

Data – the Foundation for the Highway Economic Requirements System

U.S. DOT Datapalooza 2015
Conditions & Performance Session
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HERS Capabilities

- Projects overall conditions & performance of nation's Federal-Aid highways over 20 years at alternative potential levels of investment.
- Identifies and evaluates potential improvements to sections using engineering criteria & benefit-cost analysis (BCA)
- Estimates investment needs relative to user-specified targets - e.g. average speed, minimum BCR (benefit-cost ratio)

Evaluated Improvements

Pavement preservation

- rehabilitation
- reconstruction
- resurfacing, etc.

Capacity expansion

- adding lanes
- major widening
- new highway construction

Selected HERS Outputs – 2013 C&P Report

- Assume VMT grows at recent trend rate
- Estimates of real growth in investment on highway preservation and capacity expansion:

| Investment target | Annual % growth in investment, 2010-2030 |
|---|--|
| Fund all cost-beneficial improvements | + 3.95 |
| Maintain overall conditions & performance at 2010 level | -0.95 |

Operational improvements

- Ramp metering, variable speed limits, incident management systems, upgraded traffic signals, etc.
- HERS estimates incidence and impacts of current and future deployments
 - But does not subject these deployments to BCA.

Non-modeled improvements

- Safety improvements
 - Rumble strips
 - Safety edges
 - Median treatments
 - Signalized intersection improvements
 - Guardrails, etc.
- Other improvements –e,g. landscaping

HPMS Sample Database

- Section-level data on Federal-Aid highways: arterials, urban collectors, & rural major collectors
- 106,000 sample sections in 2010
- Large enough sample for each state to allow estimation similar to national level
 - HERS-ST model

HPMS Inputs to HERS: Inventory Items

- Number of through lanes
 - Peak vs Counter-peak
- Turn lanes
- National Highway System identifier
- Speed limit

HPMS Inputs to HERS:

Traffic

- AADT
 - Base year level
 - Forecast for 20th future year*
 - Vehicle composition – LDV, SU truck, Combo truck
 - Directional & “K” Factors
- Traffic Control Devices
 - Number of intersections by type (traffic control)
 - Signals: predominant type
 - Stop signs – number

HPMS Inputs to HERS:

Geometric

- Widths – lanes, median, shoulders
- Types - medians & shoulders
- Grades – horizontal & vertical
- Number of intersections by type (traffic control)
- Widening feasibility*

HPMS Inputs to HERS:

Pavements

- Surface & base - types and thickness
- Improvement history
- Pavement roughness & PSR
- New distress measures:
 - Rutting
 - Faulting (rigid pavements)
 - Fatigue Cracking
 - Transverse Cracking

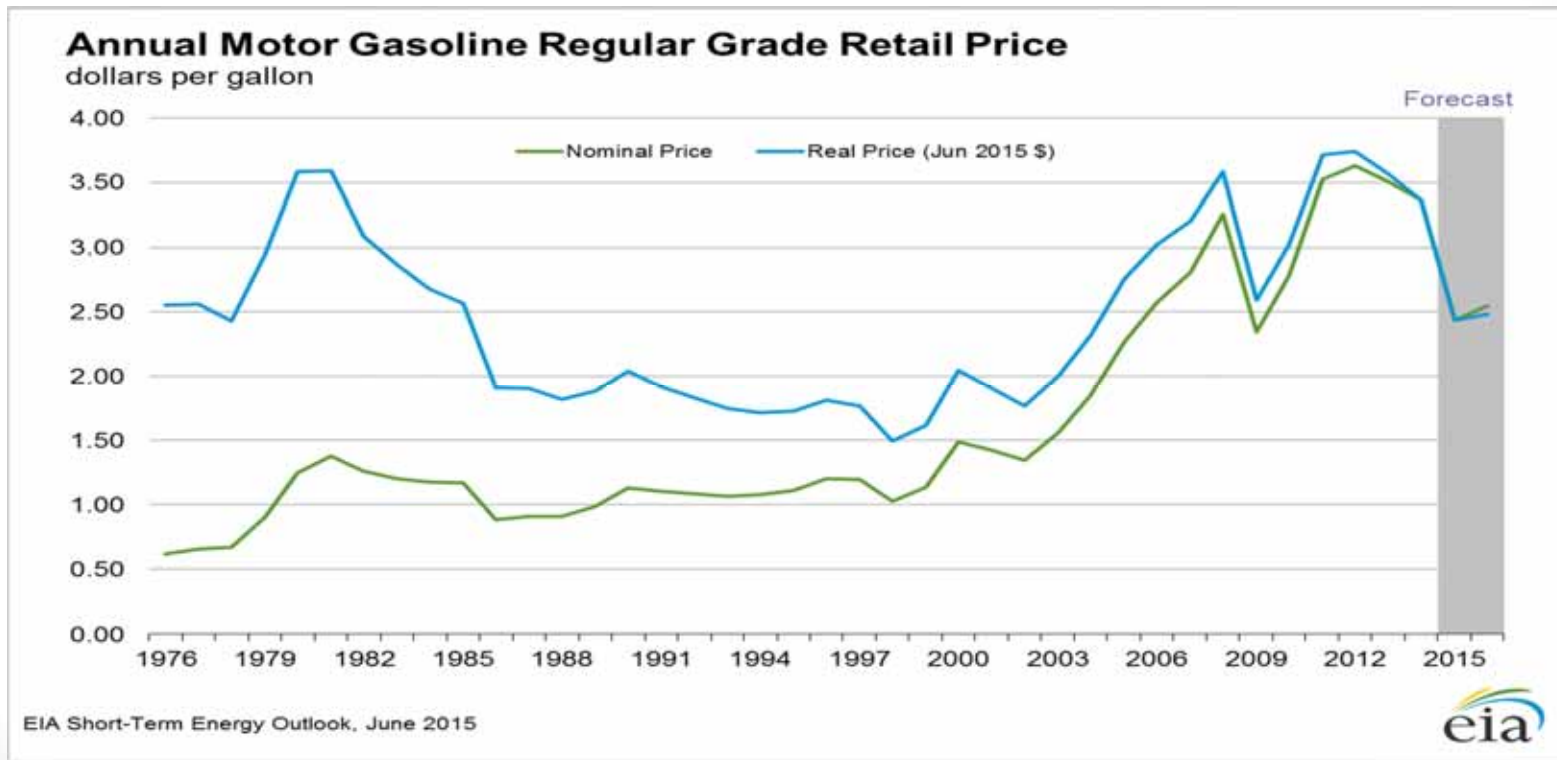
Other Data Inputs

- Improvement Costs by Type
 - Estimates for reference year (currently 2002)
 - Price indexing to update to base year
- Data used to estimate model equations
 - Naturalistic Driving Study – speed cycles
 - National Household Travel Survey
 - Data used to estimate models of speed and travel time reliability (HCM, SHRP2)

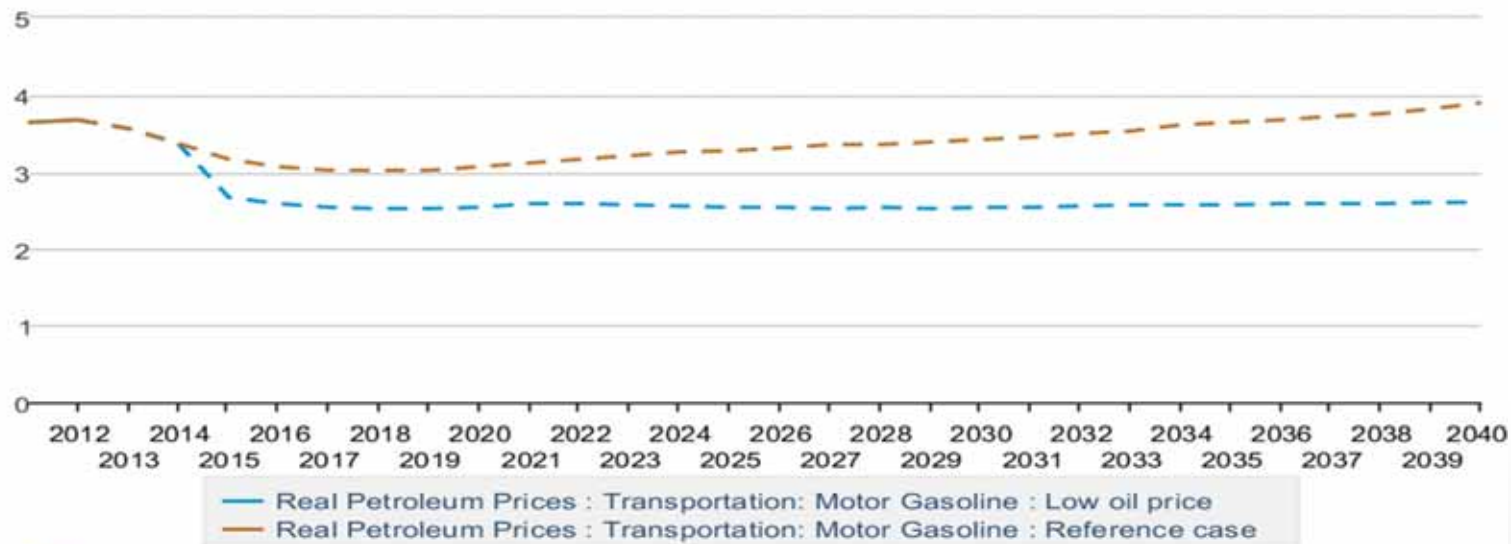
HERS Database – Projections & Parameters

- Fuel Costs
- Vehicle Fuel Efficiency
- Improvement (construction) costs
- Value of travel time savings per hour
- Induced demand

Volatile Gasoline Prices

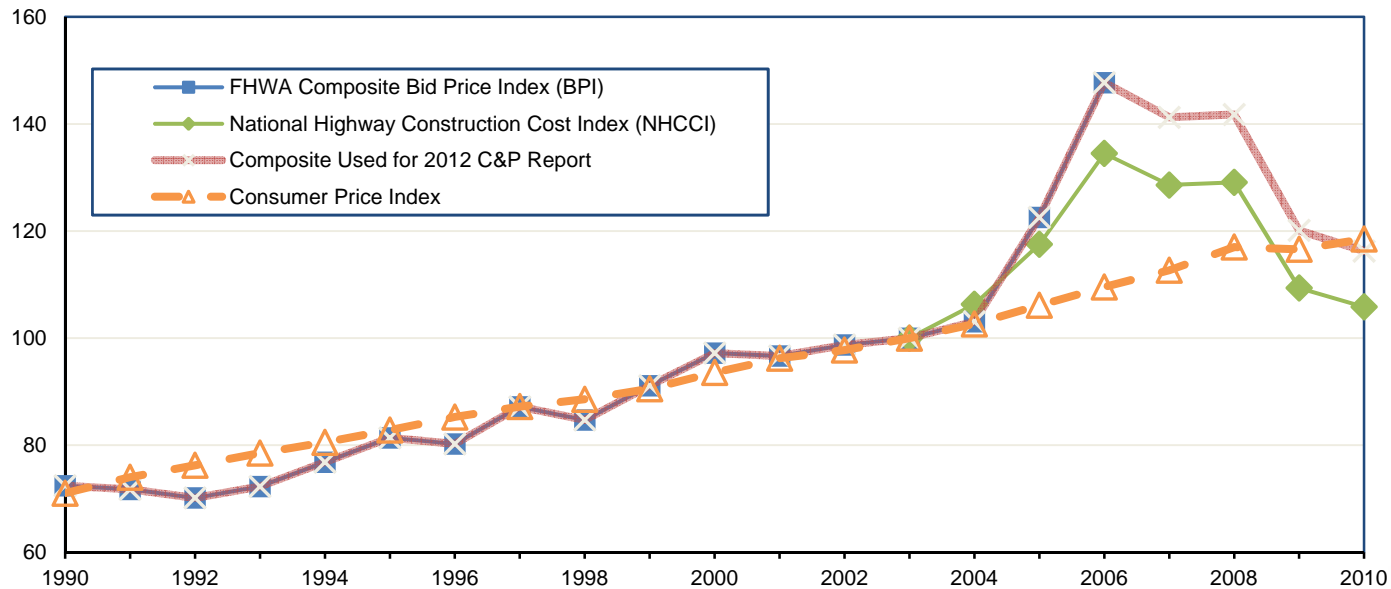


AEO Gasoline Price Projections: Reference & Low-Oil Price Cases



 Source: U.S. Energy Information Administration

Highway Construction Cost & Consumer Price Indices (2003 Base Year), 1990-2010



Big Data Challenges

- Benefit-cost optimization gets computationally challenging when the problem includes:
 - Funding constraints
 - Options for implementing a project now versus later
 - Many possible combinations of improvement options
 - Induced demand
- FHWA developing a testbed for advanced computational algorithms
 - **Highway Intertemporal Simulator**

Value of Travel Time (2002)

| | Medium Auto | 5-Axle Comb. |
|-------------------------|----------------|----------------|
| Business Travel | | |
| Value per Person | \$23.20 | \$20.80 |
| Avg. Vehicle Occupancy | 1.15 | 1.12 |
| Vehicle Depreciation | \$1.45 | \$6.16 |
| Inventory Costs | \$0.00 | \$1.78 |
| Total Business | \$28.36 | \$32.24 |
| Personal Travel | \$28.36 | |
| Value of Time | \$10.60 | |
| Avg. Vehicle Occupancy | 1.53 | |
| Total Personal | \$16.22 | |
| Percent Personal | 91% | |
| Weighted Average | \$17.31 | |