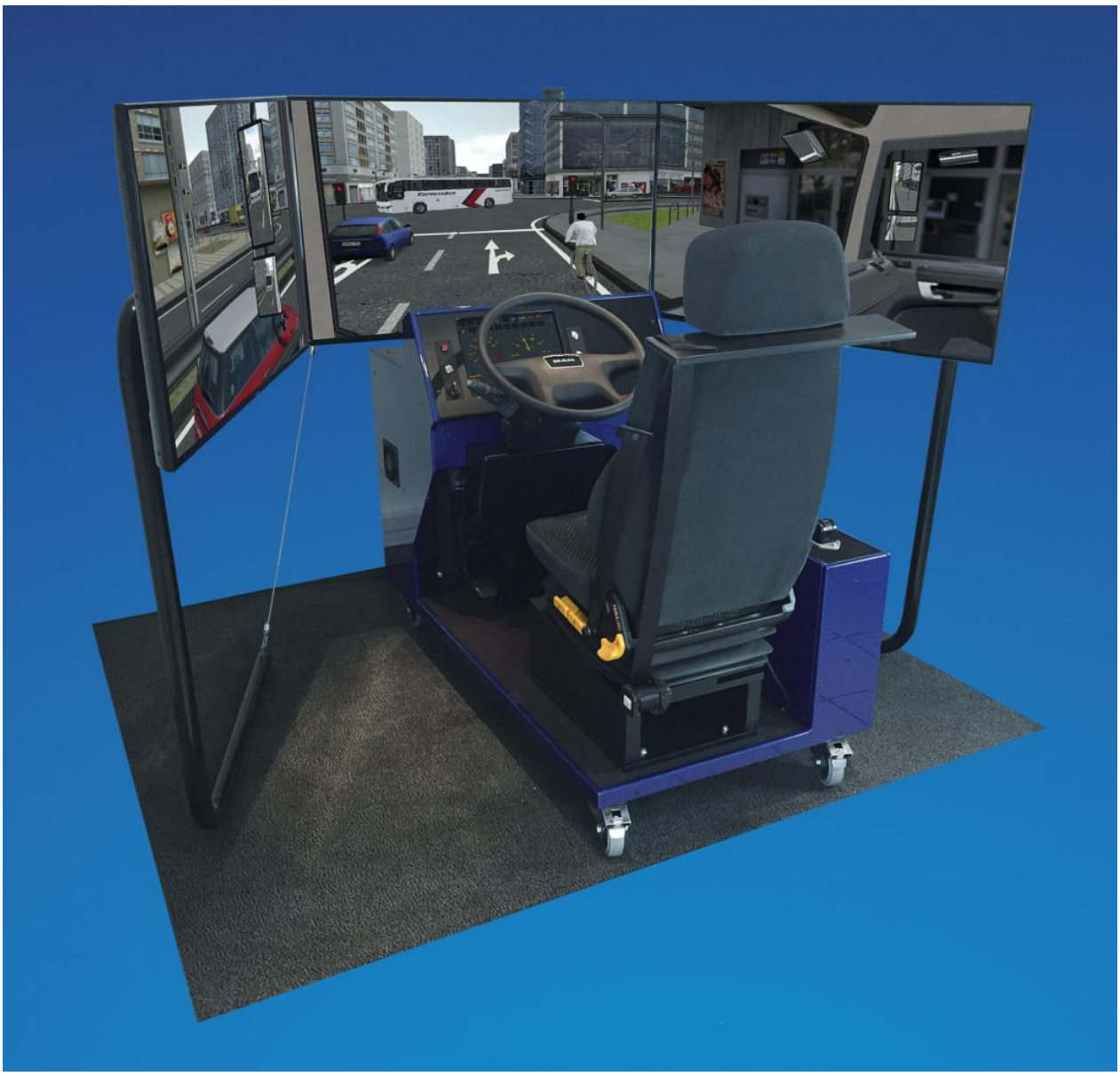
FOERST
Driving Simulators
Research Development Production

Foerst GmbH
Industriegelände 5
D-51674 Wiehl
Germany
Tel.: 0049-2262-72970 0
Fax: 0049-2262-72970 12
info@fahrsimulatoren.eu
www.fahrsimulatoren.eu

Truck/Bus -Simulator „Tutor“

Type: F12HF-3/L43

Product Description and Technical Specification



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General

The truck simulator serves not only the purpose that the handling of the operational elements in a short time, fuel-efficient, environment-friendly, without wear and tear, and without risk for man and machine can be trained, but it can also be used without any regard to weather and traffic conditions. Further advantages of our simulators are the reproducibility of traffic situations, the replay after driving failures, the repeatability of exercises and the exact evaluation of driving and operating mistakes. A special advantage, is that trainees are confronted with unexpected situations, which may happen in real traffic but, due to the danger, can not be integrated in the educational program. So the simulator serves the operational control as well as making decisions. Due to its high-tech image and its reliable objectivity it is appreciated by all users.

Driving Stand:

The casing is a compact, robust construction with original MAN-components including a large steering wheel. For the gearshift a softtip lever is used. It can be used in automatic and a manual mode. The dashboard is replaced by a flat screen 15” and adaptable to various truck or bus types. The seat is adjustable in three degrees of freedom. The stand is equipped with the required controls for driving of a truck or bus such as:

- Steering wheel
- Gearbox (manual and automatic)
- Accelerator pedal
- Brake pedal
- Clutch
- Retarder
- Speedometers, temperature engine instrument, oil pressure etc.

Dimension:

The overall dimensions are :

Width: 2.20m, length 1.70m, height: 1.50m

Sight System

The Sight-system will be built out of three picture screens. The complete system enables a virtual hhorizontal angle of view 180-degrees. The pictures serve the visual presentation of the virtual world of driving simulators.

Technical Speciation:
Type: LED Monitors
Number of LEDs: 3
Resolution: Full HD 1920 x 1080 per channel.
Diagonal of each screen: 43”

Simulator Computer Hardware

For the Simulator a normal-shaped personal computers is used. The PCs are of new commercial standard.

Technical Characteristics:
- Operating System: Windows 10, 64bit
- CPU: QUAD Core. I5 or better
- RAM: 8GB
- Graphic card: NVIDEA 1060 or better

Audio System

The audio system comprises two channels and at least two loudspeakers for the treble frequencies and one loudspeaker for the bass frequencies. The loudspeakers are of the active type, so that they can be connected directly to the audio output-signal of the PC. They are accommodated in the cabin.

All sounds are made by sampled recordings, especially the engine sound, which is dependent upon the revolvation and the torque of the simulated engine. Other sounds are starter, squeaking tyres, crashes, rain, drive wind, splash water, scratching tooth wheels, traffic and human voice.

Software Performance of the Driving Computer

The software includes driving dynamics, noise generation, graphics generation, data base, virtual objects, scenarios, training/curriculum, menu control, adaptation to the customers’ country’s conditions and evaluation.

Driving Dynamics

The characteristics of a real vehicle are simulated. Any parameters as maximum speed, acceleration, deceleration at braking, vehicle mass, torque/revolvation-characteristics, gear ratio, maximum power, and wind resistance are modifiable. Also longitudinal and lateral accelerations are computed. At excessive centrifugal acceleration in curves the tyres drift to the outside, so that the barrier may be touched.

Graphics Generation

Picture resolution 1920 x1080 pixel per channel, colour depth 24 bit (true colour), The images have texture mapping with anti-aliasing.

Data Base

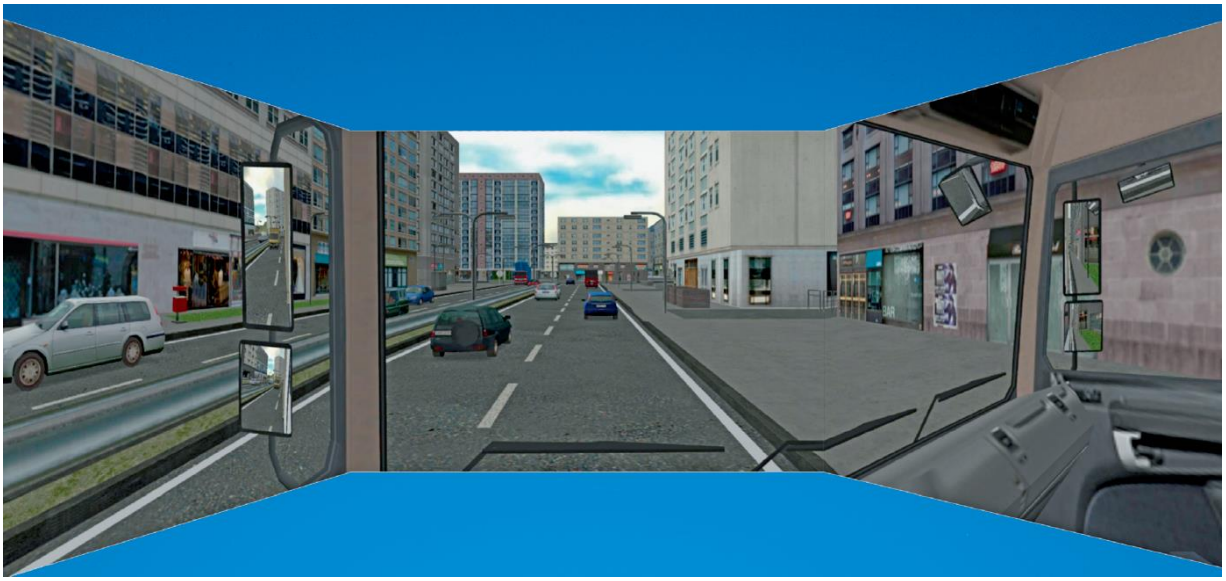
The virtual world comprises rural, mountain and urban roads, highways and motorways. The courses include crossings, traffic lights, traffic signs, rises and falls, forest, entrances and exits for motorways.

Virtual Objects

The system offers houses, cities, wood, many extras, traffic signs, animated pedestrians and animals. There are cars, trucks, buses, motor cycles, cyclists and other vehicles.

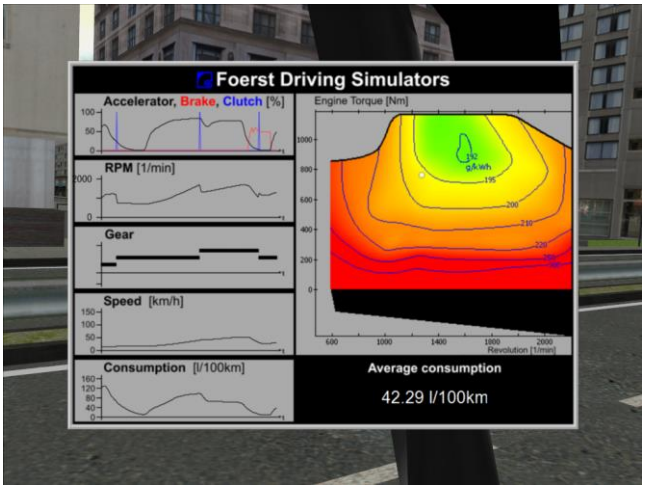
Rear Mirrors

The images for the left and the right exterior mirror are generated and displayed on LCD screens. They show all virtual objects from the back side and all following and removing road users.



Replay and diagrams

The simulator provides the possibility to show a complete replay of the last driven scenario. There is a possibility for fast forward, fast backward, stop and play. The view point is a helicopters view. Addinal the simulator can show diagrams of the most important parameters during the replay (if requested also during the ride)



Traffic

The traffic includes at least 30 road users with artificial intelligence, comprising passenger cars, trucks, pedestrians and cyclists, who may at the same time appear in the view range. They observe the traffic rules, the distance to the foregoing vehicle and the speed limits, come to a stop before red lights and crossing traffic, accelerate and decelerate in a natural way and may be passed. Obstacles are put into the scene with critical timing to cause sudden reactions. Collisions between the own car and other road users or obstacles are detected and cause reduction of the speed to zero with text edition. Run-on accidents, frontal accidents and others are detected and indicated.

Computer Diagnosis
Any technical input- and output data are shown on a diagnosis table in the menu on demand.

Simulated Vehicles and Surrounded Traffic

The trainee can drive by choice of the instructor the following standardised vehicles:

- Semitrailer
- Truck with drawbar combination
- Truck with tandem Trailer
- Coach
- Public transit bus
- Tanker Truck
- Fire-Vehicle
- Dumper Truck

Depending on the scenarios the instructor can set various parameters like the amount and the balance point of the load, the use of ABS and ESP and the use of driver assistant systems like lane deviation warning or cruise control.

The surrounded traffic includes at least 30 road users with artificial intelligence, comprising passenger cars, trucks, pedestrians and cyclists, who may appear at the same time in the view range. They observe the traffic rules, the distance to the foregoing vehicle and the speed limits, come to a stop before red lights and crossing traffic, accelerate and decelerate in a natural way and may be passed. Obstacles are put into the scene with critical timing to cause sudden reactions. Collisions between the own car and other road users or obstacles are detected and cause reduction of the speed to zero with text edition. Run-on accidents, frontal accidents and others are detected and indicated.

Curriculum & Scenarios

The simulator is an educational tool which supports the instructor to explain and the student to practice the following issues:

General driving knowledge

- recognize the risks during driving and evaluate their importance
- efficiently control the vehicle in order not to create dangerous situations
- Comply with the driving legislation
- Be aware of other drivers and secures the movement of the other vehicles
- be aware of the principles that determine his driving behavior in several weather conditions.
- be aware with all related to the safety belt use and safety issues

Driver skills

- be able to control the state of lights, mirrors.etc.
- adjust the driving seat
- adjust safety belts
- use the accelerator and brake pedal
- use the gears
- use the braking systems
- start and drive smoothly
- turning correctly
- driving backwards
- Maneuvering and parking
- Driving in a passenger friendly way (for busses)

Driver behavior

- recognize signs and dangers
- communicate and respect the other road users
- react correctly and in time
- comply with driving legislation
- adapt to driving conditions
- changing lanes
- keep safety distances
- right crossing
- overcome difficulties
- overtake parked cars

The scenarios are divided up the following sections:

- **Road Safety** (Risk Awareness). (Various hazard situation in different environments and weather conditions)
- **Maneuvering** (Maneuvering scenarios. Also designed for the training to maneuver backwards with trailer or semitrailer)
- **Eco-Driving** (Scenarios for analyzing the driving style in regard of safe and economical driving)
- **Free Driving** (Driver can train driving without special scenarios in random traffic. Useful for the training of the basic driving skills)

Road Safety (Risk Awareness)

The program “Road Safety” is meant to be used for hazard perception training. To this end, it offers a set of scenarios featuring critical situations in various surroundings. The driver is required to properly react in order to prevent an accident. Using an alcohol simulation, the traffic scenarios and the contained hazard situations can be used to demonstrate the dangers of driving under the influence of alcohol.
Additional all scenarios can be combined with the following weather conditions: Sunny, dawn, night, rain, fog or snow.

City - 3 different scenarios. Driving time 3-5 min. Each containing various hazard.

Suburb - 3 different scenarios. Driving time 3-5 min. Each containing various hazard.

Rural Roads - 4 different scenarios. Driving time 3-5 min. Each containing various hazard.

Motorway - 3 different scenarios. Driving time 5 min. Each containing various hazards.

Mountain – 4 different scenarios. The driver trains driving in the mountains. In particular, he is confronted with serpentines and tunnels.

The rides comprises various hazard situations like:

- Animals on the road
- Pedestrians passing the road
- Parking cars starts
- Road damages
- Unclear situations with limited view
- Blind bend
- And many more

Single hazard situations can also be selected separately. (Duration about 30sec)

Scoring:
At the end of every road safety scenario a “Score” will be calculated and shown in the evaluation table. Based on 100% points are subtracted for every mistake during the ride. To the bottom the score is limited to 0%.

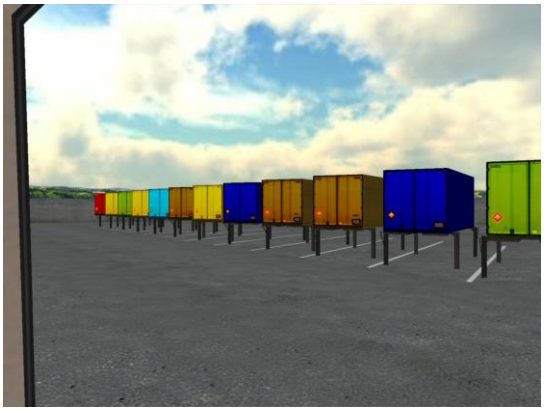
During the ride the ride can be “freezed” by the instructor and after an event some information like reaction-time, stopping distance etc. is given.

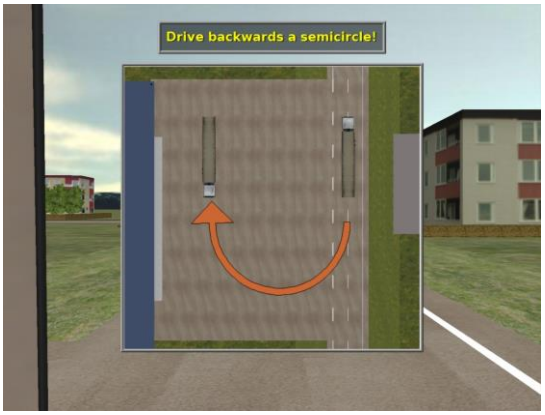
Manoeuvering

This Program offers the driving of a passenger car with a trailer. In different scenarios both driving forward and backward with a trailer will be trained.

This program offers seven scenarios with different driving tasks.

- Turning on narrow junction
- Slalom around Pylons
- Following the road backwards
- Turning with side road
- Circle drive backwards
- Parking backwards
- Loading platform
- Swap body container
- Free maneuvering





This program allows the permanent computation and the display of the current and average fuel consumption during a simulation ride.

The following techniques for fuel-efficient driving can be trained:

- overrun fuel cutoff by engine braking when decelerating
- early gear switching, using the highest possible gear when driving uphill
- avoidance of unnecessary braking and acceleration manoeuvres
- anticipatory driving style

Rides in the City, in suburban area, on a rural road , a motorway and in mountains are available.

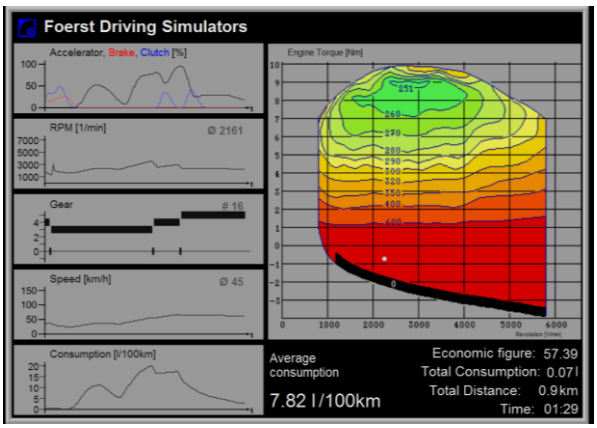
The fuel consumption of the simulated medium-class passenger car is calculated as a function of motor torque and revolutions per minute.

The position of the accelerator pedal, the speed and the current fuel consumption are diagrammatically shown as functions of time. The average fuel consumption is also constantly calculated and displayed. The specific fuel consumption (i.e. fuel consumption in relation to power output) is displayed as a point in the engine map to the right of the other diagrams.

The engine map visualizes by graphical means the physical fact that combustion engines work most efficiently at low revolutions per minute and almost open throttle valve. The axes represent the revolutions per minute and the mean piston pressure. The latter is proportional to the engine torque. The blue lines are lines of constant specific fuel consumption. The areas between them are coloured green for low consumption to red for high consumption.

A small marker square shows the current working point of the engine as determined by the trainee's driving style.

By observing the movement of the working point, one can see how the driving style influences the fuel consumption. Not only does the consumption rise with rising speed, but also it falls when choosing higher gears. By carefully choosing the right combination of torque and revolutions per minute when accelerating or going uphill, it is possible to save fuel while still moving swiftly.



Free Driving

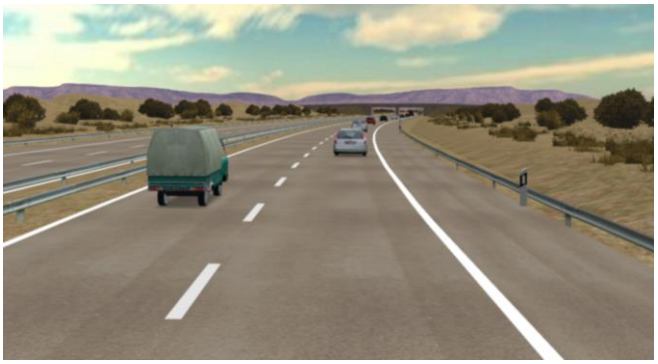
“Free driving” means, that you do not have to obey a training curriculum or are exposed to a fitness assessment, but that you may choose your speed and track by your own. Several parameters for the drive may be adjusted in the menu.

The program “Free Driving” offers the following choices:

Various Courses
Various starting points
Various sight and road surface conditions
Traffic density

The virtual world comprises rural, mountain and urban roads, highways and motorways. The courses include crossings, traffic lights, traffic signs, rises and falls, forest, entrances and exits for motorways.

The free driving module is used to train the basic handling of a truck.



Options (not included in the basis-version)

Option: Motion support

A motion support is mounted under the bottom plate of a “Tutor” driving stand. So the driver’s feeling during steering, accelerating and braking is improved. Road unevenness, rises and falls and the can be simulated, The Simulator can be equipped with a motion support located under the drivers seat. It enhanced the feeling of reality in regard to accelerating, braking, side forces and road border violations.

Option: Enhanced Sight System (not included in the Basic-Version):

Instead of the 43” Screens the Simulator will be equipped with 60”.

Option: Control Desk (not included in the Basic Version):

The simulator can be supervised with aid of the control desk which offers the needed administrative services and the possibilities to start, trace and manipulate scenarios. Enhanced replay functions which are also showing diagrams of the most important information offers comprehensive post briefing.

Software Features of the Control Desk

- Replay functions include fast- forward and backward, slow motion and multi-angle perspectives (Drivers view, top-down view, helicopters view)
- Handling of drivers data
- Possibilities to create new sequences of scenarios.
- The instructor monitor the ride from various perspectives by aid of two three- dimensional views.
- The instructor is able to manipulate the scene by manually inserting or changing vehicles, weather conditions and various events.
- Overview information is provided including all current simulator status (preparing, executing, evaluating), instrument and pedal status and current drivers failures.

The control desk comprises one PC and two 24” LCD Screens. It is placed outside of the simulator.

General Restrictions of Driving Simulators

The following statements are valid for any driving simulator. They are independent from a special brand or manufacturer.

Kinetosis warning:
Driving simulators might cause a kind of dizziness called “kinetosis”. The producers of simulators try to minimize this effect, but it cannot be fully avoided.

Limitation of complexity:
There will be always a gap between “virtual reality” and “reality”. The full complexity of real traffic in regard of graphical environment, traffic behaviour and force-feed back can’t be reached. Please check our catalogues, descriptions and products to see the current level of realism.