3.18 Energy

3.18.1 Affected Environment

This section addresses energy consumption associated with road construction and use. Energy consumption related to highway projects involves construction and operational energy. Construction energy is that required to build the highway facility. Energy is consumed to construct and operate transportation facilities, manufacture materials during construction, move vehicles and transport materials, and operate construction machinery.

Operational energy is the direct consumption of fuel by vehicles using the roadway and the energy required to conduct routine, ongoing maintenance of the facility. Operational energy consumption includes fuel consumed by vehicles using the facility, which is the largest energy use over time and includes fuel consumed both during travel and while vehicles idle during traffic delays. A negligible amount of energy is also used for signals and lighting. Routine maintenance (e.g., snow plowing, pothole repair, and restriping), as well as more infrequent maintenance (e.g., guardrail replacement, repaving, and erosion protection), also requires ongoing use of energy. Emergency response to highway incidents is an ongoing operation associated with the highway that also uses energy.

In addition to engine efficiency, aerodynamic drag force, rolling friction, vehicle and load weight, and other variables, fuel consumption is influenced by vehicle types, roadway grades and other geometric characteristics, traffic speeds, and delays caused by congestion and intersection stop conditions.

3.18.2 Environmental Consequences

All alternatives are anticipated to have the same travel demand as the No Build Alternative. None of the build alternatives would substantially reduce or increase travel distances.

3.18.2.1 No Build Alternative

Direct and Indirect Impacts

Under the No Build Alternative, congestion on the existing highway would be expected to increase as traffic volumes increased. This increase would cause more vehicle delays and less efficient facility operation, which requires more operational energy consumption. Periodic roadway maintenance such as resurfacing and patching would occur over time until the condition of the roadway warranted complete reconstruction.

3.18.2.2 Issues Applicable to the Build Alternatives

Because none of the build alternatives would substantially increase or reduce travel distances or traffic volumes, there would be no substantial change in fuel use as a result of altered travel. Similarly, the availability of energy in the form of petroleum fuels for motor vehicles would not change as a result of implementation of any of the build alternatives.

Although the lengths of the segments of each alternative built on new alignments would differ slightly, the overall length of each alternative would be approximately 14.5 miles, which is similar to the length of the existing highway. Therefore, no substantial change in energy consumption based on length of travel is anticipated.

The elevation gains for each build alternative would differ. The Cooper Creek, G South, and two Juneau Creek alternatives would climb to maximum roadway elevations of 700 feet, 830 feet, and 1,180 feet, respectively. All build alternatives have maximum roadway elevations greater than the existing highway (575 feet). Because vehicles would use more fuel to climb hills, vehicle energy requirements would increase for all build alternatives. This energy consumption increase may be offset by improvements in level of service (LOS) and roadway efficiency under all of the build alternatives, which would result in energy efficiency through reduced travel times through the project area.

Energy consumed through implementation of any of the build alternatives would be chiefly for the purpose of facilitating traveler mobility. Vehicle fuel consumption is affected by road grades, through-traffic vehicle speeds, and lowered efficiencies at lower vehicle speeds associated with congestion and delay at intersections. Legislated improvements in fuel efficiencies by 2025 would affect all vehicles on all alternatives more or less equally.[1] Because newer vehicles tend to run more efficiently at slightly higher, steady speeds (approaching 50–60 miles per hour [mph] for cars), those alternatives that demonstrate higher average projected through-traffic speeds should consume less fuel. The alternatives vary in projected 2043 congestion and in delays associated with the steepness of their grades, their geometries, the number and extent of passing lanes, and their intersections (see Section 3.6, Transportation). Congestion, as well as frequent stops and starts, reduces fuel efficiency. Constantly accelerating and decelerating can cut fuel efficiency by as much as 33 percent (Oak Ridge National Laboratory 2002).

Fuel consumption for cars increases by approximately 30 percent when speeds drop from 30 mph to 20 mph; and a drop from 30 mph to 10 mph results in a 100 percent increase in fuel use. Above 55 mph to 60 mph, fuel use also increases. While every engine, transmission, and wheel combination is different, smaller, lighter, and more aerodynamic cars generally achieve their best mileage at speeds considered intermediate to that approaching highway speed. Bigger, heavier, and less aerodynamic vehicles (e.g., recreation vehicles or trucks) achieve their best mileage at lower speeds.

Even accounting for the elevation changes that motorists would have to negotiate in traveling the build alternatives, the fuel savings associated with better LOS and shorter intersection delays likely would mean less overall fuel use for any of the build alternatives than for the No Build Alternative. The Juneau Creek alternatives, with the fewest intersections, would operate most efficiently and at the most consistent speeds, likely resulting in the least overall fuel use. The G South and Cooper Creek alternatives would fall between the No Build and the Juneau Creek alternatives in fuel consumed because of more intersections. The Cooper Creek Alternative, in particular, would contend with many driveways and side roads in Cooper Landing. While still an

[1] Since the early 1980s, fuel efficiencies of new vehicles sold largely doubled, plateauing at the 2007 level, when fuel efficiency for new cars sold had approached 25 miles per gallon (mpg). That improvement was chiefly attributable to implementation of the Corporate Average Fuel Economy requirements established by Congress, coupled with sharply rising gasoline prices. Fuel efficiencies since 2007 have improved markedly because of innovations in engine design and penetration of hybrid vehicles into the market share of new vehicles sold. Federal regulations require a near-doubling in the average gas mileage for passenger vehicles to 54.5 mpg by 2025. (This is actually based on a technical regulatory formula; in real-life driving, it is expected to translate to 37–40 mpg.) Of course, the fuel efficiency of new vehicles sold is not the same as that of the fleet of all vehicles on the roads at any one time. Turnover of the entire extant vehicle fleet takes decades.

improvement over the No Build Alternative, it likely would result in greater fuel use than other build alternatives. All alternatives would have fuel consumed in the process of ongoing maintenance activities.

Construction Impacts

Energy consumption for each of the build alternatives depends on the duration of construction, the types of construction equipment required, the amount of earth material to be moved, and the distance it must be moved. In general, the build alternatives with longer distances of new construction away from the existing highway are likely to require more earth moving and somewhat greater energy use. Energy supply for construction is expected to be adequate.

Mitigation

To conserve energy, the Alaska Department of Transportation and Public Facilities could require the use of more efficient light bulbs for construction site illumination, such as Light Emitting Diode bulbs that produce more lumens and last substantially longer than incandescent or other bulbs. The contractor would produce a traffic management plan to address operational traffic delays and detours during construction that would make more efficient use of construction operations time and energy. Construction equipment and material, such as batch plants and aggregate, would be located close to the project construction site to reduce hauling distance and energy consumption.

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