Beamways AATN

An update

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Itinerary

Here is where I tell you what I am going to tell you:

- The problem for pure PRT.

- Adaptive ATN simulation.

- Beamways system prototyping.

The problem for pure PRT

Proven PRT capacity is too low to solve the problems traffic planners care about.

Attaining higher capacity by using shorter headways is a pie in the sky.

Even 3 second headway feels impossible to most transit professionals, despite being approved at least once.
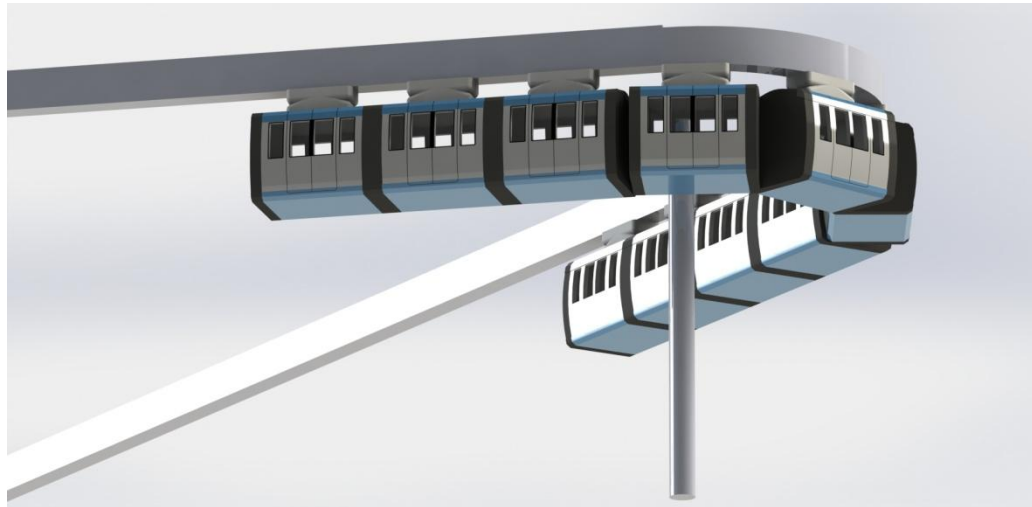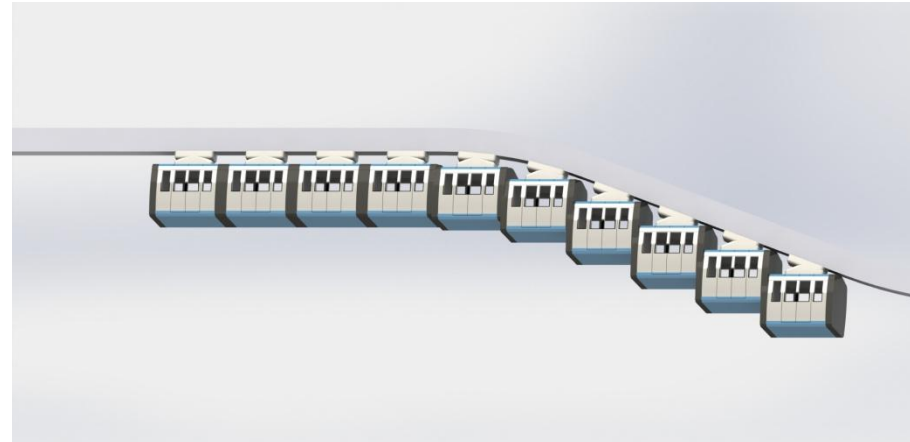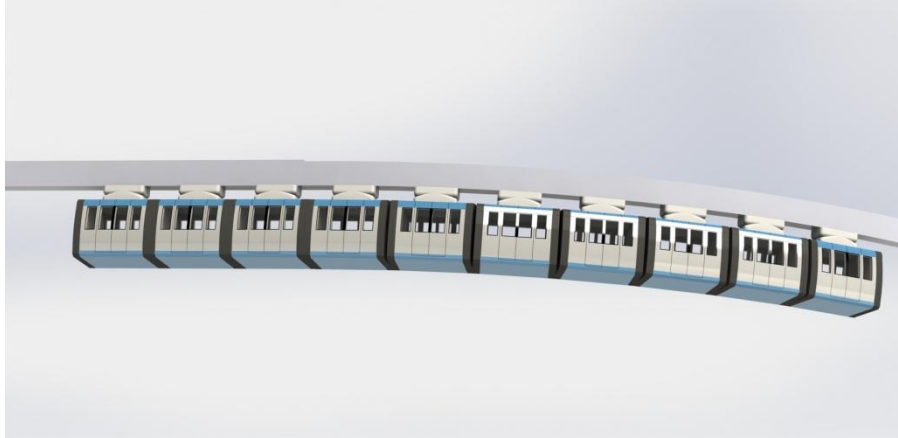
AATN line capacity requirements

- ATN must match tram line capacity.

- The infrastructure cost level must be much lower.

- Must not use headways shorter than 10-15 s.

Facts: 40 m trams hold 200 pax. Two can be connected. Min headway 3 minutes. Total capacity: **8000 pax/h.**

At 15 s headway we need 33 pax vehicles to match this.

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Beamways podtrain concept

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Station capacity considerations

A station stop takes about 30 s. For **line haul** operation other vehicles can't pass. To reach target capacity we need 66 pax vehicles.

With off line stations and skip-stop operation we can get close to line capacity with 33 pax vehicles.

With different size vehicles and **ad hoc** routing we can reach high capacity with good service for dispersed *and* directed travel patterns.
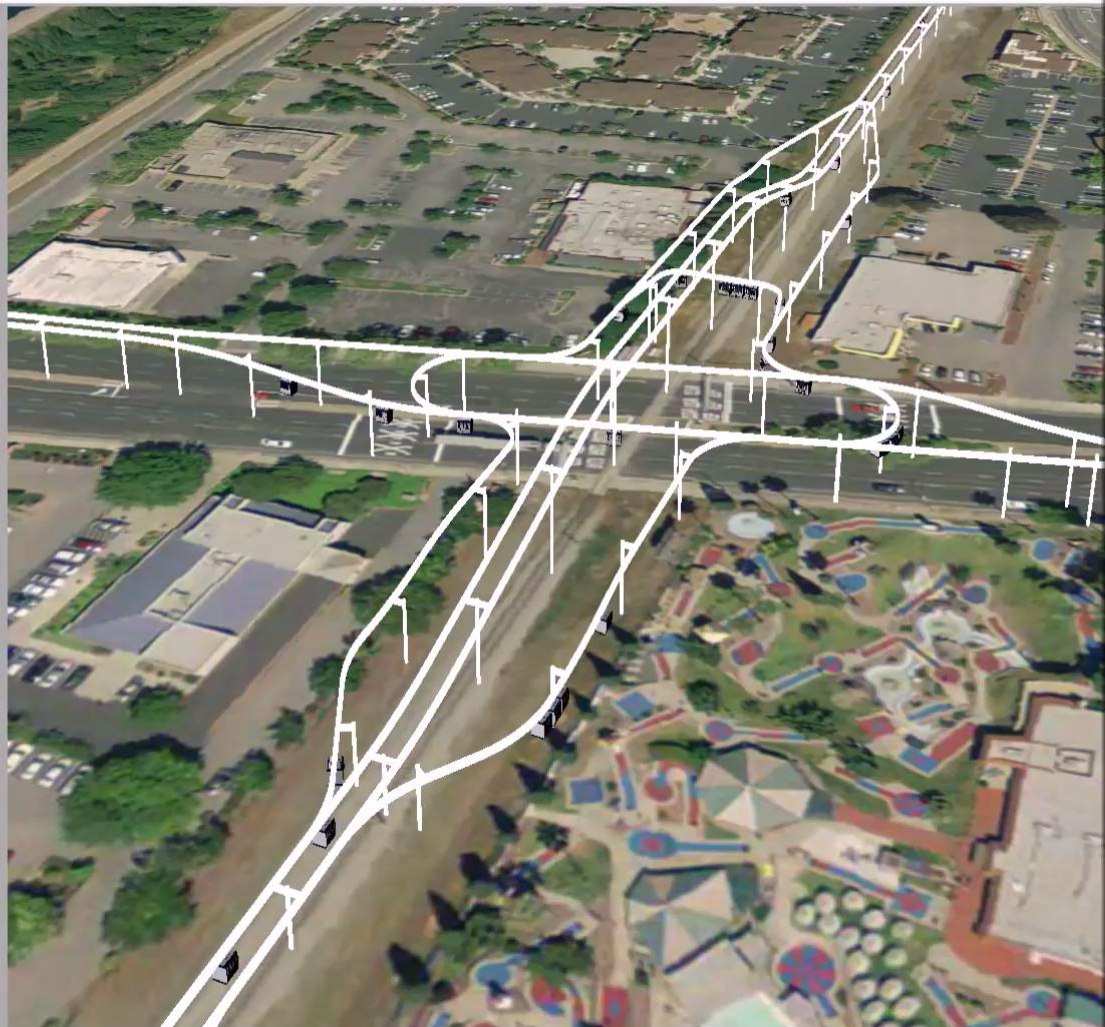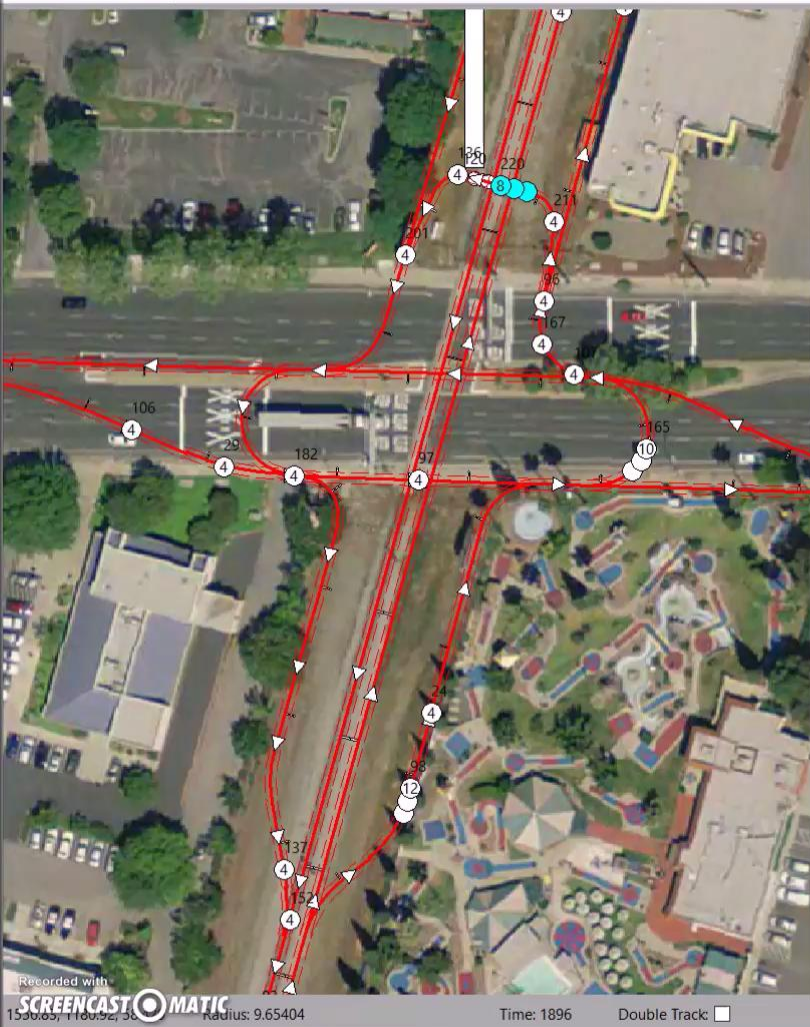
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The BeamEd 3D simulator

BeamEd 3D has a very accurate vehicle simulator with multiple vehicle sizes implemented.

The simulator works with speed-dependant headways and has full merge collision avoidance.

Each passenger is assigned to a vehicle when arriving at the station. Cost of wait time, travel time, vehicle operation etc. are taken into account in the choice.

Intermediate stops are allowed. En-route rerouting is allowed.

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BeamEd 3D: C:\4Dialog\projects\DepotTest

File   View   Macro   Setup

1550.85, 1180.92, 58...   Radius: 9.65404   Time: 1896   Double Track:

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Vehicle allocation algorithm

• The algorithm runs when a new passenger group arrives at a station. No advance warning is used.

• All vehicles are inspected and for each a **cost function** is evaluated for passing the origin and destination stations of the passengers between any previous stops.

• The cost function includes passenger wait and ride time cost, cost to split groups and cost to run vehicles, different per size.

• The cheapest option is selected and any new stops are added to the selected vehicle(s) routes..

Work to do in BeamEd 3D

Better algorithms for allocating vehicles to trips:

• Route cost to depend on predicted traffic situation.

• Vehicle allocation based on statistical knowledge of demand.

• Reevaluation of previous choices when new groups arrive.

This is going to be extremely compute power intensive.
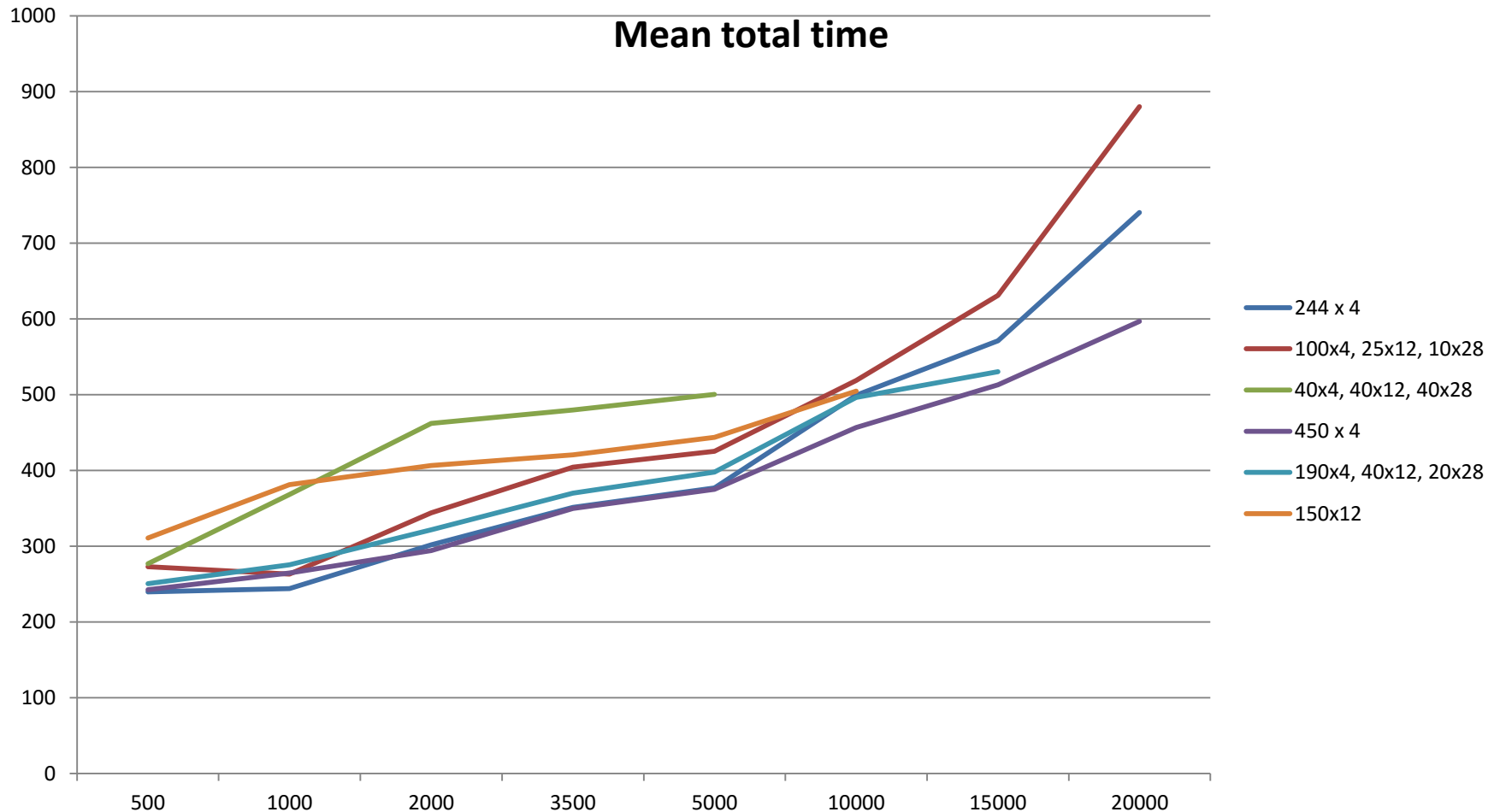
Deadlock!

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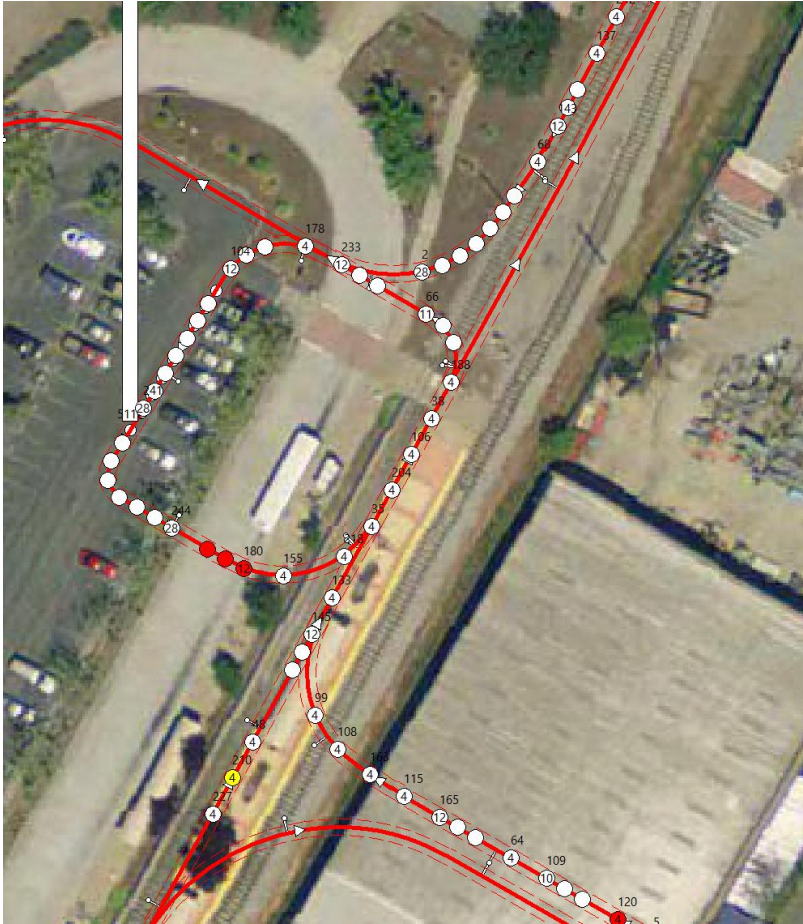
Simulation results so far

For the example network mean speed is about 35 km/h with line speed of 54 km/h.

At normal network loads each passenger gets only around **one** intermediate stop.
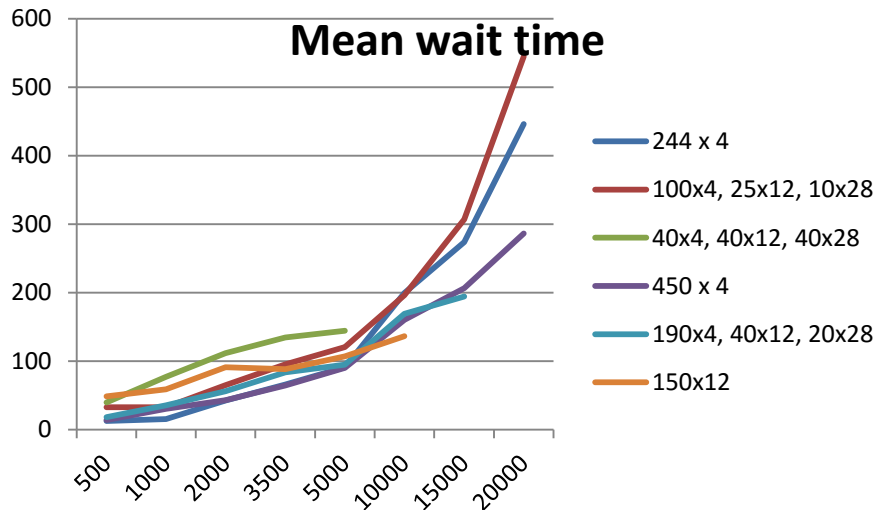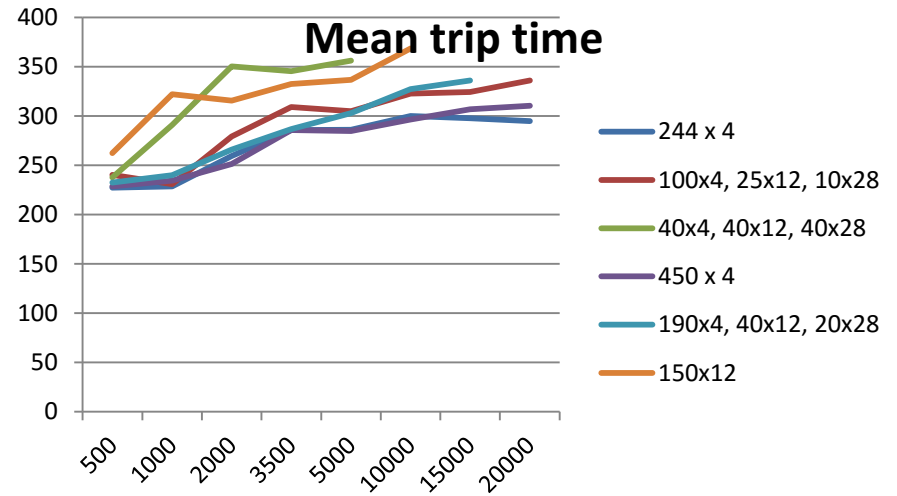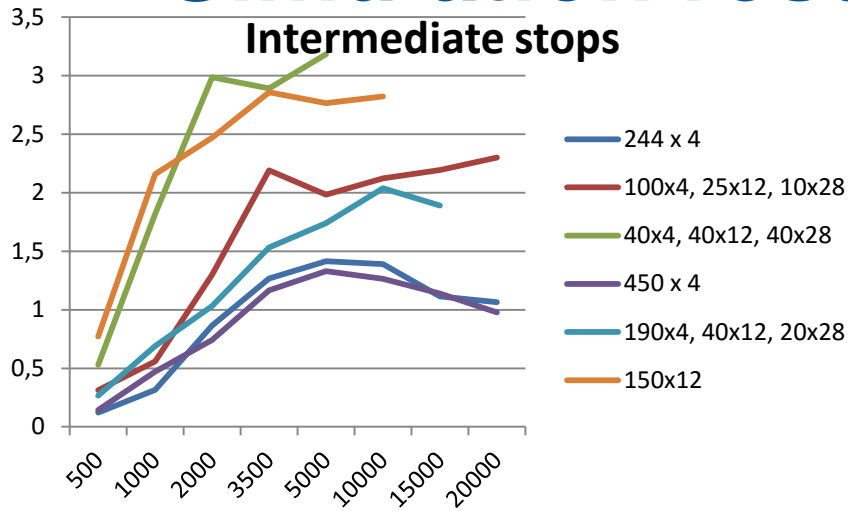
Wait times **and** ride times increase with load, but not dramatically.

With initial algorithms mixing vehicle sizes **does not improve** performance.

Simulation results so far

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Simulation results so far

Intermediate stops, **Mean trip time**, **Mean wait time**, **Passenger count** — series: 244 x 4; 100x4, 25x12, 10x28; 40x4, 40x12, 40x28; 450 x 4; 190x4, 40x12, 20x28; 150x12
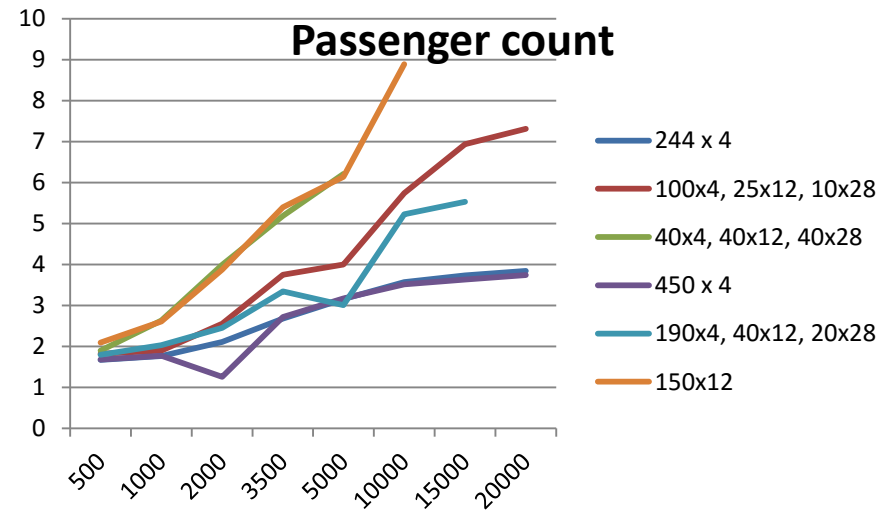
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Beamways system prototyping

Several universities world wide work on the Beamways system:

San Jose State University: Four years of Capstone courses. Models and prototypes. Summer school '15.

Linköping University, Sweden: Cabin design, 1:4 model of full switch design.

INSA, Lyon, France: Alternate switch designs, vehicle dynamics study.

Uppsala, Delft, Paris, San Francisco, U of S Illinois.

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SPARTAN
SUPERWAY

San Jose models

Two models around 1:10 scale have been made, with the purpose to act as a development platform for control software.

Images of the first year's model.

0:04 / 0:41

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San Jose full scale prototype
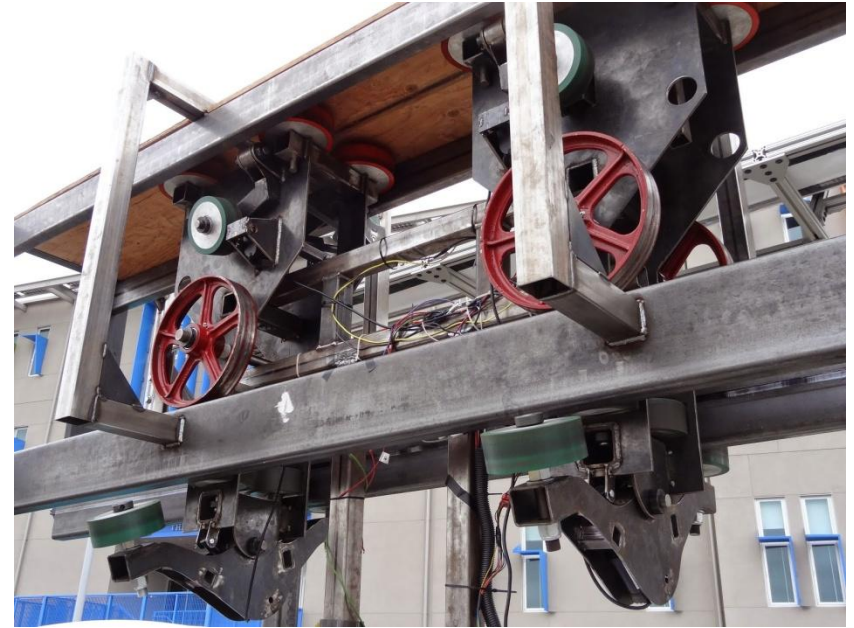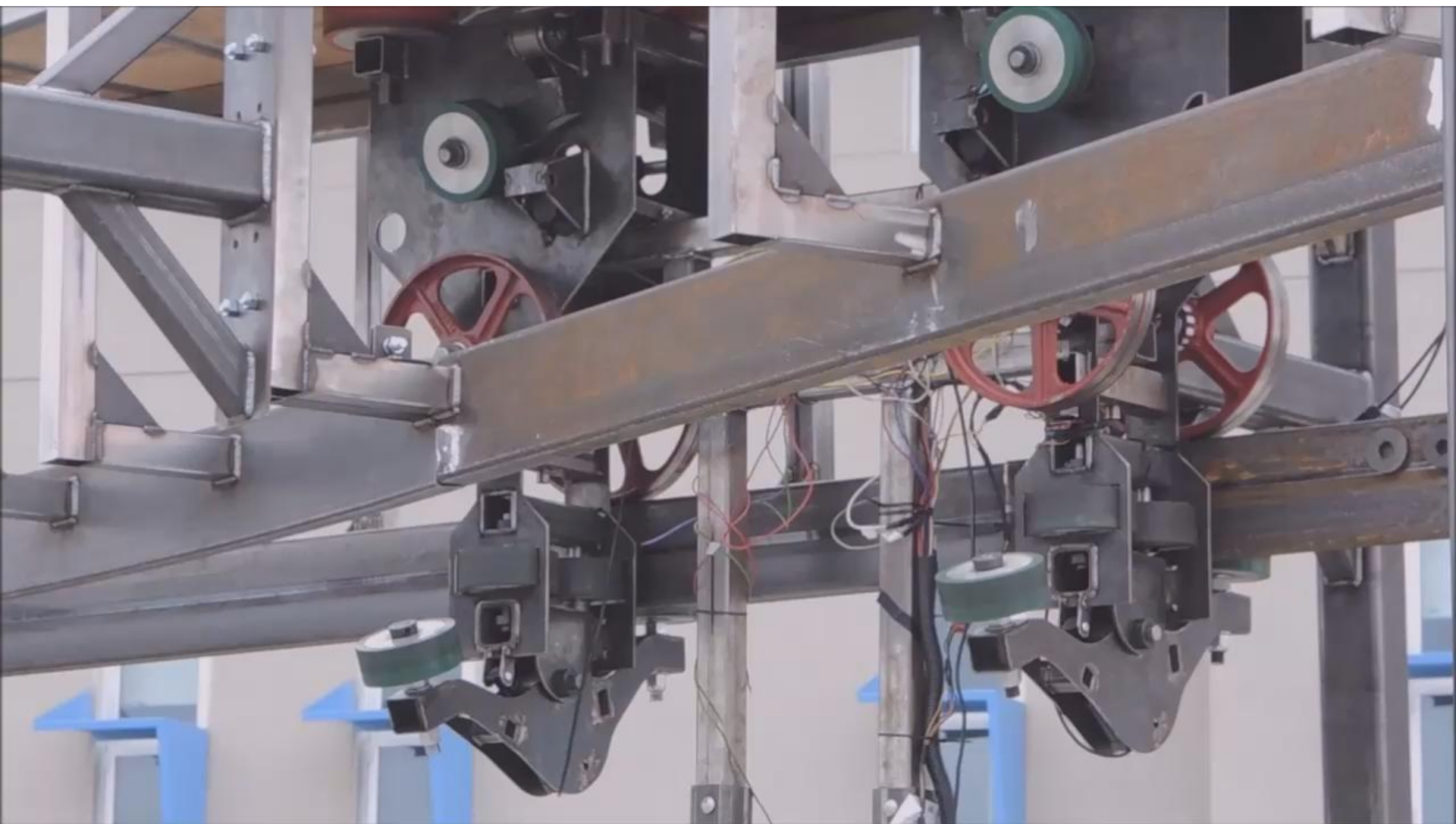
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Linköping Cabin (in San Jose)
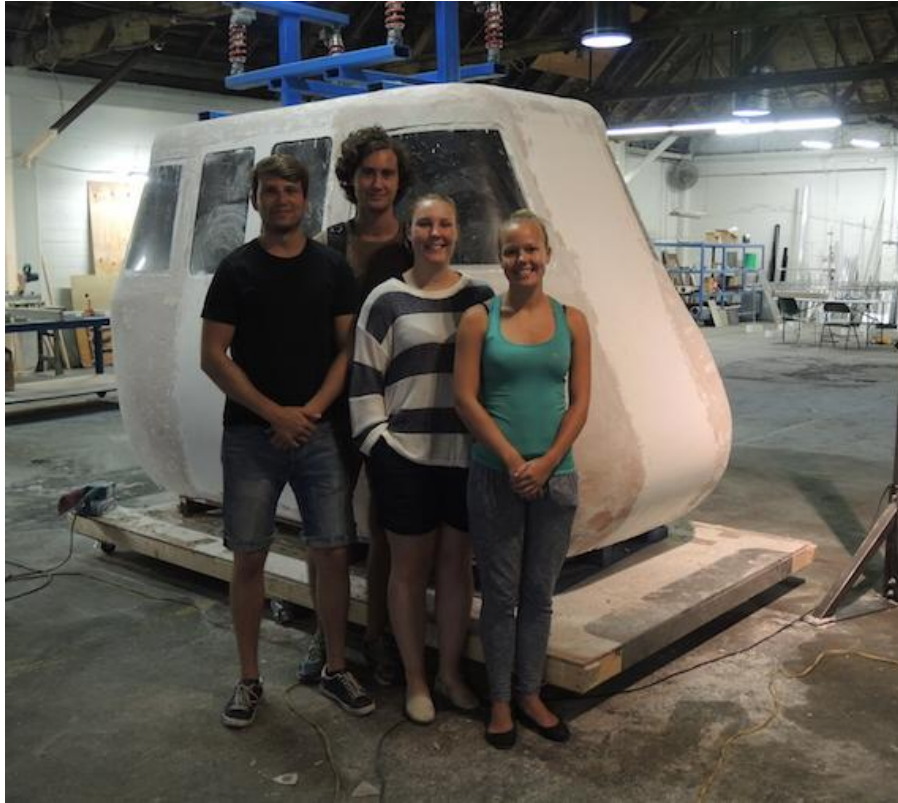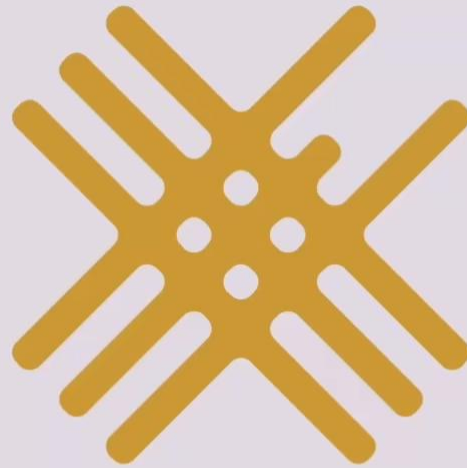
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Lyon vehicle dynamics project

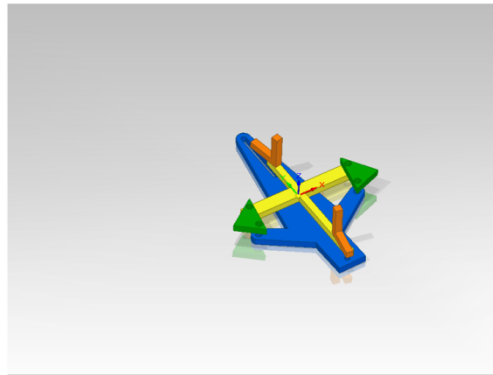
Figure 37 - Visualization of forces of contact

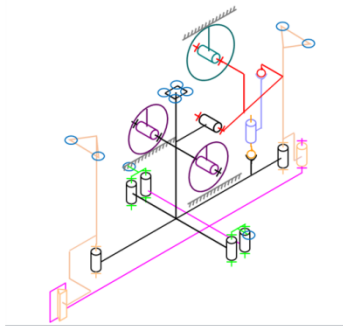## II   Le Bogie

II.4   Système de switch

2 Solutions proposées:
- Système 4 barres
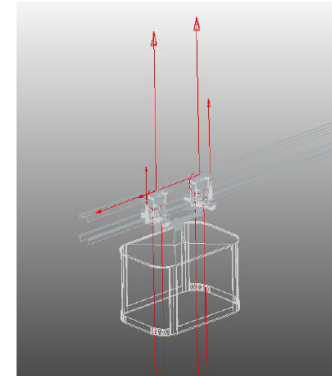- Système pignon/crémaillère
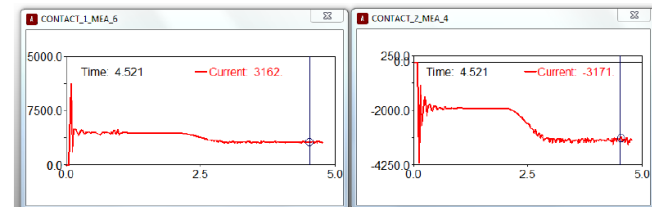
Système 4 barres

15

Figure 38 - Normal force between drive wheels 1, 4 and rail (N) = f(second)
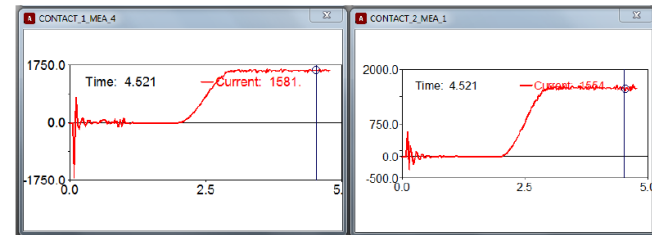
Figure 39 – Longitudinal force between drive wheels 1, 4 and rail (N) = f(second)

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Conclusions

Here is where I tell you what I told you:

- Pure PRT's capacity is not appealing to customers.

- Getting a capacity boost from multiple vehicle sizes requires better algorithms.

- Mechanical prototyping need serious funding to go much further.