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VANDERBIJLPARK RELIABILITY ENGINEERING

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Single Engine Fuel Economy Test under operational condition at ArcelorMittal South Africa – Vanderbijlpark

Test Engine:
Caterpillar Loco Engine No. 64

Test Period:
09/16/2017 – 12/16/2017

Location:
ArcelorMittal South Africa – Vanderbijlpark
Reliability Engineering Department

Goal:
To establish confirmation of improved fuel economy
with
Omstar Dx1 Synthetic Ester
added to the Engine Oil and Fuel

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Omstar DX1

Loco 64

	#	Task	Responsible Person		
Baseline	1	Weekly Samples	From COAST		
	2	Fuel Consumed in Past 2 Weeks	From Mark		
	3	Mileage/Hours in Past 2 Weeks	From Mark		
Conditioning	4	Additive to Oil During Oil Change	Scheduled Service Date		2 Week Running time
	5	Additive to Fuel*			
	6	Note Fuel Consumed			
	7	Note Mileage and Hours			
Additive	8	Additive to fuel (Lower Ratio)*			2 Week Running Time
	14	Fuel Consumed in 2 Weeks			
	15	Mileage in 2 Weeks			
Report	17	Comparison			
		Fuel and Mileage			
		Vibration			
		Sample test (Blot and Particle)			

Mixing Ratios

First Time Use			Sustaining	
Oil			Oil	
DX1	Oil		None	
1	5			
Fuel			Fuel	
DX1	Fuel		DX1	Fuel
1	256		1	1280

* Additive also to be inserted into fuel at every refueling.

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OMSTAR
ENVIRONMENTAL PRODUCTS DX1
D-1280X, INC.

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Oil contamination Test
Nitration Level

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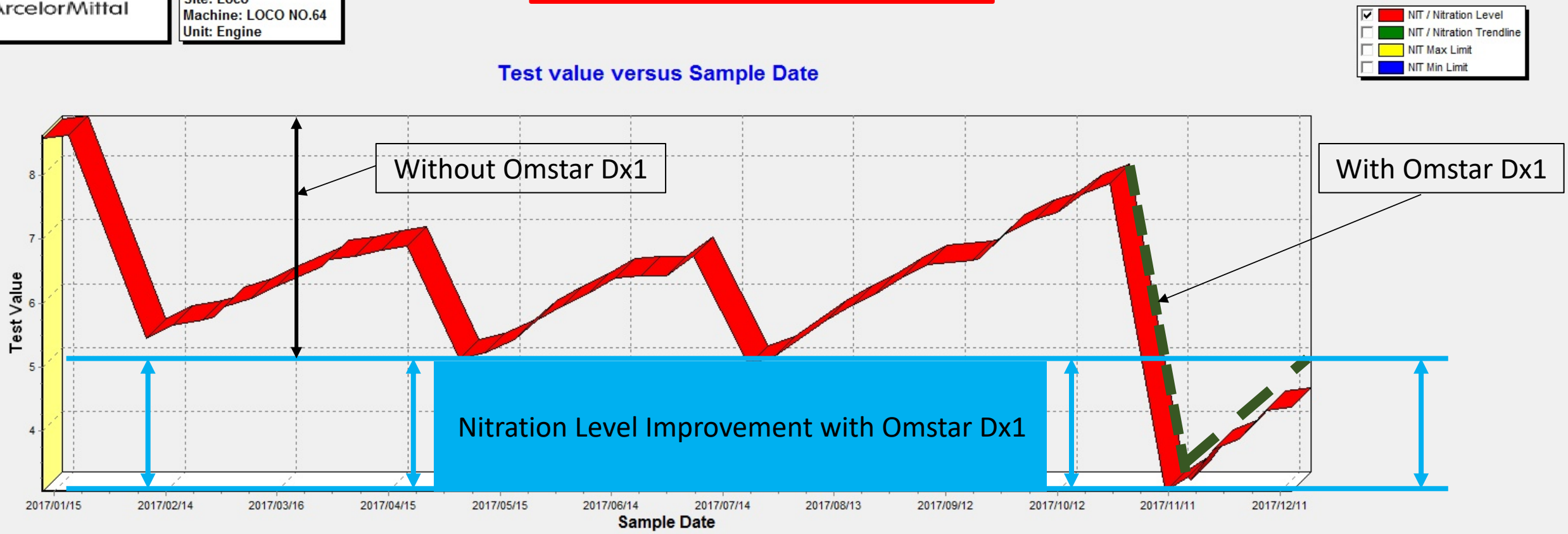
Sample Number: 362824
Customer: Loco Shop
Site: Loco
Machine: LOCO NO.64
Unit: Engine



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Oil contamination Test
Chromium Level

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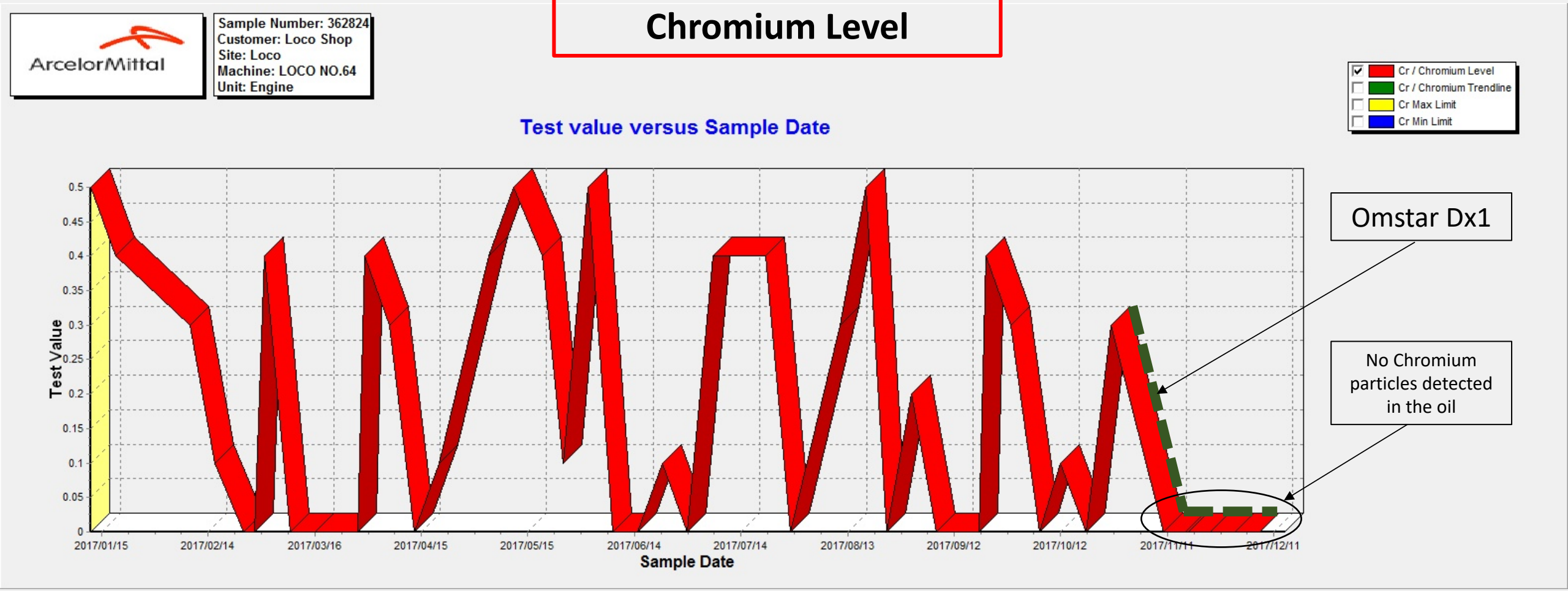
Sample Number: 362824
Customer: Loco Shop
Site: Loco
Machine: LOCO NO.64
Unit: Engine



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Conditioning Phase
Omstar Dx1 ratio 256 : 1
Improvement over Baseline 0.056 Hr./lt. fuel
73% increase in Fuel Economy

2017.12.01 — Dynamic List Display

Report :	ZMP_FUEL_TRAN_REPORTING - Fuel Interface : Fuel Transaction
Userid :	10017801 - JOHANNES BESTER
Requested :	2017.12.01 at 13:43:03 (SP2 / 112)
Report Type :	Fuel Economy Report
Summary :	Total(45); Success(0); Error(0); Others(0)

Functional Location Text	Quantity	Tank Capacity	Unit Of Measure	New Measurement Date	New Measuremen	Previous Meas	Previous Measur	Difference	Economy	Unit Of Measure		Days	Diff Hours		Tot Hrs	
Loco 64 (80Ton)	826.3	2,300.000	I	9/20/17	11:15:16	9/16/17	9:31:32	97.73	0.1182729	HR / L		4	0.07	4.07	97.73	0.11827289
Loco 64 (80Ton)	1,161.70	2,300.000	I	9/23/17	13:02:44	9/20/17	11:15:16	73.79	0.0635199	HR / L		3	0.07	3.07	73.79	0.063519937
Loco 64 (80Ton)	1,690.30	2,300.000	I	9/27/17	11:56:05	9/23/17	13:02:44	94.89	0.0561375	HR / L		4	-0.05	3.95	94.89	0.056137471
Loco 64 (80Ton)	549.8	2,300.000	I	9/30/17	6:36:49	9/27/17	11:56:05	66.68	0.1212784	HR / L		3	-0.22	2.78	66.68	0.121278445
Loco 64 (80Ton)	1,126.40	2,300.000	I	10/4/17	10:05:58	9/30/17	6:36:49	99.49	0.0883219	HR / L		4	0.15	4.15	99.49	0.08832194
Loco 64 (80Ton)	1058.8	2,300.000	I	10/7/17	7:53:20	10/4/17	10:05:58	69.79	0.0659137	HR / L		3	-0.09	2.91	69.79	0.065913718
Loco 64 (80Ton)	1,619.30	2,300.000	I	10/11/17	13:31:59	10/7/17	7:53:20	101.64	0.0627704	HR / L		4	0.24	4.24	101.64	0.062770436
Loco 64 (80Ton)	544.5	2,300.000	I	10/14/17	6:59:12	10/11/17	13:31:59	65.45	0.1202087	HR / L		3	-0.27	2.73	65.45	0.120208652
Loco 64 (80Ton)	1,549.30	2,300.000	I	10/18/17	8:48:02	10/14/17	6:59:12	97.81	0.0631342	HR / L		4	0.08	4.08	97.81	0.063134247
Loco 64 (80Ton)	950.8	2,300.000	I	10/21/17	6:56:22	10/18/17	8:48:02	70.14	0.0737683	HR / L		3	-0.08	2.92	70.14	0.073768289
Loco 64 (80Ton)	1,588.30	2,300.000	I	10/25/17	14:43:47	10/21/17	6:56:22	103.79	0.0653468	HR / L		4	0.32	4.32	103.79	0.065346772
Loco 64 (80Ton)	1,033.30	2,300.000	I	10/28/17	8:03:14	10/25/17	14:43:47	65.32	0.063219	HR / L		3	-0.28	2.72	65.32	0.063218975
Loco 64 (80Ton)	864.8	2,300.000	I	11/1/17	11:54:56	10/28/17	8:03:14	99.86	0.1154737	HR / L	Average Baseline	4	0.16	4.16	99.86	0.115473713
	14563.6							**1106.39**	**0.0759695**	**HR / L**	**0.0760**				**1106.39**	**0.07596954**
Insert Additive according to Ratio																
Loco 64 (80Ton)	615.2	2,300.000	I	11/4/17	8:57:52	11/1/17	11:54:56	69.05	0.1122381	HR / L		3	-0.12	2.88	69.05	0.112238116
Loco 64 (80Ton)	617.1	2,300.000	I	11/8/17	7:40:39	11/4/17	8:57:52	94.71	0.1534809	HR / L		4	-0.05	3.95	94.71	0.153480887
Loco 64 (80Ton)	428.1	2,300.000	I	11/11/17	7:22:30	11/8/17	7:40:39	71.70	0.1674784	HR / L	Conditioning Phase	3	-0.01	2.99	71.70	0.167478393
Loco 64 (80Ton)	850.3	2,300.000	I	11/15/17	7:17:35	11/11/17	7:22:30	95.92	0.112805	HR / L	0.1320	4	0.00	4.00	95.92	0.112804958
Loco 64 (80Ton)	368.8	2,300.000	I	11/18/17	6:43:33	11/15/17	7:17:35	71.43	0.1936897	HR / L		3	-0.02	2.98	71.43	0.193689745
Loco 64 (80Ton)	1,489.10	2,300.000	I	11/22/17	11:23:45	11/18/17	6:43:33	100.67	0.0676046	HR / L		4	0.19	4.19	100.67	0.067604593
Loco 64 (80Ton)	918.7	2,300.000	I	11/25/17	8:14:06	11/22/17	11:23:45	68.84	0.0749311	HR / L		3	-0.13	2.87	68.84	0.074931062
Loco 64 (80Ton)	1,154.90	2,300.000	I	11/29/17	10:38:25	11/25/17	8:14:06	98.41	0.0852068	HR / L		4	0.10	4.10	98.41	0.085206752
Loco 64 (80Ton)	607.800	2,300.000	I	12/2/17	8:31:25 AM	11/29/17	10:38:25 AM	69.88	0.1149775	HR / L		3	-0.09	2.91	69.88	0.114977515
Loco 64 (80Ton)	1,038.200	2,300.000	I	12/6/17	7:09:46 AM	12/2/17	8:31:25 AM	94.64	0.091157	HR / L		4	-0.06	3.94	94.64	0.09115697
Loco 64 (80Ton)	1,400.600	2,300.000	I	12/6/17	11:52:57 AM	12/2/17	8:31:25 AM	99.36	0.0709402	HR / L		4	0.14	4.14	99.36	0.070940232
Loco 64 (80Ton)	931.800	2,300.000	I	12/9/17	9:41:04 AM	12/6/17	11:52:57 AM	69.80	0.0749109	HR / L		3	-0.09	2.91	69.80	0.074910865
Loco 64 (80Ton)	1,102.600	2,300.000	I	12/13/17	12:39:55 PM	12/9/17	9:41:04 AM	98.98	0.0897704	HR / L		4	0.12	4.12	98.98	0.089770391
Loco 64 (80Ton)	716.200	2,300.000	I	12/16/17	8:28:47 AM	12/13/17	12:39:55 PM	67.81	0.0946865	HR / L		3	-0.17	2.83	67.81	0.094686463
	12239.4							**1103.39**	**0.0901506**	**HR / L**	With Addtive				**1103.39**	**0.09015057**
											0.0902					
											18.67% % increase in Fuel Economy					

Regular Operation
Omstar Dx1 ratio **1280 : 1**
18.67% increase in Fuel Economy

To determine the accurate fuel efficiency the reliability engineers used the actual production at the blast furnace of Loco 64 and measured tons / liter fuel moved.

Production at Blast Furnace

Month	BF C	BF D	Total	Date of Data	Month End	Fuel Used on BF Locos		Ton/L
January			179437		179437	63383	L	2.831000426
February			147282		147282	54076	L	2.723612584
March			179634		179634	52522	L	3.420172696
April			202045		202045	57416	L	3.518959291
May			201561		201561	66860	L	3.01467245
June			163383		163383	57013	L	2.865714837
July			211808		211808	68180	L	3.106592842
August			209939		209939	72963	L	2.877341704
September			216135		216135	65277	L	3.311043706
October			212445		212445	69115	L	3.07379006
November			193213		193213	62800	L	3.076640127
December			202956		202956	58884	L	3.446708783
			2319838.234	**Average**	**193320**	**62374**		3.099361826
				Sum	**2319838**	**748489**		3.099361826

Fuel by Loco 64	% of BF Locos
7851	0.123866021
6255	0.115670538
6790	0.129279159
5199	0.090549673
8430	0.126084355
8240	0.144528441
5436	0.079730126
9252	0.126803997
6218	0.095255603
10336	0.149547855
7050	0.112261146
8012	0.136064126

Ton/L for Jan-Oct					
2.831000426					
2.723612584					
3.420172696					
3.518959291					
3.01467245					
2.865714837					
3.106592842					
2.877341704					
3.311043706					
3.07379006					
2.723612584	**Hardest Month**	**3.07429006**	**Average Month**	**3.5189593**	**Easiest Month**
0.253470434	**Std Dev**				
55750	Liter for Loco1-9 for November				
171391.67	Estimated Production for Loco 1-9				
21821.33	Tons moved by Loco 64				
193213	Total Tons moved November				

Load Estimation

	Hardest Month	Above 1 STD Month	Average Month	Below 1 STD Month	Easiest Month
Litres Expected	8012	7736	7098	6557	6201
Litres Actual	7050	7050	7050	7050	7050
% Difference	**12.01%**	**8.87%**	**0.68%**	**-7.51%**	**-13.69%**

Loco 14 was out of rotation during the October-December; giving reason to declare that Loco64 worked harder during the month of November

179437.3
147282.0741
179634.3103
202044.5667
201561
163383
211807.5
209939.4828
216135
212445
193213
202956