

Vehicle Dynamics Challenges for Heavy Vehicles

Stefan Edlund

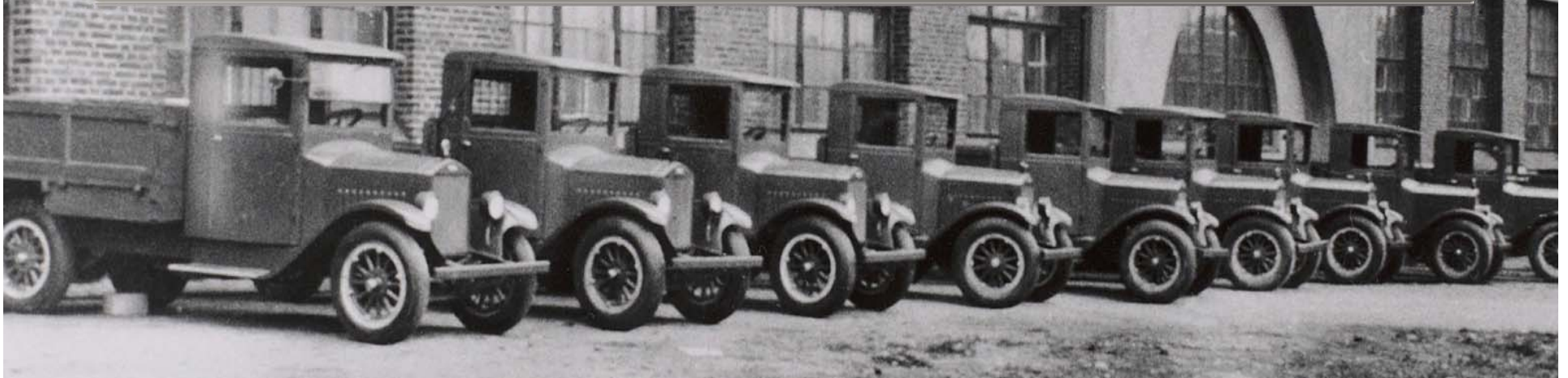
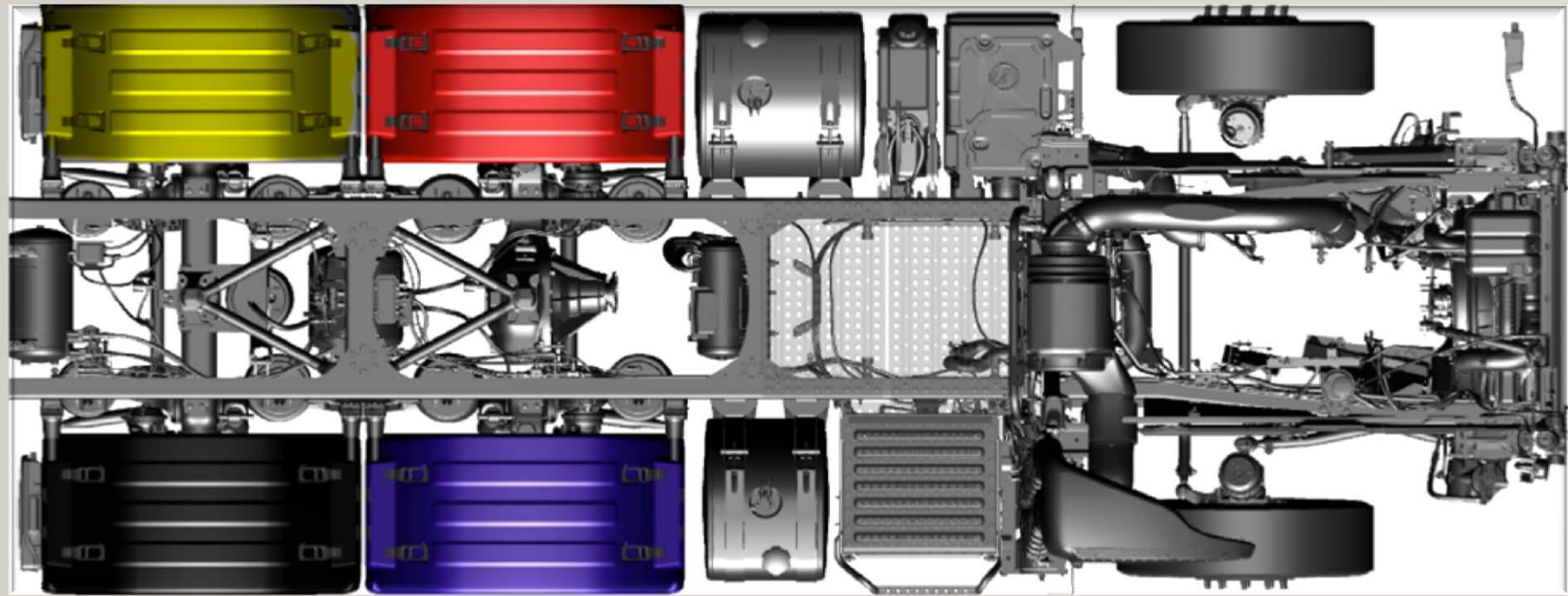
It's about Trucks ...



Volvo Group Trucks Technology

VOLVO

Chassis & Vehicle Dynamics Engineering

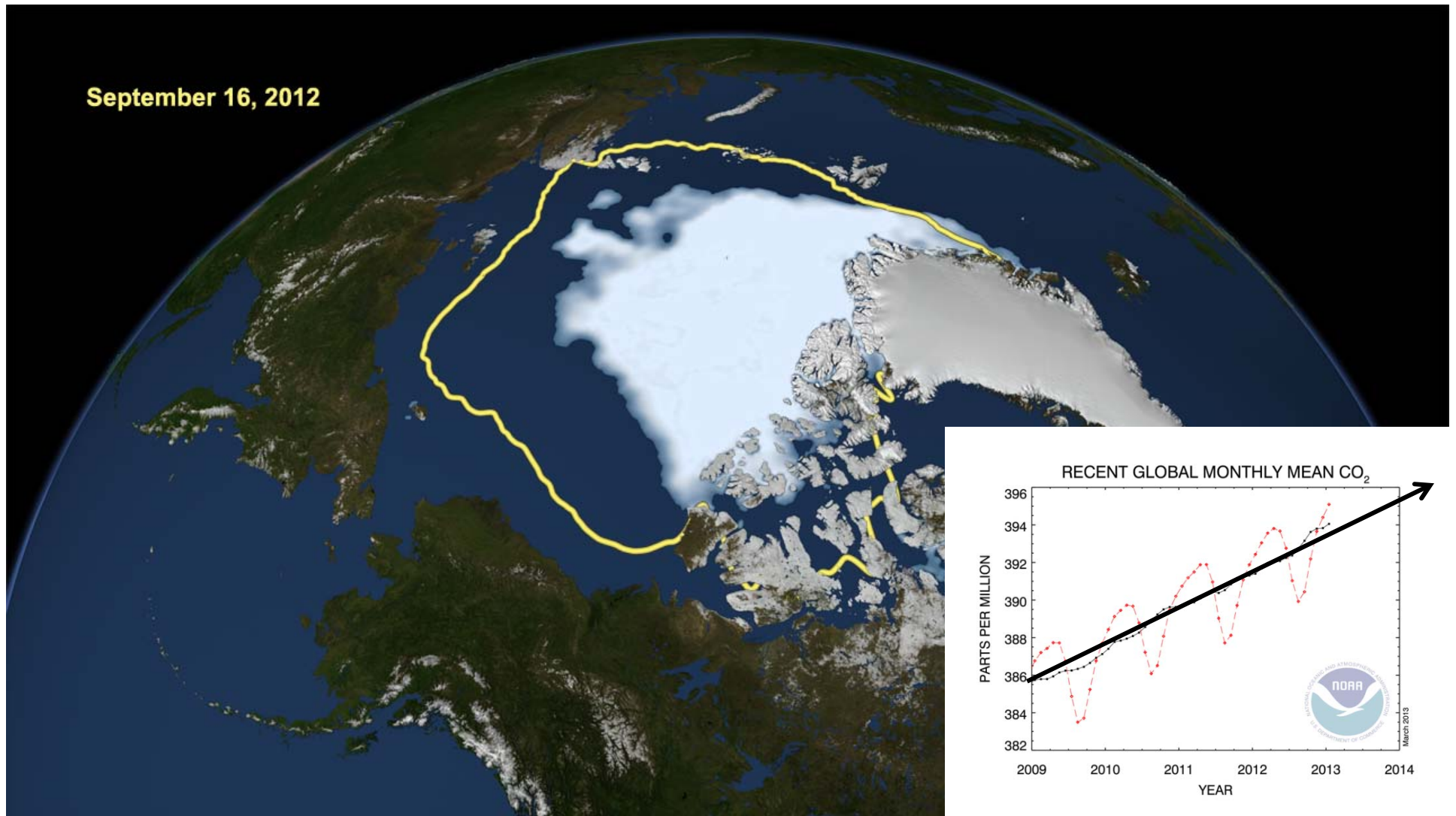


From Reality

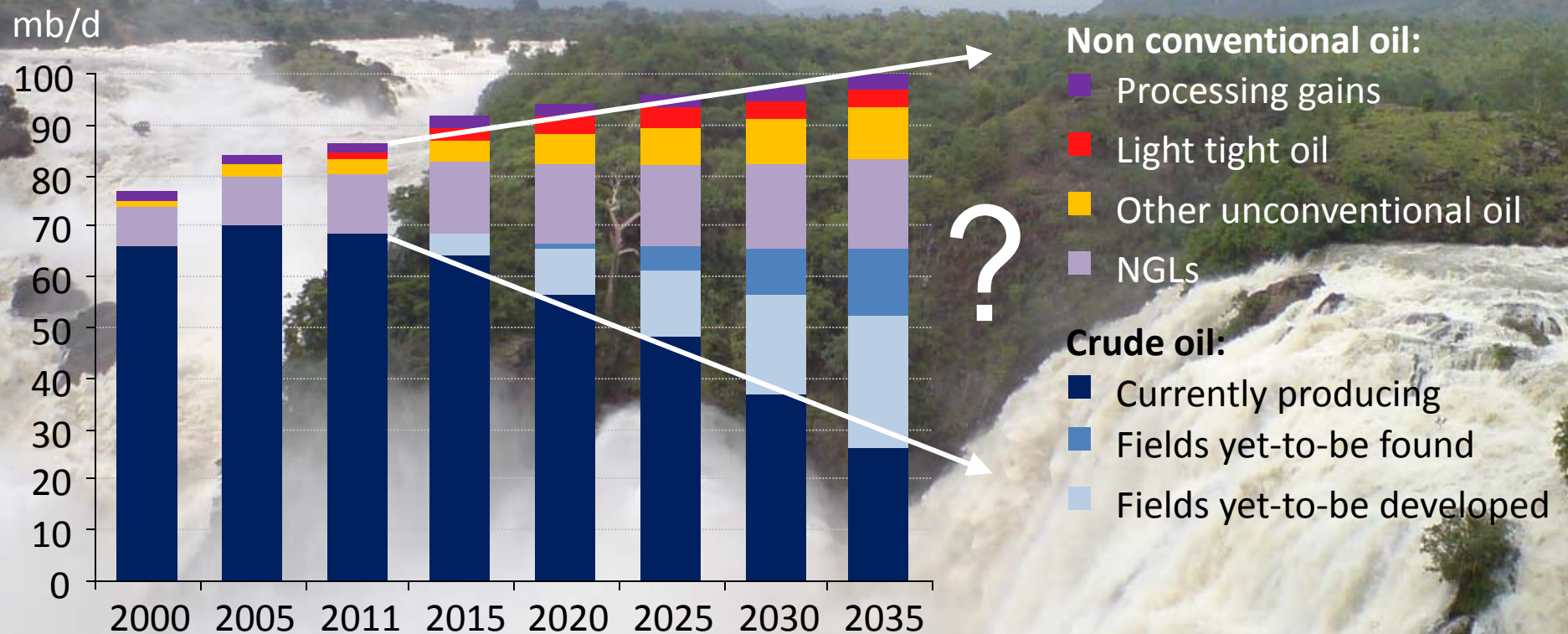
... to Reality



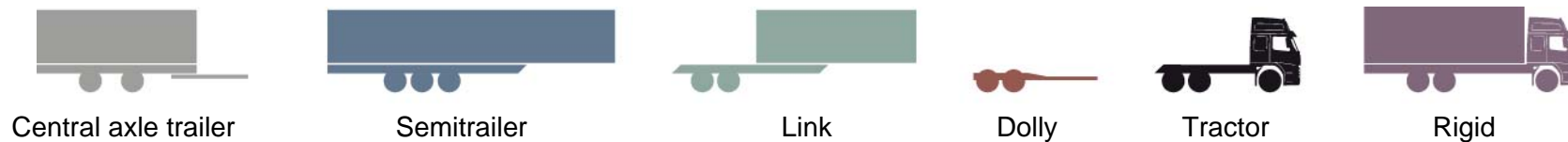
Global warming



More than 150 cubic meter per second



EMS modules



Standard vehicle (EU)

16,5 m 40/44 ton



EMS-vehicle (Sweden, Finland, The Netherlands and Denmark)

25,25 m 60 ton

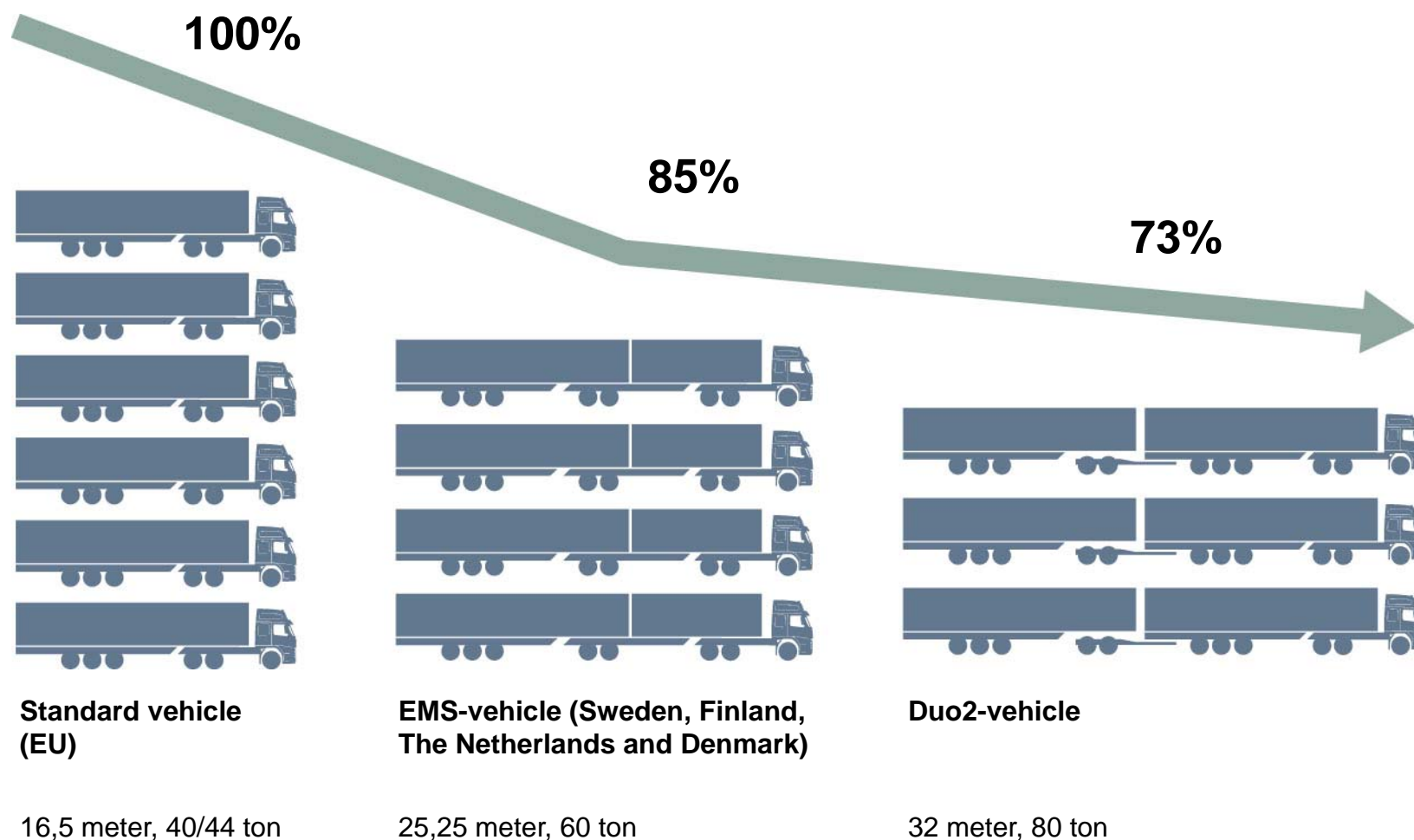


Duo2-vehicle

32 m 80 ton



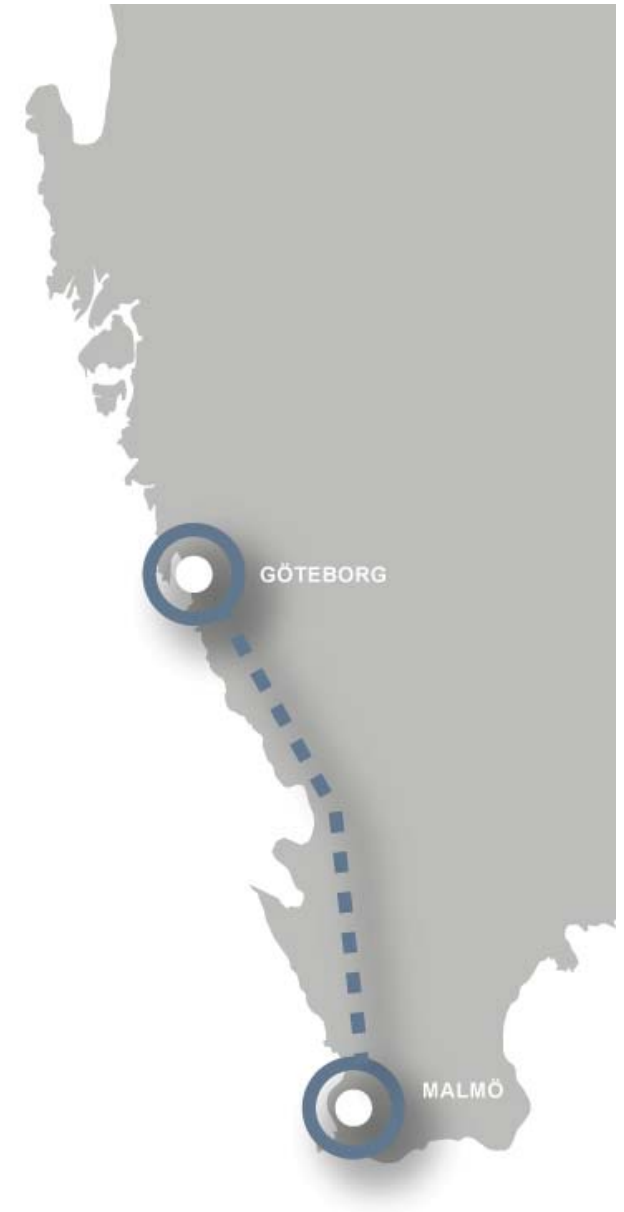
Larger Vehicles ... Less Fuel & Emissions



Tests on dedicated roads



Max 80 ton distributed on 11 axles

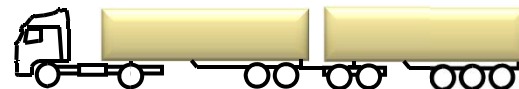


EMS – European Modular System

1
New Vehicle
Combinations



Directive 96/53



Potential combinations

Product Variance

A semi-truck is driving on a two-lane coastal highway. The truck is moving away from the viewer, kicking up a large spray of water from the wet pavement. To the left of the road is a steep drop-off to the ocean with white-capped waves crashing against the shore. To the right is a concrete guardrail and a steep, rocky hillside. In the distance, a curved overpass or bridge is visible against a cloudy, grey sky. Three white arrows point from three grey rectangular boxes towards the truck. The boxes are labeled 'Transport Mission', 'Vehicle Utilization', and 'Operating Environment'. The title 'Product Variance' is in the top left corner.

Transport Mission

- Vehicle Type
- Body & Equipment
- GCW

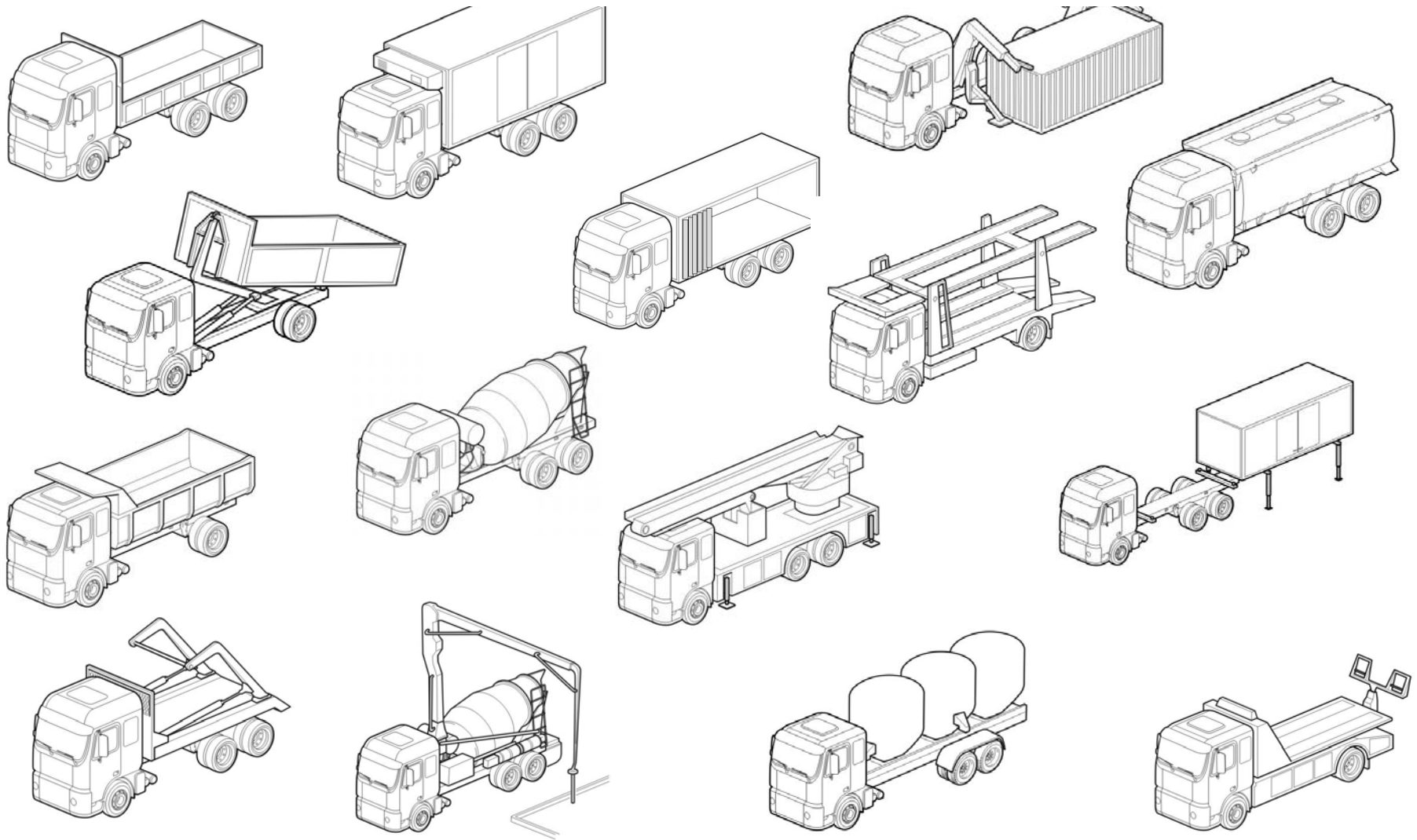
Vehicle Utilization

- Operating Cycle
- Speed changes
- Manoeuvring
- Yearly usage

Operating Environment

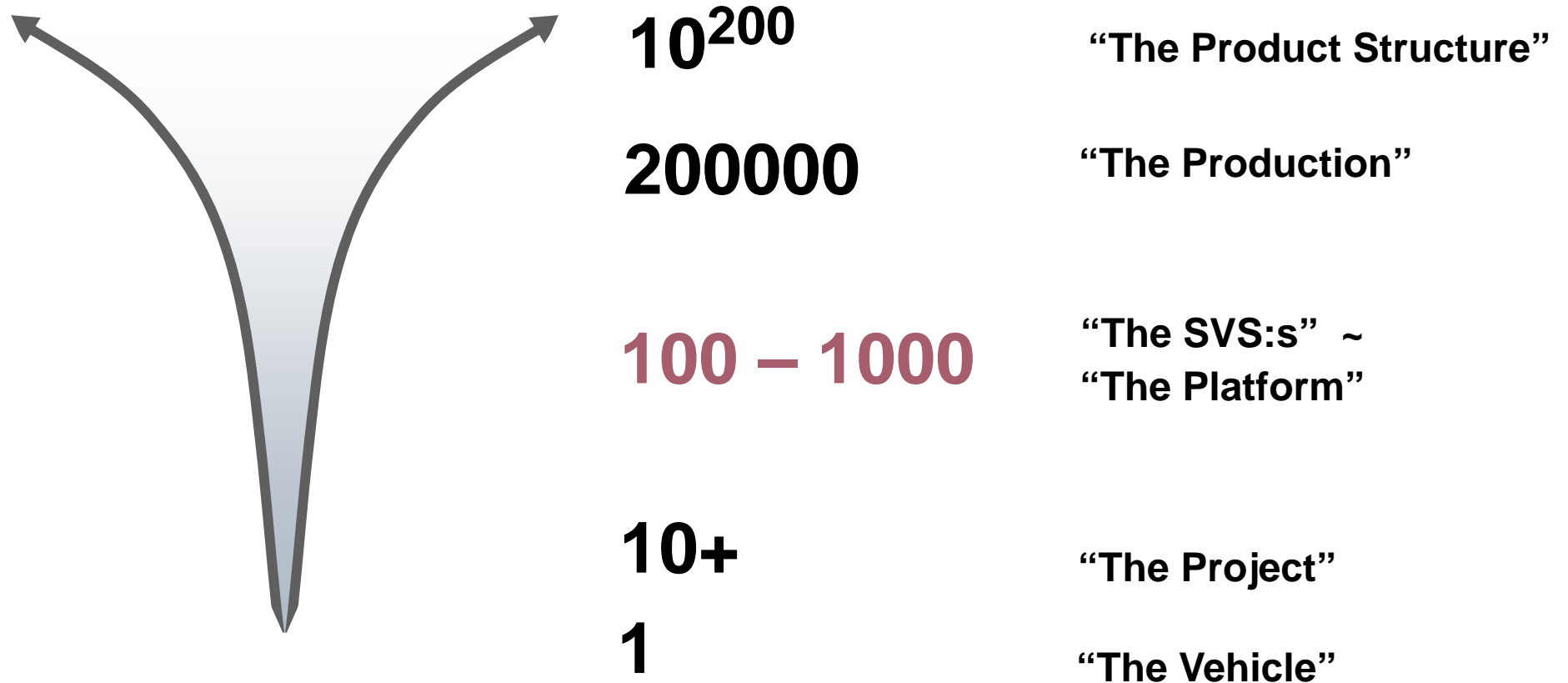
- Road Condition
- Topography
- Curve Density
- Altitude
- Ambient Temp.

Product Variance



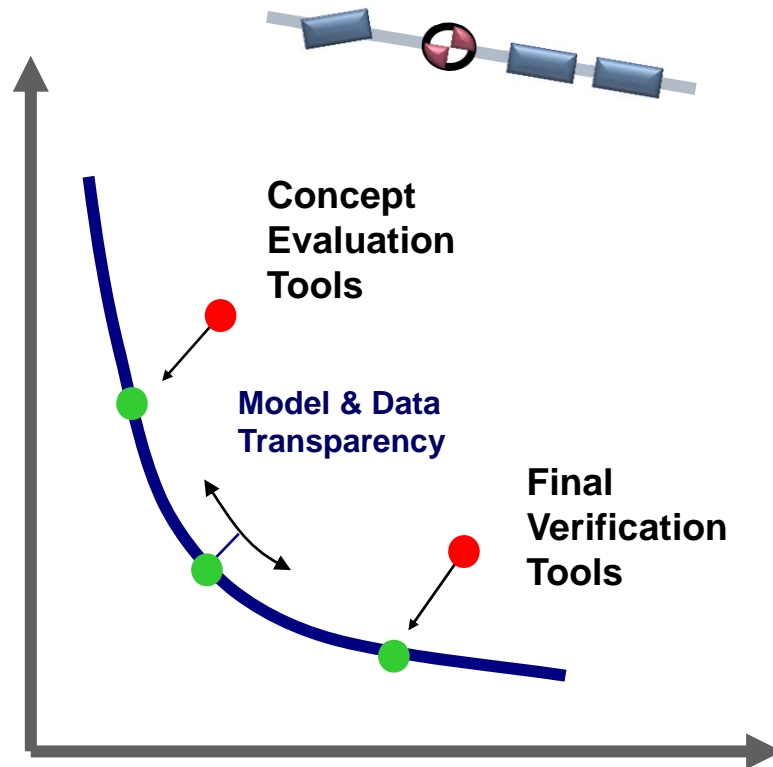
Strategic Vehicle Specifications

#2
Product
Configurations



Analysis Quality & Throughput

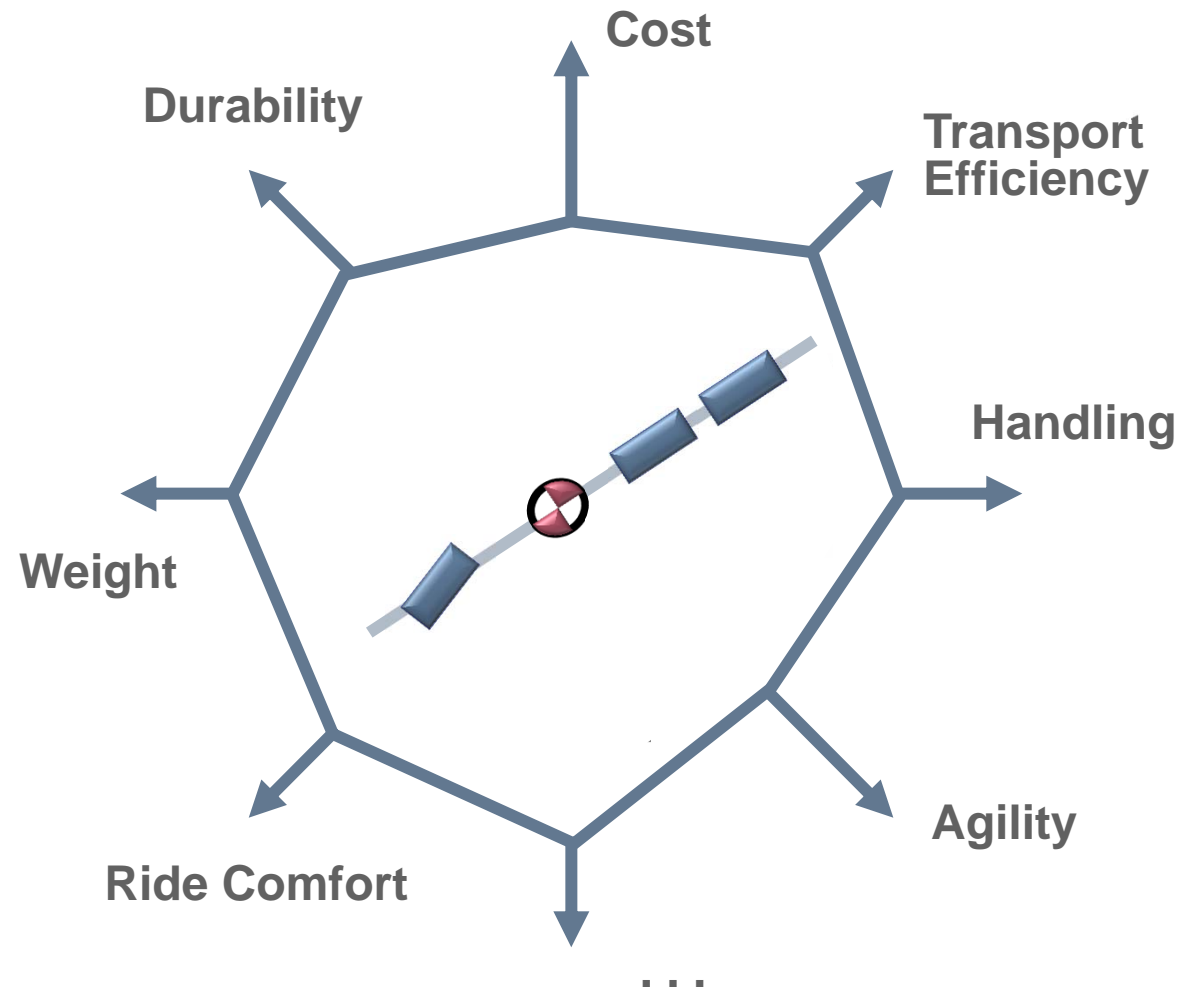
“Error” or
“1 / Quality”



“Analysis Time” or
“1 / Throughput”

Multi-Criteria Optimization

#3
Lean
Simulations



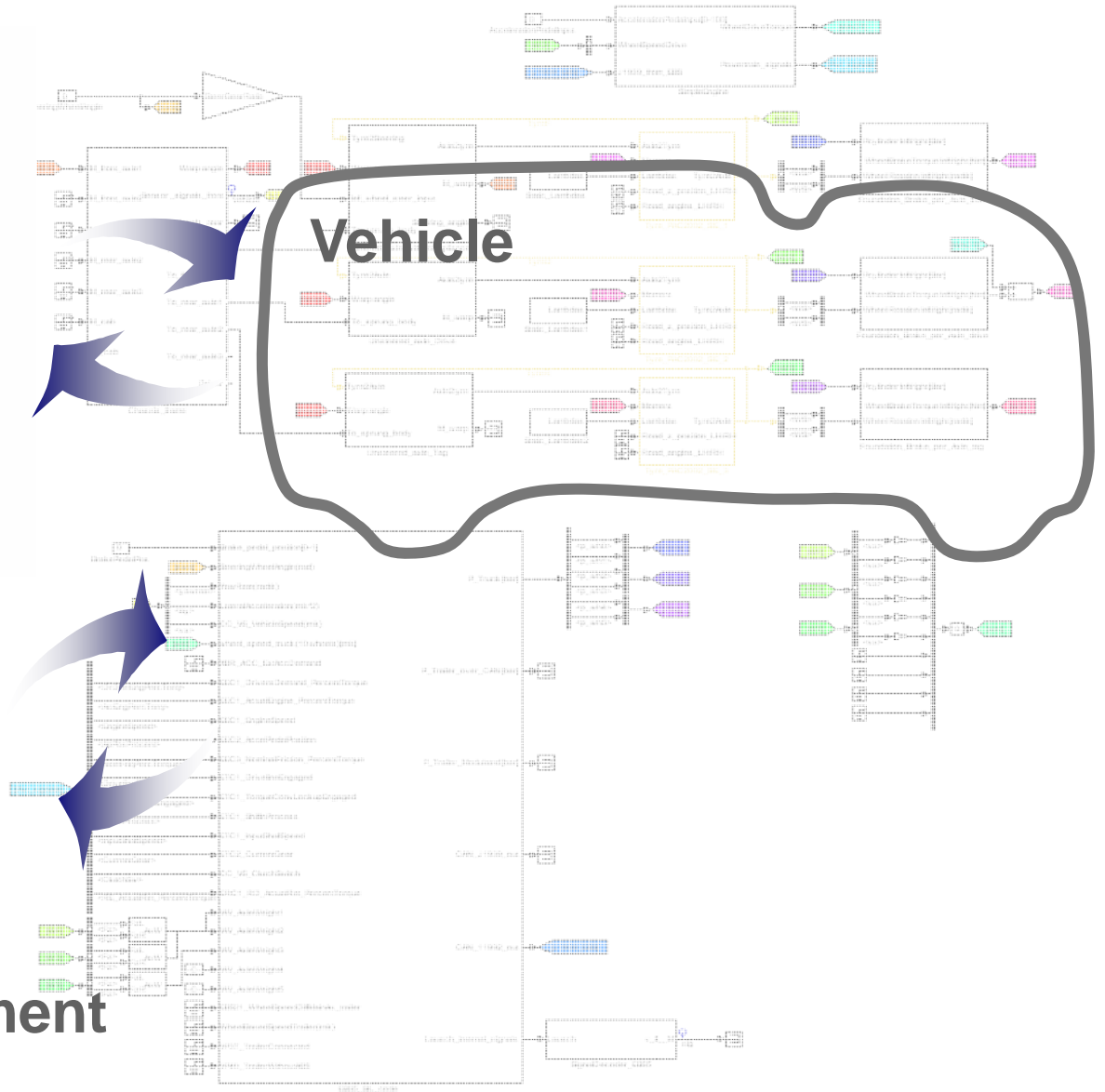
In Control

... of Control

Driver



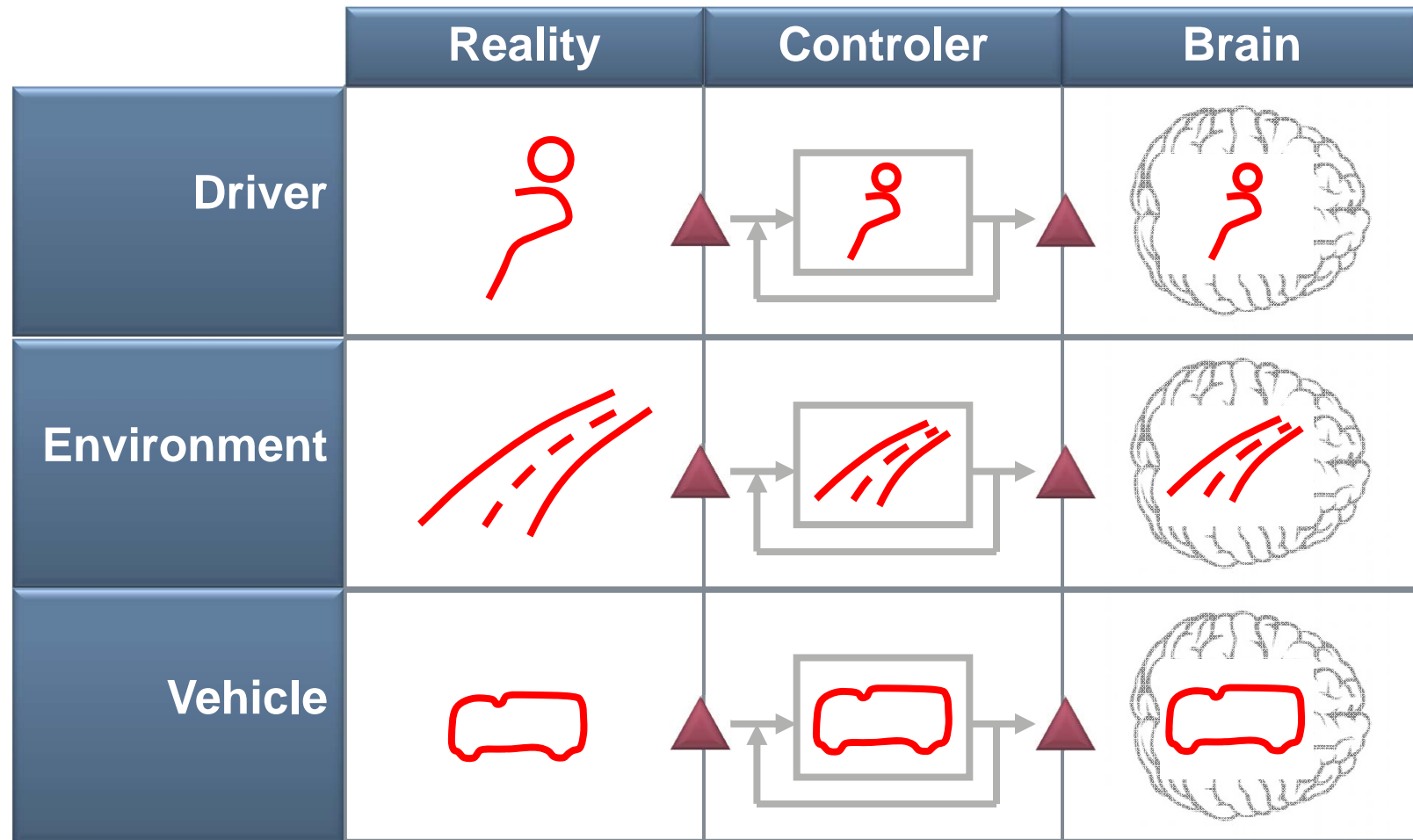
Vehicle



Environment



Interactions



Driver Variance




4
Driver Models



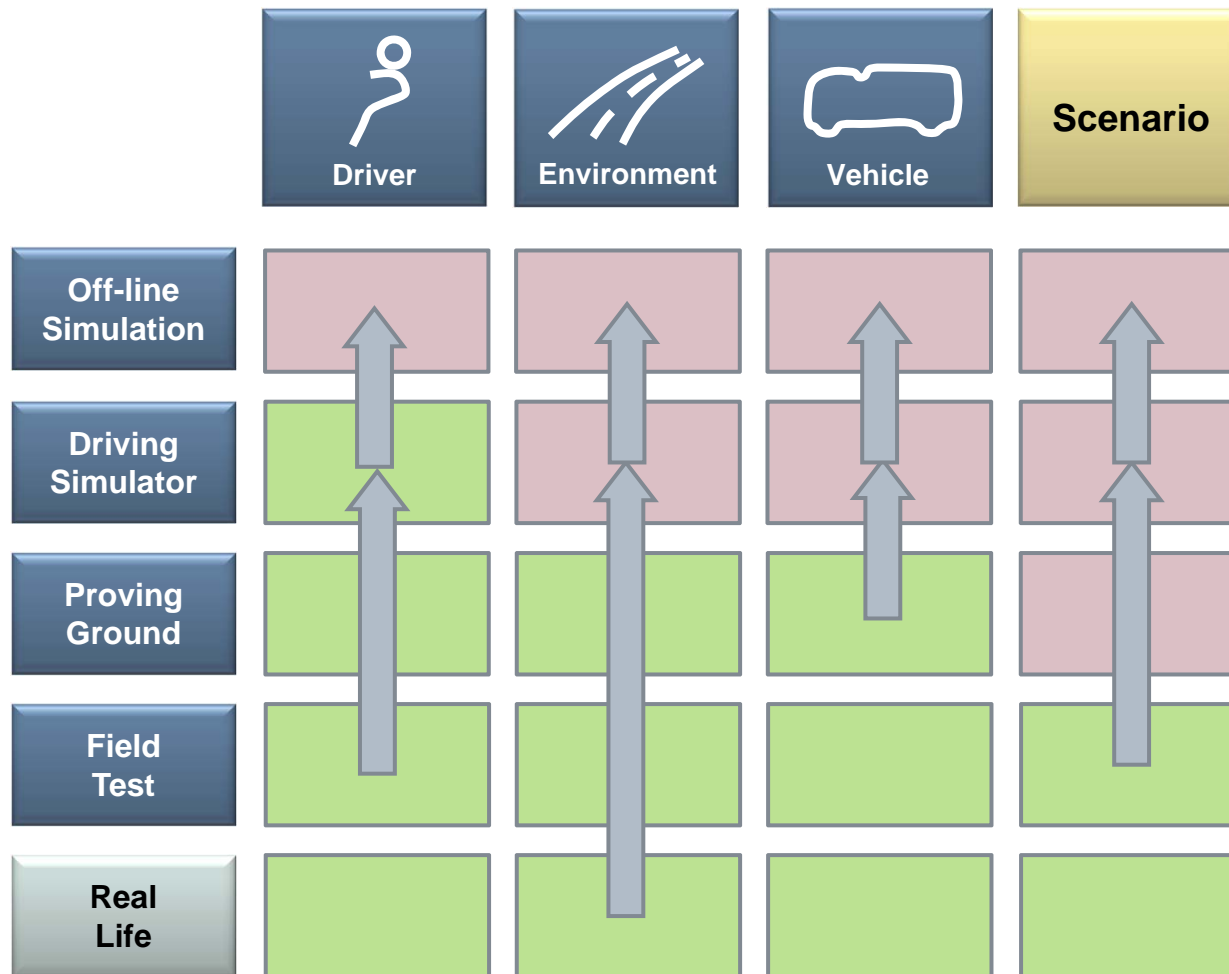
Volvo Group Trucks Technology

VOLVO

What's real?

	 Driver	 Environment	 Vehicle	Scenario
Off-line Simulation				
Driving Simulator				
Proving Ground				
Field Test				
Real Life				

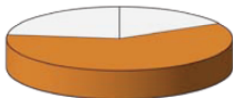


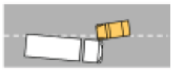











Driving Simulator Studies



Accident Research

5
Scenarios

Traffic Accidents Involving Heavy Trucks Causing Serious to Fatal Injuries - WESTERN EUROPE

Road user Group	Type Accident		Frequency
<p>B. Car Occupants</p> <p>55-65%</p> <p>60%</p> 	B1 Truck- car collision, oncoming traffic Truck front vs. car front,		35% 
	B2 Truck- car collision, oncoming traffic, Truck side vs. car front/ side (Sideswipe)		10% 
	B3 Truck- car collision, oncoming traffic Truck front vs. car side		5% 
	B4 Truck- car collision, traffic ahead in same direction Truck front vs. car rear		10% 
	B5 Truck- car collision, intersection Truck front vs. car side		15% 
			10% 
			

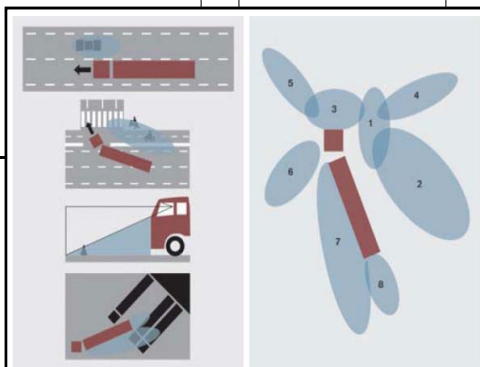


Figure 4. Truck seen from above. The numbered fields, 1-8, show areas that can be difficult for the driver to see.



Vehicle Dynamics Challenges

1
New Vehicle
Combinations

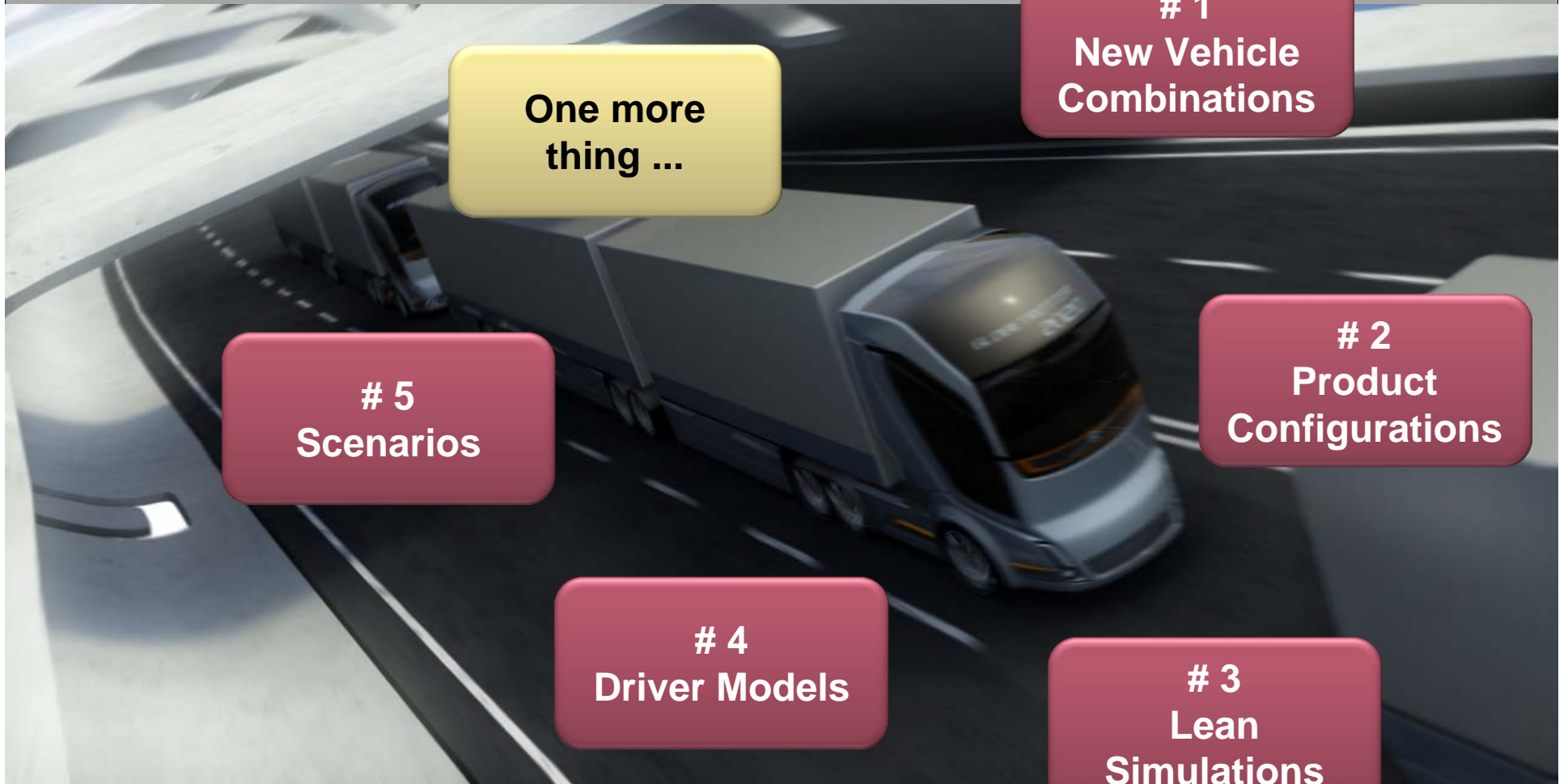
One more
thing ...

2
Product
Configurations

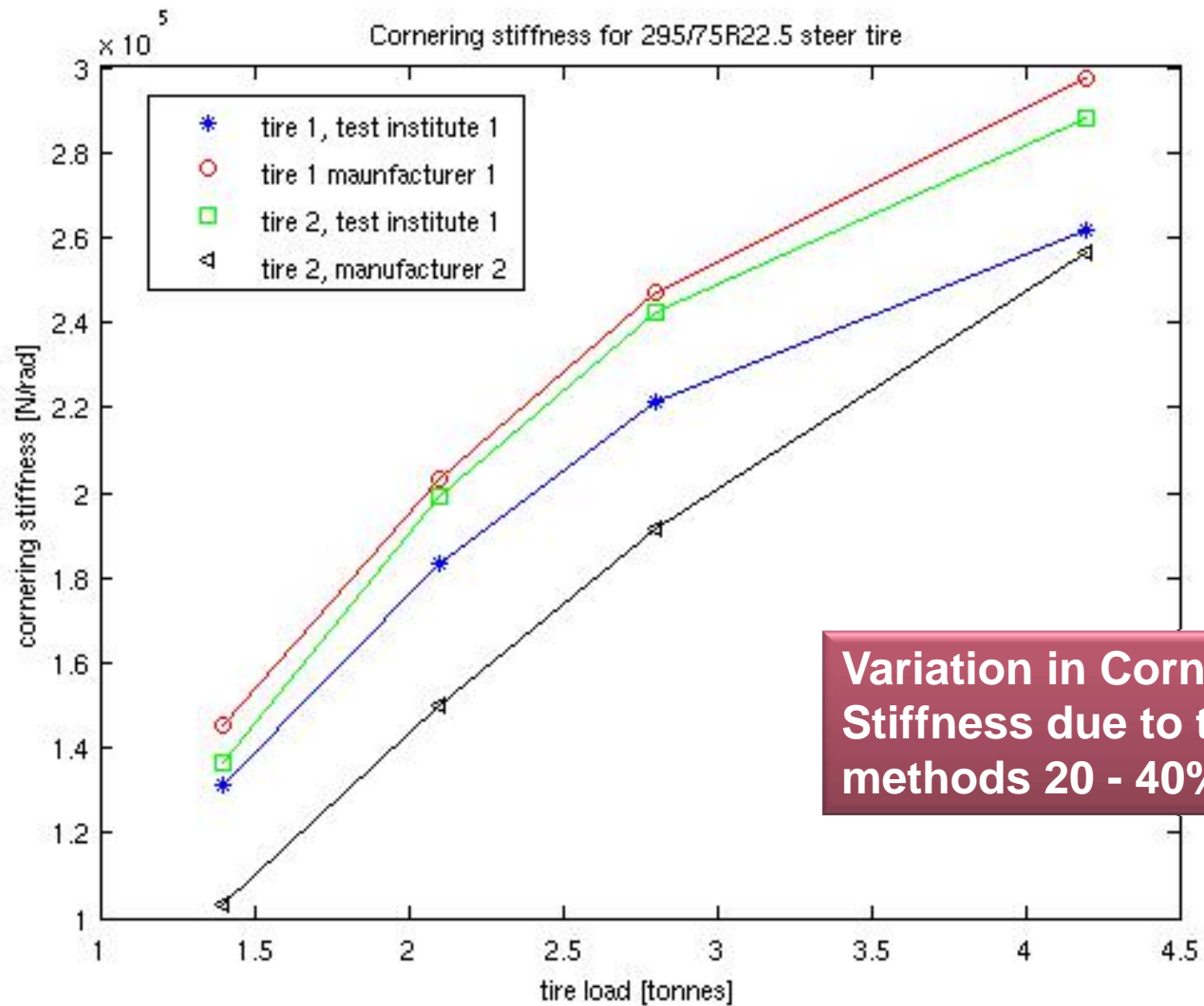
5
Scenarios

4
Driver Models

3
Lean
Simulations



Tyre Models!

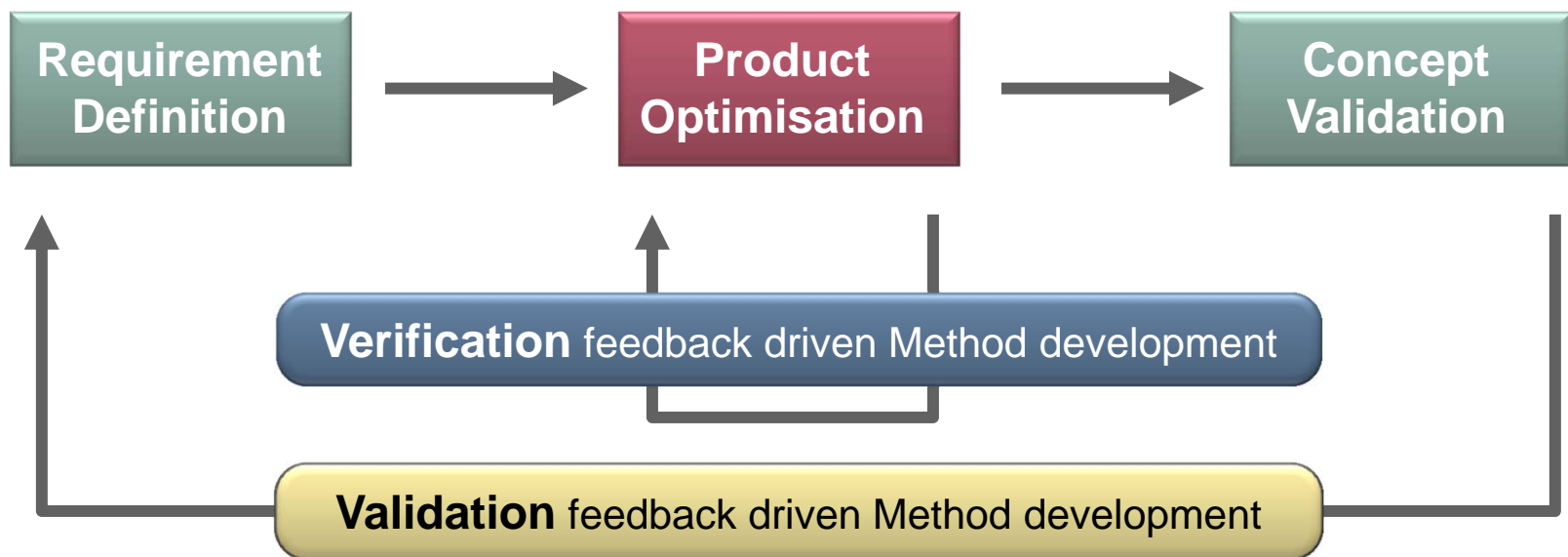


Variation in Cornering Stiffness due to test methods 20 - 40%

Balance

**Limited knowledge about
Customer Behaviour & Perceptions in their Operating Environments
can not be compensated by state-of-the-art Analysis Methods**

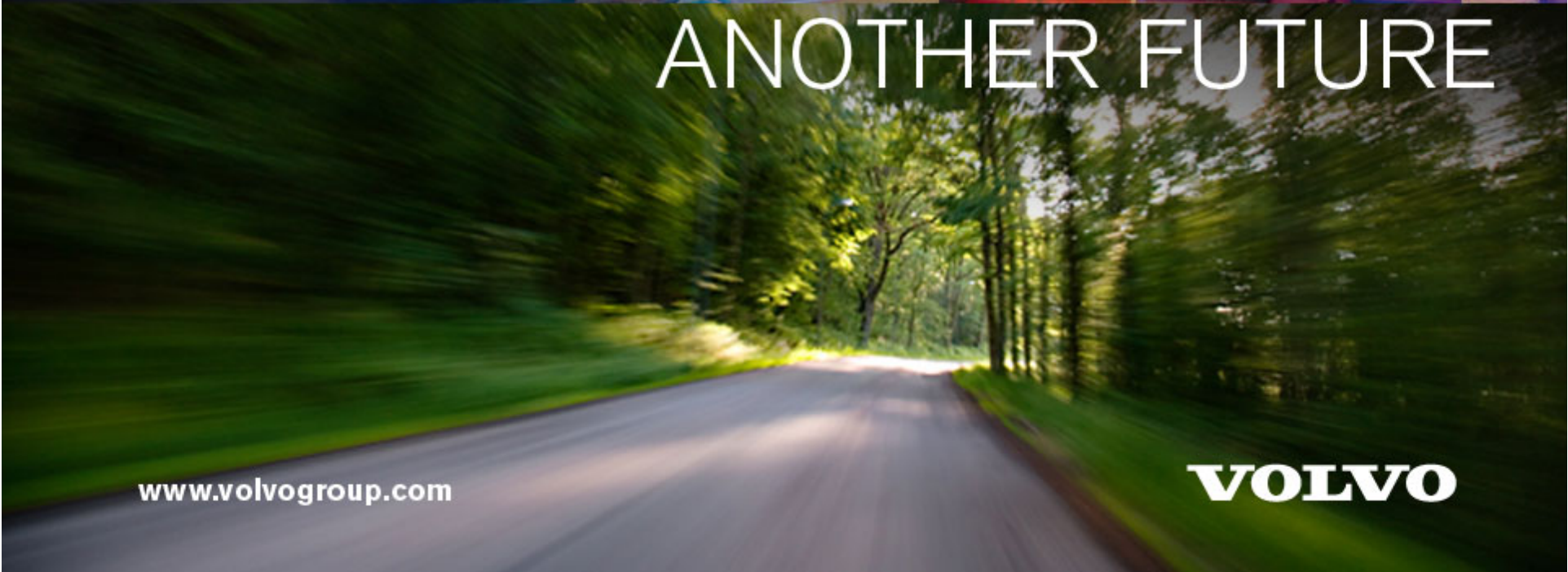
All areas have to be in balance and continuously improved





SHAPING

ANOTHER FUTURE



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VOLVO