Chicago - July 6, 1972
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Mr. G. A. Kellow:

Recent operating tests have established that it is possible for production model, electric locomotives, equipped with individual thyristor control of traction motors, to achieve 25% or better adhesion under all working conditions, on heavy curvature mountain grades up to 2.2%.(1)(2) I believe there is now enough operating evidence with high adhesion electric engines available to warrant a re-evaluation of the number of electric engines used in the economic justification study in connection with the proposed extension of electrification on lines west. Locomotives which are purchased with an intended operating life of 30 plus years must be of the latest and best design, and would therefore be specified at purchase to produce a guaranteed 25% working adhesion, or possibly even more, based on latest designs.

A six axle electric locomotive with 900 HP traction motors and 25% working adhesion will provide about 5,200 HP at the rail at 20 MPH. This is double the rail horsepower that can be obtained from the SD-40 diesel units which were used in the diesel portion of the study, and will naturally reduce the required number of electric locomotives. In Figure 1 attached, I have re-cast the projections developed by the study group. Using the figures developed, required electric units drop from 61 to 49, and new electric units from 49 to 37.

Using the GE price of $468,000 per unit for 49 units gives a total study price of $22,932,000. If we assume 25% adhesion locomotives, with zero weight-transfer truck design to cost $525,000 each in lots of 37,

then the total cost for higher performance locomotives would be $19,425,000 a yielding cost savings of $3,517,000.

Further benefits would also be realized:

1. Reduction of fuel[1] to haul 190 tons deadweight per train, through elimination of one 390,000 # engine unit.

2. Reduction in electric engine versus diesel maintenance costs for the 49 electric vs. 82 diesel motive power fleet.

I suggest the advisory committee be convened to review the validity of my assumptions, and to determine if further investigation is in order. There is no question in my mind that extension of electrification will be predicated on locomotives equipped with individual thyristor motor controls and zero weight-transfer trucks designed to produce minimum guaranteed adhesions on the order of 25% over our electric territories.

(1) Electric Power

cc: Messrs: G. R. Frazier
M. Garelick
J. J. Drinka
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Attachments-3

BIBLIOGRAPHY

(1) Adhesion Tests With A Thyristor Locomotive

Author: Arnie Magnusson
Traction Department
ASEA
Vasteras, Sweden

IEEE Conference Paper #72-943-4-IA

(2) Testing Of High Performance Locomotives

Author: Glen T. Fisher
Canadian Pacific LTD
Montreal, Quebec, Canada

IEEE Conference Paper #72-941-8-IA

July 6, 1972

"Advanced" Electrics Show High Adhesion

A session on railway electrification at the recent ASME-IEEE railroad conference heard several reports on the electric locomotive tests run for Canadian Pacific last year in Europe.

G. T. Fisher, director special projects for CP Rail, told about the tests, which were made to aid CP Rail in its study of possible electrification of its line between Calgary, Alta., and Vancouver, B. C. This line crosses both the Rocky mountains and the Selkirk range. "Advanced design" electric locomotives of the Swedish State railways (built by ASEA) and the Berne-Loetschberg--Simplon line (Brown-Boveri) were tested respectively on the Bergen-Oslo line of the Norwegian State and on the Spiez-Brig(Switzerland) line of the BLS. The test sections were selected to approximate the kinds of conditions to be found on CP Rail line under study.

More than 100 starting and running tests were made with the two locomotives, which have continuous ratings of 4560 hp and 6360 hp respectively. Both locomotives performed in excess of their builders' specifications and were capable of producing peak horsepower during acceleration in excess of 8000 hp. Both locomotives operated successfully over varying track conditions at a level of "effective adhesion" of over 30 percent. In several starting tests, adhesion levels of 40 percent or greater were obtained.

The two test locomotives, according to Mr. Fisher, performed "at levels of tractive effort and horsepower, for their weight, considerably higher than the present generation of diesel locomotives. Where the effective adhesion of a diesel locomotive is about 18 percent at 20 mph, these electric locomotives easily achieve over 27 percent and maintain a figure in this range up to 50 mph."

Reasons for the high performance, as reported by Mr. Fisher in IEEE paper C 72 941-8-IA, include the low weight-transfer trucks, the large (49 in.) wheel diameters, very precise control of wheel speed, smooth control of tractive effort, and the torque and horsepower capabilities of the large traction motors.

ELECTRIFICATION VS. DIESELIZATION

Figure 1 - Locomotive Requirements (3)

TRAINS	CONSISTS	THROUGH SERVICE DIESEL (1)	THROUGH SERVICE ELECTRIC (2)	ROCKY MOUNTAIN DIESEL	ROCKY MOUNTAIN ELECT	COAST DIESEL	COAST ELECT	TOTAL DIESEL	TOTAL ELECTRIC
261-262	4	16	8					16	8
263-264	4	20	12					20	12
265-266	5	15	15(1)					15	15
Helpers				4	2	2	1	6	3
Extra Svc.	___	___	___	8	4	4	2	12	6
TOTALS		51	~~30~~ 35	12	6	6	3	69	44
SPARES								13	5
TOTAL UNITS								82	49

(1) Based on SD-40 Units
(2) Based on GE Units or equivalent with guaranteed 25% adhesion.
(3) Revised from original figures developed by Electrification Study Group dated May 5, 1972.

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