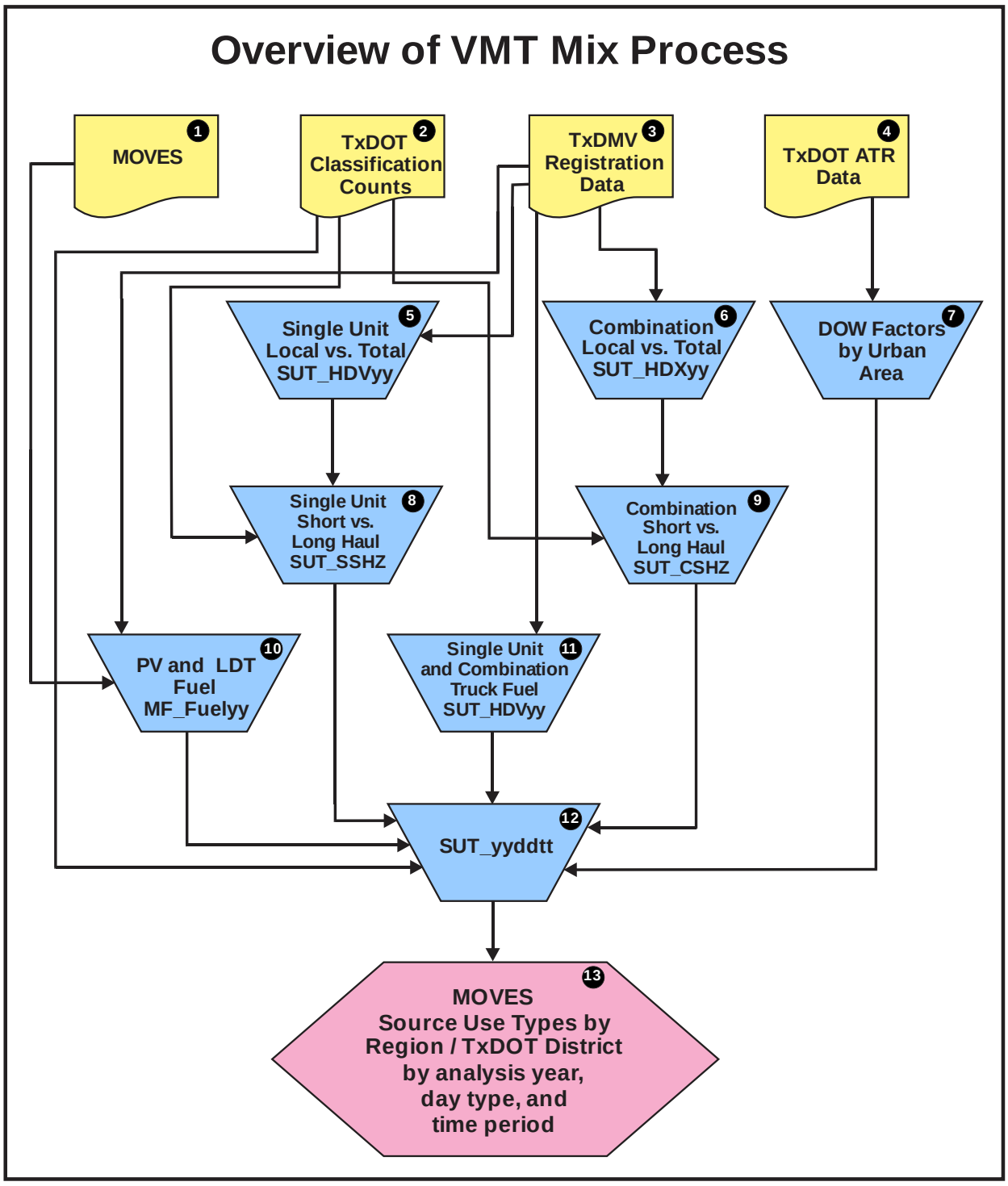
Finally, road type is re-defined under MOVES. Fortunately, these map directly to the current roadway functional classifications used for the classification count data. No further manipulation is necessary, beyond the simple re-definition shown in Table 5.

These measures and procedures provide a functional, region-specific, disaggregate link-level application of MOVES as currently configured. Figure 1 shows a simplified process flow chart. Each step is defined as follows:

1. MOVES – Data files of MOVES default values extracted from MOVES databases or pro forma runs.
2. TxDOT Classification Counts – Data files of standard TxDOT classification data assembled and used for determining the in-use road fleet mix.
3. TxDMV Registration Data – Data files of standard TxDMV vehicle registration summary data assembled and used for determining the in-use road fleet mix.
4. TxDOT ATR Data – Data files of TxDOT ATR data assembled and used to allocate VMT by season and day-of-week.
5. Single Unit Local versus Total SUT_HDVyy – Procedure based on registration data to generate factors to separate Single-Unit versus Combined-Unit trucks by region. (SUT_HDVyy has multiple outputs based on vehicle category and fuel.)
6. Combination Local versus Total SUT_HDXyy – Procedure based on registration data to generate short-haul and long-haul combination truck proportions by region.
7. Day of Week (DOW) Factors by Urban Area/TxDOT District – Seasonal day-of-week factors from TxDOT ATR data used to allocate VMT by season and day-of-week by urban area/TxDOT District.
8. Single Unit Short versus Long Haul SUT_SSHZ – Procedure to separate single-unit short-haul versus single-unit long-haul using factors generated at SUT_HDVyy and classification count data. Short-haul and long-haul are functionally defined as local and pass through.
9. Combination Short versus Long Haul SUT_CSHZ – Procedure to separate combined short-haul versus combined long-haul using factors generated at

SUT_HDXyy and classification count data. Short-haul and long-haul are functionally defined as local and pass through.

10. PV and LDT Fuel MF_Fuelyy – Procedure to generate passenger vehicle and light truck fuel allocation by year based on MOVES national default values and local registration data.
11. Single Unit and Combination Truck Fuel SUT_HDVyy – Procedure to generate single-unit and combined truck fuel allocation factors from registration data. (SUT_HDVyy has multiple outputs based on vehicle category and fuel.)
12. SUT_yyddtt – Procedure to generate SUT proportions by year, day type, and time period based on the previous steps.
13. MOVES Source Use Types – Output file of MOVES SUTs by region, analysis year, day type, and time period.



14. Source: TTI, October 2015.

Figure 1. Simplified Overview of the VMT Mix Process.

APPENDIX B—DEVELOPING VMT FORECASTS FOR CONFORMITY

BACKGROUND

VMT is a critical parameter in transportation planning, including but not limited to emissions estimation and conformity demonstrations. For historical analysis years of virtual-link and TDM-based analyses, county HPMS VMT is used as reported in TxDOT's Road Inventory Functional Classification Record. (TTI virtual link emissions estimation procedure is an HPMS-based emissions inventory methodology [as opposed to TDM link-based estimates] developed for counties without TDMs available, as well as for analyses where network link-level detail is unnecessary.) For future analysis years for virtual-link based analyses, county VMT is forecast. These VMT forecasts are based on historical TxDOT HPMS county VMT data (e.g., 1990 through 2014) and official Texas State Data Center (TSDC) population projections. (TDM-based analyses for future years are based on regional TDM VMT.)

ESTIMATING VMT

The VMT estimation process produces estimates of analysis year seasonal day-type-specific VMT for each county by hour and direction for each HPMS roadway functional classification and area type combination. These estimates are a function of episode, hourly volume, directional split, and VMT forecasts in the case of future year analyses.

DATA SOURCES

Two traffic data sources are used for developing VMT estimates and forecasts. These are ATR counts and HPMS data estimates. Both are collected by TxDOT on a formal and on-going basis as part of the larger HPMS data collection program. The U.S. Census Bureau (Census) and TSDC county population statistics and projections are also used in the VMT forecast portion of the procedure.

HPMS VMT estimates are available for all counties. ATR data are available for most but not all counties. Consequently, ATR data are typically aggregated (e.g., to TxDOT Districts) to provide adequate data coverage.

ATR vehicle counts are collected by TxDOT at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and weekday, as well as on an average annual daily basis (i.e., AADT). Since they are continuous, they are especially well-suited for making seasonal, day-of-week, and time-of-day comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area.

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the FHWA designed to estimate VMT (as well as lane miles and centerline miles). A wide range of traffic data is collected under the HPMS program. The focus for this application is specifically the VMT, centerline miles, and lane miles estimates made as part of the HPMS program. The HPMS VMT is categorized by seven roadway functional classifications and three area types.

Seasonal Day-of-Week Factors

Emissions estimates are typically required for seasonal (e.g., summer) weekdays (Monday through Friday). Since the VMT data and forecasts are for Monday through Sunday, January through December, the conversion of AADT to specific days and seasons (e.g., summer weekday or ANSWT) is required.

Multiple years (e.g., 2007–2016) of ATR vehicle counts are typically aggregated by geographic area (e.g., by planning region or TxDOT District). We use these aggregated ATR counts to develop VMT adjustment factors for the episode (e.g., summer weekday). These factors are the ratio of analysis episode volume-to–total volume.

County VMT Forecasts and Control Totals

VMT control totals are required to estimate the seasonal, day-type-specific county VMT at the HPMS roadway functional classification and area type category level. Forecast VMT, based on historical HPMS VMT and county population, along with the ATR-based adjustment factors described in the preceding section are used to calculate county control totals.

Each VMT control total is then disaggregated into roadway functional classification and area type. This procedure disaggregates the forecast VMT control total proportionally to

the historical AADT VMT estimate for each of the roadway functional classification/area type combinations by county.

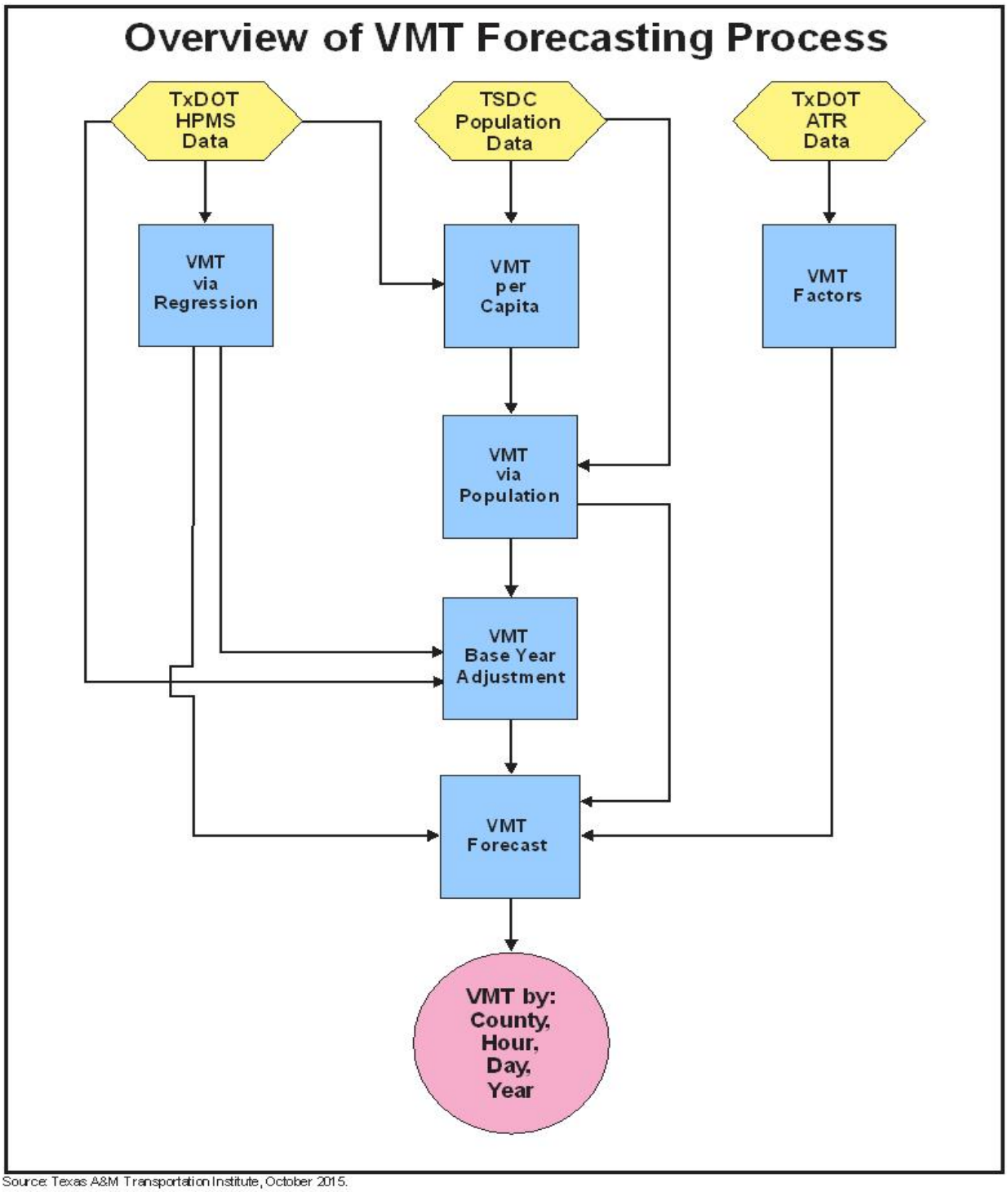
VMT forecasts are based on historical TxDOT county HPMS VMT data (e.g., 1990 through 2016) and Census/TSDC county population statistics and projections. Conceptually, there are two types of VMT—local and through. Local VMT is generated by the residents of the county. Through VMT is generated by persons and vehicles passing through the county. The relative importance varies by the proximity of the county to large urban areas (that generate substantial VMT of their own).

Theoretically, local VMT is more closely related to population, while through VMT is more closely related to historical VMT. Though these distinctions are not absolute (i.e., local VMT is not independent of historical patterns and through VMT is not independent of county population), they imply very different strategies for forecasting. Local VMT is likely to be a function of population, while through VMT is likely to be a function of historical VMT (i.e., growth). If used alone, however, each tends to err in a different direction.

Population-based forecasts (i.e., VMT per capita) tend to under-estimate future VMT, especially in small counties adjacent to large urban areas. Conversely, historical-based forecasts (i.e., VMT over time) tend to over-estimate future VMT, especially in areas where there has been recent atypical rapid growth. These two forecast streams form the range of credible results. Our HPMS and population-based VMT forecasting method combines the population-based and historical VMT-based forecast streams with equal weight, and then calibrates the combined forecast result to the latest historical HPMS VMT data using a step-function adjustment. The VMT per-capita-based forecasts are developed using VMT-to-population ratios (again, based on the latest HPMS VMT) applied to future official population projections. The historical VMT forecasts are developed using traditional regression analyses based on historical HPMS VMT data by county.

Since the VMT forecasts are 24-hour estimates, hourly factors are required to allocate the VMT to each hour of the day. TxDOT continuous ATR data (e.g., 2007–2016) are aggregated by geographic area (e.g., planning area or TxDOT District) to develop hourly weekday travel factors.

Annual average daily VMT and summer weekday VMT by county for 1990 through 2050 are currently available. We also provide county name, county FIPS code, and TxDOT District for identification and reference.



Source: Texas A&M Transportation Institute, October 2015.

Figure 2. VMT Forecasting Process.

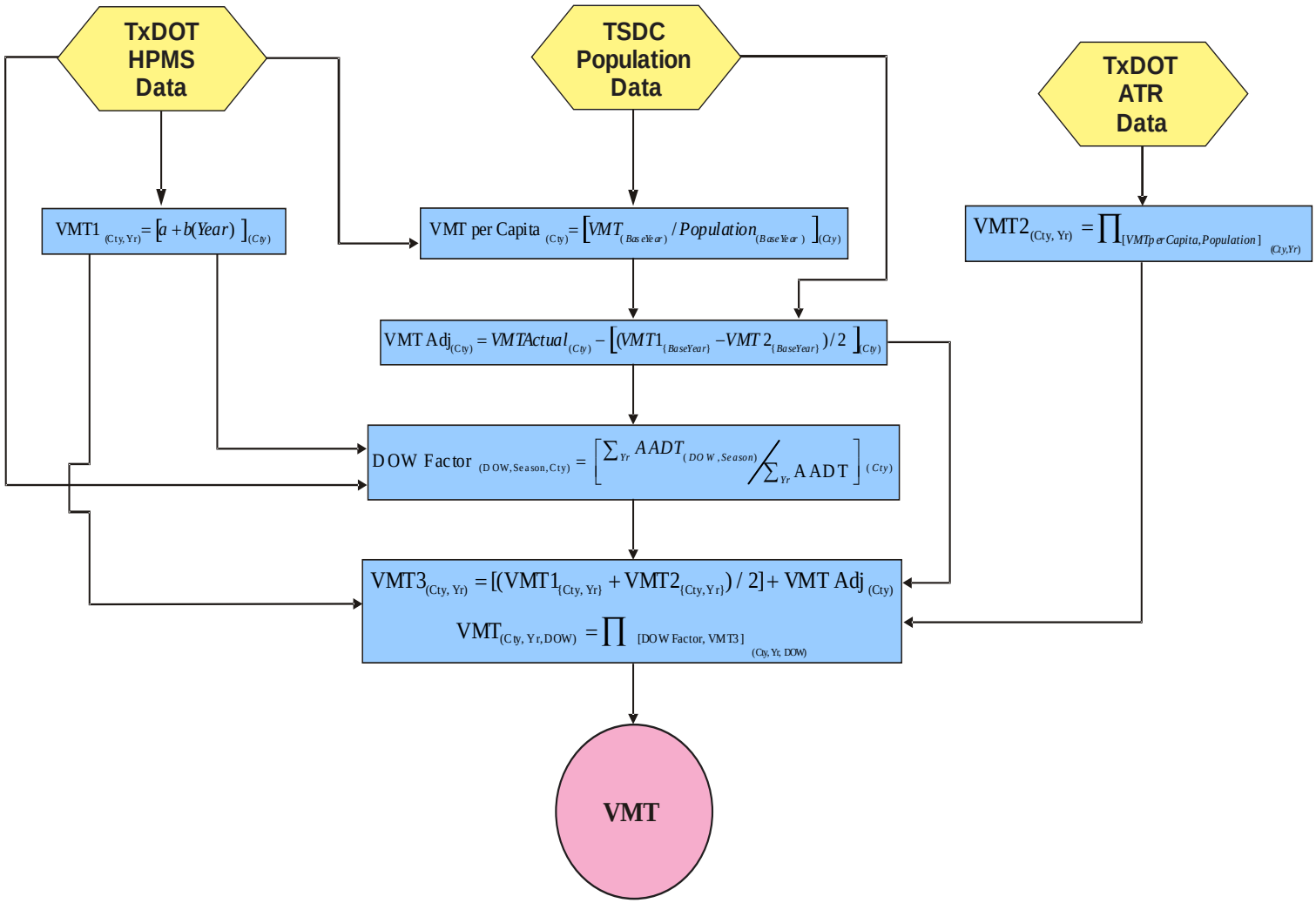


Figure 2. VMT Forecasting Computation.

APPENDIX C—INTERNAL TTI MEMO: "HISTORY & STATUS OF VEHICLE REGISTRATION DATA"

MEMORANDUM

TO: Andrew Birt **DATE:** 18 December 2017

FROM: Dennis Perkinson

SUBJECT: History & Status of Vehicle Registration Data

Background

TxDMV registration data is currently used for two purposes, both are critical to the conformity (and SIP) inventory process. Mid-year registration data (county level) is used for the age distribution input to the MOVES rate calculation. It is also used to estimate county vehicle population for source hours parked in MOVES. Year-end registration data is used, along with several other data sets, to estimate the Source Use Type proportions / VMT mix used in conformity and SIP inventories. (The most comprehensive description of the SUT / VMT mix estimation process is in the TxDOT-TPP deliverable for IAC-A Task 4.3.)

Both of these applications use registration data extracted specifically for us, originally by TxDOT when they had responsibility for registration data, and then by TxDMV when that function was moved several years ago. The point for this discussion being that the data are highly specialized and designed specifically for use in emissions inventories with the utilities we designed. This is true of both content (the GVWR categories) and format (ASCII flat file with model year and category columns).

The other critical aspect of these registration data sets is that they are compiled / extracted by the cognizant state agency. They are official. This avoids us having to QA/QC any extraction and compilation procedures, and having to defend any other aspect of the data. Registration under the current arrangement is reliable and official. That's about as good as it gets, except that it now appears to also be unavailable!!

According to the various conversations and inquiries we've had with TxDMV, the problems with our registration data are due to several factors. These are, in no particular order, budget cuts, retirements of key staff, and migration to a different computing platform. In response to these issues, it is our understanding that TxDOT has offered / suggested paying for the data, offering TxDOT staff to do the coding necessary to extract the data, or extracting the data ourselves (TxDOT and/or TTI). The in-house extraction has come up in the past and been summarily rejected because of the

sensitivity of the data (it contains the financial history of the vehicle and identifying information for every owner) and the size of the records and there for the data set (very large). Consequently, I assume the option of TTI directly extracting data from the full data set is (still) a non-starter (though apparently TxDOT access is still a contender... see current status below). It is unclear whether the other two, payment and coding support are still viable at some level. (The current status section below implies they are not, though they have apparently not been explicitly rejected.)

At various times there has been informal discussion / consideration of using another source, such as one of the various VIN decoding services. While superficially feasible, this is impractical since it would need to be done for the entire state fleet of approximately 24 million registered vehicles, which would require access to the registration database. To my knowledge, the cost of having these data provided by one of the commercial services has never been explicitly priced out. (On this as well, see the current status section below.)

Communication Sequence

19 May 2014

TTI / Perkinson email to TxDOT-TPP / Temple. Initial on schedule formal request for various activity data sets for the 2014 cycle of updates, including registration data (early).

27 August 2014

TTI / Perkinson email follow up to phone message regarding the various activity data requests then in the pipeline. Requested TPP assistance in general. May 2014 request included.

[Hiatus in pursuit of registration data as the other data sets were received.]

8 July 2015

TTI / Perkinson request for TxDOT-TPP help getting various conformity related data sets, including registration data. May and August 2014 emails included.

30 September 2015

TTI / Perkinson email to TxDMV / Jonathan O'Quinn describing TTI use of requested registration data. Description requested by TxDMV.

2 November 2015

TTI / Perkinson follow up to September request and TxDMV / O'Quinn response.

17 December 2015

TxDOT-TPP follow up to November follow up to September request for registration data, with TxDMV response. September and November emails attached / included.

Separate email from TTI / Perkinson to TxDOT-TPP / Temple documenting conversation regarding TxDMV registration data. Documentation requested by TxDOT-TPP.

21 December 2015

TTI email to TxDOT-TPP regarding status of the registration data (attachment). Status update requested by TPP. Separate email advising TTI-HMP staff of situation.

[Hiatus in discussion of registration data acquisition at the direction of TxDOT-TPP while the matter reviewed within TxDOT.]

17 October 2016

TTI / Perkinson follow up and re-request (with examples) of the registration data request. In response to TxDOT-TPP follow up email with TxDMV / O'Quinn. (Three emails. Initial TxDOT email, then two emails from TTI due to attachment size.)

21 October 2016

TxDOT-TPP updating NCTCOG on status of the registration data availability situation.

2 December 2016

Coordinated email exchange between FHWA and TxDOT-TPP. TxDOT advising FHWA of the situation and the possible need to deal with it in some manner.

17 January 2017 / 19 January 2017

Follow up phone calls / messages to O'Quinn per TPP Janie Temple

[Hiatus in discussion of registration data acquisition at the direction of TxDOT-TPP while the matter is escalated within TxDOT.]

DMV Registration Data Summary - 5 June 2017

(email text for background and/or discussions with TxDMV)

This is in response to your request for a summary of the DMV provided registration data we use in our emissions and conformity work. As you know and as has been communicated to DMV, these data sets are critical for our emissions inventory work that supports conformity demonstrations and SIP emissions budget development. Specifically, in order to complete the inventory work scheduled for this Fiscal Year, we need to have these data sets. (At a minimum 2016 mid-year and 2016 year-end, ideally 2014 year-end and 2015 mid-year. Described below.)

The data extracts are summaries of the vehicle registration database maintained by DMV. Specifically, they are summaries by vehicle weight category (GVWR) and model year. We require (and have historically received) these data sets for mid-year (i.e., July 1st) and year-end (as of December 31st). Multiple files are required and have been historically provided, one for all vehicles, one for heavy duty gas vehicles, another for heavy duty diesel vehicles, and some for specialized vehicles such as refuse trucks, motor homes, etc. DMV has been provided examples.

(As you know, the mid-year summaries are reformatted and used as inputs to the EPA emissions rate calculation software (MOVES) to calculate emission rates by county or county group. The year-end summaries are used to calculate the mix of vehicle types by county or county group (known as VMT mix) to calculate various factors relating to vehicle type and fuel, which are combined with TxDOT vehicle classification counts to get an accurate picture of the fleet by county and county group. Both applications are critical for the accurate estimation of emissions specific to Texas counties and regions.)

These data are a critical element in our work for TxDOT and TCEQ. We use these data in estimating on-road mobile source emissions for setting emissions budgets (i.e., not to exceed targets) and demonstrating conformity with those targets. I believe the extraction code was developed specifically by DMV for this purpose and is not used for any other purpose. Similarly, the format is critical for our use, as is the consistency of format over the nearly twenty years we've been receiving these data...

3 October 2017

Follow up email from TxDOT / Temple to TTI / Perkinson and FHWA / Maley regarding discussion at the STAQS conference regarding the availability of registration data. The TxDOT response in its entirety reads as follows:

Dennis and Barbara,

We are making some progress in two different quarters. We may be able to enter a new interagency agreement with the DMV to get the raw data in the future. It also seems NCTCOG may have an agreement in place already that gives them the raw data but they don't have a way to process it. I'm going to be speaking with Jenny this week to see what they have (NCTCOG region only or whole state) and what their agreement allows. If the agreement allows them to share the data, we can request from Bill as the Air Quality IAC manager to have TTI process the data for the state. Both approaches will require processing the data which we did not do before. We hope to have something more definitive to share by the TWG meeting.

Janie

Current Status

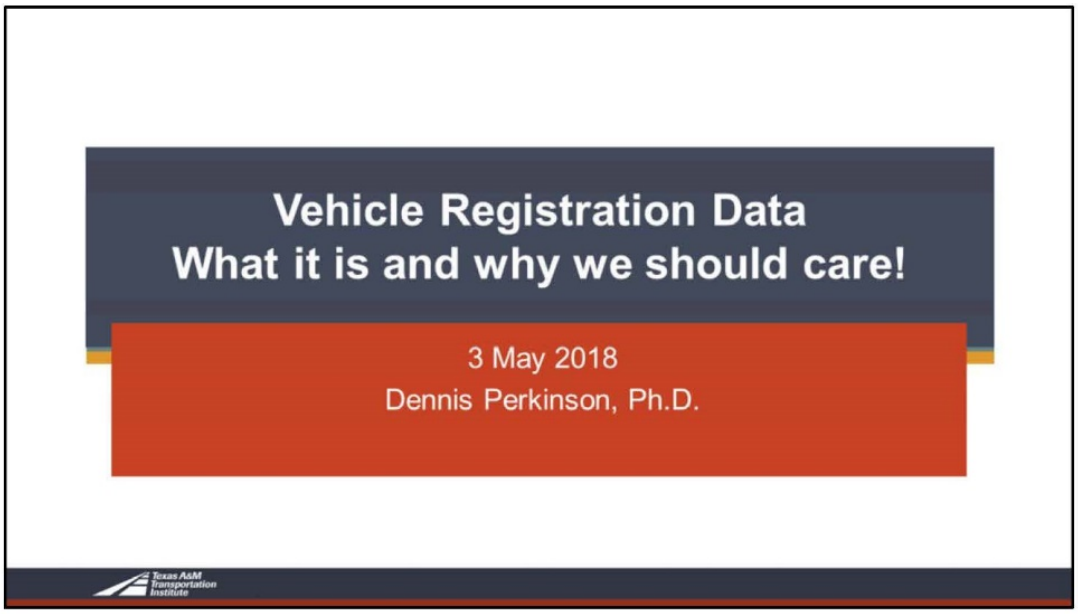
Based on a recent phone conversation with TxDOT / Temple, the current situation as of this writing is that TxDMV has firmly stated that there can be no resurrection of the previous format. The code for those extractions is lost and the underlying format of the data has changed as part of a migration to a different computing platform. My understanding is that subsequent to the 3 October TxDOT email (above) there were discussions regarding TxDOT access to the entire data base for TxDOT access and extraction (similar to what NCTCOG is believed to currently have). I believe these discussions are on-going.

The issue has also formally been escalated to the inter-agency level. FHWA has been keep informed of the situation and is now actively being involved in identifying and evaluating alternative approaches and sources. TTI / Perkinson continues to actively monitor the situation and actively participate as appropriate, under the auspices of the TWG, as well as IAC-A Task 4.3 and through the various consultation

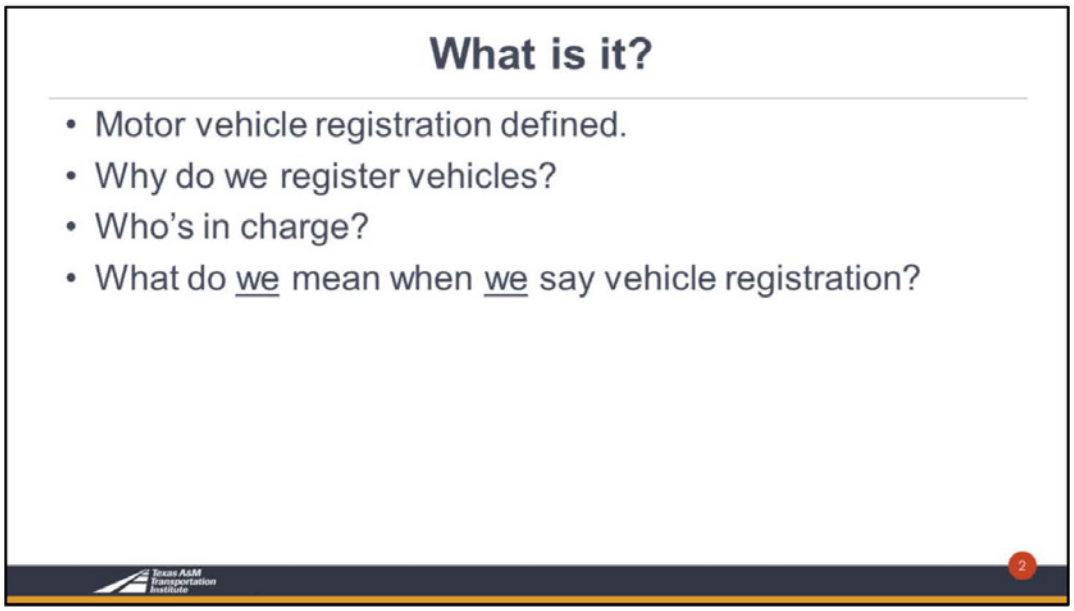
[Note: The effort to obtain usable vehicle registration data has continued since the date of this memo. We presented a more recent summary to the TWG at its May 2018 meeting. An annotated copy of that presentation follows in Appendix D.]

APPENDIX D—3 MAY 2018 TWG PRESENTATION ON VEHICLE REGISTRATION DATA

In this section, the TTI team provide annotated PowerPoint slides that were presented to the Technical Working Group for Mobile Source Emissions (TWG) at a meeting held at TTI on May 3, 2018. The goal of the presentation was to help reinstate the annual updates of Vehicle Registration data from TxDMV. The presentation was designed to refresh TWG participants of the importance of Texas vehicle registration data, summarize how it is used, and define the format of data required for conformity. Dennis Perkinson (TTI) presented the material, which was followed by a productive discussion among the group on how to proceed with obtaining the data.


Vehicle Registration Data
What it is and why we should care!
3 May 2018
Dennis Perkinson, Ph.D.
Texas A&M Transportation Institute

1



At its most basic, motor vehicle registration links a vehicle with its owner, under the auspices of a designated government agency.

Passenger and commercial vehicles must be registered as a condition of use on a public road. Vehicles not used on public roads, such as tractors or regular vehicles whose use is limited to private property, are not required to be registered.

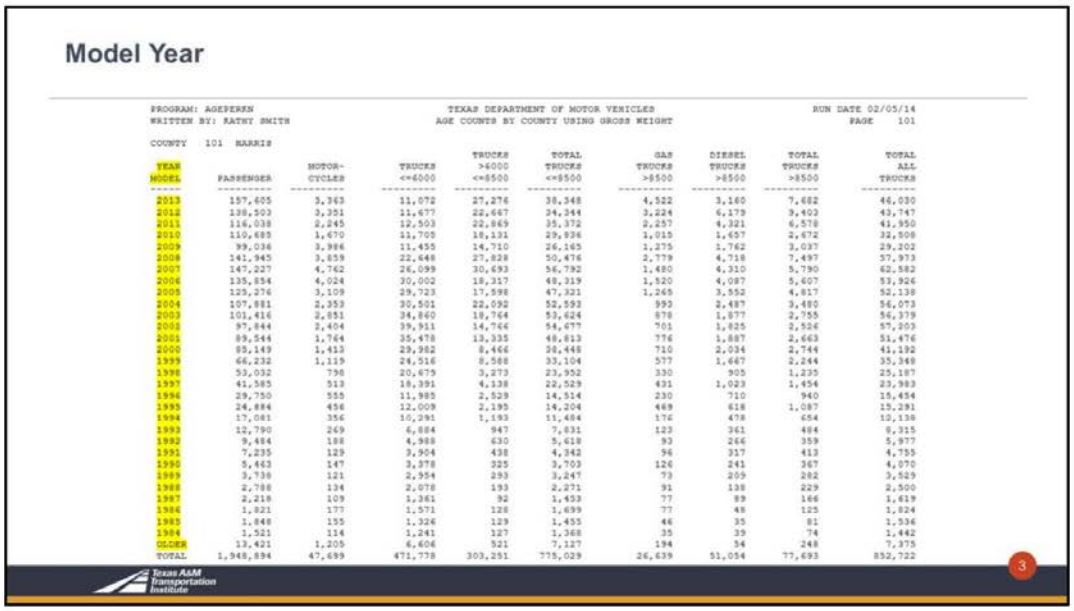
Vehicle registration in the United States is managed by each state, typically a department of motor vehicles (DMV). In Texas vehicle registration is handled by the Texas Department of Motor Vehicles (TxDMV).

When **we** talk about vehicle registration, we are usually referring to the various datasets we use in our emissions estimation work. For each county for each year, we get a fleet wide count of vehicles by Gross Vehicle Weight Rating (GVWR) / fuel category by model year.

In addition, two separate datasets are provided for heavy trucks by the eight sub-categories of GVWR and fuel type (diesel and gasoline). We use all three dimensions of the registration data, model year / age, total vehicles, and vehicle category.

Here are examples for Harris County…

2



Model Year

PROGRAM: AGEPERSN
WRITTEN BY: KATHY SMITH

TEXAS DEPARTMENT OF MOTOR VEHICLES
AGE COUNTS BY COUNTY USING GROSS WEIGHT

RUN DATE 02/05/14
PAGE 101

COUNTY 101 HARRIS

YEAR MODEL	PASSENGER	MOTOR-CYCLES	TRUCKS <=6000	TRUCKS >6000 <=8500	TOTAL TRUCKS <=8500	GAS TRUCKS >8500	DIESEL TRUCKS >8500	TOTAL TRUCKS >8500	TOTAL ALL TRUCKS
2013	157,605	3,363	11,072	27,276	38,348	4,522	3,160	7,682	46,030
2012	138,503	3,351	11,677	22,667	34,344	3,224	6,179	9,403	43,747
2011	116,038	2,245	12,503	22,869	35,372	2,257	4,321	6,578	41,950
2010	110,685	1,670	11,705	18,131	29,836	1,015	1,657	2,672	32,508
2009	99,036	3,986	11,455	14,710	26,165	1,275	1,762	3,037	29,202
2008	141,945	3,859	22,648	27,828	50,476	2,779	4,718	7,497	57,973
2007	147,227	4,742	26,099	30,693	56,792	1,480	4,310	5,790	62,582
2006	135,854	4,024	30,002	18,317	48,319	1,520	4,087	5,607	53,926
2005	125,276	3,109	29,723	17,598	47,321	1,265	3,552	4,817	52,138
2004	107,881	2,353	30,501	22,092	52,593	993	2,487	3,480	56,073
2003	101,416	2,851	34,860	18,764	53,624	878	1,877	2,755	56,379
2002	97,844	2,404	39,911	14,766	54,677	701	1,825	2,526	57,203
2001	89,544	1,744	35,478	13,335	48,813	776	1,887	2,663	51,476
2000	85,149	1,413	29,982	8,466	38,448	710	2,034	2,744	41,192
1999	66,232	1,119	24,516	8,588	33,104	577	1,667	2,244	35,348
1998	53,032	798	20,679	3,273	23,952	330	905	1,235	25,187
1997	41,585	513	18,391	4,138	22,529	431	1,023	1,454	23,983
1996	29,750	555	11,985	2,529	14,514	230	710	940	15,454
1995	24,884	456	12,009	2,195	14,204	469	618	1,087	15,291
1994	17,081	356	10,291	1,193	11,484	176	478	654	12,138
1993	12,790	269	6,684	947	7,631	123	361	484	8,115
1992	9,484	188	4,988	630	5,618	93	266	359	5,977
1991	7,235	129	3,904	438	4,342	96	317	413	4,755
1990	5,463	147	3,378	325	3,703	126	241	367	4,070
1989	3,738	121	2,954	293	3,247	73	209	282	3,529
1988	2,788	134	2,078	193	2,271	91	138	229	2,500
1987	2,218	109	1,361	92	1,453	77	89	166	1,619
1986	1,821	177	1,571	128	1,699	77	48	125	1,824
1985	1,848	155	1,326	129	1,455	46	35	81	1,536
1984	1,521	114	1,241	127	1,368	35	39	74	1,442
OLDER	13,421	1,205	6,606	521	7,127	194	54	248	7,375
TOTAL	1,948,894	47,699	471,778	303,251	775,029	26,639	51,054	77,693	852,722

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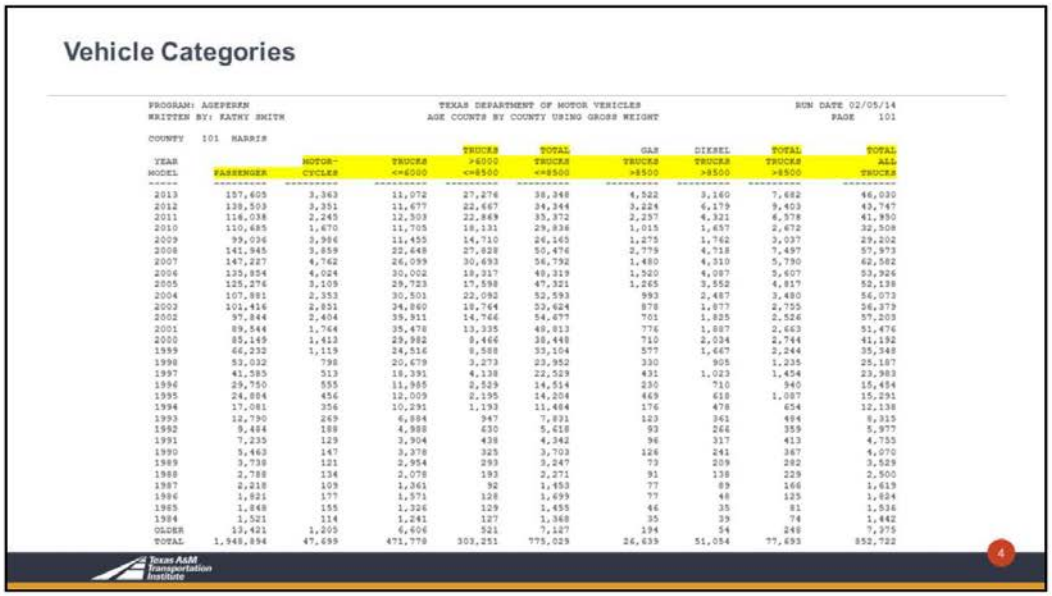
3

[Examples: Walk through each and point out the highlighted elements.]

Here the model year vector is highlighted. Sometimes used directly. Other times generalized to vehicle age.

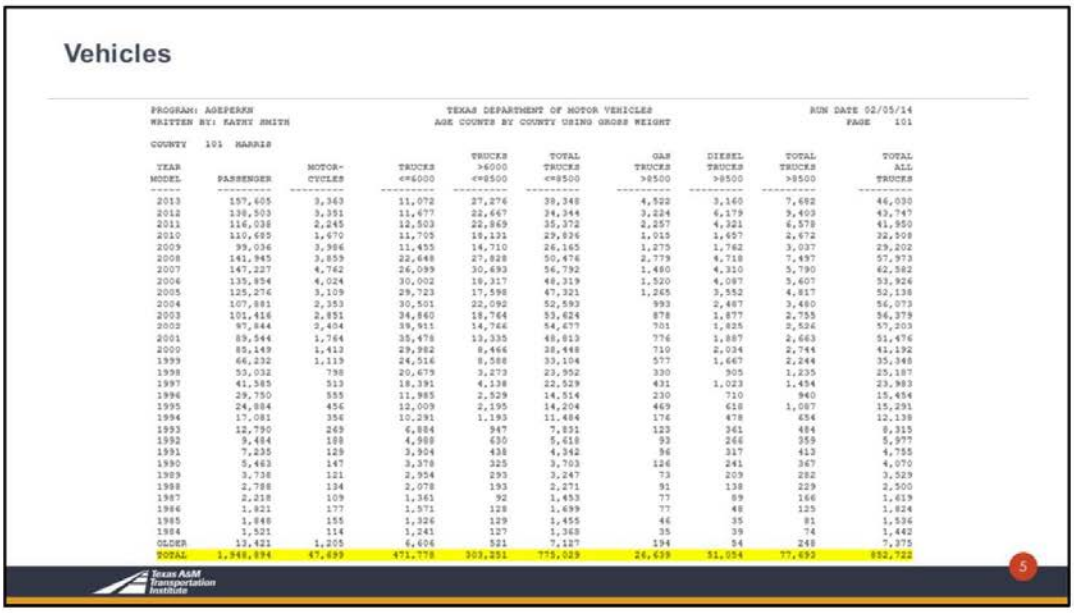
3



[Examples: Walk through each and point out the highlighted elements.]

Here's the same Harris County data showing the vehicle GVWR categories / fuel type categories.

4



Vehicles

PROGRAM: AGEPERYR
WRITTEN BY: KATHY SMITH

TEXAS DEPARTMENT OF MOTOR VEHICLES
AGE COUNTS BY COUNTY USING GROSS WEIGHT

RUN DATE 02/05/14
PAGE 101

COUNTY 101 HARRIS

YEAR MODEL	PASSENGER	MOTOR-CYCLES	TRUCKS <=6000	TRUCKS >6000 <=8500	TOTAL TRUCKS <=8500	GAS TRUCKS >8500	DIESEL TRUCKS >8500	TOTAL TRUCKS >8500	TOTAL ALL TRUCKS
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1984	1,521	114	1,241	127	1,368	35	39	74	1,442
OLDER	13,421	1,205	6,606	521	7,127	194	54	248	7,375
TOTAL	1,948,894	47,699	471,778	303,251	775,029	26,439	51,054	77,493	852,722

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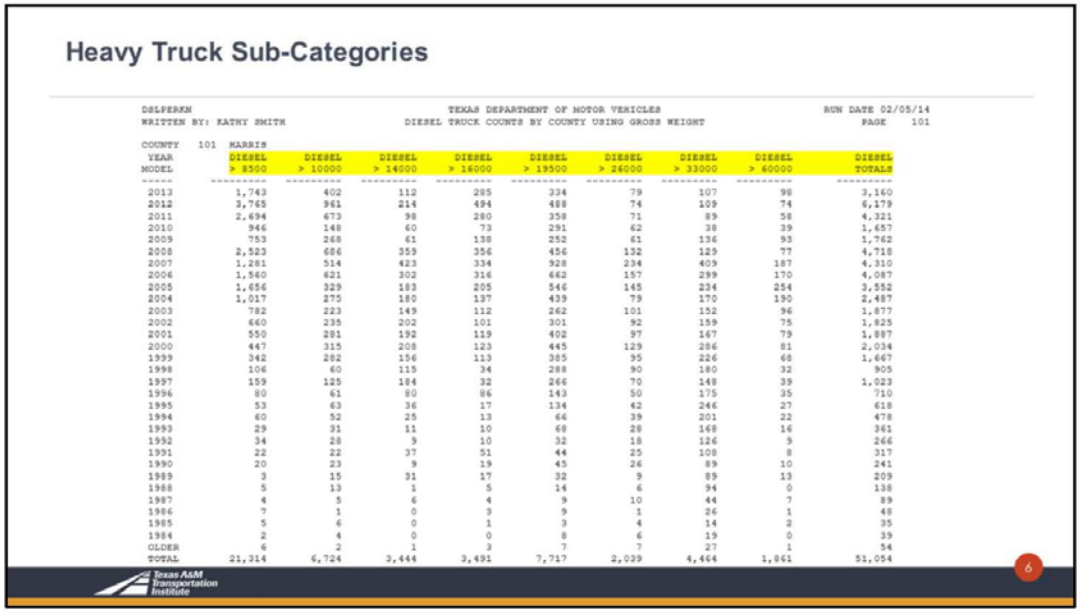
5

[Examples: Walk through each and point out the highlighted elements.]

Here's the same Harris County data showing the vehicle GVWR category totals. As with model year, sometimes these are used directly. Other times the category totals are generalized into proportions.

5



Heavy Truck Sub-Categories

DSLPERKN — TEXAS DEPARTMENT OF MOTOR VEHICLES — RUN DATE 02/05/14
WRITTEN BY: KATHY SMITH — DIESEL TRUCK COUNTS BY COUNTY USING GROSS WEIGHT — PAGE 101

COUNTY 101 HARRIS

YEAR MODEL	DIESEL > 8500	DIESEL > 10000	DIESEL > 14000	DIESEL > 16000	DIESEL > 19500	DIESEL > 26000	DIESEL > 33000	DIESEL > 40000	DIESEL TOTALS
2013	1,743	402	112	285	334	79	107	98	3,160
2012	3,765	961	214	494	488	74	109	74	6,179
2011	2,694	673	98	280	358	71	89	58	4,321
2010	946	148	60	73	291	62	38	39	1,657
2009	753	268	61	138	252	61	136	93	1,762
2008	2,523	686	359	356	456	132	129	77	4,718
2007	1,281	514	423	334	928	234	409	187	4,310
2006	1,560	621	302	316	662	157	299	170	4,087
2005	1,656	329	183	205	546	145	234	254	3,552
2004	1,017	275	180	137	439	79	170	190	2,487
2003	782	223	149	112	262	101	152	96	1,877
2002	660	235	202	101	301	92	159	75	1,825
2001	550	281	192	119	402	97	147	79	1,887
2000	447	315	208	123	445	129	286	81	2,034
1999	342	282	156	113	385	95	226	68	1,667
1998	106	60	115	34	288	90	180	32	905
1997	159	125	184	32	266	70	148	39	1,023
1996	80	61	80	86	143	50	175	35	710
1995	53	63	36	17	134	42	246	27	618
1994	60	52	25	13	66	39	201	22	478
1993	29	31	11	10	69	28	168	16	361
1992	34	28	9	10	32	18	126	9	266
1991	22	22	37	51	44	25	108	8	317
1990	20	23	9	19	45	26	89	10	241
1989	3	15	31	17	32	9	89	13	209
1988	5	13	1	5	14	6	94	0	138
1987	4	5	6	4	9	10	44	7	89
1986	7	1	0	3	9	1	26	1	48
1985	5	6	0	1	3	4	14	2	35
1984	2	4	0	0	8	6	19	0	39
OLDER	6	2	1	3	7	7	27	1	54
TOTAL	21,314	6,724	3,444	3,491	7,717	2,039	4,464	1,861	51,054

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6

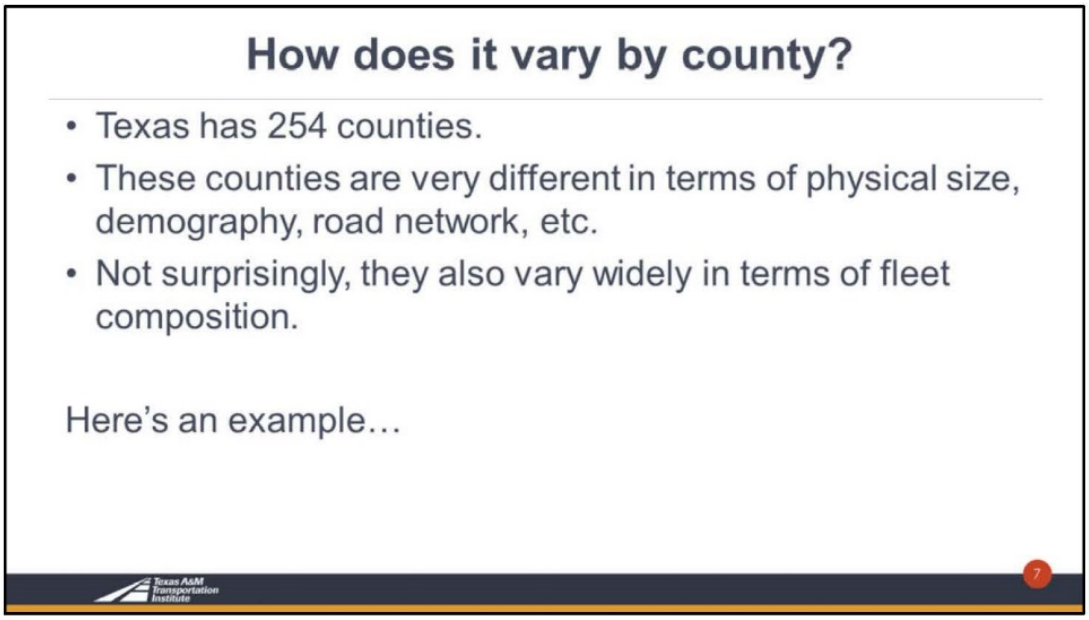
[Examples: Walk through each and point out the highlighted elements.]

Finally, here's something a little different… sort of:

Here's a separate dataset of the same Harris County data showing the heavy truck sub-category data. There is a similar data set for gasoline powered heavy trucks. (Not a very interesting category for obvious reasons… there aren't many gasoline powered heavy trucks!)

Not surprisingly, these counts are sometimes used directly and other times as proportions.

6


How does it vary by county?
• Texas has 254 counties.
• These counties are very different in terms of physical size, demography, road network, etc.
• Not surprisingly, they also vary widely in terms of fleet composition.
Here's an example…
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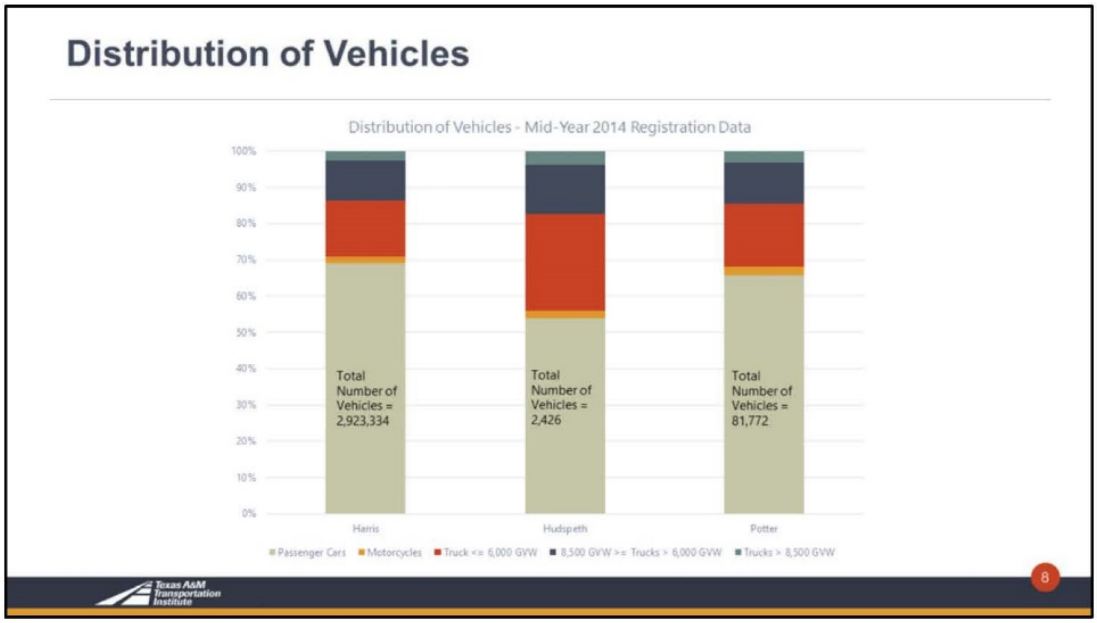
7

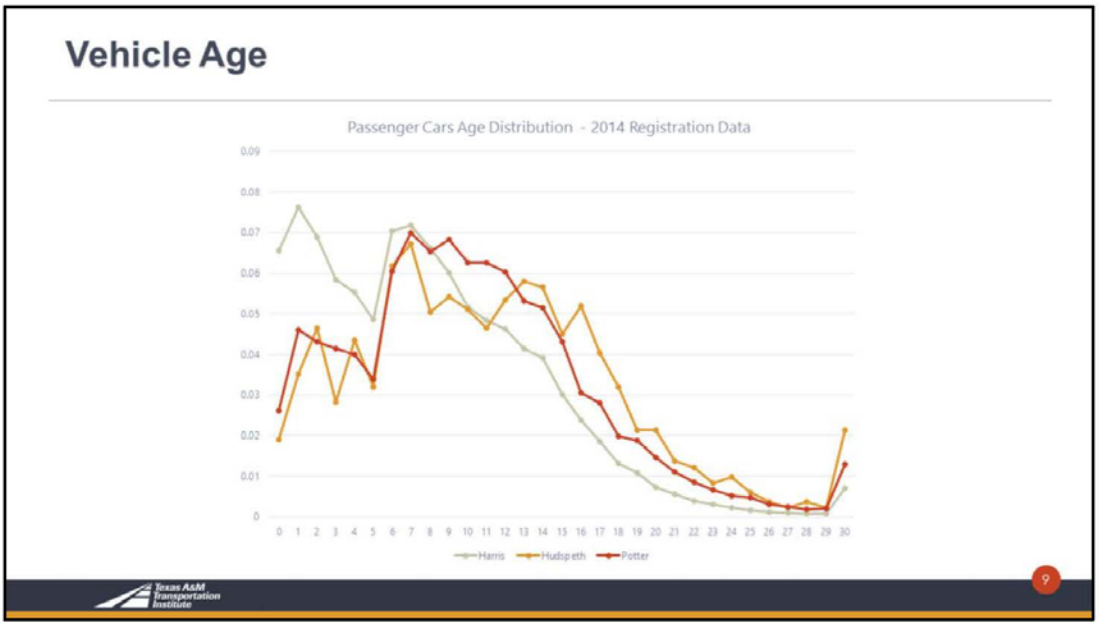
7



Distribution of Vehicles

(Point out basic layout.)

Here are three counties, bars are percentages, blue is PV, grey is PT, total vehicles are printed in the bars. [Discuss as seems appropriate for the audience.]



Passenger Car Age Distribution

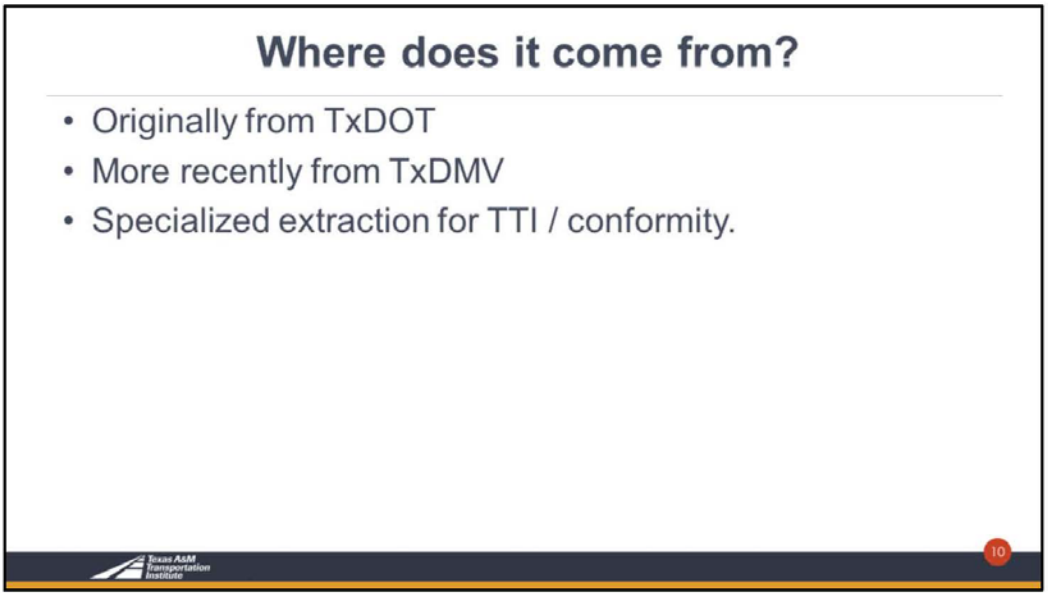
Fleet age also varies widely by county.

Here's the passenger car age distribution for the same three counties.

(Point out basic layout.) Here are plots of age distribution for the three counties.

Blue is Harris, orange is Hudspeth, grey is Potter. Obviously very different. Note the spike at the far right, the oldest vehicles. This is the "older than" category we saw on the ASCII example. More interestingly, note the drop in six year old vehicles. This is 2014 data so this would be 2008, i.e., the economic downturn. (Remember this. We'll talk about it later.)

9



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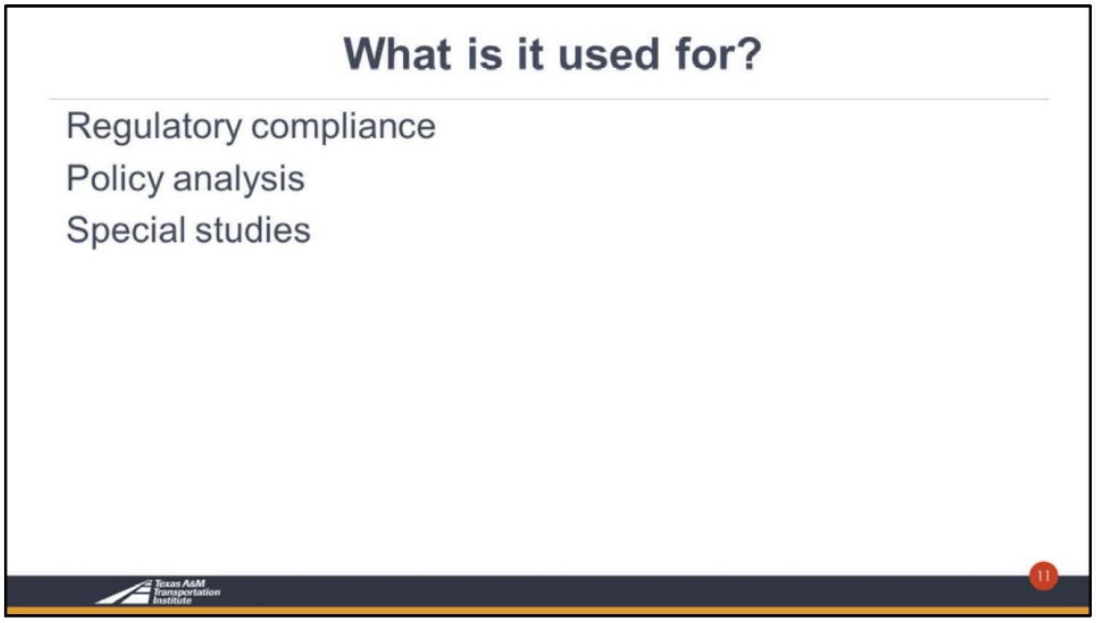
Vehicle registration under the current arrangement is reliable and official. That's about as good as it gets, except that it now appears to also be unavailable!!

10



Registration data is critical to the overall emissions estimation process.

The most important element of which is regulatory compliance in the form of the emissions inventories necessary for the conformity demonstration process.

However, emissions are also important for transportation related policy analysis and special studies through out the state.

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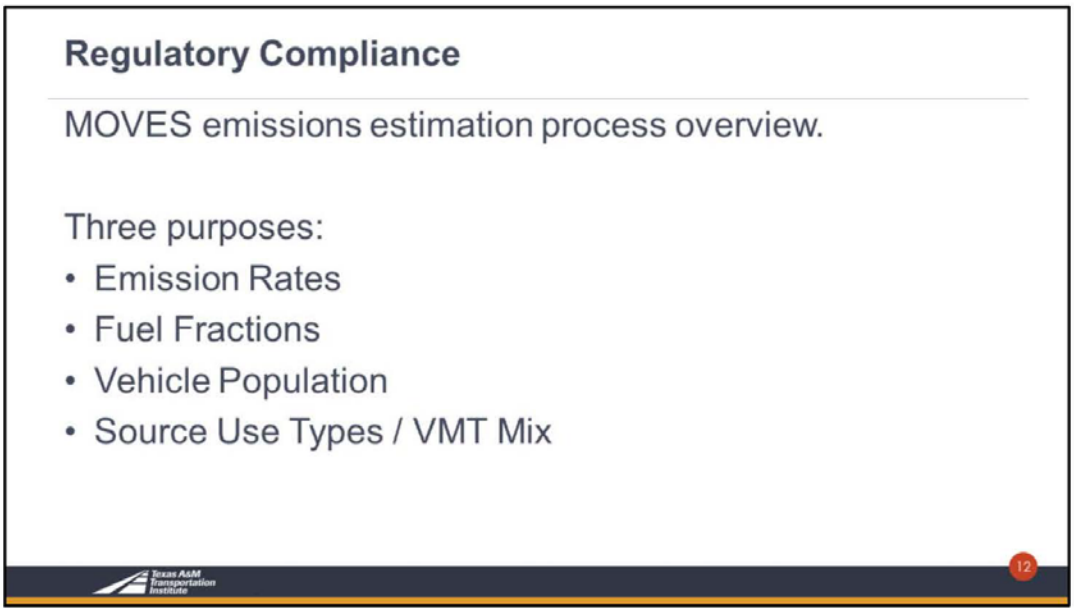


Registration data is one of the datasets that are critical to the overall emissions estimation process.

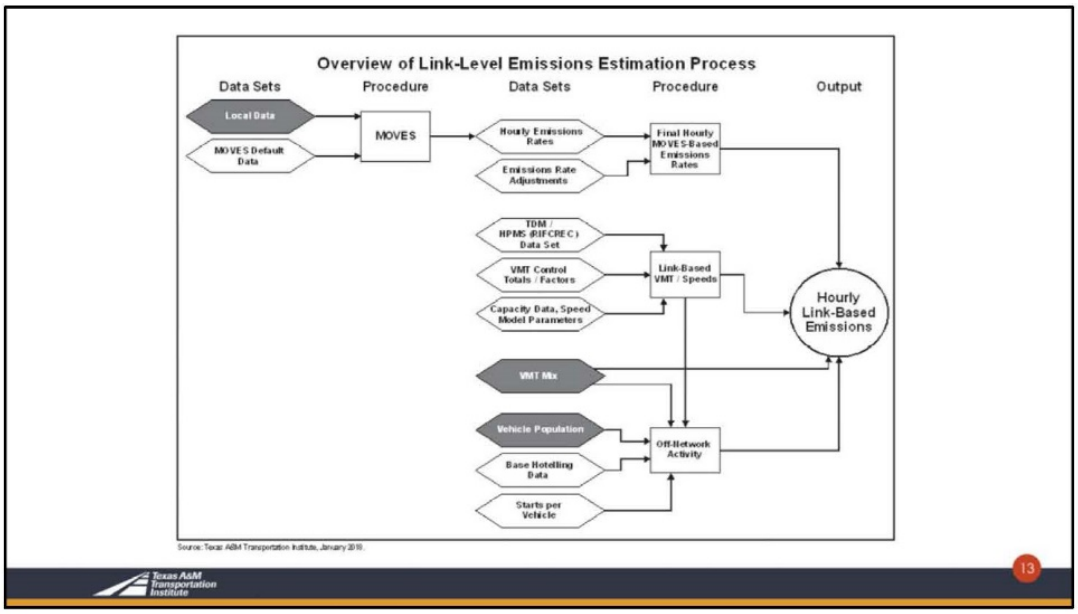
TxDMV provided vehicle registration data is currently used for four purposes within the official emissions estimation process.

All four uses are critical in the estimation of on-road mobile source emissions (aka emissions inventories) associated with the demonstration of conformity with air quality regulations (conformity inventories) and the associated setting of budgets (SIP inventories).

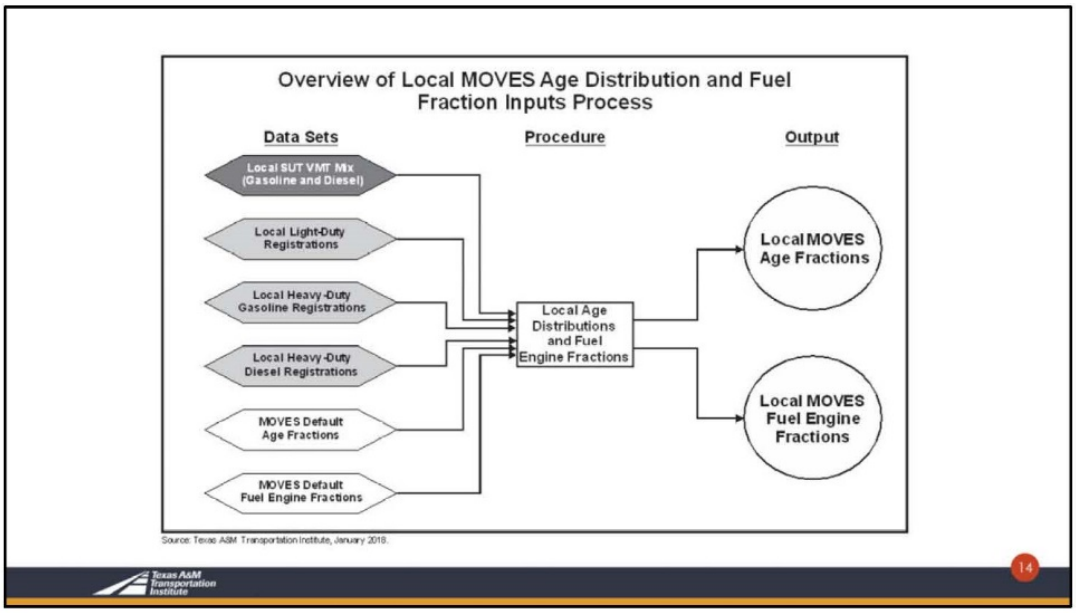
Let's take a quick look at each one…

[Walk through each process. Point out the darkened boxes where registration data is involved.]

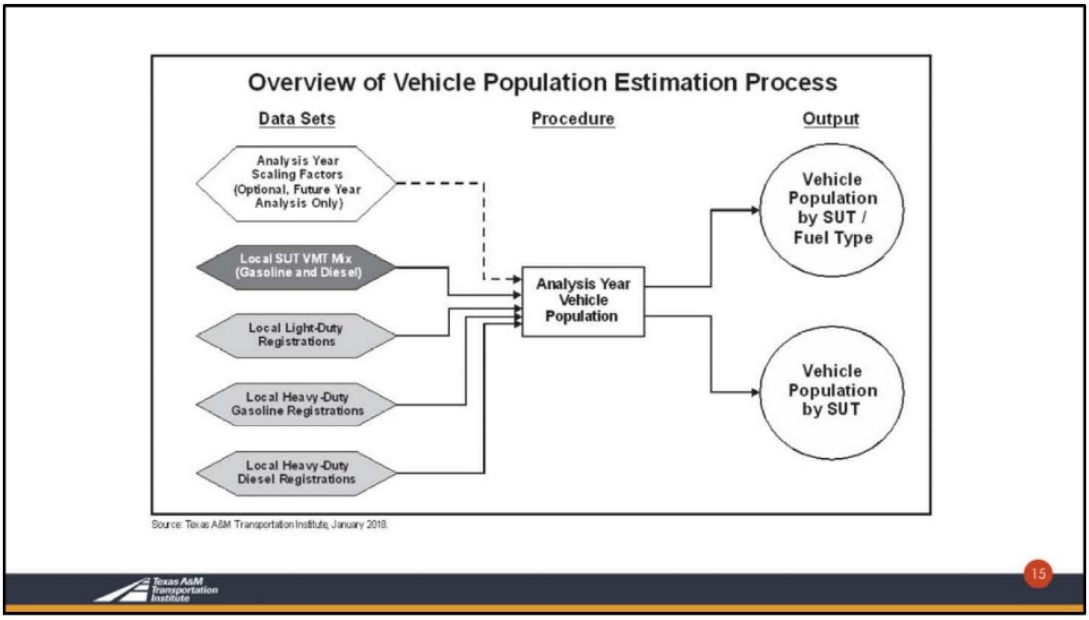
12



Mid-year registration data (county level) is used for the age distribution input to the MOVES rate calculation. The distribution of vehicles by model year is used for the age distribution for generating MOVES emissions rates.

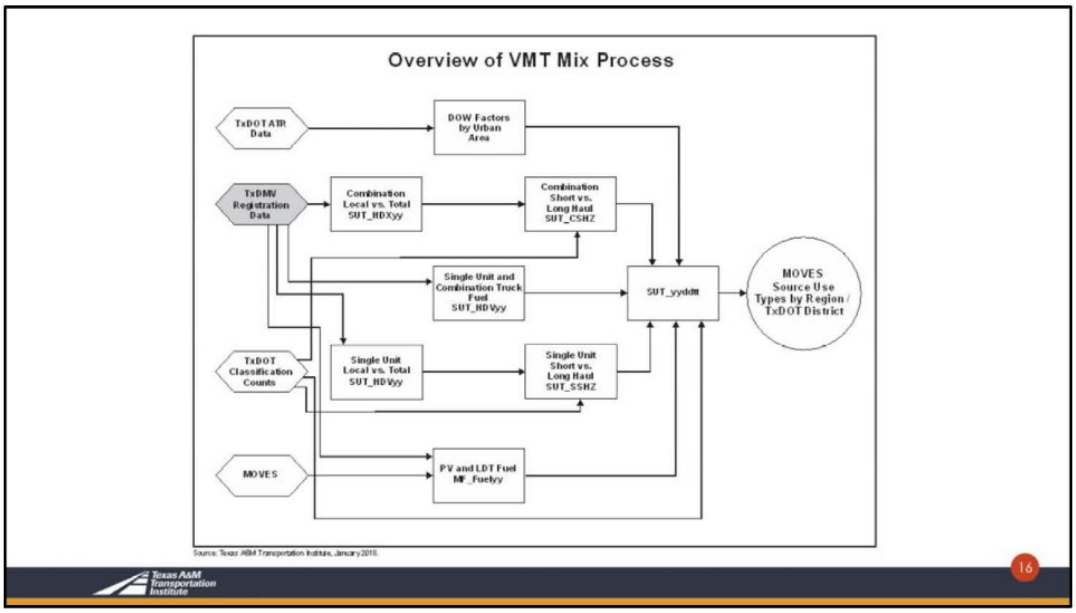


Fuel fractions go along with the age distribution element of the emissions rate calculations.



Mid-year registration data is also used to estimate county vehicle population for source hours parked in MOVES. The number of vehicles registered in a county is the basis for estimating source hours parked in MOVES.

15



Year-end registration data is used, along with several other data sets, to estimate the Source Use Type proportions (formerly known as VMT mix) used in conformity and SIP inventories.

Specifically, year-end registration data provide fuel type and certain vehicle sub-categories is used in conjunction with vehicle classification count data to estimate the proportion of MOVES source use types to determine VMT mix by roadway functional classification.

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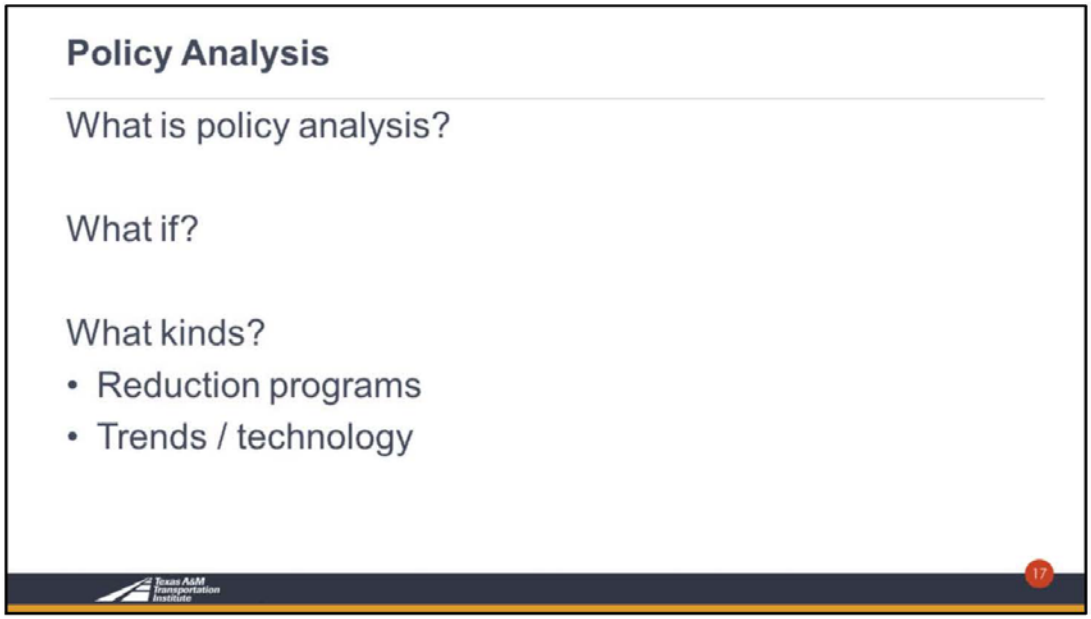

Policy analysis in this context is the analytical examination of "what if" questions involving potential impacts on vehicle emissions, either by design or as side effects. These can be explicit policies directed at reducing emissions (such as examinations of the efficacy and effectiveness of reduction measures in context), or hypothetical / optional actions that may have tangential effects on emissions (such as road way improvements examined in advance of formally including these projects in the transportation plan).

Regardless of the underlying rational for the "policy" analysis, the use of emissions estimations methods consistent with those used for regulatory compliance are necessary for the credibility of these analyses, even though there may not be the mandatory data and methodological requirements. These include

- Estimating the impacts of hypothetical policies (such as older vehicle buy back / replacement programs), and

- Hypothetical changes in fleet make up (such as the adoption of electric vehicles, alternative fuel programs, etc.)

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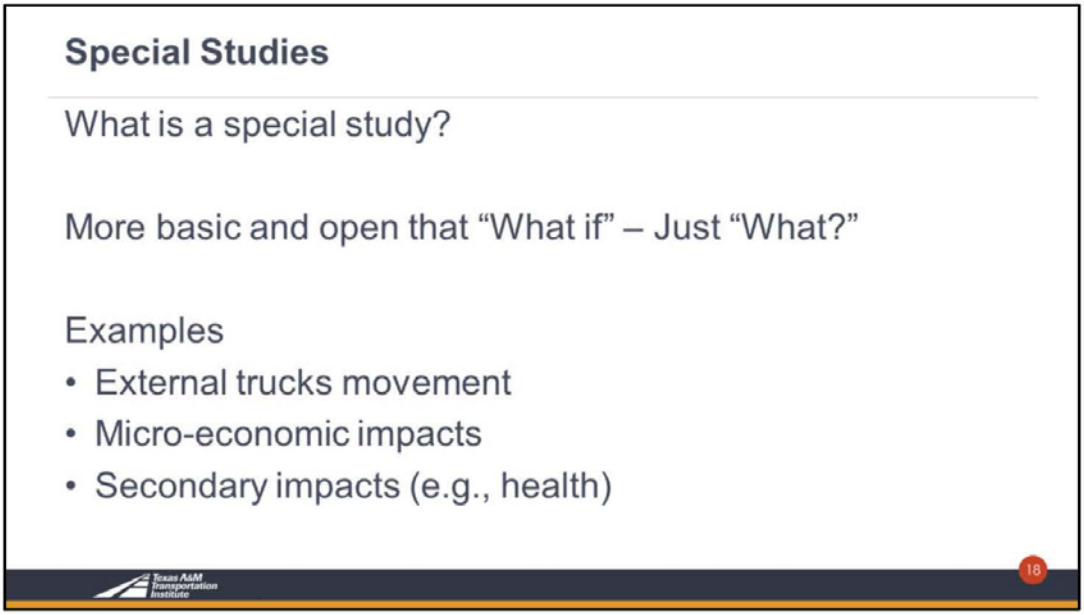
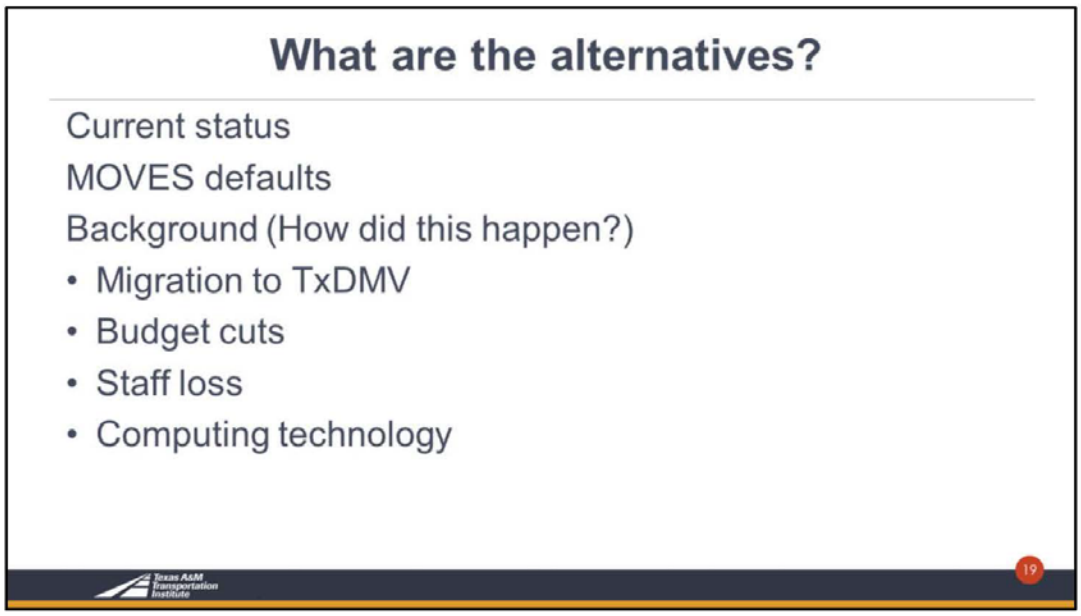


Beyond these "official" uses of the registration data (inventories and policies), there are other areas where these datasets are invaluable for answering various questions, not all related to emissions. The vehicle registration data and our ability to interpret it has been the basis of:

- Estimates of external truck movements in various urban areas in Texas.
- An assessment of the impact of changes in the economy on vehicle sales and by extension the age of the fleet, ultimately impacting emissions (older vehicles have higher emissions). Beaumont after the 2008 economic down turn and counties involved in the fracking oil boom (and subsequent bust).
- A proposed study to look at the impact of vehicle replacement from hurricane Harvey on fleet age, possibly with the opposite impact (a newer fleet is a cleaner fleet).



Current status – As noted, these datasets are currently unavailable.

MOVES defaults – At first glance, an obvious alternative appears to be MOVES defaults. MOVES default values for fleet parameters based on national statistics are available within the MOVES software.

However, EPA explicitly recommends the use of local data. No doubt some (smaller) states use these defaults. State DOT or DMV registration data resources similar to Texas are known to exist in other states (Nevada, for example).

As a practical matter, the availability of local data (including registration data) precludes the use of MOVES default values for official Texas emissions inventories.

Background – A first step to addressing any problem is to take a look at what caused the problem. The problems with our registration data are due to several factors. These are, in no particular order, budget cuts, retirements of key staff, and migration to a different computing platform.

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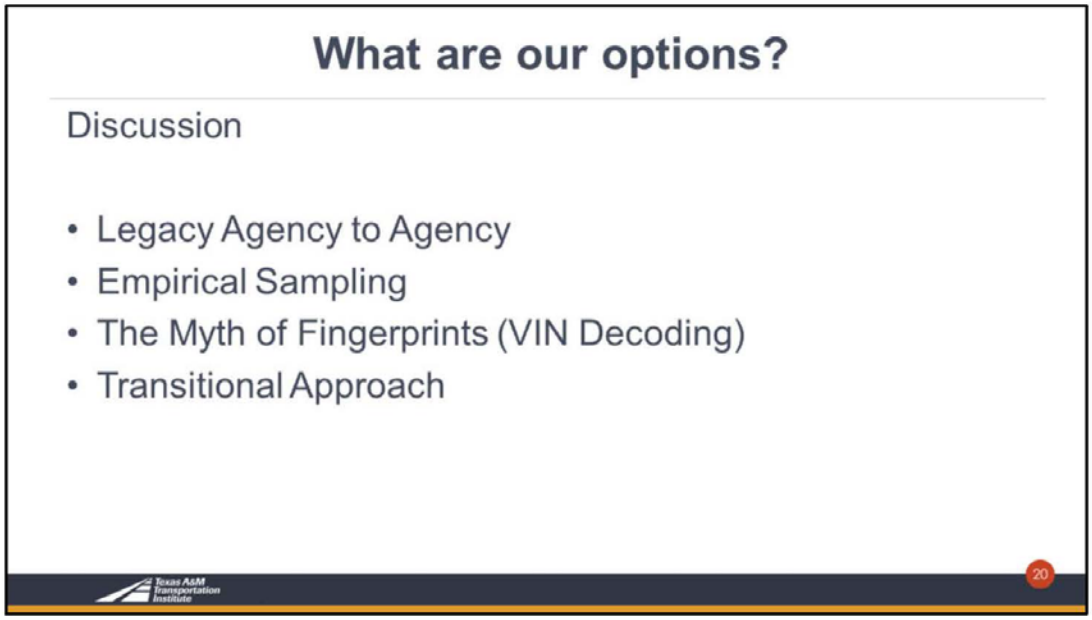

Any kind of empirical direct data collection effort is impractical in terms of quality and cost. Any sample would be extremely expensive, as well as by definition be inferior to the comprehensive exhaustive dataset itself.

At various times there has been informal discussion / consideration of using other sources, such as one of the various VIN decoding services. TTI use of decoding software itself begs the question, since we would still have the issue of acquiring the data from TxDMV. Purchasing the entire state of Texas data (24 million vehicles) directly from a service has not to my knowledge been priced, data only or in the format we need.

An alternative strategy is for TTI to go directly to either TxDMV or on of the data services and get the data for subsequent extraction by TTI. This bypasses any legacy issues between TxDOT and TxDMV, as well as allowing TTI maximum flexibility in use of the data for a wider array of analyses.

Segue to TxDOT / current status.

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