GUIDELINES FOR THE PLANNING AND OPERATION
OF TROLLEY BUS SERVICES IN EDMONTON

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1.0 INTRODUCTION

Trolley buses were introduced into Edmonton shortly before World War II as a replacement for the street car system. Unlike many other North American cities Edmonton did not succumb to the temptation to scrap these vehicles in turn in favour of the diesel bus. Edmonton presently has 192.8 round trip kilometers of trolley routes and 137 trolley buses of which 37 are presently laid up (Figure 1.0.1).

The purpose of this paper is to show that the trolley bus is capable of producing significant economies for Edmonton Transit, and to set guidelines for the planning, construction and operation of trolley routes.

1.1 Cost per Vehicle Mile (Km)

The use of cost per mile has been part of diesel bus promotion for many years. The ready acceptance of this basis for comparison all over North America has brought tragic destruction to electric traction fleets, resulting in the delivery of transit systems as captive accounts to the bus manufacturers and oil companies. The use of cost per mile alone provides no indication of value, as an extreme example a ten car freight train hauled by one locomotive unit costs much less per mile than a hundred and fifty car train
hailed by five units and on the basis of cost per mile would be considered the most desirable. No one with any knowledge of transportation would subscribe to that conclusion since it is the cost per ton mile which determines a profitable or non-profitable situation.¹

Cost per unit of distance has little bearing on the worth of a vehicle to the system, other than possibly indicating that the vehicle with the highest cost per mile must be doing the most work and therefore earning the highest revenue per mile. However this conclusion is not necessarily correct because it ignores relative equipment efficiency and characteristics.²

1.2 Performance Characteristics

The General Motors 6V-71 motor used in Edmonton Transit diesel buses is rated by the manufacturers at 170 B.H.P. at 2,200 R.P.M., giving a power-to-weight ratio of 19 HP/t. Since a diesel motor can deliver no more than its rated power, buses with low power-to-weight ratios can have either a high acceleration rate or high maximum speed (by different transmission ratios), but not both.

Because of these limitations and the high cost of providing adequate power for all aspects of vehicle performance, most buses are designed either for regular service on streets, with high
acceleration capability, or for express service on freeways, with high-speed capability. Buses for cities with hilly terrain are usually designed for better climbing ability at the expense of high speed.

Data on acceleration and jerk characteristics, customarily given for rail transit vehicles, are seldom supplied by bus manufacturers. Only the times needed to reach several different speeds from start are sometimes quoted. Measurements in different cities show that typical acceleration rates of buses are in the range 0.7 to 0.9 m/s\(^2\), but some models may exceed this range.\(^3\)

The typical curve for a bus powered by a 6V-71 motor is plotted in Figure 1.2.1 and shows that acceleration falls off rapidly compared with the corresponding performance of a similarly loaded trolley bus.

The series-wound D.C. electric motor has been used for traction purposes ever since the invention of the electric street car in the mid 19th Century. In spite of its relative complexity compared with A.C. motors its characteristic of maximum torque at stall speed makes it ideal for this application. For the same reason its performance is superior to the diesel engine which is essentially a constant speed motor requiring some form of slipping clutch to enable it to start a load moving. To the passenger transit industry this means that a trolley bus with a similar
Fig. 1.2.1 Acceleration curves for 12m diesel and trolley buses under seated load conditions.
horse-power rating can outperform a diesel bus especially in the lower speed ranges where city vehicles spend most of their time.

The acceleration for a B.B.C. trolley bus is compared with a G.M.C. 6V-71N powered bus under seated load conditions in Figure 1: both have the same 184 H.P. rating. The superior acceleration of the trolley bus may be used to achieve faster start to stop times and hence higher commercial speeds.

As shown in Figure 1.2.2, over the range of urban stop spacings, the trolley bus will save 5 seconds on account of its superior acceleration. The start to stop time for a diesel bus for a typical stop to stop distance of 300 metres is 36.5 seconds, to which must be added 0.5 seconds turn on time and 8 seconds passenger loading for a total of 45 seconds. A five second reduction in this total represents a saving of 11%, or one bus in every nine presently on the road.

Figure 1.2.3 shows the variation of commercial speeds for diesel and trolley buses under seated load conditions making 8 second stops and with a layover time equal to 10% of the running time.

Platform hours vary inversely with the commercial speed of a transit vehicle. By operating diesel buses instead of trolleys (or by operating trolley buses to schedules designed for diesel bus performance) a penalty of excess platform hours is incurred. The magnitude of this penalty is shown in the table below.
Fig. 12.2. Start to stop times for max speed of 50 km/h.
Fig. 1.2.3. Variation of commercial speeds with stop spacing.
(8 second stops - 10% layover time)
The average annual kilometers operated by each bus in Edmonton in 1982 was 38,594; at an average stop spacing of 300 metres the annual saving in operating hours per trolley bus used would be 199.5. This means that, assuming cost per operating hour for trolley and diesel to be equal, by employing the 100 B.B.C. trolley buses exclusively on trolley routes and adjusting the schedules accordingly, a cost saving of approximately $700,000 per annum would be realized, and by placing the 37 sidelined Flyers back in service, a further $260,000 would be saved.

1.3 Atmospheric Pollution

A comparison of transit vehicles is not complete without consideration of the diesel's contribution to air pollution and its effect on the community in general.
For the purposes of calculation the following assumptions have been made:

a. That the GMC 6V-7l engine exhausts approximately 0.15 cubic metres per minute per horsepower at an engine speed of 2200 RPM.

b. That in normal service in Edmonton the engine speed is maintained at 2200 RPM for 35 percent of the time, output for the balance of the time is ignored.

c. That the 6V-7l engine is assumed for calculations #1 and #2 following, to be 170 HP at 2200 RPM.

d. That all of the nitric oxide generated in the engine, and exhausted, becomes nitrogen dioxide upon contact with air.

Calculation No. 1 follows and is a determination of the tons of nitrogen dioxide produced on an average weekday by diesel buses in Edmonton.

a. Since the GMC 6V-7l engine under full load is assumed to exhaust about 0.15 cubic metres of gas per minute, per horsepower, then 0.15 x 170 horsepower equals 25.5 cubic metres per minute.
b. According to S.A.E. Paper #863, titled "Diesel Exhaust Odor - Its Evaluation and Relation to Exhaust Gas Composition" by F. G. Rounds and H. W. Pearsall of the Fuels and Lubricants Department of General Motors Research staff, presented at the S.A.E. National Diesel Engine Meeting at Chicago, November 1-2, 1956, the 2 cycle 6V-71 engine produces 954 parts per million of nitric oxide, when under full load with a coefficient of variation of only 4.7%.

c. $25.5 \times 0.000954 = 0.024$ cubic metres of nitric oxide per minute, per bus.

d. The gram molecular weight of nitric oxide is 30. Upon exposure to air this becomes nitrogen dioxide with a gram molecular weight of 46. This converts to cubic metres = $46 \times 44.65 = 2054$

e. $2054 \times 0.024 = 49.3$ grams of $NO_2$ per minute, per bus. (Say 50 grams).

f. A typical weekday schedule calls for a minimum of 400 diesel buses operating for 7.5 hours.

g. $7.5$ hours = 450 minutes, therefore $50 \times 450 \times .35 = 7875$ grams per bus, per 7.5 hour weekday for a total of $7875 \times 400 = 1,000,000 = 3.15$ tonnes of nitrogen dioxide released into the air of Edmonton each day by the Edmonton Transit diesel fleet.
Nitrogen dioxide is rated by the American Conference of Governmental Hygenists at a threshold limit for an eight hour working day of five parts per million. This is one-twentieth their rating for carbon monoxide. Calculation No. 2, follows in which is determined the amount of fresh air required to dilute 3.15 tonnes of NO₂ down to the 5 parts per million maximum allowable concentration as stipulated by the ACGIH.

a. \((954 - 5) - 1 = 191 - 1 = 190\) m³ of fresh air for every m³ of total exhaust from 400 diesel buses operating a 7.5 hour day at 35 percent full load.

b. \(25.5\) m³ per bus \(\times\) 450 minutes = \(11475\) m³ of exhaust per bus, per day \(\times\) 400 buses = \(4,590,000\) m³ \(\times\) 0.35 = 1,606,500 m³ of exhaust.

c. 190 \(\times\) 1,606,500 = 305,235,000 m³ of fresh air total, to detoxify 3.15 tonnes of NO₂ per 7.5 hour day, down to 5 PPM. This times a 22 weekday month, equals over 6.7 billion cubic metres of fresh air per month: enough to cover the City of Edmonton 9 kilometers deep. This implies fresh air to start with, and equal dispersion of the poison throughout such a volume.
The electric vehicle contributes no pollutants to the air at the vehicle. Pollutants produced at the power plant in producing electricity are minor especially in view of the fact that most City power is produced from natural gas, the products of combustion of which are water and carbon dioxide, both natural constituents of the atmosphere.

1.4 Visual Pollution

The overhead wires required to supply power to trolley buses are frequently pointed to as being "unsightly", leading to the impression that if they were only removed the clear sky would show through in all its pristine glory. The facts of the matter are that, except at junctions, trolley wires constitute a very small part of the aerial clutter which adorns our main thoroughfares. When street lighting, direction signs, commercial signs, traffic signals, detection devices and support cables for Christmas displays are considered, the removal of two pairs of trolley wires would do very little to improve the upward view, especially when offset against the very tangible increase in noise and air pollution which would necessarily take place.

Intelligent overhead design can reduce visual intrusion to a large extent and this is considered in section 3.3.
1.5 **Flexibility**

Mainlines, such as those on which trolley buses are utilized change little over the years, except perhaps in length as the city expands. The need for flexibility of routing occurs in connection with traffic diversion schemes, when adequate planning ensures that trolley wire changes are just one factor in the total program. Disruptions from emergent causes such as fires or utility line breaks have little effect outside the central business district, and service can usually be maintained by such expedients as coasting past or using the opposite wire to bypass an obstruction. Longer term disruptions can be accommodated by moving the wires laterally along the spans. In the downtown area adequate planning of alternate routes can provide for temporary diversions to be set up on short notice.

With the experience of several months of L.R.T. construction in the downtown area, as well as the introduction of one-way streets and contra-flow bus lanes, the "lack of flexibility" of the trolley bus cannot be said to have figured very prominently in Edmonton's transportation problems.

Experiments have been and are being made in Europe with auxiliary power systems such as internal combustion (gas or diesel), battery, or kinetic energy (flywheel). The cost-effectiveness of such additional equipment seems to be low having regard to the minor nature of the problem which they are designed to solve.
2.1 The Trolley Bus in the Range of Transit Modes

Traditionally trolley buses have followed very closely the design of I.C.E. powered vehicles and currently most manufacturers use modified diesel bus bodies. In most countries dimensional regulations apply equally to both diesel and trolley. Three main types are in use, single deck rigid vehicles 11 or 12 metres long, single deck articulated vehicles 16 or 18 metres long and double deck vehicles 10, 11 or 12 metres long.

Passenger capacity being equal to that of a diesel, the trolley's advantage comes from its superior performance characteristics which give it a productivity 10 to 12 percent higher than that of the diesel and make it eminently suitable for routes with close stops and heavy loading. The small size of the motor compared to a diesel coupled with the inherent divisibility of the rest of the propulsion components make it possible to design the bus with larger entrance doors and more passenger circulation space than with a diesel to further enhance its suitability for short stage transit. A version using motors mounted in the rear hubs to provide a floor low enough to be accessible to the wheelchair handicapped has reached the prototype stage.

The use of trolley buses as "expresses" utilizing a third or third and fourth pair of wires extends beyond what is usually considered to be its ideal operating range, but it can present economies where the trolley is the main component of a mixed fleet.
2.0 PLANNING FOR TROLLEY BUSES

Transportation Planning requires the resolution of a broad spectrum of technical and social questions. The trolley bus is one tool that can be used to attract riders and to improve the financial results of the transit system on medium traffic routes and as a predecessor to L.R.T. in the heaviest corridors. These guidelines have been developed to assist planners to make technical and planning decisions tuned to the needs of the communities concerned.

The information comprised in these guidelines is based upon the experience of similar transportation systems in North America and Europe in finding solutions to the problems of improving transportation within limits imposed by financial and environmental considerations.

As in all matters closely impacting upon communities, the adoption of a plan for a trolley route in any corridor should be preceded by adequate exchange sessions where the general public as well as special interest groups are fully informed of the environmental impacts and encouraged to have input which will be used in arriving at the final designs. The earlier the public is involved the more readily will the plans be accepted, both at the decision-making level and perhaps more importantly by the transit patron.
2.2 Integrating Trolley Buses into the Transportation System

The basic concept used to guide transit planning in Edmonton consists of a series of mainline services linking the hub or central business district with major suburban activity centres at which off-street transfer facilities known as Transit Centres are established. From the Transit Centre, local services radiate into surrounding neighborhoods, connecting with mainline services at fixed intervals. This is the geographic basis for the Timed Transfer System. In peak hours buses originating in the neighborhoods continue to downtown as expresses over the mainline or line-haul portion of the route whenever loadings justify.

The reason for introducing trolley buses is to increase productivity, carrying more passengers per unit of road space at less cost fiscally and in terms of social impact. The greatest need for productivity is seen in mainlines, and those that are most suited for trolley buses are what have been described as "street-car commercial" thoroughfares (Figure 2.2.1). Travel demand in these corridors has developed over many years and will continue to exist in spite of growth in other areas. They are characterized by a well-developed sense of community, in many cases strengthened by ethnic ties, and by high transit ridership. Streets tend more to be "people places" and the qualities of silence and freedom from fumes which characterize the trolley bus are especially appreciated.
3.0 TROLLEY INFRASTRUCTURE

While the diesel bus can operate without infrastructure beyond garage and office support facilities, trolley buses not being prime movers, require generating, transforming and rectifying equipment and poles and wires to deliver power to each vehicle. Nowadays few traction properties maintain their own generating facilities, finding it more economic to purchase power from the public supplier, an advantage to both, since the transit load is offset from industrial load peaks and requires little if any increase in generating capacity. Additionally Edmonton Transit contracts with the Power Department to supply rectifying facilities, construction, maintenance and emergency services which may not be such a good idea.

3.1 Economics of Trolley Overhead

The capital cost of trolley overhead is amortized over the life of the material, or over a shorter period if necessary to comply with adopted accounting practices. Capital cost includes the cost of materials plus the cost of erection and can be expressed as a sum "per kilometre of negative wire" (the use of the term "negative wire" is the equivalent of track km for a street railway and indicates all the poles, span wires, trolley wires and fittings required for operation in one direction, and avoids the confusion inherent in the use of terms such as "one way route").
To this amortization cost must be added the cost of maintenance and of emergency repairs which will vary according to the number of vehicles operated. Assuming that the effects of the weather may be ignored, maintenance costs should be roughly in proportion to the number of vehicles using the line. On the other hand emergency repairs entail stand-by charges and will decrease as the system increases in size up to about 200 km of negative wire when the distances involved would call for a second crew to keep response times within reasonable limits.

Between different modes, the economic comparison is cost per passenger kilometre which is simply cost per vehicle kilometre divided by the number of passengers carried. In distributing overhead costs, it is the figure "vehicle km per km of negative wire" which must be maximized in order to minimize the cost per passenger kilometre.

To make the trolley bus system cost-effective, the following policies must be vigorously pursued.

a) Maximize the number of passengers, by making the service attractive, by advertising it, and by eliminating as far as possible competing services.
b) Maximize the number of buses using the overhead by making sure sufficient trolleys are available at all times, including nights, Sundays and holidays.

c) Increase the service speed by making fullest use of the trolley's acceleration and braking capabilities and by taking advantage of traffic control methods such as stop siting, bus lanes and restricted parking.

3.2 Substations

The most economic spacing of substations is one in which the interest on the capital investment in equipment is equal to the cost of power losses in transmission. Modern technology applied to current rectification and remote control dictates that small substations should be placed at frequent intervals along the line rather than a large installation serving a wide area. In practical terms provision should be made for substations at 2-4 kilometre spacing. About 20 to 25 square metres of floor area is required and access should be provided in the form of removable wall panels for installation and replacement of the heavier equipment such as transformers. In the long term, mainline trolley bus routes are prime candidates for extension of L.R.T. and substation design, location and equipment selection should be made with this in mind.
"Overhead clutter" is an impact that is readily identified, less easily quantified, and seldom subjected to a design analysis. One possible approach to this problem is to systematically review the functional elements of an overhead system, decide why it is considered unattractive, and what remedial measures are practical.

The basic problem is simply how to suspend a pair of power wires within reach of the trolley poles so as to allow the bus freedom to maneuver. This is the sole requirement. The other components of overhead (poles, span wires, messenger wires, feeder cables and guys) can be constructed in a variety of ways, each with different costs and visual implications. It is here that the application of visual sensitivity can make the difference between a design that is visually offensive, and one that is visually and functionally satisfactory.

Design Treatments

The development of satisfactory overhead design treatments requires a basic understanding of how overhead wires are perceived. Some streets are already subject to a jumble of utility poles, wires, billboards, and signs that create an unsatisfactory visual environment. Setting is therefore one
important element in overhead design, and provides an indicator as to the appropriate level of investment in visual design. In many situations, the combination of overhead in a coordinated approach to other street furniture can result in an overall visual improvement.

The first and basic concept governing visually effective overhead design is that wires are conspicuous only in silhouette. Where wire silhouette is masked by vegetation or by buildings, it becomes at the least inconspicuous, and often even invisible.

Where overhead silhouette cannot be hidden, then its mass must be minimized, and its shape made as regular and geometrically pleasing as possible. This is the second concept.

These two concepts provide a basis for a systematic approach to the visual design of overhead based on:

1) Minimizing hardware in the sky.
2) Management of the wire silhouette.

**Hardware Minimization.** The techniques to achieve this objective are relatively straightforward. Where possible, contact wire should be sized so that feeder cables are unnecessary and where this is not possible feeder cables should be underground. Usually
poles with bracket arms are less conspicuous than poles with span wires, particularly if integrated with street lighting. In some cases it may be possible to disperse with poles altogether by attaching span wires to buildings.

The pressure to reduce cost in the absence of effective community or environmental control may tend to allow wires and poles to proliferate as needed with little thought for appearance. The adoption of a comprehensive systems approach to the installation of street facilities can do much to avoid the installation of separate poles or wires for street lighting, traffic signs, signals and utilities.

Management of Wire Silhouette. The techniques for managing wire silhouette are less obvious and are worthy of discussion in more detail. Three approaches can be used:

Landscaping
Decoration
Geometry

Landscaping. The landscaping approach is already widely applied. It consists basically of using trees or buildings either to hide or to provide an alternative silhouette to the overhead from common viewpoints. Figure 3.3.1 illustrates how both buildings and
Fig. 3.3.1. Limits of overhead silhouette due to landscaping and buildings on a downtown street.
trees can interrupt the wire silhouette for an observer's normal viewpoint, so that it becomes an inconspicuous element of the street scene. Notice that wire silhouette can be interrupted from in front of or from behind with equal effect.

The observer's viewpoint is critical to silhouette management. Overhead is almost always conspicuous to auto occupants and can be screened from this viewpoint only with landscaping directly overhead.

Decoration. The second approach is to apply decoration. This was widely used on the earliest street car installations, particularly in Europe where ornate cast iron poles and bracket arms were often seen. In the first decade of this century, the use of wrought iron scroll work, ornate finials and pole bases became a highly developed art form. The decorative approach need not necessarily be ornate. A common variation has been the use of curved bracket arms, providing both a pleasing and functional design. Similar designs are often used for street lights.

Geometry. With the geometric approach, the designer's objective is not to hide the wires but rather to create a pleasing, or at least inoffensive pattern through the use of clean, simple and functional design. The geometric approach is largely a modern concept and has been applied with considerable success on a number
of recent installations. Geometric design is particularly effective with bracket-arm overhead, since this permits elimination of all wires but the contact wires themselves. Often, but not always traction poles are integrated with street lighting. The bracket arms may be cantilevered, hinged, or supported by stays or props. Bracket arm selection depends in part upon the method of wire tensioning used, and whether expansion compensation is to be included. In the last few years, a number of effective geometric designs have been installed, both in Europe, and, in North America. One attraction of the geometric approach is that it need cost little more than a design developed without aesthetic consideration.

The design and installation of electric transit overhead often provides an opportunity for simultaneous removal of utility wires and coordination with street lighting. While it may sound self-defeating to place utilities underground at the same time that electric transit overhead is installed, the visual impact of this treatment can be very effective due to the reduction in the amount of aerial hardware, and the geometric coordination of what remains. The cost of such projects should not be borne solely by the transit operator. Two recent examples include the rewiring of the San Francisco LRT overhead, which includes overhead utility removal, and the extension of the Seattle trolley bus system, which similarly incorporates the removal of all other unnecessary utility and lighting poles by way of visual "compensation".
An added design element which can aid aesthetics is careful layout of the network itself. By study of the network as it develops complex intersections may in many cases be avoided, or at least greatly simplified.

3.4 Erection, Maintenance and Emergency Repair of Trolley Overhead

Under the existing mandate maintenance and repair work is carried out by Edmonton Power under standing interdepartmental requisitions. Understandably this arrangement leads to difficulties in assigning priorities and in assuring that the work is carried out in an efficient manner. One dedicated crew is on shift from 0730 to 1600 hours for maintenance and emergency repairs, with a response time of up to 45 minutes depending on location, traffic conditions and the nature of the work in which they are involved at the time of the call. Outside of this time the street lighting crew responds to emergencies, but frequently do not have the necessary spares on board their truck to carry out even the most minor of repairs. This situation has been largely brought about by the ready availability of diesel buses which has detracted from the urgency of overhead repairs.

Due to the sporadic nature of trolley construction Edmonton Power finds it difficult to accommodate this work when it is needed: cost estimates are often understated by large percentages.
resulting in budget over-runs, and general efficiency is low. It has been suggested that new construction be let to outside contractors, however as in any specialized field, the resulting product may not be satisfactory, since all the skills available within a reasonable radius of the city are possessed by Edmonton Power personnel.

The requirement is for budgetary and manpower control and this may be best met by transferring the present Edmonton Power dedicated crew to Edmonton Transit. This would take care of maintenance and emergency repairs, with construction being done by contract on which Edmonton Power could bid but with Edmonton Transit supervision.

Similarly, power outages could be more efficiently dealt with if the substations were under the direct control of Transit staff.
4.0 TROLLEY OPERATION

4.1 Operational Control of Trolley Buses

The essential feature in trolley operation is that vehicles on sections shared by more than one route must be kept on schedule. If this is not done buses will tend to bunch with the leading vehicle taking all the load and getting further and further behind time.

The section most affected by this problem is Jasper Avenue and in order to make sure that this problem does not occur it is necessary to station an Inspector at 124 Street and 102 Avenue and an equivalent point east of the city centre to monitor inbound buses that are running late and ensure that they are dispatched in the correct order and at suitable intervals.

4.2 Fear of Trolley Buses

One of the main factors in not being able to get optimum performance from the trolley bus fleet is the reluctance of some operators to sign for trolley routes for many months after their training. This breeds an inordinate fear of the unknown which is usually not dispelled by the few spare board trips made with a vehicle so different from the diesel to which they have been
accustomed. A nervous operator does not keep good time, is
distracted in dealing with passengers and may even be a safety
hazard. Some program of re-training or upgrading is indicated,
possibly similar to that for L.R.T.

4.3 Upgrading of Electrical Supply and Overhead

Interviews with several trolley drivers have elicited lavish
praise for K & M "soft suspension" overhead. Most concerns are
concentrated on the need for speed reduction on curves and through
special work. In the long term the crude Ohio Brass overhead
should be replaced, but in the interests of realism at the present
time, a fairly cheap fix could be obtained by installing long
curve segments at some of the worst spots.

Low voltage has been mentioned as a problem both in the downtown
and at the extremeties of feeders. This will be taken care of
when the new Central substation is installed and the other
stations are converted to 2MW solid state equipment from the
present 1MW mercury arcs.

4.4 Long Term Improvements to Vehicles

Since the trolley is essentially a heavy mainline service vehicle
whatever can be done to increase its capacity and its ability to
move crowds quickly should be considered. Some of the
possibilities are:
1) Future vehicles to be articulated.
2) Rebuild existing vehicles with double stream front doors.
3) Look into multi-door vehicle design such as Fiat.
4) Look into low-floor design such as Townobile.

4.5 Trolley Bus Operating Committee

Several problems have arisen in the past due to lack of an established means of communication between the various groups involved with trolley vehicles. The following can be cited as typical examples:

- Construction not following approved plans.
- Wire locations unsuitable for traffic flows.
- Switches poorly located.
- Operator concerns not expressed or not passed on for corrective action.

A standing committee which should meet monthly at one of the operating garages should be set up with representatives from:

- Marketing
- Operations Planning
- Operations Supervision
- Safety Section
- Training
- Electrical Plant
- Equipment
- Drivers

Each member of the committee should be charged with bringing the concerns of his section forward for resolution and should have the authority to speak on the various issues raised or be able to bring answers back to specific questions.

The committee's mandate should cover all aspects of trolley operations including bringing recommendations forward to the Manager of Transit for system expansion and on following up new developments in the industry.
5.0 TROLLEY BUS INCIDENT MANAGEMENT

On the basic assumptions that trolley bus routes are to be scheduled to take full advantage of the potentially greater productivity of this vehicle without provision being made for diesel replacement, and that these services will be operated by trolleys at all times, an incident management program will be required to control deviations from this standard. This program should be administered by the Trolley Bus Operating Committee. The Program should recognize that diesel substitution carries a penalty of approximately 11% in operating cost per passenger and should seek to recognize this fact in budget preparation, and in recovery measures whenever a third party is involved. Most incidents can be divided into planned closures and emergencies.

5.1 Planned Closures

Many closures can be avoided with a little advance planning when this is encouraged by pointing out the cost of dieselisation.

Alterations to overhead or to feeders can usually be carried out in such a manner as to avoid interruption to service. Wholesale replacement of overhead over a long stretch should be done on weekends. The Operating Penalty Cost should be assessed as part of the capital cost of the installation.
Substation upgrading can be carried out at times of low demand by feeding the affected area from adjacent stations.

In most cases roadway excavations or encroaching hoardings can be accommodated within the reach of bus poles or at the extreme by moving the wires laterally along the spans. If total closure requiring diesel substitution is necessary the Operating Penalty Cost should be charged to the Department or contractor concerned.

Parades and similar events which occur on a regular basis should be provided for by setting up alternate route diversions.

5.2 Emergencies

In the case of a city-wide power failure both trolley and L.R.T. routes would have to be served by diverting diesel buses from other routes. This possibility is quite remote and it should be realized that Transit's problems will not appear to be of great significance in the midst of the general chaos attendant on such a contingency.

Local power failure should be covered by switching to alternate feeders if the disruption is on the A.C. side or by connecting the overhead to an adjacent section fed from an unaffected substation if it is a D.C. failure. The overhead should be suitably sectionalized and switched to allow this to be done expeditiously.
A wire break due to equipment failure or dewirement should be dealt with by the emergency crew (see Section 3.4). If it is a tear-down due to a high load or vehicle being in collision with a pole, all costs should be charged to the party causing the damage.

In the case of a vehicle breakdown or accident, the replacement vehicle should be a trolley.

5.3 **Incident Disposal**

All incident reports should be forwarded to the Trolley Bus Operating Committee (see Section 4.5) who should be empowered to make whatever further enquiries are necessary and to submit reports and recommendations to the Transit Manager on a regular basis.
6.0 MARKETING THE TROLLEY BUS

The advantages of the trolley bus - silence, freedom from pollution, smooth acceleration are customer values. If Edmonton Transit is convinced that the trolley bus is more economical and is a better passenger hauler, then it should use the values that the customer understands to sell it. In the past decade each attempt to begin this process has been frustrated by equipment or service uncertainties.

6.1 The Trolley Identity Crisis

The Edmonton passenger in the 1960's would stand back at his downtown bus stop letting buses go by because he knew "his bus" had poles on top: on the few occasions when trolley services were disrupted, drivers of substitute diesels had to call out to reassure patrons that indeed this was "a number five". In short, there was a sense of "ownership" pertaining to the trolleys, and ownership breeds patronage. Various causes, disruption due to L.R.T. construction, the Flyer fiasco and the scrapping of the Brills before replacements were available destroyed this positive image of the trolley - today it is just another bus. We may say this is just because Edmontonians have become more sophisticated, even blase, but "sophisticated" people don't ride buses.

When full trolley service is resumed with accelerated schedules, a distinctive identity must be re-established for the trolley. Just
as L.R.T. is appreciated by our patrons as being "something special", so the trolley bus must acquire similar recognition if it is to realize its potential in attracting more riders to Transit.

Some of the methods which may be used in addition to news releases announcing service improvements are:

- Distinctive pictograph for route brochures, etc.
- Trolley route card card maps
- Variation in vehicle paint scheme
- Coloured destination and/or route number signs
- Indication on transit zone signs and on system guide
- Special "trolley-only" fares to encourage off-peak short distance riding to and through the "street-car commercial" strips.
- Local merchant promotions in connection with above.
- Use of vintage vehicles to enhance downtown attractions on off-peaks and weekends

6.2 System Pride

We do not question that Edmontonians are proud of L.R.T. and the proudest are those who actually work on the system. In spite of ten or more years of discouragement there are still operators who
consistently sign trolley routes. Now, with the arrival of the B.B.C. vehicles we also have shop staff who are proud to be associated with trolleys. These are the attitudes which ought to be encouraged and used to advantage. Better production can be encouraged through rivalry; friendly competition between trolley and diesel sections can lead to better schedule keeping and less concern about tight timing.

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