

The Future of Travel Demand

A Forecasting Model for Vehicle Miles Traveled (VMT)

Developed by

Volpe The National Transportation Systems Center
Advancing transportation innovation for the public good

for

Federal Highway Administration (FHWA)

Office of Highway Policy Information

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Introduction

FHWA's Traffic Analysis Framework:

- System of forecasting models for highway travel demand, as measured by vehicle miles traveled (VMT)
- National multimodal passenger travel origin destination data and information.
- National Model where both freight and passenger travel demand can be analyzed with the current highway networks supporting various investment and policy initiatives.

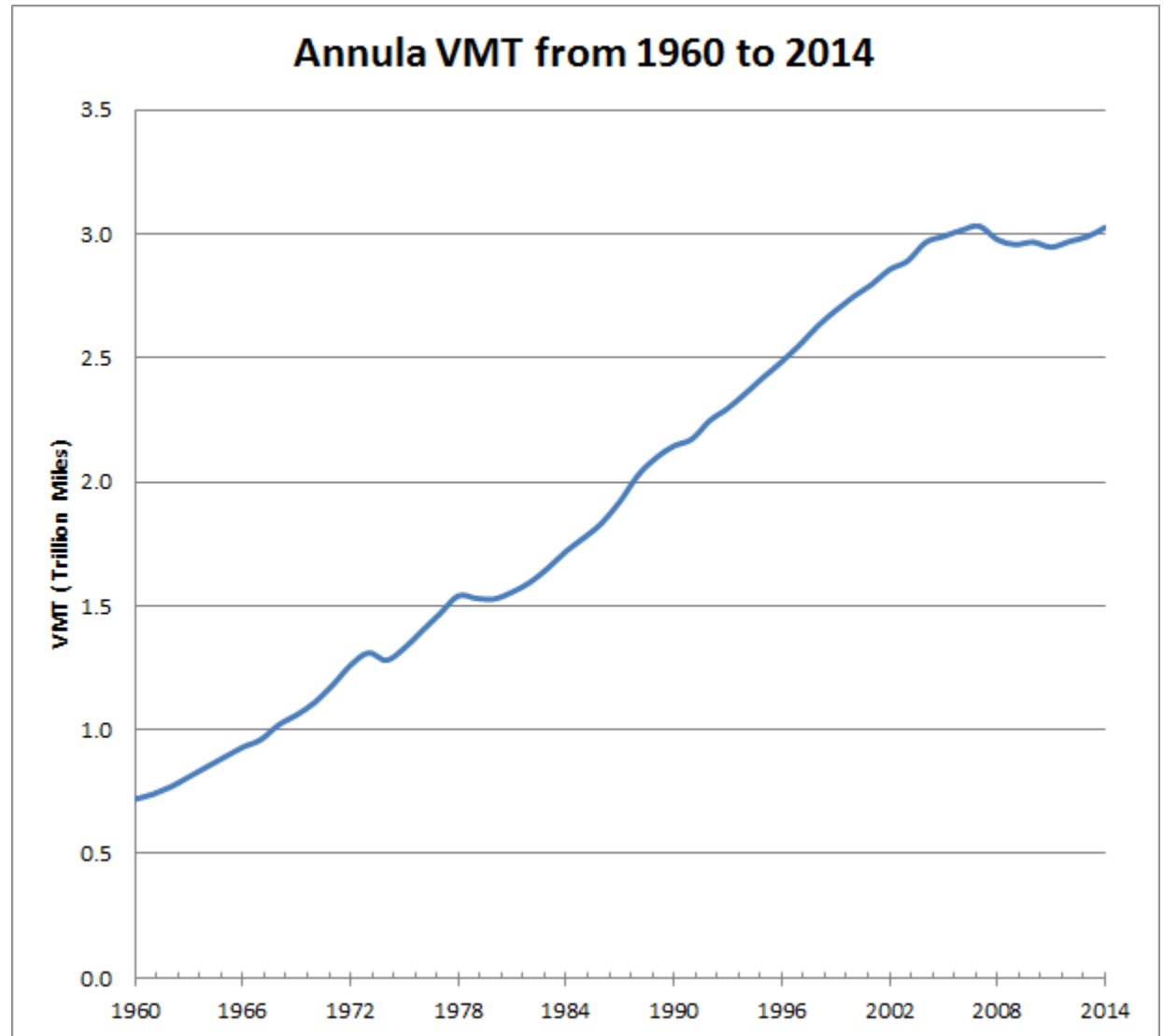


VMT Model

- Forecast changes in VMT in response to expected changes in future economic conditions and demographic trends
- Output from the model covers 30 years into the future, reported at 10 year intervals.



VMT from 1960 to 2014 on All Public Roads



Information is based on FHWA's Highway Performance Monitoring System (HPMS)

Current National Demographic and Economic Forecasts

Demographic and Economic Indicators	Historical Growth Rate
U.S. Population	1.02%
GDP (Real 2009\$)	2.84%
Real Goods Component of GDP (Real 2009\$)	3.18%
Disposable Personal Income per Capita (Real 2009\$)	1.94%
Gasoline Price per Gallon (Real 2009\$)	1.34%

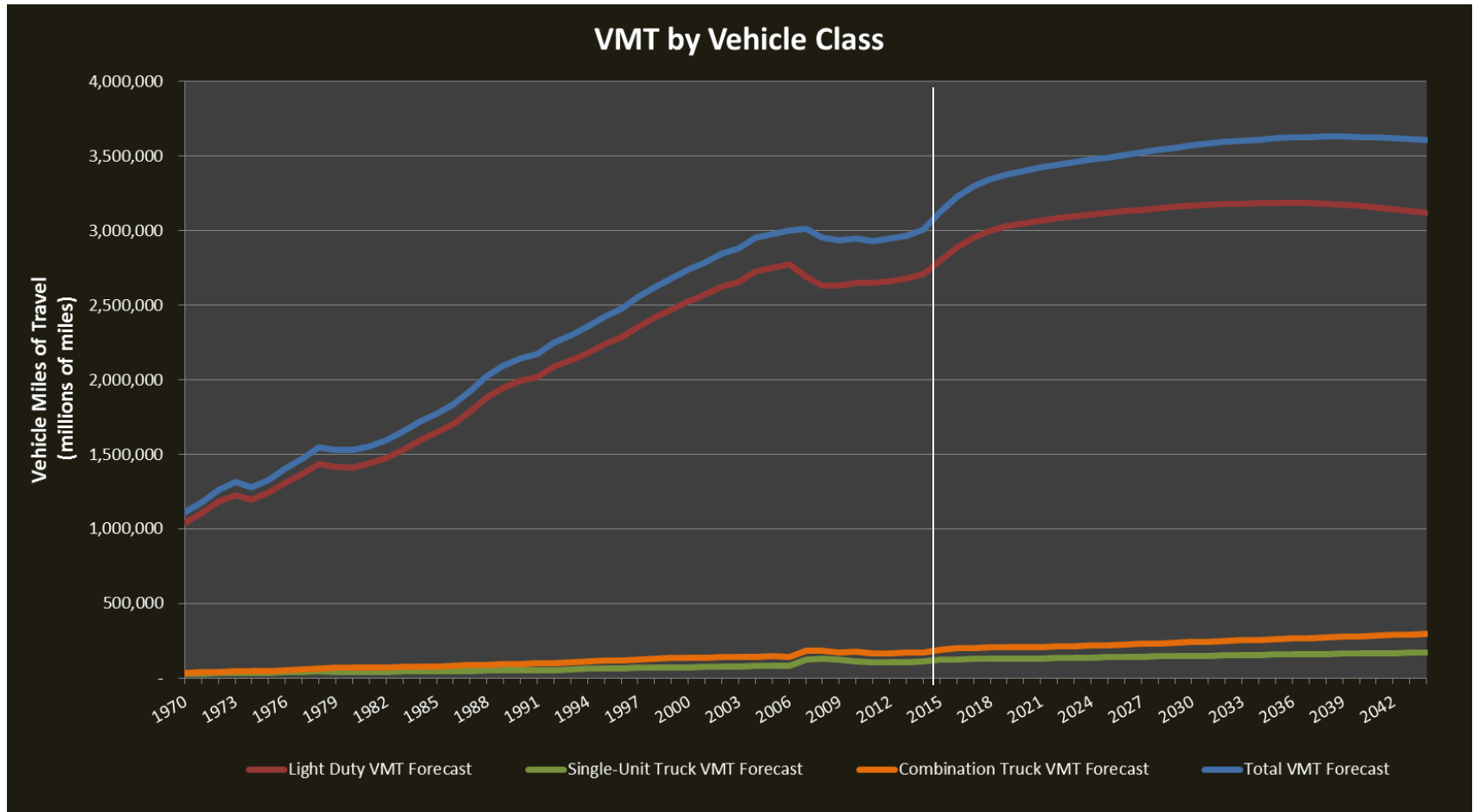
Current National Demographic and Economic Forecasts

Demographic and Economic Indicators	Historical Growth Rate	Forecast Growth Rate: 2014-44
U.S. Population	1.02%	0.65%
GDP (Real 2009\$)	2.84%	2.21%
Real Goods Component of GDP (Real 2009\$)	3.18%	2.95%
Disposable Personal Income per Capita (Real 2009\$)	1.94%	1.65%
Gasoline Price per Gallon (Real 2009\$)	1.34%	0.14%

Current National VMT Forecasts

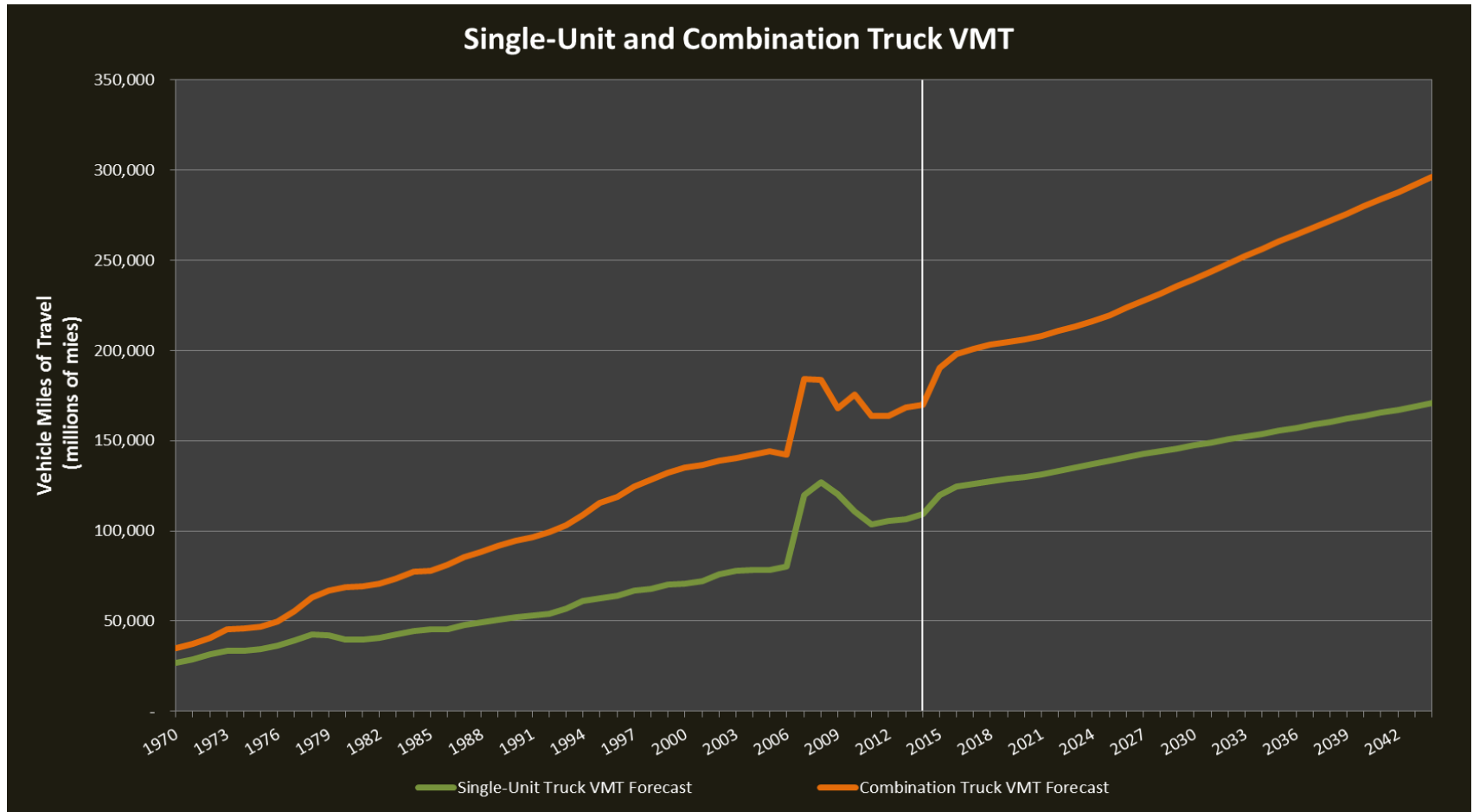
Vehicle Class	Compound Annual Growth Rates					
	Low Economic Growth Outlook		Baseline Economic Growth Outlook		High Economic Growth Outlook	
	2014 - 2034 (20 Year)	2014 - 2044 (30 Year)	2014 - 2034 (20 Year)	2014 - 2044 (30 Year)	2014 - 2034 (20 Year)	2014 - 2044 (30 Year)
<i>Light-Duty Vehicles</i>	0.69%	0.44%	0.81%	0.47%	0.80%	0.46%
<i>Single-Unit Trucks</i>	1.31%	1.05%	1.73%	1.50%	2.00%	1.72%
<i>Combination Trucks</i>	1.59%	1.44%	2.08%	1.87%	2.48%	2.24%
<i>Total</i>	0.76%	0.53%	0.92%	0.61%	0.96%	0.65%

Current National VMT Forecasts



- LDV VMT expected to grow strongly in next few years
- Growth expected to slow in outer years of forecast, as rising income increases opportunity cost of travel

Current National VMT Forecasts



- Combination truck VMT recovers sharply in near term, before moderating to long-term trend
- Single Unit truck VMT recovers in next few years, before returning to historical trend

VMT Forecasting System

- ❑ Developed based on economic theory of travel demand
 - Utilizes current statistical techniques to capture relationships between economic and demographic variables and travel demand
 - Expert panel participated in development process
 - Continual review process to ensure model specification incorporates recent changes in VMT and economic background

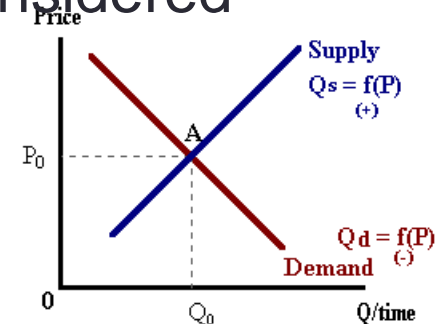
- ❑ 30 year VMT forecasts
 - Published annually



Model Development: Economics

Grounded in economic theory of travel demand

- Personal travel demand factors considered
 - Household demographics: total number, size, composition, location
 - Economic circumstances: disposable income, employment
 - Cost per mile driven (e.g., gasoline price and fuel economy, plus vehicle depreciation), vehicle maintenance costs
 - Prices of alternative modes
- Commercial (truck) travel demand factors considered
 - Economic activity (manufacturing, goods production)
 - International trade
 - Construction activity
 - Cost per mile driven
 - Drivers' wages



Model Development: Econometrics

Preferred forecasting model selection based on

- Variables consistent with economic theory
- Minimizing input and specification error
 - Input error attributed to imperfect forecasts of input variables (e.g. future gasoline prices)
 - Specification error reflects how well the design of a model captures the primary determinants of VMT
- Logical direction and magnitude of effects measured by explanatory variables
- Adjustments made for statistical issues such as autocorrelation, unit roots, and cointegration
- State model uses a panel data structure
- Final review by expert panel

National Level Specifications

Light Duty VMT per capita:

Lagged LDV VMT per capita, disposable income per capita, (disposable income per capita)², fuel cost per mile, consumer confidence index

Combination Truck VMT:

Real goods imports plus exports, fuel cost per mile, de-regulation indicator, indicator for change in the CT VMT data generating process after 2006

Single Unit Truck VMT:

Private residential plus non-residential fixed investment, consumption of other non-durable goods, fuel cost per mile, indicator for change in the SUT VMT data generating process after 2006

State Level Specifications

Light Duty VMT (per capita):

Lagged LDV VMT per capita, disposable income per capita, (disposable income per capita)², fuel cost per mile, population under 20/total population, lane miles per capita

Combination Truck VMT:

State GDP, Real goods imports plus exports/US GDP, fuel cost per mile, rural lane miles/land area

Single Unit Truck VMT:

Lagged SUT VMT, State GDP per capita, fuel cost per mile, urban lane miles/total lane miles

Input Data Sources

IHS Global Insight:

30 year forecasts of national and state economic and demographic data
GDP, disposable income, oil/gasoline prices, population, exports and imports of goods, consumer confidence, private residential and non-residential fixed investment, consumption of other non-durable goods

Current outlook: slower growth in GDP and income than historical rates, fuel prices decline through 2017, then return to \$3.00+ per gallon by 2020-25

Federal Highway Administration:

Historical national and state VMT, fuel economy and road supply data
(Highway Statistics)

Forecast of Fuel Economy (based on CAFE standards)

Current outlook: road mileage increases <1% annually, fuel economy rises gradually through 2040

FHWA VMT Model Key Personnel Acknowledgement

FHWA Program Manager: Dr. Patrick Zhang, PE

Volpe Center Economists: Dr. Don H Pickrell, David M. Pace, and
Jacob Wishart