

Technology Evaluations with Engine Angel

2018-03-19

Topics

- Intro
- Good testing methodology: Control and Performance Groups
- Testing vehicles before and after implementation of a new technology
- Testing Original and Upgraded sets of vehicles over same period of time
- Sample Consideration
- Results

Purpose

- There are a continuing stream of technological Innovations bombarding fleet managers, promising a wide variety of benefits.
- Good business practice suggests that the claims should be verified in your operations prior to complete implementation across the fleet.
- The functionality to define groups and attach resources to those groups enables the fleet manager to tag multiple resources to the group as controls (not outfitted with the new technology) or performance (those resources that are outfitted with the technology).
- The two sets, control versus performance, should be of equal size and expected to be operated in very similar fashion over the duration of the study.
- The group should be defined for a specific period of time so that Engine Angel can collect data from trips during that period of time that are associated with the indicated resources. The data from those trips can be analyzed between the two sets, control and performance for statistical significance.

Definitions

- **Groups:** We use the term ‘Groups’ to mean a set of trips made by specified vehicles with, or without trailers, between a start and end date. As implied, the new technology might be applied to the tractor or trailer, or both.
 - If the new technology is only applied to the vehicle, the trailers do not need to be included. But if the new technology is applied to the trailer, both the vehicle and trailer must be specified because the trip data is attached to the vehicle number.
- **Controls:** A control set of trips come from a specified set of control vehicles/trailers such that the trips all end between start and end dates that may be different for each vehicle/trailer.
- **Performance:** A set of trips by specified vehicles/trailers that have been upgraded to employ the new technology being evaluated, using trips ending between start and end dates that may be different for each vehicle/trailer.

Note: The same vehicle(s) may be in both Groups provided that the start and end dates of the Control Group assignments precede the Performance Group interval.

Groups

The first step is to define the Study and identify the vehicles with or without trailers that will serve as controls vs. those that will be 'upgraded' with the new technology for comparison.

Secondly, name each Group of trips for the technology evaluation.

Next, attach (assign) a vehicle/trailer to the 'performance' or 'control' set. The assignment has a Start date and an End date for each vehicle/trailer assignment. This will be used to select trips that the vehicle/trailer was 'on' from which we can get performance data. That will be the basis of the statistical analysis to compare performance with control trips.

Master Data → Groups → (Add a new Group)

Select the Groups function and click on the red + in the upper right to add a new Study.

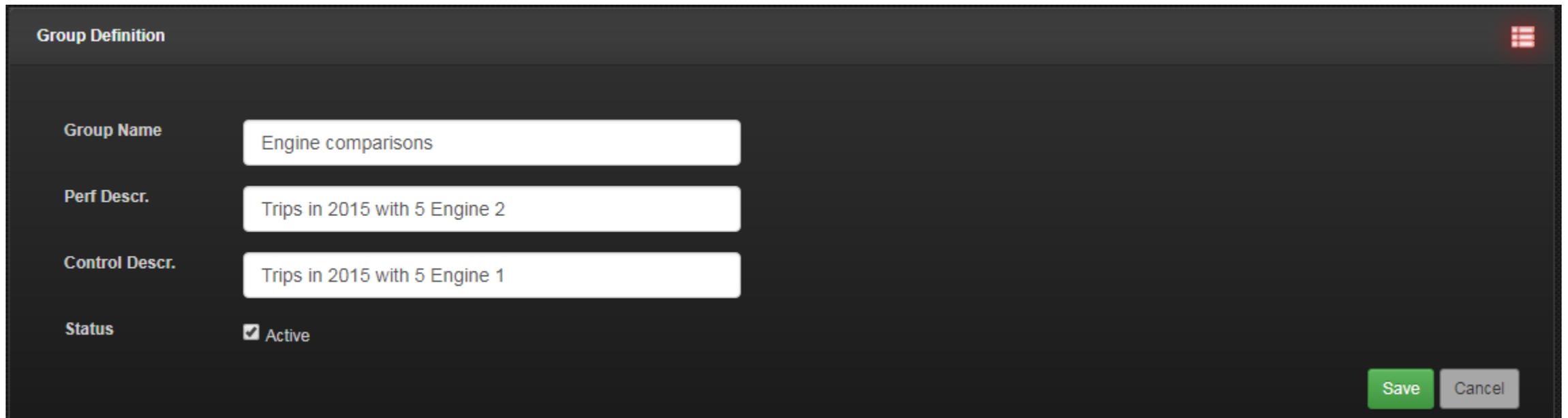
The screenshot shows a web application interface with a dark theme. The top navigation bar includes 'HOME', 'ACCOUNT', 'REPORTS', 'MASTER DATA', and 'DISPATCH'. The 'MASTER DATA' section is active, with sub-tabs for 'People', 'Vehicles', 'Trailers', 'Engines', 'Data Connections', 'Facilities', and 'Groups'. The 'Groups' sub-tab is selected. Below the navigation, there are tabs for 'Groups', 'Assignments', and 'Evaluation'. A search bar and a 'Show 10 Rows' dropdown are visible. The main content area displays a table with columns for Group, Status, and Description. The table contains three rows of data, each with edit and delete icons.

Group	Status	Description
179	Active	Performance: After high SenX score (bad) Control: Before high SenX score
Engine comparisons	Active	Performance: Trips in 2015 with 5 Engine 2 Control: Trips in 2015 with 5 Engine 1
Fuel Injector failure	Active	Performance: Injectors replaced Control: Prior to replacement

Enter the Data and Save it

Provide a name for the study (Group Name) and a short description of the units that are assigned to the Performance and the Control groups. Then Save the data.

Save the Group Name with Ctrl 'C' from the screen to specify it on the following Assignments screen.



The screenshot shows a dark-themed software interface titled "Group Definition". It contains four input fields and a checkbox. The "Group Name" field contains "Engine comparisons". The "Perf Descr." field contains "Trips in 2015 with 5 Engine 2". The "Control Descr." field contains "Trips in 2015 with 5 Engine 1". The "Status" field has a checked checkbox labeled "Active". At the bottom right, there are two buttons: a green "Save" button and a grey "Cancel" button. A red hamburger menu icon is visible in the top right corner.

Group Name	Engine comparisons
Perf Descr.	Trips in 2015 with 5 Engine 2
Control Descr.	Trips in 2015 with 5 Engine 1
Status	<input checked="" type="checkbox"/> Active

Enter Assignments of Vehicle/Trailers to Groups

Paste the saved group name into the search field to limit the screen to only the Vehicle/Trailers of interest. Click on the Function to sort the list with Controls first. Use the red + to add more assignments.

Groups **Assignments** Evaluation

Show 10 Rows

Engine comparisons

Group	Function	Vehicle Id	Trailer Id	Start Date	End date	
Engine comparisons	Control	252		2015/01/01	2015/12/31	
Engine comparisons	Control	251		2015/01/01	2015/12/31	
Engine comparisons	Control	230		2015/01/01	2015/12/31	
Engine comparisons	Control	223		2015/01/01	2015/12/31	
Engine comparisons	Performance	266		2015/01/01	2015/12/31	
Engine comparisons	Performance	263		2015/01/01	2015/12/31	
Engine comparisons	Performance	240		2015/01/01	2015/12/31	
Engine comparisons	Performance	266		2015/01/01	2015/12/31	
Engine comparisons	Performance	236		2015/01/01	2015/12/31	

Showing 1 to 9 of 9 entries (filtered from 18 total entries)

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Evaluation of the Study

- To run an Evaluation of the trips, from the Groups Tab, click on the Evaluation option. Then select the Group title. (From this screen you may enter Start and End Dates for both the Control and Performance trip intervals to override the values set earlier. If you do, these newly input dates will be applied to all vehicle/trailer assignments for this run of the Evaluation. Such dates will NOT be stored so future access will revert to the previous date intervals. This is not typically done.)
- Assuming that the Start dates of both the Control and Performance Groups are in the past, far enough for some trips to have been completed, the statistics from the ECM data from the trips will be analyzed and displayed as shown on the next page.

Technology Group Evaluation screen

Evaluation of Group:

Engine comparisons

Start date:

End date:

Export [CSV](#) [PDF](#)

Control

Trips in 2015 with 5 Engine 1

Avg Vehicle Age(Months):	45	Odometer:	225,402
Number of Vehicles:	4	Trips:	123
Distance Covered	136,561		
Average Trip Distance	1,110		
Drive Fuel Economy	7.74	± 0.39	
Fuel Consumption	0.1295	± 0.01	
Speed	57.81	± 1.14	
Load%	41.41	± 0.48	

Performance

Trips in 2015 with 5 Engine 2

Avg Vehicle Age(Months):	39	Odometer:	90,678
Number of Vehicles:	5	Trips:	104
Distance Covered	66,693		-51.16%
Average Trip Distance	641		-42.25%
Drive Fuel Economy	8.56	± 0.30	10.53%
Fuel Consumption	0.1170	± 0.00	-9.653%
Speed	57.01	± 1.88	-1.38%
Load%	39.54	± 0.70	-4.51%

Fuel Cost:

2.80



Fuel costs would decrease 3,500 USD/year per 100,000 mi from base of 36,260 USD/yr

Dispatched hrs/yr:

6000



Travel miles would decrease by 1,150 mi from a base of 83,250 mi/yr

Drive Fuel economy was **higher** for the Performance Subgroup

Performance Group seems to **work less hard**

The above conclusions are valid if the trips in the two groups were similar: similar variety of weather, roads, loads, driver behaviors, etc. By altering the Start and End dates of the comparisons, you can eliminate trips that might be extremes. The confidence of the analysis will increase as extreme driving conditions between the two sets are reduced.

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Results shown on the Evaluations screen

- The Study name and Control and Performance titles are shown near the top of the screen. If the Start and End dates are blank, the assignment dates are used.
- In blue, the average age of the vehicles and average odometer readings at the end of trips are shown, along with the number of vehicles and number of trips in each group.
- Then the total distance of all vehicles in each group is shown with the average distance per trip are shown to provide evidence of statistical significance.
- Performance of each group is shown with: Drive Fuel Economy, Fuel Consumption, Average speed, and Load%.
- You can input your 'standard' for fuel cost and average number of hours per year the vehicles are expected to be dispatched per year ($\text{hrs} = \text{days} * 24$), then hit the red 'recalculate button'.
- The system will return the expected fuel cost change per 100,000 miles (odometer change) AND
- The expected distance travelled based on the input number of hours dispatched times the average control vehicle utilization. If the new technology allows increased speed, the vehicle might make more trips per year.