Operation Cost

The cost of operation is influenced by:

1. Speed of train operation.
2. Average drawbar horsepower required to operate air conditioning system.
3. Length of the cooling season.
4. Cost of power produced by the locomotive at $0.00493 per horsepower-hour.
5. Proportion of time the cooling equipment is operated during the cooling season considered as 56 per cent.
6. Cost of additional necessities as: *a*. Ice in bunker, at $4.42 per ton, *b*. Propane on the car, at $0.039 per pound, *c*. Steam at $0.021 per 100 pound.

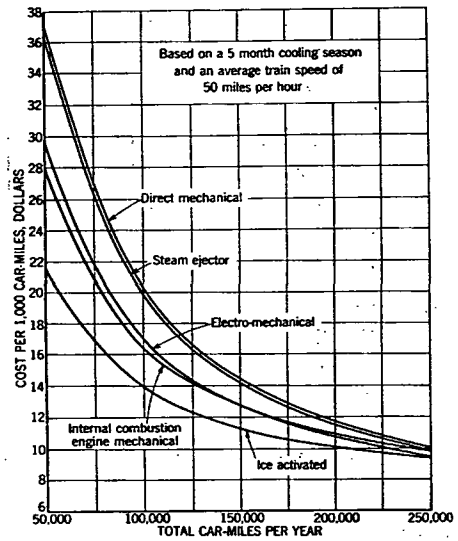

FIG. 3. COMPARATIVE TOTAL COSTS FOR RAILWAY PASSENGER CARS

The operation cost in dollars per 1000 car-miles is:

$$OC = \frac{1000\,K}{12\,S}\,(D \times E + 0.56\,F \times G) + \frac{1000\,(12 - K)}{12\,S}\,(H \times E) \qquad (3)$$

where

OC = operation cost, dollars per 1000 car-miles.
D = average drawbar horsepower demand on a locomotive at speed S.
E = cost per horsepower-hour, dollars.
F = additional necessities such as ice, steam or propane, pounds per hour.
G = cost of additional necessities, dollars per pound.
H = drawbar horsepower required when system is not operating.
S = speed of train operation, miles per hour.
K = length of cooling season, months.
0.56 = Proportion of operation time to total time during the cooling season.

Total Cost of Air Conditioning

When the fixed charges, maintenance cost, and operation cost are each expressed in terms of 1000 car-miles, addition of the three elements will give the total cost of air conditioning on that basis.

Comparisons of the total cost per 1000 car-miles for the five methods of air conditioning are shown in Fig. 3, representing costs for an average condition, namely a cooling season of five months and an average speed of 50 mph.

COOLING LOAD CALCULATIONS

The calculated heat gain for a railway passenger car is dependent on several variables which may be determined from the basic data given in Chapters 5, 6 and 8.

REFERENCES

Summary Report on Air Conditioning of Railroad Passenger Cars, by Division of Equipment Research, *Association of American Railroads*, November 24, 1936.

Engineering Report on Air Conditioning of Railroad Passenger Cars, by Division of Equipment Research, *Association of American Railroads*, April 15, 1937.

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PROBLEMS IN PRACTICE

1 ● What item is the greatest among the cooling loads figured in the design of a summer air conditioning system for a passenger car?

The heat from passengers.

2 ● To what extent does bright sunshine increase the cooling requirements of a passenger car?

About 1.2 tons of refrigeration.

3 ● What is the total refrigerating capacity generally required in a passenger car?

5.5 to 7 tons per car.

4 ● What is the effect of train speed upon the cooling requirements of a car?

Requirements are slightly increased because of increased heat transmission.

5 ● What is the fan capacity of the air conditioning unit in the average car?

2000 to 2500 cfm.

6 ● When is it economical to take all air for car cooling from outdoors?

When the outdoor wet-bulb temperature is lower than that in the car.

7 ● What various arrangements are used for distributing cooled air into cars?

Bulkhead delivery at center or ends of car, center duct, and side duct on one or both sides.

8 ● What types of cooling systems are used?

Ice-activated, steam-ejector, and mechanical compression systems.