LCT User Guide

Lane-Change-Test Driving Simulation according to ISO 26022
2011-09-16

This document describes the installation and basic application of the Lane Change Test (LCT) software. For detailed information of the test procedure see ISO 26022.

Important Note
The LCT software and this documentation were developed within ISO/TC22/SC13/WG8 by the Lane Change Test (LCT) Task Force members and their colleagues on a volunteer "best effort" basis. The intent was to implement the algorithms and computational procedures defined in ISO 26022 to the extent practicable, and for the benefit of interested users. However, ISO, the LCT Task Force, and its volunteer member participants do not warranty the software or its documentation in any manner, including accuracy of representation of the algorithms or completeness of the computational procedures. The computational procedures and data analysis methods provided in the Standard speak for themselves. If there is any question, a user of the Standard is free to independently implement those computational procedures and methods in any way that they see fit.

Hardware requirements

- PC with Windows 2000, XP, Vista, Windows 7 and DirectX 8 (or higher) installed. DirectX is a software interface which can be downloaded from Microsoft free of charge.
  Recommended: 512 MB RAM and Processor speed >= 2GHz, XP professional; but less might also be sufficient.
- Graphics board with real DirectX 8 features (Vertex- and Pixelshader). Having a new version of DirectX on your computer does not necessarily mean that your graphics board has the required features!
  *Note: **Any PC which can handle modern 3D game software should work with the LCT.** But some PCs or Notebooks designed for office work (with low cost onboard graphics etc) might not be sufficient. If you use hardware of 2005 or older: There are two kinds of gforce4 graphic boards: "Ti" and "MX". The simulation works only with a "Ti" board (e.g. "gforce 4 Ti 4800") since the MX board does not support vertex- and pixelshader!*
- Force-feedback game steering wheel with foot pedals (accelerator and brake) with USB or Gameport connection (typically a yellow 15-pin connection). If the steering wheel is not recognized by Windows it might be necessary to use a setup of the steering wheel as a "2-axes, 4 button – joystick". The force-feedback is only used for centering the wheel.
  Note: There are two exe-versions available to start the simulation. If one of them doesn't work, you should try the other. If neither exe works correctly (e.g. if the foot pedals don't work) you might have to try another steering wheel. If no steering wheel is connected to the PC you can test the software with the arrow keys on the keyboard. Press F5 to toggle keyboard vs. steering wheel control.

- PC-Loudspeaker connected to sound card (engine sound and other sounds are simulated)

Installation

There is no real installation procedure. Just extract the LCT archive file to your hard disk. Make sure you have selected the "Extract with pathnames" option in your compression software!
Remember that DirectX 8.x or better must be installed (see above).

To adjust the steering wheel according to ISO 26022 (see the respective section in the ISO document) it is recommended to check the adjustments of the game device settings of Windows first (system settings, game controller). For a more detailed tuning of the steering wheel behavior the values *Ratio* and *Progr* in the section “Lenkung” in the file config.ini (main directory of LCT simulation software) can be adjusted:

[Lenkung] steering parameters
Ratio=1.0 steering ratio: resulting steering angle given full movement of steering wheel in radian (1.0 ≈ 57°)
Progr=1.0 steering progressivity

approx. sa = sm^sp * sr
sa: steering angle
sm – steering wheel movement
sp – steering progressivity
sr – steering ratio

If adjustment seems to be necessary, it is recommended to change the values in small steps of 0.1.

3. Lane Change Test driving simulation

Double click *“mbc_pc_std.exe”* or *“mbc_pclogitech.exe”* in directory *“LCT Sim v1.2”* to start the driving simulation. Which version you should apply, depends on the steering wheel you are using; (simply try out, which version works). Use the hardware sound adjustment of your loudspeakers to adjust the engine sound to a moderate level.

Key assignment

ESC	end simulation
X	toggle speedometer on/ off
D	toggle debugging info on/ off
1-9, 0	put car to the start of track 1-9, 0 (=numbers above letters on keyboard)
M	increase marker (shown in upper right corner for a few seconds)
N	reset marker to zero
NUM-Block	set marker 0-9
Ctrl + NUM-Block	set marker 10-19

Other keys (not needed for LCT)

F1	third person view = you see your car, only for demonstration (note that the experiments must be carried out in 1st person view)
F5	toggle input device: steering wheel/ keyboard (use arrow keys to drive)
Crtl/ left Shift	Gear up/down
R	Reset car to road
P	Screenshot (*.bmp file is written to hard disk)
Q	car model parameters (do not change!)

Details on the procedure

ISO26022 requires to use at least 5 different tracks in a randomised order to avoid learning effects. In the present software, 10 different tracks are implemented. After track selection the car will be set at the end of the previous lane. For example, when you press the number “5” the car will be set to the very end of lane 4. The driver must navigate through the U-shaped curve in order to reach the start of Lane 5. At the end of the curve he/she must drive at the maximum speed (which is limited to 60km/h in the config.ini file). The subjects are not allowed to reduce speed when they are on the track. Instead, the driver should keep the accelerator pedal pressed to the floor the entire time he/she is driving so that longitudinal control requires no effort at all.
For all other details on the procedure see ISO 26022.

Data Files and Logging

The output file is written to the main directory of your LCT simulation (LCT.exe) and is automatically named according to date and time (e.g. *“040105_093015.txt”* if the simulation started on January 5th 2004 at 9:30:15 o’clock). It is recommended to rename the file according to the experimental condition (e.g. from *"010104_093000.txt "* to *"s01_radio01.txt"*).

It is possible to connect to another computer for data logging. See the respective section in

the file “config.ini” and change the IP address and Port number accordingly.

[Logging] TCP/IP-Logging
IP=127.0.0.1 IP-Address of logging server
Port=4955 Port of logging server; Port=0 disables TCP/IP-Logging

LCT PC software sends a single text string with all available data/variables separated by a comma: Time(GMT), X-Position, Y-Position, Speed, SteeringAngle, TrackIndex, Marker, EngineSpeed, Gear