

# Information into Action

Putting the asset information to use

**Louis Cripps**

*Regional Transportation District*

*Asset Management*

*Denver, Colorado*

# Presentation Goals

- Overview of RTD Denver's Asset Management program
- Leadership commitment drives success
- Age, Condition and Performance Assessments
- Data converted to Information
- Converting information into action

# Background

## RTD Overview

- Service area 2,410 sq. miles
- 1000 + transit coaches, >140 routes
- 110 Park-N-Rides / Stations, >10,000 stops
- 6 Rail lines
- 172 LRV's (+29 on order)
- 56 Commuter Rail vehicles (PP3)
- Accessibility services, Call-n-Rides, seasonal rides and many other programs



# Leadership





# Cultural Shift

- From support to Invest
- Burn the ships not wait and see
- Compliance to Value



# Long Term Thinking

- Independence of asset management
- Long range vision and performance planning
- Improvements, focused investments
- Savings
- Reduced risks
- Better decisions

# Timeline

2011

- **Strategy**

- Proof of Concept, Pilot Program, GM Task Goal

2012

- **Tactical**

- 3 Year Implementation Plan

2013

- **Implementation**

- Foundational Policies, Procedures, & Standards

2014

- **Results**

- Completion of Rolling Stock, Rail and Facilities Assets

2015

- **Early Returns**

- Input into Strategic Budget Plan
- First Annual Report



# Asset Management

*Asset management is not just a  
once or twice per year exercise...  
its every day*



# Repeatable Scalable

## Predictable Standardized Processes

- Bus
- Rail Vehicle
- Rail Infrastructure
- Facilities
- Public Facilities
- Information Technologies



Asset Management  
State of Good Repair

## RAIL INFRASTRUCTURE

SGR MOW Inspection

Asset Management  
State of Good Repair

## RAIL INFRASTRUCTURE

Rail Infrastructure Standards

Asset Management  
State of Good Repair

## RAIL INFRASTRUCTURE

Safety Qualification

This document is for the purpose of detailing the different steps that need to be taken by SGR inspectors to become safety qualified for performing inspections out on the Right of Way.

REGIONAL TRANSPORTATION DISTRICT - DENVER

Latest Revision:  
By: Michael Klier

This procedure includes information for the SGR Inspection of the RTD Light Rail Vehicles.

## SGR LRV Inspection

I

This document contains information for SGR inspectors to rate assets in a uniform format.

## SGR Standards

LRV Inspect

This document contains information important to the SGR inspectors. This information includes definitions, terminology, systems, and specific components.

## LRV Familiarization

SGR[inspecto]

Regional Transportation District

Last revision: 05/2013  
By: Kevin Steele

## Asset Management State of Good Repair

# PUBLIC FACILITIES

## Public Facilities Inspection Standards

## Asset Management State of Good Repair

# PUBLIC FACILITIES

## Public Facilities Inspection Procedure

This document  
and Park-n-

## Asset Management State of Good Repair

# PUBLIC FACILITIES

## Public Facilities Inspection Standards

This  
inform  
of the

REGIONAL TRANSPORTATION

This document contains standards for SGR Inspectors to rate rail stations  
and Park-n-Ride facilities in a uniform format.

REGIONAL TRANSPORTATION DISTRICT - DENVER

Latest Revision: 05/2016  
By: Coyne Krupskie

### PUBLIC FACILITIES INSPECTION FORM

Inspection Date:  
Location:

(1) DRS		Drivers Relief Station					
Aesthetics-	Repulsive	1	2	3	4	5	Like New
Function-	Awful	1	2	3	4	5	Excellent
(2) GROU		Grounds					
Lawn-		1	2	3	4	5	
Shrubs-		1	2	3	4	5	
Trees-		1	2	3	4	5	
(3) LOT							
Striping-		1	2	3	4	5	
Surface-		1	2	3	4	5	
(4) PLAT		Platform					
Aesthetics-	Repulsive	1	2	3	4	5	Like New
Stairs-	Awful	1	2	3	4	5	
Surface-		1	2	3	4	5	
Tactile-		1	2	3	4	5	
(5) PLAZ		Plaza					
Aesthetics-	Repulsive	1	2	3	4	5	Like New
Stairs-	Awful	1	2	3	4	5	Excellent
Surface-		1	2	3	4	5	
(6) STOR		Storage					
Aesthetics-	Repulsive						
Function-	Awful						
(7) STRU							
Aesthetics-	Repulsive						
Stairs-							
Striping-							

PUBLIC FACILITIES INSPECTION FORM									
Location:								Date:	
Assets:	DRS	GROU	LOT	LANE	PLAT	PLAZ	STOR	STRU	
SGR-PUB-DRS		Drivers Relief Station							
SGR3020-AESTHETICS		1	2	3	4	5			
SGR3080-FUNCTION		1	2	3	4	5			
SGR-PUB-GROU		Grounds							
SGR3110-LAWN		1	2	3	4	5			
SGR3140-SHRUBS		1	2	3	4	5			
SGR3190-TREES		1	2	3	4	5			
SGR3200-LANDSCAPE MATERIAL		1	2	3	4	5			
SGR-PUB-LOT		Perking Lot							
SGR3160-STRIPING		1	2	3	4	5			
SGR3170-SURFACE		1	2	3	4	5			
SGR-PUB-LANE		Drive Lanes							
SGR3165-STRIPING		1	2	3	4	5			
SGR3175-SURFACE		1	2	3	4	5			
SGR-PUB-PLAT		Rail Platform							
SGR3020-AESTHETICS		1	2	3	4	5			
SGR3150-STAIRS		1	2	3	4	5			
SGR3170-SURFACE		1	2	3	4	5			
SGR3180-TACTILE		1	2	3	4	5			
SGR-PUB-PLAZ		Pedestrian Plaza							
SGR3020-AESTHETICS		1	2	3	4	5			
SGR3150-STAIRS		1	2	3	4	5			
SGR3170-SURFACE		1	2	3	4	5			
SGR-PUB-STOR		Storage/Security & Elec. Room/Ticket Kiosk							
SGR3020-AESTHETICS		1	2	3	4	5			
SGR3080-FUNCTION		1	2	3	4	5			
SGR-PUB-STRU		Perking Structure							
SGR3020-AESTHETICS		1	2	3	4	5			
SGR3150-STAIRS		1	2	3	4	5			
SGR3160-STRIPING		1	2	3	4	5			

RTD



Asset Management  
State of Good Repair

## *SGR STANDARDS*

*FM Building Inspections*

Asset Management  
State of Good Repair

## *SGR BUS*

### *INSPECTION*

*Bus Inspection Procedure*

Asset Management  
State of Good Repair

## *FACILITIES*

*Building Inspection Procedure*

This document

## *BUS*

*Inspection Standards (Non-Hybrid)*

REGIONAL T

This procedure includes information for the SGR inspection of the RTD buildings and grounds.

This document contains information for SGR inspectors to rate bus assets in a uniform format.

REGIONAL TRANSPORTATION DISTRICT - DENVER

Latest Revision: 09/2014  
By: Ed Cellies/Paul Mink

REGIONAL TRANSPORTATION DISTRICT - DENVER

Latest Revision: 04/2016  
By: Louie Carbone



# Assessing Assets

## Age -based

Assets should be scheduled for replacement beyond a certain maximum age  
Expected Useful Life (EUL)

## Condition-based

Assets should be replaced once inspections identify deteriorated conditions

## Performance-based

Assets should be replaced when the asset fails to meet required performance and reliability levels

## Comprehensive Assessment

Combines **age**, **condition**, **performance** data, and maintenance history, Criticality and risk

Less Burden

More Accuracy

# Age

- Works well when there is a set life span
  - Consistent utilization
  - No other factors influence decay



# Condition

## Advantages:

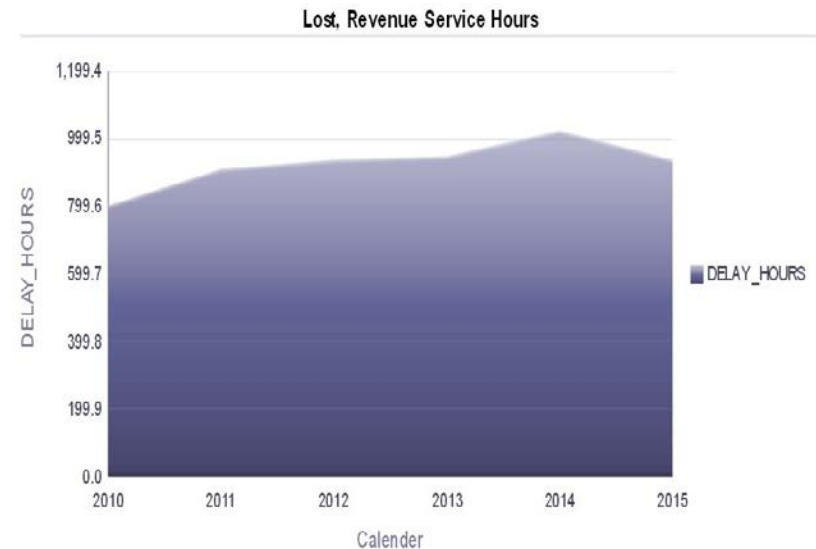
- Easy to define inspection measures
- Creates historical decay records
- Evaluation to component levels
- *Condition may need to include the performance measure of cost*

SUBCATEGORY	Age Based Score	Condition Based Score	Cost Based Score	Road Call Based Score	Incident Based Score	SGR Overall Score
TRANSTEQ2000	2.2	2.8	0.0	0.0	0.0	1.0

# Performance

## Advantages:

- Different performance measures can be used
  - Can be real-time
  - Includes utilization
- 
- Tools often provide visualization

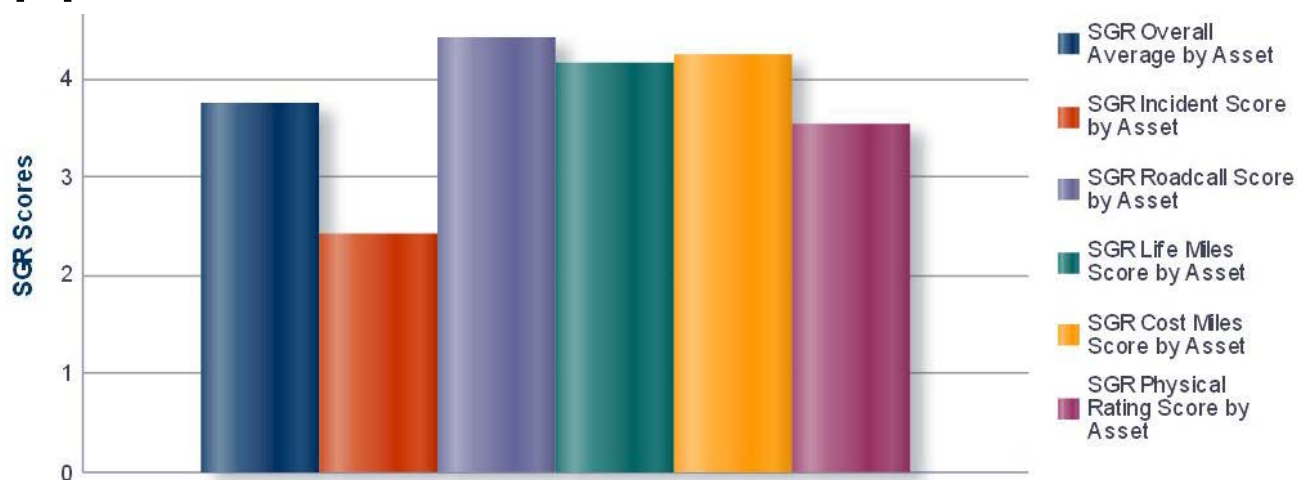




# Comprehensive

## Advantages:

- Includes the strengths from Age, Condition and Performance.
- Best comparison between modes.
- Uncover opportunities



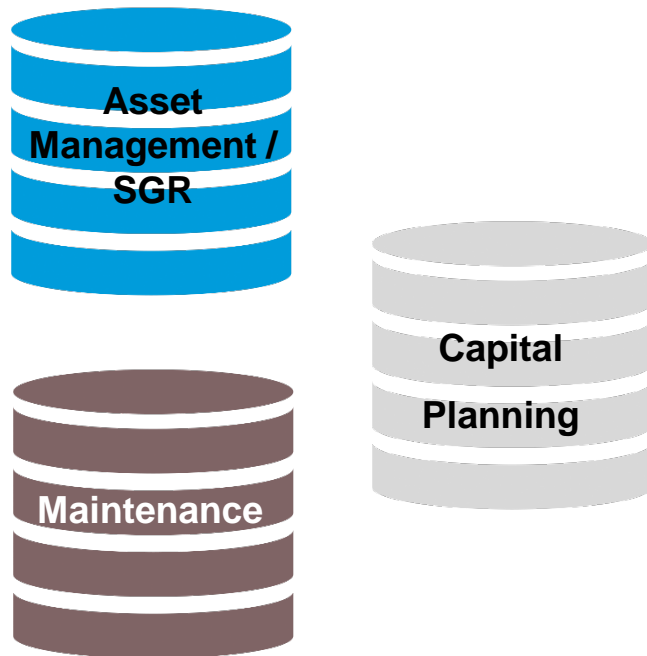
# Data Quality

*If the quality of data is low then decisions based on this data without external input cannot exceed our level of confidence in the data.*

# Balance

- Data is a means to an end
- That end is information-based decision making
- The truth is in the data, don't change the data to fit a narrative

# Asset Data Challenges



- Multiple, disconnected asset systems
- No “single source of truth”
- Difficulty collecting, aggregating and updating asset data!
- Asset decisions are disconnected from the on-the-ground reality



# Data Confidence

- We rely heavily on the data captured at the transaction levels
- How do we address data quality?

# Testing Data Quality

- SGR Inspectors evaluate and score system data accuracy
- Automated data mining techniques evaluate the confidence so immediate actions can be taken to correct / improve the quality of input.
- System exception reports further automate the process of identifying suspect records.

# Exception Report

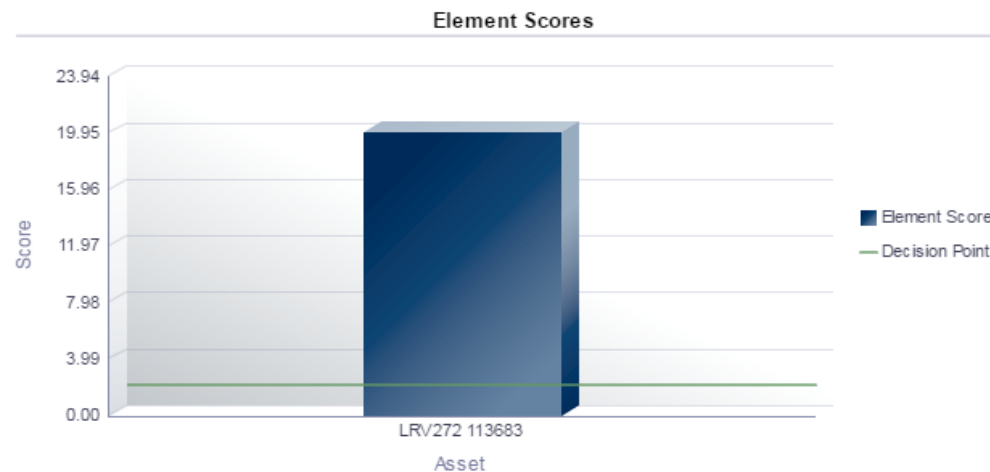


## LRV Test Element Score Exception Report

Time run: 5/19/2015 12:55:22 PM

SG  
the

**Report 2.3.2 (SGR LRV Element Score Exceptions):** This report displays test element scores of "NULL", greater than score of "FIVE" or Less than "Zero".



VEHICLE_ID	Test Element	Test Description	Element Score ▲ ▼	TEST ID
LRV272	SGR2009	TRACTION MOTORS	20.00	113683

CATEGORY is equal to / is in **LRV**  
and VEHICLE\_ID is not LIKE (pattern match) %-R  
and SCOREAVG is greater than 5

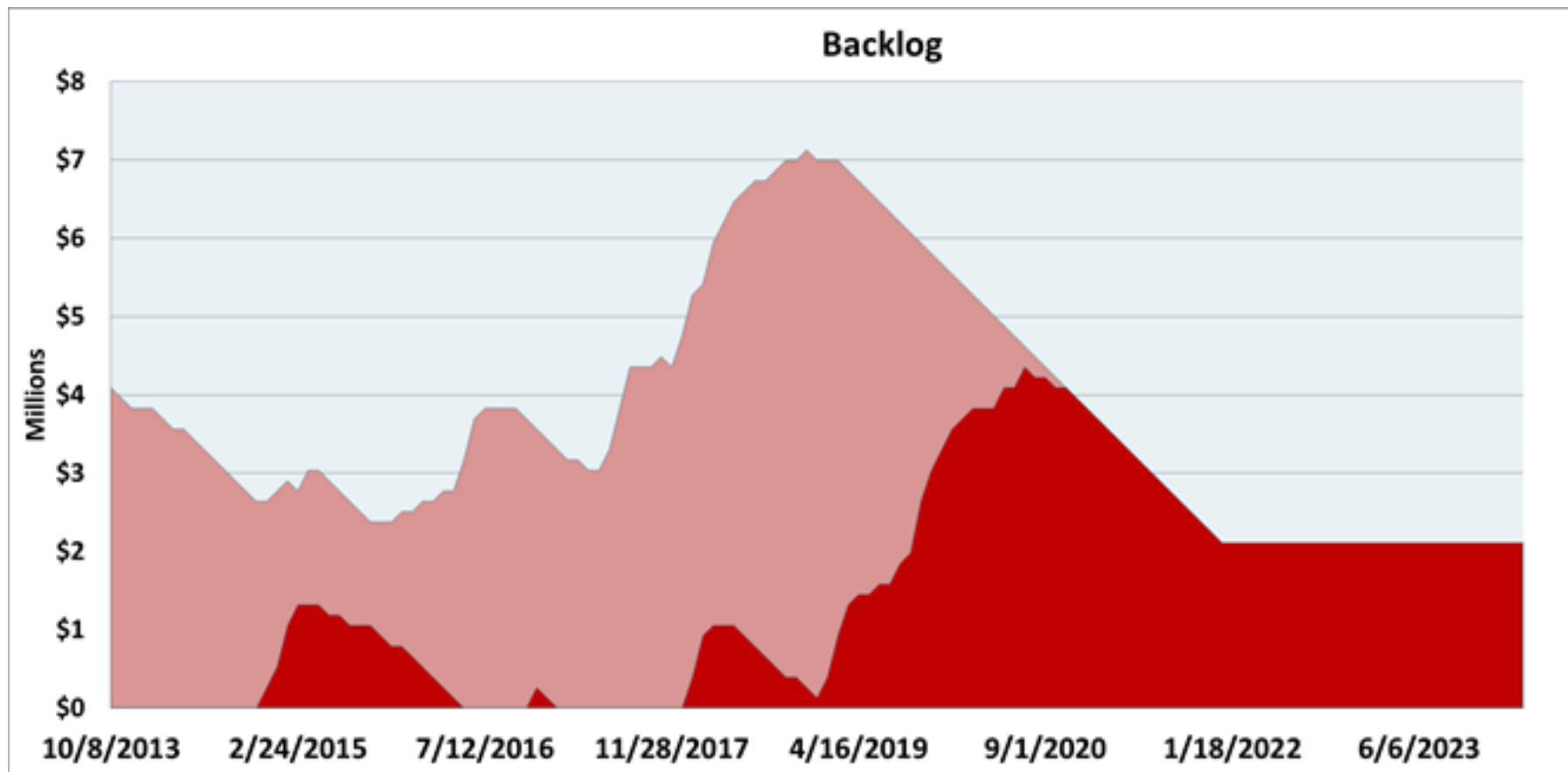
# Results

AM Division returning value - Safe proven ideas that pay off in the long run

- Imbedded track in downtown
- Motor / gearbox
- Transmissions
- Automatic tire chains
- HVAC Units
- Midlife
- Fuel tank farms
- Escalators and Elevators
- Equipment retirement prioritization
- Capital Project Prioritization
- Grant applications
- UAS systems



# Maintenance Interval Analysis

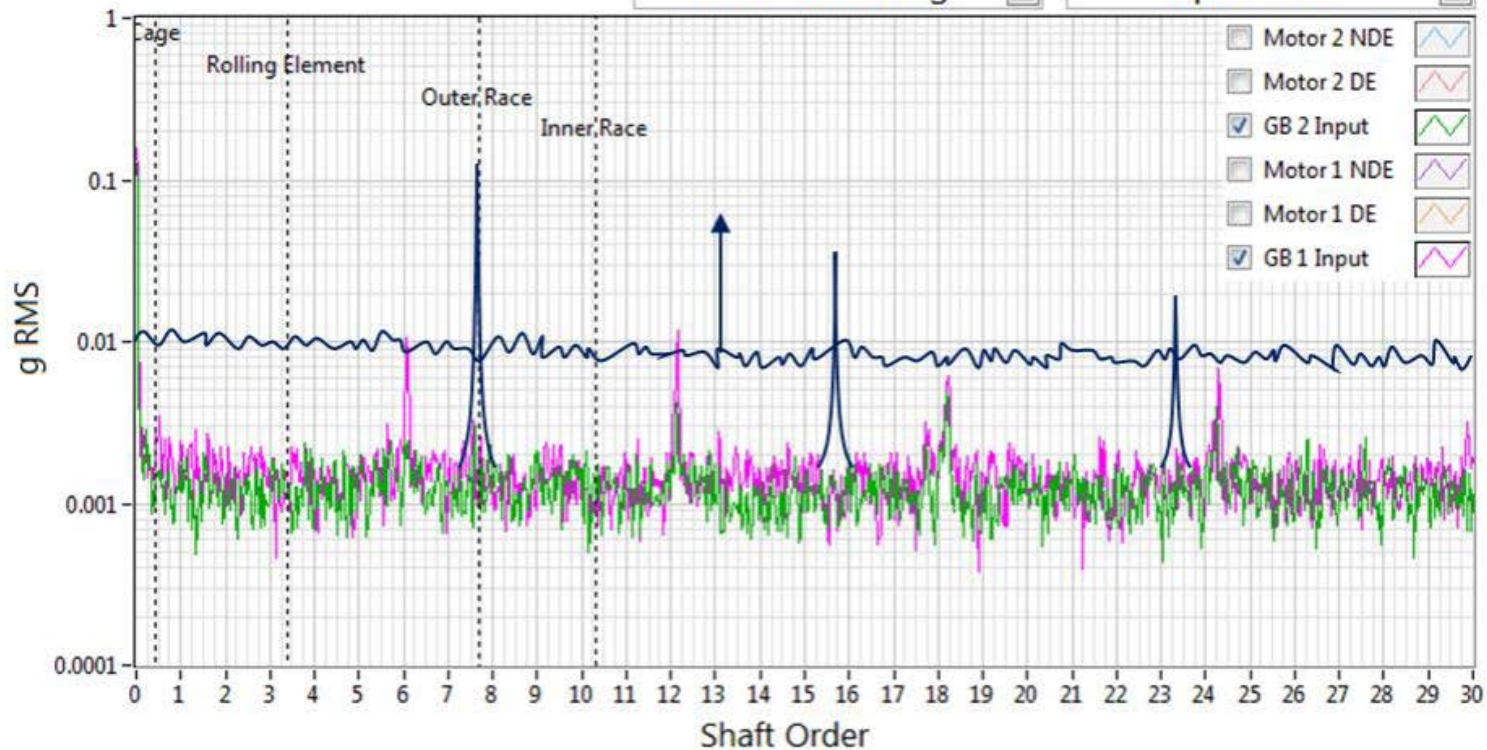


# Gearbox Data

LRV 241-A, 3:50:22 PM 2/2/2015

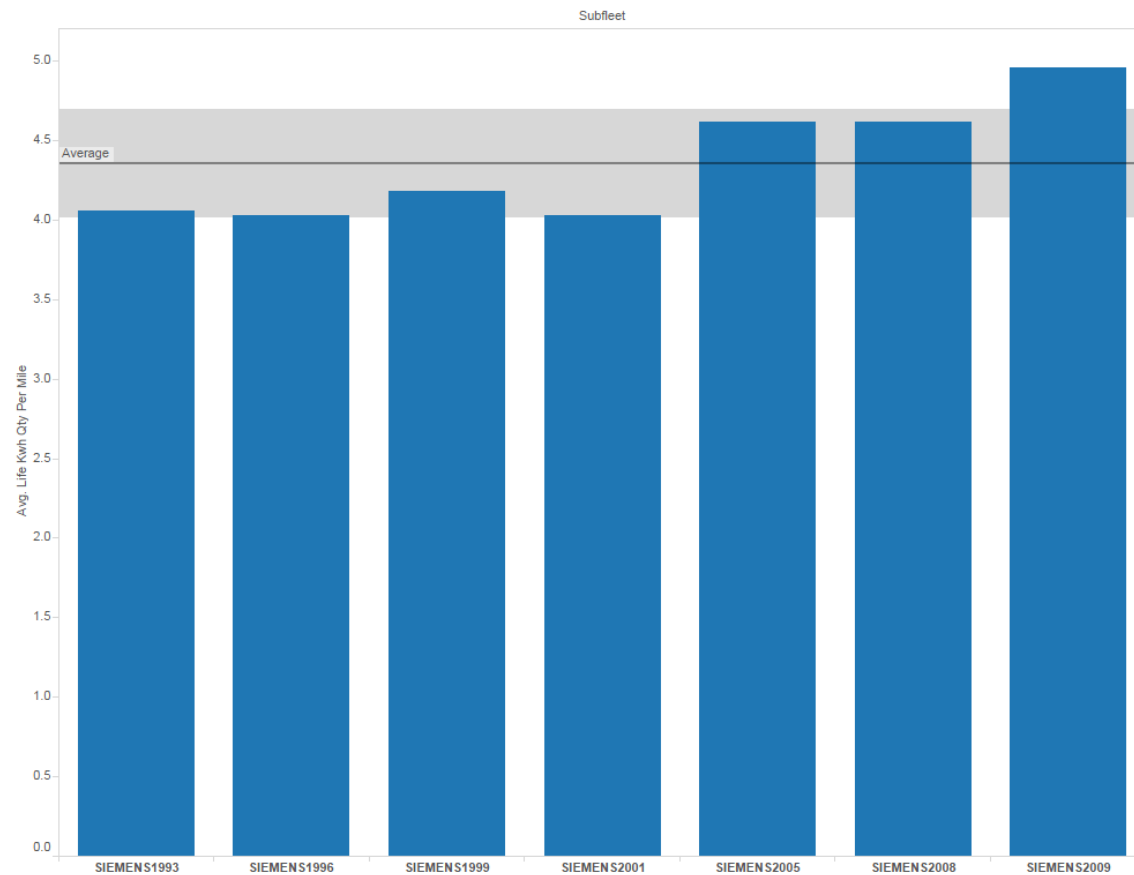
Gearbox Bearings

Input Shaft

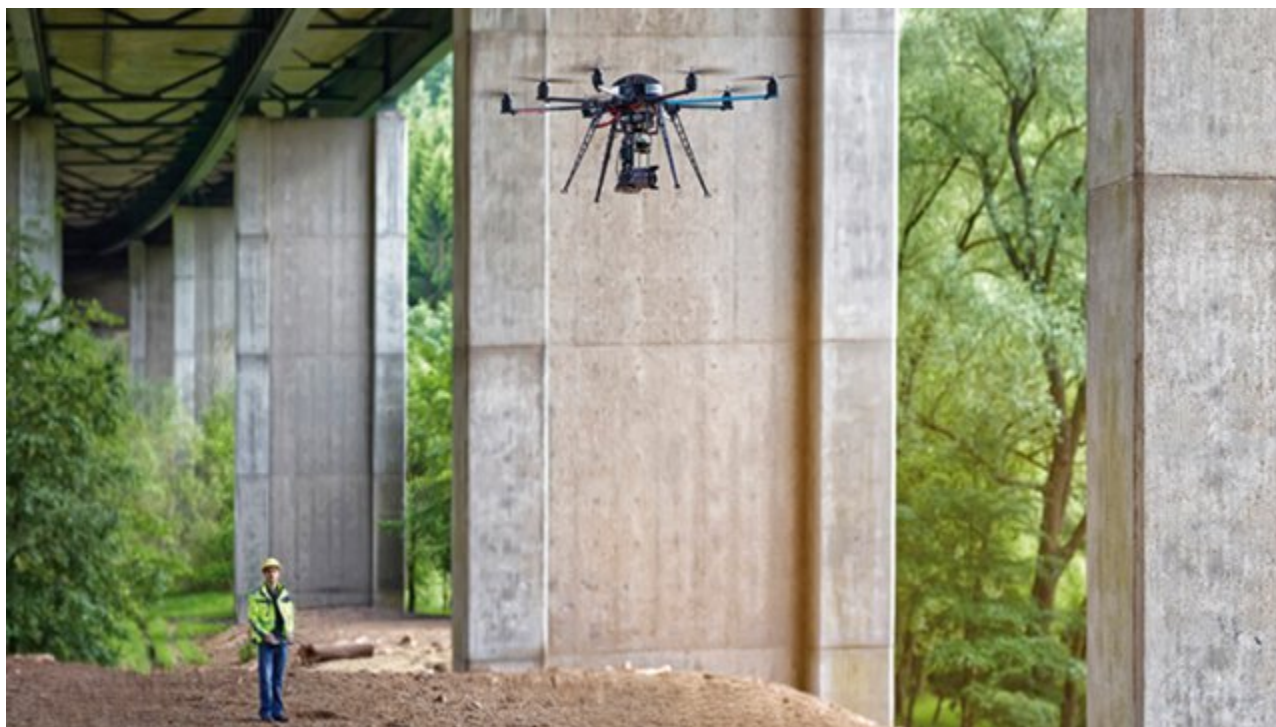


# Predict future expenses

Kwh per Mile



# RTD Unmanned Aerial Vehicle Inspections



# Passenger Delay Hours

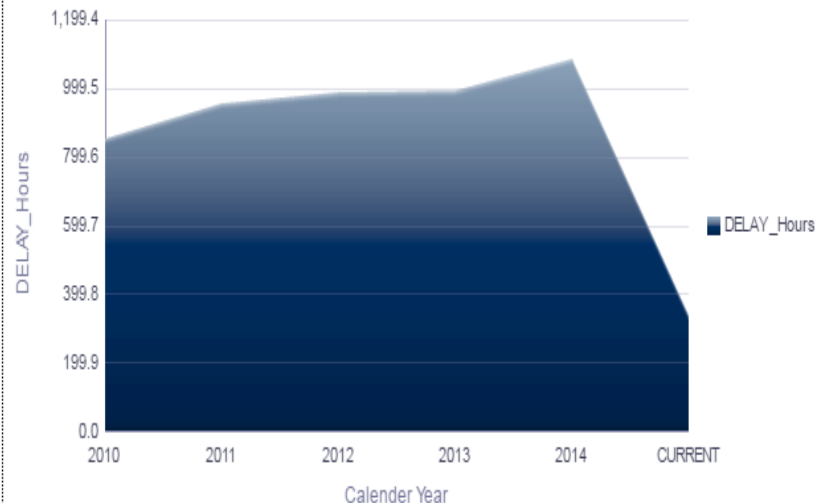



## In-Service Delay Hours By Year

Time run: 5/19/2015 8:38:39 AM

**Report 2.1.1 (In-Service Hours By Year Comparison):** This report displays Revenue Service Delay, Lost Hours due to Technical Breakdown for Rolling Assets Category[ RTD BUS & LRV] by Year Since Year 2010.

Lost, Revenue Service Hours- Technical Breakdown

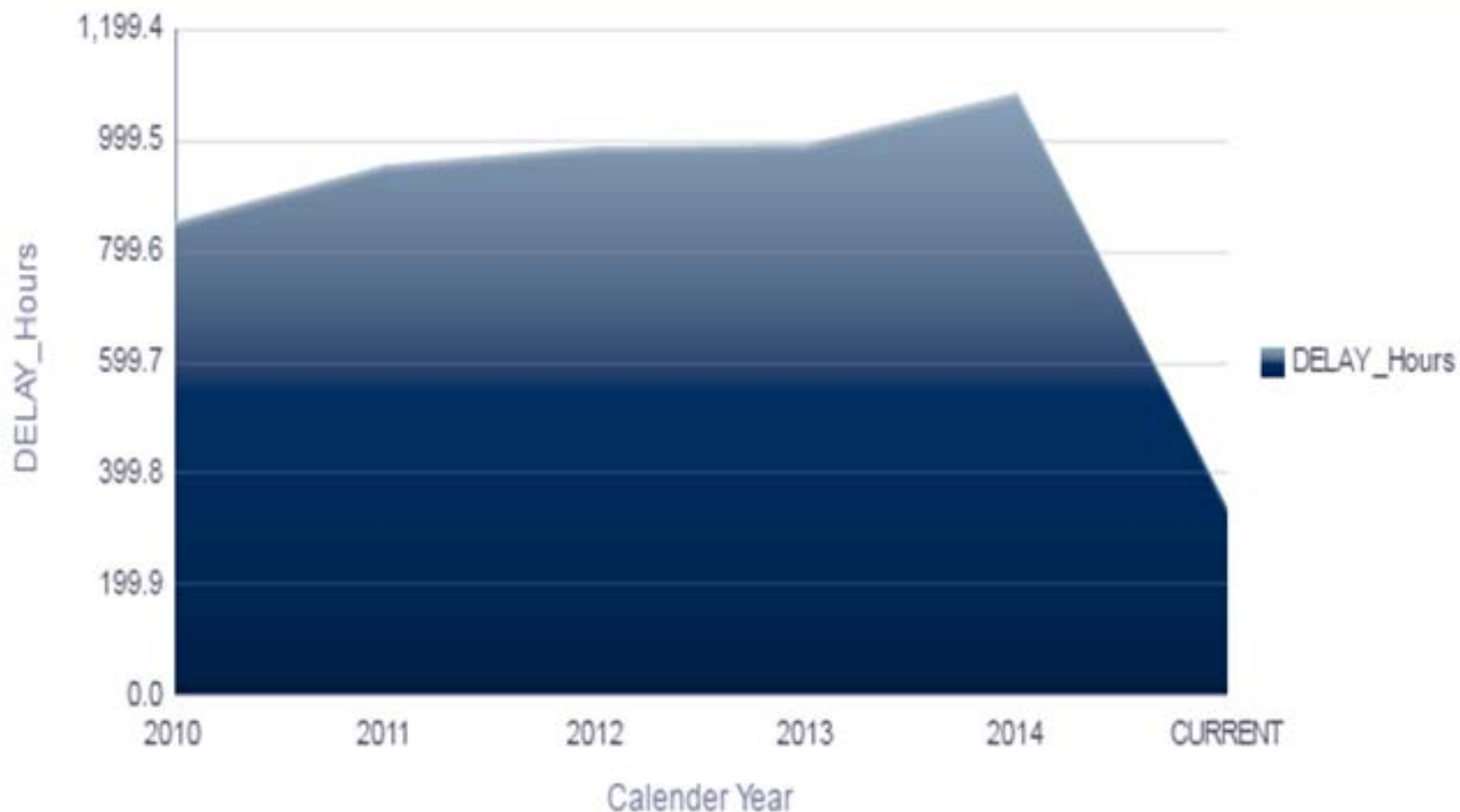


Calender Year 	DELAY_Hours
CURRENT	335.7
2014	1,086.5
2013	994.7
2012	989.9
2011	955.1
2010	849.9



# Passenger Delay Hours

Lost, Revenue Service Hours- Technical Breakdown

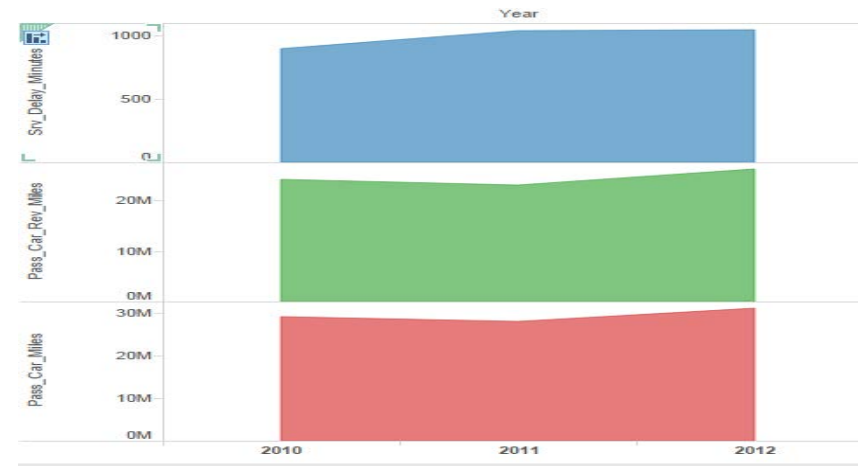
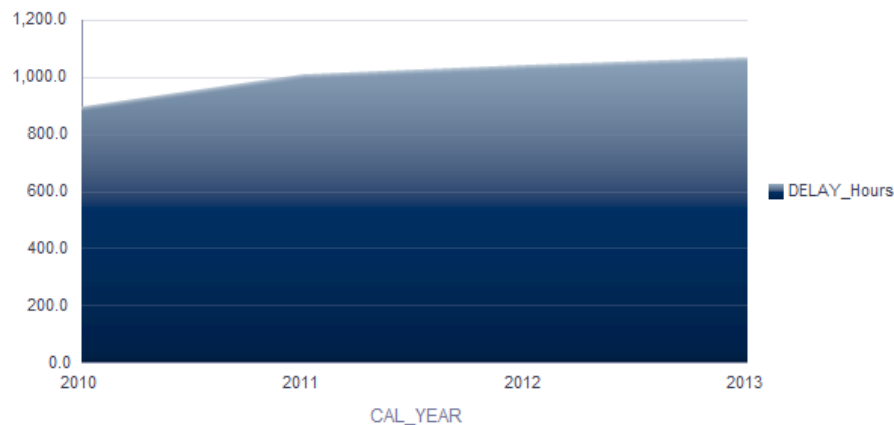




# Passenger Delay Hours

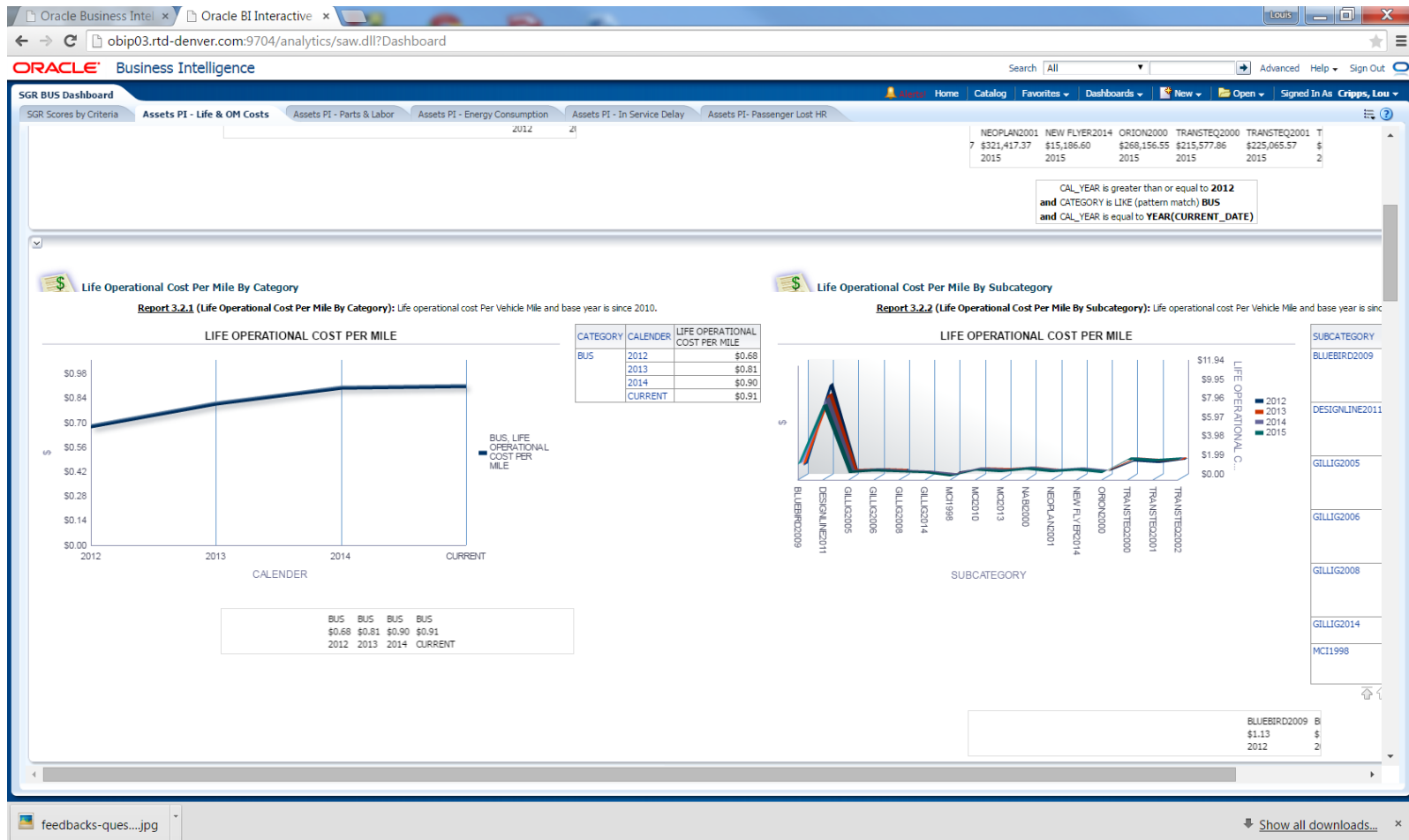
- Key Performance Indicator 'In-Service Delay Minutes' indicates Lost Revenue Service is in increasing trend while Revenue mile is almost flat for the period.

Lost, Revenue Service Hours- Technical Breakdown



- Increasing trend of Lost In-service Delay without significant Revenue mile increase is an indication of Assets deterioration trend due to Age and Condition.

# Cost Per Mile



# SGR Scores by Sub-fleet



## RTD- SGR Score by SubCategory

Excluding All Assets In Replacment Process

**Report 1.2.1 (State of Good Repair Score By Subcategory):** Overall Average SGR Score based on Age, Condition & Performance basis (Cost, Road call & Incidents) by Sub Fleet.

SUBCATEGORY	Age Based Score	Condition Based Score	Cost Based Score	Road Call Based Score	Incident Based Score	SGR Overall Score
TRANSTEQ2000	2.2	3.0	0.6	0.0	0.0	1.2
TRANSTEQ2001	2.2	3.0	0.7	0.0	0.0	1.2
TRANSTEQ2002	2.2	3.0	1.3	0.0	0.0	1.3
MCI1998	1.4	2.6	1.8	1.9	0.6	1.7
ORION2000	1.9	2.9	1.8	1.4	1.2	1.9
NEOPLAN2001	2.2	3.0	1.4	2.0	1.0	1.9
NABI2000	1.9	2.9	1.0	1.3	2.6	1.9
GILLIG2005	3.1	3.5	2.8	3.0	2.0	2.9
GILLIG2006	3.8	3.1	3.0	2.6	4.1	3.3
GILLIG2008	3.9	3.5	3.5	2.9	3.4	3.4
BLUEBIRD2009	3.4	3.6	3.2	3.5	4.0	3.5
MCI2010	4.0	3.6	3.7	3.9	3.4	3.7
MCI2013	4.4	4.4	4.7	4.6	4.4	4.5
GILLIG2014	4.9	5.0	5.0	4.6	4.7	4.8
NEW FLYER2014	4.7	5.0	4.9	4.9	4.8	4.9

CATEGORY is equal to / is in **BUS**  
**and** SGR\_PHY\_RATING\_SCORE\_BY\_ASSET is not null  
**and** ETL\_CONTROL\_FLG is equal to / is in **C**  
**and** ASSET is not LIKE (pattern match) %-R  
**and** LOCATION is not equal to / is not in **RETIRE**

# LRV Midlife

## ACTION:

- One work order with 60 unique tasks and task codes
- Created a clearly define the scope of work
- Removed repair tasks from the midlife

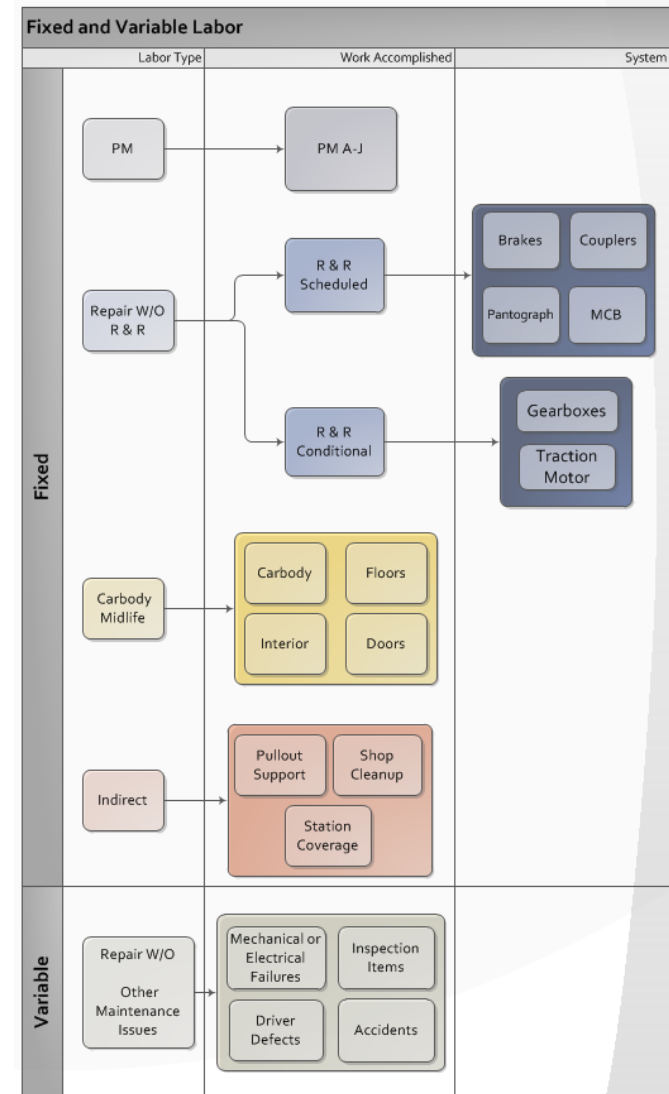
## GOALS:

- Accountability—Consistency---Man-hour tracking
- Easier to budget short and long term
- Easier to track progress
- Improve productivity without cost increases
- Reduce parts & labor variance

## RESULT:

- Single work order for renovation allowed RTD Light Rail to apply for a CDOT FASTER Grant.

Work order ID	MARMA	2016	169	Equipment ID	LRV124	Job status	OPEN
Posted transactions							
		Hours/cost posted		2986.30 / 0.00		Displaying 5	
Row #	Task ID	Work accomplished code	Date	Employee	Revers	Labor hours	
1	E31-R500		04/05/2016	6277	<input type="checkbox"/>	6.85	
2	E31-R500		04/06/2016	6277	<input type="checkbox"/>	8.27	
3	E63-U100		04/07/2016	19469	<input type="checkbox"/>	0.77	
4	E63-U100	R03	04/07/2016	21520	<input type="checkbox"/>	1.12	
5	E31-R500		04/07/2016	6277	<input type="checkbox"/>	7.97	



# Results

*To be added.....*



