

Dear Edmonton Councillors,

I am a Chartered British Mechanical Engineer with more than 25 years of experience in the engineering and operation of diesel and trolleybuses.

I wrote in 2004 after examining a consultant's study by the firm of Booz, Allen and Hamilton that did not provide a sound basis for making any decision on the future of the trolleybus system. I am glad that it did not influence Edmonton to abandon its trolleybus system then.

There are roughly 360 trolleybus systems in the world today as well as about 300 electric light rail/tramway installations. Both of these modes are experiencing growth. Trolleybuses recently returned to the streets of Philadelphia, and I read in the press that after flirtation with CNG and hybrids, the return of trolleybuses in Toronto is on the agenda. Edmonton would be out of line with a growing world trend, not to mention a North American trend, if it abandoned its trolleybus system.

I am greatly concerned to find that there still seems to be a continued administrative push in your city to eliminate trolleys--to the point it seems that any potential for administrative objectivity on this issue must have been lost. I have studied various reports and documents that have been recently placed on the web and, as in 2004, there seems to be much potentially misleading professional advice.

I do not wish in a letter to discuss every point, but the following seem to indicate the sorts of areas that ought to be of concern. (Please note that I use the term diesel below to refer to both hybrids and straight diesels, as hybrids are essentially diesel motored buses with electric rather than mechanical transmissions).

### **Relative Costs**

The reports include much data attempting to make cost comparisons between trolleys and diesels/hybrids. To be blunt, the comparisons do seem to be loaded against trolleybuses because of the inclusion of figures that are surprising, or should be, to anyone actually familiar with modern trolleybus technology and trolley versus diesel relative economics. For example: -

- Edmonton trolley annual mileages quoted of 21120 km/year are amazingly low by other standards - a trolleybus should be running 50,000 km per year or more.
- An assumed 18 year life span for a trolleybus is low by any other standards - 25 years would be more the current norm.
- A figure of C\$32k per year maintenance for a trolleybus compared with C\$18k to C\$21k for a diesel/hybrid beggars belief! The trolleybus figure is partly high due to the inclusion of C\$12k for "Backup Replacement". No professionally managed trolleybus system anywhere else in the world would just accept the very high level of diesel backup that seems to be the norm in Edmonton. Even

without the "backup" figure, the cost of trolleybus maintenance (C\$20k) is too high. Aside from common items like body/structural corrosion, wear and tear, tyres, cleaning etc., the major costs in maintaining vehicles long term relate to the traction/braking systems. Modern (AC) trolleybus equipment is about as close to zero maintenance requirements as you can possibly get as I noted in an article I published in 1999 comparing different types of trolleybus equipment. All major items of equipment should last the full vehicle life span (25) years or more (there is potential to recycle equipment into new vehicles) and routine maintenance, unlike diesel, is minimal. I consider that a figure of around C\$14k would be a fairer maintenance figure for a trolley (a third less than diesel with negligible diesel substitution).

- Fuel/energy costs per 100 km for trolleys are shown as C\$32 compared with a range from C\$46 to C\$58 for diesel/hybrids. In contrast Vancouver is quoted as CNG C\$44, diesel C\$49 and trolley C\$14 and the question must be asked why is the trolley figure for Edmonton so high? In long term comparisons of different transport modes, energy costs are a crucial part of any equation. A very particular issue regarding energy costs when comparing electric with diesel modes is the long term relative relationship between these energy costs. The reports appear to take for granted that there will be little or no relative difference long term. This is a not a widely held view in Europe. The overwhelming probability is that in the longer term, trolley energy costs relative to diesel, will be substantially less than even they now are.

Such differences inflate trolleybus figures and load the dice against trolleybuses. It is inevitable that in attempting long term comparisons between modes as different as conventional diesel, diesel hybrids and modern trolleybuses there will be substantial uncertainties over items like long term relative maintenance and energy costs, and there is a range of possible outcomes. A thing that is totally lacking in all the reports is any serious attempt to address this range of uncertainty by modelling a reasonable range of scenarios - Dr Checkel's figures effectively represent a worst case scenario for trolleybuses. This is a serious deficiency and effectively means that any substantive conclusions drawn are of little value.

## Emissions

I have commented before on the false emissions comparisons between trolleys and diesels in the Edmonton context, embedding as they do confusion between local [street level] emissions and what one might term 'global' emissions. It is the local street level emissions that are most damaging to health, NOT the global emissions. Recognising the importance of this, all modern combustion engined buses depend on complex and expensive technology to try to limit street level emissions. Trolleybuses emit nothing at all into the streets - it is an intrinsic feature of the technology and cannot deteriorate with age or less than perfect maintenance or operational practices. All those harmful diesel/hybrid NOx, PM10, SOx, CO and HC emissions go straight into the streets to be breathed whereas trolley related emissions do not.

Even though the important comparison between trolleys and diesels is what goes into the air on the streets, there is apparently still an assumption that Alberta power generation is extremely dirty and will remain so.

I have extracted figures from article that I wrote in 2002 in *Urban Transport International*, which came from a Swedish trolleybus report for European trolleys running on grid electricity (Netherlands) with a large proportion of coal fired generation like Alberta. Comparing this data with 2008 figures for Edmonton included in the reports on the web: -

- For NO<sub>x</sub> the comparison is Netherlands grid 1.27 g/km while Edmonton is 2.64 g/km i.e. about twice as large.
- For particulates the Netherlands grid figure [all particulates] is 0.012 g/km and the Edmonton figure [PM<sub>10</sub> particulates] is 0.59 g/km i.e. at least 49 times greater.
- For SO<sub>x</sub> the Netherlands figure is 0.62 g/km while the Edmonton figure is 3.27 g/km i.e. some 5 times greater.
- For CO<sub>2</sub>, the Netherlands figure is 1.38 kg/km and the Edmonton figure 1.93 kg/km i.e. about 40% higher.

If it be true that Alberta grid power is as dirty as it is made out to be and will continue to be so, then Edmonton has a very much larger problem to address than just the future of trolleybuses, including the future of the LRT system using the same electricity. The future of Edmonton's trolleys should not be simply predicated on the present or future environmental friendliness or otherwise of Alberta grid power.

## Noise

It is clear from the noise test results quoted that while some combustion engined buses can be noticeably noisier externally (78.6 dBA) than others (70.1 dBA), all are noisier than trolleys (68 dBA). Unfortunately the external noise test results are flawed in that they were not all conducted in the same location. The presence or absence of horizontal and vertical reflecting surfaces as well as the opportunity to make all test comparisons can make a significant (several dB) difference to such results. An attempt was made to correlate the results from the different (trolley and diesel) test locations, but as the report contained in *App\_B\_NoiseTestReport.pdf* notes when referring to the diesel hybrid tested in both locations " *When this bus was re-tested later on 80th Street, the highest noise level modes were avoided since speeds were limited by the limited space available*". Conducting noise tests was once part of my professional duties and there is no doubt in my mind that even the quietest diesel engined buses in practice in city traffic will prove to be noticeably noisier than new trolleybuses, and that the advantage of trolleybuses will improve with age as the technology is fundamentally quiet, unlike any diesel based technology which depends on the maintenance of efficient noise reduction measures over time.

## A vision for Edmonton?

Increasing numbers of European operators are finding trolleybuses to be cost competitive with conventional diesel and more than cost competitive with other alternatives to

conventional diesel on core routes, as well as environmentally superior. Rome rejoined the ranks of trolleybus operators a couple of years ago and there is even now a realistic possibility of trolleybuses returning to the UK in Leeds (see <http://www.wymetro.com/ProjectsAndPlans/Tram-trainsandtrolleybuses/Trolleybuses.htm>)

A movement toward electric transit is an industry trend. I am aware that Edmonton has a sizeable investment in trolleybus infrastructure, totalling some 130 km and valued in your city's asset assessments at \$89 million in 2006. In view of this, the future of the trolleybus as an alternative to diesel buses in certain corridors merits *serious* consideration. There should be a vision in Edmonton to realise an improved and expanded (and more economic as a result) modern clean green electric trolleybus system to complement light rail. To do otherwise would be a great disservice to local taxpayers, not to mention to the future sustainability of your public transit system.

Should you wish to contact me [by email or telephone], please feel free to do so.

Sincerely,

Irvine Bell.

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