Investing in your future

EUROPEAN UNION
European Regional Development Fund

REGION VÄSTRA GÖTALAND

Opens in 2014:

A world unique test facility for active safety

ASTAZERO

ACTIVE SAFETY TEST AREA

Active safety
is necessary

Every year some 1.3 million people die as a result of road traffic accidents. In addition, about 20 to 50 million people sustain non-fatal injuries. If no action is taken to address the current crisis, global road traffic fatalities are forecasted to double in 2030, becoming the fifth leading cause of death.

Today, most traffic accidents are due to human factors like distraction or tiredness. One way to increase traffic safety is therefore to find a way to let the vehicles support the drivers, making the human factor less influential. This is made possible by recent technological progress which has materialized into very advanced, "active" safety systems.

By combining sensor technology, vehicle communication and on-board computers, future vehicles will be able to communicate both with each other,* and with their surroundings.** These active safety functions are regarded as a key component to further increase safety on our roads, since fully developed and tested, they can make it possible to prevent traffic accidents before they occur.

In order to maintain and improve today's safety, cars will increasingly be required to have active safety systems, as a complement to already existing "passive" technology like airbags and safety belts.

Great need for new Test Facilities

Active safety systems are currently under further development and have to be adapted to different traffic scenarios. Many tests needed for these novel active safety functions cannot be carried out in real traffic due to the risks of malfunctions. Therefore there is a great need for test facilities designed specifically for the development of these systems.

However, today there is not a single test facility in the world completely developed and dedicated to test every aspect of the new technology in one place. This is why in 2014, the AstaZero facility will be inaugurated in Sweden, a country that is world leading in many areas related to traffic safety.

The AstaZero facility is an open platform designed for developments in active traffic safety, and its unique test environments will allow the construction of all types of scenarios for research, development, testing and certification of future road safety systems.

The name AstaZero relates to the facility's connection to a vision of zero traffic fatalities; a vision that the developments of active safety might make possible in the future.

* V2V= Vehicle to Vehicle

** V2I= Vehicle to Infrastructure

ABOUT ACTIVE SAFETY SYSTEMS

Active safety systems are systems that:
Help the driver avoid accidents or reduces the consequences of an accident by warning the driver or taking control of the vehicle. Active safety systems hence work in the opposite manner to passive safety systems, such as safety belts and airbags, as these have been developed to provide protection when a collision has already occurred.

Examples

- ABS = Antilock Braking System
- ESP = Electronic Stability Program
- LDWS = Lane Departure Warning Systems
- LKS = Lane Keeping System
- CMBB = Collition Mitigation By Braking
- AEB = Automatic Emergency Braking
- PDS = Pedestrian Detection System
- Drowsiness Detection Systems
- Distraction Detection Systems
- Night Vision Systems

A part of a Swedish network

AstaZero is the result of a successful Swedish private-public collaboration. The unique involvement of governmental institutions, industry and academia is mainly due to the fact that Sweden is a world leader in many areas of road safety, and that considerable expertise has been developed by the automotive industry, their subcontractors and related research institutions. This strong national focus on traffic safety aspects has resulted in a major interest in further development of the new area of active safety.

An important part of the successful Swedish road safety work has been the development of intelligent transport systems, ITS. The Swedish Transport Administration conducts research and development in the field of ITS in collaboration with the automotive industry, academia and other stakeholders in the transport sector. Together they create cross-border solutions for monitoring, control and information. Solutions that cannot just be used in Sweden, but which are also available for international distribution.

Several collaborations promoting traffic safety

An example of such cross-border cooperation is IVSS, where the Swedish Transport Administration, together with the automotive industry and the state-owned company Vinnova, is working to develop active systems to prevent accidents with different types of security inside and outside the vehicle. Focus areas are active safety, loss prevention solutions, development of handling and crashworthiness of passenger and commercial vehicles and the development of intelligent vehicles and traffic systems.

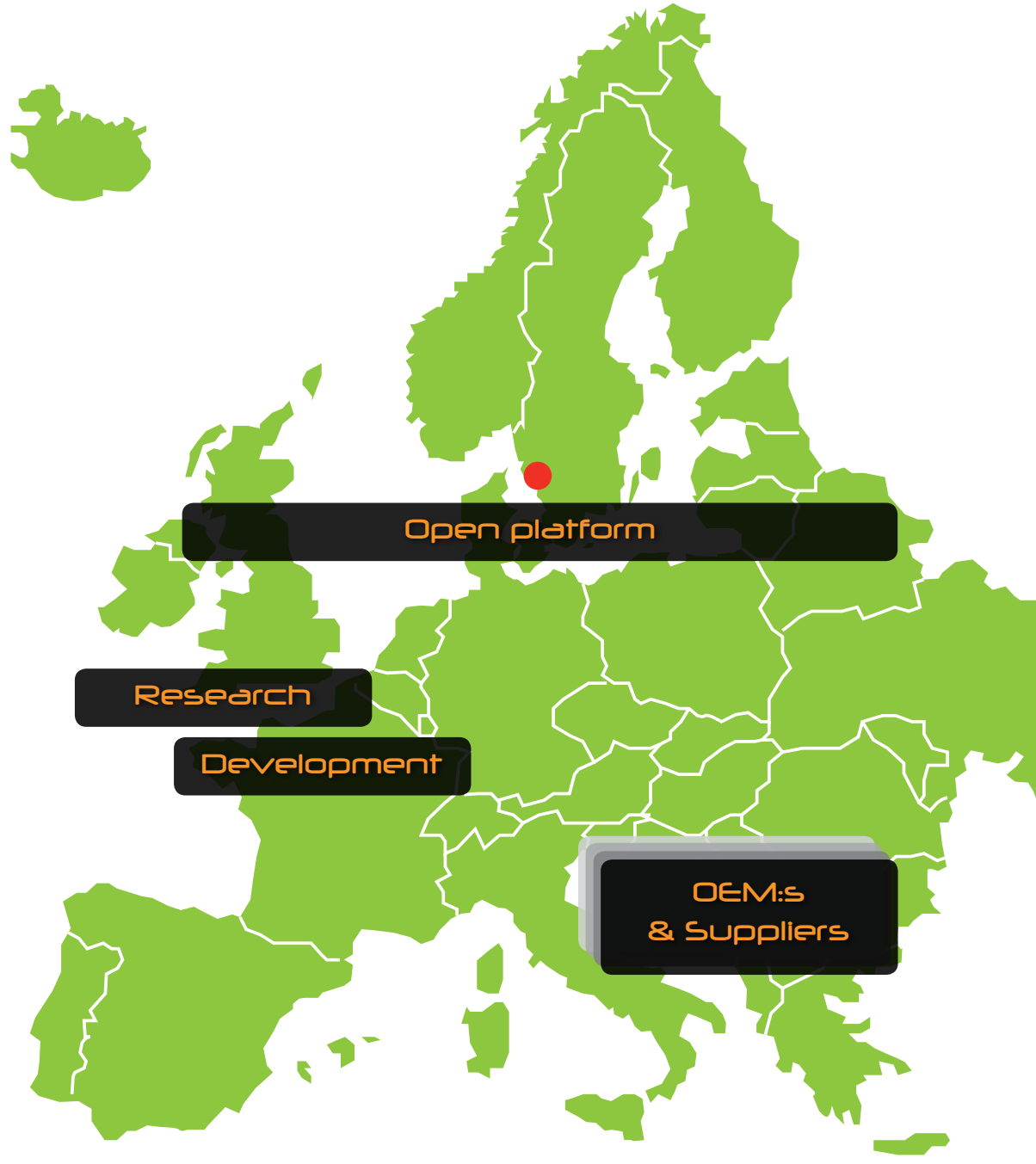
Another example of collaboration is the Vehicle Strategic Research and Innovation Program, (FFI), a partnership between government and the automotive industry to jointly fund research, innovation and development activities focusing on Climate, Environment and Security. It has come about because development in road transportation and the Swedish automotive industry in general has a significant impact on the Swedish economy.

A testbed to foster further development

AstaZero's inauguration on the 21st of August 2014 will enable further collaborations to be pursued. Sweden will then have a testbed for advanced active safety where almost any conceivable kind of test will be possible, whether to examine the functions of, for example, autonomous or connected vehicles, platooning or driver behaviour.

My belief is that this will not only strengthen the level of expertise within the Swedish vehicle cluster, but also be attractive and a major benefit for its European and international counterparts.

Pether Wallin,
CEO AstaZero



This is AstaZero

AstaZero is the trademark of ASTA– Active Safety Test Area, a company that is currently building a state-of-the-art Proving Ground for development and testing of active safety systems.

The AstaZero facility has been specified to meet several different needs, ranging from commercial vehicle testing and certification to the examination of traffic infrastructure (like signs and railings), automotive communication systems as well as research and experimentation.

Built upon the collaboration between academia, the automotive industry and the authorities, the AstaZero facility will operate as an open, international platform for all interested stakeholders like vehicle manufacturers, suppliers, legislators, road agents, universities, and technical institutes from around the world. SP Technical Research Institute of Sweden and Chalmers University of Technology are the owners and guarantee an independent operation of the facility.

Construction measures

Total surface:
About 2 000 000 square meters.

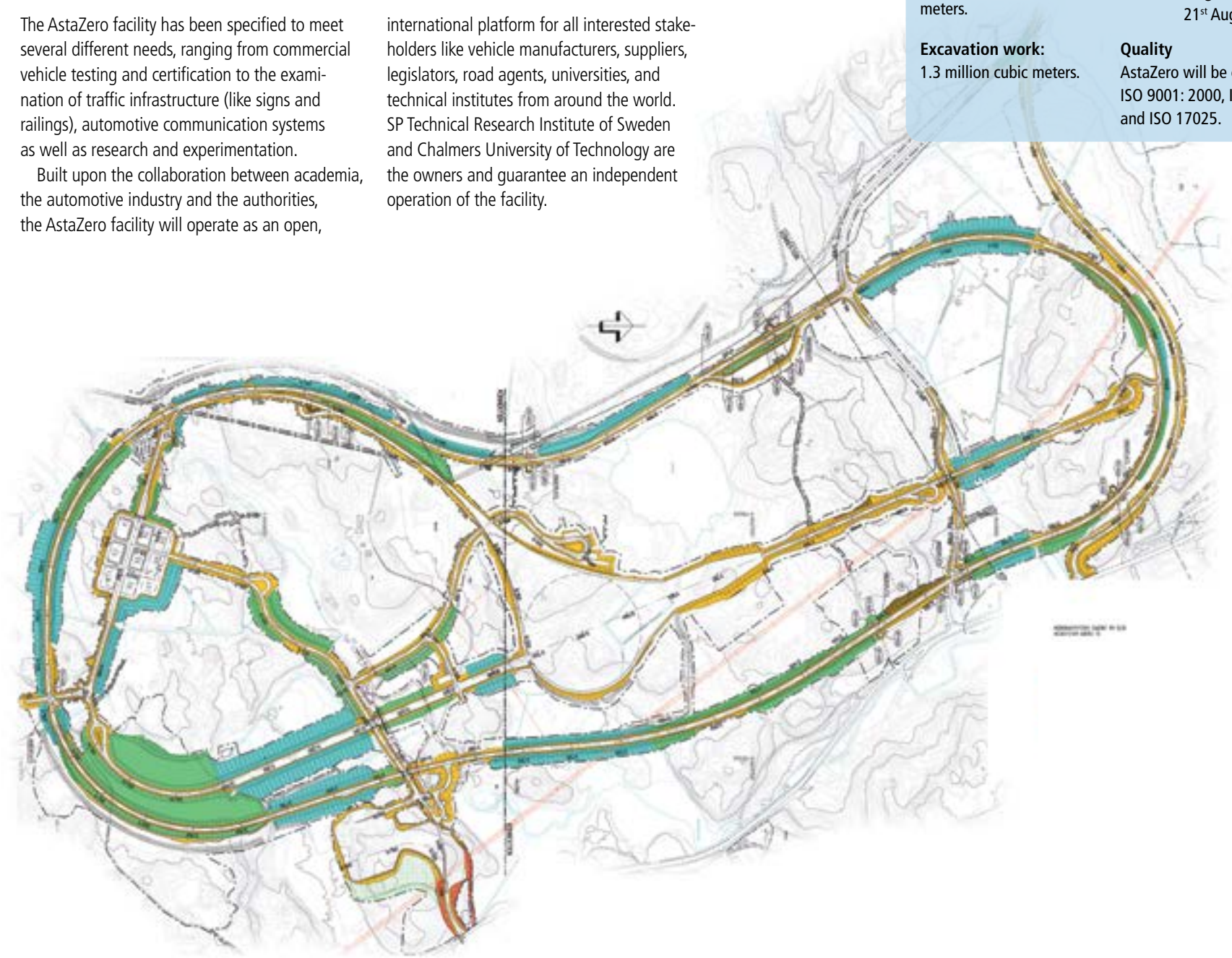
Paved surfaces:
About 250 000 square meters.

Excavation work:
1.3 million cubic meters.

Construction schedule

2011 Prospecting and design.
2012 Design and start of ground works.
2013 Construction
2014 Inaguration 21st August

Quality
AstaZero will be certified for ISO 9001: 2000, ISO 14001 and ISO 17025.



BASIC INFORMATION

Core Services

- Unique environments to build any scenario in order to develop, test or certify new traffic safety solutions; making it possible to test literally all aspects of active safety in one place.
- Centre of Excellence in development of methods and test equipment.
- Proving Ground cooperation.
- Simulation of the entire facility to run pre-tests or for the early stages of research and development.
- Demonstration facility and assistance with product launches, conferences and corporate events.

Complementary services
AstaZero will provide a range of services that clients may need during their stay, like:

- Hotel booking.
- Catering.
- Organisation of events.
- Shuttle traffic to and from the facility.
- Car rental.
- Shipments.
- Reparations.
- Loading and unloading client´s materials.
- Special fuel purchasing.
- Weather information.

Location
The AstaZero facility is located close to Gothenburg in the south western part of Sweden, where the climate allows all-year-round testing with warm summers and cold winters. The facility is only half an hour drive from Landvetter International Airport, and accessable by motorway.

Offer

AstaZero will guarantee a world-class Proving Ground; offer a range of services that will lead to great customer satisfaction and a customer interface that is characterized by highest levels of service, efficiency and professionalism. The facility has been specified to meet industrial needs, and at the facility, customers individual challenges and their solutions are the focus of the entire operation.

Proving Ground offer
AstaZero will always adapt its offer based on the varying customer needs. Customers choose if they want their tests to be carried out in secret or not, and if they want to rent the entire facility or just one or a few of the different track sections:

- Simply hire the facility or parts/part of facility
- Hire the facility and available expertise (different options depending on requirements)
- Hire the facility, expertise and subsequent execution of test analysis.

Technician offer
Research engineers and other technicians employed by AstaZero will be available to provide support and assistance during testing and development work and participate in research projects by:

- Developing and contributing tests and testing methods and measurement equipment.
- Developing and maintaining equipment, devices and aids.
- Functioning as a resource for customer company's development and test projects.
- Contribute to the design/development and creation of prototypes for different functions as assigned by customers.

Open environment
AstaZeros open environment means that anyone is welcome to test different scenarios and functions at the facility. In addition to the opportunities for testing, research and development, AstaZero will also host demonstrations and assist with product launches, conferences and corporate events.

Under constant development
The AstaZero facility will be built in two stages. Stage 1, or the facility's basic offering, is planned for completion in August 2014. Extensive work is already underway in preparation for stage 2, by gathering information about future requirements within the automotive cluster; all to ensure that from an international perspective, AstaZero can provide a most comprehensive range of testing and research environments involving active safety.

However, the AstaZero facility will always be possible to develop in order to constantly be at the forefront of development, maintaining its unique customer offering. One part of this unique offer is to continously give customers the opportunity to influence the facility's design for their individual requirements.

Bookings
Since the 1st of January 2013 it is possible to book AstaZeros facility from the 1th of October 2014.

For booking inquiries, please contact us at: phone number **+46 703 435 945** or email address **bookings@astazero.com.**

Research and development

Research carried out in recent years has brought about great technological progress in the field of active safety. Some of the basic functions of active safety systems, such as autonomous emergency braking, are already being installed in new car models.

Several new autonomous functions are set to be developed in the next few years. Semi-autonomous driving with, for example, vehicle platoons is predicted to be just 5-10 years away from large-scale introduction.

Designing an active safety system to be in use for at least 10 years is a difficult task, and one of the main challenges is to make sure that we will be able to handle increasingly intelligent traffic systems in a holistic manner. Collaboration between academia and industry is therefore vital as there is a tendency for the challenge to be viewed from different perspectives.

While OEMs primarily focus on how to develop smarter in-car systems, academia tries to focus not only on vehicular systems but also on other traffic participants and integrated traffic management in general. These perspectives - how to equip vehicles (cars, trucks, buses etc.) and road users (cyclists, motorcyclists, pedestrians, the elderly etc.), and how mobility management in general affects active safety - are equally important and necessary if we are to enhance traffic safety in the future.

NUMEROUS RESEARCH AREAS

Academia and industry have identified several areas of research that are essential if active safety systems are to be reliable at all stages throughout the lifetime of a vehicle.

New research areas are continuously being identified, so the small number of areas described here are only to be regarded as examples, indicating rather than establishing what kind of research and tests might be conducted at AstaZero in the future.

In this context it is important to stress that AstaZero as an organisation will not be performing this kind of research and development, but that the facility itself will enable research and development in all possible areas related to active safety.

As what AstaZero offers will always be adapted to customer needs, it is the industry and the academy in general that will define what areas will be most important at any given time.

Some areas of possible interest

AUTONOMOUS DRIVING

Autonomous driving could be described as active safety in its most advanced form. It will be accomplished when and if technology allows vehicles to be completely self-operating, independent of any input at all from the driver. In reality this requires vehicles to have driving capabilities comparable to those of an experienced human driver with the addition of being able to handle critical traffic situations reliably and that the systems are meticulously tested. There is a clear trend among prototype developers to create technology for self-driving vehicles, but an enormous amount of research and development is still required if the systems are to be sufficiently safe and reliable throughout a vehicle's lifetime.

COMMUNICATION SYSTEMS (SATELLITE GPS, V2X)

Intelligent communications systems can be used to realize better active safety systems. The basis of these new systems is that they will make it possible both for vehicles to communicate with other vehicles and for vehicles and infrastructure to communicate with each other. (V2V and V2I). Precise localisation with international satellite navigation systems such as the US GPS, Russian GLONASS and the forthcoming European Galileo in combination with communication capabilities can enable interconnected protective systems. Highly accurate positioning of test vehicles (initially via GPS and differential GPS) is required as reference on test-tracks in order to test and develop this technology.

PROTECTION OF VULNERABLE ROAD USERS

Road users without vehicles such as pedestrians, cyclists and light moped riders are the most vulnerable to traffic accidents. As vulnerable road users account for a large proportion of global road traffic deaths, developing safety systems to increase their protection is paramount. This is a complex area that relates to everything from integrated traffic management systems to how we can develop and improve warning systems that alert these road users. Hybrid buses, for example, are very quiet compared with normal car engines and can therefore be difficult to detect, not least for the blind. As people in traffic are trained to use their ears to detect danger, it might sometimes be necessary to create artificial noise for silent vehicles.

DEVELOPMENT OF TEST TARGETS AND EQUIPMENT

Test targets for active safety need to be equipped with camera and vehicle to x-communication since they will be part of an interconnected system. For example, it must be possible to mount these targets on flat carriers and to link and connect them with GPS and localisation systems. They can thus be programmed for predefined trajectories. In turn it must be possible to equip the carriers with cameras in order to analyse nearby test collisions. Several different embodiments of test targets will be required, target vehicles with metallic surfaces of different vehicle sizes for example, and test targets for bicycles, motorcycles and pedestrians (children and adults).

TEST METHODS FOR FALSE POSITIVES (FALSE ALARMS)

Together with researchers, AstaZero aims to build a catalogue of methods for how to provoke false positives in order to test the robustness of active safety systems, confirming whether the algorithm is safe and reliable enough. Here methodology needs to be suitable for the actual test performed as, for example, camera-based and radar-based systems have different characteristics of false positives.

CREATION OF TEST SCENARIOS

Advanced tests require careful pre-planning in order to ascertain the correct scenarios. Although some tests at the AstaZero facility can be standardised, most tests will probably need to be conducted first in an AstaZero 3D virtual environment. It is only then that the researchers will know which scenarios are most critical, and will then be able to focus more specifically on them. This is also a good way to guarantee the quality of the test, ensuring that the time spent at the facility is not wasted by selecting the wrong test scenarios or even technical problems, which can be ruled out with proper test preparation based on simulations.

DRIVER BEHAVIOUR

Human factors such as distractions or tiredness are the main reason behind most traffic accidents. Modern cars will therefore increasingly have electric controls, including warnings that alert the driver to the risk of an accident situation. Advanced systems are under development that detect whether the driver is dozing off, stressed or under the influence of alcohol. When developing these systems, account must be taken of the fact that people react differently to specific situations, and extensive research and testing is therefore necessary to develop driver models that produce reliable systems.

NEW POWERTRAINS

The introduction of electric vehicles has brought with it some new risks that have to be tested, not least for new active safety functions. Apart from the more common problem of how to store batteries in the car with respect to centre of gravity and weight, there are also several aspects related to how to heat vehicles sustainably. Furthermore, safety also has to be guaranteed for electrification in an accident situation, for instance due to a voltage drop or where there is an electric shock or a fire. It is important to test whether, and the extent to which, the safety systems still work if they are involved in an accident.

GENERAL DESIGN

All paved surfaces are designed for:
- 60 tons maximum vehicle weight. (tonne if 1000 kg = 1 tonne)
- 12 tons axel load. (tonne if 1000 kg = 1 tonne)
- Maximum vehicle length of 25.25 meters.

All internal roads are designed for:
- Bi-directional traffic.
- Right-hand traffic.
- Road width of 7 meters.

Areas for calibration:
- 3 by 15 meters.
- Made out of concrete.
- Flatness better than 0.1 degrees in all directions.

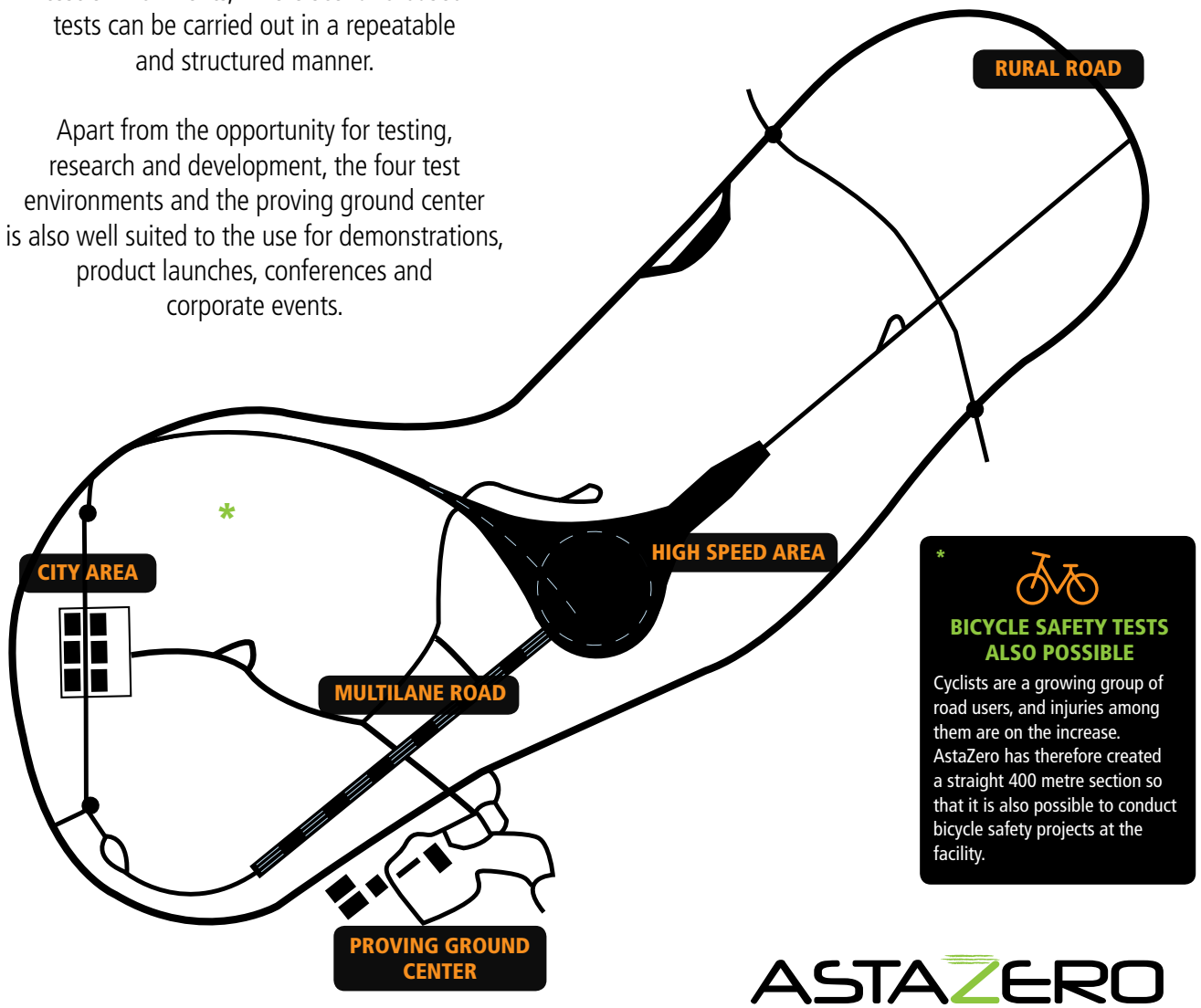
Roadside infrastructure:
- Conduit for electric power, fibre and communication/control. Installed along the full length of the accelerations roads, the Multi-Lane road and the Rural Road.
- Access points every 150 meters.
- Underpasses to the remote side at each access point.
- V2V and V2I.
- Conduit to appropriate control rooms for future installations.

Differential GPS:
- Base station which covers the whole area.
- Target – Hunter systems with Real Time Kinematic (RTK).
- Video system synchronized to position.

The facility

The AstaZero facility consists of four test environments, where scenario based tests can be carried out in a repeatable and structured manner.

Apart from the opportunity for testing, research and development, the four test environments and the proving ground center is also well suited to the use for demonstrations, product launches, conferences and corporate events.



* **BICYCLE SAFETY TESTS ALSO POSSIBLE**

Cyclists are a growing group of road users, and injuries among them are on the increase. AstaZero has therefore created a straight 400 metre section so that it is also possible to conduct bicycle safety projects at the facility.

ASTAZERO
ACTIVE SAFETY TEST AREA

GENERAL DESIGN

Dummies:
- Pedestrians.
- Balloon cars.
- Animals.
- Material to make new targets.
- Remote control of balloon cars and test vehicles.

Garages
- Garages for passenger cars, 6x8 meters.
- Garages for trucks, 7,2x25 meters.
- Garages at control rooms, 5,8x10 meters.

Communication resources:
- Wi-Fi coverage for the area.
- High-speed Internet connection in all control rooms and garages.
- Mobile phone coverage in the area.
- Video conferences.
- V2V and V2I – installation prepared.

Communications technology (V2V and V2I)

An important aspect of active safety is based on new and advanced technologies which allows vehicles to communicate with each other (V2V) and with their surrounding environment (V2I). At the AstaZero facility, customers will be able to test the very latest in communications technology.

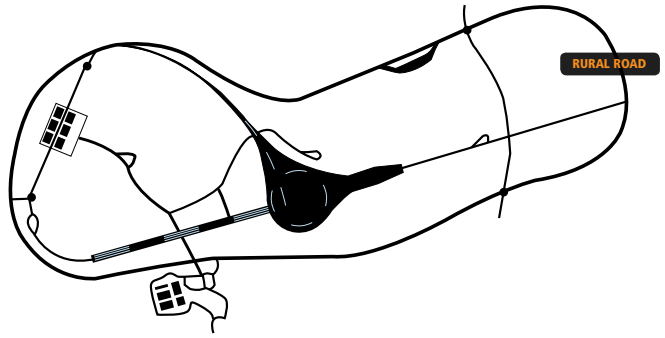
Rural Road, August 2013.

FEATURES

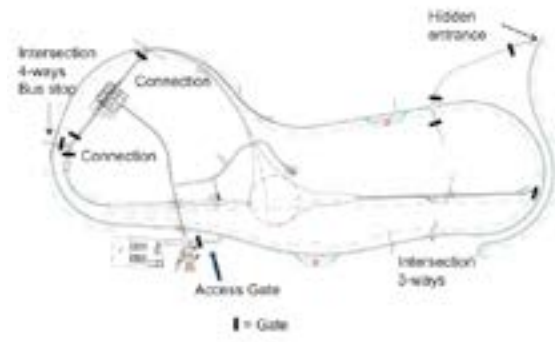
- Normal road standard/safety.
- NOT for advanced driving.
- Slightly hilly, max 4.5 % incline.
- For Bi-directional traffic.
- Normal setup = right-hand traffic and one-way traffic.
- Foundation for traffic signs.
- Hidden access to public roads.
- Traffic signs showing:
  – Distance.
  – Name of the place.
  – Curve radius.
- Electronically controlled signs, 4 pcs.
- Prepared places for testing with different targets like pedestrians, cyclists, crossing vehicles, bus stops etc.

TEST ENVIRONMENTS

Rural road

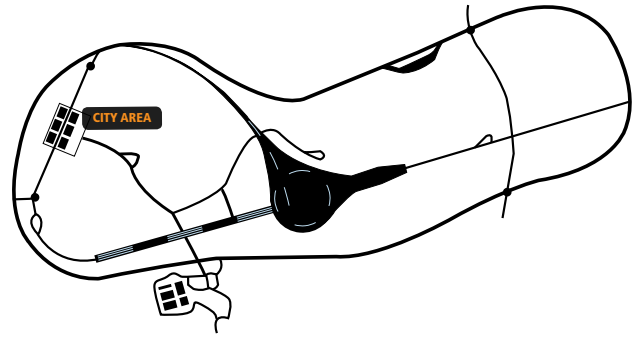


The Rural Road encircles the facility. It is approximately 5.7 km long, of which one half is adapted for 70 km/h and the other half for 90 km/h. The Rural Road is specially designed for different tests of driver behavior and is well-suited for the use of hidden or suddenly appearing obstacles. At the road, there will be two T-junctions and a crossroad with signage in the specified language and changeable to suit customer requirements. The Rural Road will also have bus stops/lay-bys at two locations.

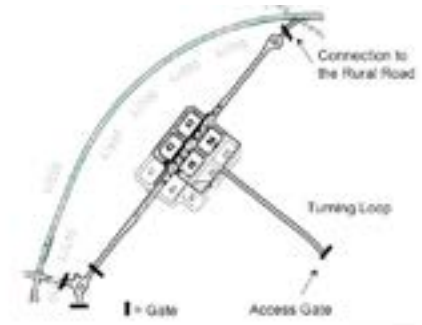


TEST ENVIRONMENTS

City Area



The City Area is located in the southern part of the facility and is connected to the Rural Road in two places. It will initially consist of 4 blocks, but there are plans to supplement it with a further five. The City Area will primarily be used to test the vehicle's capacity to interact with the surrounding environment to avoid hitting buses, cyclists, pedestrians or other road users. The area therefore covers a number of different sub-areas, such as a town centre with varying street widths and lanes, bus stops, pavements, bike lanes, street lighting and building backdrops. The City Area also has a road system with different kinds of test environments such as roundabouts, T-junction, return-loop and lab-area.



City Area, August 2013.

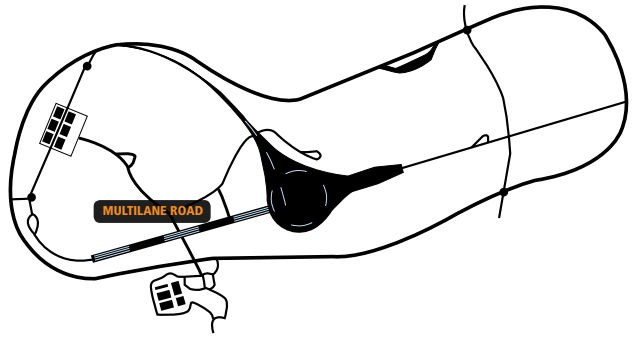
FEATURES

- Each Block 40 by 25 meters, approx. 4 meters high. Streets have a 2.0% incline for good drainage into sewage drains.
- Acceleration roads, longer than 150 meters before the intersection.
- Lab area approx. 100 by 30 meters.
- Loading dock for trucks; 10 by 1.5 meters.
- Main street equipped with "Portals" with traffic signs.
- Pavements, bike lanes and lane markings.
- Crossing street, 7 meters wide plus pavements.
- Pedestrian crossing with signs.
- Prepared foundations for additional traffic signs.
- Outlets to charge electric vehicles and batteries.
- Simple garage for weather protection.
- Equipment to generate various scenarios.
- Refuge, traffic signs, curbs and traffic lights.
- Platform for visitors.

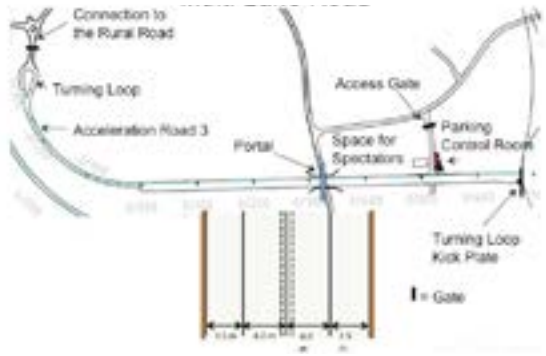
FEATURES

- Four lanes with space for barriers.
- Acceleration road approx. 300 meters long, 7 meters wide with turning loop for long vehicles.
- 2 % lateral incline for good drainage, split between lane 1 and 2.
- Small intersection.
- "Portal" with road signs.
- Separate control tower.
  - Two stories high for good visibility.
  - Platform on the roof for visitors and prepared space for 100 spectators.
- Parking space with outlets to charge electric vehicles and batteries.
- Warehouse for equipment like traffic signs and cones.
- Remote control of targets, balloon cars and driving robots.

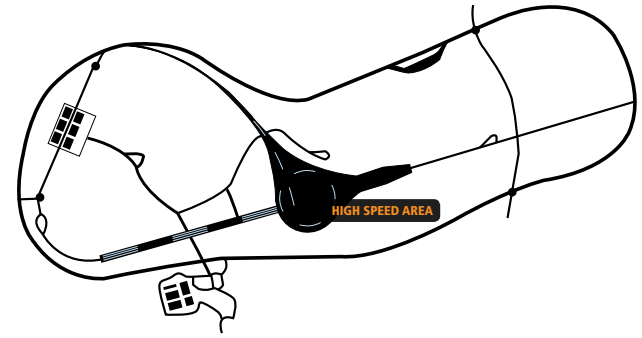
Multilane Road



The Multilane Road is 700 meters long and consists of four lanes. These are connected to the High-Speed Area, with an acceleration road that is approximately 300 meters long, 7 meters wide and with turning loop for long vehicles. Several different scenarios can be tested on the multilane road, such as lane changes, different collision scenarios and crossing scenarios. For example, it will be possible to change the direction of travel in different lanes, as well as to build a temporary central barrier and different types of traffic barrier railings.



High-Speed Area



The High-Speed Area is located at the centre of the facility. It consists of a circular area with drop ad-ons, 240 meters in diameter with two acceleration roads. Acceleration road one is approximately 1 kilometre long. In addition to the two acceleration roads, it is also possible to use the Multilane Road for acceleration, which means vehicles can enter the High-Speed Area from 3 different directions. In this area, focus will primarily be on vehicle dynamics like avoidance manoeuvres at very high speeds.

FEATURES

- Slopes 1% laterally.
- Completely flat in the longitudinal direction, (flatness 1.0 acc. to IRI).
- Asphalt acc. to SN75-80.
- Basic illumination.
- Rigid fences around the whole area with cushions in front.
- Turning loop for long vehicles (25,25 m) at the end and halfway with a width of 7 meters.
- Separate control tower.
  - Two stories high for good visibility.
  - Platform on the roof for visitors and prepared space for 100 spectators.
- Parking space with outlets to charge electric vehicles and batteries.
- Space for 10 cars plus one bus.
- Warehouse for equipment, traffic signs and cones.
- Remote control of targets, balloon cars and driving robots.
- Calibration area at the first turning loop (for gyros).
- Conduit along the acceleration roads (for future needs).

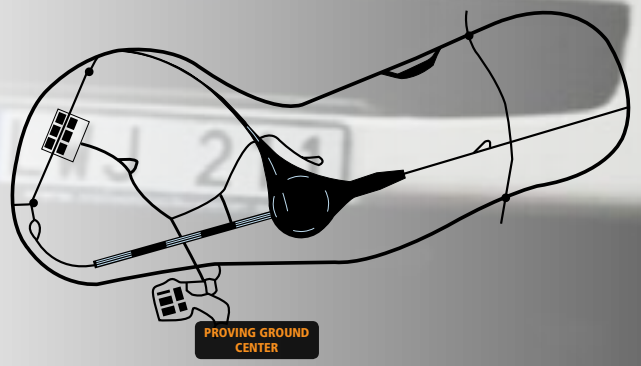
Proving Ground Centre,
August 2013.

FEATURES

- Garages for 10 cars (5 with lifts).
- Garages for 2 long vehicles, 25,25 meters long.
- Overhead crane for loading, capacity 2-3 tons.
- Fuel depot.
- Car wash.
- Calibration surface (for gyros).

TEST ENVIRONMENTS

Proving Ground Centre



The AstaZero Proving Ground Centre consists of several elements, including a guarded reception, traffic control, a visitor's centre, conference rooms, office space and separate research areas for visiting personnel, as well as garages and workshops.

Both office space and research areas will be available with the option of long as well as short term rental. These areas will also be adapted to each customer's requirements, and can be used for open as well as closed projects. Safety and privacy are of the highest priority.

For more information about the test environments, please visit the AstaZero homepage at www.astazero.com

A step towards zero traffic fatalities

AstaZero is constructed for the development, testing and certification of active safety systems, necessary if we are to limit future accident statistics.

Contact information

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Booking inquiries
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