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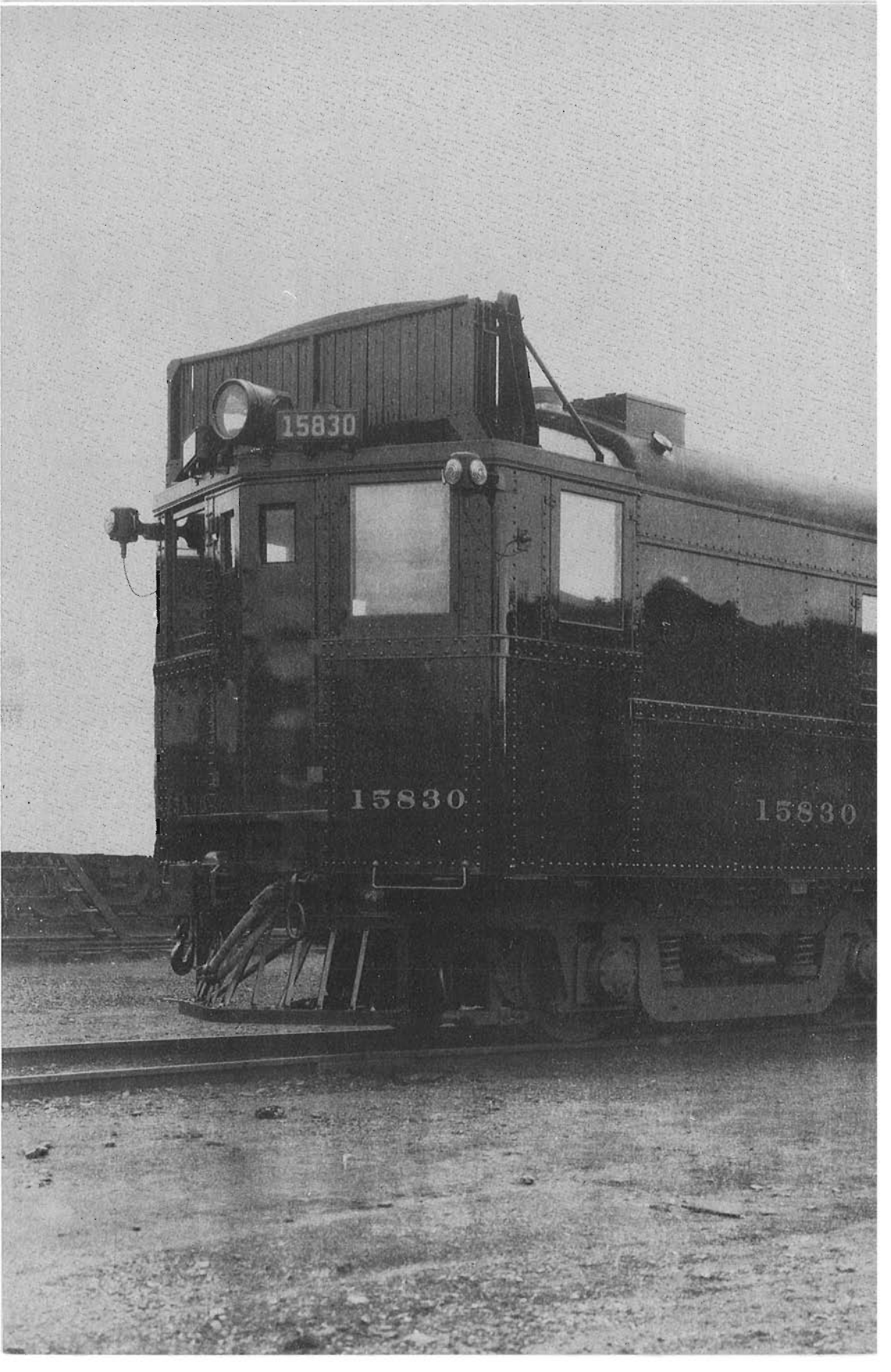
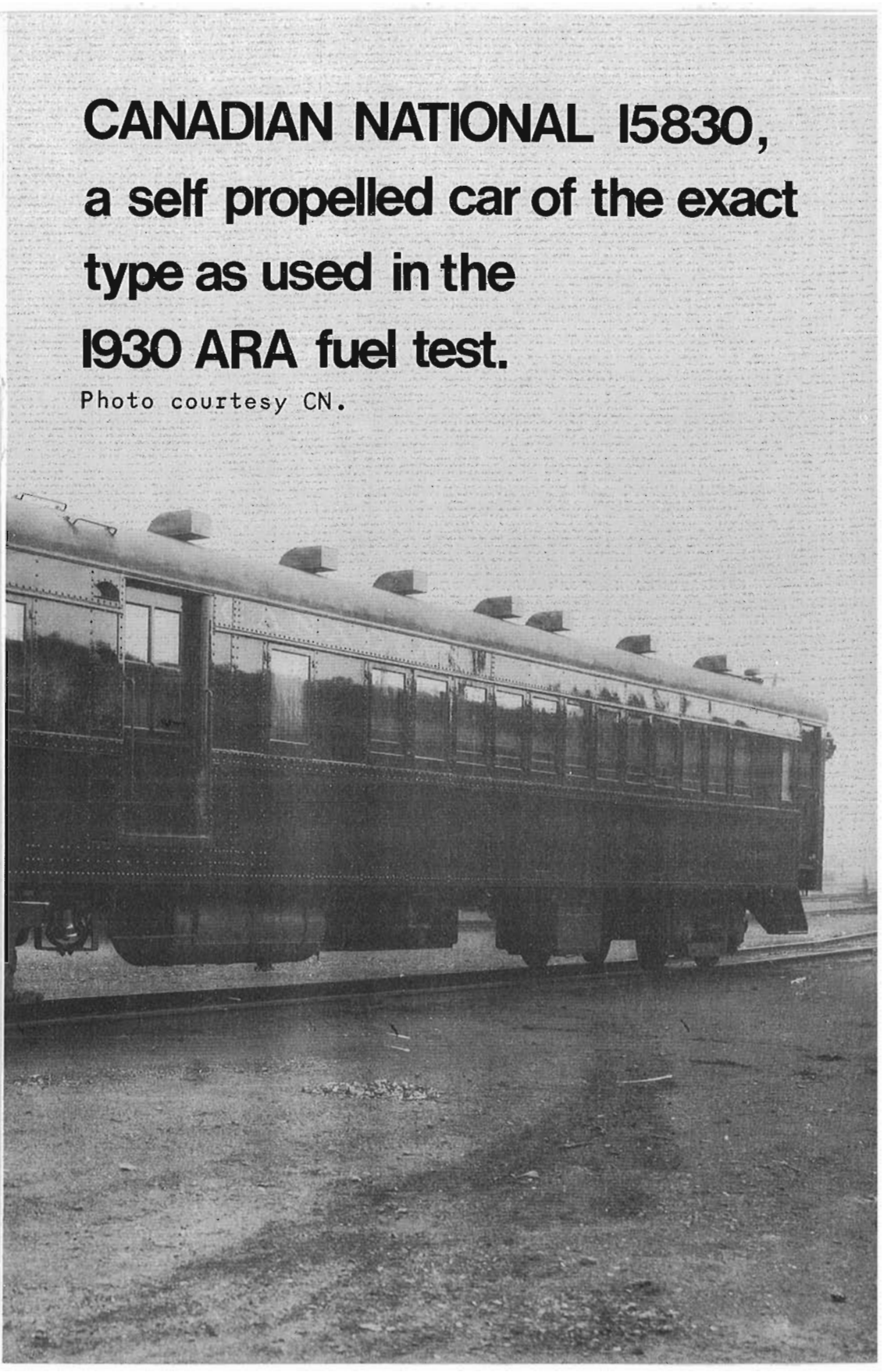
COVER PHOTO:
The domaine of steam was rapidly yielding to the more efficient Diesel when Jim Shaughnessy caught CNR 8734 heading train 430 south at Palmer Mass. in the early fifties. The wayfreight steamer is 'in the hole' waiting for the mainline drag to clear. Photo from the CRHA Archives, S. S. Worthen Collection.

INSIDE FRONT COVER:
Oddly enough the initial interest in Diesel locomotion focused on its use in yard switching and low horse-power applications. Early Diesels were in no way powerful enough to replace the steam giants such as this 1923 Kingston Locomotive Works product No. 6010. This U-1-a class Mountain Type is seen pulling the CN's crack 'Continental Limited' across the Fraser River at Cisco, B.C. Photo from the CRHA Archives, S. S. Worthen Collection.


15830
15830
15830

CANADIAN NATIONAL 15830, a self propelled car of the exact type as used in the 1930 ARA fuel test.

Photo courtesy CN.



1930 ARA fuel test.

William G. Blevins P. Eng.

In these days of rising fuel costs and threatened shortages we tend to think of fuel conservation as a recent phenomenon. A review of the historical records of the railway trade would give the lie to this as the literature abounds with tests, data and devices encouraging the economic use of fuel. Certainly coal represented the vast bulk of railway fuel used in 1930 when the steam locomotive reigned supreme as the prime mover of people and goods.

A usurper was not only in the wings at this time but had already demonstrated its potential and practicability. The internal combustion engine could easily deliver power to the rails at four times the efficiency of a typical reciprocating steam locomotive. While the threat was there, the size was not. No practically-sized internal combustion engine could rival the five to six thousand horsepower ratings of the mainline 4-8-4 passenger locomotive or 2-10-4 freight locomotive of the day in the United States. It was instead, the yard switching and branch line assignments, where power requirements were in the regime where the internal combustion engine could compete. The question was: "Which internal combustion engine: gasoline, distillate or oil engine?" Both the gasoline and distillate engines relied on spark ignition as does the automobile, while the oil engine utilized the compression ignition of the diesel cycle. By 1930 all three types of engines, no matter how fueled, were almost universally coupled to an electric transmission with an engine-driven generator and axle-hung traction motors. Throughout the '20's and early '30's the engine controversy attracted the attention of the railway mechanical and technical staffs whose function it was to design, purchase, and maintain rolling stock which provided the greatest service and utility at the least cost.

The fledgling Canadian National Railways had indeed been from its beginnings a pioneer in the use of internal combustion engines in railway vehicles. Chief of Motive Power, Mr. C.E. Brooks had presented several learned papers to the technical societies and journals of the day on CNR experience with non-steam powered equipment. By the late twenties, experience had shown the oil-electric to be the system of choice for CN. This had resulted in sizable orders for self-propelled oil-electric passenger cars with the Westinghouse-Beardmore oil-engine of air-ship fame. The primary use of these cars was to replace steam power where steam was least efficient, i.e. branch-lines with one- or two-car passenger and baggage loads.

As a leader in the field, Mr. C. E. Brooks was in 1930 the Chairman of the America Railway Assiciation Committee on Automotive Rolling Stock. Under his auspices a series of tests to compare the fuel efficiency of the three types of fuel burning internal combustion engines was undertaken. Testing took place in February and March of 1930 on the Union Pacific (distillate cars), Chicago and Northwestern (gasoline cars) and Canadian National (oil cars).

Rather than rewrite the report, the author has extracted the substantive portions of the Report of the Committee to the ARA Convention of 18 - 25 June 1930 at Atlantic City, N.J. The author has also taken the liberty of emphasizing the CNR portion of the test for obvious reasons.

REPORT OF COMMITTEE ON AUTOMOTIVE ROLLING STOCK

To the Members:

COMPARATIVE FUEL TESTS CONDUCTED BY COMMITTEE ON AUTOMOTIVE ROLLING STOCK

I - General Determination of Method

Rail motor cars have been designed and developed to utilize a variety of fuels. At present the principal grades in general use are gasoline, distillate and fuel oil. The choice of fuel to be used on any given railroad is governed primarily by the location of that railroad with respect to its oil supply; the choice may also be influenced by mechanical features of the motor car equipment for burning the various grades. With this in mind, the Automotive Rolling Stock Committee proposed to make a series of comparative tests of different types of fuel as utilized in the various rail motor cars designed for each type of fuel. It was thought such a series of tests would produce information and data which would be useful to any railroad undertaking the selection of rail motor equipment best fitted to its own needs.

In order to eliminate as many variables as possible, it was decided to run the tests on three representative railroads in the same general geographical territory; the characteristics of the runs, the profiles, the classes of service and the fuel sources would, therefore, be comparable. Furthermore motor cars of the same or nearly the same horsepower and with similar electrical equipment would be selected.

It was originally decided to obtain a figure on each of the three railroads of kilowatt hours per gallon of fuel consumed. Such figure to a great extent would exclude variable conditions external to the car, such as, for instance, wind resistance, grade resistance, high or low temperature, etc. Load factor, however, would still affect the results, as it might influence the efficiency of the various power plants. It is interesting to note that, working towards an ultimate figure of kilowatt hours per gallon of fuel used, sufficient additional information was obtained to make possible considerable enlargement of final results.

II - Instruments

It was the desire of those conducting the tests to make all the runs under as nearly actual operating

conditions as possible. Therefore, decision was made to install the fewest possible meters consistent with the results to be obtained, such meters being comparatively small and easily installed. A graphic watt meter was installed to measure the output of the main generator and a second graphic watt meter was installed in the exciter circuit to measure auxiliary power. To obtain figures of total kilowatt hours for both the main generator and exciter, locomotive type watthour meters were also installed. The purpose of the graphic meters was to give a picture of the load curve of the power plant at any particular part of the runs, while the purpose of the watthour meters was to furnish figures of total energy over any part or parts of the test runs.

III - Accuracies and Inaccuracies Present in the Tests

Laboratory accuracy is claimed for none of the tests or the results. It is possible to determine kilowatt hours per gallon of fuel for any power plant in the shop or on the test floor by artificial loading. It was thought to be more representative of actual conditions, however, to obtain such a figure during regular service runs. Enginemen were instructed to handle the cars in their regular manner and forget the test instruments or personnel so far as possible. For the most part this was done and the results are considered comparable to every-day operation.

Mileages as given and used are only between stations, the relatively few miles operated between stations and engine houses being neglected. This was necessary on account of the various methods of handling motor cars and trailers between engine houses and stations on the various railroads. In some cases a steam switcher was employed; in other cases the trailer was uncoupled and the motor car operated alone, and in other instances both motor and trailer car were operated to and from the roundhouse.

IV - Description of Tests

The railroad with probably the longest experience in the use of distillate for rail motor cars is the Union Pacific. Owing to this and to the fact that it had available for test single power plant cars of 300 h.p., it was selected for the distillate tests. The Canadian National Railways operate two oil-electric rail motor cars of the same nominal horsepower in Western Canada, and having had particular experience with this type of fuel, were selected for the fuel oil tests. The Chicago & North Western Railway, operating in the same central territory, has single power plant cars of about the same horsepower, and it was accordingly selected for the gasoline tests. It will be noted that the conditions outlined in Article (1)

as to characteristics of runs, profile, classes of service, etc., are all met in the selection of the three railroads above named.

The general procedure in the case of every car tested was approximately as follows:

At the engine house or terminal the watthour meters and graphic watt meters were installed and meters tested for correct direction of readings, etc. The fuel tank or tanks were filled just to the point of overflowing; watthour meter readings were taken at the start and end of the run, and at each regular stop; also time of arrival at each station was noted. In the case of the Union Pacific cars, where two kinds of fuel were used, meter readings were taken only when operating on distillate.

A sample of the fuel used in each car for each run was obtained and analysis made to determine B. T. U. value and gravity. Figure (4) shows standard specifications of the various fuels. Relative costs as obtained from the purchasing departments of the various railroads in question are also shown for comparison.

A synopsis of runs on the three railroads follows:

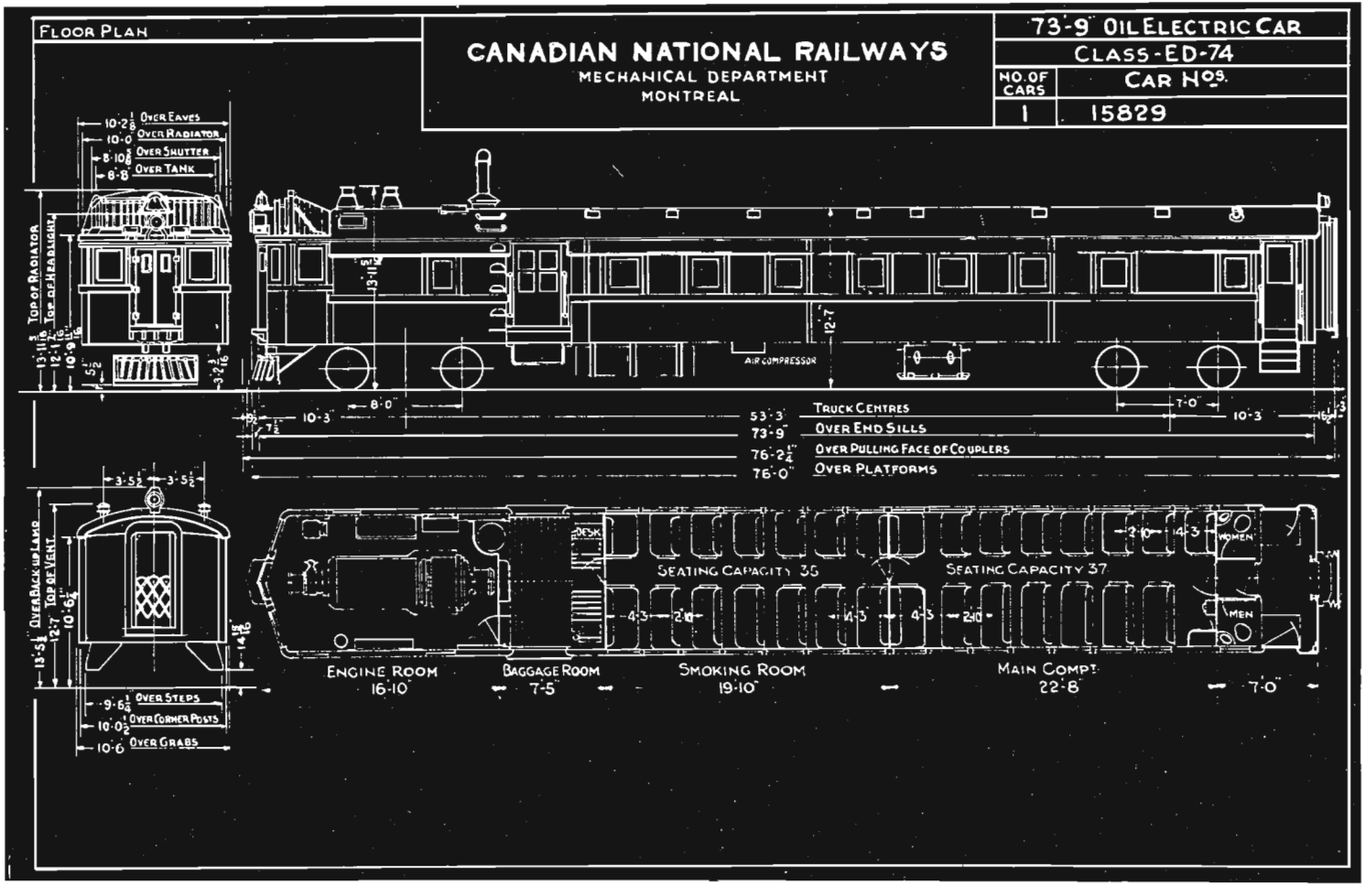
UNION PACIFIC SYSTEM

First run, Leavenworth, Kansas, to Miltonvale, Kansas. Distance between stations 166 miles, distance credited to distillate operation 164 miles. Motor No. M-24, trailer No. T-19. Severe grades in spots, particularly when leaving Missouri River Valley; otherwise generally flat, rolling country. Total estimated load, 3 tons; total light weight of train, 76 tons.

Second run, Salina, Kansas, to Oakley, Kansas, and return. Total miles 380, total miles credited to distillate operation 378. Motor No. M-41 and main line steel baggage car No. 1773. Some severe grades, but mostly flat prairie country. Total estimated load, 8 tons; total light weight of train, 117 tons.

Third run, Denver, Colo., to Fort Collins, Colo., and return. Total distance 136 miles, total credited to distillate operation 130 miles. Motor car No. M-40, without trailer. This was an exceptionally fast run over flat, rolling country. Total load estimated at 2 tons; light weight of car, 56 tons.

Four run, Kearney, Neb., to Stapleton, Neb., and return. Total distance 205 miles, of which 204 miles were credited to distillate operation. Motor car No. M-30, trailer No. T-10. Run was through



PLAN OF CN 15829

CAR No. 15829 — OIL ELECTRIC CAR

DATE BUILT, 1927

BUILDER, CANADIAN CAR & FDY. Co. [FRAME] C.N.RYS. PT. ST. C. [FINISH AND TRUCKS]

LENGTH OVER PLATFORMS, 76'-0" OVER END SILLS, 73'-9"

" MAIN COMPT. 11'-4" SMOKER, NIL

" BAGGAGE COMPT. 38'-7" ENGINE ROOM, 16'-10"

WIDTH OVER SIDE SILLS, 10'-0" WIDTH INSIDE, 9'-6¼"

HEIGHT INSIDE, 8'-0" FROM RAIL TO ROOF, 12'-7"

SEATING CAPACITY, MAIN COMPT. NIL SMOKER, NIL BAGGAGE, NIL

WEIGHT IN WORKING ORDER — ON FRONT TRUCK, 93,560* REAR, 54,860* TOTAL 148,420*

STYLE OF BODY, STEEL UNDERFRAME, FRAME AND SHEATHING

" " VESTIBULE, ENCLOSED, TRAP DOORS

" " DOORS, SIDE, HINGED END, HINGED BAGGAGE, SLIDING

WINDOWS, No., SEE DIAGRAM SIZE, STYLE, SINGLE RAISE SASH

SEATS, SIZE, UPHOLSTERY,

TRUCKS, No. 2-4-WHEEL COMMONWEALTH

" , WHEEL BASE, FRONT, 8'-0" REAR, 7'-0" TOTAL WHEEL BASE, 60'-9"

AXLES, SIZE, TRAILER TR. 5"x9" " MATERIAL, CARBON STEEL REF, MOTOR TR. 3H-10816 TRAILER 3H-10817
MOTOR TR. 5½"x10" SPECIAL

WHEELS, ROLLED STEEL DIA., 36" REF., 3H-9822

BEARINGS, FRONT TRUCK, SKF. I-31069 JOURNAL BOX, 3-H-9813
REAR " " SKF. I-31069 JOURNAL BOX, 3H-9813

SPRINGS, DWG. REF. ELLIPTIC MOTOR TRUCK, 3H-9913
HELICAL " " " 2H-14597
ELLIPTIC TRAILER " " 3H-9913
HELICAL " " " 2H-14597

ENGINE, BUILDER, WM. BEARDMORE & Co. LTD.

" TYPE, 6-CYL. 4 STROKE CYCLE WEIGHT, ENGINE & FLYWHEEL 6,900 Lbs.

" SIZE, CYLRS. 8¼" DIA. 12" STROKE 300 B.H.P.

" SPEED, 800 R.P.M.

GENERATOR, BUILDER, CANADIAN WESTINGHOUSE Co.

" TYPE, *477 — 198 KW. WEIGHT, 6825*

GENERATOR, VOLTAGE, 600 VOLT D.C.

BATTERIES, 64 VOLT - 17 PLATE - EXIDE No. OF CELLS, 32

MOTORS, 2-WESTINGHOUSE 569 C-4 600 VOLT 215 H.P. RY. MOTORS ON FRONT TR.

LIGHTING SYSTEM, 32 VOLT STORAGE BATTERIES

BRAKE EQUIPMENT, WESTINGHOUSE FRONT TRUCK, A.S.E. TYPE SIMPLEX CLASP BR.
REAR " " C.N.R. SINGLE TYPE BRAKE

AIR COMPRESSOR, WESTINGHOUSE TYPE, DH-20

HEADLIGHT, 12" GOLDEN GLOW TYPE, C.N.R. STD.

CLASSIFICATION LAMPS, C.N.R. STD.

MARKER LAMPS, C.N.R. STD.

HORN: 2 WESTINGHOUSE PNEU PHONICS

BELL, 1-30 Lb. LOCO. TYPE

COUPLERS, VAN DORN *2374 DWG. 3H-11063.

SANDERS, HANLON

HEATING, PETER SMITH HOT WATER HEATER TYPE, O.C.I-A

LAVATORY, DUNER HOPPER [1] WASH BASIN [1]

VENTILATION, J4 - UTILITY

FUEL OIL TANK CAP., 120 - GAL. IN CAR, 120 GAL. UNDER CAR

LUB. OIL TANK CAP., SUMP, 45 - GAL.

WATER TANK CAP., 100 - GAL.

CONTROL, SINGLE END

MISCELLANEOUS,

MODINE RADIATOR, MINIERE WINDOW CLEANER
ON FRONT WINDOW. 1" DOUBLE COWHAIR FELT
INSULATION APPLIED TO FLOOR, WALLS & CEILING OF VESTIBULE
END OF BAGGAGE ROOM

CANADIAN NATIONAL RAILWAYS

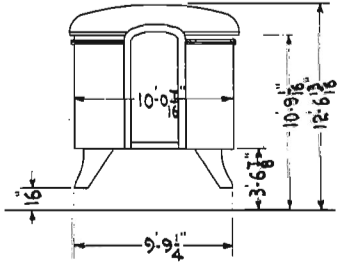
MECHANICAL DEPARTMENT

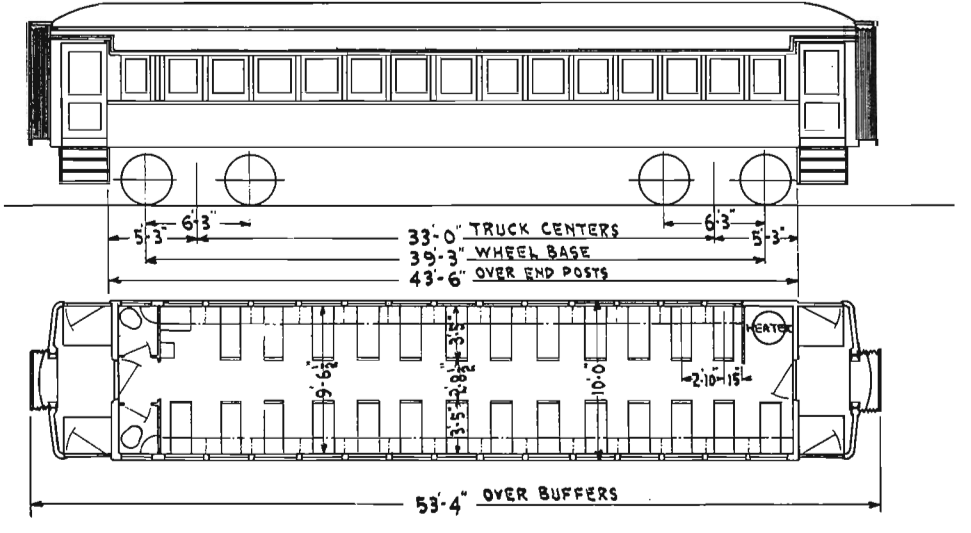
TRANSCONA

43'-6" TRAILER	
CLASS-EPB-43-A-1	
No. OF CARS	CAR NUMBERS
2	15740 & 15741.

Builder & Date:- NSC. 1926

Tare Weight :- 30 Tons





SEATING CAPACITY - 53.

PLAN OF CN 15740

CANADIAN 332 RAIL

rolling country with worst grades westbound. Total load estimated at 4 tons; total light weight of train, 85 tons.

CHICAGO & NORTH WESTERN RAILWAY

First run, Des Moines, Iowa, to Ames, Iowa, and return (two round trips). Total miles, 138. Motor car No. 9918, trailer No. 188. Fast runs in Sunday service between the two cities, with heavy grades in each direction. Total load estimated at 2 tons; total light weight of train, 93½ tons.

Second run, Eagle Grove, Iowa, to Fox Lake, Minnesota, and return. Total miles, 199. Motor car No. 9920, trailer No. 1124. Rolling country with some severe grades. Total load estimated at 4 tons; total light weight of train, 89 tons.

Third run, Wall Lake, Iowa, to Tama, Iowa. Total miles, 146. Motor car No. 9912, trailer No. 1069. Rolling country with ruling grade favorable to eastbound movement. Total load estimated at 6 tons; total light weight of train, 73 tons.

Fourth run, Carroll, Iowa, to Sioux City, Iowa, and return. Total miles, 256. Motor car No. 9926, trailer No. 1109. Rolling country with very heavy grades in spots. Total load estimated at 5 tons; total light weight of train, 87 tons.

CANADIAN NATIONAL RAILWAYS

First run, Winnipeg, Man., to Somerset, Man., and return (two round trips). Total mileage, 408. Motor car No. 15829, trailer No. 15740. Extremely severe fifteen (15) mile grade westbound, otherwise flat, prairie country. Very severe snow conditions on second westbound trip. Total load estimated at 3 tons for three one-way trips and 2 tons for the fourth trip; total light weight of train, 98 tons.

Second run, Saskatoon, Sask., to Regina, Sask., and return. Total miles, 445. Motor car No. 15827, trailer No. 15741. Mostly flat, rolling country with several severe grades in each direction. Total load estimated at 5 tons southbound and 4 tons northbound; total light weight of train, 98 tons.

V - Data Obtained

Figure 1 shows complete tabulated data of each run of the entire test, including such information as engine manufacture, model, and horsepower; manufacture and model of the generator; type control; schedule and clapsed time; kilowatt hours from generator, exciter, and total; U.S. gallons of fuel consumed; miles per gallon; watthours per ton mile; kilowatt hours per gallon of fuel consumed, and over-all efficiency of the power plant.

TABULATION OF DATA

Date	R.R.	Car Nos. Motor	Car Nos. Trailer	Engine Mfr. & Model	H.P.	Fuel	Generator Mfr.& Model	Control	Test Run From	Test Run To	Mls	Time Sched.	Time Actual	K.W.H. Gen.	K.W.H. Ex	K.W.H. Total	U.S. Gals Fuel	Mls per Gal.	W.H. per T.M.	KWH per Gal	Over all Eff. of P.P.
Feb. 5	U.P.	M-24	T-19	Hall Scott	350	Distillate	West.181A6	"K"	Leavenworth	Wiltonvale	164	8'25"	8'05"	440	10	450	95.5	1.72	34.7	4.71	11.7%
Feb. 7	"	M-41	1773	" "	"	"	West.181A	Torq gov.	Salina	Oakley	188	8'0"	7'59"	698	26	724	139.0	1.35	30.5	5.20	12.8%
Feb.7,8	"	"	"	" "	"	"	"	"	Oakley	Salina	190	7'15"	7'02"	437	23	460	95.5	1.99	19.2	4.82	11.9%
Feb.7,8	"	"	"	" "	"	"	"	"	Round trip		378	15'15"	15'01"	1135	49	1184	234.5	1.61	24.6	5.06	12.5%
Feb.9,10	"	M-40	"	" "	"	"	"	"	Denver	Ft.Collins & Rt	130	3'58"	3'49"	306	12	317	67.0	2.28	41.9	5.56	13.7%
Feb.12	"	M-30	T-10	" "	160	"	G.E.DT507C	"K"	Kearney	Stapleton & Rt	204	7'55"	7'46"	506	15	521	94.0	2.17	28.6	5.56	13.7%
Feb.16	CANW	9918	188	Winton	120	275 Gasoline	G.E.DT507BZ	"K"	Des Moines	Ames & Rt (2)	128	4'20"	4'30"	440	8	448	94.5	1.46	34.0	4.76	13.1%
Feb.18	"	9920	1124	" "	"	"	"	"	Eaglegrave	Fox Lake & Rt	199	6'56"	6'55"	570	13	583	105.6	1.89	33.3	5.53	15.2%
Feb.19	"	9912	1069	" "	"	"	"	"	Wall Lake	Tama	146	5'35"	5'31"	390	9	399	80.0	1.83	34.4	4.99	13.2%
Feb.20	"	9926	1109	" "	146	300 "	G.E.DT516A	"	Carroll	Sioux City & Rt	256	9'35"	9'37"	950	17	967	194.5	1.32	41.1	4.97	12.7%
Feb.27	CNR	15829	15740	Beardmore	-	300 Fuel oil	West.198KW	Torq gov.	Winnipeg	Somerset & Rt	204	8'10"	8'06"	653	15	668	57.8	3.54	32.5	11.60	26.3%
Feb.28) Mar.1)	"	"	"	" "	"	"	"	"	"	" "	204	8'10"	7'59"	728	14	742	72.0	2.84	36.1	10.31	23.4%
Feb.27) Feb.28) Mar. 1)	"	"	"	" "	"	"	"	"	"	" & Rt (2)	408	16'20"	16'05"	1381	29	1410	129.8	3.15	34.2	10.86	24.7%
Mar. 4	"	15827	15741	"	"	"	"	"	Saskatoon	Regina	220	8'15"	8'10"	693	12	705	67.2	3.28	31.0	10.49	23.8%
Mar. 5	"	"	"	"	"	"	"	"	Regina	Saskatoon	225	8'35"	8'33"	648	13	661	63.6	3.54	28.7	10.40	23.5%
Mar.4,5	"	"	"	"	"	"	"	"	Saskatoon	Regina & Rt	446	16'50"	16'43"	1341	25	1366	130.6	3.40	29.8	10.45	23.6%

Note: Union Pacific figures corrected for road miles on gasoline.

Figure 1

An inspection of the graphic records brings to light a very important factor, namely, that the average power plant in a rail motor car is rarely up to full capacity, and, if so, but a very short time in the total run. In each run there is considerable time when the engine is either shut down or idling.

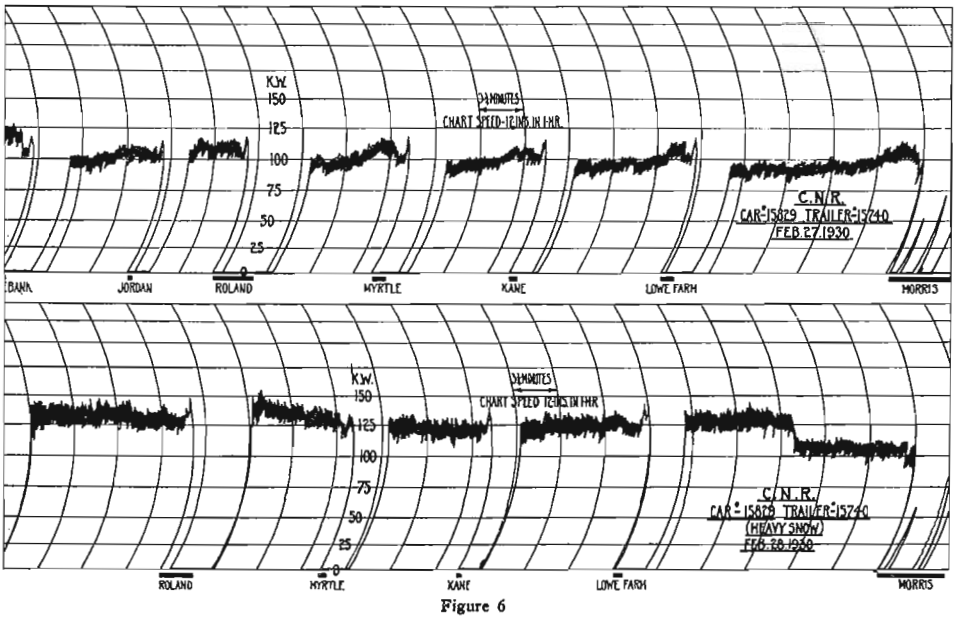


Figure 6

Figure 2

GENERATOR KILOWATT OUTPUT

Portion of Winnipeg-Somerset Runs

It is particularly interesting to compare the last half of the two runs from Winnipeg to Somerset. The first was made on a quiet, cold winter night, the engine throttle being advanced only to the sixth notch at maximum; the second was made in an extremely severe blizzard where snowdrifts as high as the car floor were encountered and where the throttle was advanced to its extreme open position.

It is to be noted that the over-all efficiency of the oil-electric power plant is about 10 higher than the figures for the gasoline or distillate plants. This is quite evidently due, as would be expected, to the higher inherrent efficiency of the oil engine. Gasoline and distillate power plants show approximately the same over-all efficiency. The important point to note in this connection is the fact that approximately the same kilowatt hours are obtained from a gallon of distillate as from a gallon of gasoline. In view of the price differential of seven and one-half cents as on the Union Pacific and the Chicago & North Western, this shows the potentialities of burning distillate if a given railroad can economically obtain a good supply.

Kilowatt hours per gallon are an approximate measure of the over-all efficiency of the power plant, assuming the same B. T. U. and gravity characteristics of the different fuels. For any two cars operating from the same fuel, the kilowatt hours per gallon figure obtained is a direct measure of the efficiency from the raw fuel to electric energy at the main generator and exciter terminals, and is a relatively convenient figure to obtain.

PROFILE AND LOAD CURVE OF CANADIAN
NATIONAL RUN
WINNIPEG—SOMERSET
Car 15829 Trailer 15740

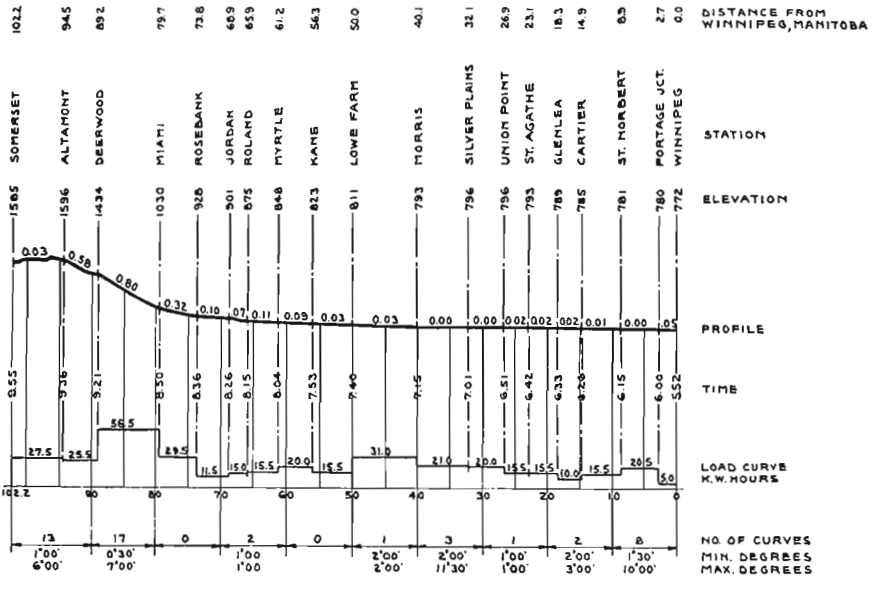
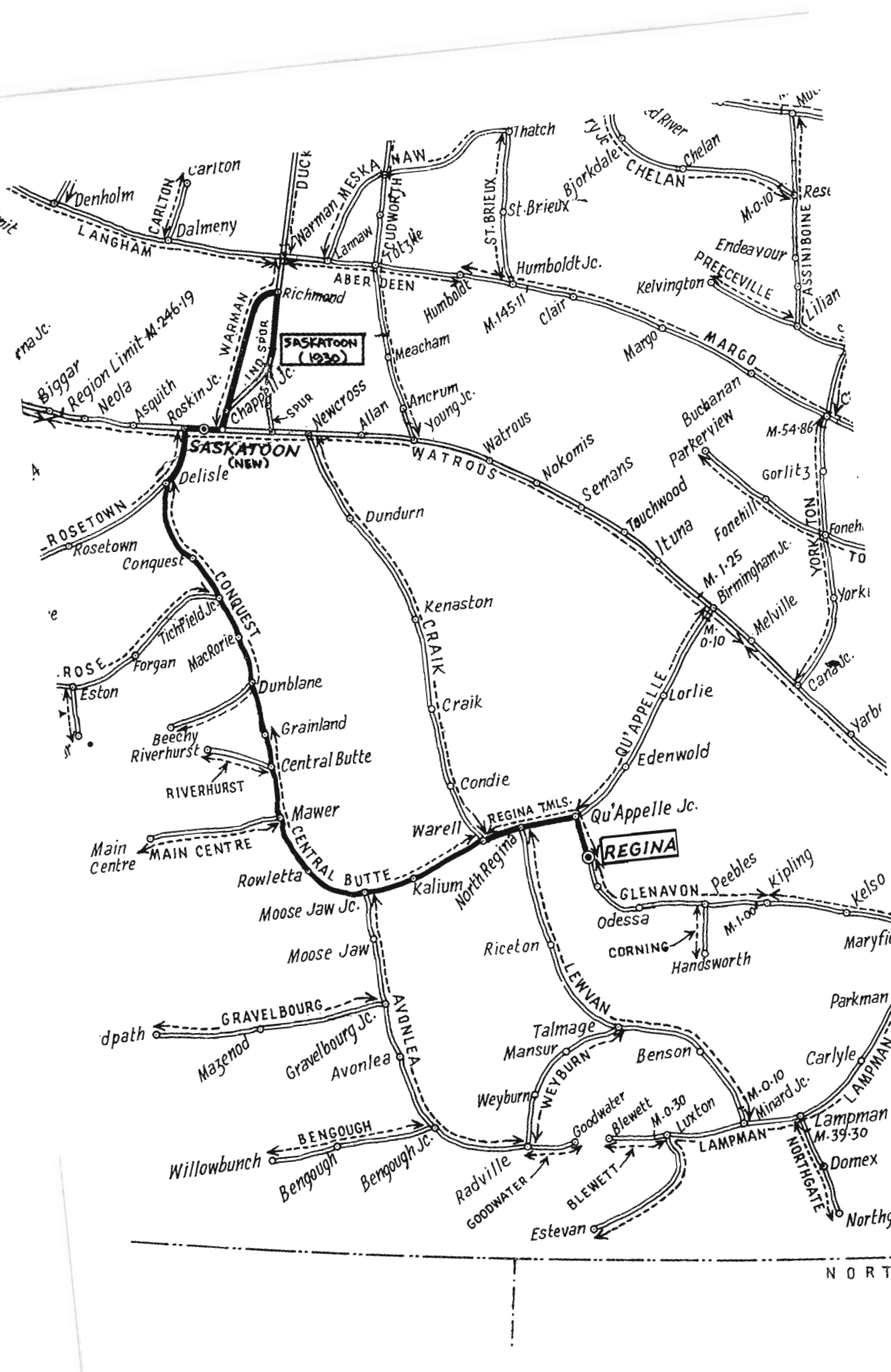


Figure 3a


Denholm
LANGHAM
CARLTON
Carlton
Dalmeny
DUCK
Warman
MESKANAW
Lanaw
TUDWORTH
Tobyhe
Thatch
ST. BRIEUX
St. Brieux
Bjorkdale
CHELAN
Chelan
M.0-10
Endeavour
PREECEVILLE
Kelvington
ASSINIBOINE
Lilian
ABERDEEN
Richmond
Humboldt
Humboldt Jc.
M.145-11
Clair
Margo
MARGO
WARMAN
IND. SPUR
SASKATOON (1930)
Region Limit M.246-19
Biggar
Neola
Asquith
Roskin Jc.
Chappell Jc.
SPUR
Meacham
Newcross
Allan
Ancrum
Young Jc.
Watrous
Buchanan
Parkerview
M.54-86
Gorlitz
SASKATOON (NEW)
Delisle
WATROUS
Nokomis
Semans
Touchwood
Ituna
Fonehill
YORKTON
Foneh
TO
ROSETOWN
Rosetown
Conquest
Dundurn
M.1-25
Birmingham Jc.
Yorkt
CONQUEST
Tichfield Jc.
Kenaston
CRAIK
Melville
M.0-10
Carla Jc.
ROSE
Forgan
MacRorie
Eston
Dunblane
Craik
Lorlie
Yarb
Grainland
Beechy
Riverhurst
Central Butte
QU'APPELLE
Edenwold
RIVERHURST
Condie
Mawer
REGINA TMLS.
Qu'Appelle Jc.
Warell
Main Centre
MAIN CENTRE
CENTRAL BUTTE
Rowletta
Kalium
North Regina
REGINA
GLENAVON
Peebles
Kipling
Kelso
Moose Jaw Jc.
Odessa
M.1-00
Maryfi
Moose Jaw
Riceton
CORNING
Handsworth
LEWVAN
Parkman
GRAVELBOURG
dpath
Talmage
Mansur
Benson
Carlyle
Mazenod
Gravelbourg Jc.
Avonlea
AVONLEA
WEYBURN
Weyburn
M.0-10
Minard Jc.
LAMPMAN
Goodwater
Blewett
M.0-30
Luxton
Lampman
M.39-30
BENGOUGH
Willowbunch
Bengough
Bengough Jc.
Radville
GOODWATER
BLEWETT
Estevan
NORTHGATE
Domex
North
NORT

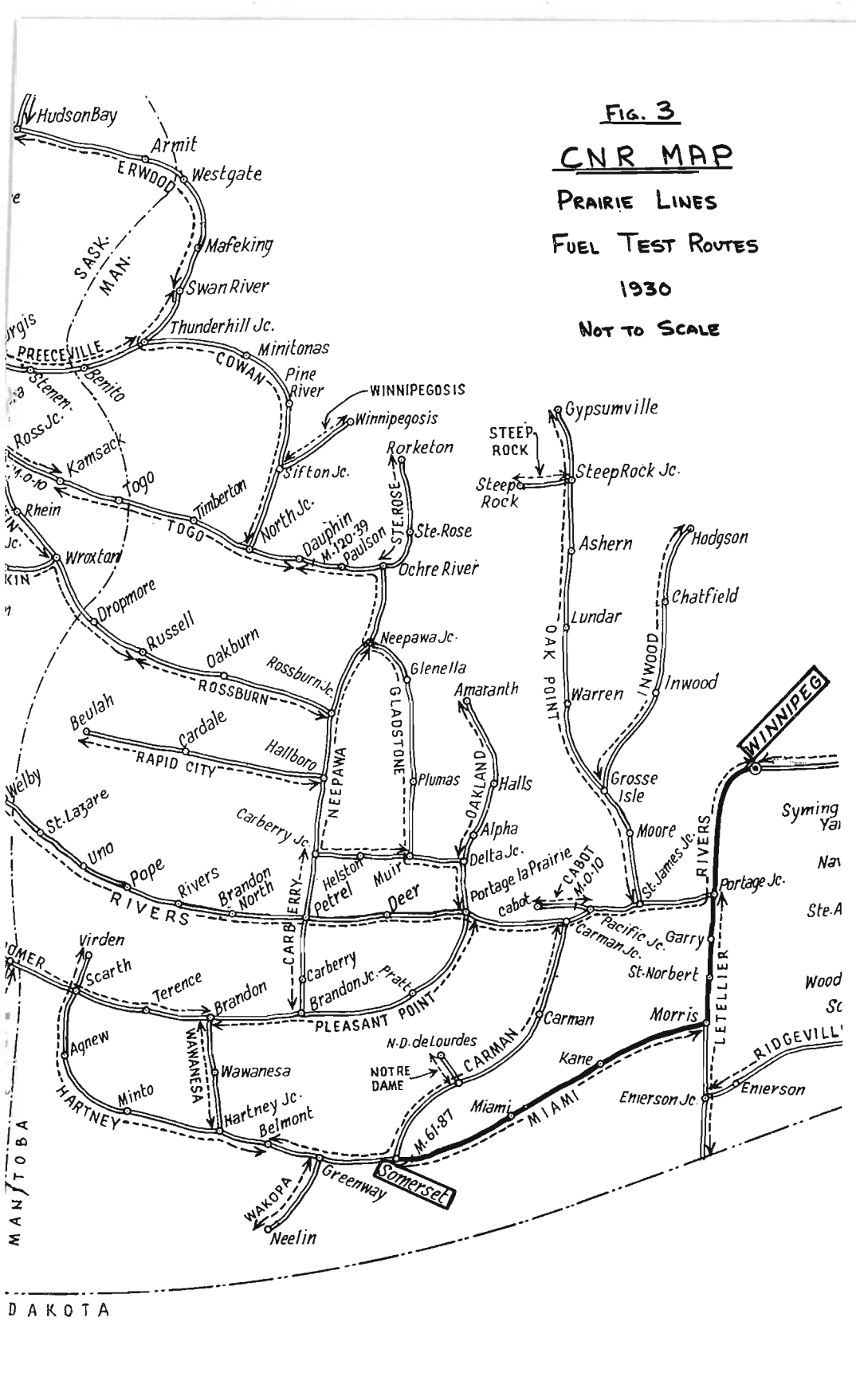


FIG. 3
CNR MAP
PRAIRIE LINES
FUEL TEST ROUTES
1930
NOT TO SCALE
HudsonBay
Armit
ERWOOD
Westgate
SASK.
MAN.
Mafeking
Swan River
Thunderhill Jc.
PREECEVILLE
Benito
COWAN
Minitonas
Pine River
WINNIPEGOSIS
Winnipegosis
Ross Jc.
Kamsack
Togo
TOGO
Timberton
Sifton Jc.
North Jc.
Dauphin
M.120-39
Paulson
STE. ROSE
Rorketon
Ste. Rose
Ochre River
Rhein
Wroxton
Dropmore
Russell
ROSSBURN
Oakburn
Rossburn Jc.
Neepawa Jc.
Glenella
GLADSTONE
Amaranth
Beulah
Cardale
RAPID CITY
Hallboro
NEEPAWA
Plumas
OAKLAND
Halls
Welby
St. Lazare
Una
Pope
Rivers
Brandon North
RIVERS
Carberry Jc.
CARBERRY
Helston
Petrel
Muir
Deer
Alpha
Delta Jc.
Portage la Prairie
CABOT
M.0-10
cabot
Virden
Scarth
Terence
Brandon
Carberry
Brandon Jc.
Pratt
PLEASANT POINT
Carman Jc.
Pacific Jc.
Garry
St. Norbert
Agnew
WAWANESA
Wawanesa
N.D. de Lourdes
NOTRE DAME
CARMAN
Carman
Kane
Morris
LETELLIER
Minto
HARTNEY
Hartney Jc.
Belmont
M.61-87
Miami
MIAMI
Emerson Jc.
Emerson
RIDGEVILLE
Greenway
Somerset
WAKOPA
Neelin
MANITOBA
DAKOTA
Gypsumville
STEEP ROCK
Steep Rock
Steep Rock Jc.
Ashern
Lundar
OAK POINT
Warren
Grosse Isle
Moore
Hodgson
Chatfield
INWOOD
Inwood
WINNIPEG
St. James Jc.
RIVERS
Portage Jc.

PROFILE AND LOAD CURVE OF CANADIAN
NATIONAL RUN
SASKATOON—REGINA
Car 15827 Trailer 15741

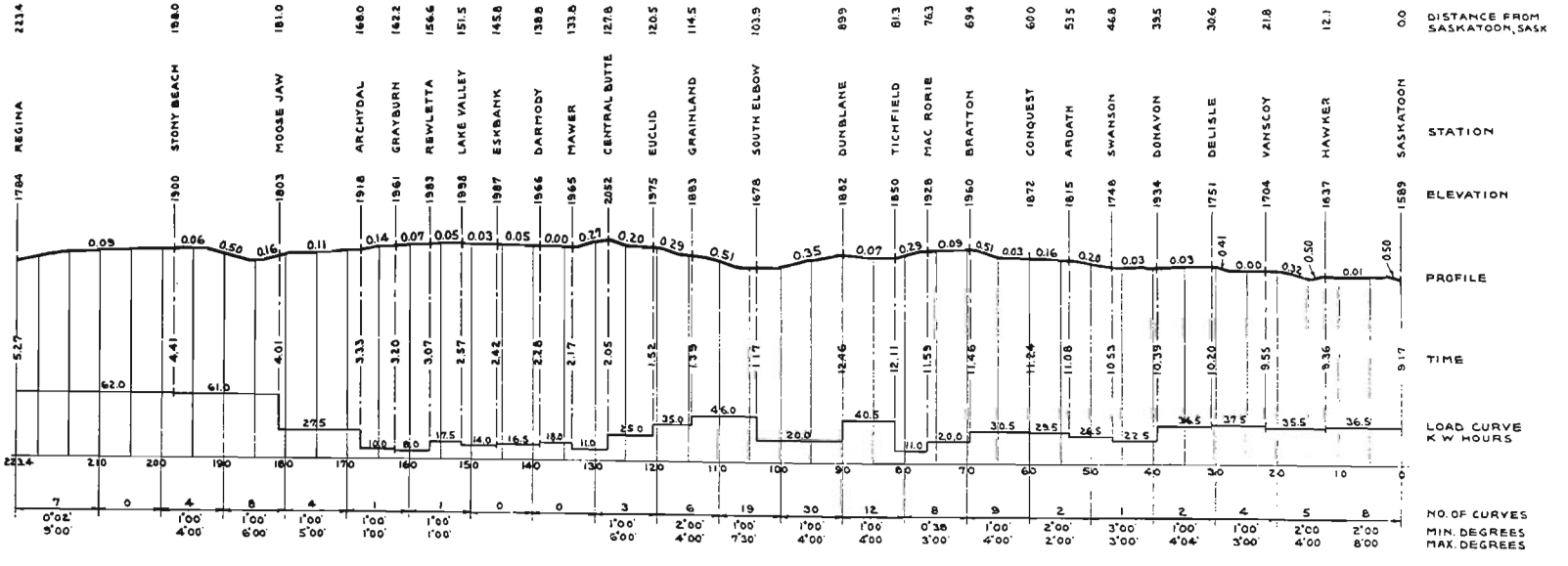


Figure 3b

VI - Conclusions

The results set forth in this report are in no way to be considered as reflection on the performance of any of the railroads involved. Very fine co-operation on the part of all was given the sub-committee in conducting the tests. We believe the data obtained will be helpful to any railroad considering the purchase of internal combustion rail car equipment as pointing out what may be considered representative conditions to be met with the three classes of fuel.

Any railroad, in making a decision, however, should take into account not only the cost and efficiency of conversion of a power plant using a given fuel, but also the accompanying expenses for maintenance, lubricating oil, etc., resulting from the use of it.

Respectfully submitted,

COMMITTEE ON AUTOMOTIVE ROLLING STOCK.

Conclusions - 47 Years Later

The resultant figure of greatest interest to the fuel conservationalist is the thermal efficiency of the power plant. This is simply the percentage of the total energy that is available in the fuel that has been transformed into electrical energy out of the main generator. The CNR oil-electric cars converted on average 24% of the available energy in the fuel while both the spark ignition competitors (distillate on UP and gasoline on C&NW) could only produce electric power with 13% of the available fuel energy. Given the higher cost of gasoline, this meant a fuel bill well over three times higher than the oil car, while the UP distillate fuel, being cheaper per gallon, was only 20% higher in cost of running the car. The fuel cost of a steam locomotive to handle the same load would have been about three times higher than the oil-electric car.

It is of interest to note from Fig. 4 that the #2 Diesel Fuel oil of today is almost identical to the Distillate used by UP. The difference is, of course, that today the diesel compression ignition is used rather than spark ignition.

Figure 4

Typical Fuel Characteristics

Type	UP 1930 Distillate	C&NW 1930 Gasoline	CN 1930 Fuel Oil	CN 1977 #2 Diesel
Specific Gravity	.847	.743	.96	.845
Gravity Baumé ° @ 60°F	35.3	60	16	35.7
Viscosity @ 100°F (S.U.)	34	31	62	34
BTU per lb.	19,560	20,800	18,900	19,590
Cost per U.S. Gallon	5¢	12.5¢	7.5¢	33.3¢

In 1977 it is clear that the oil-electric cars of 1930 which evolved into the diesel-electric locomotives of today were the winners of the contest. To the foresightedness of men like Mr. C. E. Brooks we owe an enormous debt. Had the steam locomotive not been replaced, the fuel budget of today's railways would have driven freight rates to unprecendented levels.

The routes used for the CNR tests in 1930 have long since dropped passenger service, indeed one section of the Regina to Saskatoon route is now flooded by Lake Diefenbaker formed by the damming of the South Saskatchewan River. The cars are now scrapped, with a sister car (15824) now a museum piece. The technological heritage remains, however, and the concern for fuel efficiency is something that will increase as the years pass and liquid fuel reserves dwindle.

EDMONTON REVIVAL

by W.Brow and E.Johnson

After a twenty-seven year absense, flanged wheel transportation has returned to the Edmonton Transit System. The decision to build Canada's third rapid transit system was made after Edmonton was selected as the site for the Eleventh Commonwealth Games in August 1978.

On April 24th, 1978, a 7.2 km line was opened from downtown Edmonton to the northeast section of the city. The $64.9 million project commenced in Oct. 1974 and the first cars were delivered in May, 1977. Service started April 24th, 1978.

The route begins at 101 St. and Jasper Ave., the center of the city, in a cut and cover station called Central. Two blocks east the line turns north and angles across to Churchill Station, by the City Hall. The control office for the system is located here. Extensive pedestrian tunnels connect with many of the buildings from these two underground stations. The underground section comes to the surface at 95th St. between the CN tracks. The crossing at 95th St. is one of 9 grade crossings on the route.

Running northeastward, the first surface station is Stadium, site of the new, magnificient Commonwealth Stadium, built for the games. Bus lines feed in here and park and ride parking is available. Four grade crossings are crossed in quick succession (112 Ave. 82 St., 114 Ave., 115 Ave.) and this is followed by the

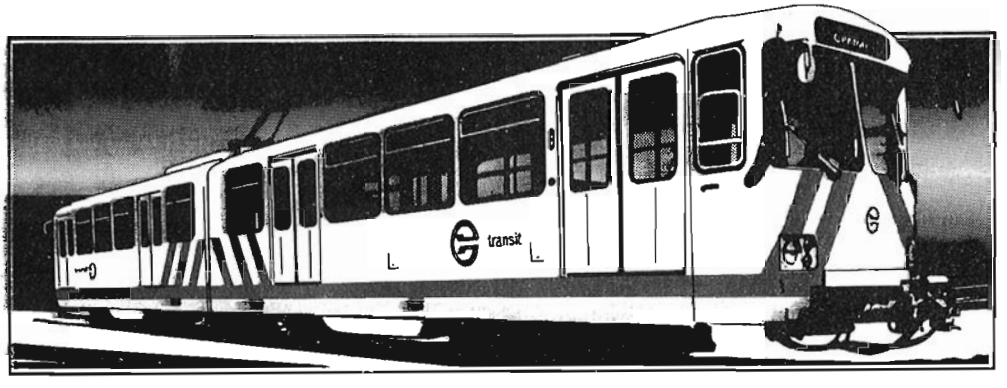
Cromdale Car Shops (part of the original street railway barn built in 1913.) where the 16 cars are serviced and stored.

The second surface station is built over 118th Ave. and is called Coliseum. The station serves the Coliseum, the new home of the Edmonton Oilers' hockey team and scene of many trade shows. Across the street to the south is the Exhibition Grounds. Nine feeder bus lines connect with the LRT here. The track continues northward past three major packing plants and the CN's North Edmonton Station, across 66th St. and then dives under the main CN line and reaches Belvedere Station at 129th Ave. This station is of a temporary nature.

Service

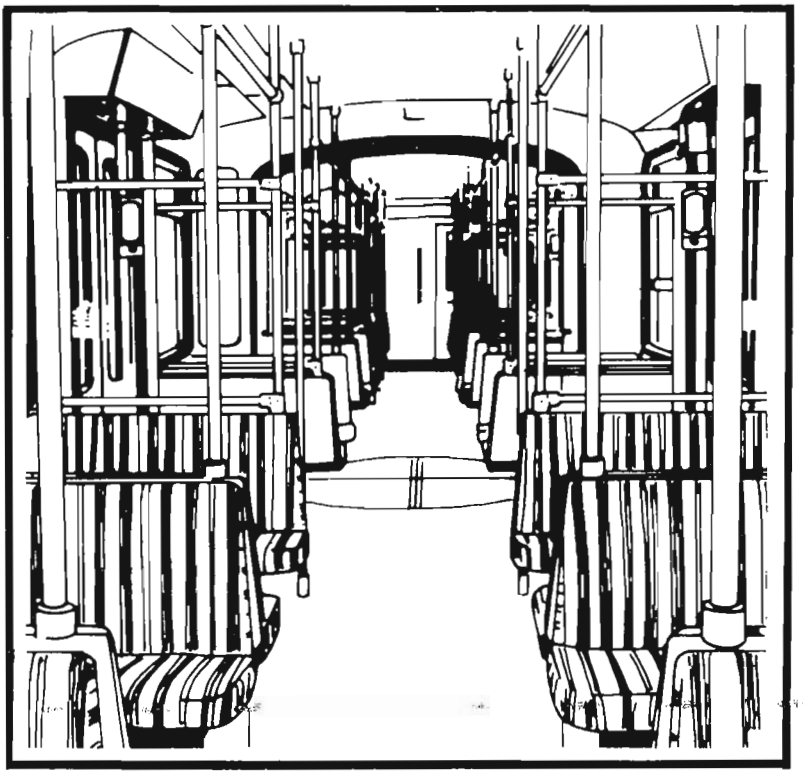
Known as LRT Route 101. Weekday services commence with 10 minute service, 5:30 AM to 7:05 when 5 min. scheduling is used to 8:45. Again 10 minute service resumes through to 3:25 PM when 5 min. service is offered until 5:35 PM. 10 minute service completes the day to about 1:00 AM. On Saturdays, Sundays and Holidays, a 10 min. service is used from 6:00 AM until shortly after 1:00 AM on Saturday and to midnight on Sundays and Holidays. During football games and other special events, 8 and 5 minute service has been advertised. Running time from Belvedere to Central or return is 11 minutes. Trains consist of two cars and three trains each way provide normal service.

Edmonton's Light Rail Vehicle, RTE1



Cars

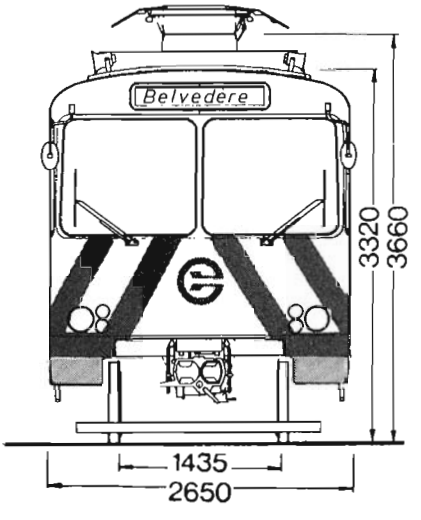
16 cars were supplied by Siemans-Duwag Ltd. at a cost of $550,000 each. These cars are 6-axle, 2-section, articulated double end light rail vehicles. There are 4 motored and 2 non-motored axles. 218 HP motors running on 600 V.DC are used. Top speed is 80 km/h. The length of one car is 2429 mm (79'-8½"). Weight is 29,700 kg (33 tons). One car will seat 64 and stand an additional 120 or 368 passengers for a 2-car set. Cars are numbered 1001 to 1016, inclusive.

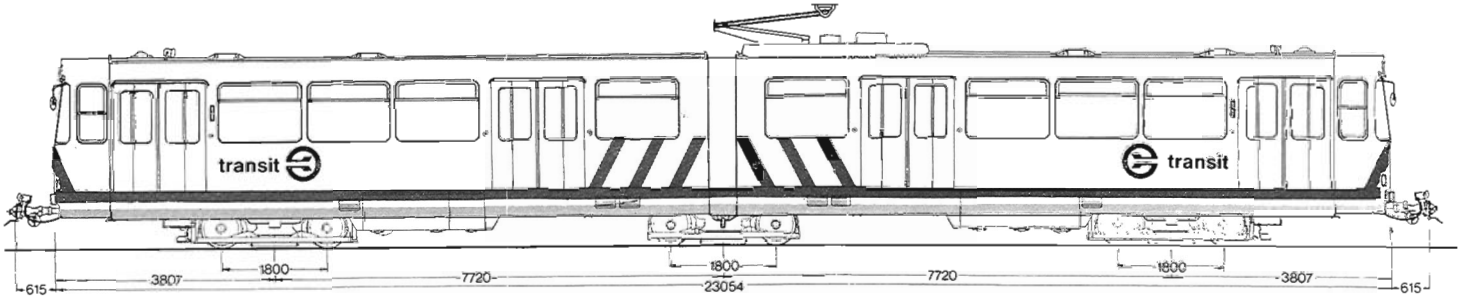


Technical Data:

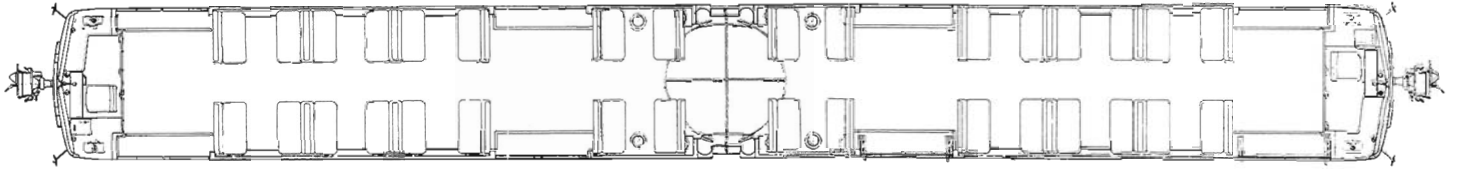
Type	6 axle, 2 section articulated double-end light rail vehicle.
Axle Arrangement	4 motored and 2 non-motored.
Motors	2 self-ventilated 218 h.p. series-wound traction motors.
Top Speed	80 km/h (50 m.p.h.)
Length	23, 054 mm. (75'8")
Length incl. couplers	24,284 mm. (79'8")
Width	2,650 mm. (8'8¾")
Height	3,660 mm. (12'0")
Voltage	600 v.dc
Passenger Capacity	64 seated, plus 162 standing
Noise	50 ft. from car 75 dB. (quieter than a diesel bus).

Edmonton transit





measurements in mm.



Light Rail Transit has become a reality for Edmonton. The City of Edmonton has the distinction of being the first city in Canada with a metropolitan population base of under 1 million to have such a system.

Edmonton has selected the Siemens/DüWag car for use on the Northeast Light Rail Transit Line. Although the car is German built, approximately 35% of the car's components were manufactured in Edmonton.

The car body is a lightweight welded steel design. The whole atriculated portion of the car is covered by reinforced plastic parts, which are harmoniously adjusted to the interior lining of the car and provide maximum protection for the passengers. The articulated platform permits safe passage from one section of the car to the other.

Good noise insurlation has been provided by noise absorbing layers on the inside of the side walls and by glass wool layers within the ceiling. The floor is made of 16 mm. Delignit plywood and is covered with a solid carpet. Further noise reductions have been achieved by insulating motor trucks with rubber buffers.

Edmonton's light rail vehicle has upholstered seats of modern design. They are arranged compartment-wise. At the aisle side, they are suspended from the car roof by the vertical hand-rails.

Fully enclosed drivers' cabs are provided at both ends of the car, with access from the passenger compartment by a door. The cab's design allows for easy operation of the control equipment, good visibility, good ventilation, a comfortable driver's seat and pleasing colours.

Heating is provided by forcing outside air through the electric resistance coils and then into the passenger compartment. The heated air is controlled by thermostats. During the summer, the equipment is used for ventilation of the car. The air in the car is exchanged about 30 times per hour.

The car's doors are individually operated by a passenger push-button after having been released by the operator. Safety of these doors is guaranteed by photo-electric cells and sensitive edges.

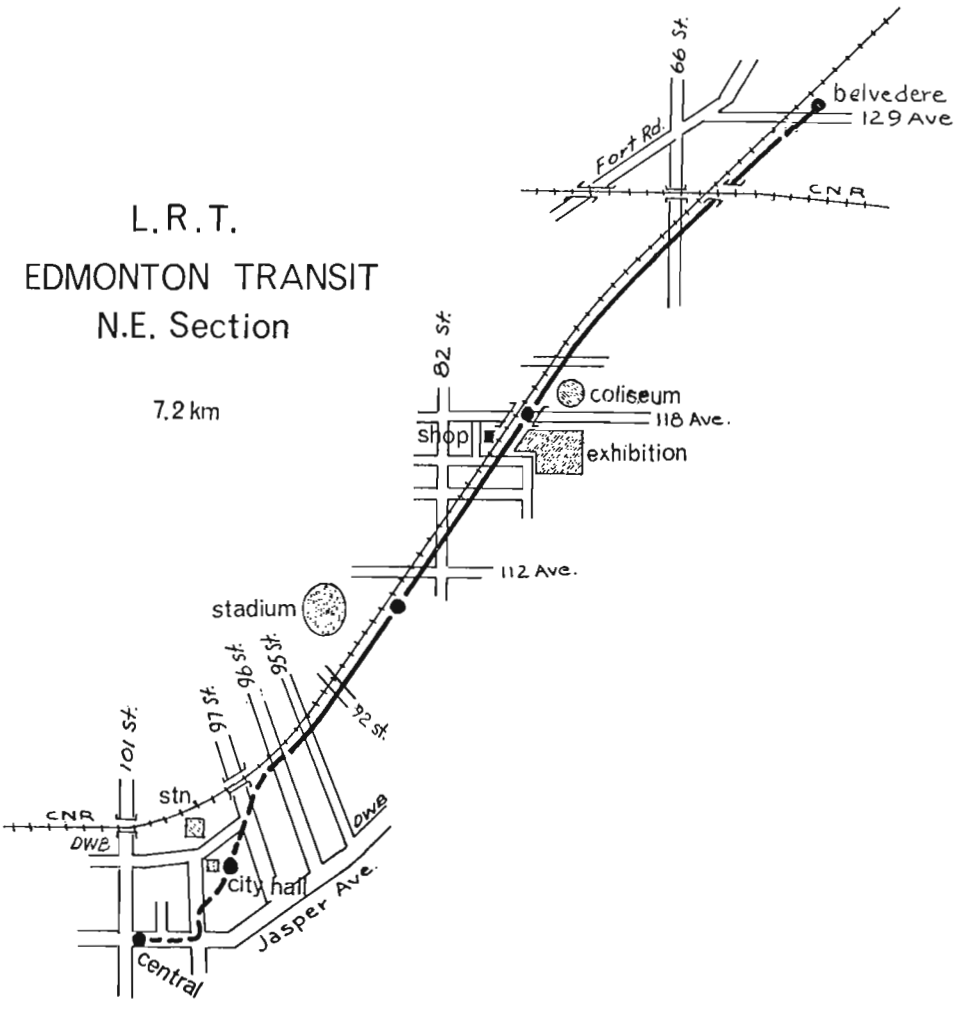
For additional ventilation in summer, the upper portion of the window can be opened. All window panes are of safety glass.

Electronic controls prevent wheel spinning or sliding and solenoid-operated, heated sanders are provided at both sides of each motor and truck in order to improve adhesion under bad conditions.

Edmonton's initial order of 14 light rail cars will have the capacity to comfortably carry 5,000 to 6,000 people per hour in each direction during peak periods. These vehicles, with a top speed of around 80 km/h will travel the 4.5 mile Northeast Line in 12 minutes. This is about half the time required for an automobile or bus to the travel the same distance.

LRT train 1001 leaving Stadium Station on May 23, 1978. The LRT system was immediately put to the test by transporting thousands of visitors and athletets alike to and from the Eleventh Commonwealth Games which were held in August. Photo courtesy Ted Wickson.

Car 1012 heads a train into the sunlight at 95th. St., CN tracks are on both sides of the LRT at this point. The LRT line terminates 1.6km underground and to the left. Photo courtesy of the authors.

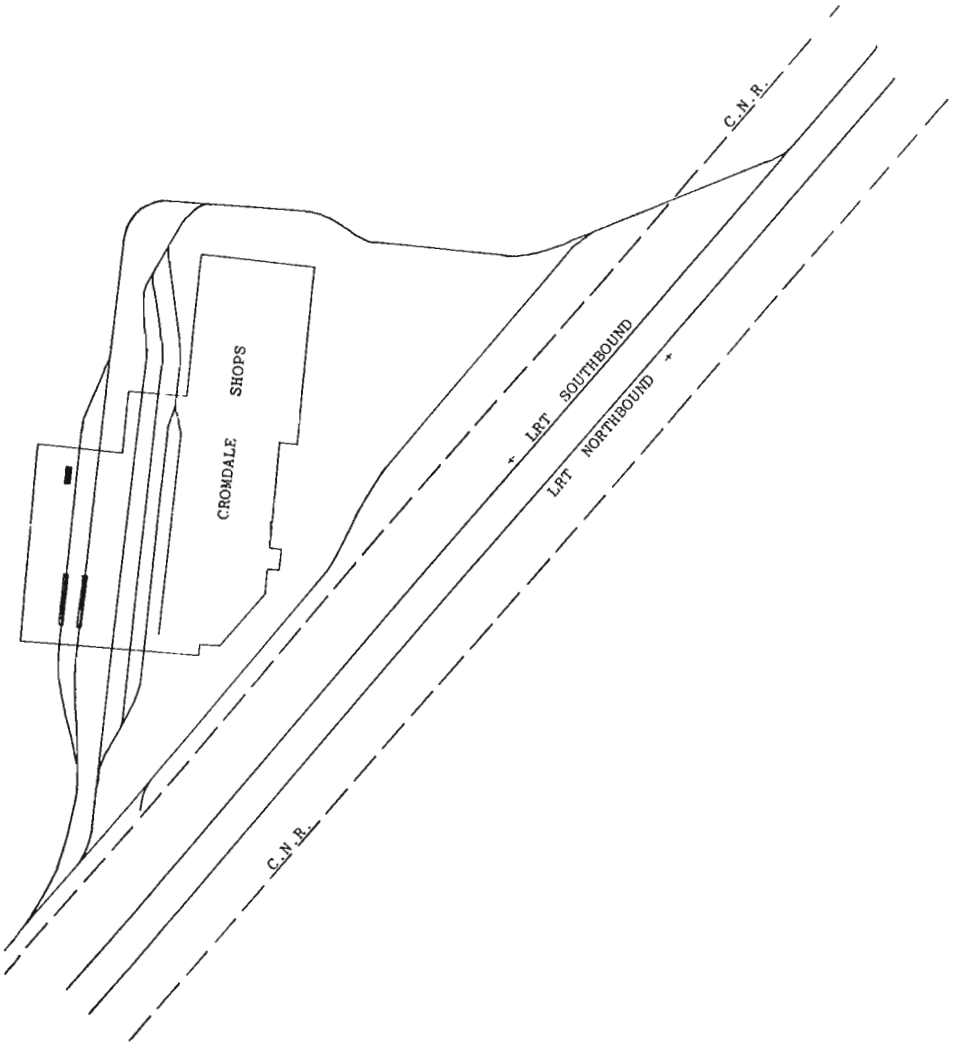


Right of Way

Welded rail is used on wood ties in the subway and joined rail is used on the surface. Underground, the rail and tie are separated by rubber pads and Pandrol clips are used. Track centres are 3.55 m (11'-8"). Overhead, single catenary wire is suspended on brackets from a pole between the tracks. In the subway, the wire is fastened to hangers from the ceiling. Track sections are blocked and speed controls are installed between the rails. Telephones connect all cars with the control center and 88 remote cameras patrol the stations.

On May 24, 1978 Ted Wickson caught this LRT train at Central Stn. the downtown terminus.

Car 1014 leads this inbound train at Stadium Station on May 23, 1978. Photo courtesy Ted Wickson.

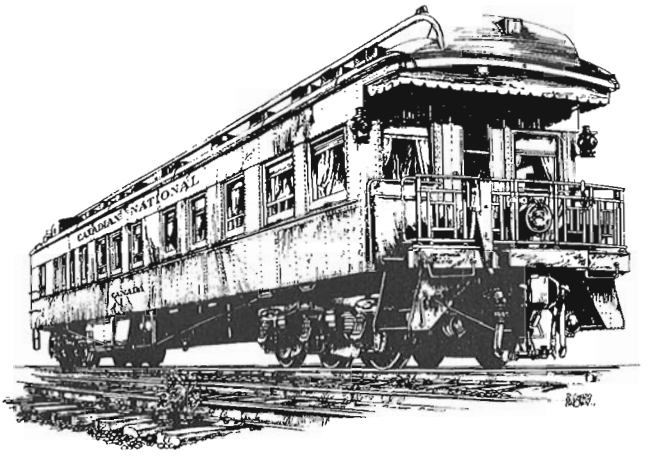


Conclusion

Since 1970, Edmonton Transit has experienced a 43.6 per cent increase in ridership, outpacing the 25 per cent population increase, strong indication that people will use public transit.

Future plans call for an extension to the Southside and Mill Woods area, the cost of which is estimated at $137 million. It is proposed that the existing line be extended about 2 km to Clareview Town Centre, a new development. Studies are underway to evaluate lines to west Edmonton and another northwest to the City of St. Albert.

It is generally agreed that the line is a welcome addition to help reduce the autos moving in Edmonton's core. The LRT is an excellent modern system and Edmontonians can be very proud of their new line.



The business car

WE WISH TO TAKE THIS OPPORTUNITY TO WELCOME JACK BEATTY INTO THE Canadian Rail family. Jack is no stranger to our readers as he has contributed on a regular basis over the years to our magazine. Jack will be our BUSINESS CAR editor effective with this issue. John Welsh who has held the post for over a year now will assume the 'fireman's seat' and will continue to help out as his time and health permit. We wish to take this opportunity to thank John on behalf of all our readers for his Business Car presentations over the past months.

VIA RAIL PROGRESSES FURTHER. SOME TIME AGO, COMMENT WAS MADE TO the effect that the only tangible evidence was a consolidated time-table. Since then, of course, that has been divided into three regional folders. Also, a common-fare structure has been implemented. However, at the Fall Change of Time Oct. 29th, it is expected that a number of the Government's proposals for rationalisation will be implemented:

(1) A train will operate from Montreal to Vancouver via CN tracks from Central Station to a point yet to be determined between Dorval and Ste. Annes, thence via CP rails to North Bay, returning to CN North Bay-Vancouver via Capreol, Winnipeg and Edmonton.

(2) A train from Toronto to Vancouver, using CN rails from Union Station to South Parry and CP Parry Sound-Vancouver via the present route of "The Canadian".

(3) Schedules will be adjusted so that both trains will be in Winnipeg at the same time. They will divide at Winnipeg, with one train taking the CP route to Vancouver, and the other going via CN. This will permit passengers en route from Montreal to Calgary or from Toronto to Edmonton to make suitable connections.

(4) To facilitate arrangements for sleeping car passengers, it is expected that one sleeper will be on the train from Montreal to

Winnipeg, where it will be transferred to the train from Toronto for handling Winnipeg-Vancouver via Calgary. Likewise, a sleeper on the train from Toronto to Winnipeg will be transferred to the train from Montreal for the trip to Vancouver via Edmonton.

VIA is also echoing the viewpoint of many when it condemns the misguided policy of moving stations to the suburbs. Whatever is gained in reducing the number of level crossings over well-travelled city streets or in uprooting rail lines within a city's limits is lost in the inconvenience travellers have in getting to the relocated terminal. Rail stations have already been moved to the outskirts in Quebec City and Saskatoon, while future moves are planned for Moncton and Regina. It isn't too late to reverse the trend. Moncton and Regina can be left alone, and Saskatoon can look to Quebec City where a study group is looking at the feasibility of reopening the old downtown Palais Station to passenger traffic. (Montreal Gazette)

U.S. AUTO MAKERS ARE NOW REQUIRING CARRIERS TO USE ENCLOSED rack cars, which are intended to stem the theft and vandalism of transported cars that last year (1977) cost an estimated $212 million in losses, reports "Business Week" (May 15/78)

IF YOU WERE READING "RAILROAD STORIES" IN 1936, YOU WILL REMEMBER the first of Donald M. Steffee's annual speed surveys, later run in "Trains". The latest appears in Quarterly Issue No. 3 of "The Timetable Collector" (May 15/78) and spans 17 pages, with many reproductions from tts, guides and the first survey of world trainspeeds that was available to the reading public - the now rare "Express Trains - English and Foreign" by Forwell and Farrer, published in 1889. Mr. Steffee subtitles his article, Keys to the Speed Survey, and discussed in critical detail the clues and reasoning that go into his work. In his five-page tabulation of today's"fastest" (75 MPH or better) U.S. has 73 runs by Amtrak Metroliners and one by a Conrail Silverliner; six runs by Amtrak diesel-powered trains. For Canada, CN is credited with 12 runs by Montreal-Toronto Turbos and Rapidos.

His overseas listings include Japan, Great Britain, France West Germany, U.S.S.R., France & Belgium, Italy and Sweeden. Three countries show runs averaging in excess of 100 mph. Japan, of course, leads with Hikari averages as high as 110.2 mph. France has one run (Etendard) of 62.7 miles at 101.5 pmh. The British have four trains Swindon-Reading at an average of 103.2 mph.

The Foxwell/Farrer book recognizes the following "best express mileage" in Canada, based on August 1888 timetables:

Grand Trunk - Chatham-London, 63 miles at 41 mph;
" " - Point Edward-London, 64 miles at 41 mph;
Michigan Central - Niagara Falls-Windsor, 225 miles at 40 mph (by two trains)

VANCEBORO (MAINE) ENGINE HOUSE, FORMERLY OWNED BY THE MAINE Central and now by CP Rail, has been leased by the San Louis Central, southern Colorado shortline, to handle maintenance of 250 of San Louis' reefers now leased by CP Rail to handle potato traffic in the Maritimes. This is reported in "The 470" (Portland Division, Railroad Enthusiasts), June/78. The cars assigned to this service represent more than 50 per cent of the 12-mile roads fleet. Much of the fresh produce business once handled by the San Louis Central on its home line, Monte Vista-Center, has been captured by truckers. Now, the Vanceboro operation employs four men full-time.

E & N UPDATE - FROM JULY 28, THE VICTORIA COURTENAY SERVICE HAS been improved by addition of a second RDC, following urgings by B.C. Premier Bennett and others. A Vancouver Sun story, July 22, said "the decision to add the extra car was made after CP Rail officials noticed an increase in passengers due to the introduction of reduced fares July 8 by Via Rail". Two weeks earlier Bennett rode the line and found many prospective passengers being turned away for lack of seats. (Victoria-Courtenay one-way fare has been reduced to $8.00 from $14.45; Victoria-Nanaimo to $5.00 from $7.60) The Committee to Save The E & N has been active in promoting public support for the provincial government's fight to keep the service going, despite the CTC's decision to allow CP Rail to terminate it Dec. 13/78.

ENTERPRISE IN CRANBROOK, B.C. IS REPORTED IN "THE SANDHOUSE" (of CRHA's Pacific Coast Branch), June/78. In a letter to the editor, Garry W. Anderson of Cranbrook, writes "We are presently building Stage 1 of a Railway Museum dedicated to the "Crowsnest and Kettle Valley" route of the CPR (i.e. the southern CPR). Stage 1 includes the renovation/restoration of one of the Class "A" dining cars built by the CPR in 1929, as well as the restoration of an old 1912 caboose. Stage II will see another coach added for exhibition purposes and an old water tower relocated to our site. Stage III should see an old station built and Stage IV, a locomotive added to complete the picture. Included in our project is the development of our archives which will consist of a small but expanding library, a catalogued collection of photographs and many historical pieces of railroad artifacts". Garry writes on behalf of the Cranbrook Archives, Museum and Landmark Foundation.

TROUBLE ON THE TAZARA - CHINESE RAILWAY EXPERTS IN TANZANIA AND Zambia who were due home at the end of the year will stay in Central Africa for another two years. The Tazara Railway, Chinese-built lifeline for Zambia to a seaport, has suffered through "local workers' negligence, complacency and extravagance", according to Tanzania's Transport Minister. A group of Chinese technicians arrived recently in Zambia to train new railwaymen to replace those under arrest for stealing freight. In addition, less than 50 per cent of Zambia's rolling stock and only eight locomotives are serviceable through lack of maintenance.

(London Daily Telegraph, Aug. 4/78)

ALGOMA CENTRAL LAST YEAR CARRIED A TOTAL OF 108,000 PASSENGERS on tours and regular service, up from 103,000 a year earlier. With its Agawa Canyon trains in summer and snow tours for three months in winter, ACR carries at peak (in September) 2,400 passengers a day requiring two trains of 22-24 cars each, according to a Toronto Globe & Mail review, Aug 23/78, which quotes vice-president (rail division) Stanley Black. ACR has been making a profit for the past decade. Profit in 1977 was $7.1 million compared with $4.1 million in 1976.

HALIFAX-MONTREAL RAIL PASSENGER TRAFFIC ROSE 40 PER CENT IN THE first six months of 1978, compared with the corresponding period last year. This statement by a Via Rail Canada spokesman, published Aug. 10/78 prompted (for no particular reason) a look-back at the June 1912 schedule of the "Ocean Limited"

	No. 199			No. 200	
Halifax	lv.	8:00	Montreol	lv.	19:30
Moncton	"	14:20	Levis	"	24:10
Levis	"	3:00	Moncton	"	15:45
Montreal	arr.	7:35	Holifax	arr.	22:00

AMTRAK UPDATE (SUBJECT TO CHANGE WITHOUT NOTICE) - THE U.S. House of Representatives voted June 23/78 to prohibit Amtrak from dropping any passenger trains before Oct. 1, 1979. The Transportation Department had proposed paring Amtrak's system from 27,000 miles to 18,900 miles. Its documentation of Amtrak's cost-problems focussed on making the system more labor efficient; "ontiquated work rules" are cited for inflating Amtrak's operating crew costs to $87.9 million annually. ICC records show that the average annual salary of a Santo Fe passenger train engineer last year was $27,652. Conductors were paid $24,763; brakemen $23,236; firemen $23,220. A Chicago Tribune article, "Labor rules run Amtrak into the ground", says of the Southwest Limited operation: "If engineers and conductors were required to work an 8-hour day, it would oppear that Amtrak could cut in half the $3.97 million a year it pays for the operating crew". Last year, the loss on the Southwest Limited totalled $24.6 million.

The leaves have fallen and the first whisp of snow flutter across the barren November landscape as CP Jubilee Type 2927 (4-4-4) steams along near West Brome, Quebec in the early fifties. Note the mixed consist including wooden trussed baggage car, heavyweight coaches, and a 'sewer' arched roof car. Photo courtesy of Jim Shaughnessy, from the CRHA Archives, S.S.Worthen Collection. ➡