Fourth Quarter
CTTRANSIT

Demonstration and Evaluation of Hybrid Diesel Electric Transit Buses

April, May & June 2004

Report No. CT-170-1884-4-04-11

PROGRAM PARTNERS

CTTRANSIT
Allison Transmission
Horiba Instruments Inc.
New Flyer Bus Industries
University of Connecticut
CDOT Division of Research
The East Coast Hybrid Consortium
CDOT Bureau of Public Transportation
Connecticut Academy of Science and Engineering

Prepared By
Stephen W. Warren

Technical Report Documentation Page

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15. Supplementary Notes
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16. Abstract
The project goal is to identify the next generation of transit vehicles for future fleet replacement that are cost effective, reliable, produce fewer emissions, and have improved fuel economy compared to the standard heavy-duty diesel powered bus. Data are being collected to produce an estimated life-cycle cost analysis, using emissions information, mileage, fuel economy, power production, brake pad wear, maintenance & repair costs. Driver & customer surveys are also being performed.

Two 2003 model year 40 ft low floor New Flyer Allison hybrid diesel electric buses were placed into service in June 2003. Performance data collection began on July 1, 2003 on these buses as well as two virtually identical 2002 model year 40 ft low floor New Flyer standard diesel buses. The hybrids and base buses operate in virtually identical conditions on equivalent routes each day.

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Fourth Quarter
CTTRANSIT
Demonstration and Evaluation of
Hybrid Diesel Electric Transit Buses

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This project was sponsored by the Connecticut Department of Transportation in Cooperation with the U.S. Department of Transportation, Federal Highway Administration.

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CTTRANSIT
Demonstration and Evaluation of
Hybrid Diesel Electric Transit Buses
Summary of Activities and Findings

- Two 2003 model year 40' low floor New Flyer Allison hybrid diesel electric buses were placed into revenue service in mid-June, 2003. Performance data collection began on July 1st, 2003, on these buses as well as two virtually identical 2002 model year 40' low floor New Flyer standard diesel buses.
- The test buses were randomly assigned to operate on every route in the system in order to test their capability and versatility in different operating conditions. These routes vary in passenger loads, operating speed and terrain. In order to make the test data as comparable as possible a standard base diesel bus was assigned to "shadow" a hybrid bus on following trips each day as much as possible. The hybrids and base buses therefore should operate in virtually identical conditions each day.
- Performance data collected included route and driver assigned, noon temperature and weather, miles operated, fuel and oil consumed, road calls, trouble codes, maintenance performed and cost of maintenance and repair.
- To date the new hybrid buses have operated very well. Only one hybrid system related road call has been experienced. The other road calls have been attributed to oil cooler and engine harness issues which are not related to the hybrid bus design.
- The hybrid buses have been popular with our customers and Drivers. A survey of Drivers was conducted last quarter and documented in the third quarter report. A passenger survey was conducted this quarter with the very favorable results summarized in this report.
- The hybrids are in great demand for demonstrations by various groups and special events. The only downside is that this has reduced their in-service testing time.
- To date the hybrids demonstrated good reliability and low maintenance costs. They have shown to average about 10% to 15% better fuel economy than their peer test diesel buses and 35% better than the fleet average.
- The emissions testing component of the test program began last quarter. Some emissions testing delays were experienced by very cold weather and snow conditions. A representative from the EPA and two representatives from the East Coast Hybrid Consortium observed emissions testing on February 25th and June 29th respectively and all commented that they were very impressed with our program. The EPA is extremely interested in real world mobile emissions testing and our project. We note that they recently have proposed an in-use emissions testing program for heavy-duty trucks. A similar program for heavy duty buses is also expected in the near future.
- The test buses were transferred to the **CT**TRANSIT Stamford division in mid-June, 2004, for emissions testing on ultra low sulfur diesel fuel.
- Three standard bus routes are utilized for emission tests. The E-Farmington Avenue service is our heaviest ridership route and is representative of a common transit route with frequent stops to board and alight passengers. The Enfield express is a high speed park and ride which uses the HOV lanes on the interstate highway and has only one initial pickup and one final destination stop. The Avon Express is a route which traverses a very steep grade over Avon Mountain.
- The AGM Maintenance toured the BAE hybrid drive and Orion hybrid bus manufacturing plants in June, 2004.

EMISSIONS MEASUREMENT PROJECT UPDATE – CT TRANSIT
JUNE 6, 2004

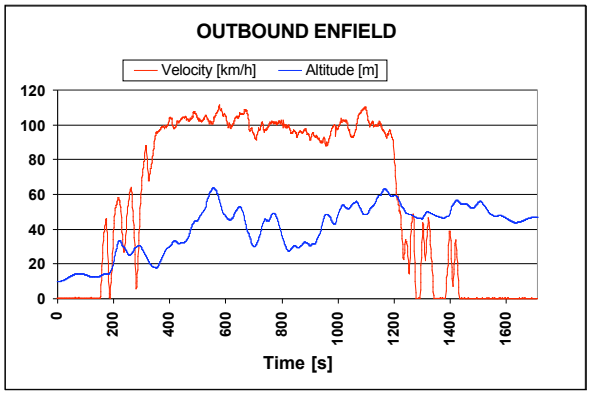
Project Objective:
One of the main objectives of this project is to measure the emission concentrations of CO, CO_2, NO_x and UHC (unburned hydrocarbons) of 2 Hybrid Diesel-Electric buses and 2 conventional Diesel buses under regular operation conditions employing an on-road emission measurement equipment (Horiba 1000). These measurements are to be used to:

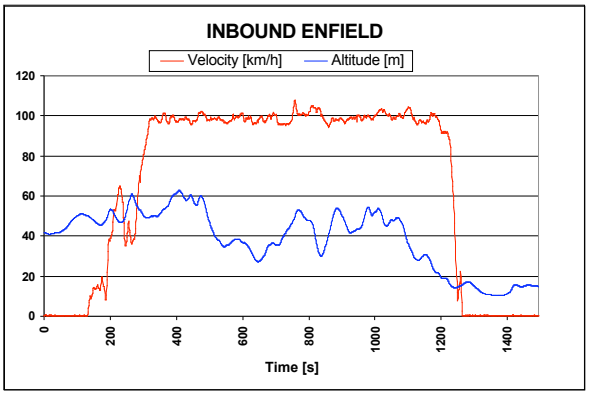
- Compare fuel consumption and exhaust gas emissions characteristics of the Hybrid Diesel-Electric buses with the conventional Diesel buses
- Test the reliability of the Hybrid Diesel-Electric buses under regular daily operation conditions

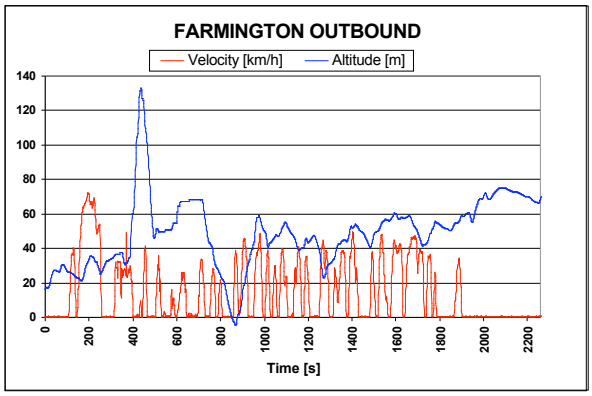
This information will be used to qualitatively evaluate the reliability, fuel consumption and emissions reduction of the Hybrid Diesel-Electric bus in comparison with conventional Diesel transportation. It will also become a decision making tool for future investments in alternative energy technologies at CT Transit.

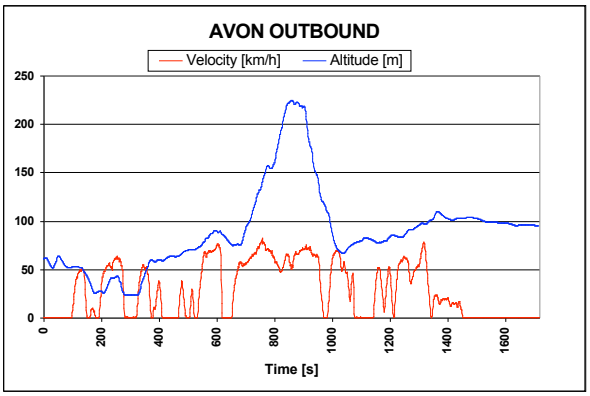
Driving Cycles
Driving cycles have been modified since last report was issued. This has been done to increase equipment calibration times, therefore providing better accuracy of emission measurements.
Driving cycles:

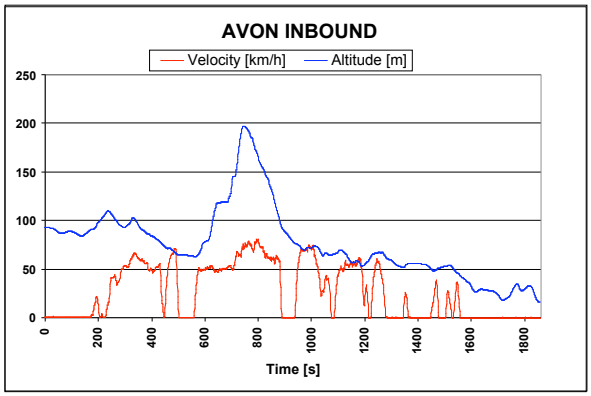
1. Enfield Outbound: Highway driving cycle (16.7 miles)
2. Enfield Inbound: Highway driving cycle (16.7 miles)
3. Farmington Outbound avenue city route: City driving cycle (5.6 miles)
4. Avon mountain Outbound route driving cycle (8.2 miles)
5. Farmington Inbound avenue city route: City driving cycle (5.6 miles)
6. Avon mountain Inbound route driving cycle (8.2 miles)

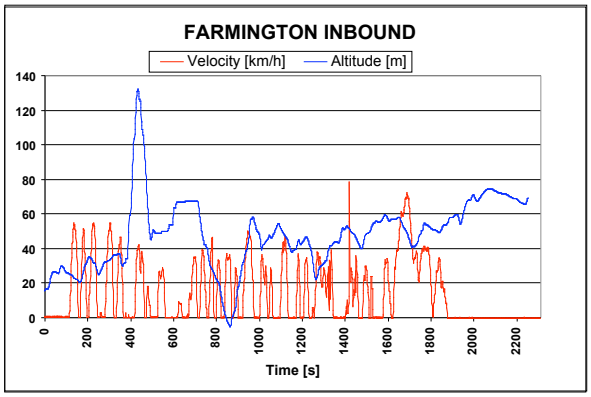












Data Gathered

For each one of the driving cycles we have recorded the following data:

1. CO, CO_2, NO_x, UHC emissions and Air Fuel Ratio (AFR)
2. Speed and Location (longitude, altitude and latitude)
3. Ambient Pressure, Temperature and Humidity
4. Exhaust Flow Rate, Pressure and Temperature
5. State of Charge (SOC)

Testing Status

	CONVENTIONAL BUS		HYBRID BUS	
Date	**201**	**202**	**301**	**302**
6-Jan			X	
21-Jan			X	
23-Jan	X			
30-Jan	X			
11-Feb		X		
13-Feb		X		
18-Feb		X		
27-Feb				X
16-Apr			X	
21-Apr			X	
23-Apr	X			
27-Apr		X		
30-Apr				X
26-May		X		
28-May		X		
29-Jun		X		

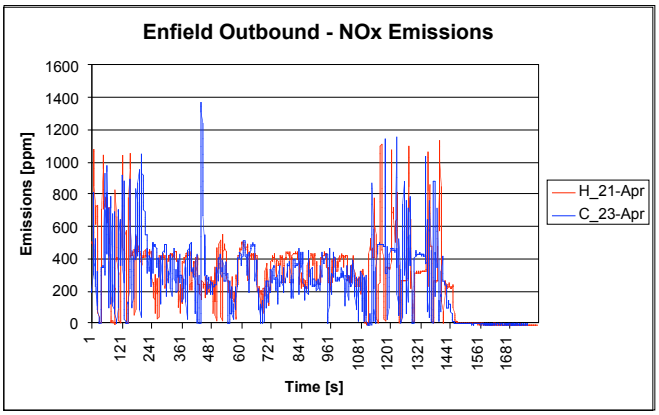
With Modifications

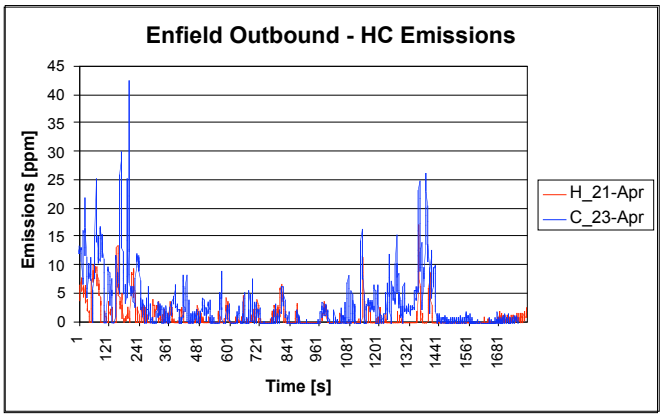
Without Modifications

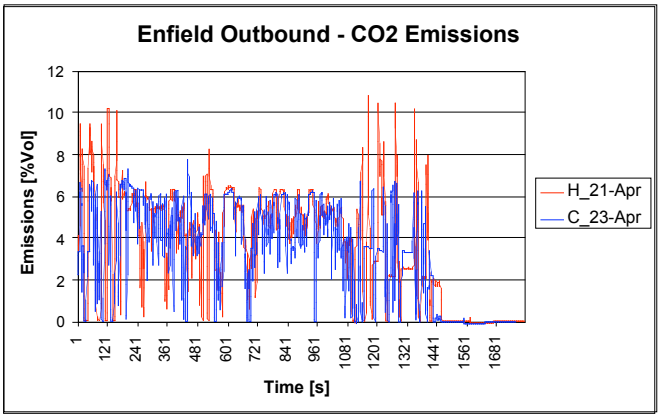
As a consequence of issues identified in prior measurements (difficulties on data acquisition synchronization, presence of negative exhaust flow and hydrocarbons readings and lack of NO_x sensor calibration), important modifications had to be applied to Horiba's system. All cells in white show the testing that has been performed with those modifications.

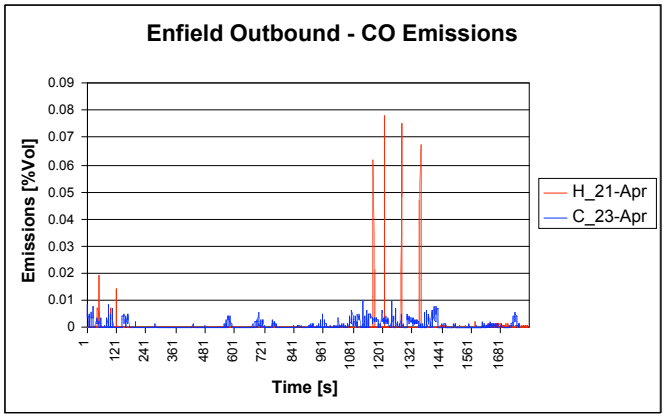
Emission Samples

1. Enfield Outbound

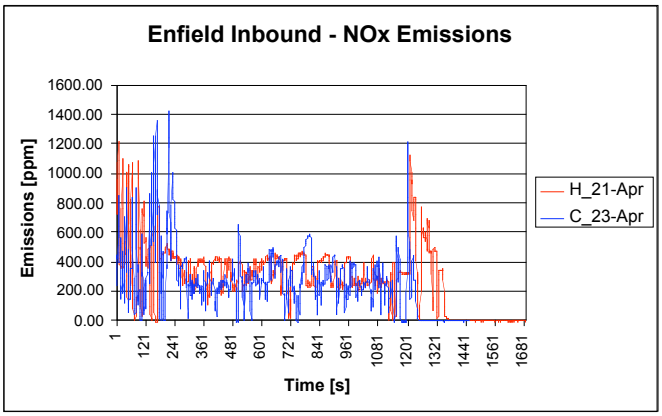


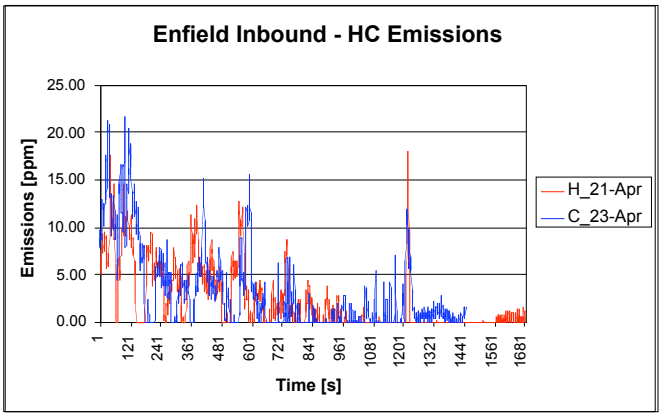


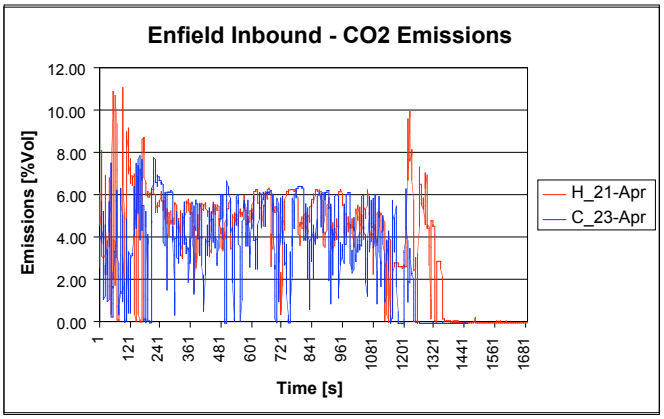


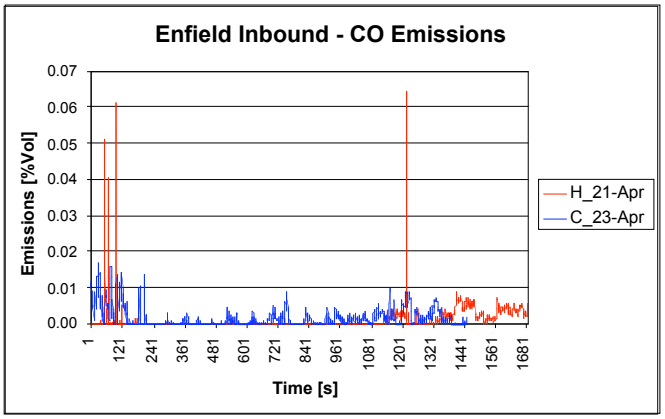


2. Enfield Inbound

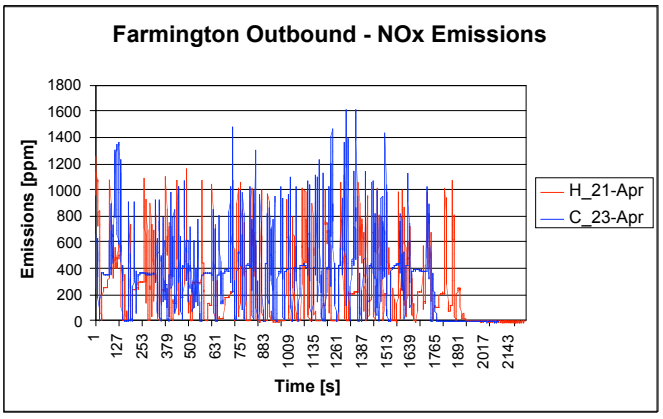


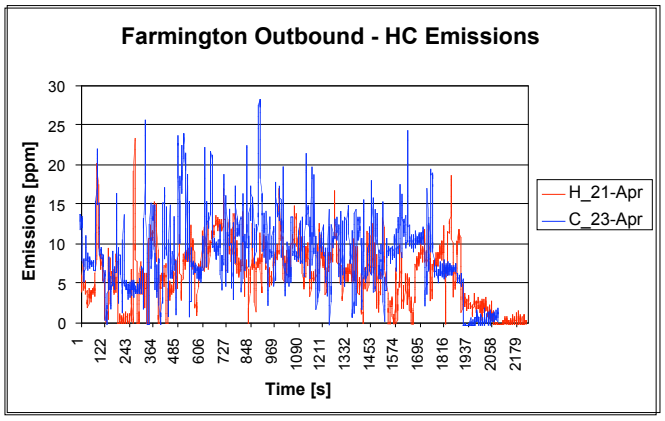


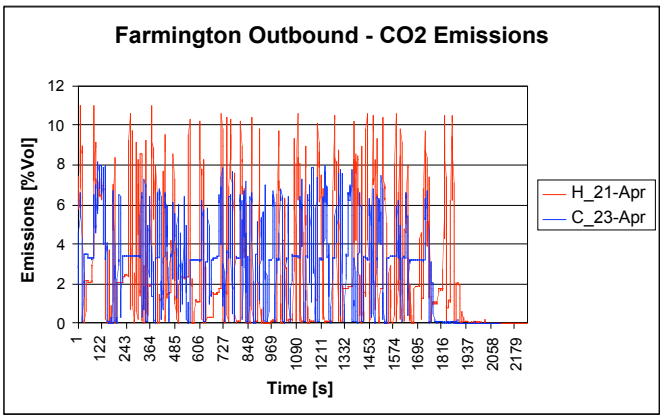


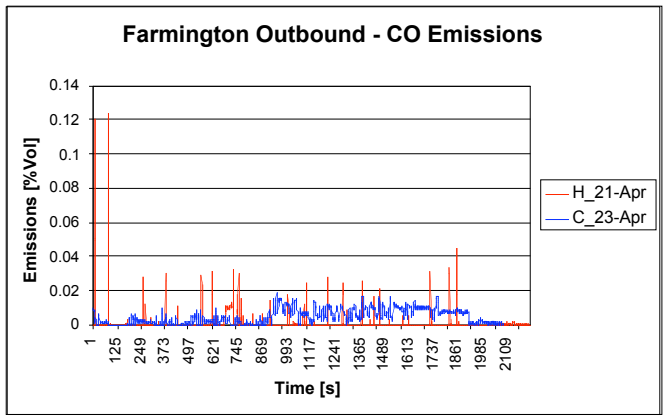


3. Farmington Outbound

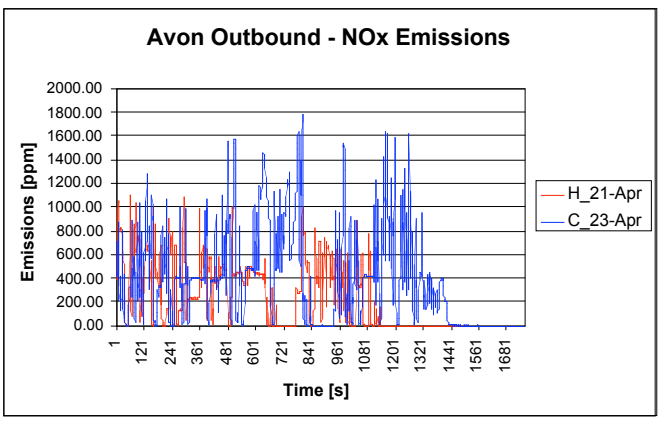


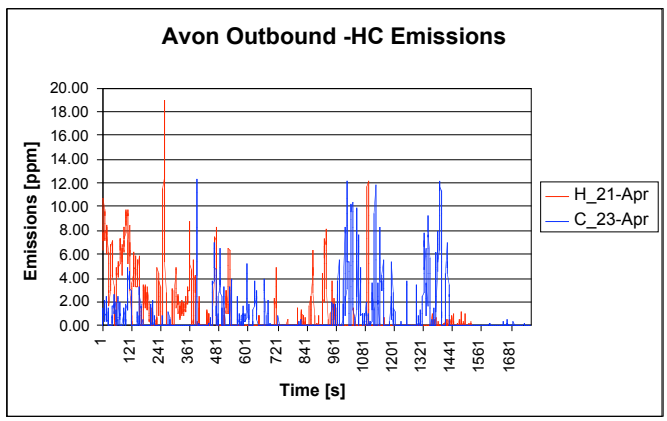


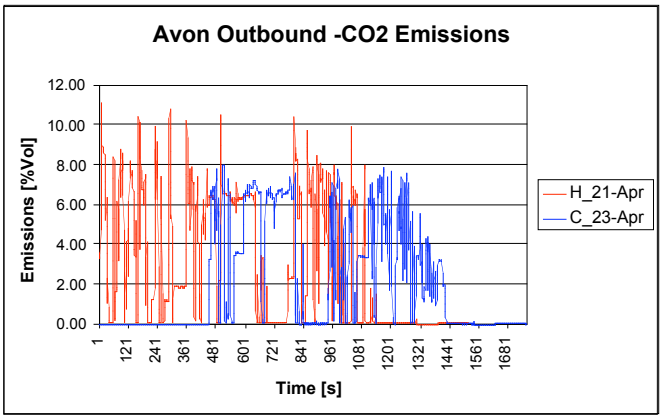


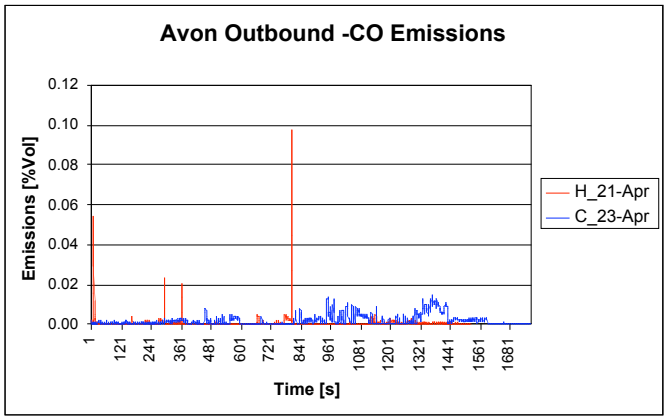


4. Avon Oubound

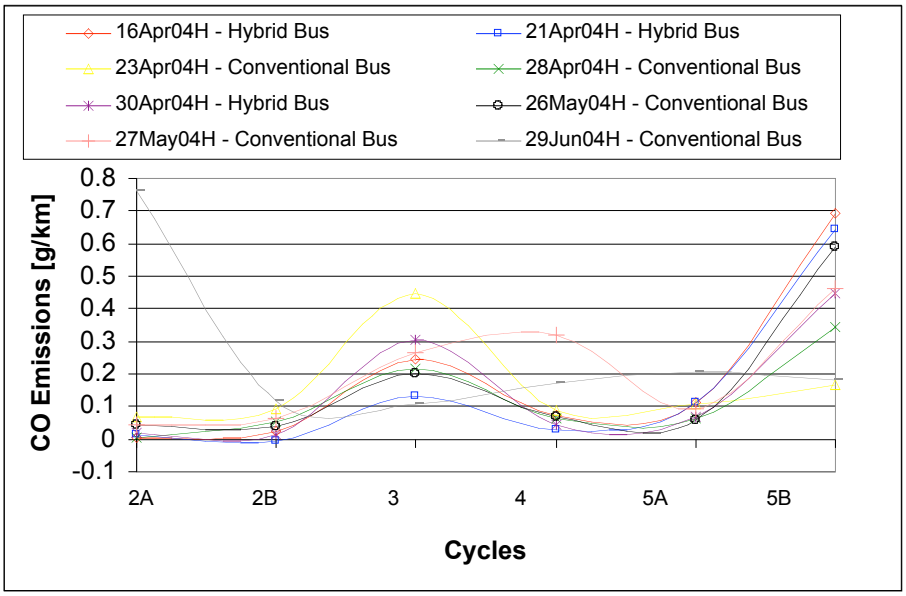


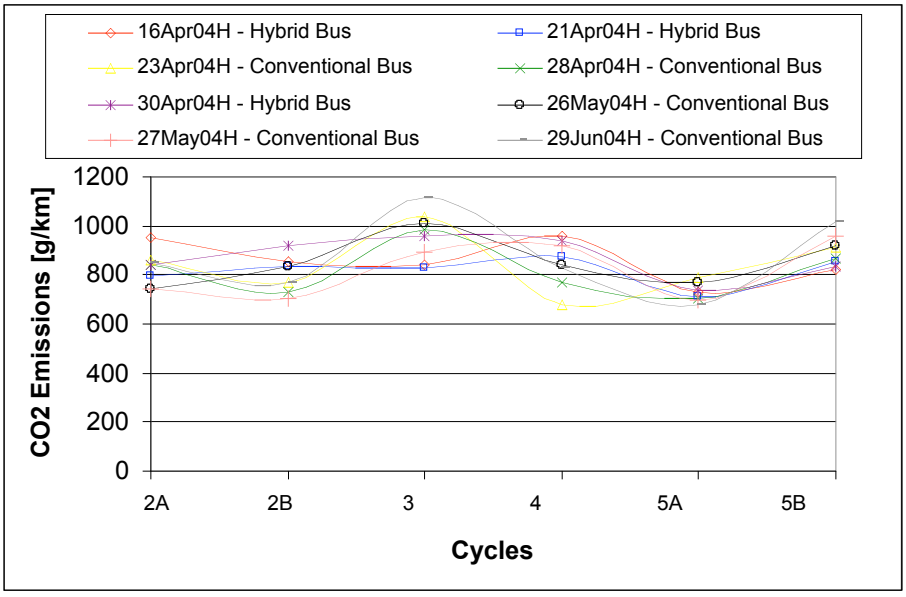


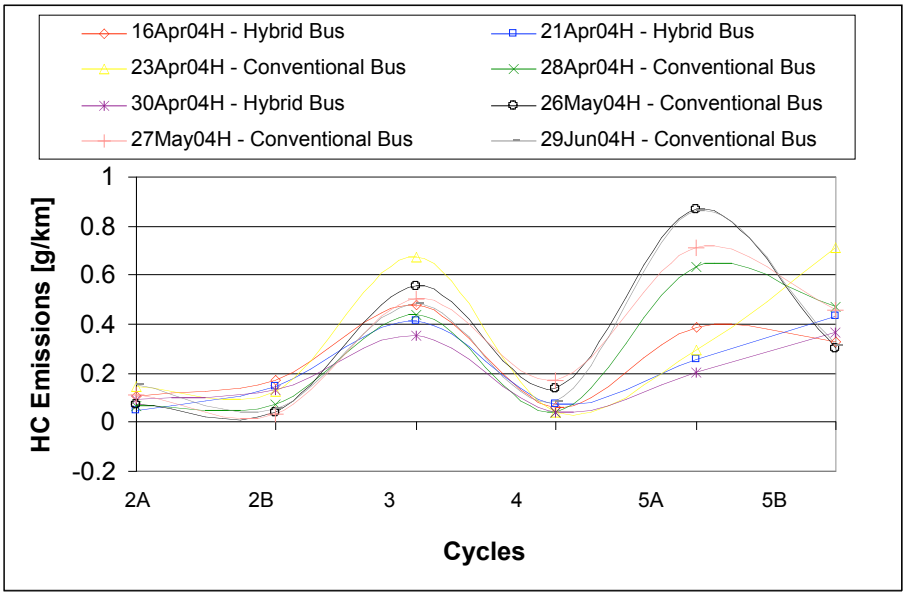


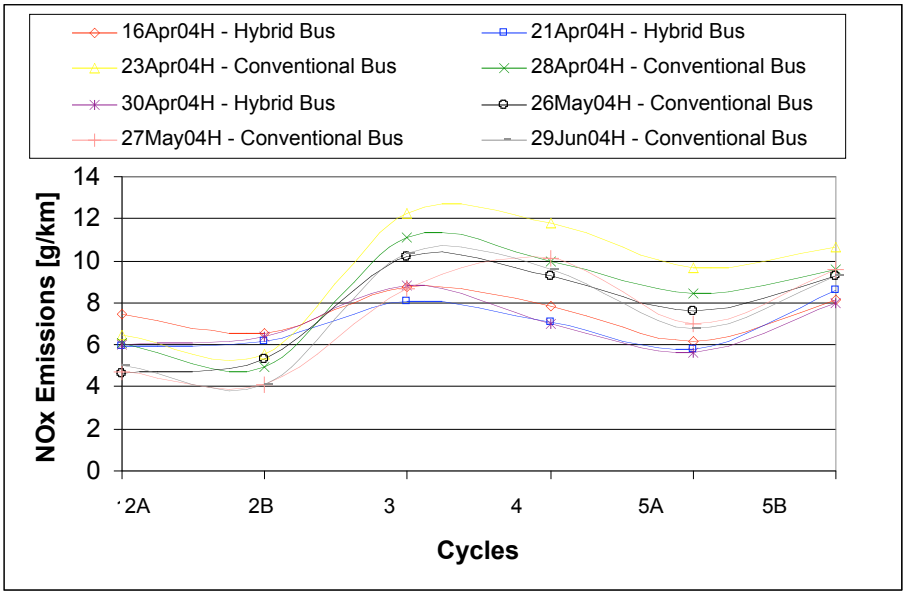


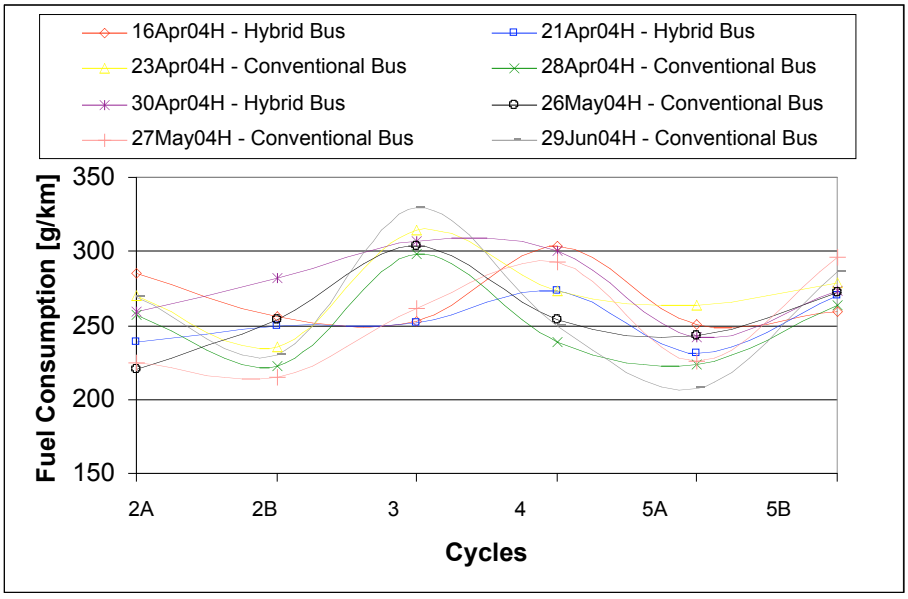
Driving Cycle Comparisons






16Apr04H - Hybrid Bus
21Apr04H - Hybrid Bus
23Apr04H - Conventional Bus
28Apr04H - Conventional Bus
30Apr04H - Hybrid Bus
26May04H - Conventional Bus
27May04H - Conventional Bus
29Jun04H - Conventional Bus
HC Emissions [g/km]
1
0.8
0.6
0.4
0.2
0
-0.2
2A
2B
3
4
5A
5B
Cycles


16Apr04H - Hybrid Bus
21Apr04H - Hybrid Bus
23Apr04H - Conventional Bus
28Apr04H - Conventional Bus
30Apr04H - Hybrid Bus
26May04H - Conventional Bus
27May04H - Conventional Bus
29Jun04H - Conventional Bus
NOx Emissions [g/km]
14
12
10
8
6
4
2
0
2A
2B
3
4
5A
5B
Cycles


16Apr04H - Hybrid Bus
21Apr04H - Hybrid Bus
23Apr04H - Conventional Bus
28Apr04H - Conventional Bus
30Apr04H - Hybrid Bus
26May04H - Conventional Bus
27May04H - Conventional Bus
29Jun04H - Conventional Bus
Fuel Consumption [g/km]
350
300
250
200
150
2A
2B
3
4
5A
5B
Cycles

Connecticut Transit Hybrid Bus Project
Particulate Matter Emissions
Progress Report

April 1, 2004-June 30, 2004

Principal Investigator: *Britt A. Holmén*

Research Objective(s):
This research aims to compare the available engine, fuel and aftertreatment configurations available to the CT Transit fleet in terms of ultrafine particulate matter number and mass emissions in order to determine the combination that will best meet current and likely future particulate matter emission standards. Specifically, Table 1 defines the six different engine-fuel- aftertreatment combinations that will be tested and compared.

Table 1. Project Transit Bus Configurations for Emissions Comparison*

Standard **Diesel Bus** configurations:	(D1) #1 diesel fuel, no aftertreatment.
	(D2) ULSF, no aftertreatment.
	(D3) ULSF + diesel particulate filter/trap.
Hybrid Diesel-Electric Bus configurations:	(H1) #1 diesel fuel, no aftertreatment.
	(H2) ULSF, no aftertreatment.
	(H3) ULSF + diesel particulate filter/trap.

*ULSF = ultralow sulfur fuel with S < 15ppm.

The project objectives are being addressed using "on-board" emissions testing. This new approach involved significant research challenges and appreciable changes in instrumentation and testing protocols compared to dynamometer testing, but provides unique opportunities for evaluating the real-world emissions of in-service transit buses.

Accomplishments This Quarter:

1. Collected emissions measurements on *April 16, 21, 23, 28 and 30; May 25, 26, 27; June 2 and 29* as indicated in updated Table 2.

Table 2. On-Road Tests of Commuter, Local and Mountain Routes

Date	Bus	Comments
21Jan04	H301	Mass flowmeters operational, but noisy. ELPI ch12 = extreme currents. ELPI no initial TB. Roof hatch insulation added.
23Jan04	201	New RS-232 cables for mass flowmeters to reduce noise. ELPI flange fitting missing – Ruben jury-rigged w/washers. Trouble w/Prolink's connection—scantool was bad on Warmup run only. Computer clock offsets measured periodically throughout day. (Driver = Al).
30Jan04	201	Low noise Labview readings for first time. JW logging voltage from socket (Scopeview). JW trouble with Prolink communication (13:27).
11Feb04	202	Two erratic t/c readings (ch0 and ch2) JW has new laptop for logging. New procedure – stop and open doors every third bus stop.
13Feb04	202	Replace t/c ch 2 connector – no noise. AC changed NOx analyzer output signal range to 2000 ppm (was 1000 ppm). Failure of compressor joint at 11:19am – test series collected after joint repaired until second failure at 14:20 (Avon

		Mountain return).
18Feb04	202	Logsheets for intersection crossings and magnehelics added to protocols. Replicate sets of 3 bus routes collected.
27Feb04	H302	New SS swagelok for flowmeter A to replace copper. First hybrid current probe measurements. Larry Oeler (EPA NTE group) visiting.
16Apr04	**H301**	New VANSCO Data Link Adapter (USB model) for scantool testing – hexadecimal and log formatted data recovered. Jimmy Dowd = Driver. No Tunnel Blank #2 today for PM mass.
21Apr04	**H301**	Garmin GPS and Fugawi software to synch all laptop clocks to GPS time. DayHill Road HOV lane entrance closed today—took Jennings Rd. exit on 91S.
23Apr04	**201**	Diluter A 0-6" magnehelic problem – no response after 12:10pm (warm-up)
28Apr04	**202**	VANSCO collecting with CANsniff software. New Horiba zeroing and pitot calibration routine started.
30Apr04	**H302**	New dessicant. Sears air compressor (5.5hp, 22gal) not filling; purchase new Husky compressor (5hp, 26 gal) and run with it – Husky does not cycle off at all.
26May04	**202**	CPC fuse replaced; BNC cable provided by Jimmy. SMPS cannot maintain aerosol flow rate – constantly cycling to + flow. High HEPA counts for SMPS ($8/cm^3$) and liquid level light on w/o BtOH connection (off at 12:04). ELPI AUX button OFF, Trav = 0V. Prolink parameters changed - %load, RPM, speed, engine time (no coolant temp). Many ELPI vibration spikes on warm-up.
27May04	**202**	(no BH) All OK.
28May04	**H301**	(no BH) Diluter B magnehelic problem. First notice water in air compressor line.
02Jun04	**H301**	JHRAC visitors. Enfield run only due to water in compressor line to silica dryer. ELPI counts high (100k fA range).
29Jun04	**202**	East Coast Hybrid Consortium visitors, Art Vatsky and Russ Owens. Repaired Sears compressor is back. New "de-aqua-vator" system between air compressor and silica gel – Never got water in first collection vessel, only compressor tubing line. *First runs on ultralow sulfur diesel fuel.*

Work Plan:

While continuing to collect emissions data from the diesel and hybrid buses, the following data analysis tasks will also be conducted.

1. Analyze particle number distribution data to compare vehicle configurations.
2. Quantify ultrafine particle emissions as a function of engine operating parameters.
3. Write final report summarizing project research methods and findings.

CTTRANSIT'S HYBRID & CONVENTIONAL DIESEL EMISSIONS MEASURMENT PROJECT
July 12, 2004

Principle Investigator: *John D. Warhola*

Project Objective:

To measure both gas and particulate emissions simultaneously from each of the two identical Diesel Electric Hybrid buses and two conventionally powered buses. Data obtained from this project will be evaluated and utilized to choose the best configuration producing the best performance and least amount of emissions in **CT**TRANSIT'S "real world" bus routes.

Project Direction:

As of June 2004 all four test buses have been transferred to the Stamford Division for revenue service and to operate on Ultra-Low Sulfur Diesel fuel. This is the second of three stages of testing. The last stage of testing will include not only Ultra-Low Diesel, but will include the installation of particulate filters on all four-test buses for emissions comparison.

Note: All four buses in the testing program are fueled in Stamford with Ultra–Low Sulfur Diesel. They are then driven to the Hartford facility. The buses have the capacity to travel between divisions and undergo emissions testing without any refueling.

Project Changes & Modifications:

- Calibration of the Horiba OBS – 1000's NOX sensor at 2000ppm now takes place every time it is moved to a different bus and or every two weeks with a three-point calibration gas. Vapor pressure & Temperature correction is utilized on all three gases.

- Vapor pressure & Temperature correction is utilized on all the other gases involving calibration.

- A two-minute data logging prior to and after sampling has been adopted on the Horiba side as per their recommendations.

- Clock synchronization of all data logging equipment occurs before and after each leg of a run. Approximately 30 minutes between checks.

- On May 4th, a test involving the Horiba system only was run. It involved the thermal insulation of the exhaust sampling pipe system from where the exhaust pipe exited the bus roof all the way up to and including the Horiba tailpipe adapter where all Horiba sensors are mounted.

- Testing concluded there was no significant benefit to insulating the exhaust-sampling pipe to reduce exhaust flow measurement issues. In other words thermal loss from air flowing over the exterior of the sampling exhaust pipe with a 6" diameter did not generate additional turbulence within the exhaust stream and affect low flow exhaust measurements.

- As of 4-16-04 per Horiba's instructions, a six-inch exhaust pipe extension was installed onto the end of the Horiba tail pipe adapter, which all sensors are mounted in. This extension was recommended to improve low exhaust flow accuracy.

- The baffle plate located forward of the end of the exhaust sampling pipe has been enlarged and lengthened to accommodate and protect the end of the exhaust from siphoning effects at high speeds which could affect emissions readings.

- Horiba recommended expediting quickly the re-zero process of the exhaust flow calibration to avoid large temperature swings in the exhaust pipe and pitot tube, which may be introducing errors. This has been adopted.

- As of 4-16-04 a prototype data logging tool built by Vansco has been acquired on a trial basis. Its capacity to capture all data messages transmitted on the J1939/1708 communication network is beneficial overall. The one time challenge to isolate only the messages required for emissions testing is time consumming but will be an asset to all future testing of buses for emissions or performance.

- On the 4-30-04 run Professor Holmen's [oilless air compressor] failed. A new one was acquired and the test was fully completed the same day without further complications. The temporary replacement air compressor ran hot the entire emissions testing and was never able to cycle off.

- NOTE: The swing of outside ambient temperatures from extreme cold to well into the 80's will bring about new issues. All equipment operating parameters will be checked to see if cooling may be necessary in the upcoming months.

- Up until May 28, 2004 humidity collecting in the compressed air system used for particulate measurement has not posed a significant problem or has been anything of an issue. On the 28th weather was medium rain. Moisture caused a measurement failure involving a magnehelic during the inbound run to Enfield. Particulate measurement was cancelled at the end of the outbound run from Enfield due to saturation of desiccant dryer. Water was collecting and leaking out of the base of the desiccant dryer tube.

- To eliminate contamination and the passage of saturated air through to Professor Holmen's desiccant dryer/filter system a water extraction device was built by Technical Services & **CT**TRANSIT personnel. It is referred to as the de-aqua-vator and is mounted in the bus. This system has two stages, which have not allowed moisture in visible form to pass or collect in the second stage as of yet. Further testing in the upcoming months of August and September will challenge the de-aqua-vator.

- Protocol involving draining & purging of water extraction system at various points on a 30-minute interval has been set and will insure proper equipment operation and integrity.

- On the next test setup, the compressed air line, which runs from the trailer into the bus, will be installed to facilitate the drainage of water into the de-auqa-vator. This will help to avoid condensation collecting in the hose and causing a bubbling action. Also the least amount of compressed air line will be left outside of the bus. With a majority of hose inside of the bus it should act as a cooling line to drop out as much moisture as possible prior to the de-aqua vator.

- As of test date June 29th, a new NOX sensor has been calibrated and will be in use marked along with the change in emissions testing with the test buses burning Ultra-Low Sulfur Diesel. A degradation chart is being generated through the calibration process of the NOX sensor to keep tabs on the life of the sensor. Horiba gave this sensor to **CT**TRANSIT. Horiba requests that we supply the degradation chart for their analysis on the performance of this expendable sensor, which normally costs $2500.00.

Continuation of Emissions Testing:

- Including April 16th up to June 29th,2004 there has been 11 test days.

- On May 4th a thermal insulation test took place involving the Horiba Gas Emissions analyzer system only.

- On June 2nd members of the JHRAC were given full emissions testing demonstration aboard H301. Professor Holmen and John Warhola were in attendance to explain procedures and processes.

- On June 29th Art Vatsky & Russ Owens from the East Coast Hybrid Consortium accompanied the emissions team with Professor Holmen and John Warhola aboard Bus 202 for the entire test. The processes & procedures were witnessed first hand by both Mr. Vatsky and Mr. Owens.

- On June 29th John Warhola meet with Art Vatsky & Russ Owens for a short period of time while Bus 202 was being prepared & emissions equipment was being calibrated prior to emissions testing which they were scheduled to attended on behalf of the East

Coast Hybrid Consortium. The June 29th test was the first test involving the test vehicles running on Ultra–Low Sulfur Diesel fuel.

Immediate Project tasks to be accomplished

- Have just received another Cummins Software Update. This update is supposed to contain the control of data logging frequency. This must be verified.

- **CT**TRANSIT has purchased the SAE J1939 document package, which contain information to decipher the engine data stream output by the ECM for data logging with the newly acquired Vansco data logger. Specific data points to log must be identified and verified prior to our next scheduled test.

- Request operators of all testing equipment to check temperature-operating parameters and supply them to John Warhola for consideration of cooling issues.

- John Warhola to contact Stamford for repair of boost leak on test Bus 202 which occurs on the Avon Mountain run.

Future concerns to be considered

- As far as oilless compressed air supply, the duty cycle on the air compressor is high. Purchase of a single stand-alone oilless air compressor without a holding tank, which can deliver 75% or more of the volume of compressed air needed, should be investigated. This would insure steady volume & psi. This would also avoid running the main air compressor at 100% duty cycle, which does not allow it to shut off for more than two minutes.

- John Warhola needs to check on installation of particulate filter. Does it increase backpressure and what affect in the category of turbulence.

- John Warhola is to provide information requested by Art Vansky and Russ Owens of the East Cost Hybrid Consortium.

- Discuss with team about running Delta P. across existing filters on the two different engines:

@ IDLE
50 % load
100 % load

- Compare above Delta P. after installing the particulate filter if exhaust flow measurements are significantly different.

Advanced Electricity Energy Storage Module

Contains sealed nickel-metal hydride batteries that provide power to the electric drive motors. The batteries also store electricity, which is produced when the motors turn into generators as they help to brake the bus.

Connecticut's First Hybrid Electric Bus

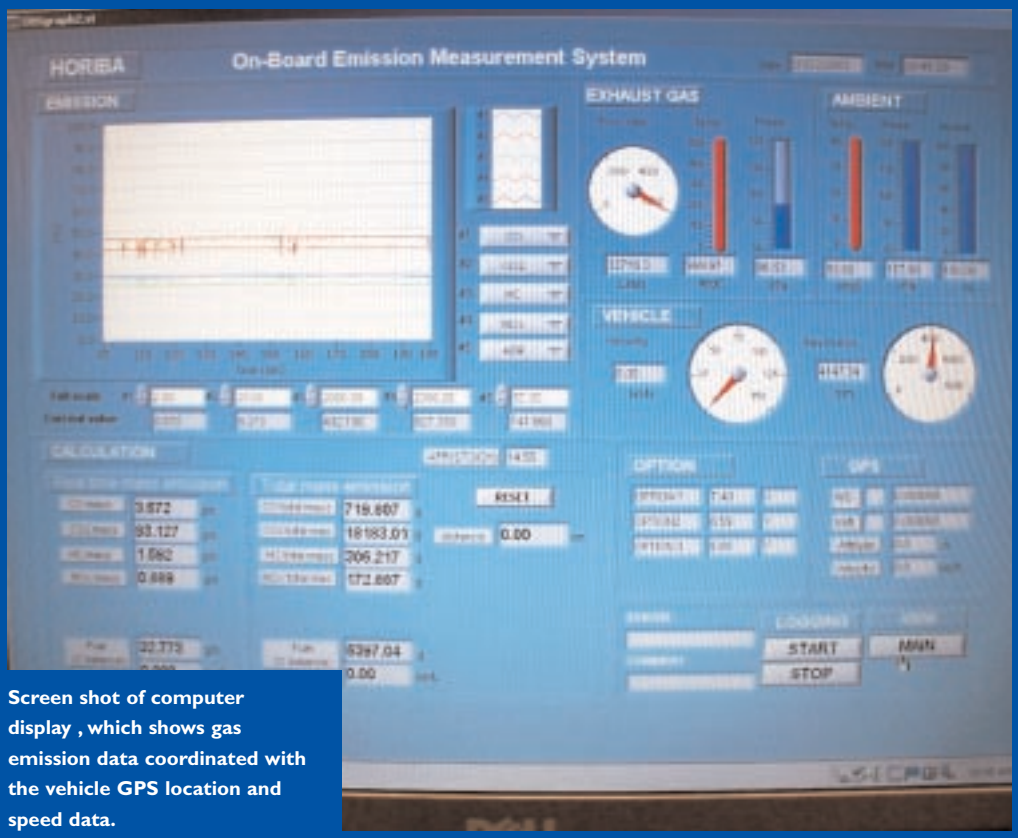
40-foot New Flyer low-floor bus with hybrid parallel Allison electric drive.

An electrical generator and air compressor are installed on a trailer to provide the electricity and clean compressed air for the sophisticated emissions test equipment located inside the bus.

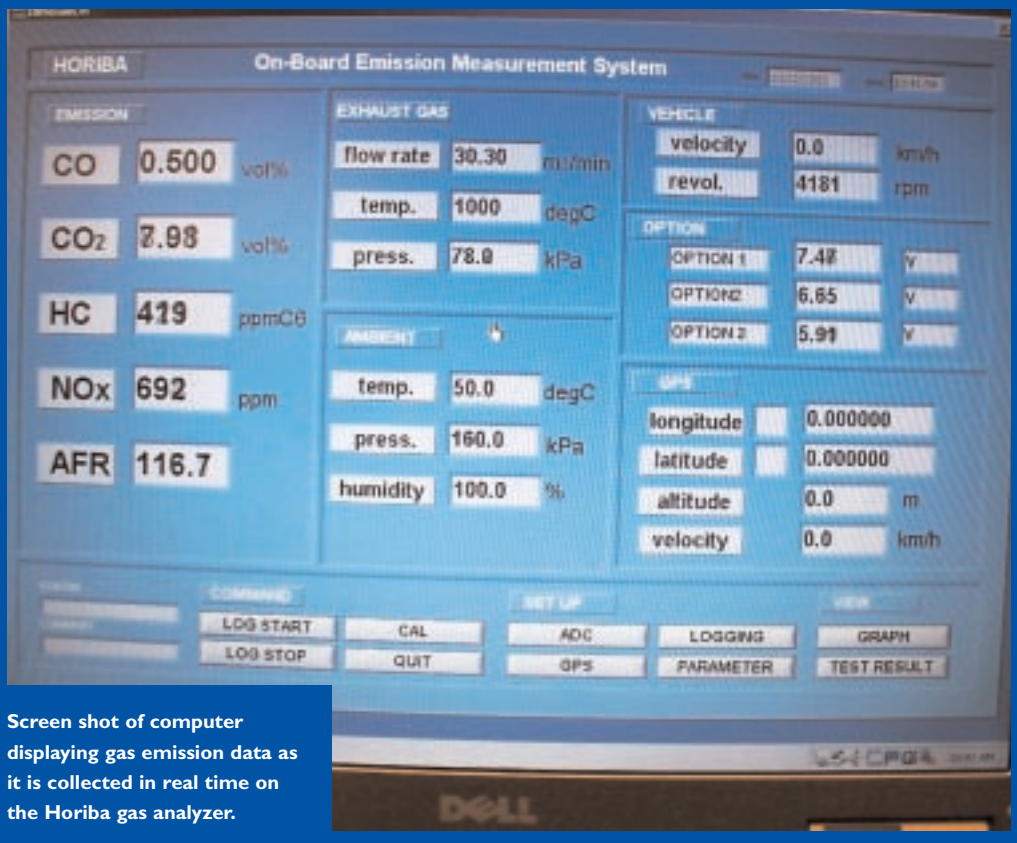
Emissions tests are collected on three different route types: low speed/frequent stops; high speed highway; and steep grade roadways. Testing is also done on #1 diesel, ultralow sulfur diesel, and ultralow sulfur diesel with a particulate filter.

University of Connecticut graduate students operate and monitor the particulate matter mass and particle size measurement equipment.

A University of Connecticut graduate student calibrates the lab emissions test equipment using known calibration gas before each test is run.



Screen shot of computer display , which shows gas emission data coordinated with the vehicle GPS location and speed data.



Screen shot of computer displaying gas emission data as it is collected in real time on the Horiba gas analyzer.

CTTRANSIT PASSENGER HYBRID DIESEL ELECTRIC BUS SURVEY

1. I have ridden in the hybrid bus: ❑ first time today ❑ occasionally ❑ often

2. When you boarded the bus were you aware that it was a special hybrid bus? ❑ yes ❑ no

3. Were you aware that the hybrid bus...

...has 90% fewer emissions than a standard diesel bus? ❑ yes ❑ no

...gets 10% to 15% better fuel economy when compared to a standard diesel bus? ❑ yes ❑ no

...runs on a combination electric drive and conventional drive system? ❑ yes ❑ no

...converts the electric motors to generators upon braking to charge the batteries? ❑ yes ❑ no

...uses advanced state-of-the-art nickel metal hydride batteries with a six year life? ❑ yes ❑ no

4. How does the hybrid bus overall **noise level** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

5. How does the hybrid bus **acceleration** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

6. How does the hybrid bus **braking** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

7. How does the hybrid bus **vibration** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

8. How does the hybrid bus **interior heat** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

9. How does the hybrid bus **interior air conditioning** compare to a standard diesel bus?
❑ better ❑ worse ❑ the same

10. Do you prefer to ride in a hybrid bus or a standard diesel bus? ❑ hybrid ❑ standard diesel
Why? _____

11. What is the most pleasing feature of the hybrid bus? _____

12. What is the most annoying feature of the hybrid bus? _____

13. From your perspective, what should be changed on the hybrid bus if **CT**TRANSIT were to purchase additional hybrids?

_____

_____

Please list any comments, positive or negative, that **you** may have about this special bus:

_____

_____

_____

_____

Thank you! (please return this survey to the CTTRANSIT representative on the bus)

CTTRANSIT Hybrid Passenger Survey May, 2004

1. I have ridden in the hybrid bus	First Time Today	Occasionally	Often
	20	46	30
	20.8%	47.9%	31.3%
2. When you boarded the bus were you aware that it was a special hybrid bus?	**Yes**	**No**	
	52	37	
	58.4%	41.6%	
3. Were you aware that the hybrid bus … has 90% fewer emissions than a standard bus?	**Yes**	**No**	
	27	62	
	30.3%	69.7%	
3. Were you aware that the hybrid bus … gets 10% to 15% better fuel economy?	**Yes**	**No**	
	25	57	
	30.5%	69.5%	
3. Were you aware that the hybrid bus … runs on a combination electric drive and conventional drive?	**Yes**	**No**	
	42	43	
	49.4%	50.6%	
3. Were you aware that the hybrid bus … converts the electric motors to generators upon braking?	**Yes**	**No**	
	31	52	
	37.3%	62.7%	
3. Were you aware that the hybrid bus … uses advanced state-of-art nickel metal hydride batteries?	**Yes**	**No**	
	22	59	
	27.2%	72.8%	
4. How does the hybrid overall noise level compare to a standard bus?	**Better**	**Worse**	**The Same**
	64	3	24
	70.3%	3.3%	26.4%
5. How does the hybrid bus acceleration compare to a standard diesel bus?	**Better**	**Worse**	**The Same**
	53	5	30
	60.2%	5.7%	34.1%
6. How does the hybrid braking compare to a standard diesel bus?	**Better**	**Worse**	**The Same**
	54	2	29
	63.5%	2.4%	34.1%
7. How does the hybrid bus vibration compare to a standard diesel bus?	**Better**	**Worse**	**The Same**
	59	5	20
	70.2%	6.0%	23.8%
8. How does the hybrid bus interior heat compare to a standard diesel bus?	**Better**	**Worse**	**The Same**
	50	5	31
	58.1%	5.8%	36.0%
9. How does the hybrid bus interior air conditioning compare to a standard diesel bus?	**Better**	**Worse**	**The Same**
	54	5	23
	65.9%	6.1%	28.0%
10. Do you prefer to ride in a hybrid bus or a standard diesel bus?	**Prefer Hybrid**	**Prefer Standard**	
	58	8	
	87.9%	12.1%	

CTTRANSIT PASSENGER SURVEY

#10 Do you prefer to ride in a hybrid bus or a standard diesel bus? Why?

Smooth motion
Better comfort
Makes no difference
Less noise
Because its better
It's better for the environment. It's better overall
Because it's better
Glad for the environment
The seats are more comfortable
It's better
Because it's better
It good
Overall better ride
Air conditioning
Comfort
More counteble
Better
The smell
Better service
All the same
I prefer hybrid bus
Is more comfortable
Smoother
Lessor people
Better as far as going over bumps
Because it's different
Its more convienent for handicapped
I don't known
Both
Either
Less noise
Because the are more space in the middel to carry stuff
Dosen't matter
Doesn't matter, need to get from point A to point B
Better for the environment – all buses should be hybrid
It better
Less emmissions
Not a lot of noise
Modern features.
Nicer, but diesel sound up from air
Helps the enisviors which helps the earth

More comfortable
This bus rides good
It was better to ride on
Are the same
Smoother ride
It rids better
Hybrid is better
Better and smoother ride
Ride is smoother
Better for the Air
It's a better ride
Less polution
Feels more comfortable

CTTRANSIT PASSENGER SURVEY

#11 What is the most pleasing feature of the hybrid bus?

Haven ridden enough to answer

Space
Rides comfortable
Feels same
A/C
Better seating
Not much vibration
I don't know
Nice looking
I feel more comfortable
Glad for the environment
The upstairs part of it
Big windows needs better seats
The smooth ride
More better seats
A/C and seating
Smoother
Air
The emissions
Air conditioning
Seating
Seat
You could see everying
The ride it self
Looks
Smaller
Cleaner/more consistant
Design on the outside
Makes it the future
The electric ramp
Photos on outside
The seats
None
Seats
Not sure
Over all everything
Seats
The looks
Looks the same
Cleaner

The ride
Quiet
Less pollution
Quiet, less pollut
Fewer emisions
The color on the outside
The back seat with star
Eventual demise of the oil and gas industry
Not noisy
AC
No comments
More comfortable
Excellet
The back seat their high
The modern look
Less noise
Less noise level
Seats are more comfortable
It rides easy
Seats
Less fumes
Smoother ride

CTTRANSIT PASSENGER SURVEY

#12 What is the most annoying feature of the hybrid bus?

Haven ridden enough to answer
None
Vibration
None
I don't know
Nothing
Need more room to recline
The cameras
Sound system
Noise
Not as wide
None
The step ramp
Loud noises
Nothing
Don't know
Uper level
Nothing
To small
None
Noise
Nothing
None
None
None
Nothing
Not sure
None
Only 2 in Hartford – should be more
Driver
N/A
O.K.
Too few of them
None yet
Nothing I can see
The seat too small
Nothing
Nothing
Loud under bus
No comment
None

None
None that I know of
None
Not sure
Drivers
Needs more seating

CTTRANSIT PASSENGER SURVEY

#13 From your perspective, what should be changed on the hybrid bus if Cttransit were to purchase additional hybrids?

Not a thing
Few more grip to hold when you stand
It great now
Put more hybrids out
They need to make the seat better
Same
Nothing
Could be the air conditioner
Nothing - I enjoy the ride
The seating
Nothing
The camera system
More seating
Width of interior
Nother
The step ramp
Nothing
Nothing
Always
Up & down stairs
More buses
Nothing
Nothing
Size
Yes
I don't know
Nothing
Nothing
More seats
None
Nothing
Nothing
Bus fare
I would have to ride on them more often to determine
Nothing
Nothing
Windows more windows at head level so you can feel the air
Shocks. Bike rack
Buy more!
Don't know yet, still new
Information that's highly visible

Nothing
Get more cheper
No change
Nothing
It is a better bus, the company could change all bus to hybrid
Make more room on the bus
NA
Maybe some more seats
Unsure
Not sure
I’m not sure
Drivers came with better attitudes
Nothing
More seats

CTTRANSIT PASSENGER SURVEY

Please list any comments, positive or negative, that you may have about this special bus:

Seat belts for the kids
Rides great
Good bus
Glad someone was smart enough to pitch this idea in the first place
It's more comfortable and faster
We should get rid of diesel or make them run on vegetable oil like the cars on the news
We need more for our money
It's a more cost efficient bus, more comfortable
Perhaps screens for the upper window openings because of bees/bugs
The cost of the fare were not as big as the Big Apple
It's better
Amable y cortes - No aburridos ni malcriados
Good looking bus
It a good bus ride
None
Very good
Wonderful scene on sides, yeah for less pollution
Hybrid is good
Its cool my son likes it a lot its better than the other bus. He says its quieter
My first time but never notice if I have ridden one before
It all positive no negative
The price range, need more seating, try getting seats belts for kids under 7yrs of age
NA
From what I have experienced the hybrid bus you get a smoother more comfortable ride, if the bus bumps into a hole you will not feel it as much with the other bus overall I feel that CT. Transit should purchase some more Hybrid buses. Thank you
Have no comment
Need more of these kind of buses, knock off the old ones.
Need more H.B type busses
Really comfortable bus ride, and I like when you first go in that it’s low enough for short people

CTTRANSIT
APRIL, 2004 HYBRID BUS TEST PROGRAM DATA

Total Fleet	*Fleet Total*	*Fleet Avg*
Miles	1,003,006.00	2526.5
Fuel - Gallons	268,333.00	675.9
Oil - Quarts	2,190.00	5.5
Road Calls	373	0.9
Maintenance Parts Cost	$187,022.36	$473.47
Maintenance Labor Cost	$118,902.04	$301.02
Total Maintenance Cost	$305,924.40	$774.49
Total Cost/Mile	$0.31	$0.31
Miles/Gallon Fuel	3.74	3.74
Miles/Quart Oil	458.0	458.0
Miles/Road Call	2,689.0	2,689.0

Base Comparison Buses	*201*	*202*	*201 & 202*	*Base Avg*	*Hybrid vs Base*
Miles	3,228	3,460	6,688	3,344	-617.5
Fuel - Gallons	711.6	811.2	1,522.8	761.4	-210.55
Oil - Quarts	4.2	0.1	4.3	2.2	1.0
Road Calls	0	1	1	0.5	0.0
Maintenance Parts Cost	$698.79	$488.25	$1,187.04	$593.52	-$149.17
Maintenance Labor Cost	$359.45	$125.58	$485.03	$242.52	-$28.66
Total Maintenance Cost	$1,058.24	$613.83	$1,672.07	$836.04	-$177.83
Total Cost/Mile	$0.33	$0.18	$0.25	$0.25	-$0.01
Miles/Gallon Fuel	4.54	4.27	4.39	4.39	12.70%
Miles/Quart Oil	768.57	34,600.00	1,555.35	1,555.35	-43.5%
Miles/Road Call	3228	3460	6688	6688	-1235

Hybrid Buses	*H301*	*H302*	*H301 & H302*	*Hybrid Avg*	*Hybrid vs Fleet*
Miles	2,524	2,929	5,453	2,727	200
Fuel - Gallons	515.1	586.6	1101.7	550.9	-125.1
Oil - Quarts	0.0	6.2	6.2	3.1	-2.4
Road Calls - Hybrid Related	0	0	0	0	-0.9
Road Calls	0	1	1	0.5	-0.4
Maintenance Parts Cost	$855.74	$32.96	$888.70	$444.35	-$29.12
Maintenance Labor Cost	$53.87	$373.85	$427.72	$213.86	-$87.16
Total Maintenance Cost	$909.61	$406.81	$1,316.42	$658.21	-$116.28
Total Cost/Mile	$0.36	$0.14	$0.24	$0.24	-$0.07
Miles/Gallon Fuel	4.90	4.99	4.95	4.95	32.42%
Miles/Quart Oil	N/A	N/A	879.52	879.52	47.93%
Miles/Road Call - Hybrid Related	0	0	0	N/A	N/A
Miles/ Road Call Total	N/A	2929	5453	5453	2764

CTTRANSIT
H301 and 201 BUS TEST DATA
APRIL, 2004

			H301						201						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
04/01/04	43	Rain	Tripper			36.9	157	4.25	Tripper			24.3	109	4.49	-5.15%
04/02/04	37	Cloudy	Tripper			29.4	141	4.80	Tripper			17.2	79	4.59	4.42%
04/03/04	41	Light Rain	Tripper			35.8	175	4.89	Tripper			20.4	98	4.80	1.76%
04/04/04	49	Cloudy													
04/05/04	36	Ptly Cloudy	7	L-1	1165	49.3	244	4.95	11	L-2	1635	46.1	227	4.92	0.51%
04/06/04	37	Clear	Tripper			20.5	107	5.22	Tripper			34.8	151	4.34	20.29%
04/07/04	46	Ptly Cloudy													
04/08/04	50	Ptly Cloudy	Tripper			27.4	141	5.15	Tripper			16.9	78	4.62	11.50%
04/09/04	55	Ptly Cloudy	Tripper			36.9	166	4.50	Tripper			8.2	35	4.27	5.40%
04/10/04	49	Clear	Tripper			24.2	134	5.54	Tripper			23.1	115	4.98	11.23%
04/11/04	49	Cloudy													
04/12/04	54	Ptly Cloudy	Tripper			46.7	258	5.52	Tripper			51.2	255	4.98	10.93%
04/13/04	44	Rain	Tripper			13.9	71	5.11	Tripper			43.4	205	4.72	8.14%
04/14/04	54	Cloudy							Tripper			18.2	79	4.34	
04/15/04	43	Ptly Cloudy							Tripper			24	113	4.71	
04/16/04	64	Ptly Cloudy							Tripper			33.4	123	3.68	
04/17/04	70	Clear							Tripper			41.1	180	4.38	
04/18/04	72	Clear													
04/19/04	71	Clear							Tripper			31.6	147	4.65	
04/20/04	66	Ptly Cloudy	Tripper			19.4	85	4.38	Tripper			36.7	149	4.06	7.92%
04/21/04	55	Ptly Cloudy							Tripper			57.3	241	4.21	
04/22/04	65	Ptly Cloudy													
04/23/04	66	Ptly Cloudy	Tripper			35.7	175	4.90							
04/24/04	67	Clear													
04/25/04	59	Cloudy	Tripper			6.3	31	4.92	Tripper			49.6	229	4.62	6.58%
04/26/04	52	Rain							Tripper			59.8	301	5.03	
04/27/04	65	Clear	22	X-2	1089	33.7	147	4.36	36	Bx 535	1693	33.3	139	4.17	4.50%
04/28/04	47	Ptly Cloudy	203	K-1	1521	44.7	241	5.39	819	K-2	1670	20.9	87	4.16	29.52%
04/29/04	65	Ptly Cloudy	Tripper			26.3	125	4.75							
04/30/04	69	Ptly Cloudy	Tripper			28	126	4.50	Tripper			20.1	88	4.38	2.78%
Totals						515.1	2524.0	4.90				711.6	3228.0	4.54	8.02%

CTTRANSIT
H302 and 202 BUS TEST DATA
APRIL, 2004

			H302						202						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
04/01/04	43	Rain	Tripper			33.2	177	5.33	Tripper			37.1	153	4.12	29.28%
04/02/04	37	Cloudy	Tripper			54.6	305	5.59	Tripper			25.1	100	3.98	40.21%
04/03/04	41	Light Rain	Tripper			27.1	150	5.54	Tripper			24	118	4.92	12.58%
04/04/04	49	Cloudy													
04/05/04	36	Ptly Cloudy							816	YM-1	1573	36.9	183	4.96	
04/06/04	37	Clear	23	Q-1	1349	43.4	230	5.30	181	Q-2	1329	33.8	127	3.76	41.04%
04/07/04	46	Ptly Cloudy	22	X-2	1089	30.4	142	4.67							
04/08/04	50	Ptly Cloudy	Tripper			46.8	261	5.58	Tripper			58.8	312	5.31	5.10%
04/09/04	55	Ptly Cloudy	203	K-1	1521	29.9	136	4.55	142	K-2	1550	26.7	114	4.27	6.53%
04/10/04	49	Clear	Tripper			24.8	113	4.56	Tripper			32.8	118	3.60	26.65%
04/11/04	49	Cloudy													
04/12/04	54	Ptly Cloudy							11	L-2	1138	43.5	211	4.85	
04/13/04	44	Rain							Tripper			50.4	258	5.12	
04/14/04	54	Cloudy	198	E-8	1455	36.3	176	4.85	120	E-13	1439	41.7	175	4.20	15.53%
04/15/04	43	Ptly Cloudy	206	U-3	1478	31.7	170	5.36	12	U-1	822	37.1	182	4.91	9.32%
04/16/04	64	Ptly Cloudy	Tripper			26.7	142	5.32	Tripper			39.3	166	4.22	25.91%
04/17/04	70	Clear	Tripper			35.2	165	4.69	Tripper			18	75	4.17	12.50%
04/18/04	72	Clear													
04/19/04	71	Clear	Tripper			29.4	130	4.42							
04/20/04	66	Ptly Cloudy	200	E-3	1346	53.3	249	4.67	201	E-4	1695	38.8	184	4.74	-1.49%
04/21/04	55	Ptly Cloudy	181	Q-2	1329	29.1	124	4.26							
04/22/04	65	Ptly Cloudy	Tripper			25.1	123	4.90	Tripper			31.5	128	4.06	20.60%
04/23/04	66	Ptly Cloudy	18	YM-2	1321	14.6	64	4.38	127	YM-1	1569	44.4	182	4.10	6.94%
04/24/04	67	Clear	Tripper			12	64	5.33	Tripper			36.4	174	4.78	11.57%
04/25/04	59	Cloudy													
04/26/04	52	Rain							Tripper			59.8	122	2.04	
04/27/04	65	Clear							Tripper			49	183	3.73	
04/28/04	47	Ptly Cloudy													
04/29/04	65	Ptly Cloudy	Tripper			3	8	2.67							
04/30/04	69	Ptly Cloudy							Tripper			46.1	195	4.23	
Totals						586.6	2,929.0	4.99				811.2	3,460.0	4.27	17.07%

CTTRANSIT
MAY, 2004 HYBRID BUS TEST PROGRAM DATA

Total Fleet	*Fleet Total*	*Fleet Avg*
Miles	963,389.00	2426.7
Fuel - Gallons	267,174.00	673.0
Oil - Quarts	1,608.00	4.1
Road Calls	329	0.8
Maintenance Parts Cost	$182,161.22	$461.17
Maintenance Labor Cost	$124,245.51	$314.55
Total Maintenance Cost	$306,406.73	$775.71
Total Cost/Mile	$0.32	$0.32
Miles/Gallon Fuel	3.61	3.61
Miles/Quart Oil	599.1	599.1
Miles/Road Call	2,928.2	2,928.2

Base Comparison Buses	*201*	*202*	*201 & 202*	*Base Avg*	*Hybrid vs Base*
Miles	3,355	4,055	7,410	3,705	-966.5
Fuel - Gallons	842.6	961.8	1,804.4	902.2	-340.15
Oil - Quarts	0.0	1.0	1.0	0.5	4.7
Road Calls	0	0	0	0	0.5
Maintenance Parts Cost	$0.00	$70.33	$70.33	$35.17	$182.32
Maintenance Labor Cost	$46.93	$101.16	$148.09	$74.05	$72.90
Total Maintenance Cost	$46.93	$171.49	$218.42	$109.21	$255.22
Total Cost/Mile	$0.01	$0.04	$0.03	$0.03	$0.10
Miles/Gallon Fuel	3.98	4.22	4.11	4.11	18.65%
Miles/Quart Oil	N/A	4,055.00	7,410.00	7,410.00	-92.8%
Miles/Road Call	N/A	N/A	N/A	7410	-1933

Hybrid Buses	*H301*	*H302*	*H301 & H302*	*Hybrid Avg*	*Hybrid vs Fleet*
Miles	3,697	1,780	5,477	2,739	312
Fuel - Gallons	780.1	344	1124.1	562.1	-110.9
Oil - Quarts	10.3	0.0	10.3	5.2	1.1
Road Calls - Hybrid Related	0	0	0	0	-0.8
Road Calls	1	0	1	0.5	-0.3
Maintenance Parts Cost	$190.20	$244.77	$434.97	$217.49	-$243.68
Maintenance Labor Cost	$154.91	$138.97	$293.88	$146.94	-$167.61
Total Maintenance Cost	$345.11	$383.74	$728.85	$364.43	-$411.29
Total Cost/Mile	$0.09	$0.22	$0.13	$0.13	-$0.19
Miles/Gallon Fuel	4.74	5.17	4.87	4.87	35.12%
Miles/Quart Oil	N/A	N/A	531.75	531.75	-12.67%
Miles/Road Call - Hybrid Related	0	0	0	N/A	N/A
Miles/ Road Call Total	3697	N/A	5477	5477	2549

CTTRANSIT
H301 and 201 BUS TEST DATA
MAY, 2004

			H301						201						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
05/01/04	64	Clear	Tripper			44.5	215	4.83	Tripper			56.3	263	4.67	3.43%
05/02/04	59	Ptly Cloudy	Tripper			47	269	5.72							
05/03/04	52	Rain													
05/04/04	54	Clear	206	U-3	1478	48	245	5.10	12	U-1	1148	23.7	114	4.81	6.11%
05/05/04	60	Cloudy	120	E-13	1763	44.8	220	4.91	198	E-8	1455	42.7	165	3.86	27.08%
05/06/04	71	Ptly Cloudy	6	K-3	1251	34.9	175	5.01	134	K-4	1655	29	141	4.86	3.13%
05/07/04	83	Clear	Tripper			31.4	153	4.87	Tripper			30.8	106	3.44	41.58%
05/08/04	52	Clear	Tripper			42.4	225	5.31	Tripper			34.9	135	3.87	37.19%
05/09/04	62	Rain							Tripper			48.6	234	4.81	
05/10/04	61	Ptly Cloudy							11	L-2	1138	25.8	89	3.45	
05/11/04	81	Ptly Cloudy	210	Q-3	1511	50.6	256	5.06	24	Q-4	1287	36.5	124	3.40	48.92%
05/12/04	76	Ptly Cloudy	Tripper			29	127	4.38							
05/13/04	76	Ptly Cloudy	Tripper			44.2	184	4.16	Tripper			38.7	142	3.67	13.45%
05/14/04	76	Clear	Tripper			43.7	185	4.23	Tripper			11.1	31	2.79	51.58%
05/15/04	82	Clear	Tripper			15.3	70	4.58	Tripper			37	115	3.11	47.20%
05/16/04	75	Clear	Tripper			38	171	4.50							
05/17/04	70	Ptly Cloudy	Tripper			32.5	136	4.18							
05/18/04	68	Ptly Cloudy	206	U-3	1430	15.7	72	4.59	12	U-1	822	57.2	237	4.14	10.68%
05/19/04	71	Cloudy	24	Q-4	1287	47.3	217	4.59	25	Bx-533	1382	43.7	166	3.80	20.77%
05/20/04	74	Ptly Cloudy	23	Q-1	1349	29	129	4.45	208	Q-2	1434	39.7	130	3.27	35.84%
05/21/04	80	Ptly Cloudy	10	F2-4	1135	35.9	153	4.26	14	F2-1	1306	33.4	127	3.80	12.08%
05/22/04	67	Cloudy	135	U-3	1611	33.1	143	4.32	169	U-2	1745	56.2	184	3.27	31.96%
05/23/04	75	Clear	Tripper			22.7	116	5.11	Tripper			35.6	146	4.10	24.60%
05/24/04	60	Cloudy													
05/25/04	72	Ptly Cloudy	Tripper			23.8	115	4.83	Tripper			41.6	184	4.42	9.24%
05/26/04	53	Cloudy	Tripper			26.3	121	4.60	Tripper			23	98	4.26	7.98%
05/27/04	68	Ptly Cloudy							Tripper			11.9	47	3.95	
05/28/04	58	Rain							Tripper			48.5	225	4.64	
05/29/04	62	Clear							Tripper			36.7	152	4.14	
05/30/04	71	Clear													
05/31/04	65	Clear													
Totals						780.1	3697.0	4.74				842.6	3355.0	3.98	19.02%

CTTRANSIT
H302 and 202 BUS TEST DATA
MAY, 2004

			H302						202						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
05/01/04	64	Clear							Tripper			33.1	146	4.41	-100.00%
05/02/04	59	Ptly Cloudy							Tripper			52.5	257	4.90	-100.00%
05/03/04	52	Rain													
05/04/04	54	Clear							Tripper			17.4	83	4.77	-100.00%
05/05/04	60	Cloudy							Tripper			63.1	314	4.98	-100.00%
05/06/04	71	Ptly Cloudy	14	F2-1	1130	46.1	235	5.10	10	F2-4	1135	43	177	4.12	23.84%
05/07/04	83	Clear	201	E-4	1465	38.8	188	4.85	200	E-3	1346	35.2	148	4.20	15.24%
05/08/04	52	Clear	Tripper			34.9	163	4.67	Tripper			39.4	149	3.78	23.50%
05/09/04	62	Rain	Tripper			30.4	157	5.16	Tripper			18.6	90	4.84	6.73%
05/10/04	61	Ptly Cloudy	Tripper			20.9	111	5.31							
05/11/04	81	Ptly Cloudy	Tripper			20.2	109	5.40	Tripper			62	249	4.02	34.36%
05/12/04	76	Ptly Cloudy							3	F1-2	1251	47	177	3.77	-100.00%
05/13/04	76	Ptly Cloudy							Tripper			45.5	139	3.05	-100.00%
05/14/04	76	Clear	Tripper			35.3	192	5.44	Tripper			18.9	79	4.18	30.13%
05/15/04	82	Clear	Tripper			25.2	131	5.20	Tripper			38.6	131	3.39	53.17%
05/16/04	75	Clear	Tripper			45.2	255	5.64	Tripper			52.9	261	4.93	14.34%
05/17/04	70	Ptly Cloudy	Tripper			3.2	17	5.31							
05/18/04	68	Ptly Cloudy	Tripper			31.3	160	5.11	Tripper			23.9	103	4.31	18.61%
05/19/04	71	Cloudy	Tripper			12.5	62	4.96	Tripper			40.7	156	3.83	29.41%
05/20/04	74	Ptly Cloudy							Tripper			32.9	129	3.92	-100.00%
05/21/04	80	Ptly Cloudy							Tripper			40.1	161	4.01	-100.00%
05/22/04	67	Cloudy							Tripper			49.2	217	4.41	-100.00%
05/23/04	75	Clear							Tripper			29.7	122	4.11	-100.00%
05/24/04	60	Cloudy													
05/25/04	72	Ptly Cloudy							Tripper			12.4	43	3.47	-100.00%
05/26/04	53	Cloudy													
05/27/04	68	Ptly Cloudy							Tripper			48.3	232	4.80	-100.00%
05/28/04	58	Rain							Tripper			38.3	140	3.66	-100.00%
05/29/04	62	Clear							Tripper			17.1	69	4.04	-100.00%
05/30/04	71	Clear							Tripper			19.5	80	4.10	-100.00%
05/31/04	65	Clear							Tripper			42.5	203	4.78	-100.00%
Totals						344.0	1,780.0	5.17				961.8	4,055.0	4.22	22.73%

CTTRANSIT
JUNE, 2004 HYBRID BUS TEST PROGRAM DATA

Total Fleet	*Fleet Total*	*Fleet Avg*
Miles	1,004,303.00	2542.5
Fuel - Gallons	297,383.00	752.9
Oil - Quarts	1,267.00	3.2
Road Calls	383	1.0
Maintenance Parts Cost	$243,380.08	$616.15
Maintenance Labor Cost	$127,225.26	$322.09
Total Maintenance Cost	$370,605.34	$938.24
Total Cost/Mile	$0.37	$0.37
Miles/Gallon Fuel	3.38	3.38
Miles/Quart Oil	792.7	792.7
Miles/Road Call	2,622.2	2,622.2

Base Comparison Buses	*201*	*202*	*201 & 202*	*Base Avg*	*Hybrid vs Base*
Miles	3,454	2,340	5,794	2,897	-2098.5
Fuel - Gallons	964.3	668.0	1,632.3	816.2	-617.2
Oil - Quarts	2.2	2.0	4.2	2.1	0.4
Road Calls	0	1	1	0.5	-0.5
Maintenance Parts Cost	$150.17	$140.34	$290.51	$145.26	-$61.51
Maintenance Labor Cost	$190.11	$213.55	$403.66	$201.83	-$20.10
Total Maintenance Cost	$340.28	$353.89	$694.17	$347.09	-$81.61
Total Cost/Mile	$0.10	$0.15	$0.12	$0.12	$0.21
Miles/Gallon Fuel	3.58	3.50	3.55	3.55	13.07%
Miles/Quart Oil	N/A	1,170.00	1,379.52	1,379.52	-76.8%
Miles/Road Call	N/A	2,340	5,794	5,794	N/A

Hybrid Buses	*H301*	*H302*	*H301 & H302*	*Hybrid Avg*	*Hybrid vs Fleet*
Miles	857	740	1,597	799	-1,744
Fuel - Gallons	214	183.9	397.9	199.0	-553.9
Oil - Quarts	3.0	2.0	5.0	2.5	-0.7
Road Calls - Hybrid Related	0	0	0	0	-1.00
Road Calls	0	0	0	0	-1.00
Maintenance Parts Cost	$167.50	$0.00	$167.50	$83.75	-$532.40
Maintenance Labor Cost	$106.90	$256.56	$363.46	$181.73	-$140.36
Total Maintenance Cost	$274.40	$256.56	$530.96	$265.48	-$672.76
Total Cost/Mile	$0.32	$0.35	$0.33	$0.33	-$0.04
Miles/Gallon Fuel	4.00	4.02	4.01	4.01	18.85%
Miles/Quart Oil	285.67	370.00	319.40	319.40	-148.17%
Miles/Road Call - Hybrid Related	N/A	N/A	N/A	N/A	N/A
Miles/ Road Call Total	N/A	N/A	N/A	N/A	N/A

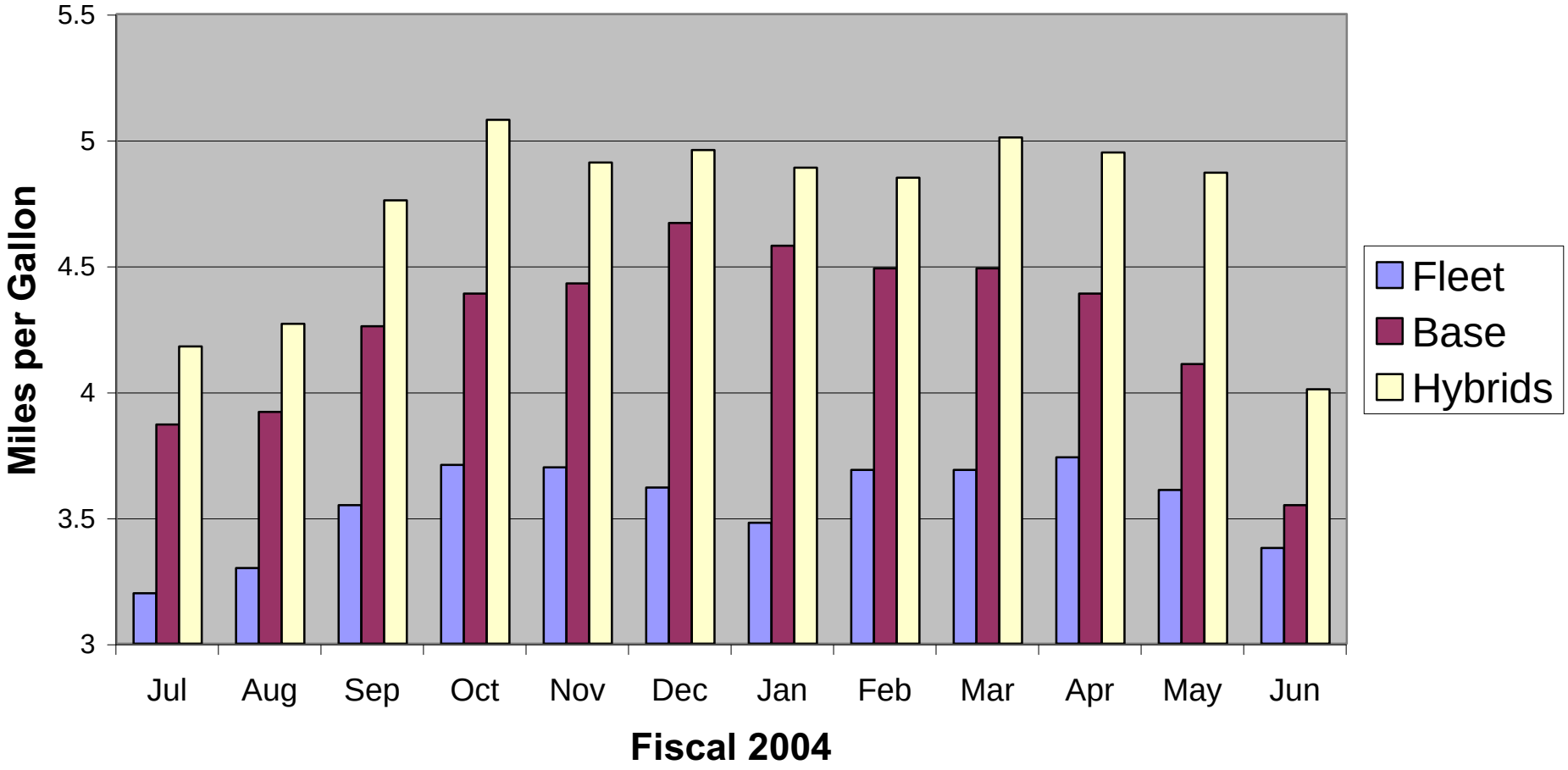
CTTRANSIT
H301 and 201 BUS TEST DATA
JUNE, 2004

			H301						201						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
06/01/04	56	Cloudy							Tripper			36.9	126	3.41	
06/02/04	72	Clear							Tripper			20.6	78	3.79	
06/03/04	70	Ptly Cloudy							Tripper			44	138	3.14	
06/04/04	64	Clear							Tripper			59.4	230	3.87	
06/05/04	72	Ptly Cloudy							Tripper			36.8	148	4.02	
06/06/04	57	Rain							Tripper			23	103	4.48	
06/07/04	71	Clear							Tripper			45.3	184	4.06	
06/08/04	88	Clear							Tripper			17.3	77	4.45	
06/09/04	88	Clear	Tripper			37.1	145	3.91							
06/10/04	69	Ptly Cloudy							Tripper			54.3	139	2.56	
06/11/04	64	Ptly Cloudy							Tripper			35	126	3.60	
06/12/04	71	Ptly Cloudy							Tripper			49.6	172	3.47	
06/13/04	76	Clear							Tripper			43.8	163	3.72	
06/14/04	69	Cloudy													
06/15/04	84	Clear							Tripper			19.6	85	4.34	
06/16/04	85	Clear							Tripper			23.7	108	4.56	
06/17/04	83	Ptly Cloudy							Tripper			62.8	209	3.33	
06/18/04	82	Ptly Cloudy							Tripper			54.6	180	3.30	
06/19/04	85	Hazy													
06/20/04	67	Clear							Tripper			33.7	134	3.98	
06/21/04	69	Ptly Cloudy							Tripper			61.1	200	3.27	
06/22/04	72	Cloudy	Tripper			24.4	115	4.71	Tripper			51.9	181	3.49	35.14%
06/23/04	83	Clear	Tripper			9.9	39	3.94	7	513	1928	12.9	42	3.26	21.00%
06/24/04	82	Ptly Cloudy	14/44	113/S202	1933/1968	18.6	69	3.71	Tripper			12.1	43	3.55	4.39%
06/25/04	75	Cloudy	1	501	1926/1967	43.4	170	3.92	Tripper			41.8	182	4.35	-10.04%
06/26/04	72	Cloudy													
06/27/04	72	Ptly Cloudy	27/804	505	1975/1984	35.2	140	3.98							
06/28/04	71	Ptly Cloudy							22/6	511	1938/1904	40.6	137	3.37	
06/29/04	74	Ptly Cloudy	40	306	1901	10.5	37	3.52	18/5	510	1914/1977	42	133	3.17	11.28%
06/30/04	78	Clear	24/12	504	1923/1907	34.9	142	4.07	22/6	511	1938/1947	41.5	136	3.28	24.16%
Totals						214.0	857.0	4.00				964.3	3454.0	3.58	11.80%

CTTRANSIT
H302 and 202 BUS TEST DATA
JUNE, 2004

			H302						202						
	NOON														% MPG
DATE	TEMP.	CONDITIONS	RUN NO.	BLOCK #	BADGE #	FUEL	MILES	MPG	RUN NO.	BLOCK#	BADGE #	FUEL	MILES	MPG	CHANGE
06/01/04	56	Cloudy							Tripper			27.3	110	4.03	
06/02/04	72	Clear													
06/03/04	70	Ptly Cloudy							Tripper			36.3	125	3.44	
06/04/04	64	Clear							Tripper			42.8	174	4.07	
06/05/04	72	Ptly Cloudy							Tripper			41.2	122	2.96	
06/06/04	57	Rain							Tripper			13	33	2.54	
06/07/04	71	Clear							Tripper			31.3	103	3.29	
06/08/04	88	Clear							Tripper			26.4	84	3.18	
06/09/04	88	Clear													
06/10/04	69	Ptly Cloudy							Tripper			62.5	227	3.63	
06/11/04	64	Ptly Cloudy							Tripper			44.9	186	4.14	
06/12/04	71	Ptly Cloudy							Tripper			37.8	159	4.21	
06/13/04	76	Clear													
06/14/04	69	Cloudy													
06/15/04	84	Clear	Tripper			13.8	51	3.70	Tripper			16.7	63	3.77	-2.04%
06/16/04	85	Clear							Tripper			25.5	119	4.67	
06/17/04	83	Ptly Cloudy							Tripper			51.4	178	3.46	
06/18/04	82	Ptly Cloudy							Tripper			60.2	147	2.44	
06/19/04	85	Hazy													
06/20/04	67	Clear													
06/21/04	69	Ptly Cloudy	Tripper			32.9	164	4.98	Tripper			60.6	215	3.55	40.50%
06/22/04	72	Cloudy	Tripper			11	42	3.82	Tripper			15	53	3.53	8.06%
06/23/04	83	Clear	20	105	1961	34.1	123	3.61	42	101	1956	22	68	3.09	16.70%
06/24/04	82	Ptly Cloudy	22/6	511	1922/1984	36.9	133	3.60	Tripper			4.7	17	3.62	-0.35%
06/25/04	75	Cloudy	6	511	1922	30.4	107	3.52							
06/26/04	72	Cloudy													
06/27/04	72	Ptly Cloudy													
06/28/04	71	Ptly Cloudy	24/12	504	1923/1977	24.8	120	4.84							
06/29/04	74	Ptly Cloudy													
06/30/04	78	Clear							Tripper			48.4	157	3.24	
Totals						183.9	740.0	4.02				668.0	2,340.0	3.50	14.87%

CTTRANSIT BUS FUEL ECONOMY



Bus Type	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Fleet	3.2	3.3	3.55	3.71	3.7	3.62	3.48	3.69	3.69	3.74	3.61	3.38
Base	3.87	3.92	4.26	4.39	4.43	4.67	4.58	4.49	4.49	4.39	4.11	3.55
Hybrids	4.18	4.27	4.76	5.08	4.91	4.96	4.89	4.85	5.01	4.95	4.87	4.01

CT TRANSIT

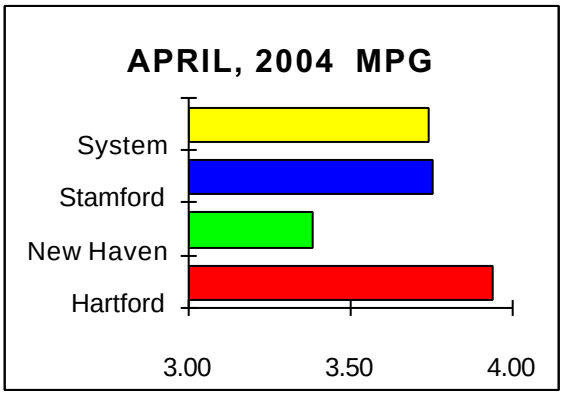
FLEET MILES & MILES PER GALLON
APRIL, 2004

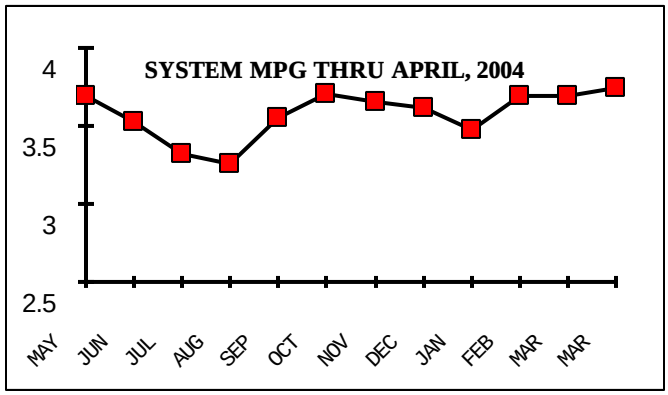
HARTFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NFI S-40 201-240	40	159,553	36,241	4.40	166,160	36,438	4.56	-6,607	-197	-0.16
NOVA 1121 9637-9649	13	34,720	8,546	4.06	42,424	10,542	4.02	-7,704	-1,996	0.04
MCI 911-915 & 9001-9200	63	107,085	31,360	3.41	170,819	49,835	3.43	-63,734	-18,475	-0.01
NFI 6V92 9301-9338	38	81,589	26,798	3.04	86,914	28,698	3.03	-5,325	-1,900	0.02
NFI S-50 9339-9340 & 9401-9428	30	72,061	16,852	4.28	79,286	18,573	4.27	-7,225	-1,721	0.01
NFI S-50 941-965	25	53,177	10,010	5.31	62,150	11,363	5.47	-8,973	-1,353	-0.16
NFI Hybrid H301 & H302	2	5,344	1,076	4.97	N/A	N/A	N/A	N/A	N/A	N/A
MCI Commuter 303-309	7	21,516	4,711	4.57	N/A	N/A	N/A	N/A	N/A	N/A
NFI S-50 310-324	14	53,059	13,828	3.84	N/A	N/A	N/A	N/A	N/A	N/A
Hartford Totals	232	588,104	149,422	3.94	607,753	155,449	3.91	-99,568	-25,642	0.03

NEW HAVEN DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9601-9623	23	57,500	16,937	3.39	68,425	19,258	3.55	-10,925	-2,321	-0.16
ElDorado 9901-9903	3	1,415	558	2.54	3,352	1,231	2.72	-1,937	-673	-0.19
NFI S-50 330-371 451-492	61	140,218	39,625	3.54	N/A	N/A	N/A	N/A	N/A	N/A
MCI 9101 - 9186	23	87,410	27,590	3.17	216,653	67,702	3.20	-129,243	-40,112	-0.03
New Haven Totals	110	286,543	84,710	3.38	288,430	88,191	3.27	-1,887	-3,481	0.11

STAMFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9626-9636	11	25,070	7,001	3.58	29,355	9,009	3.26	-4,285	-2,008	0.32
ElDorado 9904-9913	10	9,989	3,018	3.31	7,811	3,221	2.43	2,178	-203	0.88
NFI S-40 101-126	26	70,075	19,103	3.67	68,677	18,777	3.66	1,398	326	0.01
NFI S-40 127-132	6	23,225	5,079	4.57	22,250	4,745	4.69	975	334	-0.12
Stamford Totals	53	128,359	34,201	3.75	128,093	35,752	3.58	-4,285	-2,008	0.17

SYSTEM		*Current Month*			*Prior Year Month*			*Difference*		
Make	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
All buses	395	1,003,006	268,333	3.74	1,024,276	279,392	3.67	-21,270	-11,059	0.07





CT TRANSIT

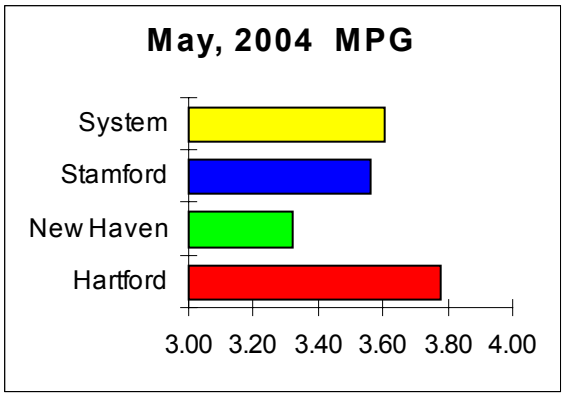
FLEET MILES & MILES PER GALLON
MAY, 2004

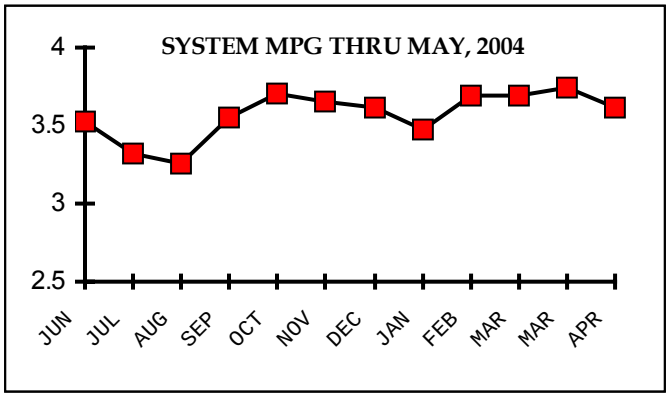
HARTFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NFI S-40 201-240	40	156,224	38,736	4.03	178,287	39,763	4.48	-22,063	-1,027	-0.45
NOVA 1121 9637-9649	13	32,579	8,267	3.94	39,599	9,747	4.06	-7,020	-1,480	-0.12
MCI 911-915 & 9001-9200	44	86,395	25,521	3.39	159,362	46,266	3.44	-72,967	-20,745	-0.06
NFI 6V92 9301-9338	38	69,848	22,886	3.05	86,934	28,130	3.09	-17,086	-5,244	-0.04
NFI S-50 9339-9340 & 9401-9428	30	67,613	17,473	3.87	78,160	18,199	4.29	-10,547	-726	-0.43
NFI S-50 941-965	25	45,328	8,862	5.11	55,081	9,991	5.51	-9,753	-1,129	-0.40
NFI Hybrid H301 & H302	2	4,899	1,035	4.73	N/A	N/A	N/A	N/A	N/A	N/A
MCI Commuter 303-309	7	21,467	4,962	4.33	N/A	N/A	N/A	N/A	N/A	N/A
NFI S-50 310-324, 401-419	33	81,358	22,072	3.69	N/A	N/A	N/A	N/A	N/A	N/A
Hartford Totals	232	565,711	149,814	3.78	597,423	152,096	3.93	-139,436	-30,351	-0.15

NEW HAVEN DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9601-9623	23	53,120	16,043	3.31	65,800	18,579	3.54	-12,680	-2,536	-0.23
ElDorado 9901-9903	3	1,080	474	2.28	3,323	1,212	2.74	-2,243	-738	-0.46
NFI S-50 330-371 451-492	74	204,200	61,068	3.34	N/A	N/A	N/A	N/A	N/A	N/A
MCI 9101 - 9186	10	15,278	4,862	3.14	212,834	66,748	3.19	-197,556	-61,886	-0.05
New Haven Totals	110	273,678	82,447	3.32	281,957	86,539	3.26	-8,279	-4,092	0.06

STAMFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9626-9636	11	25,664	7,424	3.46	31,020	8,754	3.54	-5,356	-1,330	-0.09
ElDorado 9904-9913	10	8,138	2,438	3.34	7,298	2,433	3.00	840	5	0.34
NFI S-40 101-126	26	69,359	4,968	13.96	66,891	18,525	3.61	2,468	-13,557	10.35
NFI S-40 127-132	6	21,228	20,083	1.06	22,524	4,909	4.59	-1,296	15,174	-3.53
Stamford Totals	53	124,389	34,913	3.56	127,733	34,621	3.69	-5,356	-1,330	-0.13

SYSTEM		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
All buses	395	963,778	267,174	3.61	1,007,113	273,256	3.69	-43,335	-6,082	-0.08





CT TRANSIT

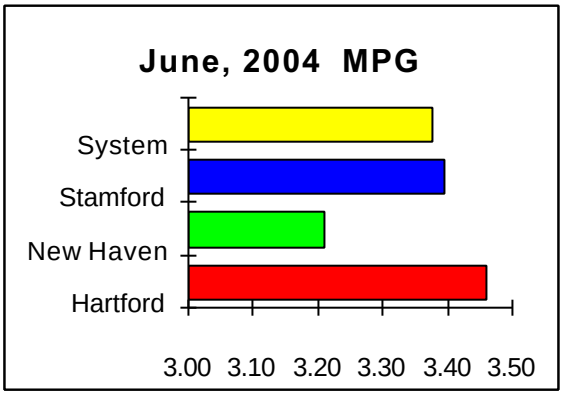
FLEET MILES & MILES PER GALLON
JUNE, 2004

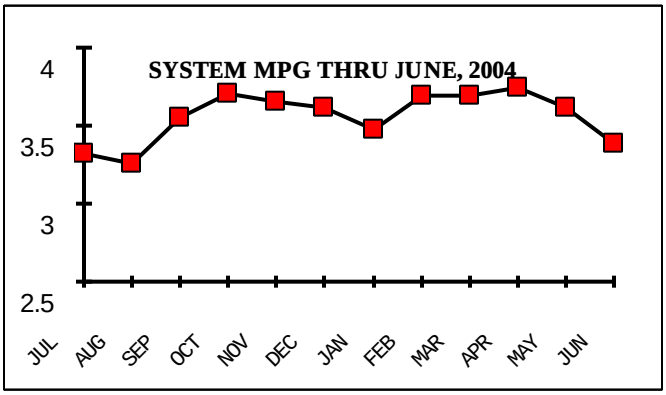
HARTFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
MCI 911-915 & 9001-9200	23	38,488	18,431	2.09	154,025	45,867	3.36	-115,537	-27,436	-1.27
NFI 6V92 9301-9338	38	61,387	20,327	3.02	85,134	28,286	3.01	-23,747	-7,959	0.01
NFI S-50 9339-9340 & 9401-9428	30	65,242	17,790	3.67	77,028	19,440	3.96	-11,786	-1,650	-0.30
NFI S-50 941-965	25	49,741	10,187	4.88	51,723	9,437	5.48	-1,982	750	-0.60
NOVA 1121 9637-9647	13	28,440	8,077	3.52	37,301	9,572	3.90	-8,861	-1,495	-0.38
NFI S-40 201-240	40	142,123	38,421	3.70	167,738	40,482	4.14	-25,615	-2,061	-0.44
MCI Commuter 303-309	7	22,426	5,198	4.31	N/A	N/A	N/A	N/A	N/A	N/A
NFI S-50 310-324, 401-441	56	187,252	53,525	3.50	N/A	N/A	N/A	N/A	N/A	N/A
Hartford Totals	232	595,099	171,956	3.46	572,949	153,084	3.74	-187,528	-39,851	-0.28

NEW HAVEN DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9601-9623, 9626	24	53,101	16,695	3.18	64,604	19,096	3.38	-11,503	-2,401	-0.20
NFI S-50 330-371 451-492	84	233,509	72,619	3.22	N/A	N/A	N/A	N/A	N/A	N/A
New Haven Totals	108	286,610	89,314	3.21	64,604	19,096	3.38	222,006	70,218	-0.17

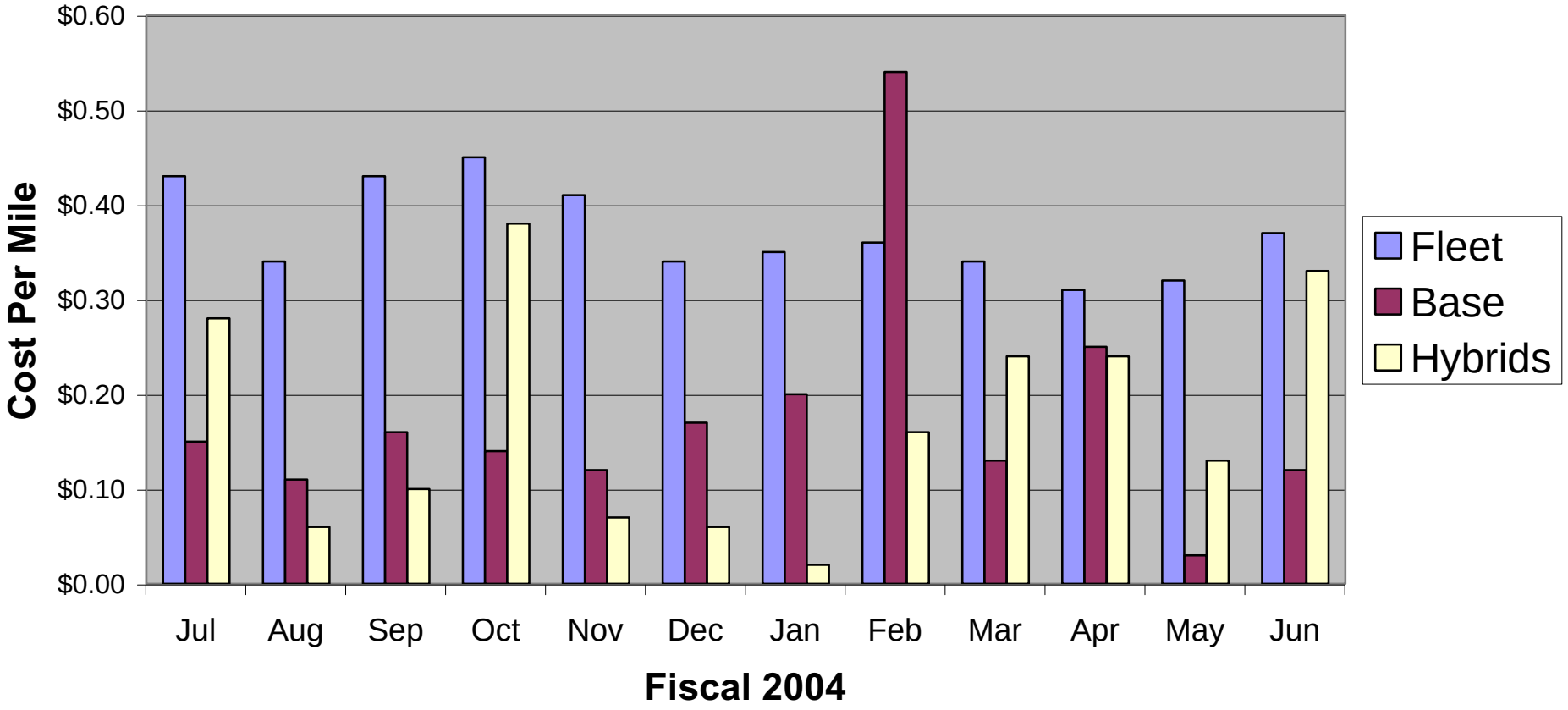
STAMFORD DIVISION		*Current Month*			*Prior Year Month*			*Difference*		
Make & Series	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
NOVA 1121 9626-9636	10	26,315	8,208	3.21	28,645	8,497	3.37	-2,330	-289	-0.17
ElDorado 9904-9913	11	10,889	3,214	3.39	7,002	2,305	3.04	3,887	909	0.35
NFI S-40 101-126	26	62,628	19,083	3.28	67,537	19,813	3.41	-4,909	-730	-0.13
NFI S-40 127-132	6	21,165	5,210	4.06	21,414	4,783	4.48	-249	427	-0.41
NFI Hybrid H301 & H302	2	1,597	398	4.01	3,075	721	4.26	-1,478	-323	-0.25
Stamford Totals	55	122,594	36113	3.39	127,673	36,119	3.53	-5,079	-6	-0.14

SYSTEM		*Current Month*			*Prior Year Month*			*Difference*		
Make	No.	Miles	Gallons	MPG	Miles	Gallons	MPG	Miles	Gallons	MPG
All buses	395	1,004,303	297,383	3.38	765,226	208,299	3.67	239,077	89,084	-0.30



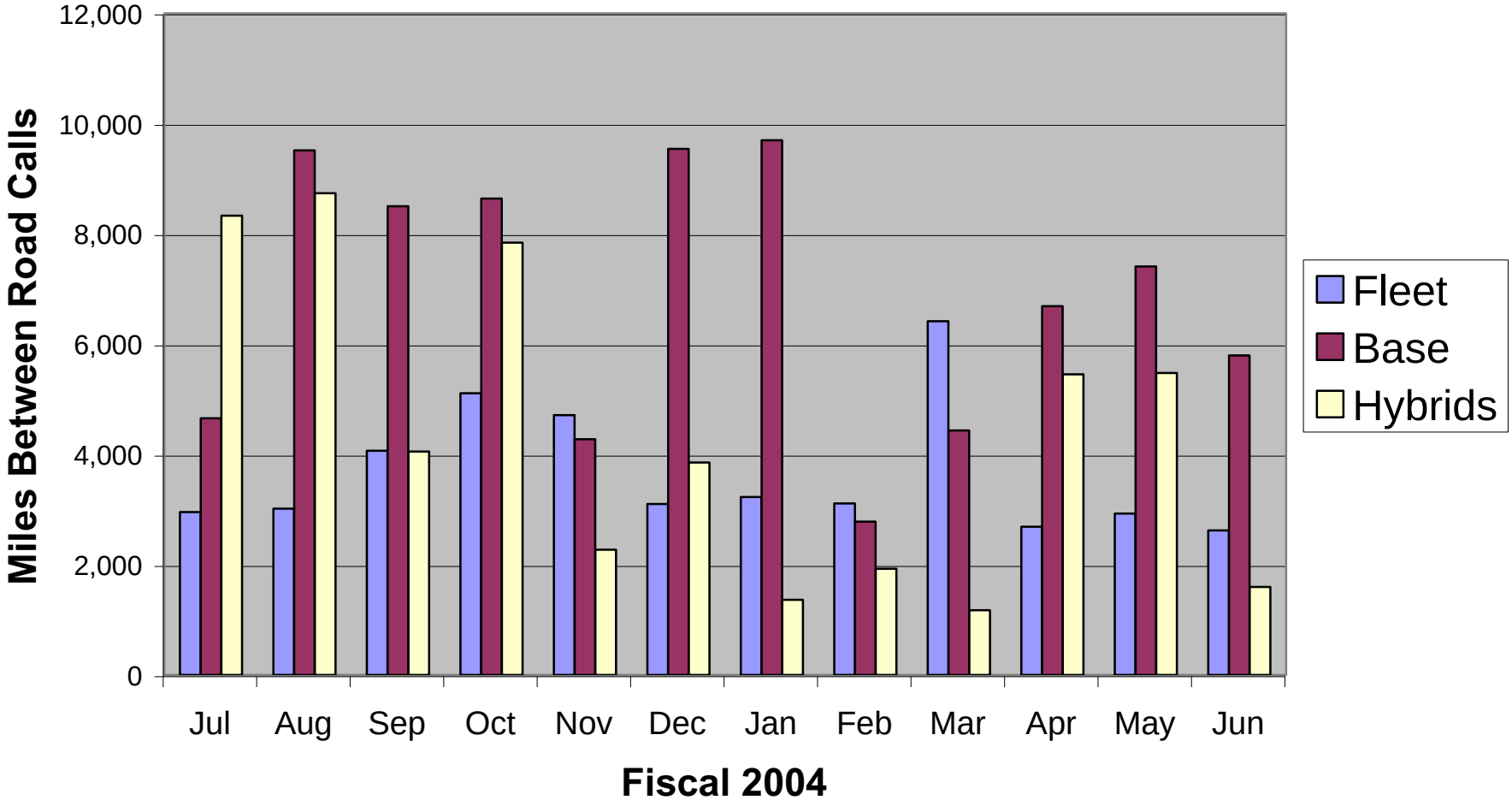


CTTRANSIT BUS MAINTENANCE
COST PER MILE

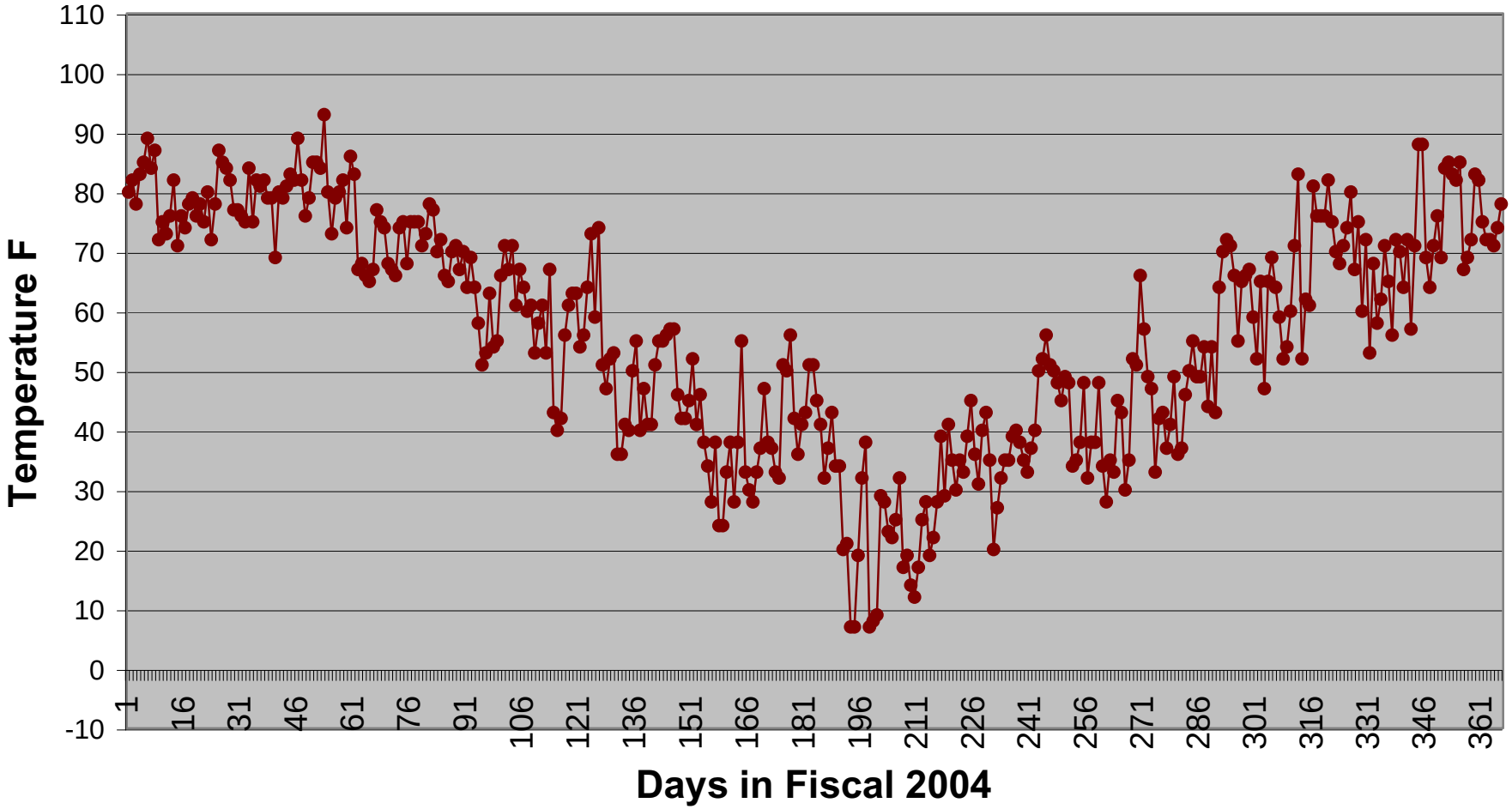


Bus Type	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Fleet	0.43	0.34	0.43	0.45	0.41	0.34	0.35	0.36	0.34	0.31	0.32	0.37
Base	0.15	0.11	0.16	0.14	0.12	0.17	0.2	0.54	0.13	0.25	0.03	0.12
Hybrids	0.28	0.06	0.10	0.38	0.07	0.06	0.02	0.16	0.24	0.24	0.13	0.33

CTTRANSIT BUS
MILES BETWEEN ROAD CALLS



HYBRID BUS DAILY NOON IN-SERVICE FIELD TEMPERATURE



WO	Task	Asset Part Number	Asset Description Task Description/Work Done	Opened	Closed	Hours	Labor Cost	Parts Cost	Equip Cost	Vend Cost
Asset		301	New Flyer Hybrid Bus							
0412339	1	301	New Flyer Hybrid Bus batteries dead	06/22/04	06/22/04	1.00	21.38	167.50	0.00	0.00
			replace batteries							
0411436	1	301	New Flyer Hybrid Bus replace hydro cooler- update	06/11/04	06/11/04	4.00	85.52	0.00	0.00	0.00
			replace hydro cooler- update							
0410199	1	301	New Flyer Hybrid Bus repair wire	05/28/04	05/28/04	3.00	64.14	77.82	0.00	0.00
			repair wire							
0405569	1	301	New Flyer Hybrid Bus bad print	04/08/04	04/08/04	0.33	6.94	855.74	0.00	0.00
			changed trim							
0409483	1	301	New Flyer Hybrid Bus Perform the E Check in accordance with Task Card	05/20/04	05/20/04	0.25	5.25	0.00	0.00	0.00
			service bus							
0408537	1	301	New Flyer Hybrid Bus Perform the D Check in accordance with Task Card	05/11/04	05/13/04	4.00	85.52	112.38	0.00	0.00
			Perform the D Check in accordance with Task Card							
0407532	1	301	New Flyer Hybrid Bus Perform the E Check in accordance with Task Card	04/29/04	04/29/04	0.25	5.25	0.00	0.00	0.00
			service bus							
0405681	1	301	New Flyer Hybrid Bus Perform the A Check in accordance with Task Card	04/08/04	04/12/04	2.00	41.68	0.00	0.00	0.00
			Perform the A Check in accordance with Task Card							
Asset		301	New Flyer Hybrid Bus	Subtotal -->		14.83	315.68	1213.44	0.00	0.00

WO	Task	Asset Part Number	Asset Description Task Description/Work Done	Opened	Closed	Hours	Labor Cost	Parts Cost	Equip Cost	Vend Cost
Asset		302	New Flyer Hybrid Bus							
0411437	1	302	New Flyer Hybrid Bus replace hydro cooler- update replace hydro cooler- update	06/11/04	06/11/04	4.00	85.52	0.00	0.00	0.00
0411061	1	302	New Flyer Hybrid Bus replace hydro cooler- update replace hydro cooler- update	06/08/04	06/10/04	8.00	171.04	0.00	0.00	0.00
0409326	1	302	New Flyer Hybrid Bus will not started replaced batters	05/19/04	05/19/04	2.50	53.45	180.91	0.00	0.00
0407611	1	302	New Flyer Hybrid Bus transmission cooler leak remove cooler assembly repair cooler reinstall cooler	04/30/04	04/30/04	0.25	5.14	16.63	0.00	0.00
0406253	1	302	New Flyer Hybrid Bus wiper wiper	04/15/04	04/15/04	15.00	320.70	16.33	0.00	0.00
0408962	1	302	New Flyer Hybrid Bus Perform the B Check in accordance with Task Card Perform the B Check in accordance with Task Card	05/14/04	05/18/04	4.00	85.52	63.86	0.00	0.00
0406786	1	302	New Flyer Hybrid Bus Perform the E Check in accordance with Task Card service bus	04/21/04	04/22/04	0.25	5.25	0.00	0.00	0.00
0405679	1	302	New Flyer Hybrid Bus Perform the A Check in accordance with Task Card a-insp.	04/08/04	04/11/04	2.00	42.76	0.00	0.00	0.00
Asset		302	New Flyer Hybrid Bus	Subtotal -->		36.00	769.38	277.73	0.00	0.00
				Grand Total -->		50.83	1085.06	1491.17	0.00	0.00

CTTRANSIT Hybrid Bus Trouble Codes

Date	H301	H302	Notes
7/14/2003	D1=7319=Inverter A Can link from TCM lost	All clear	No service disruption - transparent to user
	D2=7419=Inverter B Can link from TCM lost		
	D3=6618=Can link lost with Inverter A		
7/15/2003	All clear	All clear	Follow-up check
7/21/2003	All clear	D1=6624=Can link lost with Battery Controller	No service disruption - transparent to user
		D2=6619=Can link lost with Inverter B	
7/29/2003	All clear	All clear	Follow-up check
8/4/2003	All clear	D1=6624=Can link lost with Battery Controller	No service disruption - transparent to user
8/13/2003	All clear	D1s19=Inverter A Can link from TCM lost	No service disruption - transparent to user
		D2t19=Inverter B Can link from TCM lost	
		D3f19=Can link lost with Inverter B	
8/25/2003	All clear	All clear	Follow-up check
9/2/2003	All clear	All clear	Follow-up check
9/7/2003	D1=8002=High Voltage Discharge Fault	All clear	H301 Shut down and was flat bedded in. The system was checked and rest at the garage. A road test by a Technician noted a momentary loss of power on a 4.5 - 5 degree ramp @ 35mph. System reset on own and the problem cleared and could not be replicated. Bus was returned to service operating OK.
	D2=7491=Inverter B Isolation Fault-Shutdown		
	D3=7391=Inverter A Isolation Fault-Shutdown		
	D4=7390=Inverter A Isolation Fault-Caution		
	D5=7490=Inverter B Isolation Fault-Caution		
	D6=6618 Can Link Lost with Inverter A		
9/9/2003	All clear	All clear	Follow-up check
09/15/2003 AM	All clear	All clear	Follow-up check
09/15/2003 PM	D1=8002 = High Voltage Discharge Fault		System failed light on the dash this afternoon. The following codes were logged in the transmission keypad. The bus was driven back under its own power, but the dash switched was cycled numerous times. The road call mechanic did not detect any fault, defect or reduced power situation.
	D2=7391 = Inverter B Isolation Fault-Shutdown		
	D3=7491 = Inverter A Isolation Fault-Shutdown		
	D4=7390 = Inverter A Isolation Fault-Caution		
	D5=7490 = Inverter B Isolation Fault-Caution		

CTTRANSIT Hybrid Bus Trouble Codes

Date	H301	H302	Notes
9/25/2003	All clear	D1=6634= Can Link lost with eng. Controller, long time out	These codes had no adverse affect on the bus operation
		D2=2312=Push Button Shift Selector	
10/6/2003	All clear	No Code But Note	Indicated transmission fluid was one quart over. It has been found that the two minute waiting period for a cold bus check is insufficient. Up to 5 minutes or a drive around the facility will set the bus for proper level check. The dipstick is not considered as accurate as the electronic level sensor per Allison.
10/6/2003	All clear	D1=6634= Can Link lost with eng. Controller, long time out	These codes had no adverse affect on the bus operation
		D2=2312=Push Button Shift Selector	
11/3/2003	OL Hi 01qt.	D1=2815=Clutch 1 pressure failed on shutdown	
		D2=5615=Range2 verification-disabled clutch	
		D3=5614=Range2 verification-limit transmission output torque	
		D4=8132=Motor B overspeed - warning	
		D5=7421=inverter B Motor overspeed	
		D6=5613=range 1 verification - disable clutch	
		D7=5612=range1 verification-limit transmission output torque	
		D8=2816=No code info	
11/11/2003	D1 = Engine Torque Verification= stop system	D1-2816 = There is no listing	Cummins injection control valve found to be faulty
	C276 = High current detected	D2-5614=Range 2 verification-Limit Transmission Output Torque	
	C277=failure in the injection control valve	D3-5613=Range 1 verification - Disable Clutch	
	C449=fuel pressure exceeded maximum	D4-5612=Range 1 Verification - Limit Transmission Output Torque	
	C456= fuel pressure accumulator not changing	D5-5615=Range 2 Verification - Disabled Clutch	
		D2-2815=Clutch 1 pressure failed on Shutdown	
		D8-2916 = there is no listing	
11/13/2003	D1 = 2312 = pushbutton shift selector	All Clear	2312 is usually generated by switching off power to the transmission keypad only, while power is still applied to the system. It is a Cummins engine issue.
11/24/2003	D1 = 6523 = Enginge Torque Verification	D1 = 6634 = Can link lost	No adverse bus operations

CTTRANSIT Hybrid Bus Trouble Codes

Date	H301	H302	Notes
12/1/2003	All Clear	D1=6634	Not cleared from previous week
12/8/2003	D1=2312 Push button shift selector	D1=7605 Battery State of Charge Low Warning	No adverse bus operations
	D2=6523 Engine torque verification	D2=6634 Can link lost with engine controller	
		D3=7452 Inverter B, AC current invalid	
		D4=6523 Engine torque verification	
12/14/2003	All Clear	D1=7605 Battery Stte of Charge Low - Warning	No adverse bus operations
		D2=6634 Can Link lost with engine controller	
		D3=7452 Inverter B, AC current invalid	
		D4=6523 Engine torque verification	
12/31/2003	D1=7014 Controller Watchdog timeout TCM	D1=6618 Can link lost with Inverter A	No adverse bus operations
	D2=6513 Engine Controller Warning	D2=Can link lost with Inverter B	
		D3=Can link lost with Engine Controller	
		D4= Can link lost with Vehicle Controller	
		D5=6513 Engine controller warning	
		D6=7319 Inverter A CAN link with TCM lost	
		D7=7419 Inverter B CAN link with TCM lost	
		D8=6629 Can link lost with Minor Engine Messages	
1/5/2004	All Clear	All Clear	
1/12/2004	All Clear	All Clear	
1/19/2004	All Clear	All Clear	
1/25/2004	6513=Engine Controller warning	7421=Inverter B motor overspeed	
	5614=Range 2 verification- limit Transmission output torque	7435=Inverter B primary encoder signal lost	
	5612= Range 1 verification- limit transmission output torque		
	2815= Clutch 1 pressure failed on shutdown		
	2816= Clutch 1 pressure switch failed off		

CTTRANSIT Hybrid Bus Trouble Codes

Date	H301	H302	Notes
2/2/2004	Oil Cooler Failure had these codes	Pac Brake/Exhaust Brake Pivot Failure Codes	
	5614=Range 2 verification- limit Transmission output torque	7604=Battery State of Charge Low Caution	
	5613= Range 1 verification- disable clutch	7452=Inverter B AC current invalid	
	5612= Range 1 verification- limit transmission output torque	6513=engine controller warning	
	2815= Clutch 1 pressure failed on shutdown	6628=can link lost with electronic brake controller	
	2816= no code listed	7421=inverter B motor overspeed	
	5615= Range 2 verification- disable clutch	7435=inverter B primary encoder signal lost	
		7437=inverter B loss of both encoder signals	
		7438=inverter B secondary encoder signal lost	
		1718=inverter b can enable mismatch	
		1724=reported/calculated engine speed mismatch	
2/8/2004	All Clear	All Clear	
2/15/2004	All Clear	All Clear	
2/22/2004	All Clear	7421=inverter B motor overspeed	
		7435=inverter B primary encoder signal lost	
		7437=inverter B loss of both encoder signals	
		7438=inverter B secondary encoder signal lost	
		1718=inverter b can enable mismatch	
		8133=motor B overspeed shutdown	
2/29/2004	All Clear	All Clear	
3/7/2004	7604=battery state of charge low caution	All Clear	
	6513=engine controller warning		
	7605=battery state of charge low warning		
	7606=battery state of charge low shutdown		
3/14/2004	All Clear	All Clear	
3/21/2004	All Clear	6513=engine controller warning	
3/28/2004	All Clear	6513=engine controller warning	
4/4/2004	All Clear	All Clear	

CTTRANSIT Hybrid Bus Trouble Codes

Date	H301	H302	Notes
4/12/2004	7014=Controller Software Watchdog Timeout TCM	6513=engine controller warning	
	6513=engine controller warning		
	6629=Can Link Lost with Minor Engine Messages		
4/18/2004	6513= Engine Controller Warning	6513= Engine Controller Warning	H302 shutdown and road call - oil cooler prob
	1313=TCM Ignition Circuit Voltage Low - Cauti	2815= Clutch 1 pressure failed on shutdown	
		5612=Range 1 verification - limit transmission output torque	
		5614=Range 2 verification- limit Transmission output torque	
		5615= Range 2 verification- disable clutch	
		2816= Clutch 1 Pressure Switch Failed Off	
4/25/2004	All Clear	All Clear	
5/9/2004	6513 = Engine Controller Warning	All Clear	
6/30/2004	All Clear	7460=inverter B low voltage interrupt	H302 - Shutdown but started with reboot