DRIVES

Development and Research on Innovative Vocational Education Skills

ADAS/ADF Testing and Validation Engineer

Job Role Skill Set

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INTRODUCTION

1.1 OBJECTIVE

The objective of this deliverable is to provide an introduction to described Job Role within the applied skills definition model.

1.2 PURPOSE OF THE DELIVERABLE

The purpose of this deliverable is to define skills definitions of the ADAS/ADF Testing and Validation Engineer job role within the ECQA skills definition model.

1.3 SCOPE OF THE DELIVERABLE

The deliverable contains

- Description of the content of the Job Role
- Description of used Skill Sets and skills definitions, coverage of Qualification Schemas

The deliverable does not cover:

- Course development, as this will be done after the skill definitions clearly outlined the set of required courses.

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2 ECQA SKILLS DEFINITION MODEL

A skills definition contains the following items (see Fig. 1):

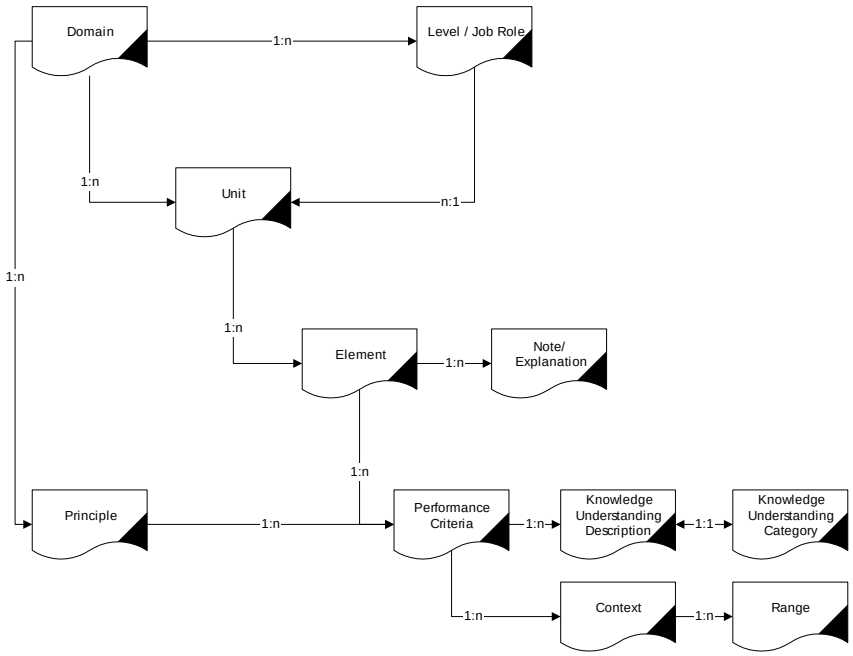


Figure 1 The Skill Definition Model (1:n = one to many relationship)

Context: A category of ranges; it represents some terminology used in a performance criterion that consists of different context, conditions or circumstances. A participant must be able to prove competence in all the different circumstances covered by the context.

Domain: An occupational category, e.g. childcare, first level management or software engineering.

Element: Description of one distinct aspect of the work performed by a worker, either a specific task that the worker has to do or a specific way of working. Each element consists of a number of performance criteria.

Evidence: Proof of competence.

Knowledge and understanding category: A category of knowledge and understanding descriptions.

Knowledge and understanding description: A description of certain knowledge and understanding. To be judged competent in a unit a participant must prove to have and to be able to apply all the knowledge and understanding attached to it.

NVQ (UK based): The National Vocational Qualification standard of England, Wales and N. Ireland.

Performance criterion: Description of the minimum level of performance a participant must demonstrate in order to be assessed as competent. A performance criterion may have relevant contexts.

Principle: A statement of good intentions; it underpins all competent domain practice.

Range: Description of a specific circumstance and condition of a performance criterion statement.

Qualification: The requirements for an individual to enter, or progress within a certain occupation.

Job Role: A certain profession that covers part of the domain knowledge. E.g. domain = Functional Safety, job role = Functional Safety Manager.

Unit: A list of certain activities that have to be carried out in the workplace. It is the top-level skill in the UK qualification standard hierarchy and each unit consists of a number of elements.

The rationales for developing the ECQA skills definition model is based on the skills definition proposed by the DTI (Department of Trade and Industry) in the UK for the NVQ (National Vocational Qualification) standards. These models have been re-used and slightly modified by other countries when they started employing skill cards [1], [2].

ECQA standards are used to describe the skills sets delivered within the DRIVES project (www.project-drives.eu). Further description and rationales are attached in annexes of this document. The ECQA structure was mapped in DRIVES project to DRIVES Reference and Recognition Framework with the links to ESCO[7], EQF[8], ECTS[9] and ECVET[10]. See more in deliverable DRIVES-D4.1.1 Reference and Recognition Framework – Analysis.pdf (www.project-drives.eu).

3 SKILLS DEFINITION FOR THE JOB ROLE "ADAS/ADF TESTING AND VALIDATION ENGINEER"

3.1 THE SKILLS HIERARCHY

Using the terminology outlined in the skills definition model and including the skills identified during the demand analysis at the beginning of the project, the following skills hierarchy for the job role "ADAS/ADF testing and validation engineer" has been designed.

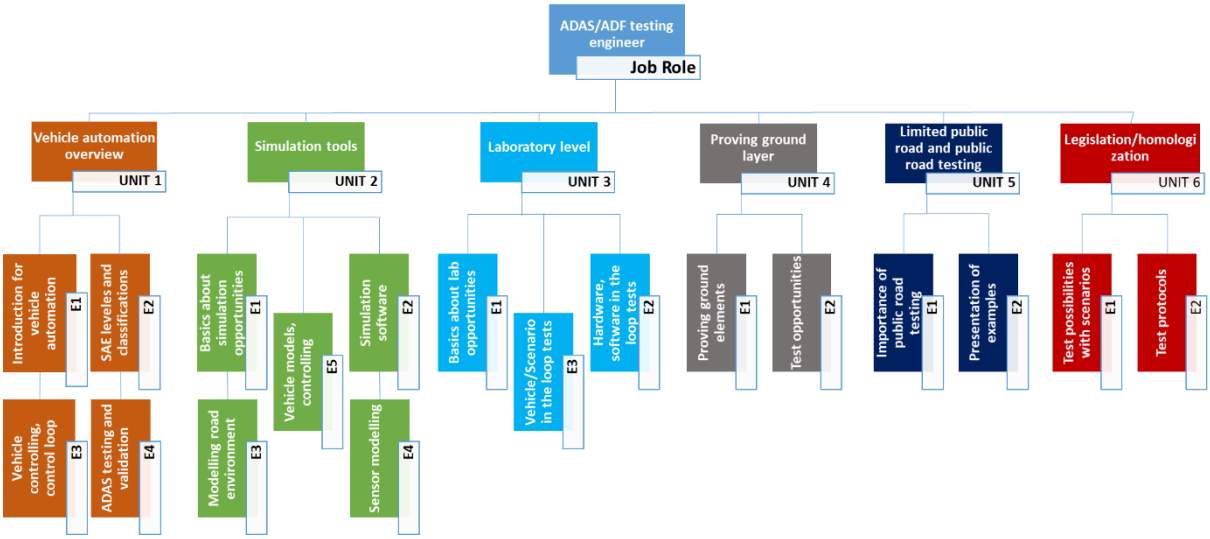


Figure 2: The Skills Set for ADAS/ADF testing and validation engineer

3.2 THE SKILLS DESCRIPTIONS – JOB ROLE ADAS/ADF TESTING AND VALIDATION ENGINEER

Domain Acronym: Engineering

Domain title: ADAS/ADF Testing and validation engineer

Domain Description:

The automation of road vehicles and road transport is in a high focus in the last decade, and it will be one of the most important development areas in the next years. Due to the complexity of this science field, it is important to have engineers who have an overview of the whole area.

Several engineer disciplines can develop connected and automated driving, like control engineers, software engineers, electrical engineers, transport engineers, mechanic engineers and mechatronic engineers. However, for effective development, a mixture of these science areas is necessary.

The purpose of this job role is to give a general overview of the development process of automated driving functions. Due to the importance of road safety, effective development requires a standardised

development process. The job role skill card presents the components of this process to make a "common language" for the above-mentioned different engineers.

The job role skill card starts with a general overview of connected and automated driving. It presents examples of automated in-vehicle functions, and it presents the standardized SAE (Society of Automotive Engineers) classification. From the second unit to the fifth, the skill card presents the development steps: simulation, laboratory, proving ground and public road testing. A principal aim is to present many examples for the student at every level. The last unit is the final step of the automated driving function development: the homologation, which has not yet been fully standardized.

Job Role Acronym: ADTESTEUR

Job Role Title: ADAS/ADF testing and validation engineer

Public description:

Due to the increasing complexity of automated vehicle systems, more emphasis should be placed on the testing and validation methodology of advanced driver-assistance systems (ADAS).

The first level of the testing and validation process has a lot of scripts and plans in simulation software. On the next level, the engineer makes plans about laboratory and proving ground tests. The safe operation of the new functions to guarantee, public road tests are also necessary. ADAS/ADF testing and validation engineers can manage and plan these testing processes of automated vehicles.

The Skill card comprises the following thematic learning units

1. Vehicle automation overview
2. Simulation tools
3. Laboratory level
4. Proving ground layer
5. Limited public road and public road testing
6. Legislation/homologization

3.3 UNIT ADTESTEUR.U1 VEHICLE AUTOMATION OVERVIEW

Acronym: ADTESTEUR.U1

Title: Vehicle automation overview

Description:

The first unit aims to give a general overview of connected and automated driving. At the first two elements, the unit presents the motivations to develop automated vehicles and the well-known standardized SAE levels (Society of Automotive Engineers). The third and the fourth elements present

the general approach of vehicle controlling and the testing and validation process of the new functions in these vehicles.

3.3.1 Unit ADTESTEUR.U1 - Element 1: Introduction for vehicle automation

Acronym: ADTESTEUR.U1.E1

Element Title: Introduction for vehicle automation

Element Note:

This element gives general information about testing and future vision and the V model of product development.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U1.E1.PC1	The student understands the main challenges in road transport.
ADTESTEUR.U1.E1.PC2	The student understands the main motivations for improving road safety.
ADTESTEUR.U1.E1.PC3	The student knows the released and applied vehicle automated functions.
ADTESTEUR.U1.E1.PC4	The student understands the difference between vehicle automation and road transport automation.
ADTESTEUR.U1.E1.PC5	The student knows the control loop elements and their connection of an automated vehicle.
ADTESTEUR.U1.E1.PC6	The student understands the legal and ethical implications of vehicle automation.

Table 1: Performance Criteria for the Element ADTESTEUR.U1.E1

3.3.2 Unit ADTESTEUR.U1 - Element 2: SAE levels and classifications

Acronym: ADTESTEUR.U1.E2

Element Title: SAE levels and classifications

Element Note:

The elements give information about SAE levels (Society of Automotive Engineers) and examples.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U1.E2.PC1	The student knows about why SAE levels (Society of Automotive Engineers) are necessary for automotive industries.
ADTESTEUR.U1.E2.PC2	The student knows the general information of automation and about SAE levels (for example law issues, responsibilities).
ADTESTEUR.U1.E2.PC3	The student knows examples of each SAE levels.
ADTESTEUR.U1.E2.PC4	The student understands the operation of ADAS systems (Advanced Driver-Assistance Systems) on each SAE levels.
ADTESTEUR.U1.E2.PC5	The student can classify ADAS systems to levels.

Table 2: Performance Criteria for the Element ADTESTEUR.U1.E2

3.3.3 Unit ADTESTEUR.U1 - Element 3: Vehicle controlling, control loop

Acronym: ADTESTEUR.U1.E3

Element Title: Vehicle controlling, control loop

Element Note:

Information about the control loop of automated vehicles and the elements of the system architecture.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADC.U1.E3.PC1	The student knows the control architecture of automated vehicles.
ADC.U1.E3.PC2	The student can present the connection between the control layers of automated vehicles.
ADC.U1.E3.PC3	The student knows the tasks of the layers.
ADC.U1.E3.PC4	The student knows the functions and responsibilities of the layers.
ADC.U1.E3.PC5	The student can categorize the hardware components of automated vehicles based on the control architecture.

Table 3: Performance Criteria for the Element ADTESTEUR.U1.E3

3.3.4 Unit ADTESTEUR.U1 - Element 4: ADAS testing and validation

Acronym: ADTESTEUR.U1.E4

Element Title: ADAS testing and validation

Element Note:

The element includes examples of ADAS and automated functions.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U1.E4.PC1	The student knows the most common ADAS (Advanced Driver-Assistance Systems) functions that can be tested according to existing independent (non-internal) protocols/standards.
ADTESTEUR.U1.E4.PC2	The student knows the organizations which provide procedures to test these functions, the student able to associate the potential functions to the defined protocols/standards/regulation.
ADTESTEUR.U1.E4.PC3	The student knows all the conditions and requirements to be fulfilled during the test execution—a condition related to weather, surrounding, data acquisition, preparing of vehicles, etc.
ADTESTEUR.U1.E4.PC4	The student is able to select and set up all of the equipment to accomplish these predefined ADAS tests. The student understands the operation of targets, driving robots, measurement systems. The student is aware of the limits and performance of the devices.
ADTESTEUR.U1.E4.PC5	The student knows the principle to assess the measured data and rate the test performances according to the assessment protocols (Focusing on EuroNCAP (European New Car Assessment Programme))
ADTESTEUR.U1.E4.PC6	The student can set up and realize optionally configured scenarios.

Table 4: Performance Criteria for the Element ADTESTEUR.U1.E4

3.4 UNIT ADTESTEUR.U2 SIMULATION TOOLS

Acronym: ADTESTEUR.U2

Title: Simulation tools

Description:

The unit aims to give an overview of simulation possibilities for automated driving. There are several commercial simulation software for automated driving, but their use is very similar. Simulation possibilities are beneficial for effective and cheaper development, and they are also very useful for education. This is the reason why this unit is the longest in this job role.

3.4.1 Unit ADTESTEUR.U2 - Element 1: Basics about simulation opportunities

Acronym: ADTESTEUR.U2.E1

Element Title: Basics about simulation opportunities

Element Note:

This element gives general information about the importance of simulation levels.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U2.E1.PC1	The student understands why simulation software is necessary for testing automated systems.
ADTESTEUR.U2.E1.PC2	The student knows general information about simulation software.
ADTESTEUR.U2.E1.PC3	The student is able to present the importance of simulation levels.
ADTESTEUR.U2.E1.PC4	The student understands the opportunities and differences between simulation software.
ADTESTEUR.U2.E1.PC5	The student can handle simulation software in automated systems testing.
ADTESTEUR.U2.E1.PC6	The student understands the typical differences between simulation tests and real environment tests.

Table 5: Performance Criteria for the Element ADTESTEUR.U2.E1

3.4.2 Unit ADTESTEUR.U2 - Element 2: Software presentation

Acronym: ADTESTEUR.U2.E2

Element Title: Simulation software

Element Note:

The element presents simulation software skills.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U2.E2.PC1	The student understands how to use simulation software.
ADTESTEUR.U2.E2.PC2	The student knows how to open and build a simulation software.
ADTESTEUR.U2.E2.PC3	The student understands which tools exist in software.
ADTESTEUR.U2.E2.PC4	The students know which environment can be built in the software.
ADTESTEUR.U2.E2.PC5	The student knows which vehicle models exist in the software.

Table 6: Performance Criteria for the Element ADTESTEUR.U2.E2

3.4.3 Unit ADTESTEUR.U2 - Element 3: Modelling road environment

Acronym: ADTESTEUR.U2.E3

Element Title: Modelling road environment

Element Note:

This element gives information about modelling of environment and examples.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U2.E3.PC1	The student is able to create an existing environment in the software.
ADTESTEUR.U2.E3.PC2	The student is able to change the environment condition in simulation software.
ADTESTEUR.U2.E3.PC3	The student is able to import the environment to the software.
ADTESTEUR.U2.E3.PC4	The student is able to create roads to the software.
ADTESTEUR.U2.E3.PC5	The student is able to create models in simulation software.
ADTESTEUR.U2.E3.PC6	The student knows examples of modelling.

Table 7: Performance Criteria for the Element ADTESTEUR.U2.E3

3.4.4 Unit ADTESTEUR.U2 - Element 4: Sensor modelling

Acronym: ADTESTEUR.U2.E4

Element Title: Sensor modelling

Element Note:

This element gives information about simulation and visualisation.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U2.E4.PC1	The student knows which sensors exist in real life.
ADTESTEUR.U2.E4.PC2	The student knows which sensors exist in a simulation environment.
ADTESTEUR.U2.E4.PC3	The student understands how to use sensors.
ADTESTEUR.U2.E4.PC4	The student is able to design the sensors' settings.
ADTESTEUR.U2.E4.PC5	The student knows how to use MatLab sensors tools.

Table 8: Performance Criteria for the Element ADTESTEUR.U2.E4

3.4.5 Unit ADTESTEUR.U2 – Element 5: Vehicle models, controlling

Acronym: ADTESTEUR.U2.E5

Element Title: Vehicle models, controlling

Element Note:

This element gives information about Traffic simulation and examples of vehicle modelling.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U2.E5.PC1	The student is able to set vehicles models.
ADTESTEUR.U2.E5.PC2	The student is able to set the velocity profile of vehicles models.
ADTESTEUR.U2.E5.PC3	The student is able to set the longitudinal and vertical parameters of vehicles models.
ADTESTEUR.U2.E5.PC4	The student is able to make simple controls for vehicles models.
ADTESTEUR.U2.E5.PC5	The student understands how can use vehicles models in MatLab.

Table 9: Performance Criteria for the Element ADTESTEUR.U2.E5

3.5 UNIT ADTESTEUR.U3 LABORATORY LEVEL

Acronym: ADTESTEUR.U3

Title: Laboratory level

Description:

Laboratory tests are the topic of the third unit. In laboratory tests, one or more elements are real parts of the tested function, the other signal inputs or outputs are simulated. There are several typical test cases for automated driving function laboratory tests, and in the last years, there are many new, up-to-date types of test cases. The unit presents these typical test cases with many examples.

3.5.1 Unit ADTESTEUR.U3 – Element 1: Basics about lab opportunities

Acronym: ADTESTEUR.U3.E1

Element Title: Basics about lab opportunities

Element Note:

This element gives general information about the boundary between simulation and reality.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U3.E1.PC1	The student knows the laboratory testing opportunities.
ADTESTEUR.U3.E1.PC2	The student knows the typical laboratory testing tools.
ADTESTEUR.U3.E1.PC3	The student knows the usability of laboratories.
ADTESTEUR.U3.E1.PC4	The student knows the result types that are able to get from laboratory tests.
ADTESTEUR.U3.E1.PC5	The student knows the modes of how to get results about laboratory tests.
ADTESTEUR.U3.E1.PC6	The student knows how to process results about laboratories tests.

Table 10: Performance Criteria for the Element ADTESTEUR.U3.E1

3.5.2 Unit ADTESTEUR.U3 - Element 2: Hardware, software in the loop tests

Acronym: ADTESTEUR.U3.E2

Element Title: Hardware, software in the loop tests

Element Note:

Information and examples of Hardware in the loop simulations.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U3.E2.PC1	The student knows the basic types of Hardware and Software in the Loop tests.
ADTESTEUR.U3.E2.PC2	The student knows the principles of Hardware in the Loop tests, and the student understands the goals and the advantages of the concept.
ADTESTEUR.U3.E2.PC3	The student knows the principle of the Software in the Loop and knows the goals and the advantages of the concept.
ADTESTEUR.U3.E2.PC4	The student knows the result types of Hardware and Software in the Loop tests.
ADTESTEUR.U3.E2.PC5	The student knows how to get results about Hardware and Software in the Loop tests.
ADTESTEUR.U3.E2.PC6	The student knows how to process results from Hardware and Software in the Loop tests.

Table 11: Performance Criteria for the Element ADTESTEUR.U3.E2

3.5.3 Unit ADTESTEUR.U3 - Element 3: Vehicle and Scenario in the loop simulations

Acronym: ADTESTEUR.U3.E3

Element Title: Vehicle and Scenario in the loop simulations

Element Note:

This element gives general information about Vehicle and Scenario in the loop simulations.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U3.E3.PC1	The student knows the principles of the Scenario in the Loop, and the student knows the goals and the advantages of the concept.
ADTESTEUR.U3.E3.PC2	The student knows the components and the basic technical requirements for the appropriate operation of the concept (e.g. latency, accuracy, communication, interfaces, equipment etc.)
ADTESTEUR.U3.E3.PC3	The student is able to build environments, and can program scenarios in the simulation module.

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U3.E3.PC4	The student is able to control each of the elements separately or synchronized with the others (real target objects, V2X (vehicle to everything) messages, sensor spoofing data, infrastructure) from the simulation/control module of the SciL system.
ADTESTEUR.U3.E3.PC5	The student is able to connect the real objects with the simulation and can run real-time tests.
ADTESTEUR.U3.E3.PC6	The student is able to measure and report the performance of the tested object (VUT – vehicle under test) and can compare the simulated results to the measured performance achieved in reality.

Table 12: Performance Criteria for the Element ADTESTEUR.U3.E3

3.6 UNIT ADTESTEUR.U4 PROVING GROUND LAYER

Acronym: ADTESTEUR.U4

Title: Proving ground layer

Description:

The new development directs the common proving grounds to implement new elements on them, typically for connected and automated vehicle tests. This unit presents the typical parts and features of an up-to-date proving ground, and it offers several test possibilities.

3.6.1 Unit ADTESTEUR.U4 - Element 1: Presentation of proving ground elements

Acronym: ADTESTEUR.U4.E1

Element Title: Presentation of proving ground elements

Element Note:

This element presents information about proving ground elements.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U4.E1.PC1	The student knows test tracks for classic vehicle durability tests for ADAS (Advanced Driver-Assistance Systems) functions and autonomous function testing within the EU and US.

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U4.E1.PC2	The student knows the opportunities and the most important parameters of classic test tracks, e.g. Dynamic surface, Braking surface, Handling course, High-speed Oval, Water basin, Hills, Bad roads.
ADTESTEUR.U4.E1.PC3	The student knows the key infrastructure parameters of AstaZero, Smart City Zone, M-City and K-City.
ADTESTEUR.U4.E1.PC4	The student knows the general registration and entry process related to a typical proving ground. Process, policy, prohibitions, tracking, safety instruction etc.
ADTESTEUR.U4.E1.PC5	The student is able to assign track elements to the tests in terms of feasibility.

Table 13: Performance Criteria for the Element ADTESTEUR.U4.E1

3.6.2 Unit ADTESTEUR.U4 - Element 2: Presentation of proving ground scenarios and examples

Acronym: ADTESTEUR.U4.E2

Element Title: Presentation of proving ground scenarios and examples

Element Note:

The element presents information and examples of proving ground scenarios.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U4.E2.PC1	The student knows the territory limitations and criteria of ADAS (Advanced Driver-Assistance Systems) test procedures.
ADTESTEUR.U4.E2.PC2	The student is able to locate the newest EuroNCAP (European New Car Assessment Programme) scenarios according to the dimension of the test track modules.
ADTESTEUR.U4.E2.PC3	The student is able to locate any customized test scenario according to requirements/needs.
ADTESTEUR.U4.E2.PC4	The student knows the operation of V2X (vehicle to everything) (V2V (vehicle to vehicle) and V2I (vehicle to infrastructure)) communication standards.
ADTESTEUR.U4.E2.PC5	The student is able to manage EU/US standard V2X messages.

Table 14: Performance Criteria for the Element ADTESTEUR.U4.E2

3.7 UNIT ADTESTEUR.U5 LIMITED PUBLIC ROAD AND PUBLIC ROAD TESTING

Acronym: ADTESTEUR.U5

Title: Limited public road and public road testing

Description:

Due to the high stochasticity of traffic use cases, it is very important to test the new automated driving functions on public roads. This environment can give the biggest number of unexpected traffic situations. Due to safety issues, the law conditions of public road tests are also essential. The fifth unit presents the test possibilities and the limits on public roads.

3.7.1 Unit ADTESTEUR.U5 - Element 1: Importance, law conditions

Acronym: ADTESTEUR.U5.E1

Element Title: Importance, law conditions

Element Note:

This element gives general information about the importance of public road tests, law conditions.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U5.E1.PC1	The student knows the countries where public road testing is allowed.
ADTESTEUR.U5.E1.PC2	The student knows the possibilities and the requirements of public road testing (Limitations).
ADTESTEUR.U5.E1.PC3	The student knows the draft of the process: notification, administration.
ADTESTEUR.U5.E1.PC4	The student knows the typical law environments for public road testing in different countries.

Table 15: Performance Criteria for the Element ADTESTEUR.U5.E1

3.7.2 Unit ADTESTEUR.U5 - Element 2: Road test realization with examples

Acronym: ADTESTEUR.U5.E2

Element Title: Road test realization with examples

Element Note:

This element gives general information about the Road test realization with examples.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U5.E2.PC1	The student knows examples for diagnostic investigation of endurance testing.
ADTESTEUR.U5.E2.PC2	The student knows examples of V2V (vehicle to vehicle) communications tests scenarios. (V2V communication, V2I (vehicle to infrastructure) communication, Road info and maintenance, Signal-phase etc.).
ADTESTEUR.U5.E2.PC3	The student knows examples of cross-border application tests.

Table 16: Performance Criteria for the Element ADTESTEUR.U5.E2

3.8 UNIT ADTESTEUR .U6 LEGISLATION/HOMOLOGIZATION

Acronym: ADTESTEUR.U6

Title: Legislation/homologization

Description:

To guarantee road safety at the end of the day, the standardization will be important for automated driving tests. Nowadays, there are several approaches, and in the future there will be many new standards. The last unit presents the law environment of the new features' homologation, and it presents the most important actual standards.

3.8.1 Unit ADTESTEUR.U6 - Element 1: Test possibilities with scenarios

Acronym: ADTESTEUR.U6.E1

Element Title: Test possibilities with scenarios

Element Note:

This element gives general information about test possibilities with scenarios.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U6.E1.PC1	The student knows the basic functions that are regulated.
ADTESTEUR.U6.E1.PC2	The student knows the basic manoeuvres and scenarios of the protocols that are regulated.
ADTESTEUR.U6.E1.PC3	The student knows the upcoming scenarios expected in the next 5 years.

Table 17: Performance Criteria for the Element ADTESTEUR.U6.E1

3.8.2 Unit ADTESTEUR.U6 - Element 2: Information about test protocols

Acronym: ADTESTEUR.U6.E2

Element Title: Information about test protocols

Element Note:

The element includes information about test protocols.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
ADTESTEUR.U6.E2.PC1	The student knows all of the regulations and standard related to ADAS/DAS (Advanced Driver-Assistance Systems).
ADTESTEUR.U6.E2.PC2	The student understands all of the regulations of ADAS/DAS. E.g. UN ECE R13/H UN-ECE R130, UN-ECE R131, UN-ECE R139, UN-ECE R140, UN-ECE R141, UN-ECE 151.
ADTESTEUR.U6.E2.PC3	The student understands ISO and SAE protocols related to ADAS. e.g ISO11270, ISO15622, ISO15623, ISO17361, ISO19237, ISO22839, ISO/DIN22078, SAE J3087, SAEJ3029, SAEJ3045.
ADTESTEUR.U6.E2.PC4	The student is able to set up and execute the tests according to the protocols mentioned above.
ADTESTEUR.U6.E2.PC5.	The student is able to assess the executed tests.

Table 18: Performance Criteria for the Element ADTESTEUR.U6.E2

ANNEXES

The annex provides overview of used skills set, coverage of Qualification Schemas and Legal background for Certification

ANNEX A ECQA DESCRIPTION

ECQA – EUROPEAN CERTIFICATION AND QUALIFICATION ASSOCIATION

ECQA standards are used to describe the skills sets delivered within the DRIVES project (www.project-drives.eu). ECQA is the pilot Certification body, which structure is mapped to DRIVES Reference and Recognition Framework providing the EU-wide overview of training courses and possible certifications, and micro-credentials. DRIVES Reference and Recognition Framework provides links to ESCO[7], EQF[8], ECTS[9] and ECVET[10]. See more in deliverable DRIVES-D4.1.1 Reference and Recognition Framework – Analysis.pdf (www.project-drives.eu).

Europe Wide Certification

The ECQA is the result of a number of EU supported initiatives in the last ten years where in the European Union Life Long Learning Programme different educational developments decided to follow a joint process for the certification of persons in the industry.

Through the ECQA it becomes possible that you attend courses for a specific profession in e.g. Spain and perform a Europe wide agreed test at the end of the course.

Access to a Vast Pool of Knowledge

ECQA currently supports 27 professions in Europe and with the continuous support until 2012 by the European Commission the pool is growing to 30 certified professions in Europe. ECQA offers certification for professions like IT Security Manager, Innovation Manager, EU project manager, E-security Manager, E-Business Manager, E-Strategy Manager, SW Architect, SW Project Manager, IT Consultant for COTS selection, Internal Financial Control Assessor (COSO/COBIT based), Interpersonal Skills, Scope Manager (Estimation Processes), Configuration Manager, Safety Manager, and so forth.

The ECQA guide can be downloaded at www.ecqa.org -> Guidelines.

Defined procedures are applied for:

- Self assessment and learning

- http://www.ecqa.org/fileadmin/documents/Self_Assessment/eucert-users-self-assessment-learning-guide-v5-doc.pdf
- Exam performance
- http://www.ecqa.org/fileadmin/documents/ECQA_Exam_Guide_Participant_v2.pdf

ECQA SKILLS DEFINITION MODEL

The ECQA skills definition model, used for Job Role definition, is described in section 2 of this document.

ECQA SKILL SET STRATEGY

Imagine that in the future Europeans will have a skill set like a card with a chip which stores your skill profile to fulfil specific professions, job roles, and tasks. It's working like an ID card. This future scenario requires -

- A standard way to describe a skill set for a profession, job, or specific task.
- A standard procedure to assess the skill and to calculate and display skill profiles.

Such a common set of skill sets in Europe is needed due to the free mobility of workers. European countries such as UK, The Netherlands, and France already have well established open universities which support APL (Accreditation of Prior Learning). In APL the skills of students are assessed, already gained skills are recognised, and only for the skill gaps a learning plan is established. The skill assessment bases on defined skill units and a skill profile displaying how much of the skill units are covered.

In a previous project CREDIT (Accreditation of Skills via the Internet) [1] in which some of the project partners were involved such an Internet based skills assessment system has been built. Therefore another possible scenario of the future is that representative educational bodies per country in Europe maintain skill profiles in databases which can be accessed via defined ID codes for people.

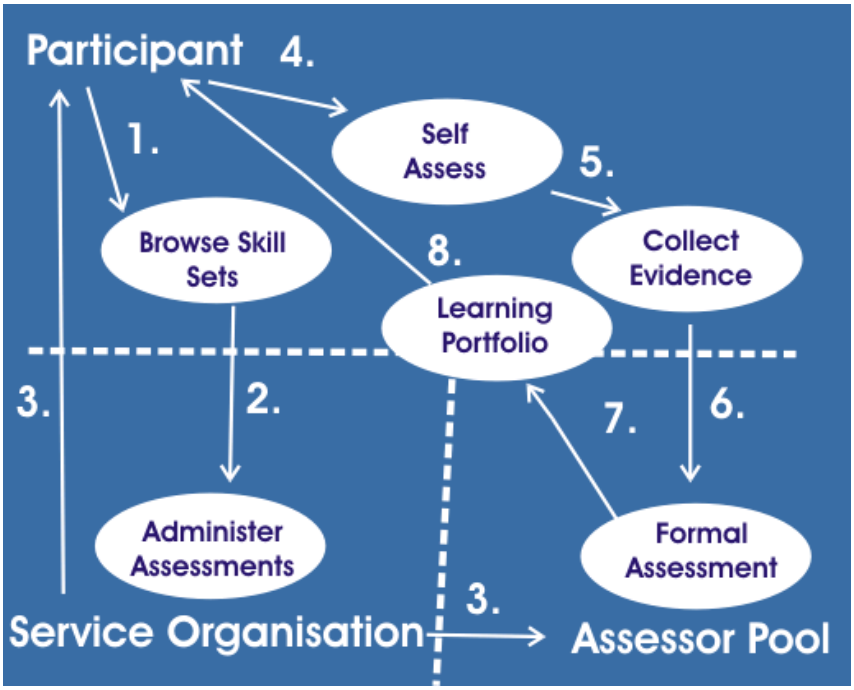
ECQA SKILLS ASSESSMENT MODEL

Step 1 – Browse a Skills Set: You select a set of skills or competencies, which are required by your profession or job using national standards or your company standards. You browse different skills cards and select a job role you would like to achieve.

Step 2 – Register for Self Assessment with a Service Unit : This can be a service unit inside your own company (e.g. a personnel development department) or a skills card and assessment provider outside

your company which offers skills assessment services. In case of the Safety Manager Project the registration will automatically assign a predefined service unit.

Step 3 – Receive an Account for Self-Assessment and Evidence Collection : With the registration you automatically received an account to login to the working space in which you can go through the steps of online self assessment and the collection of evidences to prove that you are capable of certain performance criteria.



Picture 1: Basic steps of the skills assessment model

Step 4 – Perform Self Assessment: You log into the system , browse through the skills required and self assess performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. A skills gaps profile can be generated and printed illustrating in which areas your self assessment shows improvement potentials.

Testing of Skills (Addition to Step 4) – The system provides a multiple-choice test for each performance criteria so that you can check your capabilities as realistically as possible.

Step 5 – Collect Evidences: Before you want to enter any formal assessment you need to prove your skills by evidences. Evidences can be any electronic files (sample documents, sample graphics, results of some analysis, etc.) or any references with details (e.g. a certificate received from a certain

institution). Evidences you can then link to specific performance criteria or whole elements of skills units.

Testing of Skills (Addition to Step 5) – In traditional learning schemes people have always needed to go to a learning institution (university, accreditation body, professional body, etc.) to take exams and they received a certificate if they pass. This traditional approach however is insufficient when it comes to measuring experience and (soft) skills learned on the job and fails to give recognition to skills gathered on the job. The APL (Accreditation of Prior Learning) approach, by contrast, collects so called evidences. Evidences can be certificates obtained in the traditional way, but also references from previous employers, materials from previous projects in which the person took ownership of results (e.g. a test plan) to prove their capability, as well as any kind of proof of competence gathered on the job. The assessors will then evaluate the evidences provided and not only rely on certificates and exams.

Step 6 – Receive Formal Assessment: Formal assessors are assigned by the service unit to the skills assessment. Once formal assessors log into the system they automatically see all assigned assessments. They select the corresponding one and can see the uploaded evidences. They then formally assess the evidences and assess the formal fulfilment of performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. In case of missing competencies they enter improvement recommendations, a well as learning options.

Step 7 – Receive Advise on Learning / Improvement Options: After the formal assessment the participants log into the system and can see the formal assessment results from the assessors, can print skills gaps profiles based on the assessor results, and can receive and print the improvement recommendations and learning options. If required, the generation of learning options can also be automated through the system (independent from assessor advises).

ECQA CERTIFICATE TYPES

In the standard test and examination procedures for levels of certificates are offered:

- Course Attendance Certificate
  - Received after course attendance
  - Modular per Element
- Course / Test Certificate
  - Test in a test system (European pool of test questions)
  - 67% satisfaction per element

- Summary Certificate
    - Overview of covered elements where the student passed the test, all elements shall be covered
    - Generation of certificate
- Professional Certificate
    - Uploading applied experiences for review by assessors
    - Rating by assessors
    - Observation of 2 years

The certificates show credited elements in comparison to all required.

ANNEX B ECQA COVERAGE OF QUALIFICATION SCHEMAS

MAPPING BASED ON NVQ QUALIFICATION LEVELS

Qualification / training levels: Five levels of qualification / training are defined by European legislation and this structure can be used for comparability of vocational qualifications from the different European countries.

- Level 1: semi-skilled assistant performing simple work
- Level 2: basic employee performing complex routines and standard procedures
- Level 3: skilled professional with responsibility for others and performing independent implementation of procedures
- Level 4: middle management & specialist performing tactical an strategic thinking
- Level 5: professional / university level

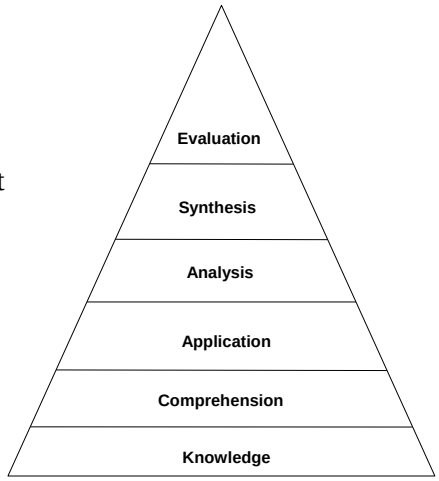
In most cases the same job role can be offered on different levels. e.g. IT Security Manager Basic Level (NVQ level 2), IT Security Manager Advanced level (NVQ Level 3), and IT Security Manager Expert Level (NVQ Levels 4 and 5).

MAPPING BASED ON EUROPEAN QUALIFICATION FRAMEWORK (EQF) LEARNING LEVELS

- Six level taxonomy:

  Level 0: I never heard of it

  1. Knowledge (I can define it):
  2. Comprehension (I can explain how it works)
  3. Application (I have limited experience using it in simple situations)
  4. Analysis (I have extensive experience using it in complex situations)
  5. Synthesis (I can adapt it to other uses)
  6. Evaluation (I am recognized as an expert by my peers)



Picture 3: Blooms Learning levels

Level	Knowledge	Example
Level 1	Basic general knowledge	
Level 2	Basic factual knowledge of a field of work or study	
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	Six Sigma Yellow Belt
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Six Sigma Green Belt
Level 7	• Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research • Critical awareness of knowledge issues in a field and at the interface between different fields	Six Sigma Black Belt

Level	Knowledge	Example
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	Six Sigma Master Black Belt

Picture 4 : EQF Learning levels

MAPPING BASED ON ECTS AND ECVET SCHEMA

ECQA has established a procedure to map ECQA skills sets onto the ECTS (European Credit Transfer System) and the ECVET framework n the European Union.

A job role is assigned ECTS and ECVET points using a defined framework.

ECTS Mapping

Each element of the skills set is assigned hours of lecturing and exercises. These hours determine the ECTS points which are then agreed among a cluster on different universities in Europe.

Level	Knowledge	AQUA	ECTS	Safety Manager	ECTS
Level 1	Basic general knowledge	-		-	
Level 2	Basic factual knowledge of a field of work or study	-		-	
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study				
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study				
Level 5	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge				
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	AQUA - Automotive Quality Integrated Skills - presentations / theory	3	AQUA - Automotive Quality Integrated Skills - presentations / theory	3
Level 7	- Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research - Critical awareness of knowledge issues in a field and at the interface between different fields	AQUA - Automotive Quality Integrated Skills - with exercises to apply on nan example (e.g. ESCL)	4	AQUA - Automotive Quality Integrated Skills - with exercises to apply on nan example (e.g. ESCL)	4
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	AQUA - Automotive Quality Integrated Skills - implementation in a research at PhD level / with link to a real project	5	AQUA - Automotive Quality Integrated Skills - implementation in a research at PhD level / with link to a real project	5

Picture 5 : Example Automotive Quality Engineer and Safety Manager

The 2 job roles illustrated in the picture above have been assigned to ECTS and are taught using the same skills set at industry and also universities.

ECVET Mapping

Also ECQA provides a framework to assign ECVET points onto elements of the skills set. The ECQA guidance recommends to offer the ECQA course (which is offered as a lecture at university) as a short course (2 weeks with exercises) in industry to retrain for a job role in industry. The recommended size is 30 ECVET points in total. The lecturing time and exercise per element determine how many ECVET points ae assigned to an element of the skills set.

Automotive Quality Engineer			
			ECVET L7&8
U1	4	U1.E1: Introduction	2
		U1.E2: Organisational Readiness	2
U2	32	U2.E1 Life Cycle	8
		U2.E2 Requirements	8
		U2.E3 Design	8
		U2.E4 Test and Integration	8
U3	12	U3.E1: Capability	2
		U3.E2: Hazard and Risk Management	8
		U3.E3 Assessment and Audit	2
U4	12	U4.E1: Measurement	6
		U4.E2: Reliability	6
		ECVET Points Total	60

Picture 6 : ECVET Mapping example - Automotive Quality Engineer

Functional Safety Manager / Engineer			
			ECVET L7&8
U1	2	U1.E1 International Standards	1
		U1.E2 Product Life Cycle	1
		U1.E3 Terminology	
U2	4	Safety management on organisational	1
		Safety Case Definition	1
		Overview of Required Engineering an	1
		Establish and Maintain Safety Plannin	1
U3	16	System Hazard Analysis and Safety Co	4
		Integrating Safety in System Design &	4
		Integrating Safety in Hardware Design	4
		Integrating Safety in Software Design	4
U4	4	Integration of Reliability in Design to I	2
		Safety in the Production,Operation an	2
U5	4	Legal aspects and Liabilities	2
		Regulatory & Qualification Requireme	2
		ECVET Points Total	30

Picture 7 : ECVET Mapping example – Functional Safety Manager / Engineer

ANNEX C ECQA LEGAL BACKGROUND FOR CERTIFICATION

SO/IEC 17024 STANDARD FOR PERSONNEL CERTIFICATION PROGRAMMES

The ISO/IEC 17024 standard describes standard processes for the examination and certification of people. Some of the basic principles described include:

- Standard exam procedure
- Standard certification procedure
- Identification of persons receiving the certificate
- Independence of examiner and trainer
- Certification system that allows to log the exam to keep a record/proof that the examinee passed the exam
- Mapping of processes towards ISO 17024

ECQA AND ISO/IEC 17024 STANDARD

- ECQA defined standard exam processes
- ECQA defined standard certification processes
- ECQA developed an exam system that generates random exams and corrects exams.
- ECQA developed a certification database to identify persons and map them to exam results
- ECQA established a mapping onto the ISO 17024 norm and published that in form of a self declaration.

LIASION WITH NATIONAL UNIVERSITIES

ECQA established cooperation with national universities who teach job roles with ECTS. The same job roles are offered with ECVET on the market by training bodies.

ANNEX D REFERENCES

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