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Centre for Railway Research and Education

Managing Risk and Cost with an EA Approach

Centre for Railway Research and Education and
Atego

Overview

- Introduction
- Architecture
- Solutions
- Analysis
- Conclusions

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Introduction

- Current Freight Transport
  - Road
  - Rail
- Future Freight Transport
  - Multi modal
  - Trunk Movement

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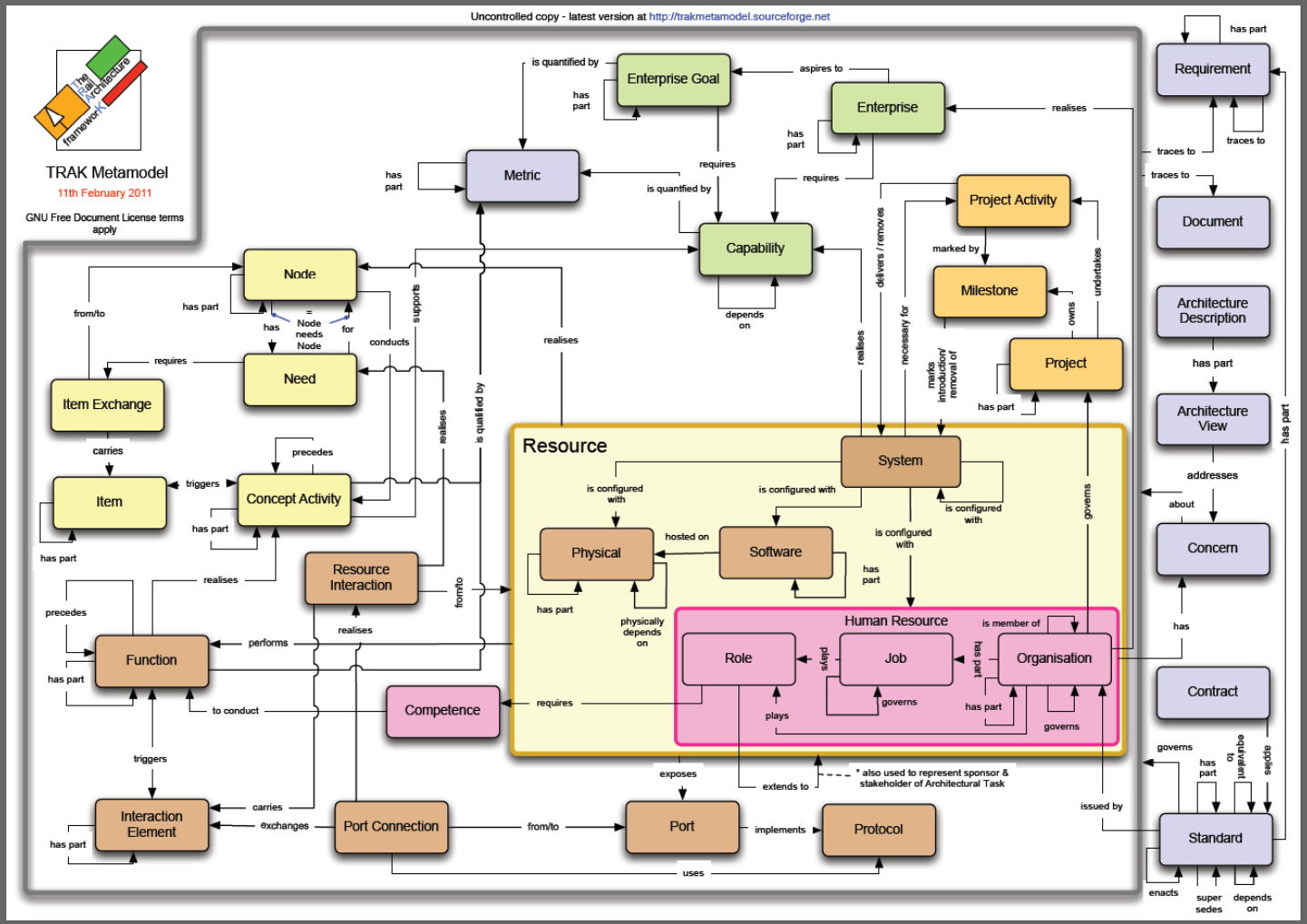
Architecture: the TRAK metamodel



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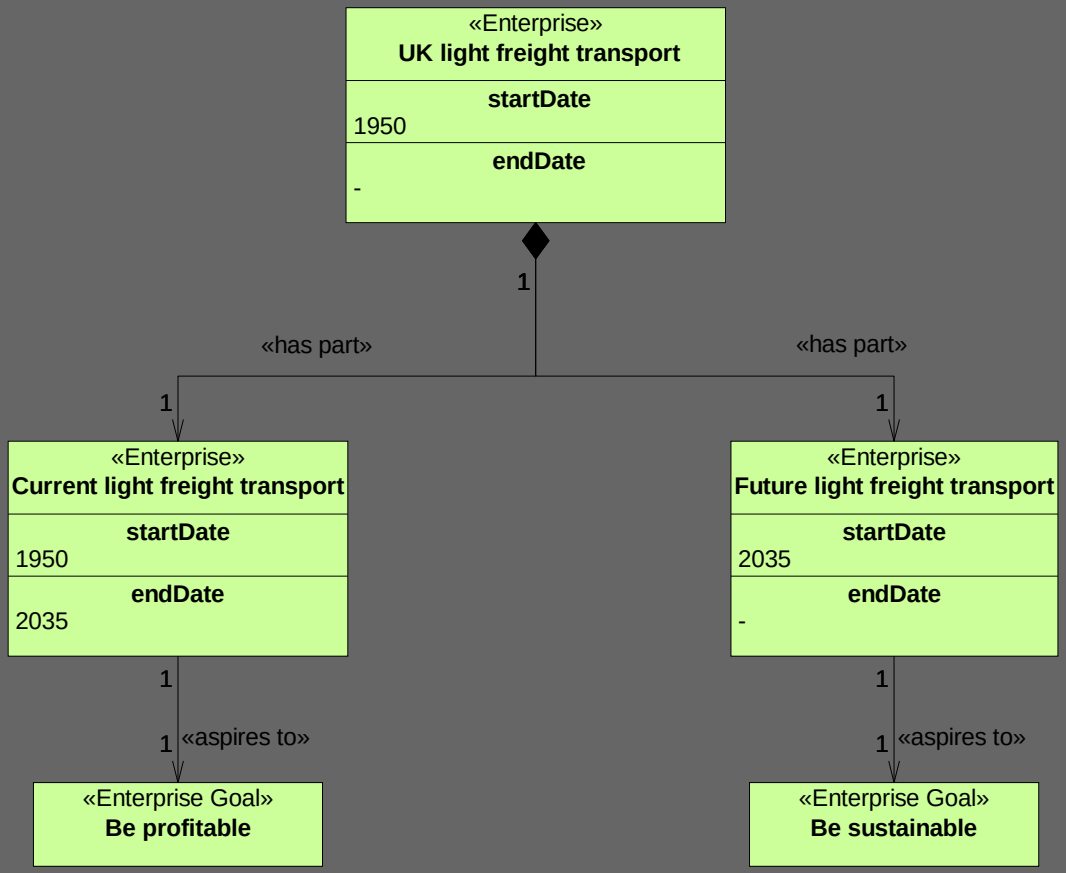
Enterprise



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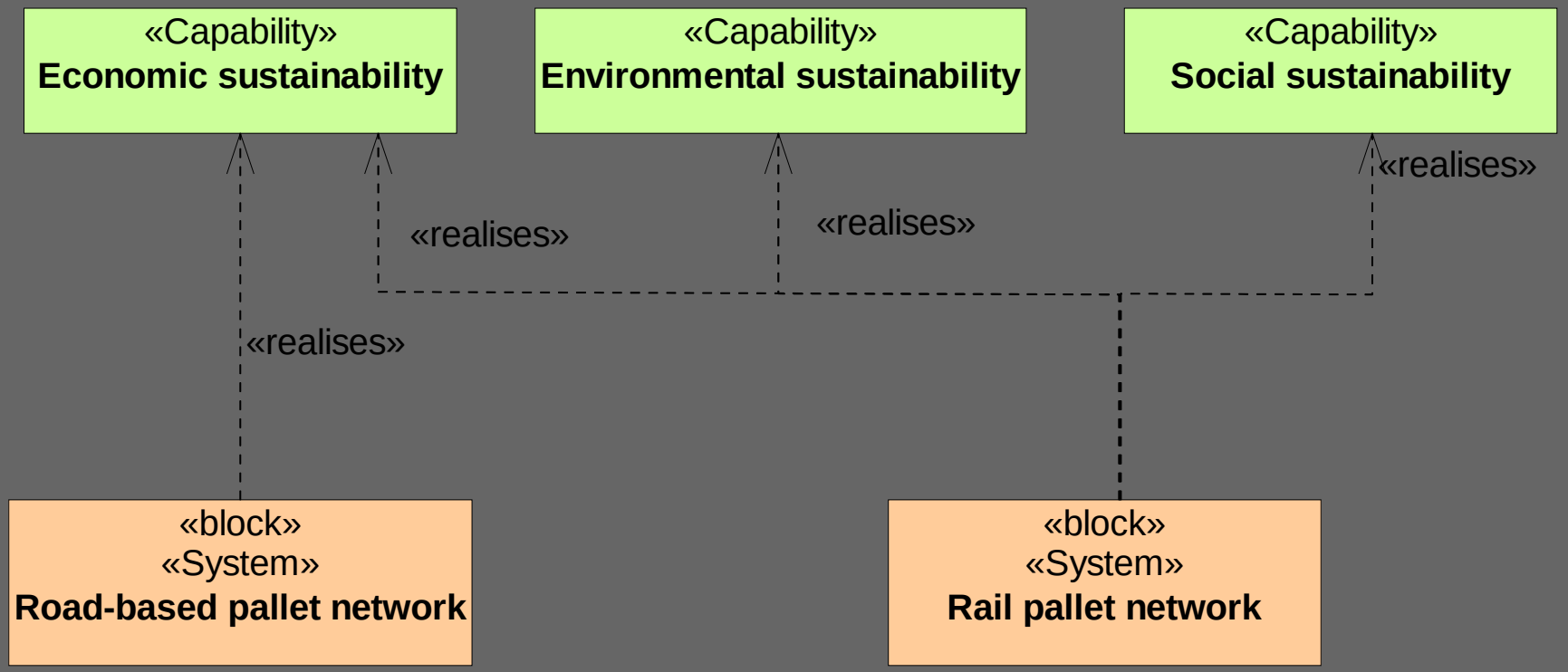
Enterprise Change



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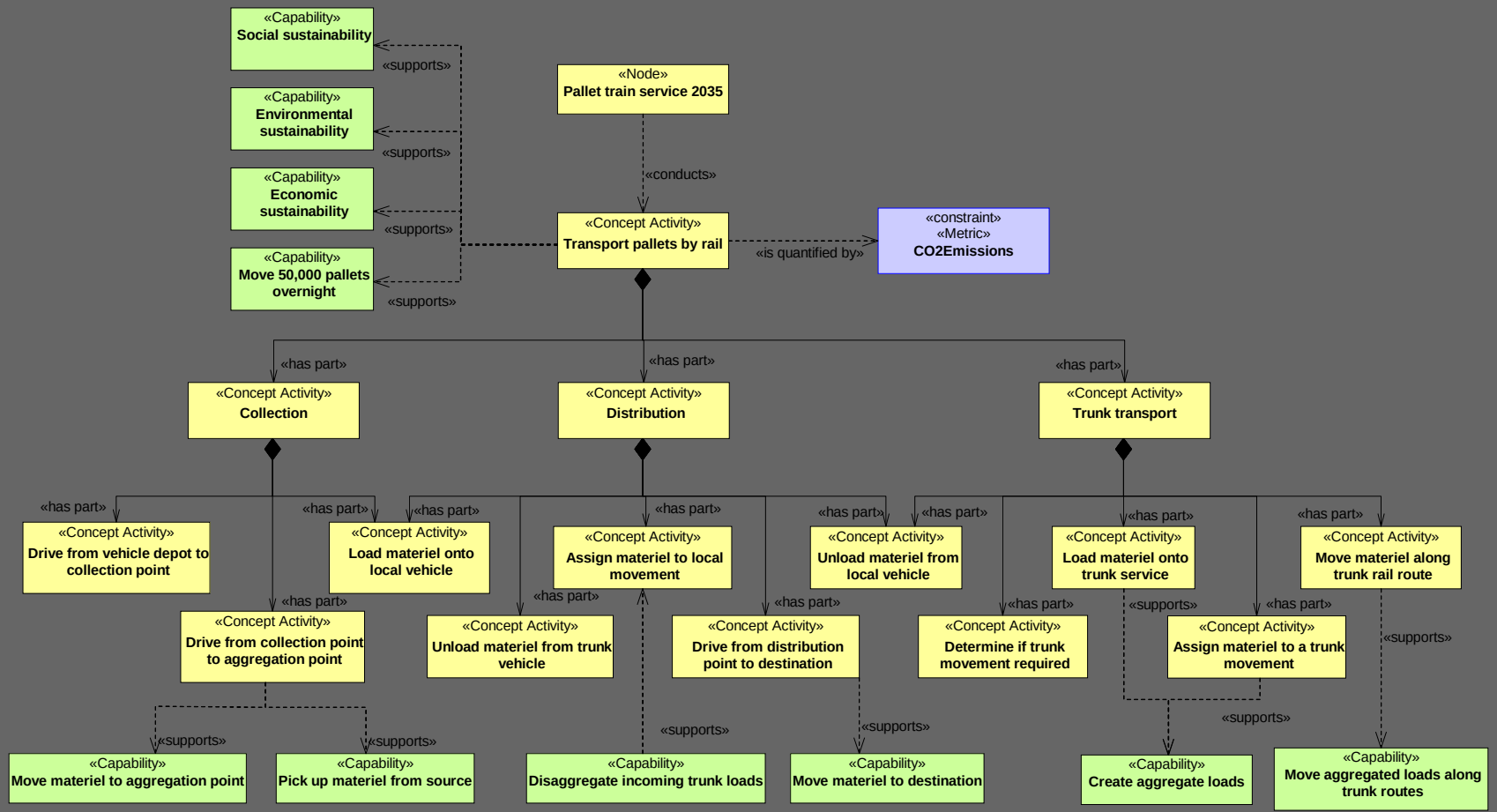
Concept Activity



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Solution

- Generic vehicles with common attributes
- Candidate solutions
  - Multiple-unit vs locomotive-hauled
  - Independent vs articulated bogies
  - Electric vs diesel
  - Projected changes in tare mass

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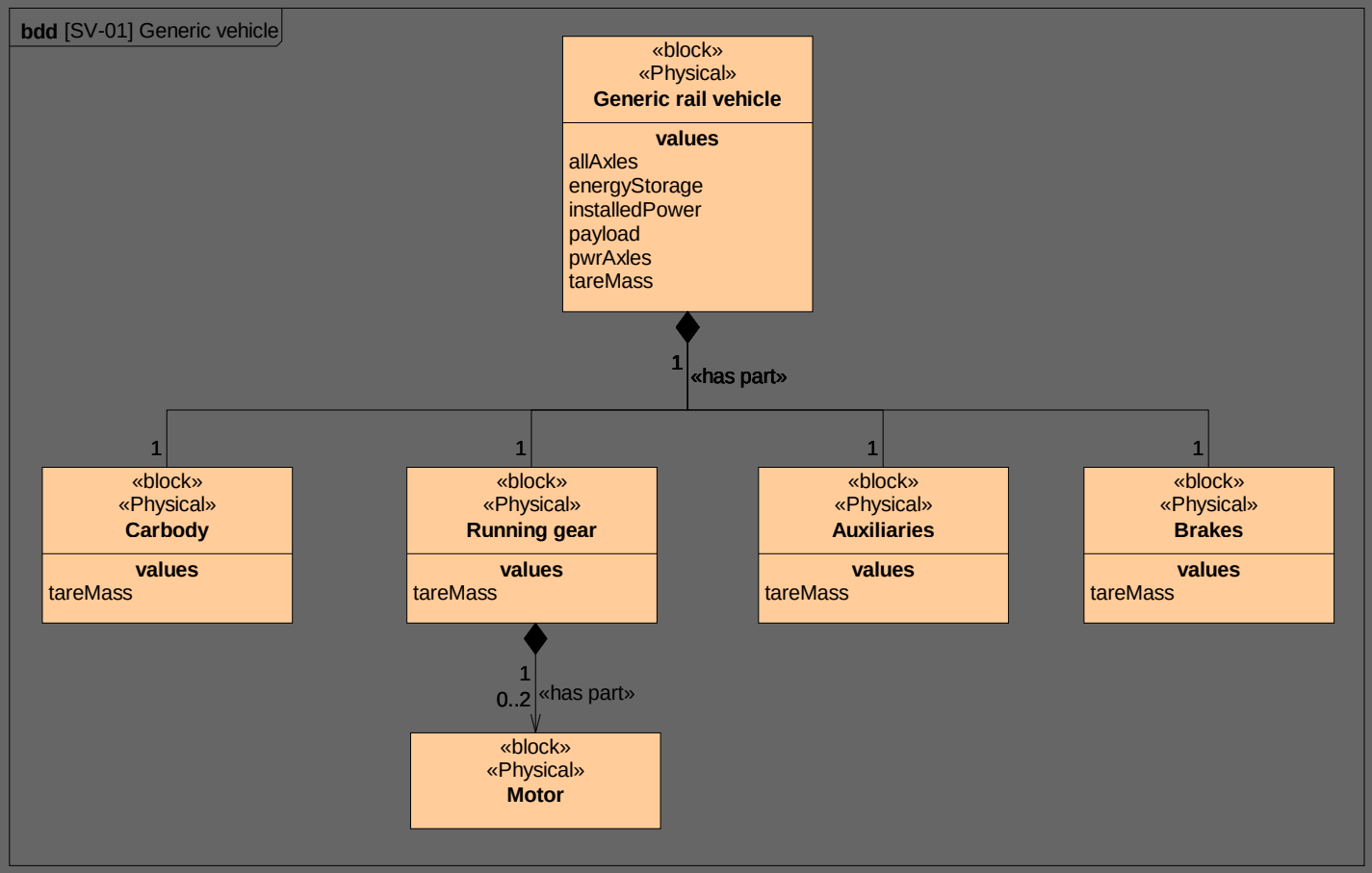
Generic Vehicle



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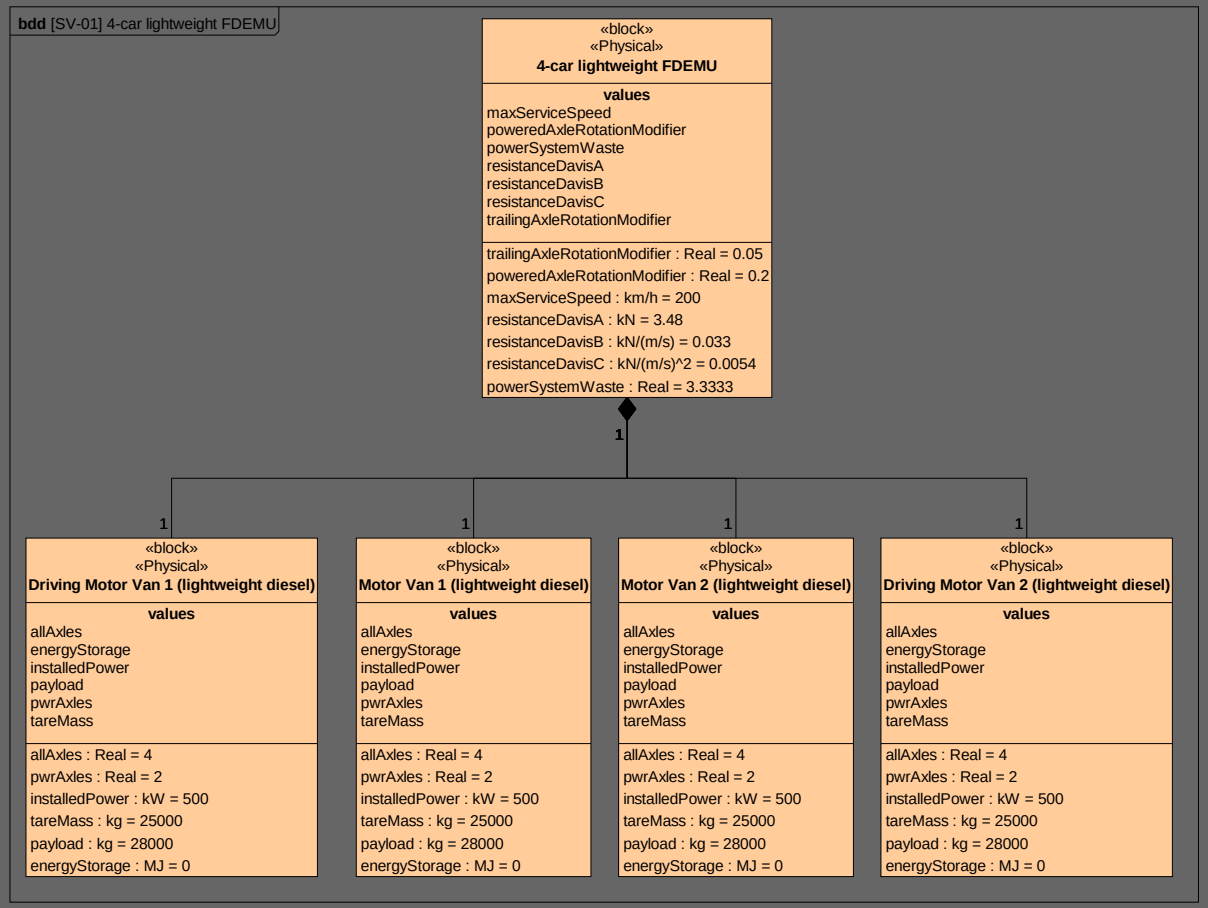
4-car lightweight FDEMU



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Analysis

- Budget and Power
  - High level, Studio to Excel
- Parametric
  - Adds consistency to the repetition of analysis
- MATLAB simulation
  - Integrated with the TRAK model

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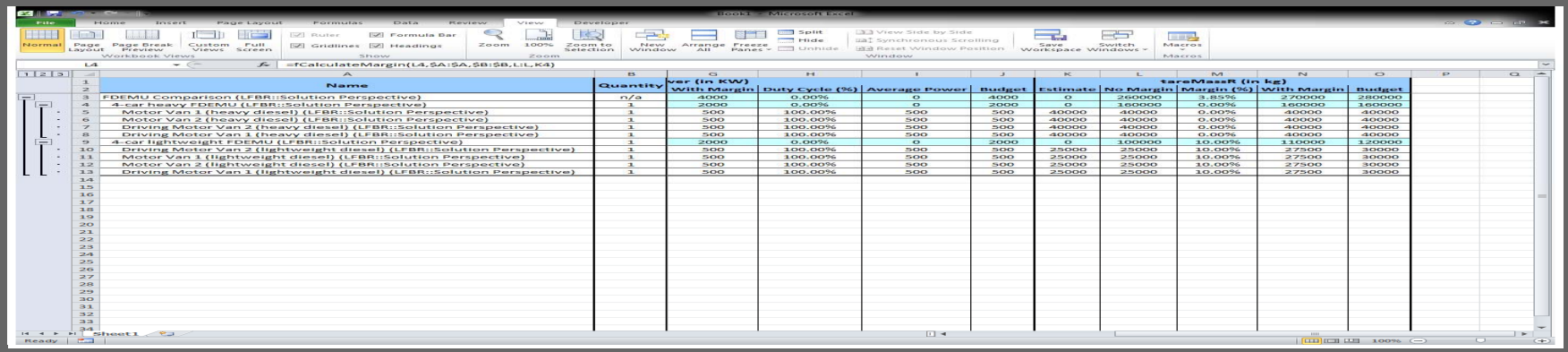
Budget Report (comparison)



Name	Quantity	Pwr (in KW) With Margin	Duty Cycle (%)	Average Power	Budget	Estimate	tareMassR (in kg) No Margin	Margin (%)	With Margin	Budget
FDEMU Comparison (LFBR::Solution Perspective)	n/a	4000	0.00%	0	4000	0	260000	3.85%	270000	280000
4-car heavy FDEMU (LFBR::Solution Perspective)	1	2000	0.00%	0	2000	0	160000	0.00%	160000	160000
Motor Van 1 (heavy diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	40000	40000	0.00%	40000	40000
Motor Van 2 (heavy diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	40000	40000	0.00%	40000	40000
Driving Motor Van 2 (heavy diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	40000	40000	0.00%	40000	40000
Driving Motor Van 1 (heavy diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	40000	40000	0.00%	40000	40000
4-car lightweight FDEMU (LFBR::Solution Perspective)	1	2000	0.00%	0	2000	0	100000	10.00%	110000	120000
Driving Motor Van 2 (lightweight diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	25000	25000	10.00%	27500	30000
Motor Van 1 (lightweight diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	25000	25000	10.00%	27500	30000
Motor Van 2 (lightweight diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	25000	25000	10.00%	27500	30000
Driving Motor Van 1 (lightweight diesel) (LFBR::Solution Perspective)	1	500	100.00%	500	500	25000	25000	10.00%	27500	30000

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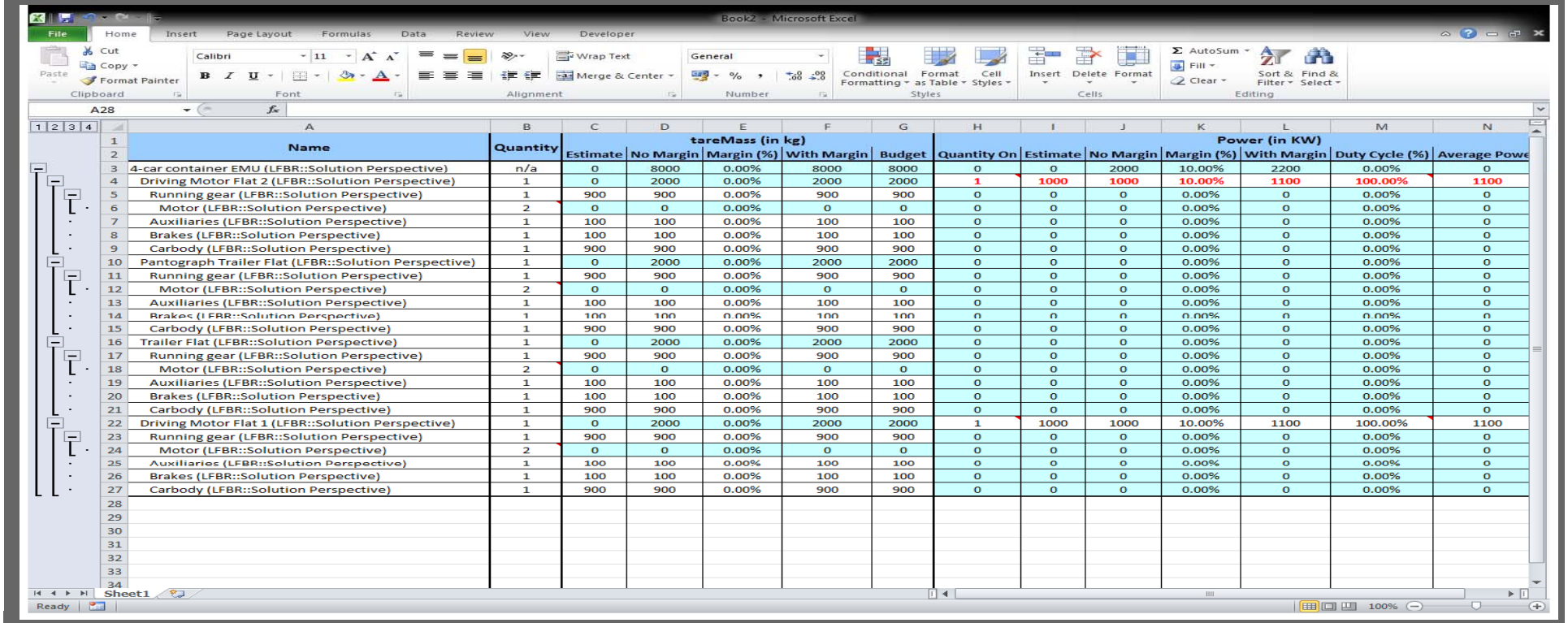
Budget Report (Detail)



Name	Quantity	tareMass (in kg)					Power (in KW)						
		Estimate	No Margin	Margin (%)	With Margin	Budget	Quantity On	Estimate	No Margin	Margin (%)	With Margin	Duty Cycle (%)	Average Powe
4-car container EMU (LFBR::Solution Perspective)	n/a	0	8000	0.00%	8000	8000	0	0	2000	10.00%	2200	0.00%	0
Driving Motor Flat 2 (LFBR::Solution Perspective)	1	0	2000	0.00%	2000	2000	1	1000	1000	10.00%	1100	100.00%	1100
Running gear (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Motor (LFBR::Solution Perspective)	2	0	0	0.00%	0	0	0	0	0	0.00%	0	0.00%	0
Auxiliaries (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Brakes (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Carbody (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Pantograph Trailer Flat (LFBR::Solution Perspective)	1	0	2000	0.00%	2000	2000	0	0	0	0.00%	0	0.00%	0
Running gear (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Motor (LFBR::Solution Perspective)	2	0	0	0.00%	0	0	0	0	0	0.00%	0	0.00%	0
Auxiliaries (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Brakes (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Carbody (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Trailer Flat (LFBR::Solution Perspective)	1	0	2000	0.00%	2000	2000	0	0	0	0.00%	0	0.00%	0
Running gear (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Motor (LFBR::Solution Perspective)	2	0	0	0.00%	0	0	0	0	0	0.00%	0	0.00%	0
Auxiliaries (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Brakes (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Carbody (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Driving Motor Flat 1 (LFBR::Solution Perspective)	1	0	2000	0.00%	2000	2000	1	1000	1000	10.00%	1100	100.00%	1100
Running gear (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0
Motor (LFBR::Solution Perspective)	2	0	0	0.00%	0	0	0	0	0	0.00%	0	0.00%	0
Auxiliaries (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Brakes (LFBR::Solution Perspective)	1	100	100	0.00%	100	100	0	0	0	0.00%	0	0.00%	0
Carbody (LFBR::Solution Perspective)	1	900	900	0.00%	900	900	0	0	0	0.00%	0	0.00%	0

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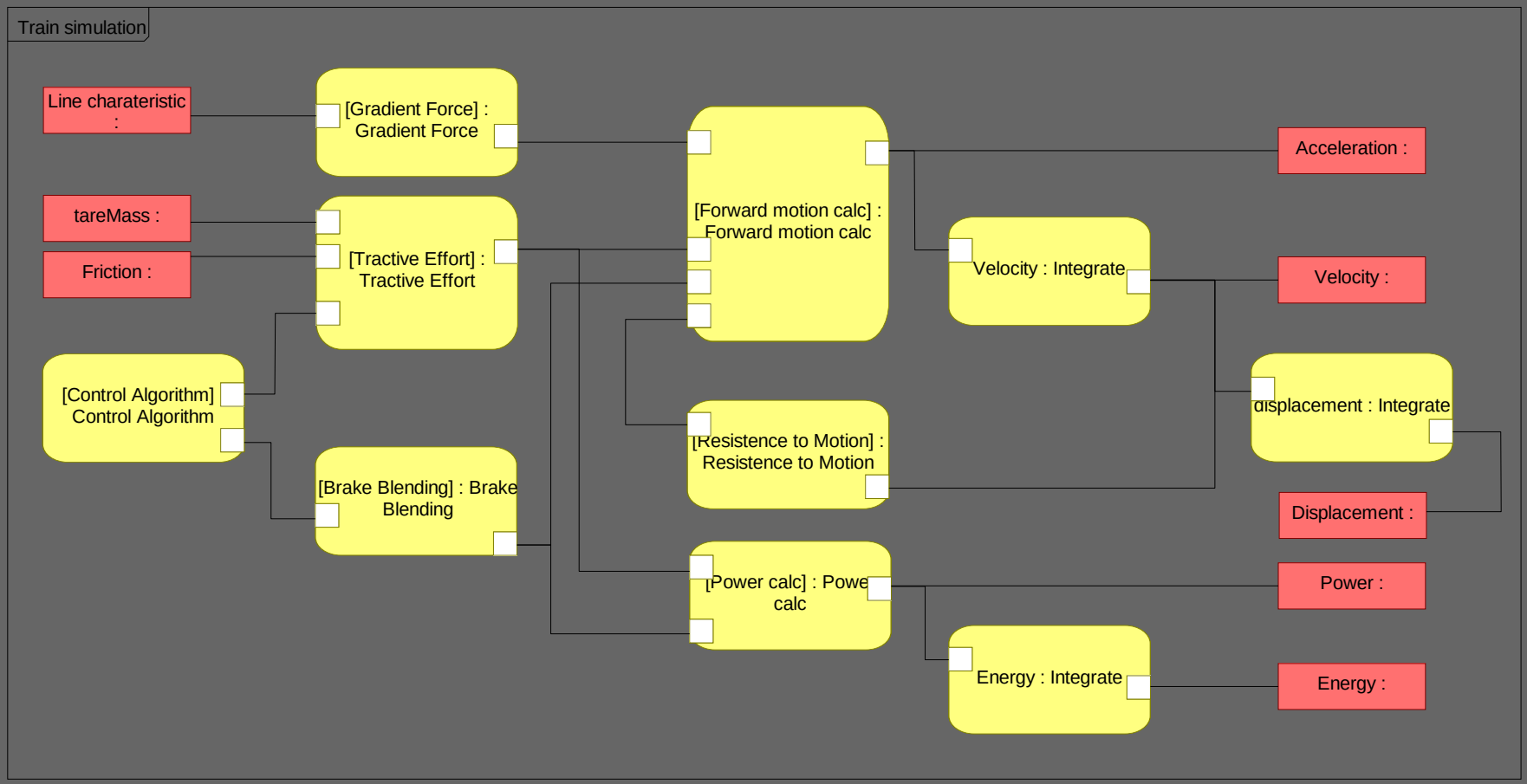
Parametric Diagram



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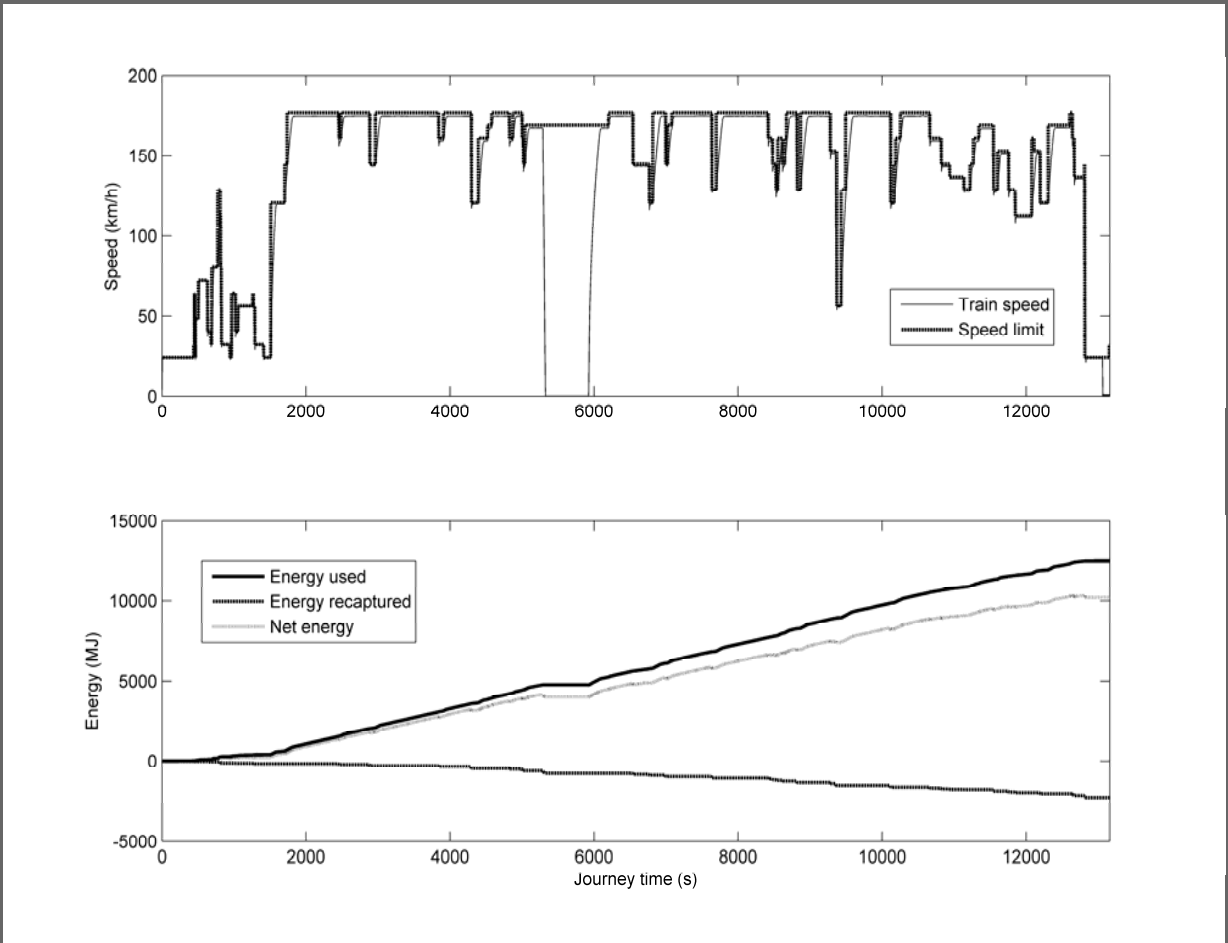
Matlab Results



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Conclusion

- Modelling exercise showed CO_2 emission reductions
  - Based on modal shift
  - Much greater improvement if UK energy mix moved from fossil fuels
- Demonstrating integration of TRAK and analysis tools.
- Benefits of MBSE – allowing simulation of changes to architecture and parameters

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