



City of Edmonton ETS Hybrid-Trolley Survey 2008

RESEARCH REPORT

April 18, 2008



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1 BACKGROUND AND INTRODUCTION

The Edmonton Transit System (ETS) operates as a Branch of the Transportation Department of the City of Edmonton and provides comprehensive public transportation services for the Capital region. Services include conventional bus, light rail transit (LRT) and disabled adult transit (DATS). Department and Branch administration are accountable to City Council for operating these transit services.

The Edmonton Transit System regularly surveys its customers to understand their perceptions and satisfaction with the system. The purpose of this research is to assist ETS in determining the future composition of its fleet of transit vehicles.

Specifically, objectives of this research are to engage citizens of Edmonton in general and obtain public opinions about the composition of the ETS bus fleet and the type of vehicle to be acquired to replace the aging trolley-buses.

The research includes feedback from:

- ✓ Edmonton citizens in general (referred to as the general public in this report)
- ✓ Current users of ETS
- ✓ ETS operators and Mobile Equipment Services (MES) maintenance staff
- ✓ Relevant stakeholder groups

2 SATISFACTION WITH BUSES

2.1 Users and the General Public

Based on preliminary secondary research that identified the pros and cons of trolley, hybrid and modern diesel buses, respondents were asked to rate their satisfaction with each bus in terms of: emission levels, operating noise, outside appearance and vehicle dependability.

2.1.1 Trolley-Bus Satisfaction

Users

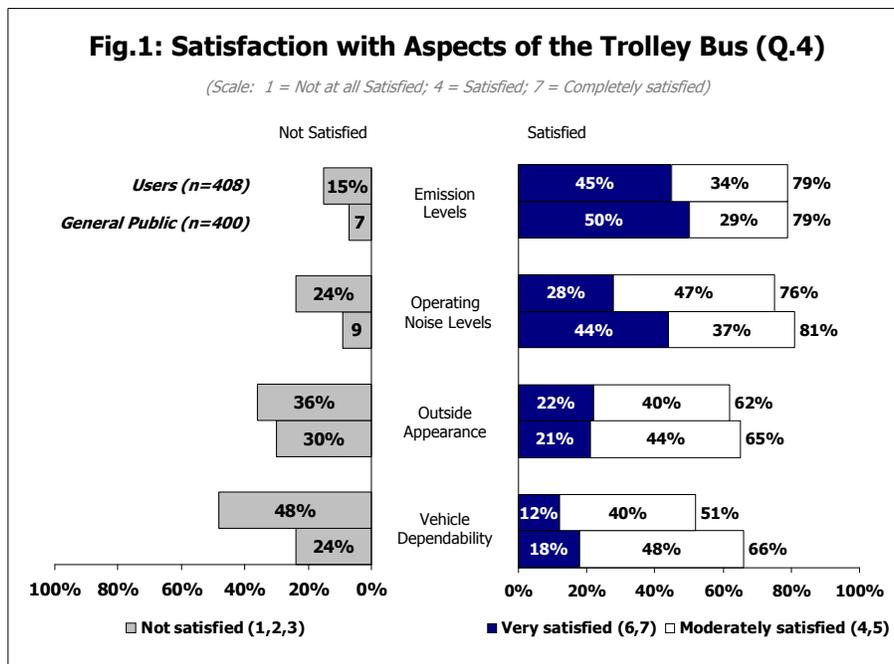
At least three-quarters of respondents are satisfied with trolley-buses in terms of:

- ✓ Emissions (79% satisfied), and
- ✓ Operating noise levels (76%).

Although still a majority, lower proportions of user respondents are satisfied with the outside appearance (62%) and the dependability (51%) of trolley-buses.

General Public

Respondents in the general public demonstrate a similar pattern in responses as compared to user respondents. However, a higher proportion of the general public are satisfied with the dependability of trolley-buses (66% vs. 51% users).



2.1.2 Modern Diesel Satisfaction

Users

Nearly all user respondents are satisfied with the dependability (97%) and the outside appearance of modern diesel buses (96%).

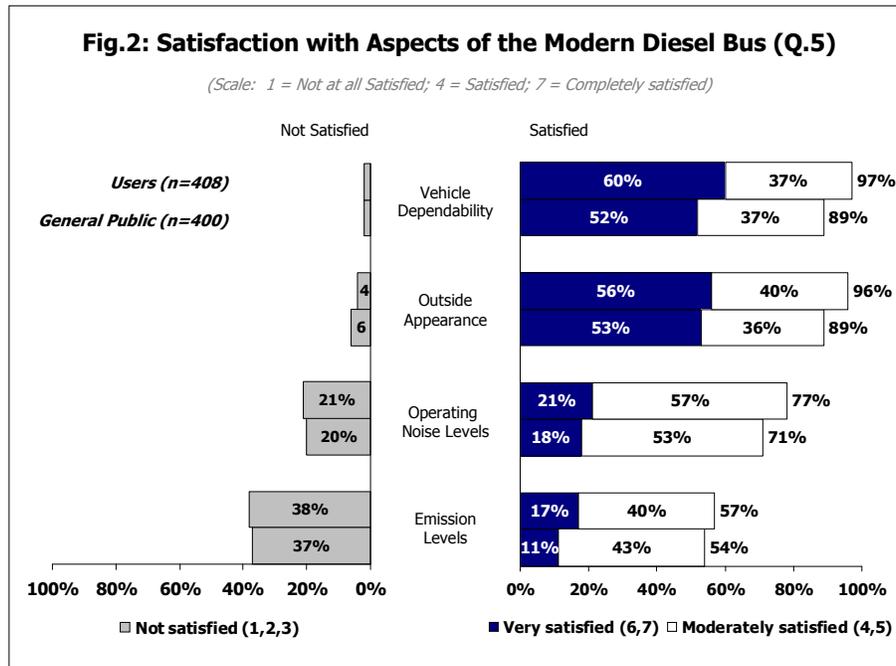
Although still a large majority, relatively lower proportions of user respondents are satisfied with the operating noise levels (77%) of modern diesel buses.

User respondents are least satisfied with the emission levels (57%) of modern diesel buses.

General Public

A similar pattern to users is demonstrated by respondents in the general public. However, lower proportions of respondents in the general public than user respondents are satisfied with:

- ✓ Vehicle dependability (89% vs. 97% users)
- ✓ Outside appearance (89% vs. 96%)



2.1.3 Hybrid Satisfaction

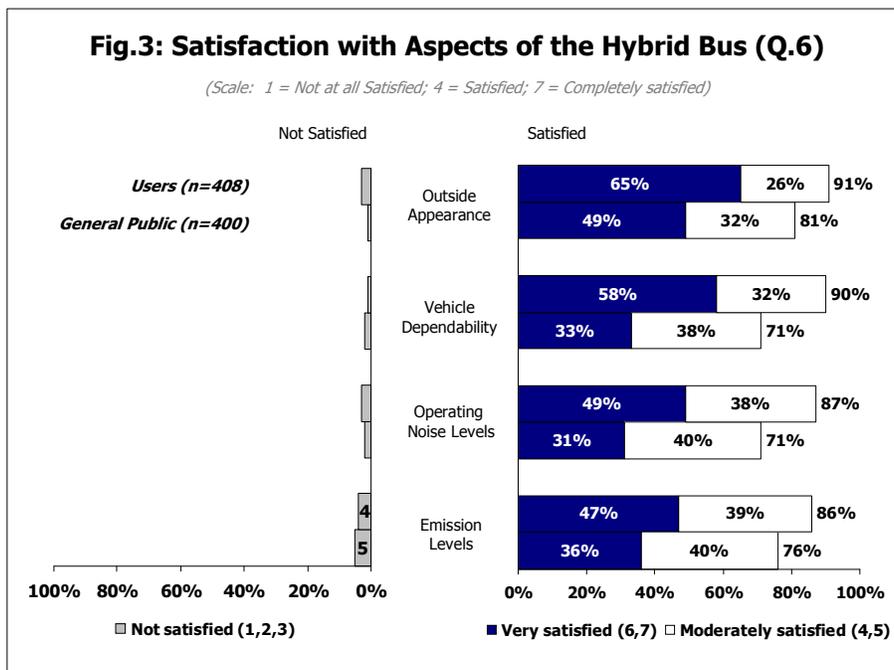
Users

Overall, user respondents are most satisfied with hybrid buses, with over eight-in-ten respondents expressing satisfaction with the outside appearance (91%), dependability (90%), operating noise levels (87%) and emission levels (86%).

General Public

Respondents in the general public are most satisfied with the outside appearance (81%) and emission levels (76%) of hybrid buses.

Compared to users, lower proportions of respondents in the general public are satisfied with any aspect of hybrid buses, mainly due to relatively higher proportions (17% to 27%) who did not provide satisfaction ratings for this technology.



2.2 Operators and Maintenance Staff

ETS operators were asked to rate their level of satisfaction with the different types of ETS buses (hybrid, trolley and modern diesel) in terms of operating noise levels, emission levels and vehicle driving experience.

Maintenance staff members were asked to rate their satisfaction with similar aspects including: operating noise levels, emission levels and ease of maintenance.

2.2.1 Trolley-Bus Satisfaction

ETS Operators

The majority (56%) of ETS operators were satisfied with the operating noise levels of trolley-buses. In comparison, a lower proportion of ETS operators were satisfied with the emission levels (40%).

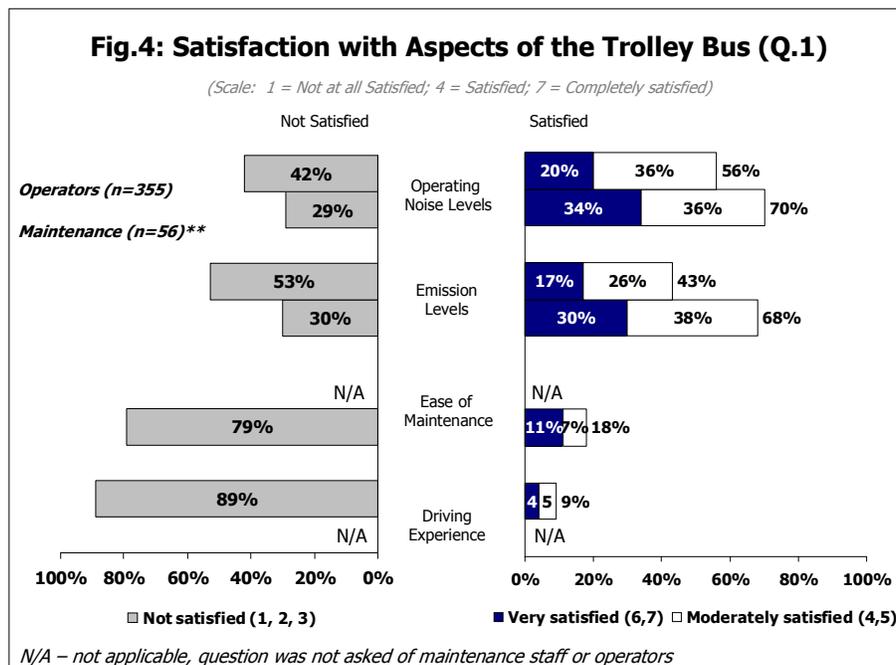
A large majority (89%) of ETS operators are not satisfied with their experience driving trolley-buses.

Maintenance Staff

Eight-in-ten (79%) maintenance staff members are not satisfied with the ease of maintaining trolley-buses.

Higher proportions of maintenance staff than operators are satisfied with:

- ✓ Operating noise levels (70% vs. 56% of operators)
- ✓ Emission levels (68% vs. 40%)



2.2.2 Modern Diesel Satisfaction

ETS Operators

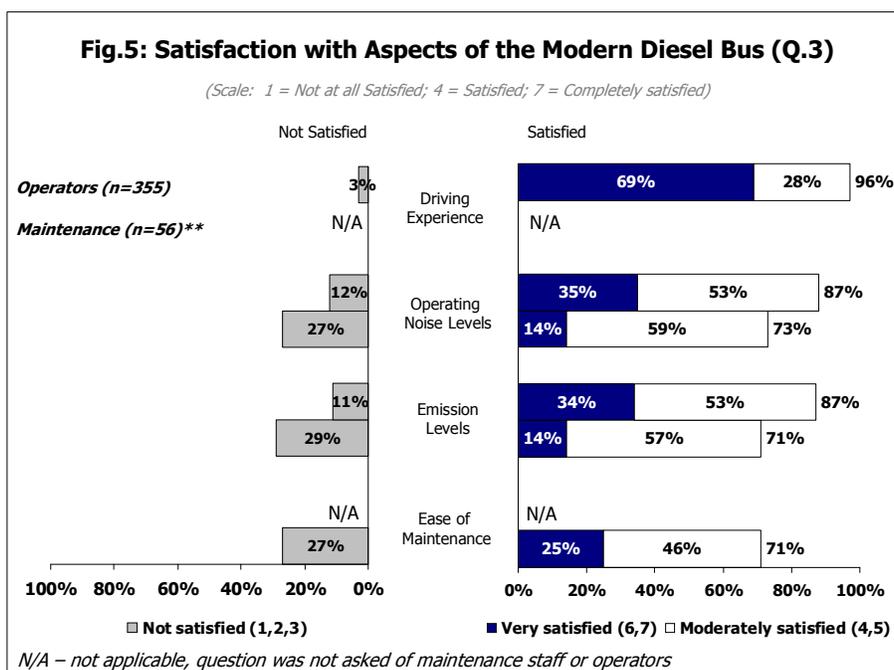
Nearly all (96%) ETS operators are satisfied with their experience driving modern diesel buses, including 69% who are very satisfied.

Over eight-in-ten ETS operators are satisfied with operating noise levels (87%) and emission levels (87%) of modern diesel buses.

Maintenance Staff

Maintenance staff members are generally satisfied with all aspects of modern diesel buses (71% to 73% satisfied), although lower proportions than operators are satisfied with:

- ✓ Operating noise levels (73% vs. 87% operators)
- ✓ Emission levels (71% vs. 87%)



2.2.3 Hybrid Satisfaction

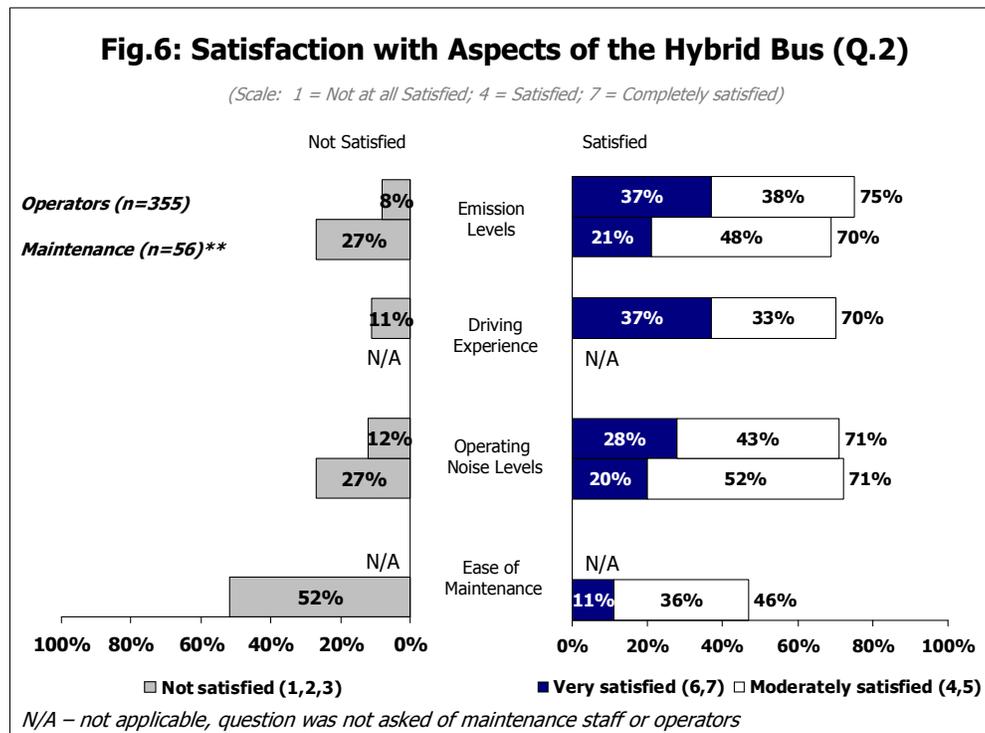
ETS Operators

At least seven-in-ten operator respondents are satisfied with hybrid buses in terms of:

- ✓ Emission levels (75% operators; 70% maintenance)
- ✓ Driving experience (70% operators)
- ✓ Operating noise levels (71% operators and maintenance)

Maintenance Staff

Lower proportions of maintenance staff members are satisfied with the ease of maintaining hybrid buses (46%) than with other aspects measured.



3 FACTORS IN PURCHASE DECISION

3.1 Ranking Importance of Factors

Respondents were given a list of four factors related to buses and then were asked to choose the three most important to them, ranked in order of importance.

Vehicle dependability was ranked by users as the most important factor, and stands out from all other factors with a score of 802 and 42% ranking it most necessary. The next most important factor was emissions, with a score of 679, followed by the cost to taxpayers with a score of 597.

Respondents in the general public ranked the cost to taxpayers as the most important factor, with a score of 721 and one-third (36%) of respondents ranking it as most important. This was closely followed by emissions, with a score of 717. Vehicle dependability was ranked third, with 655 points. The variation in points is smaller for the general public than for users, with the first choice only leading the second choice by four points.

Noise levels were ranked as being least important to both user respondents and respondents in the general public, having substantially lower scores than other factors.

Table 1: Importance of Factors in Purchase Decision (Q.1)

Rank	Factor	Users (n=408)		General Public (n=400)	
		Score*	Ranked Most Important (%)	Score*	Ranked Most Important (%)
1	Vehicle Dependability	802	42%	655	28%
2	Emissions	679	29%	717	30%
3	Cost to taxpayers	597	20%	721	36%
4	Noise Levels	370	9%	259	5%

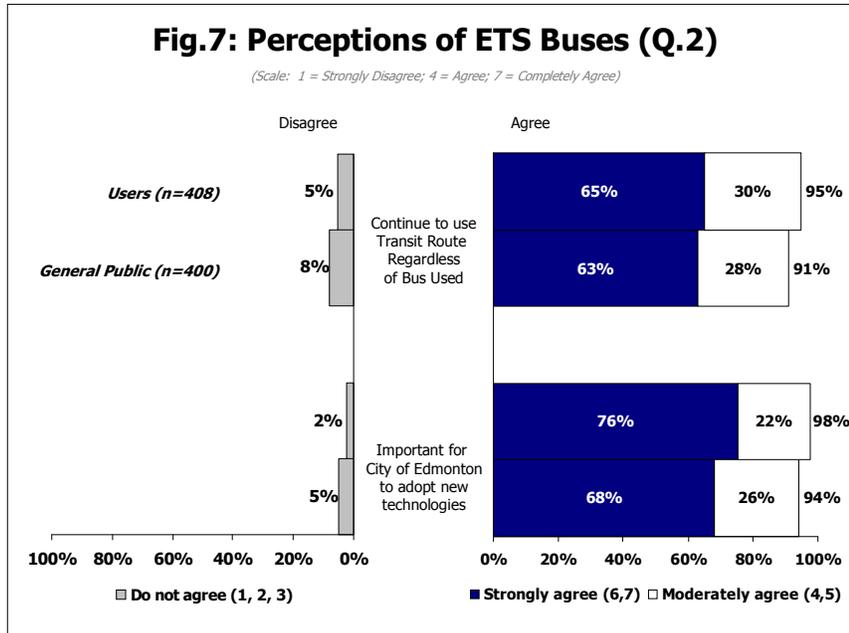
BOLD figures denote significant differences between respondent sub-groups

3.2 Perceptions of ETS Buses

All respondents were asked to rate their level of agreement with statements about public transit in Edmonton.

At least nine-in-ten respondents agree:

- ✓ They would continue to use a transit route regardless of the type of bus used on it, and
- ✓ It is important for the City of Edmonton to adopt new technologies.



4 RANKING SPECIFIC ASPECTS OF ETS BUSES

4.1 Users and the General Public

User respondents were asked to rank the three types of buses (hybrid, trolley-bus and modern diesel) on operating noise levels, dependability, emissions and usage preferences.

Respondents in the general public were asked to choose which of the buses runs most quietly, is the most dependable, has the least emissions and which they would prefer to ride on.

4.1.1 Operating Noise Levels

Users

User respondents ranked hybrid buses as being the vehicle that runs most quietly, receiving a score of 924. Diesel buses were ranked as the vehicle that runs least quietly, with a score of 622.

General Public

When compared to user respondents, a higher proportion of the general public (43% vs. 31% users) ranked trolley-buses as being the bus that runs most quietly.

Sixteen percent (16%) of respondents in the general public were unsure which bus runs the most quietly.

Table 2: Vehicle Ranking – Runs Most Quietly (Q.3A)

Rank	Type of Bus	Users (n=408)		General Public (n=400)
		Score*	Runs Most Quietly (%)	Runs Most Quietly (%)
1	Hybrid bus	924	54%	36%
2	Trolley-bus	722	31%	43%
3	Modern diesel	622	15%	5%
			<i>Don't Know</i>	16%

BOLD figures denote significant differences between respondent sub-groups

** The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.*

4.1.2 Vehicle Dependability

Users

User respondents ranked the modern diesel as being the most dependable type of bus, with a score of 890. Hybrid buses came in next, with a score of 877. User respondents rated trolley-buses as being the least dependable bus, with a score of 507.

General Public

Members of the general public chose the modern diesel (39%) and hybrid (30%) buses as being most dependable. A smaller proportion of the general public chose trolley-buses as being the most dependable (12%).

Two-in-ten (19%) respondents in the general public are unsure which bus is the most dependable.

Table 2: Vehicle Ranking – Is the Most Dependable (Q.3B)

Rank	Type of Bus	Users (n=408)		General Public (n=400)
		Score*	Most Dependable (%)	Most Dependable (%)
1	Modern diesel	890	47%	39%
2	Hybrid bus	877	43%	30%
3	Trolley-bus	507	10%	12%
			<i>Don't Know</i>	<i>19%</i>

BOLD figures denote significant differences between respondent sub-groups

**The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.*

4.1.3 Emissions

Users

Trolley-buses, with a score of 873, and hybrid bus, with a score of 864, were ranked by user respondents as having the least emissions. Modern diesel buses, with a score of 495 were ranked as having the most emissions of the three types of buses presented.

General Public

A majority (51%) of respondents from the general public believe that trolley-buses have the least emissions of the three buses. One-third (36%) of respondents believe that hybrid buses have the least emissions.

Table 3: Bus Ranking – Has the Least Emissions (Q.3C)

Rank	Type of Bus	Users (n=408)		General Public (n=400)
		Score*	Least Emissions (%)	Least Emissions (%)
1	Trolley-bus	873	52%	51%
2	Hybrid bus	864	39%	36%
3	Modern diesel	495	9%	2%
			<i>Don't Know</i>	12%

BOLD figures denote significant differences between respondent sub-groups

**The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.*

4.1.4 Preferred Bus to Ride On

Users

Hybrid buses were ranked by user respondents as the most preferred bus to ride on, with a score of 880. The modern diesel was the runner-up, with a score of 771. User respondents ranked trolley-buses as the least preferred to ride on, with a score of 587.

General Public

Respondents in the general public prefer to ride hybrid buses (48%) over the other types of buses (12% modern diesel, 17% trolley).

One-in-five (22%) respondents in the general public are unsure which is their preferred bus to ride on.

Table 4: Bus Ranking – Preferred Bus to Ride On (Q.3D)

Rank	Type of Bus	Users (n=408)		General Public (n=400)
		Score*	Preferred Bus to Ride on (%)	Preferred Bus to Ride On (%)
1	Hybrid bus	880	51%	48%
2	Modern diesel	771	30%	12%
3	Trolley-bus	587	19%	17%
			<i>Don't Know</i>	22%

BOLD figures denote significant differences between respondent sub-groups

**The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.*

4.2 ETS Operators and Maintenance Staff

4.2.1 ETS Operators

ETS Operators were asked to rank the three types of ETS buses (trolley-buses, hybrid buses and modern diesel buses) in order to determine which bus runs most quietly, the bus with the least negative environmental impact, and the bus they most prefer to drive.

Runs Most Quietly

Hybrid received the highest weighted score (713) for being the vehicle that runs most quietly, indicating it was most frequently ranked first or second by respondents. However, trolley-buses were ranked first by 43% of ETS operators.

Lower proportions of ETS operators ranked hybrid buses (29%) and modern diesel buses (23%) running most quietly.

Table 5A: Vehicle Ranking
-Runs Most Quietly-

Rank	Type of Bus	Operators (n=355)	
		Score*	Runs Most Quietly (%)
1	Hybrid bus	713	29%
2	Trolley-bus	692	43%
3	Modern diesel	579	23%

*The ranking score represents a weighting of all ranks assigned to each feature. Each rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.

Least Negative Environmental Impact

The majority (59%) of ETS operators ranked hybrid buses as having the least negative impact on the environment. Lower proportions of operators ranked modern diesel (18%) or trolley-buses (18%) as having the least negative impact on the environment.

Table 5B: Vehicle Ranking
-Least Negative Environmental Impact-

Rank	Type of Bus	Operators (n=355)	
		Score*	Least Negative Environmental Impact (%)
1	Hybrid bus	840	59%
2	Modern diesel	627	18%
3	Trolley-bus	501	18%

*The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.

Most Preferred Bus to Drive

Three-quarters (73%) of ETS operators ranked modern diesel buses as the vehicles they would most prefer to drive. Comparatively lower proportions of ETS operators ranked hybrid buses (20%) or trolley-buses (3%) as their preference.

Table 5C: Vehicle Ranking
-Preferred Bus to Drive-

Rank	Type of Bus	Operators (n=355)	
		Score*	Most Preferred to Drive (%)
1	Modern diesel	938	73%
2	Hybrid bus	715	20%
3	Trolley-bus	372	3%

**The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.*

4.2.2 Maintenance Staff

Maintenance staff members were asked to rank the three types of ETS buses (trolley-buses, hybrid buses and modern diesel buses) in order to determine which bus is the easiest to maintain, and which bus takes the most amount of time to maintain.

Easiest to Maintain

Three-quarters (77%) of maintenance staff rank modern diesel buses as the easiest to maintain.

Table 6A: Vehicle Ranking
-Easiest to Maintain-

Rank	Type of Bus	Maintenance (n=56)**	
		Score*	Rank Easiest to Maintain (%)
1	Modern diesel	140	77% (43)
2	Hybrid bus	85	7% (4)
3	Trolley-bus	73	11% (6)

*The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.

** Caution in interpretation of results due to small sample size

Most Time to Maintain

A majority of maintenance staff members rank hybrid buses as the most time-consuming to maintain. Lower proportions of maintenance staff rank trolley-buses (23%) and modern diesel buses (14%) as the most time consuming to maintain.

Table 6B: Vehicle Ranking
-Most Time to Maintain-

Rank	Feature	Maintenance (n=56)**	
		Score*	Ranked Most Time Consuming to Maintain (%)
1	Hybrid bus	114	54% (30)
2	Modern diesel	91	14% (8)
3	Trolley-bus	85	23% (13)

*The ranking score represented a weighting of all ranks assigned to each feature. A rank of 1 receives a score of 3 while a rank of 3 receives a score of 1.

** Caution in interpretation of results due to small sample size

5 PREFERENCES FOR NEW ETS BUS

Respondents were asked which type of bus they would prefer ETS to purchase. Both users (62%) and the general public (63%) prefer that ETS purchase hybrid buses. The ETS employees surveyed prefer modern diesel buses (66% of operators, 59% of maintenance staff).

5.1 Users and the General Public

Similar proportions of respondents prefer ETS to purchase hybrid buses (62% users, 63% general public).

Table 6A: Preferences for New ETS Bus (Q.7)

-Users and the General Public-

Rank	Feature	Users (n=408)		General Public (n=400) Most Preferred (%)
		Score*	Ranked Most Preferred (%)	
1	Hybrid bus	1042	62%	63%
2	Modern diesel	803	27%	25%
3	Trolley-bus	573	11%	7%

5.2 ETS Operators and Maintenance Staff

The employees surveyed prefer that ETS purchase modern diesel buses (66% ETS operators; 59% maintenance staff).

Table 6B: Preferences for New ETS Bus (Q.4)

-ETS Operators and Maintenance Staff-

<i>All respondents</i>	Operators (n=355)	Maintenance (n=56)**
Modern diesel bus	66%	59%
Hybrid bus	28%	25%
Trolley-bus	2%	11%
No preference	2%	4%

*** Caution in interpretation of data due to small sample size*

6 STAKEHOLDER WORKSHOP RESULTS

Stakeholder groups were consulted during a 3-hour workshop conducted on April 16, 2008. Representatives from the following organizations were present:

- ✓ North West Industrial Business Association
- ✓ Old Strathcona Business Association
- ✓ Edmonton Youth Emergency Shelter
- ✓ Edmonton Transit System Advisory Board
- ✓ Edmonton Federation of Community Leagues
- ✓ Canadian Taxpayers Federation
- ✓ Belgravia Community League
- ✓ Amalgamated Transit Union 569
- ✓ Edmonton Seniors Coordinating Council
- ✓ Advisory Board on Services for Persons with Disabilities
- ✓ Clean Air Strategic Alliance
- ✓ NAIT Students Association
- ✓ Edmonton Chamber of Commerce
- ✓ Transit Riders Union of Edmonton
- ✓ Edmonton Trolley Coalition
- ✓ CO² Research Representative
- ✓ DATS Advisory Group
- ✓ Edmonton Citizens for Better Transit
- ✓ Sierra Club Canada

Participants focused their discussions on the following four topics:

- ✓ Key factors to consider in the purchase of new buses
- ✓ Pros and cons of each bus in terms of these key factors
- ✓ Which type of bus(es) to purchase
- ✓ Key considerations during implementation of the purchase decision

6.1 Key Decision Factors

Participants identified the following factors as being keys to deciding which buses to purchase for the ETS fleet:

- Future energy scenarios – peak oil prices
- Public image / Market play of investment and encouraging ridership
- Community / Local impacts – noise, sulphur emissions, particulates, vibrations
- Greater environmental impacts – emissions, electricity generation
- Costs – capital cost, ongoing operating & maintenance, lifecycle / replacement parts
- Existing investments in infrastructure – trolley lines, roads, bus barns
- Vehicle reliability
- Route flexibility / Versatility
- Location of use
- Aesthetics

"You have to look at long term costs and what this world's going to look like in 30 years."

"If the route has a lot of riders, then we can afford to put a more expensive vehicle on that route."

"Can a local bus pass an express bus and get off the grid?"

"If the rest of the world is using a certain type of bus, then parts become more available and (therefore) cheaper."

"With trolley buses, you have cables hanging everywhere."

"Is the City looking at what other cities have done?... (the City should) take more than one example."

6.2 Pros and Cons of Each Bus

Trolley Buses

	Pros	Cons
Future Energy Scenarios <i>i.e. Peak Oil Prices</i>	<ul style="list-style-type: none"> Potentially cleaner way to produce electricity Produce power with any source, green or sustainable energy possible Fuel flexibility, multiple energy sources (coal, wind, water) Supports local economy (i.e. EPCOR) 	
Public Image / Market Play of Investment <i>Encouraging Ridership</i>	<ul style="list-style-type: none"> Forward thinking – electrical power, only one smoke stack 	
Community / Local Impacts <i>Noise / Vibrations</i>	<ul style="list-style-type: none"> Less noise, least noisy No noise, very quiet 	<ul style="list-style-type: none"> Blind / deaf cannot hear the bus coming
<i>Sulphur Emissions</i> <i>Particulate Emissions</i>	<ul style="list-style-type: none"> No on street (tail pipe) emissions Low local emissions, no local particulates 	<ul style="list-style-type: none"> Electricity generation pollution What is the total CO2, depends on the source Disposal of battery – but longer use of battery than hybrid battery
Costs <i>Capital</i> <i>Ongoing Operating and Maintenance</i> <i>Lifecycle</i> <i>Replacement Costs</i>	<ul style="list-style-type: none"> Future Fuel Prices Viable on busy or heavily used routes (i.e. mature neighbourhoods or core routes) More maintenance 	<ul style="list-style-type: none"> Purchase cost – initial outlay for vehicles is greater Supporting infrastructure – high cost for new areas Availability of mechanics and technicians
Existing Investments in Infrastructure <i>Trolley Lines, Roads, Bus Barns</i>	<ul style="list-style-type: none"> Supporting infrastructure already exists 	<ul style="list-style-type: none"> Infrastructure needs to be maintained Limited bus barn locations available

"In San Francisco, we never saw a trolley that jumped its wires because they're better maintained. Done well, they are very reliable."

"We have to assume the city wouldn't purchase an unreliable bus – they're all new."

"You may have a trolley-bus, but you can't use it everywhere."

"The technologies aren't the same...so you can't expect the same reliability."

"We don't have enough technical information to rate each type of bus."

Trolley Buses, cont'd

	Pros	Cons
Vehicle Reliability		<ul style="list-style-type: none"> • Electrical disruption • Jumping lines, line drops
Route Flexibility / Versatility		<ul style="list-style-type: none"> • Limited mobility for routing • Bus routes which use trolleys can be slowed down by loading/unloading persons using mobility aids. If there is a problem with the ramp it could delay all the trolleys on that route because other buses cannot pass
Location of Use		<ul style="list-style-type: none"> • Limited service areas
Aesthetics		<ul style="list-style-type: none"> • Power lines – visible pollution, ugly • Overhead wires

"In San Francisco, we never saw a trolley that jumped its wires because they're better maintained. Done well, they are very reliable."

"We have to assume the city wouldn't purchase an unreliable bus – they're all new."

"You may have a trolley-bus, but you can't use it everywhere."

"The technologies aren't the same...so you can't expect the same reliability."

"We don't have enough technical information to rate each type of bus."

Diesel Buses

	Pros	Cons
Future Energy Scenarios <i>i.e. Peak Oil Prices</i>	<ul style="list-style-type: none"> Improving diesel technology Burning sulphur off 	<ul style="list-style-type: none"> Less flexible than trolley buses
Public Image / Market Play of Investment <i>Encouraging Ridership</i>	<ul style="list-style-type: none"> Positive is only cost, but no forward thinking Cheapest option or financial responsible 	<ul style="list-style-type: none"> No consideration for environmental concerns Status quo
Community / Local Impacts <i>Noise / Vibrations</i>		<ul style="list-style-type: none"> Noise, noisiest type of bus
<i>Sulphur Emissions</i> <i>Particulate Emissions</i>	<ul style="list-style-type: none"> Tier III diesel 	<ul style="list-style-type: none"> Dirty fuel source Higher emissions (particulate) Smell of exhaust build up in downtown. Smelly emissions Greater environment pollution (production of oil)
Costs <i>Capital</i> <i>Ongoing Operating and Maintenance</i> <i>Lifecycle</i> <i>Replacement Costs</i>	<ul style="list-style-type: none"> Cheapest in operating and initial costs (cheapest capital cost) Less / no infrastructure required (i.e. wires etc.) Cheaper maintenance costs 	<ul style="list-style-type: none"> High fuel costs in future, fuel cost rising Shorter life expectancy
Existing Investments in Infrastructure <i>Trolley Lines, Roads, Bus Barns</i>	<ul style="list-style-type: none"> Existing fleet, no problem in accommodating and mechanics availability 	<ul style="list-style-type: none"> Dismantling trolley line costs
Vehicle Reliability	<ul style="list-style-type: none"> More mechanically reliable?? (break down less) 	<ul style="list-style-type: none"> Diesel availability
Route Flexibility / Versatility	<ul style="list-style-type: none"> Can go anywhere Most universal 	<ul style="list-style-type: none"> Quick to fix route detours
Location of Use		
Aesthetics	<ul style="list-style-type: none"> No wires 	

"In San Francisco, we never saw a trolley that jumped its wires because they're better maintained. Done well, they are very reliable."

"We have to assume the city wouldn't purchase an unreliable bus – they're all new."

"You may have a trolley-bus, but you can't use it everywhere."

"The technologies aren't the same...so you can't expect the same reliability."

"We don't have enough technical information to rate each type of bus."

Hybrid Buses

	Pros	Cons
Future Energy Scenarios <i>i.e. Peak Oil Prices</i>	<ul style="list-style-type: none"> Less fuel consumption More energy efficient 	<ul style="list-style-type: none"> Less flexible in fuel choices
Public Image / Market Play of Investment <i>Encouraging Ridership</i>	<ul style="list-style-type: none"> Forward thinking More energy efficient than diesel 	<ul style="list-style-type: none"> Improve technology – i.e. batteries
Community / Local Impacts <i>Noise / Vibrations</i>	<ul style="list-style-type: none"> Hybrid quieter than diesel? Hybrid possibly less peak noise, however pitch is higher Quieter (at low speeds?) 	
<i>Sulphur Emissions</i> <i>Particulate Emissions</i>	<ul style="list-style-type: none"> Less diesel usage Lower than diesel Long trips – less particulate emissions, uses less fossil fuels for longer trips 	<ul style="list-style-type: none"> Still a diesel Disposal of batteries, creation of batteries No generation sets Short trips – particulate emissions Lots of starts and stops, loses efficiency – uses more diesel
Costs <i>Capital</i> <i>Ongoing Operating and Maintenance</i> <i>Lifecycle</i> <i>Replacement Costs</i>	<ul style="list-style-type: none"> Possible more affordable – because market pressure More economical relative to trolley 	<ul style="list-style-type: none"> Battery costs Purchase cost Shorter life expectancy for vehicle Maintenance Fuel cost rising
Existing Investments in Infrastructure <i>Trolley Lines, Roads, Bus Barns</i>	<ul style="list-style-type: none"> No new infrastructure use required 	<ul style="list-style-type: none"> Dismantling trolley line costs
Vehicle Reliability	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Dual fuel More complex parts availability
Route Flexibility / Versatility	<ul style="list-style-type: none"> Go most places 	<ul style="list-style-type: none"> Too tall for High Level Bridge
Location of Use		
Aesthetics	<ul style="list-style-type: none"> No wires 	

"In San Francisco, we never saw a trolley that jumped its wires because they're better maintained. Done well, they are very reliable."

"We have to assume the city wouldn't purchase an unreliable bus – they're all new."

"You may have a trolley-bus, but you can't use it everywhere."

"The technologies aren't the same...so you can't expect the same reliability."

"We don't have enough technical information to rate each type of bus."

6.3 Which Bus(es) to Purchase

Early in the workshop discussions, participants indicated that ETS needs to consider purchasing a mix of buses, rather than investing in only one technology. When asked what the mix should be, some participants felt it would be easier to answer the question in terms of current and future fleet purchases.

Generally, in the short term, participants preferred to purchase more trolley buses than hybrid or diesel buses.

- Those who preferred to purchase more trolley buses than other types of buses indicated there is too much risk in removing the trolley infrastructure and relying on unproven (i.e., hybrid) technologies. They were especially wary of the reliability and maintenance costs of hybrid buses.
- Hybrid buses were the second most popular choice among participants, who generally felt hybrids have advantages over both diesel and trolley buses, but have not yet been proven viable in the Edmonton climate.
- While many participants indicated they would not purchase any diesels in the short term, those who preferred purchasing diesels cited cost and reliability as the reasons for their choice.

"It's not very smart for ETS to put all their eggs in one basket."

"Ten years from now, the hybrid will be the standard transit vehicle."

"We just don't know enough right now."

In the long-term purchase scenario, participants tended towards purchasing more hybrid buses than the other types of buses.

- It was generally felt that ten years from now, hybrid technology would be refined enough to justify the investment in this technology.
- While participants would continue to purchase trolley buses ten years from now, they would purchase fewer trolleys and more hybrids.
- Very few participants indicated they would purchase modern diesel buses ten years from now.

6.4 Considerations During Implementation

Participants thought that ETS should make the following considerations when implementing their purchase decision:

- Labour market for mechanics, as each technology will require different skill sets.
- Ridership patterns, for example, diesel buses should go into new neighbourhoods because of the low infrastructure cost.
- Marketing the decision in a manner that encourages ridership among the general public.
- Ensuring continuity of service and minimal disruptions.
- Cost, including externalities.
- Responsible disposal of old buses.
- Transparency and making information available to the public.
- Tracking performance of hybrids in other markets, and using multiple rather than just one example.
- Additional public consultations.
- (If trolley buses) building infrastructure.
- Options for fuel (e.g., biodiesel).
- Ensure maintenance staff are consulted and involved in the process.

"You have to think about how you're going to market whatever choice you make. If a choice is made and it increases ridership...it might make more people to make the right decision (and choose public transit)."

"Have a green line route and highlight it."

"Have your showpiece vehicle on a very busy line."

"Make information available to the public – they don't have to advertise but it should be there if people want to know."

"If you're going to expand the trolley system then you have to build infrastructure...and that means long public consultations."

"Were there benefits in terms of a bulk purchase?"

7 RESPONDENT PROFILE

7.1 Demographics (Users and the General Public)

Table 7 Demographics

<i>All Respondents</i>	<i>Users (n=408)</i>	<i>General Public (n=400)</i>
Gender		
Male	40%	49%
Female	60%	51%
Have you ever ridden on . . .		
Trolley-bus	98%	80%
Modern Diesel Bus	99%	79%
Hybrid Bus	82%	28%
Bus Ridden Today		
Trolley-bus	57%	N/A
Modern Diesel Bus	58%	N/A
Hybrid Bus	5%	N/A
Age		
15 - 19	16%	-
20 - 24	15%	15%
25 - 34	22%	20%
35 - 44	17%	19%
45 - 54	15%	19%
55 - 64	8%	12%
65+	8%	15%
Purpose of Trip on Day of Interview		
Going to/from work	62%	N/A
Personal business	70%	N/A
Going to/from post-secondary school	16%	N/A
Going to/from secondary/high school	10%	N/A
Social functions	58%	N/A
Other	3%	N/A
Frequency of Use		
At least 2 times per day (40+)	66%	14%
At least once per day (25 - 39 times a month)	11%	4%
Several times a week (9 - 24 times a month)	18%	10%
Once a week or less (< 9 times a month)	6%	24%

7.2 Staff Information

Table 8 Staff Information

All Respondents	Operators (n=355)	Maintenance (n=56)**
Have you ever driven a . . .		
Modern Diesel Bus	97%	N/A
Trolley-bus	94%	N/A
Hybrid Bus	60%	N/A
Have you ever worked on . . .		
Modern Diesel Bus	N/A	89%
Trolley-bus	N/A	77%
Hybrid Bus	N/A	43%

N/A – not applicable, question was not asked of either operators or maintenance staff

*** Caution in interpretation of data due to small sample size*

8 METHODOLOGY

8.1 Data Collection

Leger conducted data for this project in three phases:

On-site Intercept Survey

- ✓ On-site interviews conducted via hand-held data entry (Palm PDA) technology. Data was collected along two different ETS routes where all three types of buses run between March 7th and March 17th, 2008.

Telephone Survey

- ✓ A telephone survey of Edmonton Citizens was conducted between March 17th and March 21st, 2008.

Stakeholder Consultation

- ✓ A stakeholder consultation was held on April 16, 2008 with representatives from a variety of stakeholder organizations.

Employee Survey

- ✓ ETS distributed a paper survey to select employees. Results were tabulated and analyzed by Leger Marketing.

8.2 Target Respondents

The target respondents were different for each type of study completed.

On-site Intercept Survey

- ✓ Target respondents were current users of ETS.

Telephone Survey

- ✓ Target respondents were citizens of Edmonton who had used ETS in the past year.

Stakeholder Consultation

- ✓ Representatives from a variety of stakeholder organizations based on a list provided by ETS were invited to participate in a research session to discuss the fleet purchase.

Employee Survey

- ✓ Target respondents within Edmonton Transit were limited to bus operators and maintenance staff.

8.3 Sample Size

Leger completed 408 on-site interviews with current users of ETS and 400 telephone interviews with citizens in the general public. ETS received 411 paper surveys from operators and maintenance staff.

The stakeholder workshop was attended by 18 individuals representing various stakeholder groups identified by Leger Marketing and ETS as having potential interest in the research topic.

8.4 Sampling Plan

To ensure that results could be extrapolated to represent the total population being studied (all ETS riders) within a calculated margin of error, a sampling plan based on randomly selecting respondents was employed. Based on the total sample size of 400 customers, results are statistically accurate to within ± 4.9 percentage points, 19 times out of 20. The margin of error increases as sample size decreases.

8.5 Questionnaire Design

Leger Marketing developed a questionnaire in consultation with the City of Edmonton, based on secondary research on trolley bus, hybrid bus and clean diesel technologies. The questionnaire was designed to ensure the questions flowed properly and addressed the City of Edmonton's research objectives, including the need for trending, including LRT customers in the survey, and the addition of specific coding for special fare programs such as U-Pass. Changes made to the questionnaire are summarized in the Methodology Report in Appendix A.

A copy of the survey instrument is provided in Appendix B

8.6 Analysis of Findings

Throughout the questionnaire, a seven-point scale was used for respondents to rate their opinions about ETS buses. The rating scale used in the study is:

- ✓ **Satisfaction:** 1 means not at all satisfied, 4 means satisfied and 7 means very satisfied.
- ✓ **Agreement:** 1 means do not agree at all, 4 means agree and 7 means agree completely.

For the purpose of analysis and discussion, the numerical ratings were consolidated, where appropriate, into three groups:

Rating on the 1 to 7 scale	Interpretative Level
6, 7	These respondents express <i>top-box</i> positive responses.
4, 5	These respondents disclose <i>mid-range</i> responses about a particular factor, or provide a moderately positive response.
1, 2, 3	These respondents provide <i>negative</i> responses.

Throughout the user and employee questionnaire (operators and maintenance), respondents were asked to rank the types of buses on different purchasing factors. For these questions, a score was calculated based on a weighted total of the number of respondents and the rank given. Below the number of points given to each ranked response are listed:

- ✓ Rank 1 – 3 points for each respondent
- ✓ Rank 2 – 2 points for each respondent
- ✓ Rank 3 – 1 point for each respondent