Canadian Rail

april 1966

No. 176

TURBINE MOTOR TRAINS

....Michael Leduc

The coming of the steam locomotive to Canada about a hundred and thirty years ago brought about the expansion of public rail transportation, which eventually fulfilled its role by uniting the vast uninhabited areas of this nation from sea to sea. Research and development in the railway industry throughout the world brought the diesel-electric locomotive to this country in 1925; today, in 1966, both of our major railways, which initiated dieselization programs over a decade ago, are now completely dieselized, save for one 4-8-4 type locomotive on the National system which is being used for excursions.

More than ten years have elapsed since a British aircraft manufacturer sold to one of our Canadian airlines the first aircraft to be used in commercial air transportation service in North America powered by a turbine engine. This aircraft, a Vickers Viscount, was powered by four turbo-prop Dart engines. The aircraft industry has since developed many different types of turbine engines, including the jet aircraft which is powered by turbo-jet engines.

For smaller turbine-powered aircraft, United Aircraft Corporation has developed a gas turbine engine weighing two hundred and fifty pounds and capable of producing four hundred and fifty horsepower. It is this engine, the UACL ST6 that has been adapted for railway use by having its driving shaft connected to a gear box rather than the usual propeller in aircraft application.

United Aircraft Corporation has designed a light weight train, constructed of aluminum and aerodynamically designed to reduce air and surface resistance at the front and close the space at the rear of the train where a vacuum is caused when a train is moving at high speeds.

Advocates of the Turbine Motor Train claim that conventional trains are not economical at higher speeds as they require more horsepower but do not necessarily add to passenger comfort. TMTs are designed to bring about economies by lowering wind resistance in four design features. The first step was to reduce weight by specifying aluminum construction and the use of lightweight turbine engines for power. The train's streamlined design reduces aerodynamic drag at speed in excess of 80 m.p.h. The third concession to speed is the reduction in the number of axles, since each pair of wheels and axle have inherent frictional losses at bearings and between wheels and rails.

The fourth feature is the use of a car suspension system whereby axles are partially guided by the articulation of the train around curves, rather than by the flanges alone. The reduction in weight and in the number of axles is expected to lower operating and maintenance costs materially. Increased utilization is obtained through reduction of the length of time required in backshop, as the major working components -- turbines, air conditioning apparatus and wheel sets -- can be replaced, individually, in less than an hour.

In designing the train, United Aircraft has made two other changes to reduce air resistance: (a) It has encased the bottom of the train in aluminum sheathing; (b) It has provided a diaphragm at the contour line of the cars where they meet. The interior of the train will be pressurized slightly, causing air to escape from rather than enter the train, should there be any openings. Heating and air-conditioning will be electronically controlled. Each car will have two air-conditioning units, and heat will come from a sidewall duct thus eliminating wall chills. Maximum ventilation rate, per person, will be forty-five cubic feet per minute. The heating and air-conditioning systems are designed to provide normal indoor temperature through an exterior temperature range of forty below, to one hundred degrees above zero, Fahrenheit.

Interior seating configuration may be three, four or five abreast depending upon the desire of the railway. The interior arrangement can be changed in a very short period of time as the seats fit into tracks in the flooring, similar to an aircraft. The powered units at both ends will have a vista-dome where lounge chairs may be placed and bar facilities provided.

Interior of the cars will be five inches wider than conventional coaches; this is made possible by the articulated design and the elimination of exterior grab irons. The large first-class reclining airline type seats will be three inches wider than the standard railway coach seat. Each seat will have a headrest, its own armrest and an ashtray. On the back of the seat will be a folding tray table to be used for meals as served by a steward or hostess; self-controlled reading lights are also provided at each seat.

The centre of the passenger car will incorporate the galley for prepared foods, the deluxe lavatories with three-way mirrors and luminous ceilings, and the doors. The floor of the car is lower than the standard level platform; thus, when the train is in a station such as CN's Central Station in Montreal, one step up is required by the detraining passenger. At most stations with a low level platform, the passenger will only have to make two steps upward to reach the train floor level. The doors are sealed such as in an aircraft, and the steps fold out.

The vista-dome is also the cab. The engineman will be located at the end of one power dome car while his helper (or "fireman") will be located in the corresponding position at the other end of the train. Because the TMT is double-ended, there are controls and gauges located at both ends. The helper at the rear of the train can watch its performance and can immediately take over the controls should the engineman become incapacitated or an emergency develop. The rear-end man has signals and train in full view as well as communication with the engineman.

Train and turbine engine noise within the coach is suppressed to a minimum. This is accomplished by interior pressurization, generous use of rubber in isolating noise-producing elements, heavy structural skins and good lining. Each


CN
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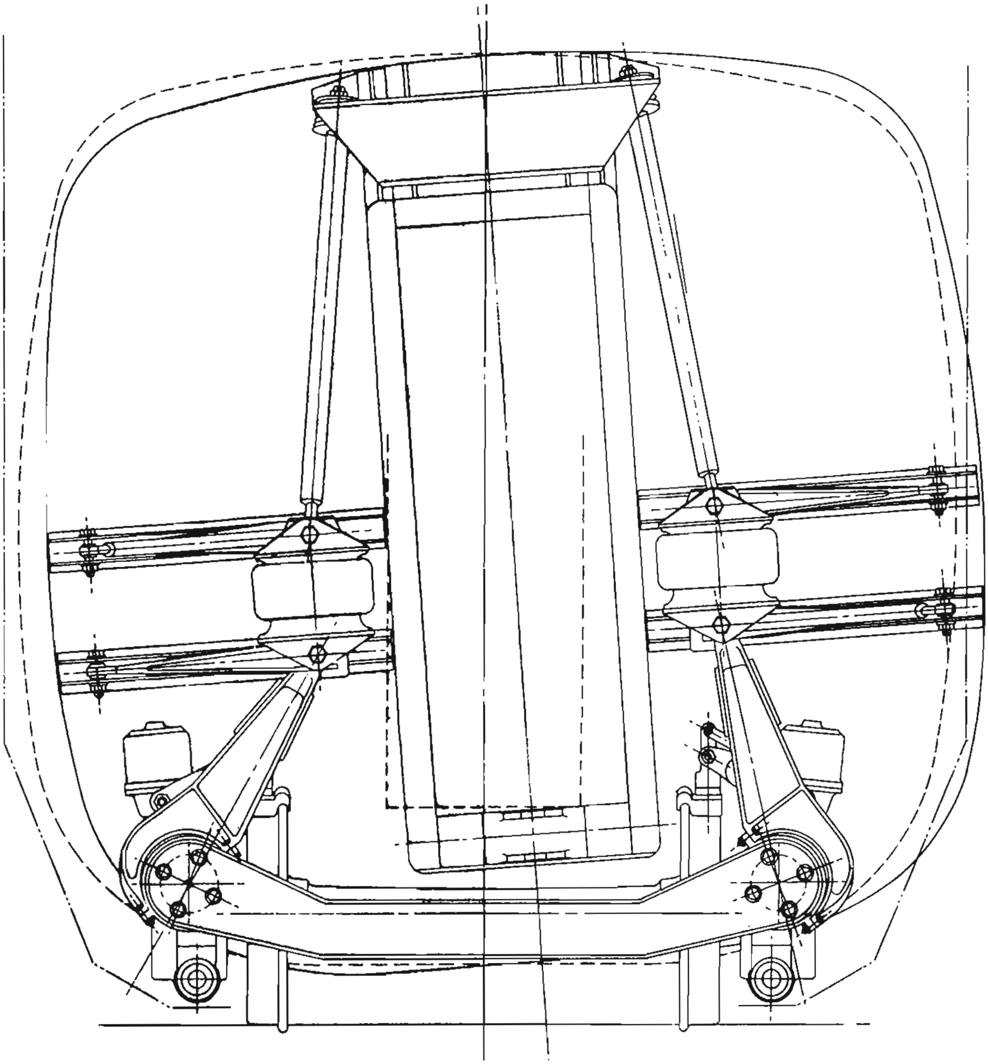


ABOVE: Single-axle truck installation, showing section of car.

LEFT: Artist's conception of the Turbine Motor Train with the night skyline of Montreal in the background.

seat has an individual window which minimizes the sound of passing trains. The noise from the turbine engines is also diminished by the low power requirements and overhead ventilation in the power dome car.

Many of the above-noted improvements to rail travel have been adapted from the commercial airline passenger aircraft of today. Suspension is one item that could not be adapted, but had to be thoroughly reviewed and improved upon for the turbine motor trains by United Aircraft. Conventional spring suspensions were disregarded because of undesirable coupling; this spring system permitted the car and its load to be tipped to the outside of a curve when taken at high speed; the designed TMT suspension supports the car from above and provides a pendulum action causing the car body to tip inwards on curves at speed. There are two supporting arms attached to the bearing housings with rubber torsilastic springs, mounted at an angle, which provides a projected support point near the roof of the car; the car itself rests on air springs mounted on top of these arms. When a lateral force is applied to the car body, as in a high speed curve, the two arms are rotated in the direction of the force. Because of the angle between the two, one arm exhibits a downward movement, the other an upward one. This banks the car body against lateral force and adds to the passenger's comfort by keeping him upright in his seat.

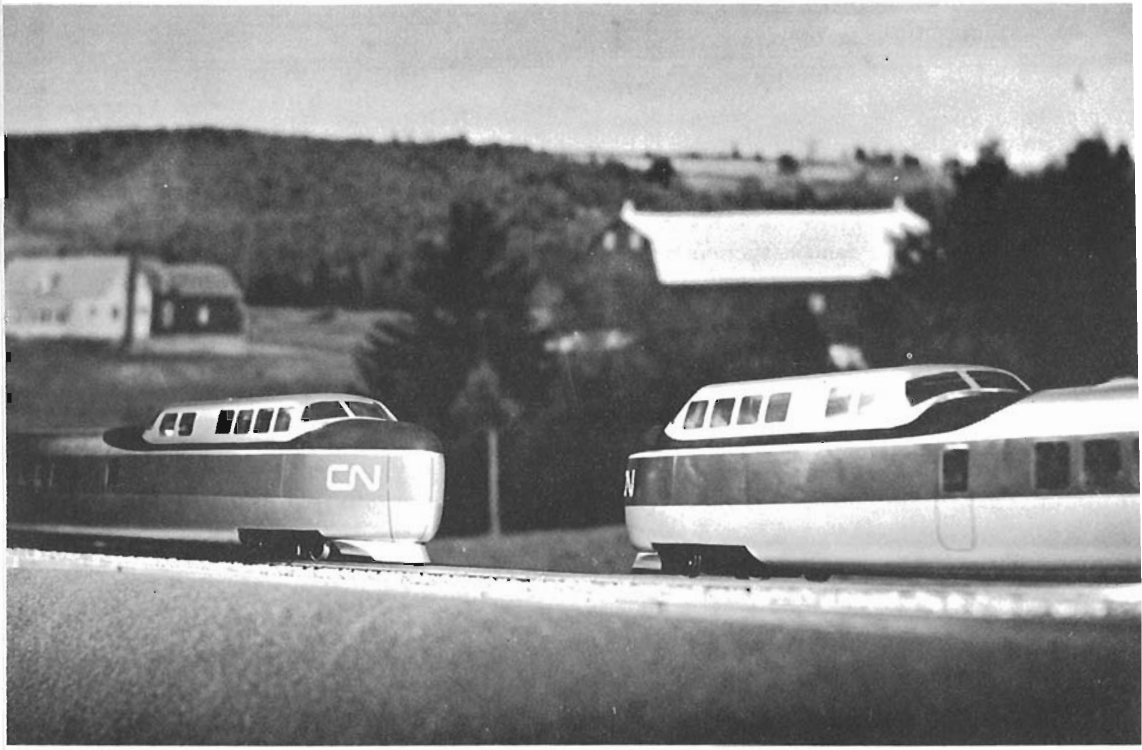
The centre of gravity of the car is forty inches above the rail head. The power dome car also has a centre of gravity lower than conventional equipment. The added height of the dome on the power car is compensated by the weight of the power plants, fuel, etc., located below. It is claimed that this provides more comfort than conventional trains on present track and under present speed conditions, especially so on present curves, where the TMT is designed for speeds up to forty percent greater than conventional equipment. The speed of conventional trains on such curves may only be raised by increasing the superelevation -- undesirable for freight trains with their slower speeds and higher centres of gravity. The degree of curvature may, of course, be lessened by land expropriation, but this is a costly procedure.

The cars are coupled just above the common axle by an articulated joint. At each end of an axle are two bars, each connected to a car. These bars are actually worm encased drag links which guide the axle around a curve; contrasted with the principle of the leading axle on a standard truck "finding" its way around it. These drag links are connected to the cars by a universal joint and can be uncoupled at the "boot" on the ends of the axle.

The air brake unit is situated above each wheel of the axle; this brake system is pneumatically controlled by the engineman. Standard emergency systems common to conventional trains form a part of this equipment.

RIGHT: (Top) Two Turbotrains in a rural setting.

(Bottom) Cutaway model showing the installation of turbine engines and mixing gearboxes below the "dome" section in the power car. The engineman sits at the front of the dome; there is a parlour-chair section with ten seats behind him.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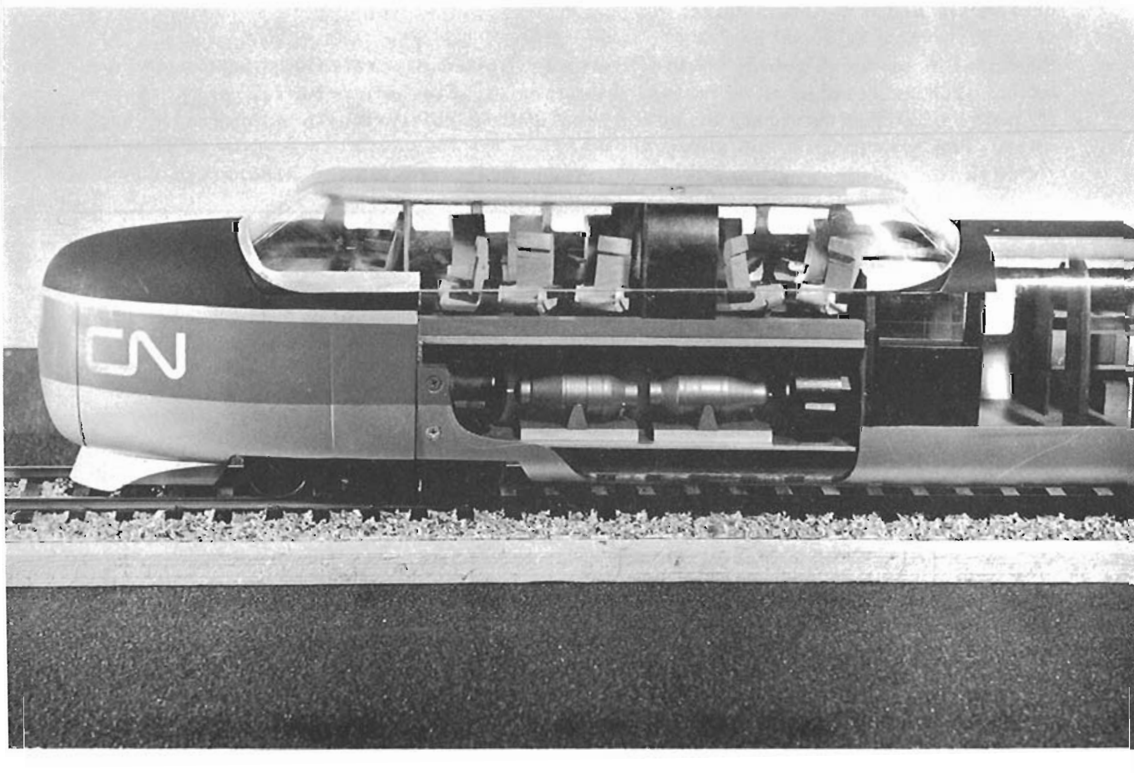

CN

The number of turbine power plants, as described previously, may vary from two to six per power dome car. The power plants are evenly distributed on each side and are connected to a right-angle; reversing gear box on the same side; this box is shaft connected to a central gear box which in turn has drive shafts transmitting power to the axles. As an aid to the operation of the trains through tunnels or other confined areas -- such as Central Station, Montreal -- where fumes might be expected to produce a hazard, the power units can be provided with an optional direct current electric traction motor connected to the central "mixing" gear box, which can draw power from a third rail. As the turbine power plants can be started electrically, there is no delay in bringing them into action in a transition from electric to turbine traction, once a tunnel or confined area has been cleared. Incidentally, the low contour of the trains keeps the vista domes well within standard clearance.

In summarizing the foregoing, the TMTs are designed to (a) attract more passengers through faster schedules, comfort and amenities; (b) reduce operating costs; (c) eliminate the use of electricity for traction, substituting turbine engines; (d) permit higher speeds without radical track alteration, and (e) decrease equipment inventory by increased utilization of the rolling stock.

UAC engineers claim that on the present CN roadbed between Montreal and Toronto, the TMTs can travel at speeds up to 125 m.p.h. They also estimate that with minor adjustments to level crossing signal circuits, the train can cover the distance of three hundred and thirty five miles in three and a half hours. Just think back a couple of years when the fastest train between these centres required six and a quarter hours!

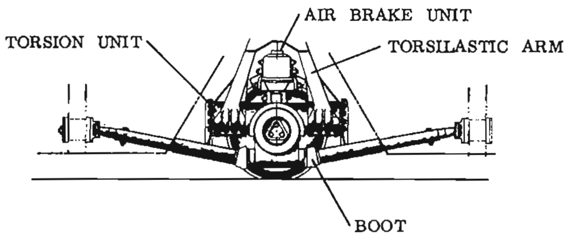
The design of the Turbine Motor Trains by United Aircraft Corporation was the topic of Mr. Thomas R. Wheaton, Manager of Marketing-Rail Transportation Systems of United Aircraft at our Association's thirty-fourth anniversary banquet. The information and some photographs for this article were made possible through the courtesy of Mr.Richmond, Vice-President, United Aircraft of Canada.

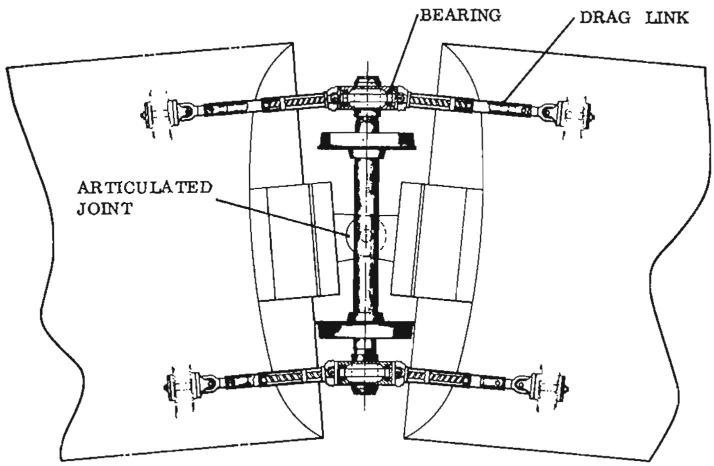
CANADIAN NATIONAL TO USE TURBOTRAINS

On May 17th, Canadian National Railways announced that it had concluded arrangements to acquire five seven-car turbotrains on a lease arrangement, to be used between Montreal and Toronto beginning in centennial year. Two trains, to be constructed by Montreal Locomotive Works (with turbines being built by United Aircraft at Longueuil, Que.) will be delivered in April 1967, two in May, and the last in June. The trains will be used in coupled pairs, making available two fourteen-car trains with a spare seven-car set under maintenance on a rotating basis. It is stated that the trains will be capable of 160 m.p.h., thus taking between three and four hours for the 330-mile journey.

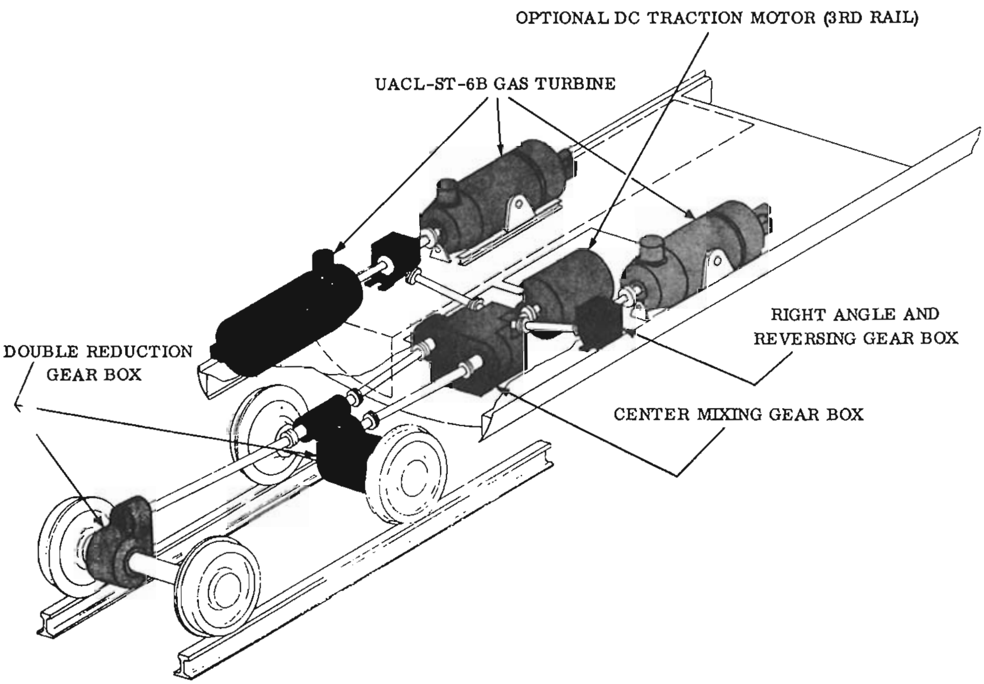
Upgrading of track and roadbed is indicated for this projected service, along with such other refinements as lengthening of signal circuits for level crossings.

NOTE TO READERS: Please bear with us until the magazine is back on schedule. For this reason, some of our features, such as "Railography" will be omitted, or appear sporadically in the next few issues. At present, the physical preparation of "Canadian Rail" is a one-man job.
(OSAL)





MECHANICAL DRIVE SYSTEM



MECHANICAL DEPARTMENT DIESEL UNIT DATA BOOK

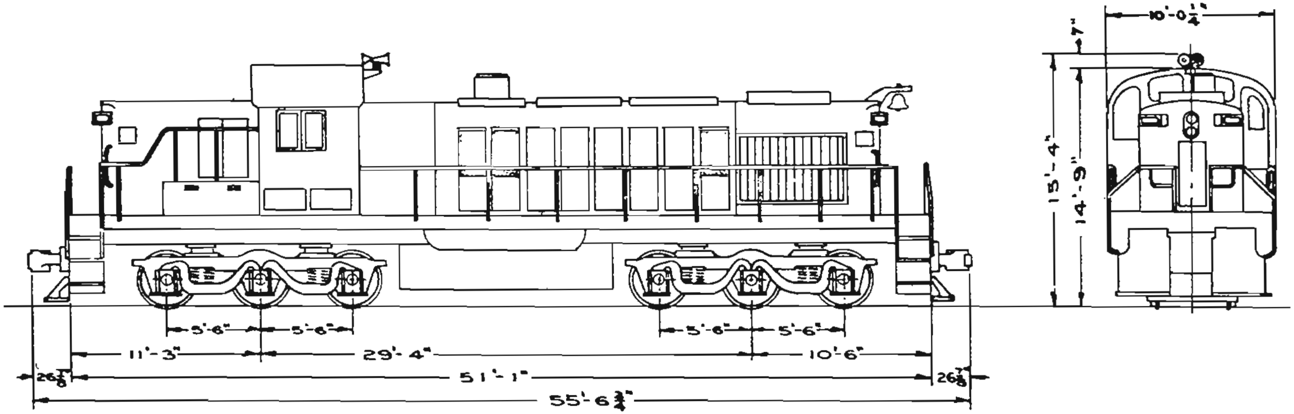
CLASS: MR-10d   NUMBERS: 1730 To 1734 *

DIESEL ENGINE:	1000 H.P. Alco D.E.W. in line Model 539 6 cylinder, 12½" bore, 13" stroke, 740 R.P.M. Full speed 315 R.P.M. Idling "

WEIGHT DISTRIBUTION	FR. MIN	REAR MIN.	TOTAL	FR. MAX.	REAR MAX	TOTAL
LIGHT	109,146	110,672	223,828	113,496	114,932	226,328
LOADED	116,750	116,750	237,500	121,000	121,000	240,000

BUILDER	M.L.W.
ORDER Nº	SO. 4205
MODEL Nº	
DATE BUILT	1957

* BEFORE CONVERSION TO MOD. NO. HQ. 580



CAPACITIES

ENG. COOLING WATER	200	IMP. GAL.
LUBRICATING OIL	67	IMP. GAL.
FUEL OIL	1000	IMP. GAL.
SAND STORAGE	27	CU. FT.
STEAM GEN. WATER	-	IMP. GAL.

OPERATING FEATURES

MAX. SPEED	60	M.P.H
GEAR RATIO	75 : 16	
T.E. STARTING		
T.E. CONTINUOUS	30,000	
OPER. CURVE ALONE: 30°	COUPLED: 30°	

WHEELS: TYPE & CLASS
A-40 "C"

JOURNALS: TYPE & SIZE
Timken 6½" x 12"

TRUCKS
All coil springs
Front Model 51540
Rear Model 51541

STEAM GENERATOR
None

AIR COMPRESSOR
WESTINGHOUSE 3 CD

COOLING FANS
One Mechanical Drive

AIR BRAKE
Westinghouse 6 SL

ELECTRICAL EQUIPMENT

TRACTION MOTORS
Four
C.G.E. 731

T.M. BLOWER
Two
Sturtevant
Mechanical Drive

MAIN GENERATOR
C.G.E. GT-553

AUXILIARY GEN: TYPE & Nº
C.G.E. G.M.G.
139 P A 3

ALTERNATOR: TYPE & Nº

M.U. CONTROL
Yes

DYNAMIC BRAKE
No

MECHANICAL DEPARTMENT DIESEL UNIT DATA BOOK

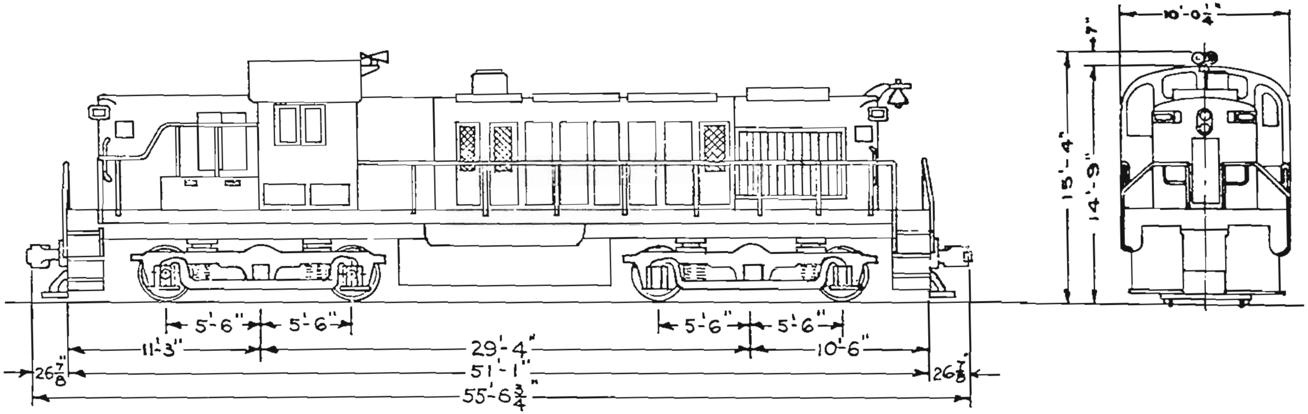
MR-10d (CLASS) — To 1730 1734 * (NUMBERS)

DIESEL ENGINE: 1000 H.P.
Alco D.E.W. in line Model 539
6 cylinder, 12½" bore, 13" stroke,
740 R.P.M. Full speed.
315 R.P.M. Idling speed.

WEIGHT DISTRIBUTION	FR. MIN	REAR MIN.	TOTAL	FR. MAX.	REAR MAX	TOTAL
LIGHT						
LOADED						231,000

BUILDER	M.L.W.
ORDER Nº	SO.4205
MODEL Nº	
DATE BUILT	1957

* AFTER CONVERSION TO MODIFICATION NO.HQ. 580



CAPACITIES

ENG. COOLING WATER	200	IMP. GAL.
LUBRICATING OIL	67	IMP. GAL.
FUEL OIL	1000	IMP. GAL.
SAND STORAGE	27	CU. FT.
STEAM GEN. WATER	-	IMP. GAL.

OPERATING FEATURES

MAX. SPEED	60	M.P.H
GEAR RATIO	75 : 16	
T.E. STARTING		
T.E. CONTINUOUS	30,000	
OPER. CURVE ALONE: 30°	COUPLED: 30°	

WHEELS: TYPE & CLASS
A-40 "C"

JOURNALS: TYPE & SIZE
Timken 6½" x 12"

TRUCKS
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Westinghouse 3 CD

COOLING FANS
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Westinghouse 6 SL

ELECTRICAL EQUIPMENT

TRACTION MOTORS
Four
C.G.E. 731

T.M. BLOWER MOTORS
Two
Sturtevant
Mechanical Drive

MAIN GENERATOR
C.G.E. GT-553

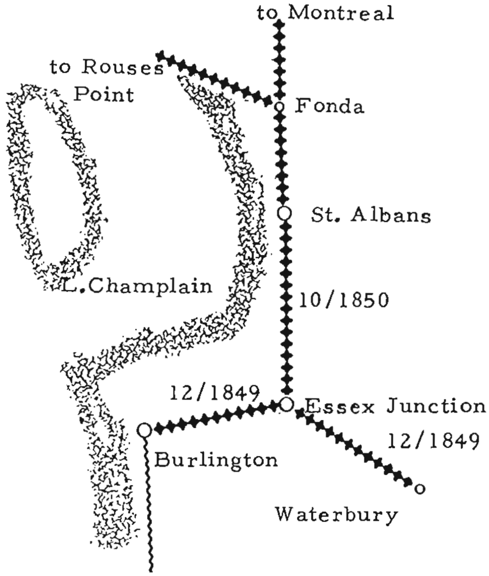
AUXILIARY GEN: TYPE & Nº
C.G.E. G.M.G.
139 P A 3

ALTERNATOR: TYPE & Nº

M.U. CONTROL
Yes.

DYNAMIC BRAKE
No.

ESSEX JUNCTION



The two railways serving Burlington, Vermont from the south -- the present Central Vermont and Vermont systems -- first reached the Lake Champlain metropolis in the year 1849. While it was some time before what was later to be the Rutland system extended its tracks northward across the Lake Champlain Islands, the Vermont Central, the CV's ancestor, had already resolved upon a continuation northward to St. Albans and Rouses Point, NY. This extension was opened to St. Albans in October 1850, and since it was not feasible to carry the new tracks on from the end of the line in Burlington, the new Vermont & Canada Rail Road took off from the parent system at a point a few miles short of Burlington, as shown in the schematic map above; situated in the corporate town of Essex, it was named, quite naturally, Essex Junction.

Train patterns being what they were at that time, it was some years before a through service was established from White River Junction through to points north of Essex Junction. Most trains southbound through St. Albans, or northbound through Waterbury went into Burlington, and corresponding services originated there. As a consequence, through passengers changed at Essex Junction. It frequently transpired that two or three trains would be in the station at once, and the unwitting farmer riding the "cars" for the first time in his life, or the nervous lady passenger with several children in tow could, and frequently did, board the wrong train in error. A contemporary Vermont legislator, the Honourable Edward J. Phelps, struck by the basic inefficiency of such arrangements and the apparent indifference of the railway management, and spurred on to literary effort after waiting nine hours for a tardy train, penned the verses which have since become far-famed as "The Lay of the Lost Traveler". These gently blasphemous lines summed up the situation to a "T"; it was apparent that if the mariners of Greek mythology had their Scylla and Charybdis, the Nineteenth Century Yankee "drummer" had Essex Junction !

-- Omer Lavallee

THE LAY OF THE LOST TRAVELER

WITH saddened face and battered hat
    And eye that told of blank despair,
On wooden bench the traveler sat,
    Cursing the Fate that brought him there.
"Nine hours", he cried, "we've lingered here
    With thoughts intent on distant homes,
Waiting for that elusive train
    That, always coming, never comes.
Till weary, worn, distressed, forlorn,
    And paralyzed in every function,
I hope in Hell his soul may dwell
    Who first invented Essex Junction ! "

" I've travelled East, I've travelled West,
    O'er mountain, valley, plain and river;
Midst whirlwind's wrath and tempest's blast,
    Through railroad's crash and steamboat's shiver,
And faith and courage faltered not,
    Nor strength gave way nor hope was shaken,
Until I reached this dismal spot
    Of man accursed, of God, forsaken !
Where strange new forms of misery
    Assail men's souls without compunction,
To hope in Hell his soul may dwell,
    Who first invented Essex Junction ! "

"Here Boston waits for Ogdensburgh,
    And Ogdensburgh for Montreal,
And late New York tarrieth,
    And Saratoga hindereth all !
From far Atlantic's wave-swept bays
    To Mississippi's turbid tide,
All accidents, mishaps, delays
    Are gathered here and multiplied !
Oh! fellow man, avoid this spot,
    As you would plague or Peter Funk shun
And hope in Hell his soul may dwell,
    Who first invented Essex Junction ! "

"And long and late conductors tell
    Of trains delayed or late or slow,
Till e'en the very engine's bell
    Takes up the cry ' No go! No go! '
Oh! let me from this hole depart
    By any route, so't be a long one",
He cried, with madness in his heart,
    And jumped aboard a train -- the wrong one;
And as he vanished in the smoke,
    He shouted with redoubled unction,
"I hope in Hell his soul may dwell,
    Who first invented Essex Junction. "

-- Hon. Edward J. Phelps


81-1547

MONTREAL METRO PROGRESS REPORT

Recently, the Chairman of Montreal Metro, Mr. Lucien l'Allier, issued a progress report indicating that the opening of the 4.3 miles of Line No. 1, and the 8.6 miles of Line No. 2, will take place sometime in October of this year. The 3.0 mile Line No. 4, serving the Expo 67 islands and the south shore, will be opened early in 1967, before the scheduled opening of Expo in April. The Metro system has lately been selecting and training crews and other operating staff for the line, and a majority of the 369 cars -- 246 motor cars and 123 trailer cars, coupled in "elements" of three units in a motor-trailer-motor arrangement -- have now been delivered by the contractors, Canadian Vickers Limited of Montreal.

Tunnelling is now completed, and is practically all concreted. The completion of all stations is now under contract and work is considered to be on schedule in every respect.

Some additional information about the Metro system and its equipment may be of interest to our readers. The cars will use direct current at a pressure of 720 volts. Each motor car is provided with four 155 HP d.c. motors, with the two motors on each truck being permanently connected in series. Initially, thirty-three "elements" (99 cars) will be assigned to Line No. 1, seventy-two elements (216 cars) to Line No. 2 and eighteen elements (54 cars) to Line No. 4. There is no Line No. 3 at present; this designation is reserved for the future, albeit problematical, integration of the CN Mount Royal Tunnel electrification into the Metro system. The motor cars, which are 56' 5" over coupler faces, 8' 3" wide and 12' 0" high, cost $134,000 each. The trailers, whose dimensions are the same except for a shorter 53' 11" length, cost $77,000 each.

The average station spacing on Line No. 1 os 2,260 feet; on Line No. 2, it will be 2,700 feet. Line No. 3, 3.0 miles long, has only one intermediate station. The shortest distance between stations is on Line No. 1 between St. Laurent and Berri-deMontigny, which is 1,480 feet. Longest distance is on Line No. 4 between Berri-deMontigny and Expo (St. Helens Island), 11,036 feet. The twenty-six stations will contain 123 escalators, which are used whenever the height between any two given levels exceeds twelve feet. All stations will be provided with public address systems. All stations are of the side-platform type, with the platforms some 500 feet in length, giving sufficient space for a nine car, three element train.

The rubber-tired concept is not the only idea which has been borrowed from the Paris Metro. Another practice which is being adapted to the Montreal Metro from the French capital is the provision of automatic barriers at the entrace to each platform, which are operated hydraulically. These barriers start to close at the approach of a train to a station, and their purpose is to temporarily suspend the flow of passengers onto the platform while a train is in a station, eliminating delays and potential injury to passengers rushing to board a train which is about to leave. For this reason, all platforms will be equipped with separate entrance and exit passages.

LEFT: Photograph shows a line-up of the new Metro trains at the shops.

TORONTO - 1891

Students of street railway track construction, may find the following table of interest. It gives us a glimpse of the streets of Toronto three quarters of a century ago, just at the close of the horsecar era in that city:-

Description of Track
showing different kinds of construction laid on streets

Street	30lb.rail 5" x 6" stringer	30lb.rail 5" x 8" stringer	25lb.rail 5" x 6" stringer	25lb.rail 5" x 8" stringer	22lb.rail 5" x 6" stringer
Front	-	8,111 ft.	1,311 ft.	-	212 ft.
King	14,513 ft.	-	5,199	-	21,521
Queen	47,354	-	32,343	-	-
College	8,933	13,472	4,555	-	-
Carlton	-	8,072	-	-	-
Gerrard	1,393	-	2,157	-	-
Winchester	704	-	750	-	-
Bloor	-	31,864	-	-	-
Broadview	-	13,652	-	-	-
Parliament	4,658	-	2,652	-	-
Sherbourne	-	16,190	-	-	-
Frederick	-	-	396	-	-
George	504	-	-	-	-
Church	-	7,351	-	9,713	-
Yonge	-	7,321	9,325	9,030	-
York	-	4,288	-	-	-
McCaul	-	6,677	-	-	-
Spadina	-	3,091	-	12,883	-
Bathurst	-	22,605	-	-	-
Strachan	161	-	628	-	-
Dundas	526	7,305	2,228	2,648	-
Dovercourt	-	5,692	-	-	-
Single track Feet	70,260	134,477	61,554	34,274	21,733
Single track Miles	13.11	31.28	11.65	6.49	4.11

Gauge of tracks, 4ft. 11in.; Devil's strip, 3ft. Ties and stringers are of pine. The ties are spaced 5 feet between centres, and are 4in. x 6in. x 7 feet long. Stringers are spiked to ties with 9in. x 1/2in. spikes, one through each tie, and placed on outside of stringers only.

Joint knees weigh 5 lbs. each and intermediate knees 2 lbs. 1 oz. each. There are 9-1/2 miles of iron rails, the balance are of steel. All curves, switches and diamond crossings are of cast iron.

NUMBER OF MILES OF EACH KIND OF PAVEMENT

The width of single track pavement is 8ft. 4in. and for double 16ft. 8in.

Cedar and Cobble	1.67 mi.	double	
Cedar Block	15.39 "	"	0.59 single
Asphalt and Scoria Blk.	0.50 "	"	
Sandstone setts on sand	1.61 "	"	
Scoria Blocks on Concrete	0.35 "	"	
Granite setts on Concrete	1.53 "	"	
Cobble with stone Kerbs	2.71 "	"	0.02 "
Cobble	2.89 "	"	
Granite setts on sand	4.53 "	"	
Macadam	0.36 "	"	0.48 "
Gravel	0.77 "	"	

The above data was copied from a neatly printed, but tattered booklet recently come to hand, which contains all the legal documents concerning the purchase of Toronto Street Railway Company, by the City of Toronto in 1891. Three arbitrators were appointed on June 18th 1890 to set a fair valuation. Their report dated April 15th 1891 placed a value of $1,453,788. on the property, and gives the following information:-

Rolling Stock

(a) Cars - 90 two-horse cars (closed) including the twelve original cars purchased by the Company; 56 open cars and 116 one-horse cars.

(b) Buses - 56 buses (Stephenson, N.Y. make); 43 other buses.

(c) Sleighs - 40 car sleighs (Speight & Son, makers) 60 car sleighs (T.S.R. Co. make)

Horses: - 1,372

Résumé of 1891 Documents

In November 1889 the Corporation of the City of Toronto had notified the Company that it would not renew the thirty year franchise granted to Alexander Easton, (under which the Company had been operating) when it expired in 1891. Instead it would assume ownership of the

Railway on payment of its value to be determined by independent arbitrators. This was done, and early in 1891, the City offered to sell the Railway and grant a new franchise to any group submitting the best terms. A bid was made on May 26th 1891 by Messrs. Geo. W. Kiely, of Toronto, Wm. McKenzie of Toronto, H. A. Everett, Secretary of East Cleveland Railway Co. (electric) and Chauncey C. Woodworth, of Rochester, N.Y. Apparently there were no other serious contenders, because the City asked this group to amend its bid three times, each time offering a higher scale of percentages of gross receipts to be paid to the City. Finally a by-law was passed on July 27th authorizing a satisfactory agreement, and the new Toronto Railway Co. came into being, holding a twenty year franchise.

A few of the conditions imposed by the new franchise are interesting:-

> "That they (the purchasers) will build and equip -----a car factory within the limits of the City of Toronto for the manufacture and repair of all cars and railway plant used on the said railways",

> "The City will construct, reconstruct and maintain in repair the street railway portion of the roadways, viz. for double track, 16'-6", and for single track 8'-3", on all streets traversed by the railway system, but not the tracks, and substructure required for the said railways".

> "The gauge of the system, 4ft. 11in. is to be maintained on main lines, and extensions thereof, and branch lines and extensions thereof;----"

> "Electric or other new system of motor, or a combined system, approved by the City Engineer ---- as suitable, shall be introduced within one year ---"

> "Until such changes are carried out in such a manner as will permit its disuse, horse power may be continued on branch and other lines, or parts of same, under written permit from the City Engineer, who shall have the right to order extra horse power to be employed on steep grades".

> "No cars shall be run on the Lord's Day until a Sunday service has been approved of by the citizens by a vote taken on the question".

--R.M.Binns

Francis Spencer Lewin

His many friends will learn with regret of the death, at the age of forty-two, of Francis Spencer Lewin, who was killed in an accident on June 28th, 1966.

Frank Lewin was a past Director of our Association, and in the first years of construction at the Delson Museum, lent unstintingly of his time and talent as a civil engineer to see the project well on its way. Frank was equally renowned as a miniature railroader of consummate skill, patience and precision. He came of his interest in railroading hereditarily, his maternal grandfather having been a superintending professional engineer for the Pontiac Pacific Junction Railway, near Ottawa.

Our condolences go to a grieving wife and children, who will remember their loving and devoted husband and father as a man who, in an all too short lifetime, was as successful as a businessman as he was as a friendly, warm-hearted human being.

R. I. P.

the cover

Imagine yourself stationed in this tunnel mouth behind an old-time 8x10 plate camera on a tripod, gambling on being able to get a good action shot of a way-freight bearing down on the tunnel mouth with the engine within reasonable distance, and still have time to make your exposure, gather up the camera and tripod, and run! A first glance at this picture would seem to indicate that a heroic, albeit unknown disciple of Niepce and Daguerre accomplished just such a feat; closer inspection reveals, however, that what appears to be the blast of a labouring locomotive is just the pattern of smoke emerging from the stack at the behest of a blower, during a comparatively long exposure, perhaps $\frac{1}{2}$ second or so. An equally symmetrical plume of steam escaping from the safety valve confirms this hypothesis; the engine is obviously at rest.

The photograph was made somewhere in British Columbia around the turn of the century, possibly in the southern Kootenays on the Crows Nest Pass line of Canadian Pacific.

The locomotive is one of that company's pioneer 2-8-0s, No. 316, built by C.P.R. in 1886 especially for service on the "Big Hill" between Field and Stephen, but by this time replaced by larger locomotives. Note that it is equipped with a horizontally-barred pilot, a comparative rarity on CP engines.

STANDING JOKE

Doug Wright -- Montreal Star

"Is this what Daddy means when he says the first thing the City must do is get public transportation back on its feet?".

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