UNIVERSITY OF BIRMINGHAM

BCRRE

A summary of Beijing Yizhuang Subway Line Energy Efficiency Project

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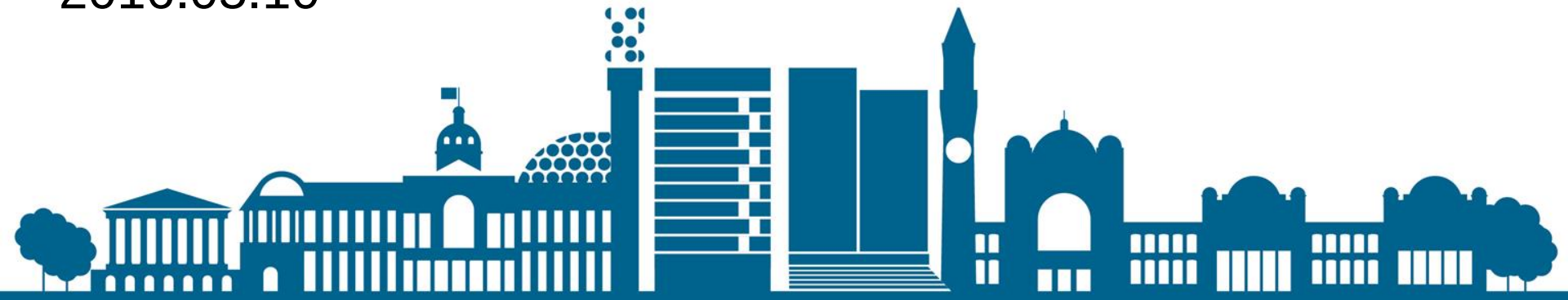
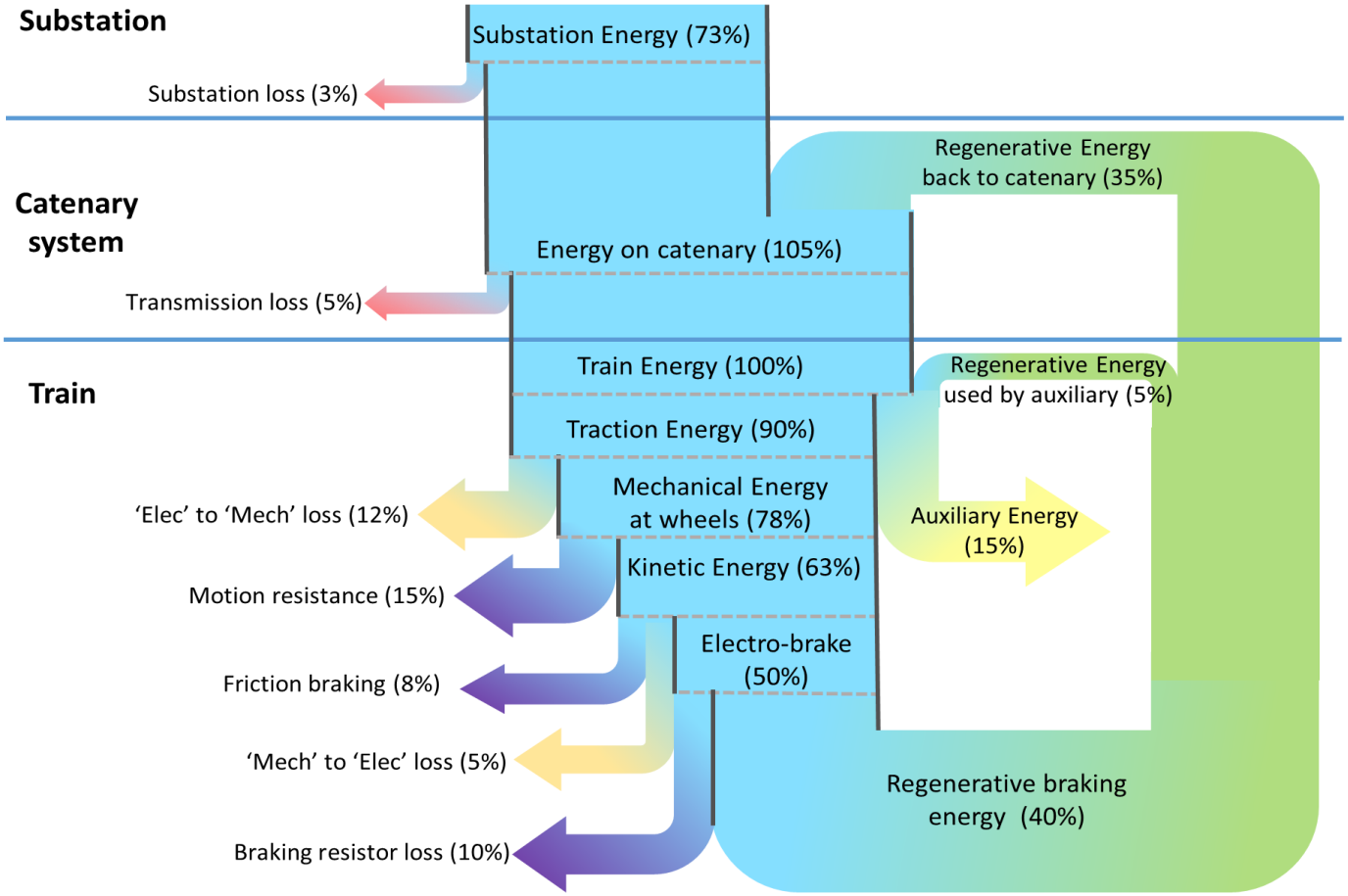
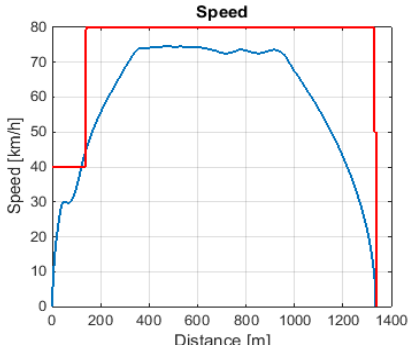


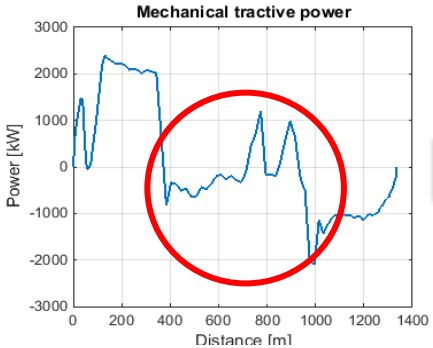
Energy Flow Simulation of Metro System



Driving optimisation and field test results

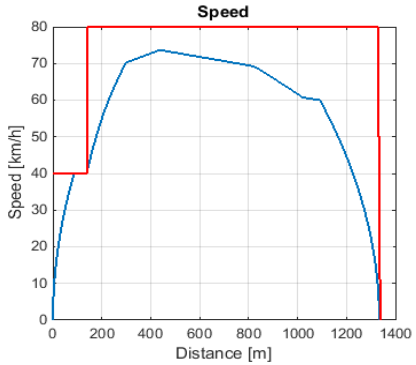
Current ATO Driving result

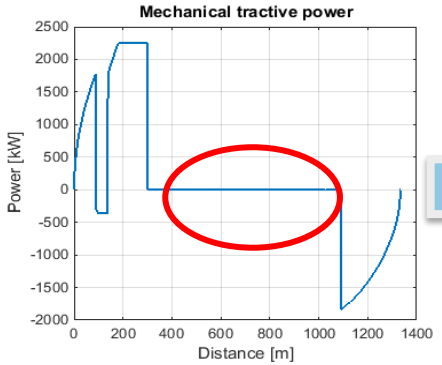




	One station	One cycle
T (s)	105	3255
E (kWh)	16.5	516

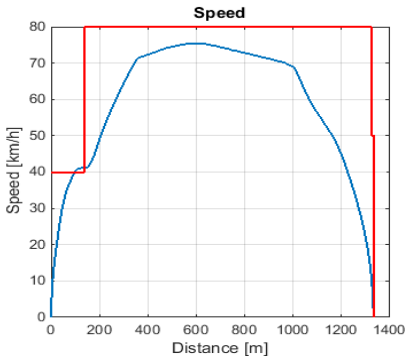
Efficient result by simulation

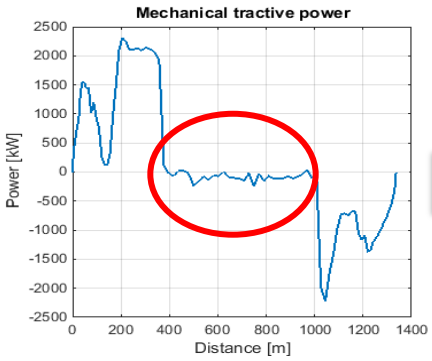




	One station	One cycle
T (s)	105	3251
E (kWh)	11.9 (-28%)	378 (-27%)

Field test result by human driving





	One station	One cycle
T (s)	105	3250
E (kWh)	13.8 (-16%)	435 (-15%)

Substation energy optimisation

	Current ATO operation	Traction energy-saving operation*	System energy-saving operation**
Cycle running time (s)	4281	4281	4287
Headway (s)	254	254	254
Substation energy (kWh)	370	271 (-26%)	246 (-10%)
Substation loss (kWh)	14	7	6
Transmission loss (kWh)	25	17	15
Traction energy (kWh)	526	372	365
Motion resistance (kWh)	106	82	82
Electro-braking energy (kWh)	290	199	194
Regenerative energy (kWh)	245	176	189
Auxiliary energy (kWh)	51	51	51

***In traction energy-saving operation, each interstation time and dwell time are the same with current ATO operation, only interstation driving styles are optimised;*

***In system energy-saving operation, each interstation time, dwell time and driving styles are optimised together under the constrains.*