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ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION

LA GRANGE



ILLINOIS

August 28, 1972

Mr. G. R. Frazier
Chicago, Milwaukee & St. Paul Railroad
2501 East D Street
Tacoma, Washington 98241

THE MILWAUKEE ROAD
TACOMA, WASH.
SEP 1 1972
OFFICE OF
ELECTRICAL ENGINEER

Subject: Electrically Boosted Diesel Locomotive

Dear George:

In a recent meeting with Mr. Upton and his staff, discussing the long range motive power acquisition program, we touched briefly on electrics. Personally, I still like the motor-generator unit we proposed but we do expect to make a chopper-controlled proposal in conjunction with ASEA later this year.

We have been doing studies on the Quebec, North Shore & Labrador with augmentation of the diesel output on grades using third rail supply. We mentioned this work with a brief discussion of what we expected to gain. Mr. Drinks asked that I make a short writeup of this work and the attached memorandum is the result.

The performance curves reflect the D77B motor with revised field and interpole coils but are conservative as to the motors performance.

We feel that this may well be an answer to many areas as an alternate to full electrification with its considerable financial committment. Since you have your wire up you are in a considerably different position. Do you think the scheme has merit in the Milwaukee application?

R. B. Wallis
Advance Engineering

cc: P. M. Sweet

RBW/lls

ASEA

FOUR NEW KING STREET, WHITE PLAINS, NEW YORK 10604 (914) 428-6000
September 5, 1972 Telex 137401

THE MILWAUKEE ROAD
TACOMA, WASH.
SEP 7 1972
OFFICE OF
ELECTRICAL ENGINEER

Mr. G.R. Frazier
Electrical Engineer
The Milwaukee Road
1100 East Milwaukee Way
Tacoma, Washington 98421

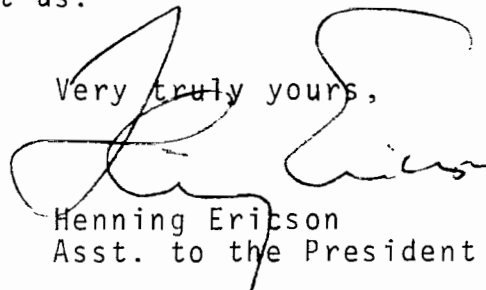
Dear Mr. Frazier:

Thank you very much for your letter of August 29. We are pleased to enclose a copy of the ASEA Journal, 1972:3 and hope that it will contain information of interest to you.

As you may know, ASEA has been discussing electrical rolling stock with representatives of the Milwaukee Road in Milwaukee. In connection with the contemplated closing of the electrification "gap", ASEA may also be interested in quoting certain supply and substation equipment. In order to establish your requirements, we will contact you within the near future. It is my understanding that you are the person responsible for these matters.

If there is anything more we can do in the meantime, please do not hesitate to contact us.

Very truly yours,



Henning Ericson
Asst. to the President

HE/dc
Enclosure

cc: Mr. F.A. Upton
Chief Mechanical Officer
The Milwaukee Road
433 West St. Paul Avenue
Milwaukee, Wisconsin 53203

Tacoma, Sept. 7, 1972

Mr. F. G. McEann:

As information, I am attaching a letter from EMD and ASEA, along with my reply to EMD.

Basically, EMD is thinking about up-grading traction motors on an SD40. To achieve full output of these motors, which is beyond the prime mover rating, supplemental electric energy from a third rail or trolley is added to the diesel generator output. Adhesion on this engine would probably be exceeded under 25 MPH, but if the supplemental power is controlled to each individual axle, then possibly 25% adhesion could be obtained, as on the ASEA locomotive, and full output down to 10 MPH utilized.

My reply points out other implications of the scheme.

grf

cc: GAK

Electrical Engineer

- 1- This would make special SD40 units capture to electric traction & other equipment at Kautokeino or spring all units running between Gards - Linn.
- 2- Cases adhesion between mountain grade. be considered - how, only that needed on heavy grade?

Chicago, Milwaukee, St. Paul & Pacific Railroad Co.
1100 East Milwaukee Way, Tacoma, Wash. 98421
Office of Electrical Engineer

Sept. 7, 1972

Mr. R. B. Wallis
EMD
La Grange, Ill. 60525

Dear Mr. Wallis,

You asked my opinion as to the merit in augmentation of diesel output by separate electrical supply on the Milwaukee Road.

To give some comparative perspective, TE curves of an SD40 and SD45 have been added to the curve you prepared(attached). The general conclusion indicated is that augmentation essentially doubles the SD40 output horsepower in the mid speed range using a double drive motor from the separate electrical supply. Such conclusion would suggest further exploration of the scheme.

This system, which presents a new management alternative to resolution of the electrification status, would not require wiring the gap or upgrading substations or feeder. It would allow through operation of power on the Idaho. It would utilize basically standard diesel parts as used throughout the country. It would allow continued use of the EFl engines.

The added engine complexity would be countered by the fewer units required and reliability and flexibility added by two power sources.

Such a flexible system suggests that time could be bought during a transitional period of uncertainty on railroads as regards mergers, coordination, motive power technological development, fuel-energy concern and possible Federal Government encouragement of electrification.

Recognizing that our trolley efficiency varies as the square of the voltage and that the boosted conversion introduces a loss, the desirability that the unit accept 3000Vdc becomes evident.

The augmented diesel could serve as a transition by other railroads to full electrification and give incentive to hardware development.

The hard fact of life-weight on drivers must still be faced. This suggests the possibility of developing a solid state module that could go in parallel with an individual traction motor. This could supply additional controlled energy to each axle modulated to result in the 25% adhesion which ASEA has attained. (see schematic)

With individual controlled added power to each axle, rapid dropping of this power to prevent slipping would tend to throw the load over to the diesel generator I believe.

This alternative would have to be justified on the basis of reduced engine maintenance and ownership cost.

Further feasibility requires estimating cost for such a unit and projected maintenance cost.

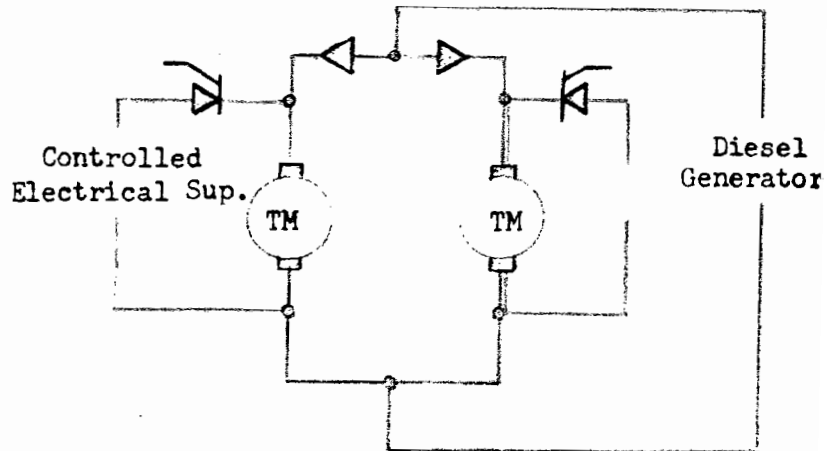
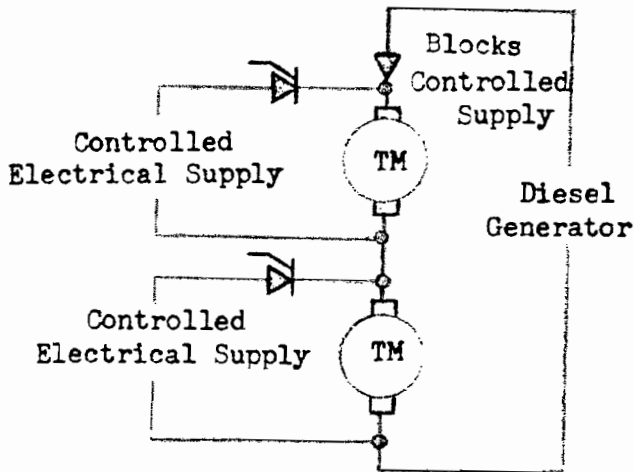
A chopper controlled electric engine that could achieve 25% adhesion is still the most promising possibility.

Very truly yours,

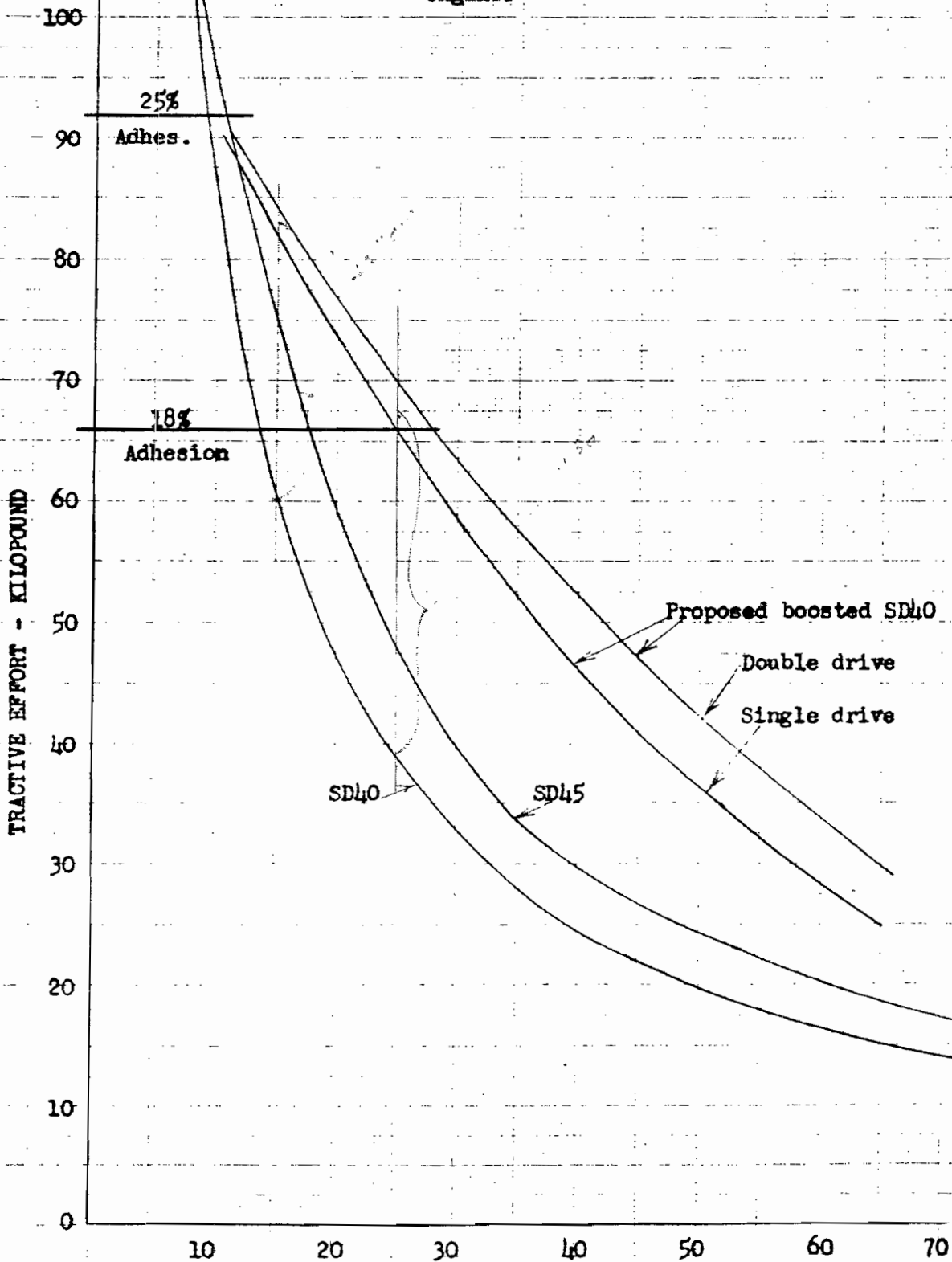


George R. Frazier,
Electrical Engineer
The Milwaukee Road

grf



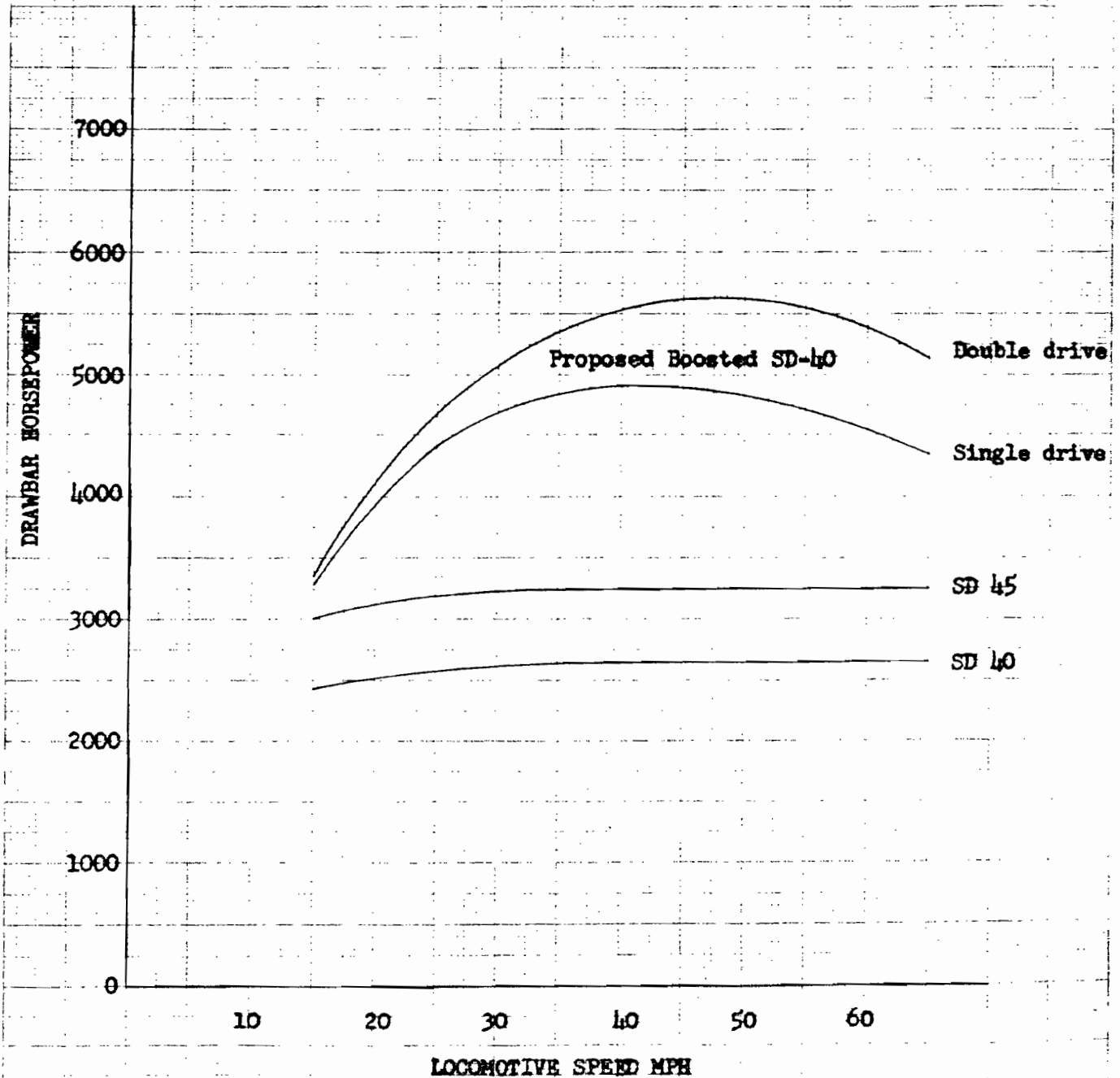
SPEED-TRACTIVE EFFORT
EMD BOOSTED SD-40-2
 compared to
 present SD40 & SD45
 engines



LOCOMOTIVE SPEED - MPH

Electrification Dept., Tacoma 9/7/72

SPEED - RAIL HORSEPOWER
EMD BOOSTED SD-40-2
compared to
PRESENT SD40 & SD45
ENGINES



Electrical Engineer
Tacoma 9-8-72

Sept. 7, 1972

Mr. Henning Ericson
4 New King St.
White Plains, New York 10604

Dear Mr. Ericson:

Thank you for the ASSE Journal and your Sept. 5 letter.

I will be interested in discussing with you our sub-station requirements and other electrification considerations. We are not committed as to the future and the main substation information required is estimating costs for our economic study.

The possibility of a chopper controlled electric engine especially interests me as attaining 25% adhesion could change the economics considerably.

Yours truly,

G. R. Frazier,
Electrical Engineer
The Milwaukee Road

grf

cc: OAK FAU

Milwaukee, Wisconsin
October 6, 1972
File: 2202-L-1

Mr. G. A. Kellow:

As a matter of further information regarding the study of electrification, Mr. Dave Lyons, of Electro-Motive and Mr. Olle Ewers of ASEA were recently at Milwaukee, and advised that ASEA was developing design details for a 3,000 volt DC electric locomotive. This locomotive would be very similar to modern Thyristor units in that each traction motor would be individually controlled and thus provide the advantages of the so-called modern AC "Chopper" locomotives.

It is anticipated that this type of locomotive would have better adhesion characteristics than typical American design.

The locomotive in general would utilize ASEA components including trucks, motors, etc. This would, of course, eliminate interchange of any parts with presently operated diesel electric or electric locomotives.

Mr. Lyons stated that Electro-Motive was in no position to furnish additional detail. Cost estimate per unit had not been prepared, but they did wish to make clear the fact that they were interested in quoting on electric locomotives if the Milwaukee was interested in purchasing 3,000 volt DC electric units. Mr. Lyons stated that he would develop at least a preliminary estimate of cost and present this information.

As you know, the ASEA truck and running gear construction is a radical departure from what is presently used on U. S. railroads. Considering possible differences in roadbed construction and condition in the U. S. versus Europe operating a test locomotive of this type on our line prior to acquisition of a significant quantity would be very desirable.

J. C. Lepton

cc: C. E. Crippen
W. L. Smith
F. G. McGinn
G. R. Frazier