THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Test Environment for Automated Lane Keeping System Verification**
Author's name:	**Oskar Krejčí**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis reviewer:	Ing. Denis Efremov
Reviewer's department:	Department of Control Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — **ordinarily challenging**

How demanding was the assigned project?

The student had to get familiar with different driving simulators and automated lane-keeping system (ALKS) specifications in the thesis. Mr. Krejčí had to choose an appropriate driving simulator, implement the baseline ALKS solution, and verify its functionality automatically using the driving simulation software. The part of the assignment was to provide the ALKS functionality verification on the 'clean' data from ideal sensors used in the driving simulator and on noisy samples, including imperfections of real sensors.
I'm marking the assignment's difficulty as ordinarily challenging.

Fulfilment of assignment — **fulfilled with minor objections**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The student fulfilled all assignment tasks except one. The proposed ALKS was not tested on noisy data from the driving simulator's sensors.

Methodology — **correct**

Comment on the correctness of the approach and/or the solution methods.

The chosen approach is correct.

Technical level — **C - good.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The author described the chosen frameworks and the driving simulator well. However, I suggest a deeper description of the driving scenarios used to verify the proposed ALKS. I could also recommend explaining the tested functionality using video demonstrations or sketch pictures. Understanding the performance from graphs could be difficult for a regular reader.

Formal and language level, scope of thesis — **B - very good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The thesis is written in good English and is well-organized. It is sufficiently extensive. However, I should emphasize one minor linking mistake in section 4.4.1, leading to listing 4.3 instead of 4.2. Also, I would recommend using vector graphics everywhere possible (for example, in diagrams 3.1 and 3.2.)

Selection of sources, citation correctness	**A - excellent.**
Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?	
The thesis has adequate references to the used sources. The selection of sources is sufficient as well. The citations meet the standards.	

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The thesis could be a good starting manual in the automatic ALKS testing regarding the UNECE R157 standards. It covers all the steps needed to implement the testing laboratory environment based on the Carla driving simulator and the baseline solution implemented in Python 3 language for the ALKS system.
However, I see problems with the assignment fulfillment. The task 4 from the assignment is not covered in the bachelor thesis. I would also recommend a deeper description of the tested specifications using graphical representations or video demonstrations of the testing maneuvers during the thesis presentation.

The grade that I award for the thesis is **B - very good.**

I pose the following questions, which should be answered during the thesis's presentation and defense:

1) The ALKS implementation uses PID controllers for the lateral and longitudinal vehicle motions. Could you explain how the PIDs constants were obtained? Did you use the vehicle dynamics to analyze the stability and robustness property of the presented solution?

2) Did you consider commercial vehicle dynamics simulators, such as CarSim or IPG CarMaker? Is the baseline Carla vehicle dynamics model sufficient to cover vehicle dynamics for ALKS tests?

3) Could you define the Level 3 of driving automation according to the Society of Automotive Engineers (SAE) and explain why the ALKS functionality fits the Level 3 specifications? Which possible functionality changes could be made to shift ALKS functionality to Level 4?

Date: **29.5.2022** Signature: