

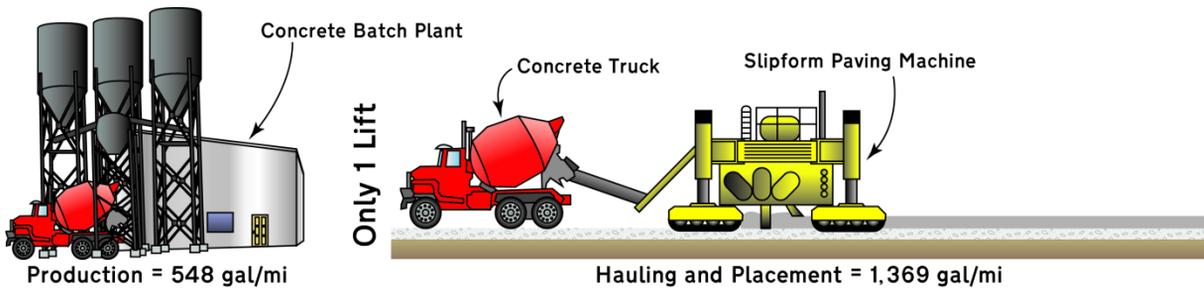
Conserving Fuel in the Road

How the choice of road materials can save fuel and reduce our dependence on oil imports

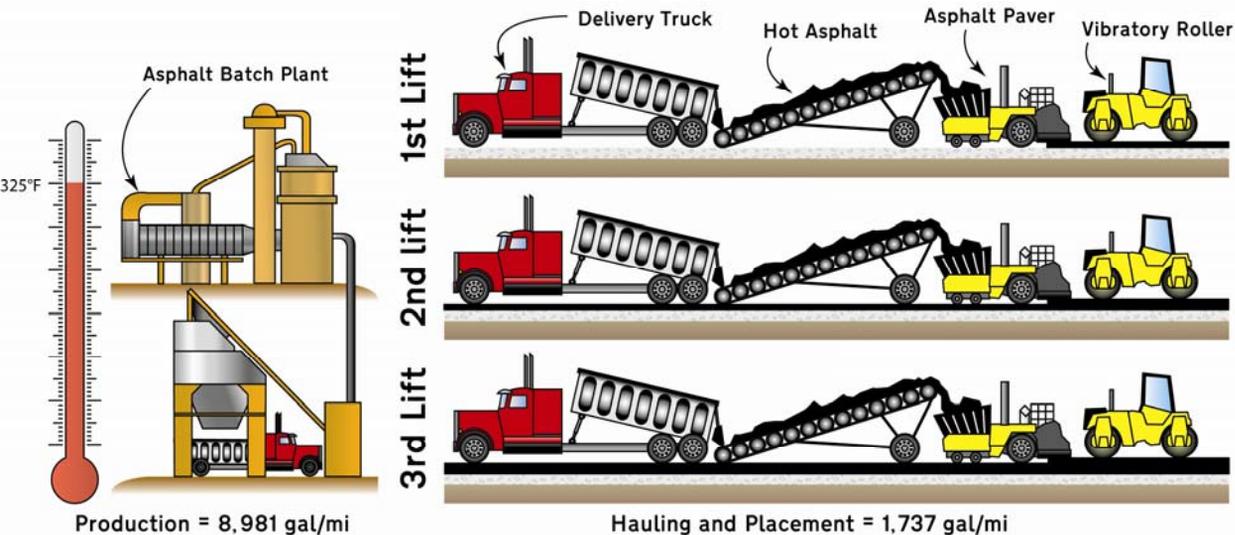
With more attention than ever being focused on energy conservation, vehicle fuel efficiency, and new alternatives such as hybrid cars and bio-diesel, few people realize the significance of road-type on energy use. The difference is black and white:

- ✓ Concrete roads deflect less under loading, so trucks get better fuel mileage.
- ✓ Concrete roads require less fuel to construct than asphalt roads do.

Just how much fuel is consumed while building pavements?



Concrete roads are typically built in a continuous, single-layer, 24-foot wide using a method called slipform paving. The result? A very efficient operation requiring a comparatively low amount of fossil fuel for construction vehicles.

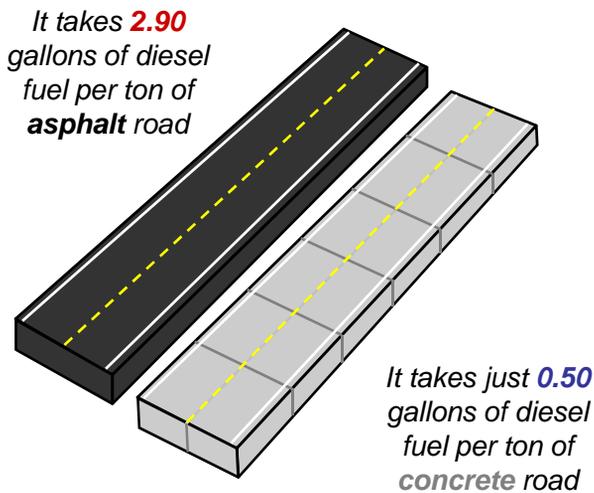


Asphalt pavements require a large amount of energy to heat materials to 325°F at the production plant. Hot asphalt is delivered to the construction site, where asphalt pavers and compaction rollers use even more fossil fuel to place the road in 12-foot wide multiple layers (often 3 or more for highways). The result? An inefficient operation that requires at least 5-1/2 times more energy than it requires to place a concrete road.

How Much Fuel?

The Federal Highway Administration (FHWA) provides data about the fuel used in various aspects of highway construction, including hauling, site preparation, producing materials, and placing (construction). Using FHWA's information, the diesel fuel used to build a mile of asphalt and concrete pavements can be calculated and compared.

Table 1 shows a comparison of the energy used in construction of two simple sections, each 10 inches thick. A 10-in. asphalt pavement requires 10,718 gallons of diesel fuel per mile of construction, which is more than **5-1/2 times higher** than the fuel required for a mile of 10-in. concrete pavement (1,916 gallons). In an engineered road design, asphalt pavements typically have to be at least 2 to 3 in. thicker than concrete pavements to provide the same structural support for loads. As such, the fuel usage difference for structurally equivalent concrete and asphalt designs is even more dramatic. In addition, about every 8 to 14 years, an asphalt surface has to be replaced with a new layer of asphalt – increasing the fuel usage even more over a road's life cycle. Concrete pavements often can last 30 to 40 years before resurfacing is necessary.



References

1. Federal Highway Administration (FHWA) website.
2. Federal Highway Administration (FHWA) Office of Pavement Technology, PowerPoint Presentation, 2007.
3. Energy Information Agency website.

Diesel Fuel Used During Construction (Gallons/Mile)

Asphalt Pavement	Low	Avg.	High
Production	6,468	8,981	12,936
Hauling (0-10 miles)	1,035	1,220	1,257
Placing (3 layers required)	222	517	739
Asphalt Total:	7,725	10,718	14,932
Concrete Pavement	Low	Avg.	High
Production	293	548	880
Hauling (0-10 miles)	645	939	1,310
Placing (1 layer required)	254	430	606
Concrete Total:	1,193	1,916	2,796

Table 1. Typical amounts of diesel fuel required to construct a mile of asphalt and concrete pavements. In this example, the roadway is a single 12 ft wide lane; 10 inches thick for both asphalt and concrete. (Assumes a typical asphalt density of 140 pounds per cubic foot.)

Save 1.2 Billion Gallons of Diesel Annually

FHWA estimates that approximately 500 million tons of asphalt are placed in the U.S. transportation network annually. This means 1.45 billion gallons of diesel fuel are consumed to build asphalt roads every year (using FHWA's fuel usage factor of 2.90 gallons of diesel fuel per ton for asphalt pavement construction).

In general terms, if the 500 million tons of asphalt road construction were replaced with 500 million tons of concrete road construction, it would take only 250 million gallons of diesel. This would result in an annual savings of 1.20 billion gallons, almost 50% of the 2.52 billion gallon average of refined low or ultra-low sulfur diesel fuel imported into the United States for the past 3 years!