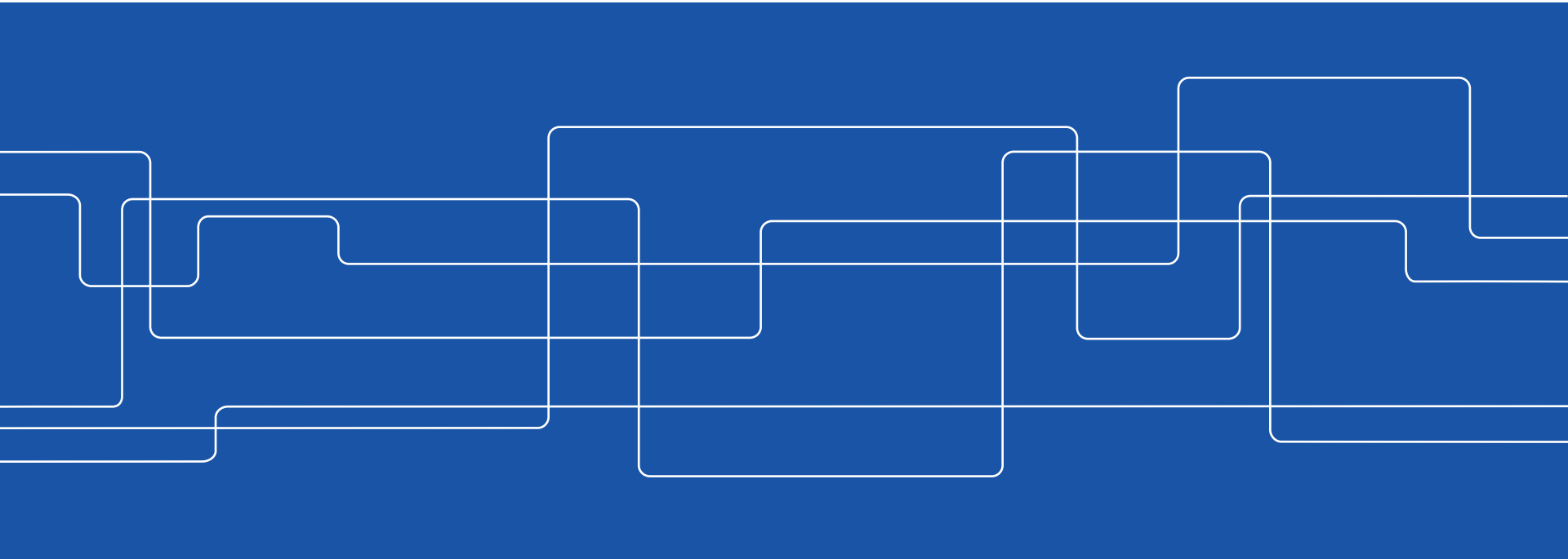




# Damage in rail applications

Carlos Casanueva – [carlosc@kth.se](mailto:carlosc@kth.se)  
KTH Railway Group





**Board**  
TRV, KTH, Bombardier,  
Vectura, SL, SJ, Interfleet



**Director**  
Prof. Sebastian Stichel, Rail Veh.



**Traffic and Logistics**  
Oskar Fröidh

**Str. Engin. and Bridges**  
Prof. Raid Karoumi

**Railway Engineering**  
—

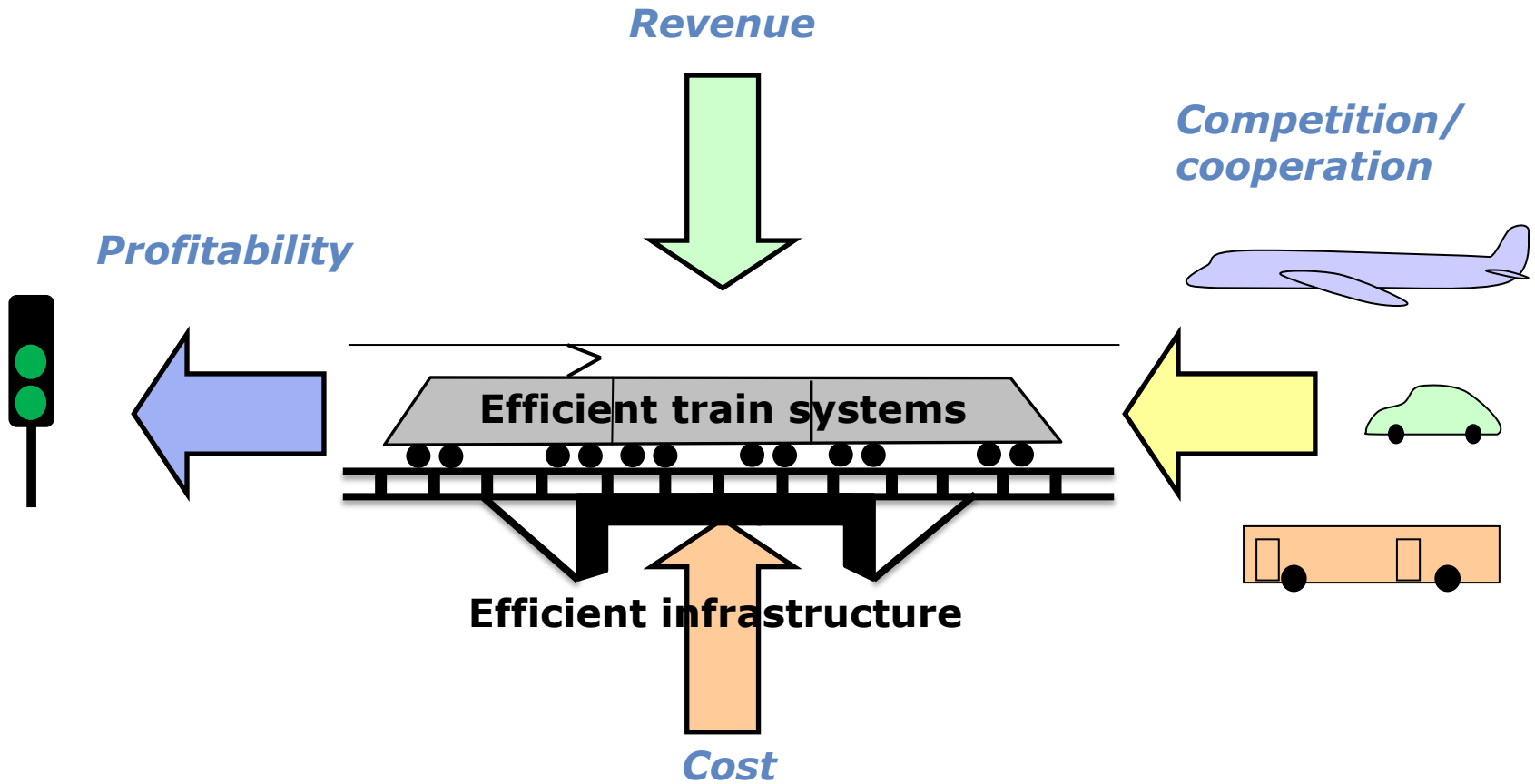
**Road and Rail Vehicles**  
Prof. Mats Berg

**Lightweight Structures**  
Tekn. Dr. Per Wennhage

**Sound and Vibrations**  
Tekn. Dr. Ulf Carlsson

**Electrical Machines**  
Prof. Stefan Östlund

**Machine Design**  
Prof. Ulf Olofsson





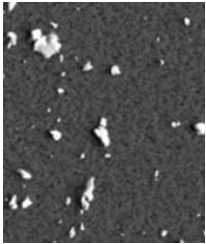
## Example: Fast regional train economics

Vehicle – capital cost	23 %
Vehicle – maintenance	21 %
Train crew	16 %
Train formation and positioning	6 %
Energy	6 %
Sales, marketing, terminals	14 %
Train traffic control and dispatching	3 %
Administration, supervision, planning	11 %
<b>In addition (&gt;80 % payed by general tax in Sweden)</b>	
<b>Infrastructure,</b>	<b>+40-50%</b>

# Vehicle perspective – wheel damage

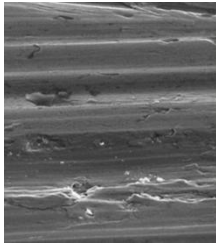
## Machine Design

Particles



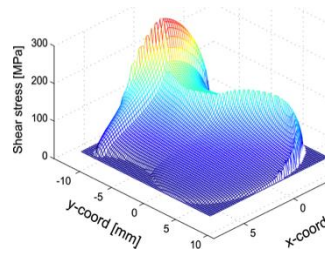
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Wear



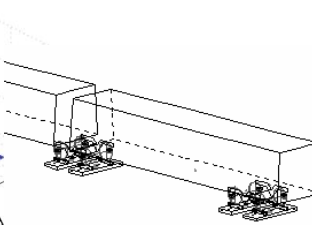
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Contact



mm

MBS



m

Route



km

Life



kkm

Length scale

## Rail Vehicles

## Traffic planning



# Roll2Rail

## Universal Cost Model (UCM)

### Motivation:

- Enhanced rail vehicle designs: Costs vs. Benefits?
- Does a higher initial vehicle cost “pay back” over vehicle life?
- That is, does the vehicle innovation give LCC efficiency?
- How to quantify possible cost efficiency of innovations?
- UCM aims at providing a European framework for cost analysis
- The present UCM focuses on innovative bogie designs

# Roll2Rail UCM

