Twin Tunnels Environmental Assessment

Energy Resources Technical Memorandum

March 2012

Twin Tunnels Environmental Assessment
Idaho Springs/Clear Creek County

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Acronyms and Abbreviations

AGS	Advanced Guideway System
BTU	British thermal unit
CDOT	Colorado Department of Transportation
CH_4	Methane
CO_2	Carbon Dioxide
DRCOG	Denver Regional Council of Governments
EA	Environmental Assessment
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
MPOs	Metropolitan Planning Organizations
N_2O	Nitrous Oxide
VMT	Vehicle Miles of Travel

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Section 1. Purpose of the Memorandum

The Federal Highway Administration (FHWA), in cooperation with the Colorado Department of Transportation (CDOT), is preparing an Environmental Assessment (EA) for proposed changes to the eastbound lanes of I-70 and the eastbound bore of the Twin Tunnels between MP 241 and MP 244 in Clear Creek County, Colorado. The Twin Tunnels area is one of the most congested locations along the I-70 Mountain Corridor. Improvements are necessary to improve safety, operations, and travel time reliability in the eastbound direction of I-70 in the study area. Additionally, the improvements will be consistent with the I-70 Mountain Corridor PEIS Record of Decision, I-70 Mountain Corridor Context Sensitive Solutions process, and other commitments of the PEIS.

This technical memorandum describes the affected environment and the impacts of the Proposed Action on energy and greenhouse gas emissions within the identified study area. The memorandum also documents mitigation measures, including applicable measures identified in the I-70 Mountain Corridor PEIS that would reduce any impacts during construction and operation. The I-70 PEIS identified comprehensive improvements for the corridor. The Proposed Action would immediately address safety, mobility, and operations in the eastbound direction at the Twin Tunnels, but would not address all of the needs in the Twin Tunnels area. The Proposed Action would not preclude other improvements needed and approved by the I-70 PEIS ROD.

Section 2. How does the analysis relate to the Tier 1 PEIS?

The Tier 1 *I-70 Mountain Corridor Final PEIS* provided a comparative operational energy analysis of corridor alternatives; this Twin Tunnels Tier 2 analysis builds on the PEIS by conducting a detailed energy analysis specific to the Proposed Action. As committed in the Tier 1 PEIS, the energy analysis for Tier 2 includes additional construction and operational analysis based on the specific Proposed Action. Tier 2 further considers power sources and mixes of energy supply types (renewable/alternative energy, fossil fuel, and other future concepts), as well as development of best management practices for the Proposed Action.

Section 3. What process was followed to analyze energy resources?

3.1 Study Area

The study area, displayed in **Figure 1**, for the energy analysis extends between Empire Junction (MP 232) and the top of Floyd Hill (MP 248). This is the area that generally realizes a reduction in congestion due to the Proposed Action. This study area encompasses the I-70 corridor from approximately mile marker 232 to mile marker 248.

FIGURE 1
Study Area

3.2 Methodology

Energy is used during the construction and operation of transportation facilities. The analysis examines both construction and operational energy. The energy used in the construction of transportation facilities is inclusive of the manufacture and transport of materials and operation of construction equipment. Operational energy consumption is the fuel used to power the vehicles using the transportation facility.

Since energy consumption directly contributes to the emissions of greenhouse gases (GHG), this analysis also provides an estimate of GHG emissions for the alternatives. Carbon dioxide, methane, and nitrous oxide are the primary GHG emissions resulting from fuel consumption.

The daily energy consumption for each of the alternatives is measured with a traditional energy unit, British thermal units (BTU). To express the energy consumption in more common terms, the results are also provided in equivalents of gallons of gasoline.

In the study area, there is an overall grade change of about 1%. Therefore, the fuel economy of all eastbound vehicles is higher than average fleet statistics, while the fuel economy of all westbound vehicles is higher than average. Since the overall grade change is relatively minor, and the effect on fuel economy is offset for eastbound and westbound traffic, grade is not taken into account in the energy analysis.

Fossil fuels are analyzed for energy resources, because in 2012 they are the predominant source for operational and construction energy. Alternative and renewable energy sources may provide operational fuel by 2035 and into the future.

Operational energy consumption is directly proportional to the number of vehicle miles of travel (VMT), but does take into account average vehicle speeds through the corridor, thus does account for congestion. The energy calculation depends on the traffic variables of vehicle volume and distance traveled, vehicle speed, vehicle type, and average fuel economy. The operational energy consumption is calculated for both the eastbound and westbound directions of travel in the study area, for both weekday and weekend conditions. The average weekday analysis is for the 24-hour period. The weekend conditions are analyzed for a typical winter Sunday, between 9:00 am and 11:00 pm.

The flow chart on page 4 specifies the methodology employed to estimate energy consumption. The study area corridor was first divided into segments, by mile marker. Projected average vehicle speeds and traffic volumes were obtained from two sources. For the weekday forecasts, the Denver Regional Council of Governments (DRCOG) Regional Travel Model (Compass) forecasts were used to estimate volumes. Speeds were estimated based on existing speed data in the corridor. For the weekend, the

"DynusT" model that was developed by the University of Arizona for the I-70 corridor was used. "DynusT" is a dynamic traffic simulation and assignment model that integrates travel demand models and microscopic simulation models, producing realistic traffic representations for regional or corridor network analysis. The model estimates the changes in travel demand and patterns resulting from the Proposed Action, plus simulates traffic flows. Daily traffic volume projections from the model were used for the weekday energy consumption analysis and hourly vehicles for the weekend assessment. Hourly weekend volumes were needed to effectively assess the impacts of ski and other recreational traffic along I-70, which can vary significantly from hour to hour.

Energy consumption is significantly different for cars and heavy trucks. Traffic data collected as part of this project ("Draft Twin Tunnels Technical Transportation Report", Felsburg Holt & Ullevig, February 2012) revealed that 8.75% of the average weekday traffic on this section of I-70 is heavy trucks. On the weekends, the heavy truck percentage averages 2.5%. For this analysis, it is assumed heavy trucks do not use the managed lane because of the surcharge. The total daily vehicle-miles of travel was calculated for cars and heavy trucks separately, by multiplying the number of vehicles by the length of each of the I-70 segments.

Table 4.26 in the "United States Department of Energy Transportation Energy Data Book: Edition 30" (Oak Ridge National Laboratory, June 2011) presents average fuel efficiency statistics, in miles per gallon, for gasoline powered vehicles at various operating speeds. Table 5.11 presents similar fuel economy statistics for diesel-powered vehicles. Dividing the vehicle-miles of travel for each I-70 segment by the fuel economy statistic for the average vehicle speed on each segment, produced the daily gallons of gasoline and diesel fuel used. Table B.4 lists energy content for various fuels, expressed in British thermal units (BTU) per gallon.

Multiplying these energy content factors by the calculated daily gallons of gasoline and diesel fuel used on each segment, produces daily energy consumption figures. For consistency in measurement, the diesel energy figures were converted to gasoline equivalents.

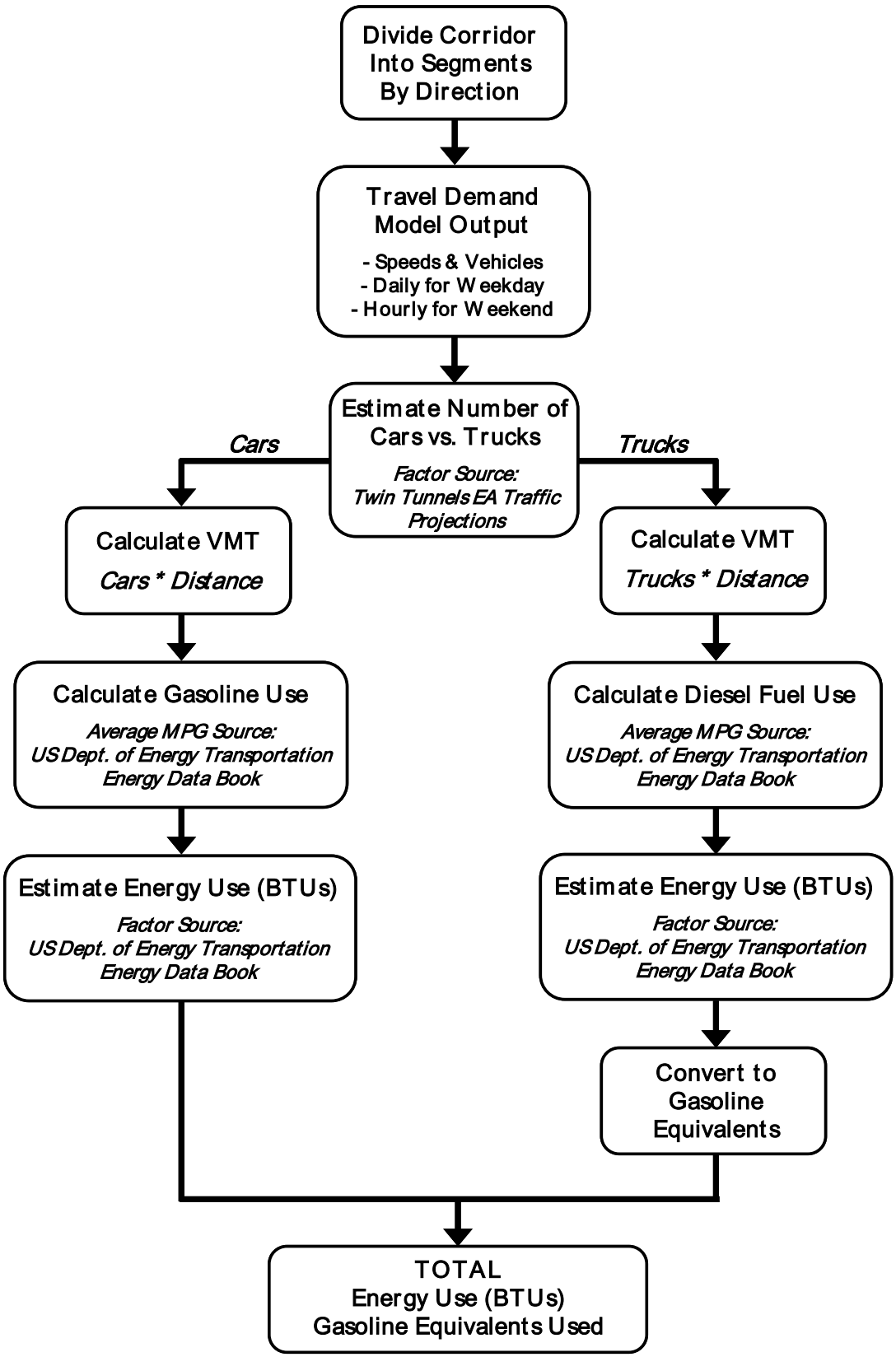
The daily operational energy consumption during construction was prepared with the same method. A design speed of 30 miles per hour was assumed for this energy analysis. Construction energy usage is described qualitatively. The fuel consumption would be higher for a design speed of 65 miles per hour, compared to a design speed of 55 miles per hour through the study area.

The calculations of greenhouse gas emissions are based on the number of gallons of fuel consumed or VMT, depending on the GHG. Carbon dioxide (CO_2) emissions are calculated from consumption of gasoline or diesel, while methane (CH_4) and nitrous oxide (N_2O) emissions are calculated by the amount of VMT, by vehicle type. The GHG emissions are reported in terms of CO_2 equivalents. Calculations for GHG emissions are based on technical data from the United States Environmental Protection Agency, "Emission Factors for Greenhouse Gas Inventories" (EPA, 2011).

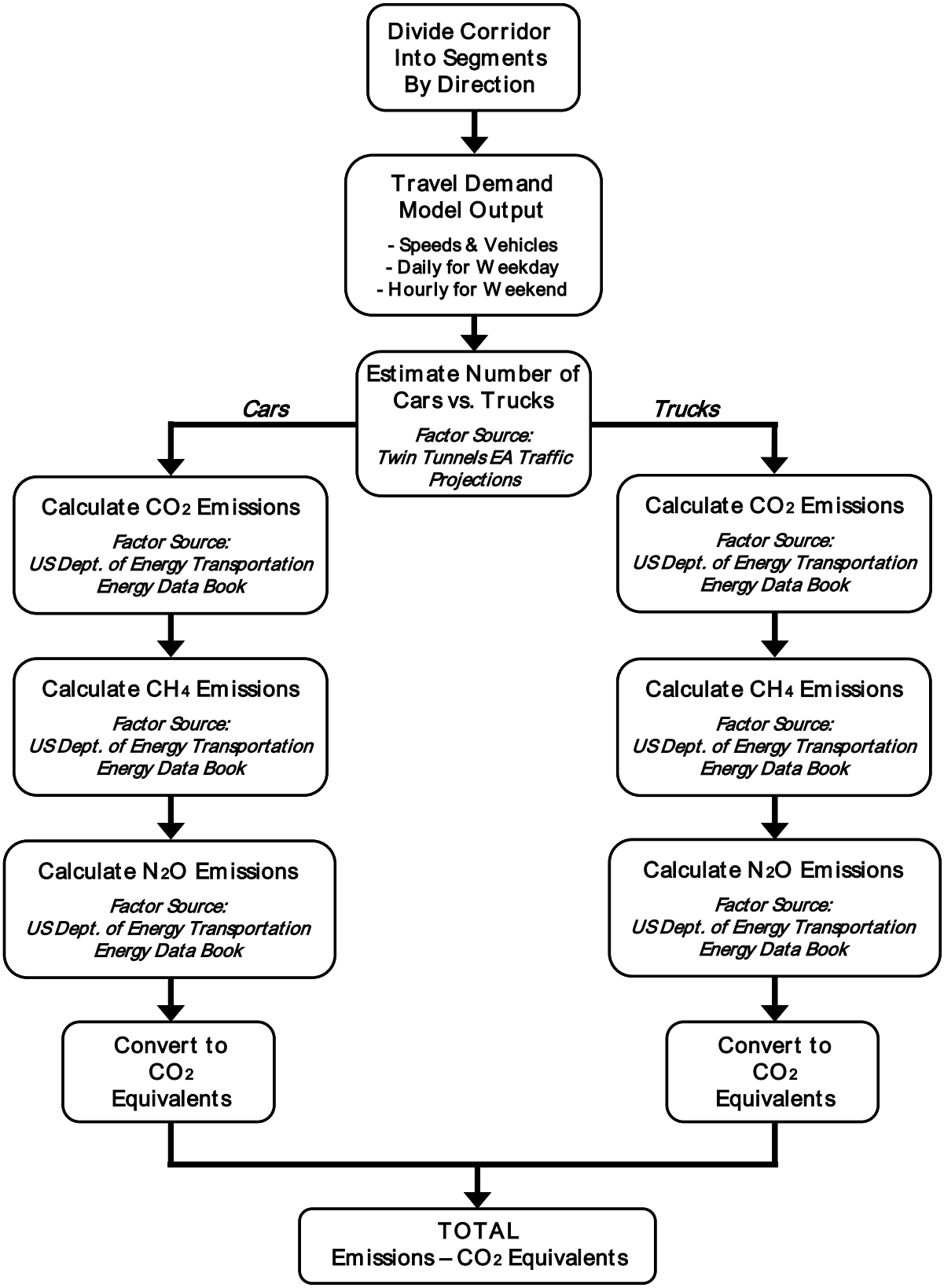
The amount of gasoline and fuel consumed, by segment, calculated above for the energy consumption estimates, was used as the initial inputs to calculate CO_2 emissions. Table 11.11 in the "United States Department of Energy Transportation Energy Data Book: Edition 30" (Oak Ridge National Laboratory, June 2011) lists typical CO_2 emissions from one gallon of various fuel types. Multiplying the calculated gasoline and diesel fuel consumed by the corresponding CO_2 emissions factor produces a resulting estimate of CO_2 generated.

The number of cars and trucks, by segment, calculated above for the energy consumption estimates, was used as a starting input for the CH_4 and N_2O emission calculations. The EPA publication, "Emission Factors for Greenhouse Gas Inventories" (EPA, November, 2011), Table 3, lists average CH_4 and N_2O emissions for various model years of gasoline passenger cars and gasoline light-duty trucks.

Energy Consumption Estimation Flow-Chart



Greenhouse Gas Emission Calculation Flow-Chart



Light duty trucks include minivans, passenger vans, pickup trucks, and SUVs. A simple average of these model year emissions was calculated then multiplied by the vehicle-miles traveled for cars, by I-70 segment, to estimate the CH_4 and N_2O emissions for gasoline-powered vehicles. Table 4 of the same publication lists average CH_4 and N_2O emissions for various types of diesel-fueled vehicles. The emissions factor for heavy duty vehicles was multiplied by the vehicle-miles traveled for heavy trucks, by I-70 segment, to estimate the CH_4 and N_2O emissions for diesel-powered vehicles. Heavy duty trucks included buses, large pick-ups, delivery trucks, RVs, and semi-trucks. The resulting CH_4 and N_2O emissions were finally multiplied by a "Global Warming Potential" factor then expressed in terms of CO_2 equivalent.

In the future, a variety of changes could affect the consumption of energy in the study area. This document acknowledges the uncertainties that these future potential transformations introduce into the energy analysis. These potential changes include:

- Vehicle technology. The fuel economy of the vehicle fleet is likely to improve, as the vehicle fleet turns over, since national trends are toward more fuel efficient vehicles and the portion of vehicles powered by non-fossil fuels could increase.
- Worldwide petroleum supply and demand, fuel costs, future public policy regarding energy use, and environmental controls. Global developments concerning petroleum could change economic factors and public policy regarding fossil fueled vehicles.
- Future public policy regarding greenhouse gas emissions. Global developments concerning greenhouse gas emissions could change public policy regarding fossil fueled vehicles.
- The implementation of an AGS transit system in the corridor. The implementation of a transit system in the corridor could reduce the demand for travel by private vehicles.

The State of Colorado is undertaking two statewide initiatives related to these areas. The first is the Advanced Guideway System (AGS) Feasibility Study which will identify and evaluate a range of technologies for a cost-effective, safe, high-speed transit system in the I-70 Mountain Corridor. The AGS study will be conducted concurrently and will coordinate with the second initiative - the Inter-Regional Connectivity Study, which will examine how high-speed rail could interface with the Regional Transportation District FasTracks system.

Furthermore, regarding energy and greenhouse gas emissions policy, the Colorado Energy Smart Transportation initiative was developed to promote inclusion of energy efficiency and greenhouse gas emissions when making transportation decisions. Improving the energy efficiency and GHG emissions will improve the economy, improve air quality, and improve the health and quality of life of Colorado residents. A team of key representatives from various federal and state agencies, Metropolitan Planning Organizations (MPOs), and rural planning partners collaborated to leverage resources and explore ways to develop a framework of "energy smart" transportation strategies. Working groups were formed to develop:

- Ways that consideration of energy efficiency and GHG emissions can be included in transportation planning. They came up with four general methods:
  - **Policies** - New policies to consider energy in transportation infrastructure planning.
  - **Long-Range Transportation Planning** – Require that energy efficiency and GHG emissions be incorporated into the next Statewide Transportation Plan.
  - **STIP and TIP Development** - Use energy consumption and GHG emissions as secondary evaluation criterion for project selection.

  - » **Project Development** - Incorporate energy considerations into the CDOT Design Manual and construction specifications.

- Methods to increase energy efficiency and reduce GHG emissions.
  - » The Advanced Technology Vehicles/Alternate Fuels Work Group considered almost 20 strategies to increase the use of alternative fuels. Prioritized near-term strategies include: promote public/private partnerships and shared station agreements to support NGV use in fleet vehicles; Truck Stop Electrification Pilot Program; consolidate alternative fuel/advanced vehicle procurement for public fleets; sustainability in design and construction; Energy Literacy Program; and investigate long-term policy options to address the impact of decreased infrastructure revenues from increased penetration of alternative fuels and fuel efficient vehicles.
  - » The Smart Systems/Trips Work Group reviewed almost 60 potential strategies to provide better transportation services by improving the efficiency of the system, improving travel times, reducing congestion, or providing citizens with more travel choices in real-time while promoting energy efficiency. Prioritized near-term strategies include: enhance real-time traveler information (smart phone application); I-70 Rolling Speed Harmonization Pilot; truck fleet enhancements; and enhance transit traveler information and improve scheduling/fares.
- Ways to measure and assess the GHG impact of potential strategies and solutions. A Data & Measurement Work Group analyzed the petroleum displaced and CO_2 equivalents emissions to generate some of the priority strategies. This served to put into practice the analysis required for including energy in decision-making.

3.3 Data Sources

The data used for the energy consumption assessment from the four main sources are presented below, with the source indicated by the following numbers:

1) "United States Department of Energy Transportation Energy Data Book: Edition 30" (Oak Ridge National Laboratory, June, 2011).

2) United States Environmental Protection Agency, "Emission Factors for Greenhouse Gas Inventories" (EPA, November, 2011).

3) DRCOG Compass Model or DynusT dynamic traffic simulation and assignment model, University of Arizona.

4) "Draft Twin Tunnels Technical Transportation Report", Felsburg Holt & Ullevig, February , 2012

4) I-70 Segments, Mile Markers and Distances		
	Mile Markers	**Miles**
Floyd Hill 244-248	244-248	3.4
Central City 243 - 244	243-244	1.4
Twin Tunnels 241 - 243	241-243	1.8
Idaho Springs 239 - 241	239-341	2.4
Downieville 232 - 239	232-239	6.5
Georgetown 228 - 232	228-232	4.3
Silver Plume 221 - 228	221-228	6.6
Herman Gulch 216 - 221	216-221	5.4
EJMT/Loveland 215 - 216	215-216	2.4

4) Truck Percentage	
weekday	8.75%
weekend	2.5%

1) Table 5.11 - Diesel Fuel Economy	
mph	**Average mpg**
55 - 60	6.99
60 - 65	6.8125
25 - 30	6.465

2) Global Warming Potential	
CH_4	21
N_2O	310

1) Table B.4 - Energy Conversion	
fuel	**BTU**
Gasoline per gallon	125,000
Diesel per gallon	138,700

1) Table 4.26 - Gasoline Fuel Economy	
Speed (mph)	**Economy (mpg)**
15	24.4
20	27.9
25	30.5
30	31.7
35	31.2
40	31
45	31.6
50	32.4
55	32.4
60	31.4
65	29.2

1) Table 11.11 – CO_2 Rates by VMT	
fuel	**CO_2, kg**
Gasoline per gallon	8.8
Diesel per gallon	10.1

2) Table 3 - Gasoline Passenger Cars Emissions		
	CH_4 (g/mile)	**N_2O (g/mile)**
1984-1993	0.0704	0.0647
1994	0.0531	0.056
1995	0.0358	0.0473
1996	0.0272	0.0426
1997	0.0268	0.0422
1998	0.0249	0.0393
1999	0.0216	0.0337
2000	0.0178	0.0273
2001	0.011	0.0158
2002	0.0107	0.0153
2003	0.0114	0.0135
2004	0.0145	0.0083
2005	0.0147	0.0079
2006	0.0161	0.0057
2007	0.017	0.0041
2008	0.0172	0.0038
2009-present	0.0173	0.0036
Average:	**0.0240**	**0.0254**

2) Table 3 - Gasoline Light Trucks Emissions		
	CH_4 (g/mile)	**N_2O (g/mile)**
1987-1993	0.0813	0.1035
1994	0.0646	0.0982
1995	0.0517	0.0908
1996	0.0452	0.0871
1997	0.0452	0.0871
1998	0.0391	0.0728
1999	0.0321	0.0564
2000	0.0346	0.0621
2001	0.0151	0.0164
2002	0.0178	0.0228
2003	0.0155	0.0114
2004	0.0152	0.0132
2005	0.0157	0.0101
2006	0.0159	0.0089
2007	0.0161	0.0079
2008	0.0163	0.0066
2009-present	0.0163	0.0066
Average:	**0.0316**	**0.0448**
Combined Average:	**0.0278**	**0.0351**

3.4 Description of the Proposed Action

The Proposed Action would add a third eastbound travel lane and consistent 10-foot outside shoulder to the I-70 highway between the East Idaho Springs interchange and the base of Floyd Hill. The eastbound bore of the Twin Tunnels would be expanded to accommodate the wider roadway section, and the existing tunnel portal face would be removed and replaced. Additionally, the Proposed Action would straighten the curve west of the Hidden Valley interchange where the highest number and most serious crashes occur. This curve reconstruction also involves replacing a bridge on I-70 over Clear Creek.

Other proposed improvements include reconstructing the chain station west of the Twin Tunnels, constructing and operating new sediment basins throughout the area to treat stormwater runoff, installing wildlife fencing, and constructing retaining walls.

CDOT is considering a range of widths between 4 and 10 feet for the inside shoulder between the west study area limit and the Hidden Valley interchange. A 4-foot inside shoulder would be provided east of Hidden Valley. A range of tunnel widths, corresponding to the variations in the inside median, is being evaluated.

CDOT is also considering whether the additional capacity will operate exclusively as a general purpose lane or as a tolled lane during peak periods (also called a managed lane).

Proposed improvements west and east of Hidden Valley interchange are show in **Figure 2** and **Figure 3.**

FIGURE 2
Proposed Action—West of Hidden Valley Interchange

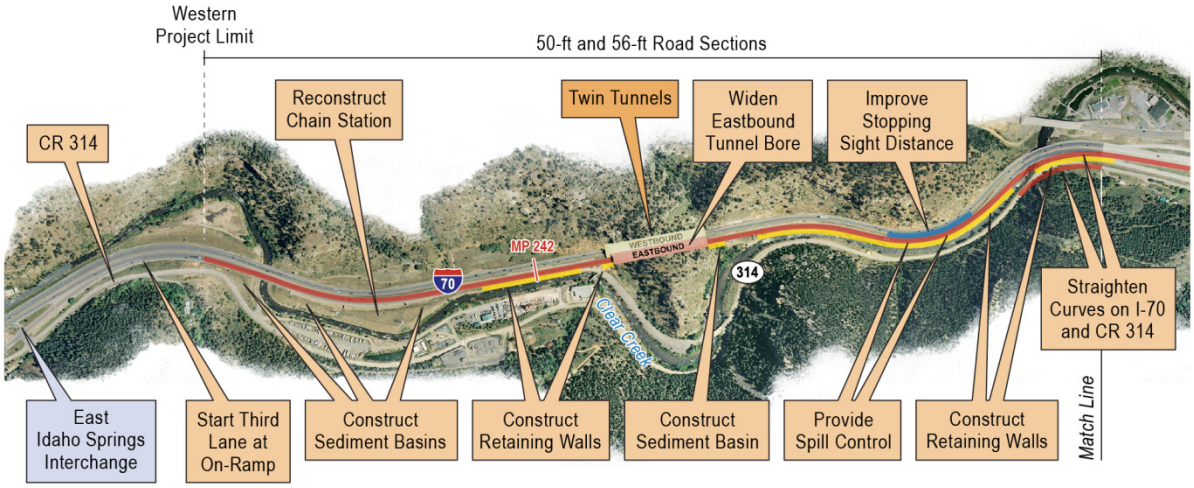
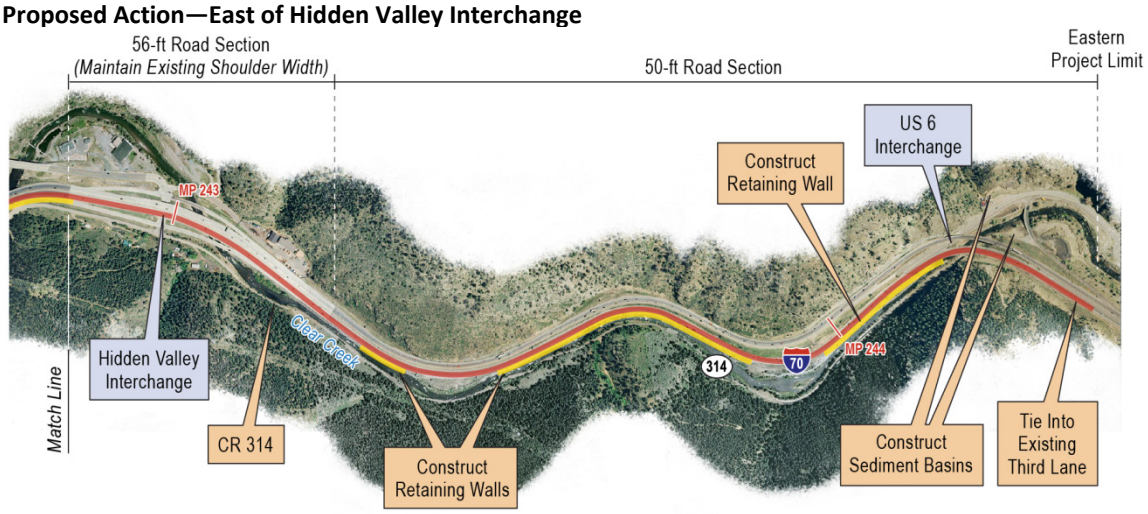


FIGURE 3
Proposed Action—East of Hidden Valley Interchange



Section 4. What are the energy resources in the study area?

4.1 Current Conditions of Energy Resources in Study Area

4.1.1 Operational Energy Resources

In 2010 on an average weekday, eastbound and westbound traffic volumes are relatively balanced. In 2010 on a typical Sunday, eastbound traffic is greater than westbound traffic, and eastbound traffic is congested for much of the analysis period. The overall energy use is higher on a typical Sunday than for the weekday period due to the eastbound congestion.

TABLE 1
Energy Resources in 2010

Weekday	Eastbound	BTU	1.49 billion
		Gasoline equivalents (gal)	11,900
	Westbound	BTU	1.41 billion
		Gasoline equivalents (gal)	11,300
	Total	BTU	2.90 billion
		Gasoline equivalents (gal)	23,200
Weekend Period	Eastbound	BTU	2.51 billion
		Gasoline equivalents (gal)	20,100
	Westbound	BTU	0.99 billion
		Gasoline equivalents (gal)	7,900
	Total	BTU	3.50 billion
		Gasoline equivalents (gal)	28,000

4.1.2 Operational Greenhouse Gas Emissions

In 2010 for an average weekday, greenhouse gas emissions from vehicles traveling through the study area amount to 212,000 kg of CO_2 equivalents. On a typical Sunday in 2010, 256,000 kg of CO_2 equivalents are emitted by vehicles traveling through the study area.

4.2 Anticipated Future Conditions of Energy Resources in Study Area

In the future, a variety of changes could affect the consumption of energy in the study area. This document acknowledges the uncertainties that these future potential transformations introduce into the energy analysis. These potential changes include:

- Vehicle technology. The fuel efficiency of vehicles is likely to improve, and the vehicle fleet may include a higher portion of vehicles that use a power source other than the fossil fuels of gasoline and diesel.
- Worldwide petroleum supply and demand, fuel costs, future public policy regarding energy use, and environmental controls. Global trends could change economic factors that affect travel by private vehicles.
- Future public policy regarding greenhouse gas emissions. Public policy may be adopted that curbs greenhouse gas emissions from vehicles.
- The implementation of an AGS transit system in the corridor. Private vehicle use may be reduced upon implementation of a transit system that serves the I-70 Mountain Corridor.

4.3 What agencies were involved in this analysis and what are their issues?

There was no formal coordination with agencies about energy issues or greenhouse gas emission in the Corridor. However, as noted in the methodology section, information from the U.S. Department of Energy and the U.S. Environmental Protection Agency was used for energy consumption and greenhouse gas emission calculations.

The importance of energy efficiency and the reduction of greenhouse gas emissions is recognized by the State of Colorado. In 2011, Colorado produced a Colorado Energy Smart Transportation Initiative, which outlines a framework for considering energy efficiency and greenhouse gas emissions in transportation decision-making. This framework includes policies to consider energy and GHG emissions in transportation infrastructure planning and project development (see Section 3.2 for further details).

Section 5. What are the environmental consequences?

5.1 How does the No Action affect energy resources?

5.1.1 Operational Energy Resources

On an average weekday, traffic volumes increase in 2035 under the No Action Alternative compared to 2010. The energy consumption reflects this by increasing 41% over 2010 levels. In contrast, on a typical Sunday for the 2035 No Action Alternative, growth in traffic volume from 2010 is constrained by capacity. For this reason the energy consumption increases only 17% compared to existing conditions in 2010.

Table 2. 2035 No Action Alternative Energy Resources

Weekday	Eastbound	BTU	2.09 billion
		Gasoline equivalents (gal)	16,700
	Westbound	BTU	2.00 billion
		Gasoline equivalents (gal)	16,000
	Total	BTU	4.09 billion
		Gasoline equivalents (gal)	32,700
Weekend Period	Eastbound	BTU	2.98 billion
		Gasoline equivalents (gal)	23,800
	Westbound	BTU	1.13 billion
		Gasoline equivalents (gal)	9,000
	Total	BTU	4.10 billion
		Gasoline equivalents (gal)	32,800

5.1.2 Operational Greenhouse Gas Emissions

In 2035 with the No Action Alternative for an average weekday, greenhouse gas emissions from vehicles traveling through the study area would amount to 299,000 kg of CO_2 equivalents. On a typical Sunday in 2035 with the No Action Alternative, 300,000 kg of CO_2 equivalents would be emitted by vehicles traveling through the study area.

5.2 How does the Proposed Action affect energy resources?

5.2.1 What are the direct effects including a managed lane?

5.2.1.1 Operational Energy Resources

The Proposed Action with one managed lane on a typical Sunday would improve travel speeds for the eastbound direction through the study area. As a result, the energy consumption on a Sunday in 2035 would be lower for the Managed Lane alternative than the No Action Alternative. Weekend westbound, and weekday, energy consumption would be the same as No Action Alternative conditions.

TABLE 3
2035 Proposed Action including a Managed Lane Energy Resource

Weekday	Eastbound	BTU	2.09 billion
		Gasoline equivalents (gal)	16,700
	Westbound	BTU	2.00 billion
		Gasoline equivalents (gal)	16,000
	Total	BTU	4.09 billion
		Gasoline equivalents (gal)	32,700
Weekend Period	Eastbound	BTU	2.81 billion
		Gasoline equivalents (gal)	22,500
	Westbound	BTU	1.13 billion
		Gasoline equivalents (gal)	9,000
	Total	BTU	3.94 billion
		Gasoline equivalents (gal)	31,500

5.2.1.2 Operational Greenhouse Gas Emissions

Greenhouse gas emissions would be the same as the 2035 No Action Alternative for an average weekday for the 2035 Proposed Action: 299,000 kg of CO2 equivalents emitted by vehicles traveling through the study area. On a typical Sunday, greenhouse gas emissions for the 2035 Proposed Action with one managed lane would be 288,000 kg of CO2 equivalents emitted by vehicles traveling through the study area.

5.2.2 How does the Proposed Action change without a managed lane?

5.2.2.1 Operational Energy Resources

The Proposed Action with all lanes free on a typical Sunday would have slightly better traffic conditions than the No Action alternative, but not as good as the alternative with a managed lane. Vehicles using the managed lane would be able to travel at a higher speed than the general purpose lanes, resulting in overall lower energy consumption. Weekend westbound, and weekday, energy consumption would be unchanged.

TABLE 4
2035 Proposed Action without Tolling Energy Resources

Weekday	Eastbound	BTU	2.09 billion
		Gasoline equivalents (gal)	16,700
	Westbound	BTU	2.00 billion
		Gasoline equivalents (gal)	16,000
	Total	BTU	4.09 billion
		Gasoline equivalents (gal)	32,700
Weekend Period	Eastbound	BTU	2.96 billion
		Gasoline equivalents (gal)	23,700
	Westbound	BTU	1.13 billion
		Gasoline equivalents (gal)	9,000
	Total	BTU	4.09 billion
		Gasoline equivalents (gal)	32,700

5.2.2.2 Operational Greenhouse Gas Emissions

Greenhouse gas emissions would be 299,000 kg of CO_2 equivalents in 2035 for the Proposed Action with all lanes free, for average weekend and typical Sunday conditions.

5.3 What indirect effects are anticipated?

The reduction in accident incidents anticipated due to the Proposed Action with or without tolling would reduce energy consumption compared to the No Action Alternative, because accidents result in energy consumption due to operation of emergency response equipment, traffic vehicle delay, and energy to repair motor vehicles. In addition, the curve straightening and tunnel widening would allow motorists to operate vehicles more efficiently, thus reducing energy consumption and greenhouse gas emissions.

The managed lane of the Proposed Action will provide a reliable and faster travel time compared to the alternative without tolling. An increase in carpooling could occur because of this benefit of the managed lane, thus reducing VMT. The managed lane would also provide a more reliable travel option for emergency vehicles, thus reducing energy consumption by emergency responders. As traffic demand grows beyond 2035 levels, the managed lane of the Proposed Action will continue to provide a reliable travel time, thus providing energy consumption benefits into the future.

5.4 What effects occur during construction?

5.4.1 Operational Energy Resources

Operational energy consumption would be higher than existing conditions during the period of construction. On an average weekday, eastbound traffic would travel a slightly longer distance at slow speeds on the detour. During the period of construction on a typical Sunday, eastbound traffic levels would be lower than existing conditions in 2010. The eastbound traffic would travel a slightly longer distance at slow speeds on the detour.

TABLE 5
2035 Construction Energy Resources

Weekday	Eastbound	BTU	1.52 billion
		Gasoline equivalents (gal)	12,200
	Westbound	BTU	1.41 billion
		Gasoline equivalents (gal)	11,300
	Total	BTU	2.93 billion
		Gasoline equivalents (gal)	23,500
Weekend Period	Eastbound	BTU	2.39 billion
		Gasoline equivalents (gal)	19,200
	Westbound	BTU	0.99 billion
		Gasoline equivalents (gal)	7,900
	Total	BTU	3.39 billion
		Gasoline equivalents (gal)	27,100

In addition, periodically during construction on weekdays, both eastbound and westbound traffic lanes would have short-term closures while blasting occurs in the tunnel. Idling of traffic during these delays would result in additional energy consumption.

5.4.2 Operational Greenhouse Gas Emissions

Greenhouse gas emissions during the period of construction would be 214,000 kg of CO_2 equivalents emitted by vehicles traveling through the study area on an average weekday. Additional greenhouse gas emissions would occur due to idling of vehicles because of full lane closures during brief periods of tunnel blasting. During construction on a typical Sunday, 247,000 kg of CO_2 equivalents would be emitted by vehicles traveling through the study area.

5.4.3 Construction Energy Resources and Greenhouse Gas Emissions

Construction energy, and greenhouse gas emissions, would be required for processing raw materials and operating equipment to build and maintain the Proposed Action. Energy would be consumed for onsite construction activity, such as tunnel widening, bridge construction, and road widening. Energy would be consumed for off-site manufacture of pavement and bridge components. Transportation energy would be required to haul tunnel detritus and to deliver materials to the construction site.

Section 6. What mitigation is needed?

Mitigation approaches for energy resources and greenhouse gas emissions identified in the Tier 1 PEIS document are relevant to this project. Table 6 and Table 7 present operations and construction mitigation measures respectively for the Proposed Action.

6.1 Operations Mitigation

TABLE 6
Mitigation for Adverse Operational Impacts to Energy Resources and Greenhouse Gas Emissions

Activity	Location	Impact	Mitigation
Maintenance	Project Area	Fuel consumption and greenhouse gas emissions due to idling vehicles	CDOT will conduct maintenance activities when feasible during periods of reduced traffic volumes to reduce idling vehicles
Vehicle Traffic	Study Area	Fuel consumption and greenhouse gas emissions	CDOT will encourage use of transit through a variety of incentive programs to reduce vehicle demand
			CDOT will encourage use of alternative fueled vehicles through a variety of incentive programs to reduce fuel consumption and emissions
			CDOT will encourage carpooling through a variety of incentive programs to reduce vehicle demand

6.1.1 Construction Mitigation

TABLE 7
Mitigation for Adverse Construction Impacts to Energy Resources and Greenhouse Gas Emissions

Activity	Location	Impact	Mitigation
Operation of Construction Equipment	Project Area and staging areas	Fuel consumption and greenhouse gas emissions	CDOT will encourage the contractor to use fuel-efficient construction vehicles (for example, low sulfur fuel, biodiesel, or hybrid technologies)
		Fuel consumption and greenhouse gas emissions due to poorly performing construction equipment	CDOT will encourage the contractor to properly maintain the performance of construction equipment
		Fuel consumption and greenhouse gas emissions due to idling of construction equipment	CDOT will encourage the contractor to minimize the idling of construction equipment
Commuting of Construction Workers	Project Area staging Areas	VMT due to workers commuting to construction staging areas	CDOT will encourage the contractor to provide carpooling incentives to workers

TABLE 7
Mitigation for Adverse Construction Impacts to Energy Resources and Greenhouse Gas Emissions

Activity	Location	Impact	Mitigation
Travel between Project Area and staging areas	Project Area and staging areas	Construction equipment VMT	Staging areas will be located as close as possible to the Project Area
Hauling of construction materials and detritus	Surrounding the Project Area	Construction equipment VMT	CDOT will encourage the use of closest source for aggregates and other materials, and the closest location for unloading of tunnel detritus
Production of Construction Material	Project Area and staging areas	Fuel consumption and greenhouse gas emissions	CDOT will encourage use of alternative fuels and asphalt binders
Traffic management during construction	I-70 approaching Project Area from east or west.	Fuel consumption and greenhouse gas emissions due to idling vehicles	CDOT will implement traffic management techniques that minimize motorist delays and vehicle idling

Section 7. References

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Appendix 1 – Weekday Energy Calculations

Energy Consumption

Weekday
Existing BTU: **2.90E+09** Gasoline Equivalents: **23,200**

	EB GP Lanes									
		EB Volumes			EB VMT		EB Fuel		EB Btu	EB Gas, gal
Segment	EB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		
Floyd Hill 244-248	65	17357	15838	1519	53850	5164	1844	732	3.32E+08	
Central City 243 - 244	65	18423	16811	1612	23535	2257	806	320	1.45E+08	
Twin Tunnels 241 - 243	65	18226	16631	1595	29936	2871	1025	407	1.85E+08	
Idaho Springs 239 - 241	65	17019	15530	1489	37272	3574	1276	507	2.30E+08	
Downieville 232 - 239	65	16228	14808	1420	96252	9230	3296	1308	5.93E+08	
SUB TOTAL							8248	3274	1.49E+09	11880

	WB GP Lanes									
		WB Volumes			WB VMT		WB Fuel		WB Btu	WB Gas, gal
Segment	WB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		
Floyd Hill 244-248	60	16861	15386	1475	52311	5016	1666	745	3.12E+08	
Central City 243 - 244	60	18109	16524	1585	23134	2218	737	329	1.38E+08	
Twin Tunnels 241 - 243	60	17990	16416	1574	29549	2833	941	421	1.76E+08	
Idaho Springs 239 - 241	60	17039	15548	1491	37315	3578	1188	531	2.22E+08	
Downieville 232 - 239	60	16068	14662	1406	95303	9139	3035	1356	5.68E+08	
SUB TOTAL									1.41E+09	11320

Weekday
2035 No-Action / Build BTU: **4.09E+09** Gasoline Equivalents: **32,736**

	EB GP Lanes									
		EB Volumes			EB VMT		EB Fuel		EB Btu	
Segment	EB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		EB Gas, gal
Floyd Hill 244-248	65	24446	22307	2139	75844	7273	2597	1031	4.68E+08	
Central City 243 - 244	65	25944	23674	2270	33143	3178	1135	450	2.04E+08	
Twin Tunnels 241 - 243	65	25667	23421	2246	42158	4043	1444	573	2.60E+08	
Idaho Springs 239 - 241	65	23968	21871	2097	52490	5033	1798	713	3.24E+08	
Downieville 232 - 239	65	22854	20854	2000	135553	12998	4642	1842	8.36E+08	
SUB TOTAL									2.09E+09	16731

	WB GP Lanes									
		WB Volumes			WB VMT		WB Fuel		WB Btu	WB Gas, gal
Segment	WB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		
Floyd Hill 244-248	60	23839	21753	2086	73960	7092	2355	1053	4.40E+08	
Central City 243 - 244	60	25602	23362	2240	32707	3136	1042	465	1.95E+08	
Twin Tunnels 241 - 243	60	25433	23208	2225	41774	4006	1330	595	2.49E+08	
Idaho Springs 239 - 241	60	24086	21978	2108	52748	5058	1680	751	3.14E+08	
Downieville 232 - 239	60	22721	20733	1988	134764	12923	4292	1918	8.03E+08	
SUB TOTAL									2.00E+09	16005

Weekday
Existing Construction BTU: **2.93E+09** Gasoline Equivalents: **23,474**

	EB GP Lanes									
		EB Volumes			EB VMT		EB Fuel		EB Btu	EB Gas, gal
Segment	EB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		
Floyd Hill 244-248	65	17357	15838	1519	53850	5164	1844	732	3.32E+08	
Central City 243 - 244	65	18423	16811	1612	23535	2257	806	320	1.45E+08	
Twin Tunnels 241 - 243	30	18226	16631	1595	32431	3110	1023	656	2.19E+08	
Idaho Springs 239 - 241	65	17019	15530	1489	37272	3574	1276	507	2.30E+08	
Downieville 232 - 239	65	16228	14808	1420	96252	9230	3296	1308	5.93E+08	
SUB TOTAL									1.52E+09	12154

	WB GP Lanes									WB Gas, gal
		WB Volumes			WB VMT		WB Fuel		WB Btu	
Segment	WB Speed	Vehicle	Auto	Truck	Auto	Truck	Gasoline	Diesel		
Floyd Hill 244-248	60	16861	15386	1475	52311	5016	1666	745	3.12E+08	
Central City 243 - 244	60	18109	16524	1585	23134	2218	737	329	1.38E+08	
Twin Tunnels 241 - 243	60	17990	16416	1574	29549	2833	941	421	1.76E+08	
Idaho Springs 239 - 241	60	17039	15548	1491	37315	3578	1188	531	2.22E+08	
Downieville 232 - 239	60	16068	14662	1406	95303	9139	3035	1356	5.68E+08	
SUB TOTAL									1.41E+09	11320

Greenhouse Gas Emissions (CO_2 equivalents)

Weekday
Existing
CO2 Equivalents. kg 211,951

EB CO2, kg		EB CH4 CO2 eq, kg		EB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
16229	7392	31	1	586	8	
7093	3231	14	0	256	3	
9022	4110	17	0	326	4	
11233	5117	22	0	405	5	
29008	13213	56	1	1047	14	
						108,444

WB CO2, kg		WB CH4 CO2 eq, kg		WB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
14660	7520	31	1	569	7	
6483	3325	14	0	252	3	
8281	4248	17	0	321	4	
10458	5364	22	0	406	5	
26709	13700	56	1	1037	14	
						103,508

Weekday
2035 No-Action / Build
CO2 Equivalents. kg 299,070

EB CO2, kg		EB CH4 CO2 eq, kg		EB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
22857	10412	44	1	825	11	
9988	4550	19	0	361	5	
12705	5787	25	0	459	6	
15819	7206	31	1	571	7	
40852	18608	79	1	1474	19	
						152,723

WB CO2, kg		WB CH4 CO2 eq, kg		WB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
20728	10632	43	1	804	11	
9166	4701	19	0	356	5	
11707	6005	24	0	454	6	
14783	7582	31	1	574	8	
37768	19372	79	1	1466	19	
						146,346

Weekday
Existing Construction
CO2 Equivalents. kg 214,475

EB CO2, kg		EB CH4 CO2 eq, kg		EB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
16229	7392	31	1	586	8	
7093	3231	14	0	256	3	
9003	6623	19	0	353	5	
11233	5117	22	0	405	5	
29008	13213	56	1	1047	14	
						110,967

WB CO2, kg		WB CH4 CO2 eq, kg		WB n2O CO2 eq, kg		TOTAL, Kg
Gasoline	Diesel	Auto	Truck	Auto	Truck	
14660	7520	31	1	569	7	
6483	3325	14	0	252	3	
8281	4248	17	0	321	4	
10458	5364	22	0	406	5	
26709	13700	56	1	1037	14	
						103,508

Appendix 2 – Weekend Energy Calculations

2010 Existing Conditions

Input Volume/Speed Data

2010 Existing Conditions	Travel Direction	Measure	Time of Day (Starting Hour)														Total Volume
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
GT to EJ	Eastbound	Volume	737	1996	2475	2596	2687	2351	2012	1878	1890	1556	930	785	691	479	23,062
		Speed	64.70	58.84	51.05	48.29	40.49	17.16	8.47	6.98	7.96	35.14	62.83	64.92	64.93	64.98	
	Westbound	Volume	506	1228	1586	1685	1660	1585	1396	1188	1184	792	498	395	270	147	14,122
		Speed	64.96	64.71	63.95	63.46	63.59	63.85	64.25	64.65	64.69	64.93	64.99	64.99	65.00	65.00	
EJ to Exit 239	Eastbound	Volume	883	2344	2862	2919	2743	2624	2293	2182	2308	2372	1919	1236	859	516	28,061
		Speed	64.62	53.12	40.11	31.24	27.42	16.97	11.45	10.95	9.62	11.39	23.78	56.50	64.85	64.94	
	Westbound	Volume	556	1193	1390	1495	1462	1353	1067	1028	1066	637	423	322	237	114	12,343
		Speed	64.94	64.65	64.19	63.79	64.02	64.26	64.58	64.58	64.66	64.94	64.94	64.98	64.99	65.00	
Exit 239 to Exit 241	Eastbound	Volume	858	2230	2837	2884	2713	2631	2576	2565	2682	2681	2498	1931	928	537	30,551
		Speed	59.58	46.79	28.59	22.88	16.17	14.66	13.94	13.76	14.82	15.15	31.00	48.19	59.62	59.97	
	Westbound	Volume	528	1091	1367	1454	1356	1297	997	954	1021	604	389	309	264	109	11,740
		Speed	59.64	59.44	59.02	58.69	58.93	59.12	59.52	59.52	59.46	59.64	59.66	59.63	59.65	59.68	
Exit 241 to BFH	Eastbound	Volume	1065	2445	3025	3129	3162	3219	3233	3241	3237	3225	3223	3175	1239	550	37,167
		Speed	53.99	40.69	30.79	28.27	27.51	25.57	24.76	23.54	24.32	25.59	25.74	25.10	52.18	54.94	
	Westbound	Volume	659	1328	1640	1721	1601	1667	1335	1197	1283	774	459	369	323	113	14,468
		Speed	54.79	54.35	52.70	51.39	53.11	50.43	54.12	54.57	54.24	54.90	54.99	54.99	54.99	55.00	
BFH to TFH	Eastbound	Volume	997	2362	2943	3175	3240	3377	3471	3481	3469	3427	3401	3406	1512	573	38,835
		Speed	54.90	51.85	47.24	45.45	44.71	43.62	42.97	42.63	43.01	43.51	43.39	42.51	52.51	54.95	
	Westbound	Volume	938	1837	2117	2129	2082	2098	1944	1854	1890	1050	551	452	383	114	19,439
		Speed	54.89	50.76	43.82	43.03	43.84	40.10	48.27	51.41	48.36	54.88	55.00	55.00	55.00	55.00	

	BTU	Gasoline Equivalent
Sum	3.50E+09	28,025
EB	2.51E+09	20,080
WB	9.93E+08	7,945

Greenhouse Gas Emissions (CO_2 equivalents)

2010 Existing Conditions			VMT	Fuel	CO_2	CH_4	N_2O	CO_2 equivalents, kg
EJ to Exit 239	Eastbound	Auto (gasoline)	177,838	6,425	56,536	103.8	1934.4	69,379
		Truck (diesel)	4,560	1,069	10,798	0.5	6.8	
	Westbound	Auto (gasoline)	78,224	2,656	23,374	45.7	850.9	27,162
		Truck (diesel)	2,006	286	2,888	0.2	3.0	
Exit 239 to Exit 241	Eastbound	Auto (gasoline)	71,489	2,645	23,276	41.7	777.6	28,509
		Truck (diesel)	1,833	437	4,411	0.2	2.7	
	Westbound	Auto (gasoline)	27,471	868	7,642	16.0	298.8	9,042
		Truck (diesel)	704	107	1,084	0.1	1.0	
Exit 241 to BFH	Eastbound	Auto (gasoline)	115,960	3,800	33,440	67.7	1261.3	41,440
		Truck (diesel)	2,973	660	6,666	0.3	4.4	
	Westbound	Auto (gasoline)	45,140	1,393	12,260	26.4	491.0	14,738
		Truck (diesel)	1,157	194	1,958	0.1	1.7	
BFH to TFH	Eastbound	Auto (gasoline)	128,737	4,109	36,156	75.2	1400.3	43,992
		Truck (diesel)	3,301	629	6,355	0.4	4.9	
	Westbound	Auto (gasoline)	64,441	2,038	17,933	37.6	701.0	21,748
		Truck (diesel)	1,652	304	3,075	0.2	2.5	

	CO_2 Equivalents
Sum	**256,010**
EB	**183,320**
WB	**72,690**

Energy Calculations (by segment)

2010 Existing Conditions	Measure	Auto/ Truck	Time of Day (Starting Hour)														Total Energy
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
EJ to Exit 239	EB Volumes	Auto	861	2,286	2,791	2,846	2,674	2,559	2,235	2,127	2,250	2,313	1,871	1,205	838	503	
		Truck	22	59	72	73	69	66	57	55	58	59	48	31	21	13	
	EB VMT	Auto	5,595	14,858	18,140	18,498	17,384	16,631	14,529	13,828	14,628	15,034	12,164	7,834	5,446	3,269	
		Truck	143	381	465	474	446	426	373	355	375	385	312	201	140	84	
	EB mpg	Gasoline	29.2	32.4	31.0	31.7	30.5	24.4	24.4	24.4	24.4	24.4	27.9	32.4	29.2	29.2	
		Diesel	7.1	5.9	5.1	4.7	4.4	3.9	3.4	3.4	3.4	3.4	3.9	6.1	7.1	7.1	
	EB Fuel	Gasoline	192	459	585	584	570	682	595	567	600	616	436	242	186	112	6,425
		Diesel	20	65	92	100	101	109	110	104	110	113	79	33	20	12	1,069
	EB BTU		2.7E+07	6.6E+07	8.6E+07	8.7E+07	8.5E+07	1.0E+08	9.0E+07	8.5E+07	9.0E+07	9.3E+07	6.6E+07	3.5E+07	2.6E+07	1.6E+07	9.5E+08
	WB Volumes	Auto	542	1,163	1,355	1,458	1,425	1,319	1,040	1,002	1,039	621	413	314	231	111	
		Truck	14	30	35	37	37	34	27	26	27	16	11	8	6	3	
	WB VMT	Auto	3,526	7,559	8,808	9,477	9,265	8,574	6,760	6,514	6,755	4,038	2,682	2,043	1,502	722	
		Truck	90	194	226	243	238	220	173	167	173	104	69	52	39	19	
	WB mpg	Gasoline	29.2	29.2	29.2	31.4	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
		Diesel	7.1	7.1	7.1	6.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	
	WB Fuel	Gasoline	121	259	302	302	317	294	231	223	231	138	92	70	51	25	2,656
		Diesel	13	27	32	36	34	31	25	24	25	15	10	7	5	3	286
	WB BTU		1.7E+07	3.6E+07	4.2E+07	4.3E+07	4.4E+07	4.1E+07	3.2E+07	3.1E+07	3.2E+07	1.9E+07	1.3E+07	9.8E+06	7.2E+06	3.5E+06	3.7E+08
Exit 239 to Exit 241	EB Volumes	Auto	837	2,174	2,766	2,812	2,645	2,565	2,511	2,501	2,615	2,614	2,435	1,883	905	524	
		Truck	21	56	71	72	68	66	64	64	67	67	62	48	23	13	
	EB VMT	Auto	2,008	5,219	6,639	6,748	6,348	6,157	6,027	6,002	6,276	6,273	5,845	4,519	2,172	1,257	
		Truck	51	134	170	173	163	158	155	154	161	161	150	116	56	32	
	EB mpg	Gasoline	31.4	31.6	30.5	27.9	24.4	24.4	24.4	24.4	24.4	24.4	31.7	31.6	31.4	31.4	
		Diesel	6.7	5.3	4.4	3.9	3.9	3.9	3.4	3.4	3.9	3.9	4.7	5.3	6.7	6.7	
	EB Fuel	Gasoline	64	165	218	242	260	252	247	246	257	257	184	143	69	40	2,645
		Diesel	8	25	39	44	42	40	45	45	41	41	32	22	8	5	437
	EB BTU		9.1E+06	2.4E+07	3.3E+07	3.6E+07	3.8E+07	3.7E+07	3.7E+07	3.7E+07	3.8E+07	3.8E+07	2.7E+07	2.1E+07	9.8E+06	5.7E+06	3.9E+08
	WB Volumes	Auto	515	1,064	1,333	1,418	1,322	1,265	972	930	995	589	379	301	257	106	
		Truck	13	27	34	36	34	32	25	24	26	15	10	8	7	3	
	WB VMT	Auto	1,236	2,554	3,199	3,402	3,173	3,035	2,334	2,232	2,389	1,413	910	722	617	254	
		Truck	32	65	82	87	81	78	60	57	61	36	23	19	16	7	
	WB mpg	Gasoline	31.4	31.4	31.4	32.4	32.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	
		Diesel	6.7	6.7	6.7	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	WB Fuel	Gasoline	39	81	102	105	98	97	74	71	76	45	29	23	20	8	868
		Diesel	5	10	12	14	13	12	9	8	9	5	3	3	2	1	107
	WB BTU		5.6E+06	1.2E+07	1.4E+07	1.5E+07	1.4E+07	1.4E+07	1.1E+07	1.0E+07	1.1E+07	6.4E+06	4.1E+06	3.3E+06	2.8E+06	1.1E+06	1.2E+08

Energy Calculations (by segment)

2010 Existing Conditions	Measure	Auto/ Truck	Time of Day (Starting Hour)														Total Energy
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
Exit 241 to BFH	EB Volumes	Auto	1,038	2,384	2,950	3,051	3,083	3,138	3,152	3,160	3,156	3,144	3,142	3,095	1,208	536	
		Truck	27	61	76	78	79	80	81	81	81	81	81	79	31	14	
	EB VMT	Auto	3,322	7,628	9,438	9,763	9,866	10,043	10,087	10,111	10,099	10,061	10,056	9,906	3,865	1,716	
		Truck	85	196	242	250	253	258	259	259	259	258	258	254	99	44	
	EB mpg	Gasoline	32.4	31.0	31.7	30.5	30.5	30.5	30.5	27.9	30.5	30.5	30.5	30.5	32.4	32.4	
		Diesel	5.9	5.1	4.7	4.4	4.4	4.4	4.4	3.9	4.4	4.4	4.4	4.4	5.9	6.1	
	EB Fuel	Gasoline	103	246	298	320	323	329	331	362	331	330	330	325	119	53	3,800
		Diesel	15	39	51	57	58	59	59	66	59	59	59	58	17	7	660
	EB BTU		1.5E+07	3.6E+07	4.4E+07	4.8E+07	4.8E+07	4.9E+07	4.9E+07	5.4E+07	5.0E+07	4.9E+07	4.9E+07	4.9E+07	1.7E+07	7.6E+06	5.7E+08
	WB Volumes	Auto	643	1,295	1,599	1,678	1,561	1,625	1,301	1,167	1,251	755	447	360	315	110	
		Truck	16	33	41	43	40	42	33	30	32	19	11	9	8	3	
	WB VMT	Auto	2,057	4,143	5,117	5,368	4,994	5,200	4,164	3,733	4,004	2,416	1,431	1,151	1,007	353	
		Truck	53	106	131	138	128	133	107	96	103	62	37	30	26	9	
	WB mpg	Gasoline	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	6.1	5.9	5.9	5.9	5.9	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
	WB Fuel	Gasoline	63	128	158	166	154	160	129	115	124	75	44	36	31	11	1,393
		Diesel	9	17	22	24	22	23	18	16	17	10	6	5	4	1	194
	WB BTU		9.1E+06	1.8E+07	2.3E+07	2.4E+07	2.2E+07	2.3E+07	1.9E+07	1.7E+07	1.8E+07	1.1E+07	6.4E+06	5.1E+06	4.5E+06	1.6E+06	2.0E+08
BFH to TFH	EB Volumes	Auto	972	2,303	2,870	3,095	3,159	3,293	3,384	3,394	3,382	3,341	3,316	3,321	1,475	559	
		Truck	25	59	74	79	81	84	87	87	87	86	85	85	38	14	
	EB VMT	Auto	3,305	7,831	9,757	10,524	10,741	11,196	11,505	11,538	11,500	11,361	11,274	11,291	5,013	1,901	
		Truck	85	201	250	270	275	287	295	296	295	291	289	290	129	49	
	EB mpg	Gasoline	32.4	32.4	31.6	31.6	31.6	31.0	31.0	31.0	31.0	31.0	31.0	31.0	32.4	32.4	
		Diesel	6.1	5.9	5.3	5.3	5.3	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.9	6.1	
	EB Fuel	Gasoline	102	242	309	333	340	361	371	372	371	366	364	364	155	59	4,109
		Diesel	14	34	47	51	52	57	58	58	58	57	57	57	22	8	629
	EB BTU		1.5E+07	3.5E+07	4.5E+07	4.9E+07	5.0E+07	5.3E+07	5.4E+07	5.5E+07	5.4E+07	5.4E+07	5.3E+07	5.3E+07	2.2E+07	8.4E+06	6.0E+08
	WB Volumes	Auto	915	1,791	2,064	2,076	2,030	2,046	1,896	1,807	1,843	1,023	537	441	374	111	
		Truck	23	46	53	53	52	52	49	46	47	26	14	11	10	3	
	WB VMT	Auto	3,109	6,090	7,018	7,059	6,902	6,955	6,445	6,145	6,266	3,480	1,825	1,498	1,271	378	
		Truck	80	156	180	181	177	178	165	158	161	89	47	38	33	10	
	WB mpg	Gasoline	32.4	32.4	31.0	31.0	31.0	31.0	31.6	32.4	31.6	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.9	5.1	5.1	5.1	5.1	5.3	5.9	5.3	6.1	6.1	6.1	6.1	6.1	
	WB Fuel	Gasoline	96	188	226	228	223	224	204	190	198	107	56	46	39	12	2,038
		Diesel	13	27	35	36	35	35	31	27	30	15	8	6	5	2	304
	WB BTU		1.4E+07	2.7E+07	3.3E+07	3.3E+07	3.3E+07	3.3E+07	3.0E+07	2.7E+07	2.9E+07	1.5E+07	8.1E+06	6.7E+06	5.6E+06	1.7E+06	3.0E+08

Future No-Action Conditions

Input Volume/Speed Data

2035 No Action	Travel Direction	Measure	Time of Day (Starting Hour)														Total Volume
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
GT to EJ	Eastbound	Volume	909	2413	2749	2661	2088	1529	1758	1649	1748	1943	1700	1590	1424	499	24,658
		Speed	64.39	50.77	38.54	38.13	18.63	5.03	4.42	4.38	4.57	4.13	4.78	5.91	28.74	63.37	
	Westbound	Volume	579	1452	1630	1906	1709	1390	1458	1454	1344	1227	865	431	334	203	15,985
		Speed	64.95	64.27	63.82	62.35	63.46	64.22	64.09	64.42	64.59	64.54	64.74	64.99	65.00	65.00	
EJ to Exit 239	Eastbound	Volume	1060	2665	2783	2644	2179	2028	2174	2289	2458	2662	2558	2364	2417	1944	32,225
		Speed	64.12	43.78	27.90	19.84	13.21	21.10	29.20	14.20	9.08	7.75	7.72	7.19	8.00	24.44	
	Westbound	Volume	617	1399	1454	1662	1445	1206	1205	1345	1278	1101	719	382	294	171	14,276
		Speed	64.93	64.33	63.84	63.30	63.90	64.47	64.48	64.08	64.39	64.55	64.76	64.96	64.98	64.99	
Exit 239 to Exit 241	Eastbound	Volume	1010	2395	2616	2390	2405	2415	2348	2390	2488	2483	2547	2508	2616	2577	33,187
		Speed	54.33	33.76	17.49	12.59	11.62	10.48	11.82	10.30	10.90	10.91	10.34	12.07	15.55	30.26	
	Westbound	Volume	568	1290	1411	1511	1371	1022	1072	1267	1219	1148	600	322	304	155	13,259
		Speed	59.62	59.07	58.75	58.56	58.90	59.48	59.46	59.08	59.19	59.24	59.47	59.63	59.63	59.66	
Exit 241 to BFH	Eastbound	Volume	1204	2624	3075	3157	3198	3218	3229	3220	3228	3225	3227	3229	3235	3202	42,273
		Speed	49.45	35.34	28.65	26.93	25.38	24.85	23.17	22.03	21.81	21.99	21.89	21.50	20.73	21.13	
	Westbound	Volume	714	1543	1694	1822	1725	1335	1439	1660	1589	1499	705	360	344	166	16,593
		Speed	54.80	53.25	51.41	48.93	50.22	53.71	53.51	48.29	47.81	52.01	53.90	55.00	55.00	55.00	
BFH to TFH	Eastbound	Volume	1117	2522	3076	3245	3367	3409	3474	3491	3486	3489	3502	3492	3482	3481	44,633
		Speed	54.71	50.97	46.49	44.69	43.52	43.17	43.17	42.76	43.04	42.68	42.40	42.96	42.80	42.06	
	Westbound	Volume	1057	2056	2116	2118	2064	1966	2024	1692	1849	2035	743	450	388	153	20,711
		Speed	54.77	45.97	42.20	37.51	38.27	40.06	33.57	17.86	26.99	35.12	52.75	55.00	55.00	55.00	

	BTU	Gasoline Equivalent
Sum	4.10E+09	32,831
EB	2.98E+09	23,811
WB	1.13E+09	9,019

Greenhouse Gas Emissions (CO_2 equivalents)

2035 No Action			VMT	Fuel	CO_2	CH_4	N_2O	CO_2 equivalents, kg
EJ to Exit 239	Eastbound	Auto (gasoline)	204,228	7,650	67,316	119.2	2221.5	83,268
		Truck (diesel)	5,237	1,347	13,603	0.6	7.8	
	Westbound	Auto (gasoline)	90,475	3,029	26,656	52.8	984.1	31,068
		Truck (diesel)	2,320	334	3,371	0.2	3.5	
Exit 239 to Exit 241	Eastbound	Auto (gasoline)	77,658	3,049	26,831	45.3	844.7	33,187
		Truck (diesel)	1,991	541	5,463	0.2	3.0	
	Westbound	Auto (gasoline)	31,026	978	8,608	18.1	337.5	10,200
		Truck (diesel)	796	122	1,235	0.1	1.2	
Exit 241 to BFH	Eastbound	Auto (gasoline)	131,891	4,557	40,101	77.0	1434.6	49,850
		Truck (diesel)	3,382	815	8,232	0.4	5.0	
	Westbound	Auto (gasoline)	51,770	1,610	14,170	30.2	563.1	17,114
		Truck (diesel)	1,327	233	2,349	0.1	2.0	
BFH to TFH	Eastbound	Auto (gasoline)	147,958	4,743	41,740	86.4	1609.4	50,845
		Truck (diesel)	3,794	733	7,403	0.4	5.6	
	Westbound	Auto (gasoline)	68,658	2,241	19,719	40.1	746.8	24,121
		Truck (diesel)	1,760	358	3,612	0.2	2.6	

	CO_2 Equivalents
Sum	299,655
EB	217,151
WB	82,504

Energy Calculations (by segment)

2035 No Action	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
EJ to Exit 239	EB Volumes	Auto	1034	2599	2713	2578	2125	1977	2119	2232	2397	2595	2494	2305	2356	1896	
		Truck	27	67	70	66	54	51	54	57	61	67	64	59	60	49	
	EB VMT	Auto	6720	16890	17637	16758	13810	12851	13775	14509	15580	16868	16211	14981	15316	12321	
		Truck	172	433	452	430	354	330	353	372	399	433	416	384	393	316	
	EB mpg	Gasoline	29.2	31.0	30.5	27.9	24.4	27.9	31.7	24.4	24.4	24.4	24.4	24.4	24.4	30.5	
		Diesel	7.1	5.1	4.4	3.9	3.4	3.9	4.7	3.9	3.4	3.4	3.4	3.4	3.4	4.4	
	EB Fuel	Gasoline	230	545	578	601	566	461	435	595	639	691	664	614	628	404	7,650
		Diesel	24	85	103	109	104	84	74	95	117	127	122	113	116	72	1,347
	EB BTU		3.2E+07	8.0E+07	8.7E+07	9.0E+07	8.5E+07	6.9E+07	6.5E+07	8.8E+07	9.6E+07	1.0E+08	1.0E+08	9.2E+07	9.4E+07	6.0E+07	1.1E+09
	WB Volumes	Auto	602	1364	1418	1620	1408	1176	1174	1311	1246	1073	701	372	286	167	
		Truck	15	35	36	42	36	30	30	34	32	28	18	10	7	4	
	WB VMT	Auto	3913	8866	9216	10531	9155	7642	7634	8524	8099	6975	4557	2419	1862	1083	
		Truck	100	227	236	270	235	196	196	219	208	179	117	62	48	28	
	WB mpg	Gasoline	29.2	29.2	31.4	31.4	31.4	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
		Diesel	7.1	7.1	6.7	6.7	6.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	
	WB Fuel	Gasoline	134	304	294	335	292	262	261	292	277	239	156	83	64	37	3,029
		Diesel	14	32	35	40	35	28	28	31	29	25	17	9	7	4	334
	WB BTU		1.9E+07	4.2E+07	4.2E+07	4.7E+07	4.1E+07	3.7E+07	3.7E+07	4.1E+07	3.9E+07	3.3E+07	2.2E+07	1.2E+07	8.9E+06	5.2E+06	4.2E+08
Exit 239 to Exit 241	EB Volumes	Auto	984	2335	2551	2330	2345	2355	2289	2330	2425	2421	2484	2445	2550	2513	
		Truck	25	60	65	60	60	60	59	60	62	62	64	63	65	64	
	EB VMT	Auto	2362	5604	6122	5592	5628	5652	5494	5591	5821	5810	5961	5868	6121	6031	
		Truck	61	144	157	143	144	145	141	143	149	149	153	150	157	155	
	EB mpg	Gasoline	32.4	31.7	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	31.7	
		Diesel	6.1	4.7	3.9	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.9	4.7	
	EB Fuel	Gasoline	73	177	251	229	231	232	225	229	239	238	244	240	251	190	3,049
		Diesel	10	30	40	42	42	43	41	42	44	44	45	44	40	33	541
	EB BTU		1.0E+07	2.6E+07	3.7E+07	3.4E+07	3.5E+07	3.5E+07	3.4E+07	3.4E+07	3.6E+07	3.6E+07	3.7E+07	3.6E+07	3.7E+07	2.8E+07	4.6E+08
	WB Volumes	Auto	554	1258	1376	1474	1337	997	1045	1235	1188	1119	585	314	296	151	
		Truck	14	32	35	38	34	26	27	32	30	29	15	8	8	4	
	WB VMT	Auto	1329	3018	3302	3537	3209	2392	2508	2964	2851	2685	1404	752	710	362	
		Truck	34	77	85	91	82	61	64	76	73	69	36	19	18	9	
	WB mpg	Gasoline	31.4	31.4	32.4	32.4	32.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	
		Diesel	6.7	6.7	6.1	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	WB Fuel	Gasoline	42	96	102	109	99	76	80	94	91	86	45	24	23	12	978
		Diesel	5	11	14	15	14	9	10	11	11	10	5	3	3	1	122
	WB BTU		6.0E+06	1.4E+07	1.5E+07	1.6E+07	1.4E+07	1.1E+07	1.1E+07	1.3E+07	1.3E+07	1.2E+07	6.3E+06	3.4E+06	3.2E+06	1.6E+06	1.4E+08

Energy Calculations (by segment)

2035 No Action	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
Exit 241 to BFH	EB Volumes	Auto	1174	2559	2998	3078	3118	3138	3149	3139	3148	3144	3146	3149	3154	3122	
		Truck	30	66	77	79	80	80	81	80	81	81	81	81	81	80	
	EB VMT	Auto	3756	8188	9593	9851	9977	10041	10076	10046	10073	10062	10069	10076	10092	9991	
		Truck	96	210	246	253	256	257	258	258	258	258	258	258	259	256	
	EB mpg	Gasoline	32.4	31.2	30.5	30.5	30.5	30.5	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	
		Diesel	5.9	4.9	4.4	4.4	4.4	4.4	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	
	EB Fuel	Gasoline	116	262	315	323	327	329	361	360	361	361	361	361	362	358	4,557
		Diesel	16	43	56	57	58	59	66	66	66	66	66	66	66	65	815
	EB BTU		1.7E+07	3.9E+07	4.7E+07	4.8E+07	4.9E+07	4.9E+07	5.4E+07	5.4E+07	5.4E+07	5.4E+07	5.4E+07	5.4E+07	5.4E+07	5.4E+07	6.8E+08
	WB Volumes	Auto	696	1505	1651	1776	1681	1301	1403	1619	1550	1461	687	351	336	161	
		Truck	18	39	42	46	43	33	36	42	40	37	18	9	9	4	
	WB VMT	Auto	2226	4815	5285	5683	5381	4164	4490	5179	4959	4676	2198	1123	1075	517	
		Truck	57	123	136	146	138	107	115	133	127	120	56	29	28	13	
	WB mpg	Gasoline	32.4	32.4	32.4	31.6	32.4	32.4	32.4	31.6	31.6	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.9	5.9	5.3	5.9	5.9	5.9	5.3	5.3	5.9	5.9	6.1	6.1	6.1	
	WB Fuel	Gasoline	69	149	163	180	166	129	139	164	157	144	68	35	33	16	1,610
		Diesel	9	21	23	27	24	18	20	25	24	20	10	5	5	2	233
	WB BTU		9.9E+06	2.2E+07	2.4E+07	2.6E+07	2.4E+07	1.9E+07	2.0E+07	2.4E+07	2.3E+07	2.1E+07	9.8E+06	5.0E+06	4.8E+06	2.3E+06	2.3E+08
BFH to TFH	EB Volumes	Auto	1089	2459	2999	3164	3283	3324	3387	3404	3399	3402	3415	3405	3395	3394	
		Truck	28	63	77	81	84	85	87	87	87	87	88	87	87	87	
	EB VMT	Auto	3702	8360	10196	10757	11163	11301	11515	11574	11555	11566	11610	11577	11543	11540	
		Truck	95	214	261	276	286	290	295	297	296	297	298	297	296	296	
	EB mpg	Gasoline	32.4	32.4	31.6	31.6	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	
		Diesel	6.1	5.9	5.3	5.3	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	
	EB Fuel	Gasoline	114	258	323	340	360	365	371	373	373	373	375	373	372	372	4,743
		Diesel	16	37	49	52	56	57	58	58	58	58	59	58	58	58	733
	EB BTU		1.6E+07	3.7E+07	4.7E+07	5.0E+07	5.3E+07	5.3E+07	5.4E+07	5.5E+07	5.5E+07	5.5E+07	5.5E+07	5.5E+07	5.5E+07	5.5E+07	6.9E+08
	WB Volumes	Auto	1031	2005	2063	2065	2013	1917	1973	1650	1802	1984	725	438	379	149	
		Truck	26	51	53	53	52	49	51	42	46	51	19	11	10	4	
	WB VMT	Auto	3504	6817	7013	7022	6843	6518	6708	5609	6128	6745	2464	1491	1287	507	
		Truck	90	175	180	180	175	167	172	144	157	173	63	38	33	13	
	WB mpg	Gasoline	32.4	31.6	31.0	31.2	31.2	31.0	31.7	24.4	30.5	31.2	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.3	5.1	4.9	4.9	5.1	4.7	3.9	4.4	4.9	5.9	6.1	6.1	6.1	
	WB Fuel	Gasoline	108	216	226	225	219	210	212	230	201	216	76	46	40	16	2,241
		Diesel	15	33	35	37	36	33	36	37	36	35	11	6	5	2	358
	WB BTU		1.6E+07	3.2E+07	3.3E+07	3.3E+07	3.2E+07	3.1E+07	3.1E+07	3.4E+07	3.0E+07	3.2E+07	1.1E+07	6.6E+06	5.7E+06	2.3E+06	3.3E+08

Future Three General Purpose Lanes Conditions

Input Volume/Speed Data

2035 3 Free Lanes	Travel Direction	Measure	Time of Day (Starting Hour)														Total Volume
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
GT to EJ	Eastbound	Volume	993	2349	2745	2769	2568	1908	1850	1684	1704	1906	2195	1373	726	381	25,151
		Speed	64.47	53.03	43.25	36.46	23.99	7.27	5.35	4.36	4.09	4.14	4.20	29.41	64.50	64.99	
	Westbound	Volume	579	1452	1630	1906	1709	1390	1458	1454	1344	1227	865	431	334	203	15,985
		Speed	64.95	64.27	63.82	62.35	63.46	64.22	64.09	64.42	64.59	64.54	64.74	64.99	65.00	65.00	
EJ to Exit 239	Eastbound	Volume	1186	2671	2987	2743	2564	2419	2376	2289	2316	2271	2465	2508	2058	805	31,658
		Speed	63.69	45.37	26.46	23.15	14.70	13.01	12.49	12.15	11.31	10.78	12.47	14.63	20.72	54.48	
	Westbound	Volume	617	1399	1454	1662	1445	1206	1205	1345	1278	1101	719	382	294	171	14,276
		Speed	64.93	64.33	63.84	63.30	63.90	64.47	64.48	64.08	64.39	64.55	64.76	64.96	64.98	64.99	
Exit 239 to Exit 241	Eastbound	Volume	1127	2500	2905	2883	2806	2795	2764	2769	2733	2773	2827	2460	2350	1478	35,168
		Speed	58.49	41.32	29.13	22.65	21.89	20.22	19.93	20.43	20.30	20.61	22.28	42.12	46.57	49.22	
	Westbound	Volume	568	1290	1411	1511	1371	1022	1072	1267	1219	1148	600	322	304	155	13,259
		Speed	59.62	59.07	58.75	58.56	58.90	59.48	59.46	59.08	59.19	59.24	59.47	59.63	59.63	59.66	
Exit 241 to BFH	Eastbound	Volume	1316	2895	3472	3853	3947	3929	4039	3908	3838	3901	3726	3310	3172	1918	47,224
		Speed	52.47	40.56	39.34	34.63	33.46	30.62	31.60	33.87	36.93	32.19	35.61	39.04	42.19	46.32	
	Westbound	Volume	714	1543	1694	1822	1725	1335	1439	1660	1589	1499	705	360	344	166	16,593
		Speed	54.80	53.25	51.41	48.93	50.22	53.71	53.51	48.29	47.81	52.01	53.90	55.00	55.00	55.00	
BFH to TFH	Eastbound	Volume	1248	2737	3425	3773	3776	3664	3781	3692	3701	3794	3605	3305	3068	2063	45,632
		Speed	54.39	49.40	43.10	39.15	38.54	41.06	39.88	40.72	40.02	39.32	41.58	44.37	45.64	49.40	
	Westbound	Volume	1057	2056	2116	2118	2064	1966	2024	1692	1849	2035	743	450	388	153	20,711
		Speed	54.77	45.97	42.20	37.51	38.27	40.06	33.57	17.86	26.99	35.12	52.75	55.00	55.00	55.00	

	BTU	Gasoline Equivalent
Sum	4.09E+09	32,703
EB	2.96E+09	23,684
WB	1.13E+09	9,019

Greenhouse Gas Emissions (CO_2 equivalents)

2035 Three Free Lanes			VMT	Fuel	CO_2	CH_4	N_2O	CO_2 equivalents, kg
EJ to Exit 239	Eastbound	Auto (gasoline)	200,631	7,633	67,167	117.1	2182.3	82,874
		Truck (diesel)	5,144	1,327	13,399	0.6	7.7	
	Westbound	Auto (gasoline)	90,475	3,029	26,656	52.8	984.1	31,068
		Truck (diesel)	2,320	334	3,371	0.2	3.5	
Exit 239 to Exit 241	Eastbound	Auto (gasoline)	82,294	2,825	24,863	48.0	895.1	30,753
		Truck (diesel)	2,110	489	4,943	0.2	3.1	
	Westbound	Auto (gasoline)	31,026	978	8,608	18.1	337.5	10,200
		Truck (diesel)	796	122	1,235	0.1	1.2	
Exit 241 to BFH	Eastbound	Auto (gasoline)	147,338	4,692	41,292	86.0	1602.7	50,755
		Truck (diesel)	3,778	769	7,768	0.4	5.6	
	Westbound	Auto (gasoline)	51,770	1,610	14,170	30.2	563.1	17,114
		Truck (diesel)	1,327	233	2,349	0.1	2.0	
BFH to TFH	Eastbound	Auto (gasoline)	151,269	4,836	42,558	88.3	1645.4	51,842
		Truck (diesel)	3,879	747	7,544	0.4	5.8	
	Westbound	Auto (gasoline)	68,658	2,241	19,719	40.1	746.8	24,121
		Truck (diesel)	1,760	358	3,612	0.2	2.6	

	CO_2 Equivalents
Sum	**298,728**
EB	**216,223**
WB	**82,504**

Energy Calculations (by segment)

2035 3 Free Lanes	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
EJ to Exit 239	EB Volumes	Auto	1156	2604	2912	2675	2500	2359	2317	2232	2258	2214	2403	2445	2006	785	
		Truck	30	67	75	69	64	60	59	57	58	57	62	63	51	20	
	EB VMT	Auto	7514	16928	18931	17386	16248	15331	15058	14508	14675	14390	15619	15895	13042	5104	
		Truck	193	434	485	446	417	393	386	372	376	369	400	408	334	131	
	EB mpg	Gasoline	31.4	31.6	30.5	27.9	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	27.9	32.4	
		Diesel	6.7	5.3	4.4	3.9	3.9	3.4	3.4	3.4	3.4	3.4	3.4	3.9	3.9	6.1	
	EB Fuel	Gasoline	239	536	621	623	666	628	617	595	601	590	640	651	467	158	7,633
		Diesel	29	81	110	114	106	116	114	109	111	109	118	104	85	22	1,327
	EB BTU		3.4E+07	7.8E+07	9.3E+07	9.4E+07	9.8E+07	9.5E+07	9.3E+07	9.0E+07	9.1E+07	8.9E+07	9.6E+07	9.6E+07	7.0E+07	2.3E+07	1.1E+09
	WB Volumes	Auto	602	1364	1418	1620	1408	1176	1174	1311	1246	1073	701	372	286	167	
		Truck	15	35	36	42	36	30	30	34	32	28	18	10	7	4	
	WB VMT	Auto	3913	8866	9216	10531	9155	7642	7634	8524	8099	6975	4557	2419	1862	1083	
		Truck	100	227	236	270	235	196	196	219	208	179	117	62	48	28	
	WB mpg	Gasoline	29.2	29.2	31.4	31.4	31.4	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
		Diesel	7.1	7.1	6.7	6.7	6.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	
	WB Fuel	Gasoline	134	304	294	335	292	262	261	292	277	239	156	83	64	37	3,029
		Diesel	14	32	35	40	35	28	28	31	29	25	17	9	7	4	334
	WB BTU		1.9E+07	4.2E+07	4.2E+07	4.7E+07	4.1E+07	3.7E+07	3.7E+07	4.1E+07	3.9E+07	3.3E+07	2.2E+07	1.2E+07	8.9E+06	5.2E+06	4.2E+08

Exit 239 to Exit 241	EB Volumes	Auto	1099	2437	2832	2811	2736	2725	2695	2699	2665	2703	2756	2399	2291	1441	
		Truck	28	62	73	72	70	70	69	69	68	69	71	62	59	37	
	EB VMT	Auto	2637	5850	6797	6747	6566	6540	6469	6478	6396	6488	6615	5756	5498	3458	
		Truck	68	150	174	173	168	168	166	166	164	166	170	148	141	89	
	EB mpg	Gasoline	32.4	31.0	31.7	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	31.0	31.6	32.4	
		Diesel	6.1	5.1	4.7	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	5.1	5.3	5.9	
	EB Fuel	Gasoline	81	189	214	242	235	234	232	232	229	233	237	186	174	107	2,825
		Diesel	11	30	37	44	43	43	42	42	42	42	43	29	26	15	489
	EB BTU		1.2E+07	2.8E+07	3.2E+07	3.6E+07	3.5E+07	3.5E+07	3.5E+07	3.5E+07	3.4E+07	3.5E+07	3.6E+07	2.7E+07	2.5E+07	1.5E+07	4.2E+08
	WB Volumes	Auto	554	1258	1376	1474	1337	997	1045	1235	1188	1119	585	314	296	151	
		Truck	14	32	35	38	34	26	27	32	30	29	15	8	8	4	
	WB VMT	Auto	1329	3018	3302	3537	3209	2392	2508	2964	2851	2685	1404	752	710	362	
		Truck	34	77	85	91	82	61	64	76	73	69	36	19	18	9	
	WB mpg	Gasoline	31.4	31.4	32.4	32.4	32.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	
		Diesel	6.7	6.7	6.1	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	WB Fuel	Gasoline	42	96	102	109	99	76	80	94	91	86	45	24	23	12	978
		Diesel	5	11	14	15	14	9	10	11	11	10	5	3	3	1	122
	WB BTU		6.0E+06	1.4E+07	1.5E+07	1.6E+07	1.4E+07	1.1E+07	1.1E+07	1.3E+07	1.3E+07	1.2E+07	6.3E+06	3.4E+06	3.2E+06	1.6E+06	1.4E+08

Energy Calculations (by segment)

2035 3 Free Lanes	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
Exit 241 to BFH	EB Volumes	Auto	1284	2822	3385	3757	3848	3831	3938	3811	3742	3803	3632	3227	3092	1870	
		Truck	33	72	87	96	99	98	101	98	96	98	93	83	79	48	
	EB VMT	Auto	4107	9031	10833	12021	12315	12258	12603	12194	11976	12170	11624	10327	9895	5985	
		Truck	105	232	278	308	316	314	323	313	307	312	298	265	254	153	
	EB mpg	Gasoline	32.4	31.0	31.0	31.2	31.7	31.7	31.7	31.7	31.2	31.7	31.2	31.0	31.0	31.6	
		Diesel	5.9	5.1	5.1	4.9	4.7	4.7	4.7	4.7	4.9	4.7	4.9	5.1	5.1	5.3	
	EB Fuel	Gasoline	127	291	349	385	388	387	398	385	384	384	373	333	319	189	4,692
		Diesel	18	46	55	63	67	66	68	66	63	66	61	52	50	29	769
	EB BTU		1.8E+07	4.3E+07	5.1E+07	5.7E+07	5.8E+07	5.8E+07	5.9E+07	5.7E+07	5.7E+07	5.7E+07	5.5E+07	4.9E+07	4.7E+07	2.8E+07	6.9E+08
	WB Volumes	Auto	696	1505	1651	1776	1681	1301	1403	1619	1550	1461	687	351	336	161	
		Truck	18	39	42	46	43	33	36	42	40	37	18	9	9	4	
	WB VMT	Auto	2226	4815	5285	5683	5381	4164	4490	5179	4959	4676	2198	1123	1075	517	
		Truck	57	123	136	146	138	107	115	133	127	120	56	29	28	13	
	WB mpg	Gasoline	32.4	32.4	32.4	31.6	32.4	32.4	32.4	31.6	31.6	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.9	5.9	5.3	5.9	5.9	5.9	5.3	5.3	5.9	5.9	6.1	6.1	6.1	
	WB Fuel	Gasoline	69	149	163	180	166	129	139	164	157	144	68	35	33	16	1,610
		Diesel	9	21	23	27	24	18	20	25	24	20	10	5	5	2	233
	WB BTU		9.9E+06	2.2E+07	2.4E+07	2.6E+07	2.4E+07	1.9E+07	2.0E+07	2.4E+07	2.3E+07	2.1E+07	9.8E+06	5.0E+06	4.8E+06	2.3E+06	2.3E+08

BFH to TFH	EB Volumes	Auto	1217	2668	3339	3679	3681	3572	3686	3600	3608	3699	3515	3223	2992	2011	
		Truck	31	68	86	94	94	92	95	92	93	95	90	83	77	52	
	EB VMT	Auto	4138	9072	11353	12507	12516	12145	12534	12240	12268	12577	11951	10957	10172	6839	
		Truck	106	233	291	321	321	311	321	314	315	322	306	281	261	175	
	EB mpg	Gasoline	32.4	32.4	31.0	31.0	31.2	31.0	31.0	31.0	31.0	31.0	31.0	31.6	31.6	32.4	
		Diesel	6.1	5.9	5.1	5.1	4.9	5.1	5.1	5.1	5.1	5.1	5.1	5.3	5.3	5.9	
	EB Fuel	Gasoline	128	280	366	403	401	392	404	395	396	406	386	347	322	211	4,836
		Diesel	17	40	57	63	66	61	63	62	62	63	60	53	49	30	747
	EB BTU		1.8E+07	4.1E+07	5.4E+07	5.9E+07	5.9E+07	5.7E+07	5.9E+07	5.8E+07	5.8E+07	6.0E+07	5.7E+07	5.1E+07	4.7E+07	3.1E+07	7.1E+08
	WB Volumes	Auto	1031	2005	2063	2065	2013	1917	1973	1650	1802	1984	725	438	379	149	
		Truck	26	51	53	53	52	49	51	42	46	51	19	11	10	4	
	WB VMT	Auto	3504	6817	7013	7022	6843	6518	6708	5609	6128	6745	2464	1491	1287	507	
		Truck	90	175	180	180	175	167	172	144	157	173	63	38	33	13	
	WB mpg	Gasoline	32.4	31.6	31.0	31.2	31.2	31.0	31.7	24.4	30.5	31.2	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.3	5.1	4.9	4.9	5.1	4.7	3.9	4.4	4.9	5.9	6.1	6.1	6.1	
	WB Fuel	Gasoline	108	216	226	225	219	210	212	230	201	216	76	46	40	16	2,241
		Diesel	15	33	35	37	36	33	36	37	36	35	11	6	5	2	358
	WB BTU		1.6E+07	3.2E+07	3.3E+07	3.3E+07	3.2E+07	3.1E+07	3.1E+07	3.4E+07	3.0E+07	3.2E+07	1.1E+07	6.6E+06	5.7E+06	2.3E+06	3.3E+08

Future One Managed Lane Conditions

Input Volume/Speed Data

2035 - 1 Managed Lane	Travel Direction	Measure	Time of Day (Starting Hour)														Total Volume
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
GT to EJ	Eastbound	Volume	979	2342	2720	2752	2209	1601	1550	1469	1482	1852	1984	1030	734	391	23,092
		Speed	64.52	52.54	40.24	32.04	17.57	5.12	4.41	4.34	4.51	4.31	4.22	23.97	63.79	64.98	
	Westbound	Volume	579	1452	1630	1906	1709	1390	1458	1454	1344	1227	865	431	334	203	15,985
		Speed	64.95	64.27	63.82	62.35	63.46	64.22	64.09	64.42	64.59	64.54	64.74	64.99	65.00	65.00	
EJ to Exit 239	Eastbound	Volume	1177	2656	2966	2634	2333	2023	2286	2273	2474	2499	2384	2566	1979	766	31,015
		Speed	63.84	45.14	25.06	24.23	13.26	18.97	22.34	19.80	13.39	10.61	15.14	13.43	26.15	53.42	
	Westbound	Volume	617	1399	1454	1662	1445	1206	1205	1345	1278	1101	719	382	294	171	14,276
		Speed	64.93	64.33	63.84	63.30	63.90	64.47	64.48	64.08	64.39	64.55	64.76	64.96	64.98	64.99	
Exit 239 to Exit 241	Eastbound	Volume	1135	2476	2866	2799	2766	2834	2748	2739	2758	2775	2775	2807	2536	1304	35,318
		Speed	58.38	39.01	23.18	16.56	16.43	18.48	15.98	15.49	17.03	17.66	19.01	21.13	39.59	52.41	
	Westbound	Volume	568	1290	1411	1511	1371	1022	1072	1267	1219	1148	600	322	304	155	13,259
		Speed	59.62	59.07	58.75	58.56	58.90	59.48	59.46	59.08	59.19	59.24	59.47	59.63	59.63	59.66	
Exit 241 to BFH	Eastbound - 2 GP	Volume	1309	2717	3109	3176	3146	2978	3105	3110	3129	3093	3072	2913	2751	1067	38,675
		Speed	52.54	38.42	32.37	30.95	31.16	34.57	32.46	32.43	31.66	32.76	33.06	35.63	36.50	52.14	
	Eastbound - 1 ML	Volume	0	20	331	737	937	1004	853	747	906	681	582	648	711	487	8,644
		Speed	55.00	55.00	54.00	51.00	48.00	46.00	49.00	51.00	48.00	52.00	53.00	52.00	51.00	52.00	
	Westbound	Volume	714	1543	1694	1822	1725	1335	1439	1660	1589	1499	705	360	344	166	16,593
		Speed	54.80	53.25	51.41	48.93	50.22	53.71	53.51	48.29	47.81	52.01	53.90	55.00	55.00	55.00	
BFH to TFH	Eastbound	Volume	1241	2593	3367	3796	3787	3767	3725	3607	3926	3661	3548	3454	3384	1693	45,548
		Speed	54.53	51.01	44.04	39.46	39.44	40.33	40.67	41.96	37.45	41.19	42.31	43.25	43.13	52.07	
	Westbound	Volume	1057	2056	2116	2118	2064	1966	2024	1692	1849	2035	743	450	388	153	20,711
		Speed	54.77	45.97	42.20	37.51	38.27	40.06	33.57	17.86	26.99	35.12	52.75	55.00	55.00	55.00	

	BTU	Gasoline Equivalents
Sum	**3.94E+09**	**31,538**
EB	**2.81E+09**	**22,518**
WB	**1.13E+09**	**9,019**

Greenhouse Gas Emissions (CO_2 equivalents)

2035 One Managed Lane			VMT	Fuel	CO_2	CH_4	N_2O	CO_2 equivalents, kg
EJ to Exit 239	Eastbound	Auto (gasoline)	196,558	7,239	63,703	114.8	2138.0	78,629
		Truck (diesel)	5,040	1,254	12,665	0.5	7.5	
	Westbound	Auto (gasoline)	90,475	3,029	26,656	52.8	984.1	31,068
		Truck (diesel)	2,320	334	3,371	0.2	3.5	
Exit 239 to Exit 241	Eastbound	Auto (gasoline)	82,644	3,125	27,503	48.2	898.9	33,611
		Truck (diesel)	2,119	511	5,157	0.2	3.2	
	Westbound	Auto (gasoline)	31,026	978	8,608	18.1	337.5	10,200
		Truck (diesel)	796	122	1,235	0.1	1.2	
Exit 241 to BFH	Eastbound	Auto (gasoline)	120,666	3,819	33,610	70.4	1312.5	41,458
		Truck (diesel)	3,094	640	6,460	0.3	4.6	
	Westbound	Auto (gasoline)	51,770	1,610	14,170	30.2	563.1	17,114
		Truck (diesel)	1,327	233	2,349	0.1	2.0	
BFH to TFH	Eastbound	Auto (gasoline)	150,992	4,836	42,554	88.1	1642.4	51,858
		Truck (diesel)	3,872	749	7,567	0.4	5.8	
	Westbound	Auto (gasoline)	68,658	2,241	19,719	40.1	746.8	24,121
		Truck (diesel)	1,760	358	3,612	0.2	2.6	

	CO_2 Equivalents
Sum	**288,059**
EB	**205,555**
WB	**82,504**

Energy Calculations (by segment)

2035 - 1 Managed Lane	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
EJ to Exit 239	EB Volumes	Auto	1147	2589	2892	2568	2275	1972	2229	2216	2412	2437	2324	2502	1930	747	
		Truck	29	66	74	66	58	51	57	57	62	62	60	64	49	19	
	EB VMT	Auto	7,457	16,831	18,797	16,693	14,785	12,820	14,486	14,406	15,676	15,840	15,106	16,262	12,543	4,856	
		Truck	191	432	482	428	379	329	371	369	402	406	387	417	322	125	
	EB mpg	Gasoline	31.4	31.6	30.5	30.5	24.4	24.4	27.9	27.9	24.4	24.4	24.4	24.4	30.5	32.4	
		Diesel	6.7	5.3	4.4	4.4	3.4	3.9	3.9	3.9	3.4	3.4	3.9	3.4	4.4	5.9	
	EB Fuel	Gasoline	237	533	616	547	606	525	519	516	642	649	619	666	411	150	7,239
		Diesel	28	81	110	97	112	84	95	94	118	119	99	123	73	21	1,254
	EB BTU		3.4E+07	7.8E+07	9.2E+07	8.2E+07	9.1E+07	7.7E+07	7.8E+07	7.8E+07	9.7E+07	9.8E+07	9.1E+07	1E+08	6E+07	21685670	1.1E+09
	WB Volumes	Auto	602	1364	1418	1620	1408	1176	1174	1311	1246	1073	701	372	286	167	
		Truck	15	35	36	42	36	30	30	34	32	28	18	10	7	4	
	WB VMT	Auto	3913	8866	9216	10531	9155	7642	7634	8524	8099	6975	4557	2419	1862	1083	
		Truck	100	227	236	270	235	196	196	219	208	179	117	62	48	28	
	WB mpg	Gas mpg	29.2	29.2	31.4	31.4	31.4	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
		Diesel mpg	7.1	7.1	6.7	6.7	6.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	
	WB Fuel	Gasoline	134	304	294	335	292	262	261	292	277	239	156	83	64	37	3,029
		Diesel	14	32	35	40	35	28	28	31	29	25	17	9	7	4	334
	WB BTU		1.9E+07	4.2E+07	4.2E+07	4.7E+07	4.1E+07	3.7E+07	3.7E+07	4.1E+07	3.9E+07	3.3E+07	2.2E+07	1.2E+07	9E+06	5181686.8	4.2E+08
Exit 239 to Exit 241	EB Volumes	Auto	1106	2414	2794	2729	2697	2763	2679	2670	2689	2706	2705	2737	2473	1271	
		Truck	28	62	72	70	69	71	69	68	69	69	69	70	63	33	
	EB VMT	Auto	2656	5795	6706	6550	6473	6632	6429	6409	6453	6494	6493	6569	5934	3051	
		Truck	68	149	172	168	166	170	165	164	165	167	166	168	152	78	
	EB mpg	Gas mpg	32.4	31	27.9	24.4	24.4	24.4	24.4	24.4	24.4	24.4	27.9	27.9	31	32.4	
		Diesel mpg	6.07	5.08	3.9275	3.9125	3.9125	3.9125	3.9125	3.9125	3.9125	3.9125	3.9275	3.9275	5.08	5.855	
	EB Fuel	Gasoline	82	187	240	268	265	272	263	263	264	266	233	235	191	94	3,125
		Diesel	11	29	44	43	42	43	42	42	42	43	42	43	30	13	511
	EB BTU		1.2E+07	2.7E+07	3.6E+07	4E+07	3.9E+07	4E+07	3.9E+07	3.9E+07	3.9E+07	3.9E+07	3.5E+07	3.5E+07	3E+07	13623920	4.6E+08
	WB Volumes	Auto	554	1258	1376	1474	1337	997	1045	1235	1188	1119	585	314	296	151	
		Truck	14	32	35	38	34	26	27	32	30	29	15	8	8	4	
	WB VMT	Auto	1329	3018	3302	3537	3209	2392	2508	2964	2851	2685	1404	752	710	362	
		Truck	34	77	85	91	82	61	64	76	73	69	36	19	18	9	
	WB mpg	Gas mpg	31.4	31.4	32.4	32.4	32.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	
		Diesel mpg	6.7	6.7	6.1	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	WB Fuel	Gasoline	42	96	102	109	99	76	80	94	91	86	45	24	23	12	978
		Diesel	5	11	14	15	14	9	10	11	11	10	5	3	3	1	122
	WB BTU		5994170	1.4E+07	1.5E+07	1.6E+07	1.4E+07	1.1E+07	1.1E+07	1.3E+07	1.3E+07	1.2E+07	6330278	3392727	3E+06	1630800.1	1.4E+08

2035 - 1 Managed Lane	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
Exit 241 to BFH	EB Volumes	Auto	1276	2649	3031	3097	3068	2903	3028	3032	3051	3015	2995	2841	2682	1041	
		Truck	33	68	78	79	79	74	78	78	78	77	77	73	69	27	
	EB VMT	Auto	4084	8477	9700	9910	9816	9291	9688	9702	9762	9649	9583	9090	8584	3330	
		Truck	105	217	249	254	252	238	248	249	250	247	246	233	220	85	
	EB mpg	Gas mpg	32.40	31.20	31.70	31.70	31.70	31.20	31.70	31.70	31.70	31.70	31.70	31.20	31.20	32.40	
		Diesel mpg	5.86	4.88	4.74	4.74	4.74	4.88	4.74	4.74	4.74	4.74	4.74	4.88	4.88	5.86	
	EB Fuel	Gasoline	126	272	306	313	310	298	306	306	308	304	302	291	275	103	3,819
		Diesel	18	45	52	54	53	49	52	52	53	52	52	48	45	15	640
	EB BTU		1.8E+07	4E+07	4.6E+07	4.7E+07	4.6E+07	4.4E+07	4.5E+07	4.6E+07	4.6E+07	4.5E+07	4.5E+07	4.3E+07	4E+07	14871596	5.7E+08
	WB Volumes	Auto	696	1505	1651	1776	1681	1301	1403	1619	1550	1461	687	351	336	161	
		Truck	18	39	42	46	43	33	36	42	40	37	18	9	9	4	
	WB VMT	Auto	2226	4815	5285	5683	5381	4164	4490	5179	4959	4676	2198	1123	1075	517	
		Truck	57	123	136	146	138	107	115	133	127	120	56	29	28	13	
	WB mpg	Gas mpg	32.40	32.40	32.40	31.60	32.40	32.40	32.40	31.60	31.60	32.40	32.40	32.40	32.40	32.40	
		Diesel mpg	6.07	5.86	5.86	5.34	5.86	5.86	5.86	5.34	5.34	5.86	5.86	6.07	6.07	6.07	
	WB Fuel	Gasoline	69	149	163	180	166	129	139	164	157	144	68	35	33	16	1,610
		Diesel	9	21	23	27	24	18	20	25	24	20	10	5	5	2	233
	WB BTU		9894095	2.2E+07	2.4E+07	2.6E+07	2.4E+07	1.9E+07	2E+07	2.4E+07	2.3E+07	2.1E+07	9816607	4988643	5E+06	2296051.2	2.3E+08
BFH to TFH	EB Volumes	Auto	1210	2528	3283	3701	3692	3673	3632	3517	3828	3569	3460	3368	3299	1651	
		Truck	31	65	84	95	95	94	93	90	98	92	89	86	85	42	
	EB VMT	Auto	4,113	8,595	11,163	12,584	12,553	12,488	12,347	11,957	13,014	12,136	11,763	11,450	11,218	5,612	
		Truck	105	220	286	323	322	320	317	307	334	311	302	294	288	144	
	EB mpg	Gas mpg	32.4	32.4	31.6	31	31	31	31	31	31.2	31	31	31	31	32.4	
		Diesel mpg	6.07	5.855	5.3425	5.08	5.08	5.08	5.08	5.08	4.875	5.08	5.08	5.08	5.08	5.855	
	EB Fuel	Gasoline	127	265	353	406	405	403	398	386	417	391	379	369	362	173	4,836
		Diesel	17	38	54	64	63	63	62	60	68	61	59	58	57	25	749
	EB BTU		1.8E+07	3.8E+07	5.2E+07	6E+07	5.9E+07	5.9E+07	5.8E+07	5.7E+07	6.2E+07	5.7E+07	5.6E+07	5.4E+07	5E+07	25061360	7.1E+08
	WB Volumes	Auto	1031	2005	2063	2065	2013	1917	1973	1650	1802	1984	725	438	379	149	
		Truck	26	51	53	53	52	49	51	42	46	51	19	11	10	4	
	WB VMT	Auto	3503.96	6816.75	7013.44	7022.28	6843.27	6518.4	6708.46	5608.98	6128.33	6744.92	2464.15	1490.65	1287.3	507.195	
		Truck	90	175	180	180	175	167	172	144	157	173	63	38	33	13	
	WB mpg	Gas mpg	32.4	31.6	31	31.2	31.2	31	31.7	24.4	30.5	31.2	32.4	32.4	32.4	32.4	
		Diesel mpg	6.07	5.3425	5.08	4.875	4.875	5.08	4.7425	3.9125	4.3975	4.875	5.855	6.07	6.07	6.07	
	WB Fuel	Gasoline	108	216	226	225	219	210	212	230	201	216	76	46	40	16	2,241
		Diesel	15	33	35	37	36	33	36	37	36	35	11	6	5	2	358
	WB BTU		1.6E+07	3.2E+07	3.3E+07	3.3E+07	3.2E+07	3.1E+07	3.1E+07	3.4E+07	3E+07	3.2E+07	1.1E+07	6624313	6E+06	2253936.2	3.3E+08

Construction Conditions

Input Volume/Speed Data

2010 Construction	Travel Direction	Measure	Time of Day (Starting Hour)														Total Volume
			9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	
GT to EJ	Eastbound	Volume	743	2007	2486	2545	2615	2373	2082	1870	1805	1621	1175	923	759	507	23,510
		Speed	64.74	58.45	50.76	49.19	42.22	16.94	8.30	6.82	4.79	8.82	53.25	64.87	64.91	64.99	
	Westbound	Volume	506	1228	1586	1685	1660	1585	1396	1188	1184	792	498	395	270	147	14,122
		Speed	64.96	64.71	63.95	63.46	63.59	63.85	64.25	64.65	64.69	64.93	64.99	64.99	65.00	65.00	
EJ to Exit 239	Eastbound	Volume	882	2345	2873	2923	2826	2593	2335	2341	2419	2287	2037	1674	1011	478	29,023
		Speed	64.66	52.96	39.74	32.74	28.72	15.95	12.21	10.99	10.16	11.78	17.36	32.16	61.99	64.97	
	Westbound	Volume	556	1193	1390	1495	1462	1353	1067	1028	1066	637	423	322	237	114	12,343
		Speed	64.94	64.65	64.19	63.79	64.02	64.26	64.58	64.58	64.66	64.94	64.94	64.98	64.99	65.00	
Exit 239 to Exit 241	Eastbound	Volume	859	2138	2704	2505	2385	2421	2320	2387	2383	2542	2306	2407	1459	457	29,271
		Speed	55.70	40.61	22.00	15.68	12.51	10.66	9.81	9.78	11.48	9.69	16.16	26.19	49.16	56.35	
	Westbound	Volume	528	1091	1367	1454	1356	1297	997	954	1021	604	389	309	264	109	11,740
		Speed	59.64	59.44	59.02	58.69	58.93	59.12	59.52	59.52	59.46	59.64	59.66	59.63	59.65	59.68	
Exit 241 to BFH	Eastbound	Volume	986	2043	2491	2493	2517	2518	2521	2512	2517	2501	2504	2540	2533	2535	33,210
		Speed	40.64	29.72	25.95	25.84	25.86	25.70	25.56	25.61	25.64	25.76	26.00	25.62	25.61	25.60	
	Westbound	Volume	659	1328	1640	1721	1601	1667	1335	1197	1283	774	459	369	323	113	14,468
		Speed	54.79	54.35	52.70	51.39	53.11	50.43	54.12	54.57	54.24	54.90	54.99	54.99	54.99	55.00	
BFH to TFH	Eastbound	Volume	902	1894	2455	2451	2450	2460	2504	2523	2507	2473	2444	2494	2477	2479	32,512
		Speed	54.96	53.83	51.85	51.65	51.75	51.83	51.86	51.97	52.23	51.83	52.38	52.13	51.87	51.97	
	Westbound	Volume	938	1837	2117	2129	2082	2098	1944	1854	1890	1050	551	452	383	114	19,439
		Speed	54.89	50.76	43.82	43.03	43.84	40.10	48.27	51.41	48.36	54.88	55.00	55.00	55.00	55.00	

	BTU	Gasoline Equivalent
Sum	**3.39E+09**	**27,090**
EB	**2.39E+09**	**19,145**
WB	**9.93E+08**	**7,945**

Greenhouse Gas Emissions (CO_2 equivalents)

2010 Construction			VMT	Fuel	CO_2	CH_4	N_2O	CO_2 equivalents, kg
EJ to Exit 239	Eastbound	Auto (gasoline)	183,933	6,691	58,878	107.4	2000.7	72,258
		Truck (diesel)	4,716	1,115	11,265	0.5	7.0	
	Westbound	Auto (gasoline)	78,224	2,656	23,374	45.7	850.9	27,162
		Truck (diesel)	2,006	286	2,888	0.2	3.0	
Exit 239 to Exit 241	Eastbound	Auto (gasoline)	68,495	2,619	23,048	40.0	745.0	28,441
		Truck (diesel)	1,756	456	4,605	0.2	2.6	
	Westbound	Auto (gasoline)	27,471	868	7,642	16.0	298.8	9,042
		Truck (diesel)	704	107	1,084	0.1	1.0	
Exit 241 to BFH	Eastbound	Auto (gasoline)	108,474	3,547	31,209	63.3	1179.9	38,791
		Truck (diesel)	2,781	627	6,334	0.3	4.1	
	Westbound	Auto (gasoline)	45,140	1,393	12,260	26.4	491.0	14,738
		Truck (diesel)	1,157	194	1,958	0.1	1.7	
BFH to TFH	Eastbound	Auto (gasoline)	107,776	3,326	29,273	62.9	1172.3	35,275
		Truck (diesel)	2,763	472	4,762	0.3	4.1	
	Westbound	Auto (gasoline)	64,441	2,038	17,933	37.6	701.0	21,748
		Truck (diesel)	1,652	304	3,075	0.2	2.5	

	CO_2 Equivalents
Sum	**247,454**
EB	**174,764**
WB	**72,690**

Energy Calculations (by segment)

2010 Construction	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
EJ to Exit 239	EB Volumes	Auto	860	2286	2801	2850	2755	2528	2277	2282	2359	2230	1986	1632	986	466	
		Truck	22	59	72	73	71	65	58	59	60	57	51	42	25	12	
	EB VMT	Auto	5592	14859	18205	18524	17909	16434	14798	14835	15330	14492	12908	10610	6407	3030	
		Truck	143	381	467	475	459	421	379	380	393	372	331	272	164	78	
	EB mpg	Gasoline	29.2	32.4	31.0	31.7	30.5	24.4	24.4	24.4	24.4	24.4	24.4	31.7	31.4	29.2	
		Diesel	7.1	5.9	5.1	4.7	4.4	3.9	3.4	3.4	3.4	3.4	3.9	4.7	6.7	7.1	
	EB Fuel	Gasoline	192	459	587	584	587	674	606	608	628	594	529	335	204	104	6,691
		Diesel	20	65	92	100	104	108	112	112	116	109	85	57	24	11	1,115
	EB BTU		2.7E+07	6.6E+07	8.6E+07	8.7E+07	8.8E+07	9.9E+07	9.1E+07	9.2E+07	9.5E+07	8.9E+07	7.8E+07	5.0E+07	2.9E+07	1.4E+07	9.9E+08
	WB Volumes	Auto	542	1163	1355	1458	1425	1319	1040	1002	1039	621	413	314	231	111	
		Truck	14	30	35	37	37	34	27	26	27	16	11	8	6	3	
	WB VMT	Auto	3526	7559	8808	9477	9265	8574	6760	6514	6755	4038	2682	2043	1502	722	
		Truck	90	194	226	243	238	220	173	167	173	104	69	52	39	19	
	WB mpg	Gasoline	29.2	29.2	29.2	31.4	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
		Diesel	7.1	7.1	7.1	6.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	
	WB Fuel	Gasoline	121	259	302	302	317	294	231	223	231	138	92	70	51	25	2,656
		Diesel	13	27	32	36	34	31	25	24	25	15	10	7	5	3	286
	WB BTU		1.7E+07	3.6E+07	4.2E+07	4.3E+07	4.4E+07	4.1E+07	3.2E+07	3.1E+07	3.2E+07	1.9E+07	1.3E+07	9.8E+06	7.2E+06	3.5E+06	3.7E+08
Exit 239 to Exit 241	EB Volumes	Auto	838	2084	2636	2442	2325	2360	2262	2327	2323	2478	2248	2347	1422	446	
		Truck	21	53	68	63	60	61	58	60	60	64	58	60	36	11	
	EB VMT	Auto	2010	5002	6327	5861	5580	5665	5430	5585	5576	5948	5396	5632	3413	1070	
		Truck	52	128	162	150	143	145	139	143	143	153	138	144	88	27	
	EB mpg	Gasoline	32.4	31.0	27.9	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	30.5	32.4	32.4	
		Diesel	6.1	5.1	3.9	3.9	3.4	3.4	3.4	3.4	3.4	3.4	3.9	4.4	5.9	6.1	
	EB Fuel	Gasoline	62	161	227	240	229	232	223	229	229	244	221	185	105	33	2,619
		Diesel	8	25	41	38	42	43	41	42	42	45	35	33	15	5	456
	EB BTU		8.9E+06	2.4E+07	3.4E+07	3.5E+07	3.4E+07	3.5E+07	3.3E+07	3.4E+07	3.4E+07	3.7E+07	3.3E+07	2.8E+07	1.5E+07	4.8E+06	3.9E+08
	WB Volumes	Auto	515	1064	1333	1418	1322	1265	972	930	995	589	379	301	257	106	
		Truck	13	27	34	36	34	32	25	24	26	15	10	8	7	3	
	WB VMT	Auto	1236	2554	3199	3402	3173	3035	2334	2232	2389	1413	910	722	617	254	
		Truck	32	65	82	87	81	78	60	57	61	36	23	19	16	7	
	WB mpg	Gasoline	31.4	31.4	31.4	32.4	32.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	
		Diesel	6.7	6.7	6.7	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	WB Fuel	Gasoline	39	81	102	105	98	97	74	71	76	45	29	23	20	8	868
		Diesel	5	10	12	14	13	12	9	8	9	5	3	3	2	1	107
	WB BTU		5.6E+06	1.2E+07	1.4E+07	1.5E+07	1.4E+07	1.4E+07	1.1E+07	1.0E+07	1.1E+07	6.4E+06	4.1E+06	3.3E+06	2.8E+06	1.1E+06	1.2E+08

Energy Calculations (by segment)

2010 Construction	Measure	Auto/ Truck	Time of Day (Starting Hour) 9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	Total Energy
Exit 241 to BFH	EB Volumes	Auto	961	1992	2429	2431	2454	2455	2458	2449	2454	2438	2442	2476	2470	2472	
		Truck	25	51	62	62	63	63	63	63	63	63	63	63	63	63	
	EB VMT	Auto	3221	6673	8137	8144	8221	8224	8233	8204	8220	8168	8180	8295	8273	8280	
		Truck	83	171	209	209	211	211	211	210	211	209	210	213	212	212	
	EB mpg	Gasoline	31.0	31.7	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	
		Diesel	5.1	4.7	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	
	EB Fuel	Gasoline	104	211	267	267	270	270	270	269	270	268	268	272	271	271	3,547
		Diesel	16	36	47	47	48	48	48	48	48	48	48	48	48	48	627
	EB BTU		1.5E+07	3.1E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.0E+07	4.1E+07	4.1E+07	4.1E+07	5.3E+08
	WB Volumes	Auto	643	1295	1599	1678	1561	1625	1301	1167	1251	755	447	360	315	110	
		Truck	16	33	41	43	40	42	33	30	32	19	11	9	8	3	
	WB VMT	Auto	2057	4143	5117	5368	4994	5200	4164	3733	4004	2416	1431	1151	1007	353	
		Truck	53	106	131	138	128	133	107	96	103	62	37	30	26	9	
	WB mpg	Gasoline	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	6.1	5.9	5.9	5.9	5.9	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
	WB Fuel	Gasoline	63	128	158	166	154	160	129	115	124	75	44	36	31	11	1,393
		Diesel	9	17	22	24	22	23	18	16	17	10	6	5	4	1	194
	WB BTU		9.1E+06	1.8E+07	2.3E+07	2.4E+07	2.2E+07	2.3E+07	1.9E+07	1.7E+07	1.8E+07	1.1E+07	6.4E+06	5.1E+06	4.5E+06	1.6E+06	2.0E+08
BFH to TFH	EB Volumes	Auto	880	1846	2394	2390	2389	2399	2441	2460	2444	2412	2383	2431	2415	2417	
		Truck	23	47	61	61	61	62	63	63	63	62	61	62	62	62	
	EB VMT	Auto	2991	6278	8138	8125	8122	8156	8300	8363	8310	8199	8101	8267	8210	8218	
		Truck	77	161	209	208	208	209	213	214	213	210	208	212	211	211	
	EB mpg	Gasoline	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
	EB Fuel	Gasoline	92	194	251	251	251	252	256	258	256	253	250	255	253	254	3,326
		Diesel	13	27	36	36	36	36	36	37	36	36	35	36	36	36	472
	EB BTU		1.3E+07	2.8E+07	3.6E+07	3.6E+07	3.6E+07	3.6E+07	3.7E+07	3.7E+07	3.7E+07	3.7E+07	3.6E+07	3.7E+07	3.7E+07	3.7E+07	4.8E+08
	WB Volumes	Auto	915	1791	2064	2076	2030	2046	1896	1807	1843	1023	537	441	374	111	
		Truck	23	46	53	53	52	52	49	46	47	26	14	11	10	3	
	WB VMT	Auto	3109	6090	7018	7059	6902	6955	6445	6145	6266	3480	1825	1498	1271	378	
		Truck	80	156	180	181	177	178	165	158	161	89	47	38	33	10	
	WB mpg	Gasoline	32.4	32.4	31.0	31.0	31.0	31.0	31.6	32.4	31.6	32.4	32.4	32.4	32.4	32.4	
		Diesel	6.1	5.9	5.1	5.1	5.1	5.1	5.3	5.9	5.3	6.1	6.1	6.1	6.1	6.1	
	WB Fuel	Gasoline	96	188	226	228	223	224	204	190	198	107	56	46	39	12	2,038
		Diesel	13	27	35	36	35	35	31	27	30	15	8	6	5	2	304
	WB BTU		1.4E+07	2.7E+07	3.3E+07	3.3E+07	3.3E+07	3.3E+07	3.0E+07	2.7E+07	2.9E+07	1.5E+07	8.1E+06	6.7E+06	5.6E+06	1.7E+06	3.0E+08