

# Swedish resources for vehicle verification and validation

Magnus Olsson

Business Area Manager Transport

SP Technical Research Institute of Sweden



SP Sveriges Tekniska Forskningsinstitut

Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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## ABOUT SP

The SP Group

is wholly owned  
by RISE

Subsidiaries

8

Employees

1 270

Revenues

SEK 1 230 Million

Customers

> 10 000



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010-5165882  
magnus.olsson@sp.se



## OUR VISION

An international leading institute for research and innovation

## OUR MISSION

We create, use and provide world class expertise for innovation and the creation of added value both for the corporate sector and for a sustainable society

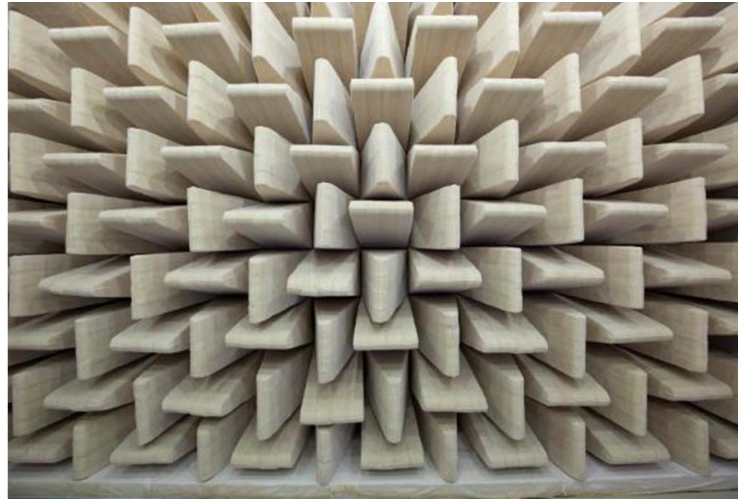
## OUR CORE VALUES

Trust, Innovation, Added value



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010-5165882  
magnus.olsson@sp.se



ADDED VALUE



INNOVATION



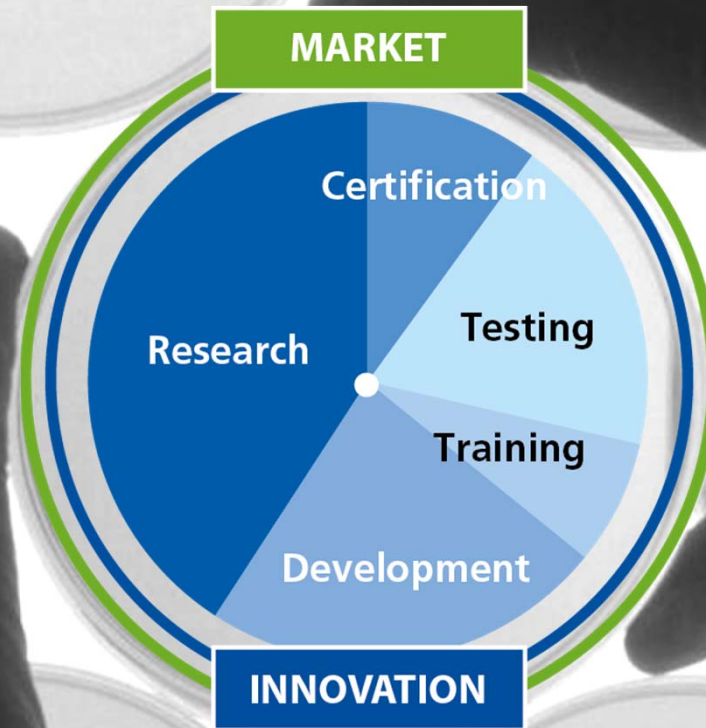
TRUST



# THE INNOVATION PROCESS

— WITH YOU EVERY STEP OF THE WAY

- > 10 000 customers
- Leading edge expertise
- Experimental resources
- Technical scope
- Interdisciplinary working method



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## 15 minutes about ...

- **ASTA ZERO – a unique active safety test site**
- Investigation to start up - Winter testing (WASA)
- Vehicle simulator – a need for fast and safe vehicle development



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# ASTAZERO

ACTIVE SAFETY TEST AREA

*Investing in your future*



EUROPEAN  
UNION  
European Regional  
Development Fund



REGION  
VÄSTRA GÖTALAND

# A unique collaboration with high competence

## OWNERS



**CHALMERS**

## FINANCIERS

*Investing in your future*



**REGION  
VÄSTRA GÖTALAND**



**TILLVÄXT  
VERKET**



**BORÅS  
STAD**

## INDUSTRIAL PARTNERS



**VOLVO**



**SCANIA**



**TSS**  
Test Site Sweden



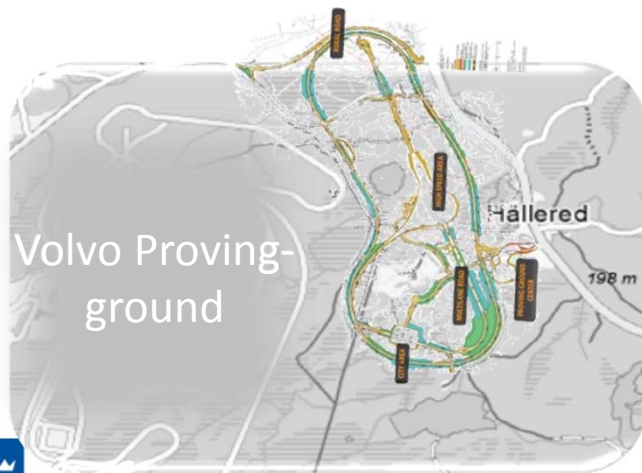
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magnus.olsson@sp.se

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# Purpose:

AstaZero will develop unique environments for road safety research, where the authorities, academia, research institutions and industry can create competitive developments together.



Borås, ~10 km

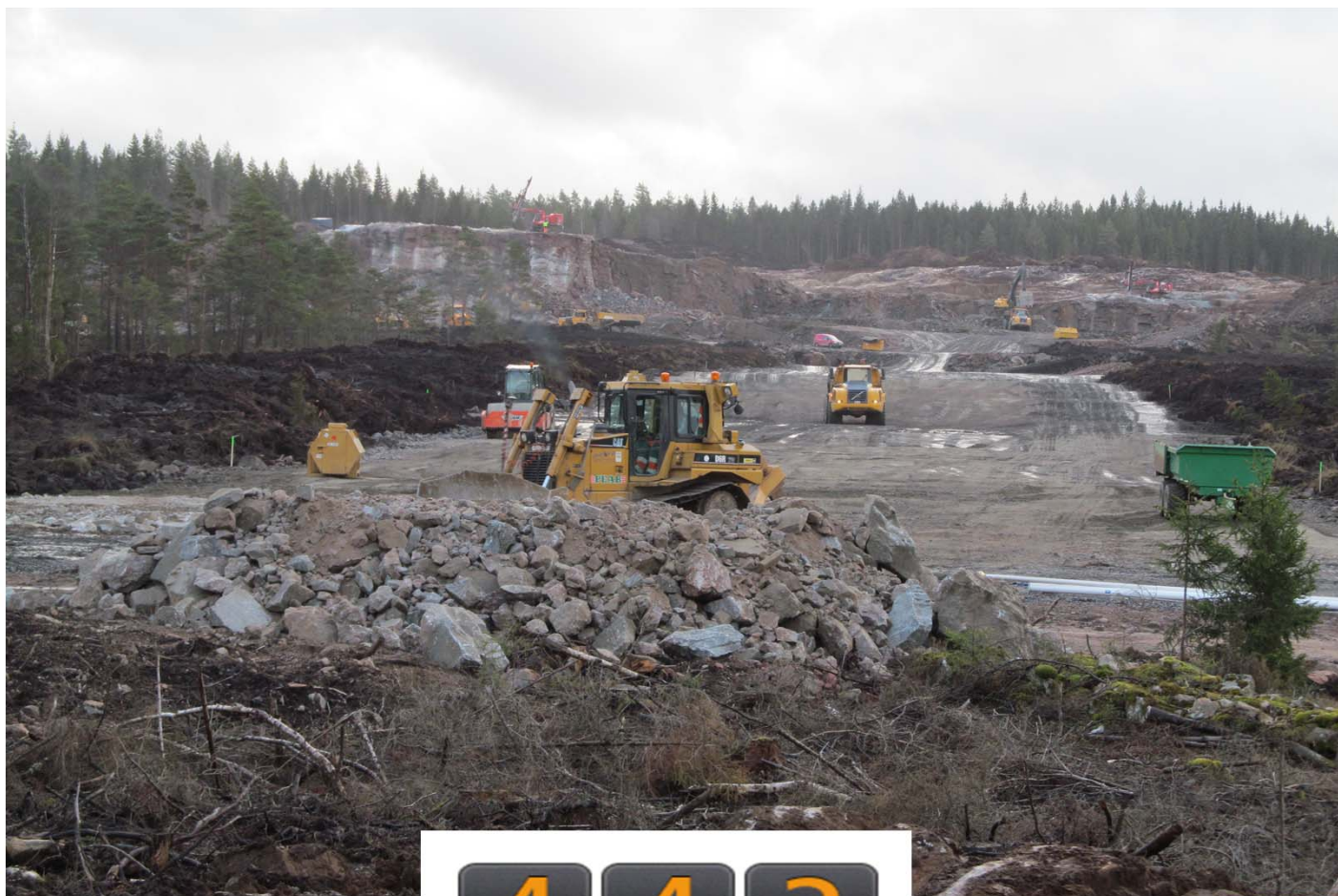


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010-5165882  
magnus.olsson@sp.se

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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

443

Days to go

ISOMRÅDE TRANSPORT



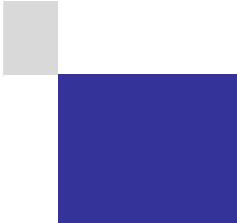
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010-5165882  
magnus.olsson@sp.se

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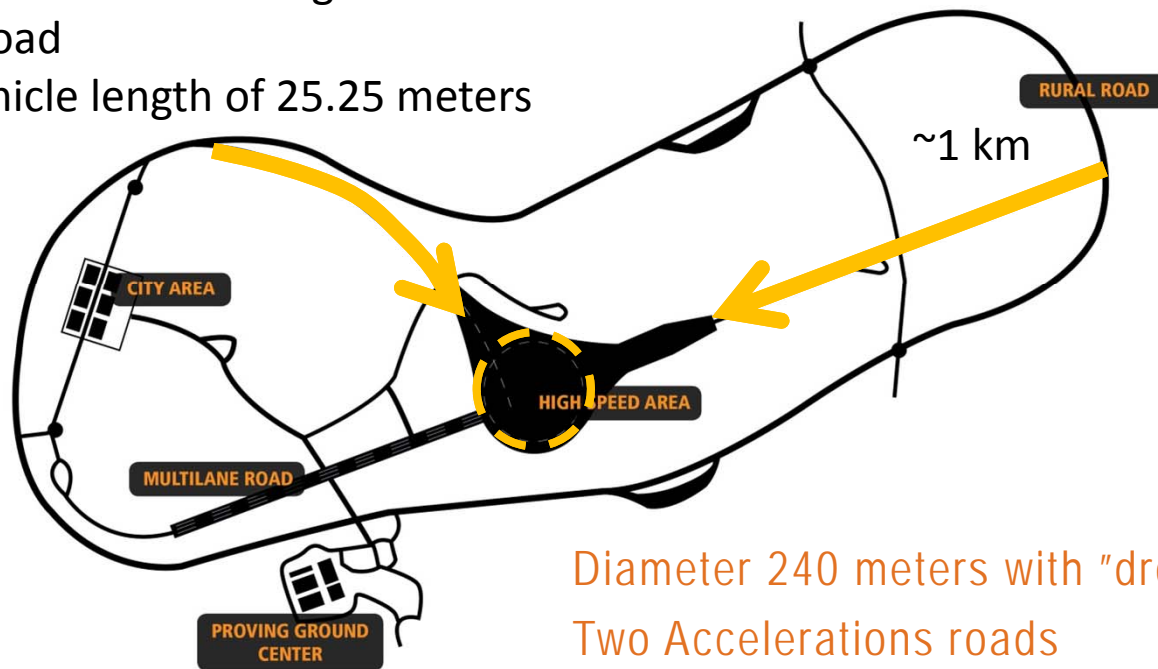
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# Test environments

60 tons maximum vehicle weight  
13 tons axel load  
Maximum vehicle length of 25.25 meters

Bi-Directional traffic  
Road width of 7 meter.



Diameter 240 meters with "drop add-ons"  
Two Accelerations roads

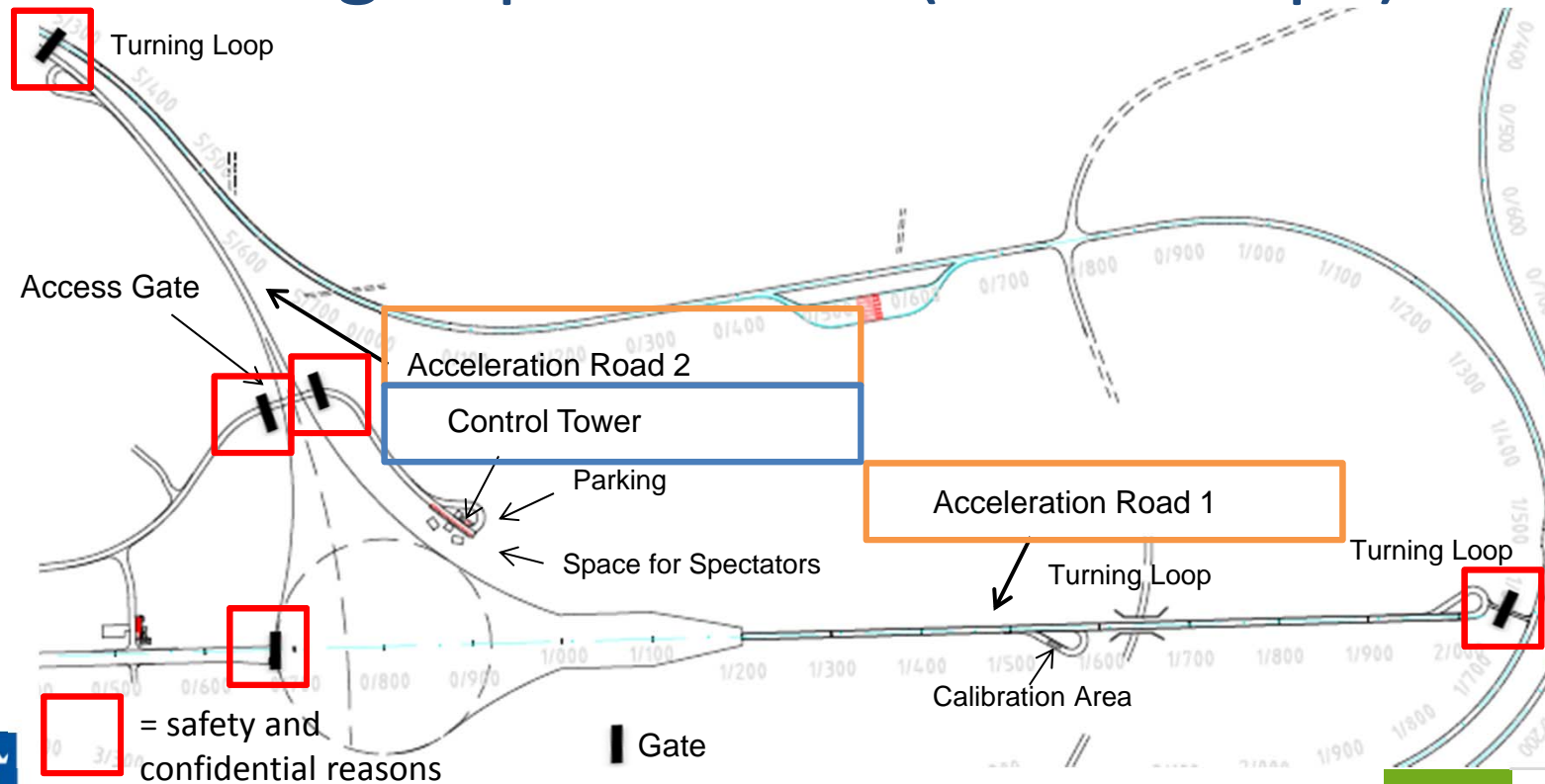


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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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# High Speed Area ("The Drop")



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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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# High Speed Area, some features.

## Diameter 240 meters with "drop add-ons"

- Broaden approach; 250 meters in length, 60 meters in width
- 1% slope sidewise, flat in the longitudinal direction
- Rigid fences around the whole area with cushions in front

## Separate Control Tower

- Two stories high for good visibility
- Prepared area for 100 spectators
- Remote control of Targets, Balloon cars and Driving Robots

## Misc.

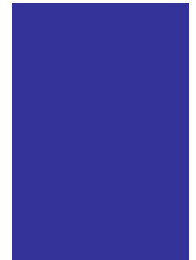
- Calibration area at the first Turning Loop (for gyros)



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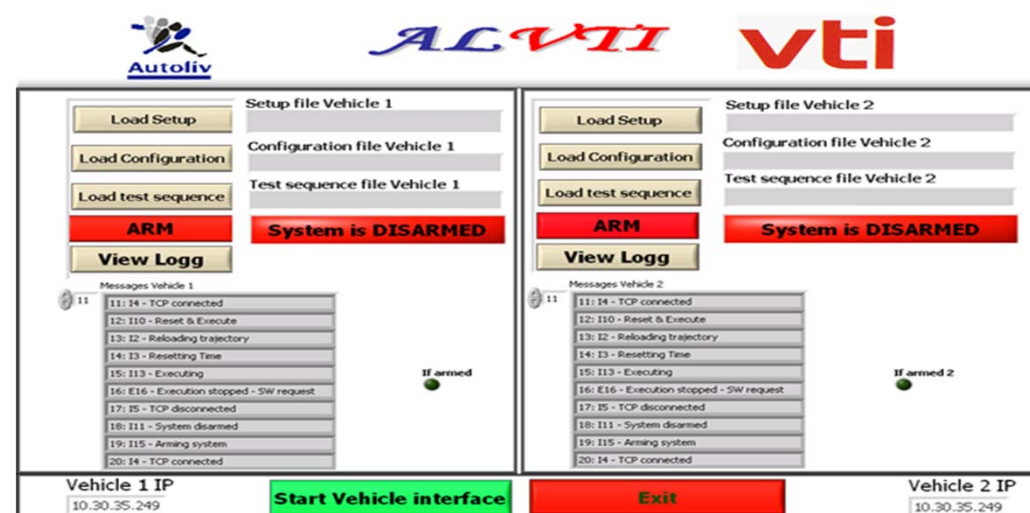
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010-5165882  
magnus.olsson@sp.se

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# Equipment cont.

Remote control of Balloon Cars and Test Vehicles  
(Driving Robots)



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010-5165882  
magnus.olsson@sp.se

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# Equipment, examples

## Dummies:

- Pedestrians
- Balloon Cars
- Animals
- Material to make new targets



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010-5165882  
magnus.olsson@sp.se

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# Goals!

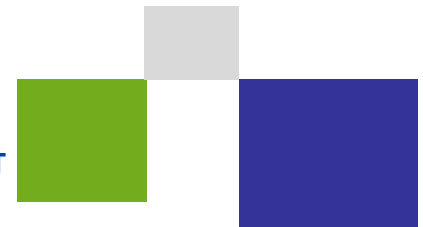
- Accredited Proving Ground
- Quality and environmental certificated; ISO 9000, 14001 and 17025
- A high level of service
- Centre of Excellence in development of methods and test equipment



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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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The schedule is as follow:

- 2011 – exploration and design
- 2012 – construction and start ground work
- 2013 – construction
- 2014 – Inauguration



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Magnus Olsson  
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magnus.olsson@sp.se

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# How can Asta Zero be used

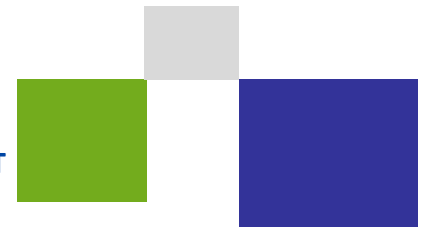
- Simply hire the facility itself
- Hire the facility and available expertise (different extents depending on requirements)
- Hire the facility, expertise and subsequent analysis
- Use AstaZero as an external development partner to carry out the entire research project



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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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## 15 minutes about ...

- ▶ **i** • ASTA ZERO – a unique active safety test site under construction
- ▶ • **Investigation to start up - Winter testing**
- ▶ • Vehicle simulator – a need for fast and safe vehicle development



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Magnus Olsson  
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magnus.olsson@sp.se

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# Investigation to start up - Winter testing

- Test Site Sweden (TSS), Swedish Proving Ground Association\* (SPGA), AstaZero
- Complementary vehicle testing in winter conditions, building from the AstaZero concept
- A pre-study will be discussed during 2013
- The pre-study will identify more partners but also the need from an research, testing, demonstration and development point of view

\*) Winter proving grounds in north of Sweden



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Magnus Olsson  
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magnus.olsson@sp.se

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## 15 minutes about ...

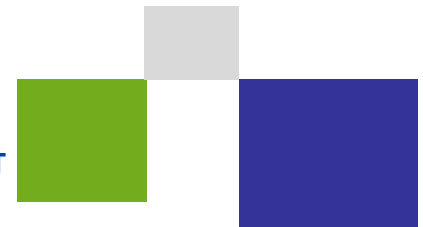
- ▶ **i** • ASTA ZERO – a unique active safety test site under construction
- ▶ • Investigation to start up - Winter testing
- ▶ • **Vehicle simulator – a need for fast and safe vehicle development**



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Magnus Olsson  
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magnus.olsson@sp.se

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# Vehicle driving simulator – a need for fast and safe vehicle development

- Why driving simulators?
  - The same scenario for all participants
  - Real people are driving
  - Quick comparisons between different alternatives
  - Creating complex situations that are not possible to stage in reality not even on a closed circuit

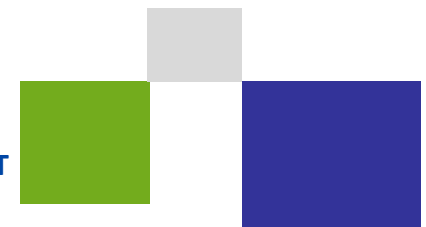


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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

**Based on information provided by VTI**

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# Areas of interests for simulators

- Human-machine interaction
- Road design and signing
- Novice drivers
- In-vehicle information devices
- Drivers with special needs
- Driving performance and impaired driving
- Vehicle dynamics
- Autonomous traffic
- Advanced HMI interfaces
- Mobility

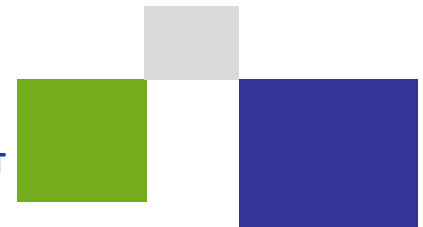


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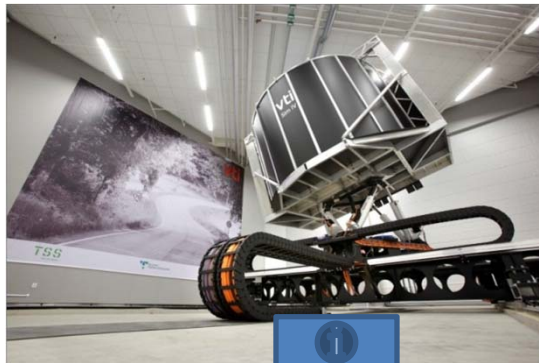
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010-5165882  
magnus.olsson@sp.se

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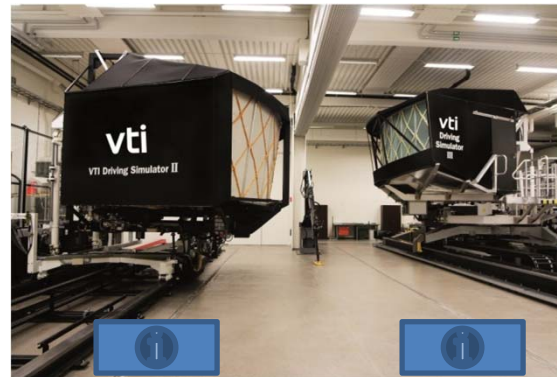


# Different simulators



Sim IV

(Gothenburg)



Sim II

Sim III

(Linköping)



VTI Foerst simulator



Train simulator



Sim I (1985 – 2002)



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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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## VTI:s Sim IV (Gothenburg)



Sim IV



Volvo XC60



Volvo FHM

Based on information provided by VTI

**vti**

# Experiments - Truck driver behavior in critical situations and the impact of surprise, 2005

## Background

Some severe accidents reported in connection with front tyre blow-outs – situation could not be recreated on test track

## Experiment:

After 40 km driving, roughly 30 min, on the wide road a blow-out on the left front wheel was simulated, surprise situation The effect of surprise is extremely clear and can explain most of reported incidents

## Results:

Both field and simulator tests indicate that braking is OK with a blow-out on the front tyre

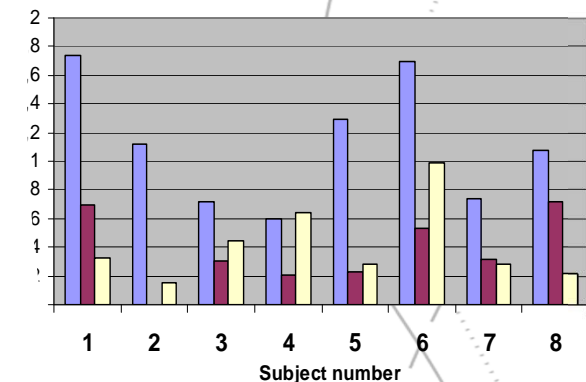
To confirm the original hypothesis of the surprise impact, a simulator with moving base was a necessary instrument

## Reference:

•Pettersson H-E. , Aurell J. , Nordmark S. Truck driver behaviour in critical situations and the impact of surprise a pilot study of a sudden blow-out on the front axle of a heavy truck. DSC 2006 Europe - Paris - October 2006, 285 ISBN 2-85782-641-9 - ISSN 0769-0266



Max. lateral motion sideways after blow-out [m]



Based on information provided by VTI

vti

# Summary

- ASTA ZERO – a unique test site for active safety development and research
  - Location: Hällered/Borås
- Pre-study and investigating to start about additional winter test opportunities in Sweden
  - Location: TBD
- Vehicle simulator – for many purposes in safe environment and fast to change test set up
  - Location: several locations but VTI simulators in Linköping and Gothenburg



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Magnus Olsson  
010-5165882  
magnus.olsson@sp.se

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# VTI Driving Simulator II, 1990-

## Technical data

### Motion system

Pitch angle: -10 to +15 degrees

Roll angle:  $\pm 22$  degrees

### External linear motion

Maximum amplitude:  $\pm 3,5$  m

Maximal acceleration:  $\pm 0,4$  g

### Vibration table

Vertical movement:  $\pm 5,0$  cm

Longitudinal movement:  $\pm 7,5$  cm

Roll angle:  $\pm 7$  degrees

Pitch angle:  $\pm 4$  degrees

### Visual system

Forward view 120 degrees

Rear view in three mirrors

Average resolution: horizontal 4,7 arcmin./linepair, vertical 5,2



**vti**

# VTI Driving Simulator III, 2004-

## Technical data

### **Motion system**

Pitch angle: -9 to +14 degrees

Roll angle:  $\pm 24$  degrees

### **External linear motion**

Maximum amplitude:  $\pm 3,75$  m

Maximum speed:  $\pm 4,0$  m/s

Maximal acceleration:  $\pm 0,8$  g

### **Vibration table**

Vertical movement:  $\pm 6,0$  cm

Longitudinal movement:  $\pm 6,0$  cm

Roll angle:  $\pm 6$  degrees

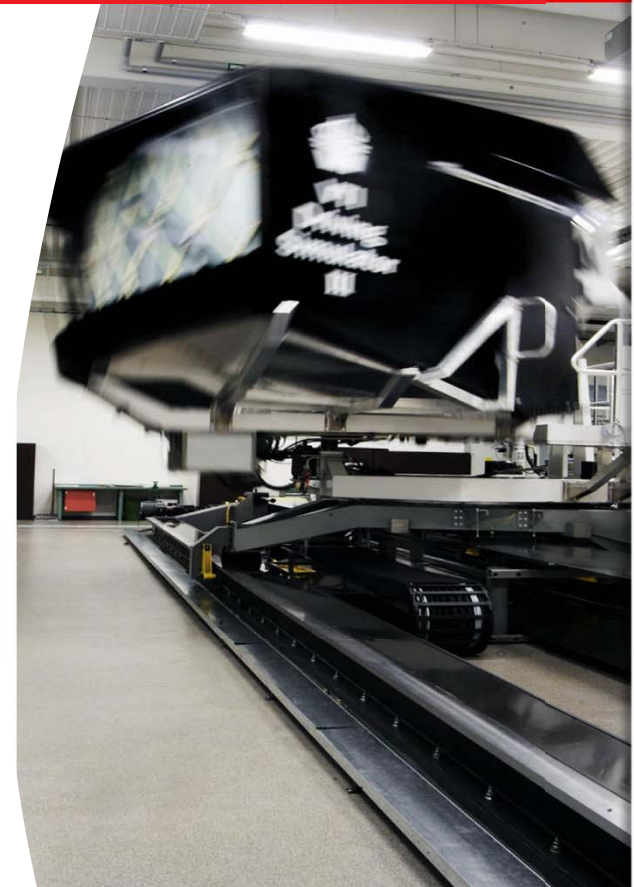
Pitch angle:  $\pm 3$  degrees

### **Visual system**

Forward view 120 degrees

Rear view in three mirrors

Average resolution: horizontal 4,2 arcmin./linepair, vert



**vti**

# VTI Driving Simulator IV, 2011-

## Technical data

### **Motion system**

Pitch angle: -9 to +14 degrees

Roll angle:  $\pm 24$  degrees

### **External linear motion**

Maximum amplitude:  $\pm 3,75$  m

Maximum speed:  $\pm 4,0$  m/s

Maximal acceleration:  $\pm 8$  g

### **Vibration table**

Vertical movement:  $\pm 6,0$  cm

Longitudinal movement:  $\pm 6,0$  cm

Roll angle:  $\pm 6$  degrees

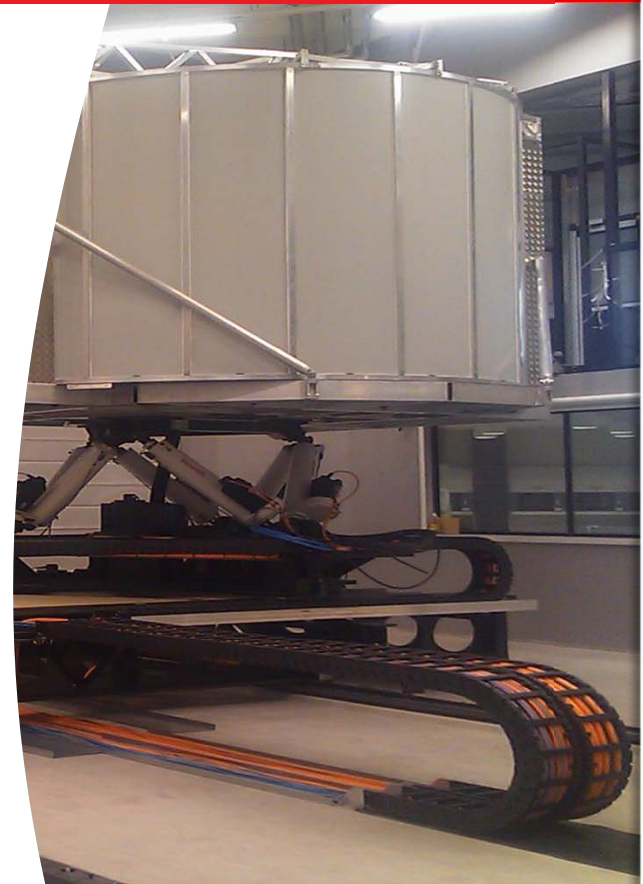
Pitch angle:  $\pm 3$  degrees

### **Visual system**

Forward view 120 degrees

Rear view in three mirrors

Average resolution: horizontal ?arcmin./linepair, vertical



**vti**