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FUEL USAGE FACTORS FOR HIGHWAY CONSTRUCTION

INTRODUCTION

The Highway Equipment Committee of the Transportation Research Board at its annual meeting in January 1974 discussed the then current fuel crisis facing the construction industry. It was decided that immediate action was needed to formulate fuel usage factors which would enable computation of fuel requirements for highway construction jobs to comply with part 211.27 of the mandatory petroleum allocation regulation published in the January 15, 1974 Federal Register. The regulation reads as follows: "Any person, firm, or government agency planning to award a construction contract under competitive bidding to contractors who may be wholesale purchasers may apply to a supplier as a new end user."

"The volume shall be estimated in an amount sufficient to complete the project. Upon awarding of the contract the allocation must then be transferred to the successful bidder."

A Task Force was appointed by the committee to pursue this objective. The Task Force was assisted in this effort by the American Roadbuilders Association and the Associated General Contractors of America who mailed the questionnaires to their members and by the Federal Highway Administration whose Region 15 Office completed the data analysis.

This publication is the result of data submitted by more than 400 highway contractors in the United States in response to questionnaires mailed to more than 3,000 contractors.

GENERAL NOTES

The survey dealt only with fossil fuels.

An effort was made to analyze the data by types of terrain but in general the differences in fuel usage did not appear to be significant.

These figures are intended as guides only in making job estimates. The low, average and high factors represent figures for jobs having average conditions. Therefore, it will be necessary for an estimator to modify these factors to take into consideration peculiarities of the particular job he is estimating

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2101 CONSTITUTION AVENUE, N.W. WASHINGTON, D.C. 20418

such as high altitude job sites, particularly rough terrain, heavy stop and go traffic in urban areas, or hauls longer than those indicated in the table.

The fuel usage factors in the table represent gallons of fuel required per unit of construction as shown in the units column, i.e. gallons per cubic yard for excavation and for portland cement concrete pavement, gallons per ton for aggregates and asphalt concrete and gallons per \$1000 of contract costs for structures and miscellaneous construction.

Haul distances shown in the table or mentioned in the notes are one-way distances but fuel factors include sufficient fuel for round-trip travel in every case.

SPECIAL NOTES

EXCAVATION

Fuel usage factors for all excavation items include mobilization, clearing and grubbing, excavating, hauling, compacting and preparing the subgrade. "Earth excavation" includes rippable rock. "Other excavation" includes all items of excavation not covered by earth or rock excavation.

Special consideration should be given if equipment is working at elevations above 4,000 ft. Unusually wet conditions would be reason for higher fuel usage. The factors shown would be applicable for hauls up to approximately 5,000 ft. in length. Beyond this distance, equipment may be changed, and additional fuel should be added for longer hauls. For urban construction requiring truck hauling the fuel factors shown may be low.

Fuel requirements for all three excavation items include the total of *both* diesel and gasoline. Basically the loading, hauling and compacting units are diesel fueled while supporting equipment such as pickup and service trucks may be gasoline powered.

AGGREGATES

On-site aggregate production fuel usage factors are to be used only when the contractor contemplates erecting a plant to produce aggregates for a particular project. The fuel usage factors do not include fuel for drilling and shooting. If a quarrying operation is to be used, fuels for this purpose should be added. These factors include fuel for generating all electric power needed for this operation.

Fuel requirements for aggregate production include the total of *both* diesel and gasoline, since gasoline is used to power support equipment.

The usage factors for aggregate base include fuel for hauling, spreading, compacting and finishing the base.

Fuel requirements for this item include the total of *both* gasoline and diesel; however, the balance between the two factors will vary depending upon the type of

fuel used for the placing equipment.

ASPHALT CONCRETE

The fuel usage factor for asphalt concrete production includes all requirements to produce a ton of asphalt concrete, including the material handling at the plant site, drying and heating of aggregates, heated asphalt storage and generating power for all plant machinery.

In the event natural gas is used for the drying and heating of aggregates, fuel demands for diesel should be reduced appropriately. For normal projects approximately two gallons of diesel per ton of asphalt concrete should be deducted. (This deduction represents removal of 6% moisture and raising aggregate temperature 250 degrees F.)

Fuel requirements for this item include the total of *both* diesel and gasoline since gasoline is used to power support equipment.

Either fuel usage factor shown for asphalt concrete hauling represents the total fuel requirement for the item. If both gasoline and diesel haul units are used, appropriate adjustments should be made.

Either fuel usage factor shown for asphalt concrete placement represents the total fuel requirement for the item. If both gasoline and diesel units are used, appropriate adjustments should be made.

Fuel usage factors represent requirements to place asphalt concrete with a paving machine and compact it with three rollers. Needs for this operation are not substantially affected by production rates.

PORTLAND CEMENT CONCRETE PAVING

Fuel usage factors for the production of portland cement concrete include all requirements to produce a cubic yard of concrete including material handling at the plant site, batching, mixing, and generating power for all plant machinery.

Fuel requirements for this item include the total of *both* diesel and gasoline since gasoline is used to power support equipment.

The fuel usage factor for hauling portland cement concrete for paving are valid up to four miles. Since most projects are built using a job site plant, very limited data was received for hauls over four miles. Since insufficient data was received on gasoline usage, the fuel usage factor for gasoline shown in the table is a conversion from the diesel fuel factor.

Either fuel usage factor shown for this item represents the total fuel requirement for the item. If both gasoline and diesel units are used, appropriate adjustments should be made.

The fuel usage factor for portland cement concrete placement includes all fuel to spread, place, finish and cure portland cement concrete paving. The fuel usage factor is valid for form riding or slip form equipment.

Either fuel usage factor shown for this item represents the total fuel requirement for the item. If both gasoline and diesel units are used, appropriate adjustments should be made.

STRUCTURES

Fuel usage factors for structures should cover all concrete and steel structures, excluding pipe. Fuel requirements for structures include the total of *both* diesel and gasoline.

MISCELLANEOUS CONSTRUCTION

The fuel usage factors for miscellaneous construction should cover all work not covered by any previously listed items.

Fuel requirements for this item include the total of *both* diesel and gasoline.

FUEL USAGE FACTORS

Item of Work	Units	Diesel			Gasoline		
		Low	Avg.	High	Low	Avg.	High
Excavation:	Gallons/Cu.Yd.						
Earth		0.27	0.29	0.30	0.11	0.15	0.21
Rock		0.37	0.39	0.42	0.17	0.18	0.22
Other		0.33	0.35	0.38	0.15	0.16	0.18
Aggregates:	Gallons/Ton						
Onsite Production		0.25	0.28	0.36	0.08	0.09	0.11
Aggregate Base							
0-10 Mi. Haul		0.24	0.27	0.33	0.22	0.24	0.28
10-20 Mi. Haul		0.35	0.42	0.54	0.27	0.39	0.49
Asphalt Concrete:	Gallons/Ton						
Production		1.75	2.43	3.50	0.07	0.14	0.18
Hauling							
0-10 Mi. Haul		0.28	0.33	0.34	0.35	0.43	0.53
10-20 Mi. Haul		0.30	0.49	0.56	0.35	0.58	0.89
Placement		0.06	0.14	0.20	0.08	0.14	0.22
Portland Cement Concrete Pavement:	Gallons/Cu.Yd.						
Production		0.15	0.28	0.45	0.12	0.15	0.21
Hauling		0.33	0.48	0.67		0.52*	
Placement		0.13	0.22	0.31	0.14	0.23	0.38
Structures:	Gallons/\$1,000	10	19	25	10	22	35
Miscellaneous:	Gallons/\$1,000	10	19	30	10	19	30

*Estimated Figure due to Insufficient Data.

INSTRUCTIONS FOR PROPER APPLICATION OF THESE FUEL USAGE FACTORS ARE CONTAINED IN THE BODY OF THIS REPORT.

SAMPLE PROJECT ESTIMATING SHEET

ITEM OF WORK	ESTIMATED QUANTITY	FUEL USAGE FACTORS FROM TABLE		PROJECT FACTOR*	ADJUSTED FACTORS		FUEL IN GALLONS	
		DIESEL	GASOLINE		DIESEL	GASOLINE	DIESEL	GASOLINE

*The project factor (determined by the estimator) is used to modify factors from the table for special job conditions such as: long hauls, altitude, stop-and-go hauls, drying highly absorptive aggregate, etc.

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