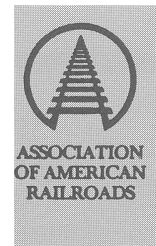


RESEARCH PAYS OFF



Broadened Diesel Fuel Specifications Reduce Railroad Cost

Problem

When the railroad industry converted its motive power from coal-fired steam to diesel-electric locomotives there was little demand for "middle distillate" products, which were byproducts of gasoline production. The oil industry was glad to sell this unwanted fuel to the railroads for a few pennies a gallon. The diesel engine manufacturers and railroads demanded the best quality of this distillate—in fact, even a higher quality than necessary. The specifications they developed led to today's ASTM No. 2-D diesel fuel oil.

These distillates are no longer low-value byproducts of the refinery process because the growing demand for jet fuel and highway diesel fuel is taxing the capacity of refineries and pushing up the price. The lightest distillates, kerosene and jet fuel, are the most expensive.

In an attempt to correct what has been described as "the railroads' addiction to premium fuels," the Association of American Railroads (AAR) has conducted on-going fuel research in conjunction with several railroads. They found that marine diesel fuels, which might have provided a solution, are not suited to the railroad environment. A cleaner fuel, probably 100 percent distillate products, appeared to be necessary.

Solution

The AAR and Southwest Research Institute (SwRI) operate a medium-speed diesel engine research laboratory on the SwRI campus in San Antonio, Texas, where another research project on railroad alternative fuels has been conducted since 1978. The early work included tests on methanol, vegetable oils, residual fuel oils, synthetic fuels, and shale oil. In 1983 the program's emphasis shifted to distillate fuel oils.

Consultations with industry experts focused on the study of two fuel properties to find the tolerances of the diesel engines: cetane number and distillation range. The cetane number, similar to the octane rating for a gasoline engine, indicates the combustibility of fuel in a diesel engine. The higher the cetane number, the higher the rating and the combustibility. The distillation range is the temperature range within which 90 percent of the fuel is burned off. These two properties were deemed most likely to correlate with engine problems and to control the price of fuel.

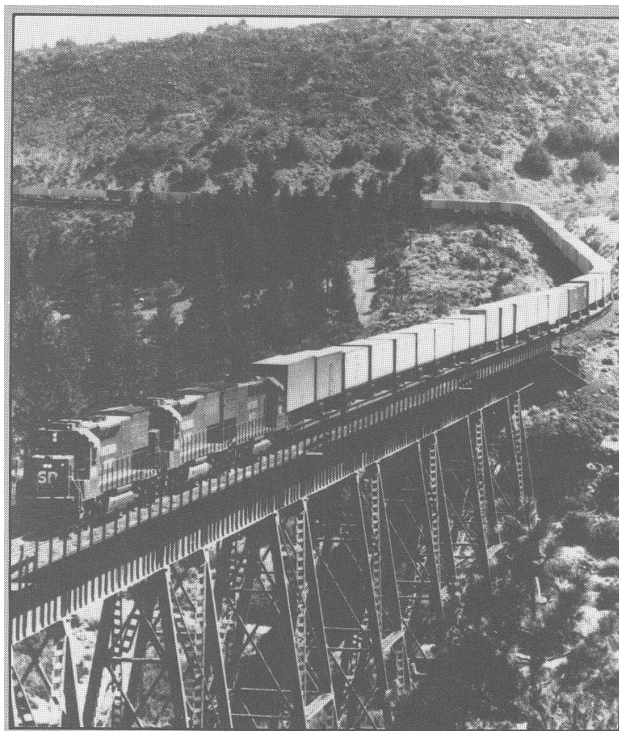
The test program included long-term engine idling (72 hours), engine performance, and limited wear/endurance. The laboratory tests were conducted on full-sized, 12-cylinder locomotive diesel engines manufactured by General Electric and General Motors' Electro-

Motive Division. One fuel was tested for a year on locomotives in revenue service.

As expected, both makes of diesel engine have a much greater tolerance for cetane number and distillation range than called for in specifications for 2-D fuel oil. These specifications call for a minimum cetane rating of 40, although it was found that cetane numbers as low as 30 caused no problem. A distillation range of more than 700°F (640°F in the 2-D specifications) also caused no difficulty.

In 1987 the AAR Operating-Transportation General Committee adopted the recommended broad fuel specifications based on the research findings. These specifications include a minimum cetane number of 32 and a maximum 90 percent distillation point of 700°F.

Because diesel fuels are almost always blends of various other fuels, the broadened specifications mean that refineries are able to use a higher percentage of lower-cost products, with resulting savings to the consumer.



Several major railroads in the United States and Canada have adopted broadened fuel specifications based on research conducted by the American Association of Railroads in conjunction with several railroad companies. With growing availability and use of these lower-cost fuels, the potential savings industrywide could be as high as \$70 million.

Application

Several major railroads in the United States and Canada have adopted broadened fuel specifications as a result of this research. Some of them began purchasing fuels with lower cetane numbers after the first fuels were tested in the AAR program. The availability and use of these fuels are growing. At present, about half of all locomotive fuel purchased by Canadian railways and about 5 percent of that purchased in the United States meets the broadened specifications. Several U.S. railroads plan to start using the specifications in 1988.

As a rule, pipeline operators will not transport fuels that have no ASTM specifications. ASTM recently began the process of adopting AAR's broadened fuel specifications as a new 3-D fuel oil specification. This development is expected to spur an increase in the supply of the fuel and will enable it to be transported by pipeline—a necessity for its widespread and economical use.

Benefits

Broadened-specification fuels generally cost less than 2-D fuel oil. In the current petroleum market of relatively low prices, most railroads report saving one or two cents per gallon of fuel, which costs about 50 cents per gallon. This represents a potential savings of as much as \$70 million a year, based on an estimated 3.5 billion gallons used by railroads in the United States. Actual savings will be less because the broadened specification fuels are not available in all areas.

None of the railroads using these broadened-specification fuels reports any increase in engine failures or maintenance cost. These fuels do not require any special handling. All of the savings in fuel costs, therefore, are net savings.

For further information, contact G. R. Cataldi, Assistant Manager—Energy and Special Studies, Association of American Railroads, 50 F Street, N.W., Washington, D.C. 20001 (telephone 202-639-2261).

Suggestions for "Research Pays Off" articles are welcome. Contact David K. Witheford, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2972).