



Reliability Measurements Besides Mean “Miles Between Mechanical Failures”

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About Los Angeles Metro

- Active fleet of 2,200 buses
- Operate 1,750 buses during peak service
- Travel 85,000,000 Miles on annual basis
- 1.5 Million Daily Boarding's
- Leader in “Clean Air” Technology with the ? Fleet of CNG uses in the Nation

Mean Miles Between Mechanical Failures (or MMBMF)

- MMBMF – Equitable method of measuring improvement/performance
- Especially between different Locations and Organizations
- LA Metro MMBMF calculated using “Major/Minor” system failure requiring a “Bus Exchange”

MMBMF Limitations

- Limits feedback due to strict reporting criteria
- Is an “After the Fact” measurement
- Distracts from “Real Time” indicators
- MMBMF is the by-product of other processes & variables. It is a good indicator whether your team is moving the right direction but does not help with real time process or behavior improvement.



Improving the “Fundamentals”

- Improvement in basic preventative maintenance & repair activity
- Developing key performance indicators coupled with reporting methods to identify areas needing improvement
- Improvement in the these areas help frontline staff to improve in the basic “fundamentals” related to their job
- MMBMF is like winning the game; as employee and vehicle effectiveness improve the MMBMF improves



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Other Performance Indicators - Frequency

- Frequency (or number) of Road Calls
- Analyzed and reported by Bus Type, Bus System, and Location
- Great deal of attention paid to Buses identified as “Repeaters”
- Buses that are identified as “Repeaters” are captured and often assigned to “Master Mechanics” (specialists)

Road Call Reports

- “Repeat Road Call Bus” Report:
 - ✓ Published Daily
 - ✓ Lists buses that have two (2) road calls of the same system or three (3) total road calls within the last seven (7) days
 - ✓ Also reported Monthly
- “Daily, Weekly, & Monthly Road Call” Report:
 - ✓ Lists all In-Service reports by Bus Type, Bus System, and Location

Repeat Road Call Report



Los Angeles County Metropolitan Transportation Authority
Fleet Management and Support Services Department
Buses with 3 or more Road Calls or 2 of the same System in the last 7 days
 (Farebox and Headsign Road Calls are excluded)
For the Period of November 1, 2016 12:00 am to November 7, 2016 11:59 pm
Division 09

Bus Number	Created Date	FET Call Sign	RESP. Div	ASSIg. Div	CURR Div	WO ID	WO TITLE	SYSTEM / COMPONENT	STATUS DESC	Troubl e	OPER. ID	Opr Err	Replac e by Bus#
4159	11/1/16 11:14 am		9	9	9	6040966	AH: A/C - B/O AIR CONDITIONER	BUS (FOR ROAD CALL)BUS (FOR R	Closed	Yes	80947		7537
4159	11/3/16 1:05 pm		9	9	9	6044776	AH: A/C - B/O AIR CONDITIONER	BUS (FOR ROAD CALL)BUS (FOR R	Closed	Yes	10965		7538
Total Number of Road Calls For Bus # 4159					2								
5859	11/3/16 6:04 am		9	9	9	6044092	EN: CHECK ENGINE LIGHT NO RESPONSE	21 Engine/BLOWER ASSEMBLY	Closed	Yes	14274		5898
5859	11/7/16 5:22 am		1	9	9	6048438	EN: ENGINE - STALLED		Open	Yes	76244		7354
Total Number of Road Calls For Bus # 5859					2								
5898	11/2/16 10:31 am		9	9	9	6042769	AH: A/C - B/O AIR CONDITIONER	11 HVAC/A/C COMP MOUNT	Closed	Yes	18922		7929
5898	11/3/16 11:53 am		9	9	9	6044500	AH: A/C - B/O AIR CONDITIONER	11 HVAC/A/C COMP OIL	Closed	Yes	04677		5850
5898	11/7/16 11:27 am		9	9	9	6048829	AH: A/C - B/O AIR CONDITIONER	BUS (FOR ROAD CALL)BUS (FOR R	Closed	Yes	25919		7904
Total Number of Road Calls For Bus # 5898					3								
7615	11/3/16 8:03 am	M-151		9	9	6044220	ES: ELECTRICAL -HORN WILL NOT STOP	20 Electrical System/HORN/BUTTON/	Closed	Yes	25377		
7615	11/3/16 8:03 am	M-151		9	9	6044220	ES: ELECTRICAL -HORN WILL NOT STOP	13 Brakes/BRAKE HOSE	Closed	Yes	25377		
7615	11/3/16 3:13 pm		9	9	9	6045161	ES: ELECTRICAL -HORN WILL NOT STOP	20 Electrical System/HORN/BUTTON/	Closed	Yes	18952		
Total Number of Road Calls For Bus # 7615					2								
7833	11/2/16 9:54 am		9	9	9	6042737	EN: ENGINE - SLOW BUS	21 Engine/BLOWER ASSEMBLY	Closed	Yes	14634		4004
7833	11/4/16 11:11 am		9	9	9	6046058	EN: ENGINE - SLOW BUS	21 Engine/BLOWER ASSEMBLY	Closed	Yes	34033		4008
7833	11/7/16 9:39 am		9	9	9	6048739	EN: CHECK ENGINE LIGHT NO RESPONSE	BUS (FOR ROAD CALL)BUS (FOR R	Closed	Yes	86489		7542
Total Number of Road Calls For Bus # 7833					3								



Daily, Weekly, & Monthly Road Call Reports



Los Angeles County Metropolitan Transportation Authority
Total Road Calls By Bus Series and System - Weekly
 For The Period From Sunday, 30 October, 2016 To Saturday, 5 November, 2016

System	Bus Series												Grand Total
	New Flyer CNG LF (3850 & 5600)	New Flyer (5000- 5522)	Cummins NABI LF (7000- 7949)	Doosan NABI LF (7000- 7949)	NABI LF (Compo 7980-89)	NABI LF (Compo 8000) 45FT	NABI Artic 60 FT	NABI LF (Compo 8100) 45FT	NABI LF (Compo Silver Line) 45FT	NABI LF (Compo 8400) 45FT	NABI LF (Compo 8500) 45FT		
A/C	18	1	1	1	0	2	6	1	0	1	2	33	
Air System	7	1	3	0	0	0	6	0	0	0	1	18	
Brakes	5	1	5	1	0	0	1	2	0	1	1	17	
Bus Equipment	17	2	2	1	0	4	8	5	0	1	2	42	
Bus Interior	22	2	4	0	1	1	11	7	0	4	8	60	
Coolant	2	4	1	1	0	1	6	0	1	2	1	21	
Doors (Bus)	12	1	3	1	0	4	20	4	0	0	1	46	
Electrical (Bus)	121	13	25	6	3	14	50	43	2	16	46	347	
Engine	38	19	10	7	6	2	47	19	6	10	19	183	
Fuel	5	2	1	0	0	2	6	4	1	0	0	21	
Headsign	4	5	5	0	0	0	2	1	0	0	1	18	
Lights	1	2	3	0	0	0	5	3	0	1	2	17	
Mirrors	11	2	3	0	0	0	14	3	0	3	3	39	
Steering	5	1	1	0	1	0	0	2	0	0	0	10	
Suspension	4	5	2	0	0	3	6	6	0	0	1	29	
Telecom Equipment	1	1	0	0	0	0	0	1	0	0	0	3	
Tires	6	2	1	1	0	0	7	1	0	3	1	22	
Transmission	3	3	4	3	0	1	1	3	0	0	1	19	
Wheelchair	8	0	1	0	0	0	3	2	0	0	0	14	
Grand Total	290	67	75	22	11	34	209	109	10	42	90	959	
Total Buses	820	139	183	52	14	100	376	235	40	90	150	2,199	
RC % of Fleet	35.4%	48.2%	41.0%	42.3%	78.6%	34.0%	55.6%	46.4%	25.0%	46.7%	60.0%	43.7%	
Mileage	623,980	55,222	108,107	42,909	4,855	61,245	261,318	194,878	39,037	64,351	119,626	1,575,328	
Total MMBRC	2,152	824	1,441	1,950	423	1,801	1,250	1,768	3,604	1,532	1,329	1,638	
Excluded Road Calls													
2 Hours	0	0	0	1	0	0	0	0	0	0	0	1	
Canceled	6	6	4	0	1	0	11	2	0	3	0	33	
D Unit	6	0	1	0	0	0	4	3	0	1	2	17	
Dirty Bus	20	3	1	0	0	1	13	6	0	3	5	52	
Maintenance Notification	88	15	24	5	2	14	59	31	2	14	32	284	
No Response	82	11	16	1	2	6	37	20	2	8	30	215	
OK Bus Change	1	0	0	0	0	0	1	0	0	0	0	2	
Training Bus	1	0	0	0	0	0	1	0	0	0	0	2	
Total Excluded	202	35	46	7	5	21	126	62	4	29	69	606	
MMBRC After Exclusions	7,091	1,726	3,728	2,881	776	4,711	3,148	4,146	6,506	4,950	5,696	4,425	



Road Process Changes

- Realization that not all “In-service” trouble reports need to be treated as a road call
- Introduction of “Maintenance Notification”. Problem is documented and reported to Maintenance staff but bus remains in-service and no bus exchange is required (Check Engine Light)
- Issue/problem is addressed but no service interruption



Results of the Maintenance Notification

- Ensured that issues are addressed that might have gone unaddressed under old “Canceled Road Call” convention
- Result of Maintenance Notification process change was an increase in MMBMF values
- More importantly it resulted in decreasing the negative impact caused by service interruptions on our riding customers
- No loss of data integrity or collection since event is documented and included in data analysis



Other Important Performance Indicators

- Material Issuances (Part Replacements)
 - ✓ Singularly the most reliable data in respect to repair activity in your shop.
 - ✓ Extremely important in understanding patterns related to:
 - ❖ Defects by Fleet or Equipment Type
 - ❖ Specific Buses (Problematic or Repeaters)
 - ❖ Defects by Component (design issues)
 - ❖ Mechanic repair and replacement patterns

Material Issuances

- Identifies problematic Bus Sub-systems
- Identifies components/parts that inherently defective as per design and/or application
- Identifies repetitive (unnecessary) repairs happening on the bus level (Spark Plugs)
- Identifies mechanic part replacement patterns (effectiveness). Does the mechanic need training?



Mechanic Training

- Develop Mechanic Training Program to reduce Road Calls
- Program based on data efforts discussed today
- Training Program focuses on four primary areas
 - ✓ Engine
 - ✓ Electrical
 - ✓ Doors
 - ✓ Suspension



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Driver Behavior

- Monitor if “No Problem Found” for Road Calls
- Report the number of “Total” and “No Problem Found” Road Calls per Driver to Transportation
- Given Transportation staff access to maintenance database to research events
- Report published monthly
- Maintenance and Transportation Directors meet weekly to discuss

Information Access & Distribution

- Must be easily accessible to front line staff
- Developed “Bus Maintenance History” Report:
 - ✓ Goes back sixty (60) days
 - ✓ All key repair factors included as part of report
 - ✓ Report Goals
 - ❖ Increase repair effectiveness while decreasing repair activity time
 - ❖ Eliminate repetitive repairs and part replacements
 - ❖ Lower part costs by lowering the number of repetitive part replacements (Spark Plugs)

Bus Maintenance History Report



Los Angeles County Metropolitan Transportation Authority
 Bus Repair History Report (Equip)
 Bus: 8508 - As of 3/3/2016 4:49:56PM
 Historical Work Orders 1/3/2016 12:00:00AM to 3/3/2016 4:49:56PM

LTD MILEAGE, MILEAGE ACCUMULATION, AND FLUID CONSUMPTION

LTD Mileage:	119,913.30	Total Mileage Accumulated:	6,490.50	MPG:	2.56	Total Fuel Consumed:	2,533.50	Total Oil Consumed (Quarts):		Total Coolant Consumed (Gallons):	2.60
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MATERIAL ISSUANCE INFORMATION

Item Description	Item #	Qty	Last Update Date	Employee Name	WO_ID	WO Title
KIT - LINKAGE, W/ACTUATING ARM, LEVELING VALVE, FRONT	143107	1	3/1/2016 11:21:13AM	RUBIO, OSCAR	5730108	CS: SUSPENSION - B.O. SUSPENSION
BELLOWS - AIR SUSPENSION, FRONT AND REAR	182348	1	2/28/2016 10:29:41PM	YEUNG, TAK	5727775	RIGHT REAR REAR BELLOW LEAKING
REGULATOR - HIGH PRESSURE, CNG, CUMMINS ONLY (ITT CONO)	137355	1	2/28/2016 7:09:37AM	HURTADO, CRISTOBAL	5727573	HIGH PRESSURE FUEL REGULATOR LEAKING
SENSOR - TEMPERATURE, ISL 8.9L	180961	1	1/27/2016 7:19:05PM	SANKAR, TOMMY	5687801	EN: CHECK ENGINE LIGHT NO RESPONSE
ARM - MIRROR, C/S EXTERIOR, DOUBLE, 18 INCHES (8100 RETROF	182908	1	1/26/2016 6:39:17AM	MARQUEZ, JULIO	5685198	BENT MIRROR ARM BRACKET
ELEMENT - WATER FILTER, CUMMINS 8.9L GAS PLUS & ISLG ENGI	138433	1	1/21/2016 9:49:19AM	WONG, TIMOTHY	5628388	MAJOR BUS INSPECTION
FILTER - AIR INTAKE, ENGINE, 13" AIR CLEANER	177798	1	1/21/2016 9:49:19AM	WONG, TIMOTHY	5628394	ENGINE AIR FILTER
FILTER - OIL, ENGINE LUBE, CUMMINS 8.9L GAS PLUS, ISLG	178182	1	1/21/2016 9:49:19AM	WONG, TIMOTHY	5628388	MAJOR BUS INSPECTION
ELEMENT - FUEL FILTER, CNG, LARGE 50-OZ. FILTER BOWL	138462	1	1/21/2016 9:49:19AM	WONG, TIMOTHY	5628388	MAJOR BUS INSPECTION
FILTER - SPIN ON, FUEL, CNG	138451	1	1/21/2016 9:49:19AM	WONG, TIMOTHY	5628388	MAJOR BUS INSPECTION
EXTINGUISHER - FIRE, 5 POUND	143495	1	1/21/2016 7:13:38AM	LEONARD, RONALD	5628388	MAJOR BUS INSPECTION
RECEPTACLE - FUEL FILL, CNG, STAINLESS STEEL ONLY	137045	1	1/3/2016 6:43:38PM	SANKAR, TOMMY	5655997	FUEL FILLER NOZZLE LEAKING

ROAD CALL INFORMATION

WO_ID	WO Title	Status	Status Date	Closing Mileage	Incident Note	WO Job Note	Mechanic of Job Note
5730108	CS: SUSPENSION - B.O. SUSPENSION	Closed	3/1/2016 1:19:00PM	119,834.50	03/01/16 06:19:38 Pended By Controller: 9214 Suspension is bad, operator can physically feel every bump in the road. Very uncomfortable. Operator states he will continue. Rolling change scheduled for north trip. 03/01/16 06:21:06 Pended By Controller: 27441 03/01/16 10:21:15 Closed By Controller: 60354	None Available	None Available



Bus Maintenance History Report



Los Angeles County Metropolitan Transportation Authority
 Bus Repair History Report (Equip)
 Bus: 8184 - As of 11/15/2016 11:07:14AM
 Historical Work Orders 9/16/2016 12:00:00AM to 11/15/2016 11:07:14AM

MATERIAL ISSUANCE INFORMATION

Item Description	Item #	Qty	Last Update Date	Employee Name	WO_ID	WO Title
STRAP - STATIC, 30" X 1-1/16" X 3/16"	102454	2	10/6/2016 3:00:59AM	PATINO, JUAN	5908600	INSPECTION REPAIRS WORK ORDER
SWITCH - DOOR, REAR, PRESSURE WAVE	106415	1	10/6/2016 1:19:32AM	PATINO, JUAN	5908600	INSPECTION REPAIRS WORK ORDER
BELT - DRIVE, 24V ALT., MICRO-V, 8 GROOVE X 51.5" LONG, CUMM	100019	1	10/6/2016 1:19:32AM	PATINO, JUAN	5908600	INSPECTION REPAIRS WORK ORDER
VALVE ASM - AUTO DRAIN, 12V (HALDEX)	188567	1	10/4/2016 5:31:51PM	LANDAVERDE, RUTILIO	5908596	MAJOR BUS INSPECTION
SQUEEGEE - 10" WINDOW, CLEANER W/SPONGE, W/20" WOOD HA	146229	1	10/2/2016 5:46:35PM	LANDAVERDE, RUTILIO	6002966	ES- ALTERNATOR LIGHT
RELAY - 12 VOLT, 30 AMP, W/RESISTOR	136127	5	10/2/2016 5:46:35PM	LANDAVERDE, RUTILIO	6002966	ES- ALTERNATOR LIGHT
NUT - BOLT, FLANGE, STANCHION	102634	1	9/23/2016 1:58:19PM	TADENA, MANUEL	5992042	LOOSE STANCHION BAR
FLANGE - CUP, STANCHION TUBING, 2 HOLE, OVAL BASE, FLOOR	142187	1	9/23/2016 1:58:19PM	TADENA, MANUEL	5992042	LOOSE STANCHION BAR
BOLT - FLANGE, STANCHION	102627	1	9/23/2016 1:58:19PM	TADENA, MANUEL	5992042	LOOSE STANCHION BAR

ROAD CALL INFORMATION

WO_ID	WO Title	Status	Status Date	Closing Mileage	Incident Note	WO Job Note	Mechanic of Job Note
6057129	EN: CHECK ENGINE LIGHT NO RESPONSE	Closed	11/14/2016 10:56:00PM	314,332.10	11/13/16 17:35:20 Pended By Controller: 72700 Check engine light and Stop engine light coach has not stalled. Operator will troubleshoot rolling change will be set up 11/13/16 17:39:05 Pended By Controller: 27441 11/13/16 18:12:39 Closed By Controller: 72700 Operator received replacement coach 8211 and was ok for time.	3 out of 6 fuel tanks were BO causing the bus to run out of fuel. low fuel pressure regulator and fuel shut off valve were contaminated with oil. repaired harness and replaced low fuel pressure regulators and valve, road tested, ok at this time Moya 22539	DE LA TORRE, JIM
6055271	C/S: SUSPENSION	Closed	11/12/2016 8:29:00PM	314,199.40	11/11/16 10:25:21 Pended By Controller: 20770 Kneel is stuck. No patron involved. Operator given trouble shooting techniques. D-2 to handle 11/11/16 10:53:24 Closed By Controller: 20770 Operator was able to clear the kneel to complete Per D-2.	None Available	None Available
6050741	EN: ENGINE - THROTTLE	Closed	11/9/2016 9:13:00PM	313,959.80	11/09/16 12:43:27 Pended By Controller: 20770 Relief operator above reports loss of power, check and stop engine light on with a buzzer. Operator made it to the	None Available	None Available

Print Date: 11/15/2016 11:07:33AM

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Thank you

