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2016 MELBOURNE

23rd World Congress on Intelligent Transport Systems

Melbourne Convention and Exhibition Centre
10–14 October 2016

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Applus IDIADA

Certification of safety and minimum performance of automated driving vehicles in Spain

Procedure and/or set of tests that should determine if a vehicles is safe enough to be allowed to get to public roads

- Should be hard enough to identify underperforming systems, not too high to block the final objective: getting AD cars in the streets

  - Being unnecessarily complex so it even affects the implementation phase

  - Technology agnostic

  - Time consuming / Bureaucracy burden

  - Expensive

  - Fair

Roadworthiness testing in Europe

- Each EU member state is responsible of their traffic code and law enforcement

  - The EC can suggest but final responsibility lies on each Member State

  - Similar situation as in the US

- Many legal initiatives in Europe – Fragmentation of legal frameworks

  - E.g. UK, Germany, France, Sweden, Austria, Greece, NDS, Spain…

- **Two different approaches:**

  - Code of Practice (UK) – Guidelines and best practices that MUST be followed by applicants

  - Proving Ground testing (Spain and The Netherlands) – A traffic authority grants a license exemption after being sure it is safe enough

Spanish license exemption

DGT Instrucción 15/V – 113 MAIN CONCEPTS

- **Glossary of terms**

  - SAE levels of automation (ANNEX 1)

- **Scope:**

  - Public testing of SAE level 3 and above in Spain

  - 2 years license

  - DGT will approve the test area → in any other area, the vehicle must be in manual mode

- **Vehicle requirements:**

  - Technically approved by a technical centre approved by ENAC

  - Technically approved by a member state technical centre following similar tests

  - Vehicle has valid insurance coverage

Spanish license exemption

**DGT Instrucción 15/V – 113** MAIN CONCEPTS

- **Driver requirements:**

    - The driver must have a valid license

    - The driver is responsible of the vehicle guidance and must retake control at any moment

    - The driver must know the vehicle and its capabilities

- **Documentation**

    - Technical description of

        - the vehicle (capabilities, characteristics, etc…)

        - The tests plan to be performed

        - The geographical area and timeplan where the tests will be performed

- **ANNEXES** – Documentation and tests to be performed

ANNEX II - Test matrix

3 stage approach for safety validation: The applicant will need to pass these three stages before having a license granted.

1. **Documentation**: The applicant must provide a technical description of the vehicle characteristics, the tests that wants to perform in the public road and the functionalities that want to be tested.

2. **Inspection**: With the documentation, the testing laboratory is able to create an inspection matrix with special relevance of the safety elements of the vehicle → Based in IDIADA risk assessment procedure

3. **Dynamic validation**: Proving ground tests of the vehicles requesting the license in order to make real safety validation according to the functionalities to be tested and the test conditions requested.
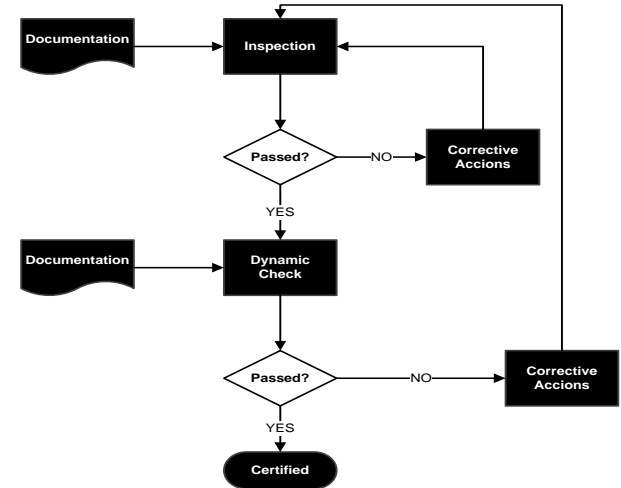
Dynamic Test matrix can be grouped in four different type of tests

1. Override mechanism validation

- Test the vehicle to validate that the driver/controller can always override the automated mode

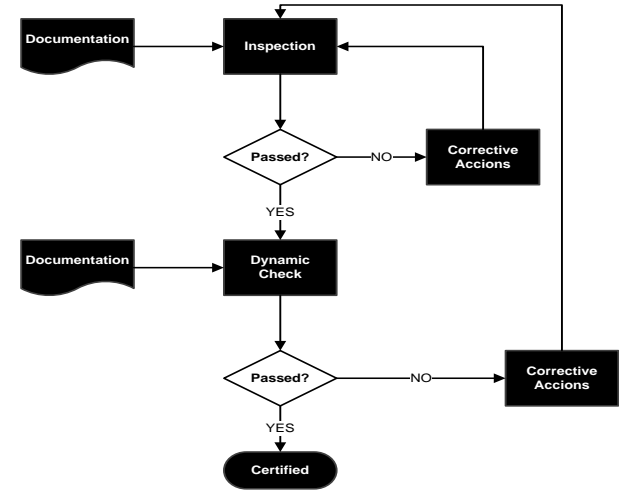### 2. Brakes and associated function validation

- Brakes validation w/o automated mode

- Longitudinal FCW validation with different targets

3. Lane associated function validation

- Lateral control associated functions validation i.e. LKA functions

4. Regulation and signage compliance

- Validation of road sign recognition/detection/knowledge and compliance

Override testing (1/2)

Steering wheel override

- **Procedure:**
  - **75% max speed - 200m straight in automated mode**
  - **Manually/remotely steering in the circuit**
- **Success if:**
  - **Vehicle started in automated mode**
  - **Actuate on steering wheel**
    - **Control retaken after acting on the steering wheel**
    - **Less than 10Nm necessary to override**
  - **Able to stay in the adjacent lane**
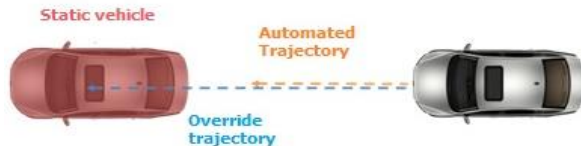 - **The automated mode is disabled**
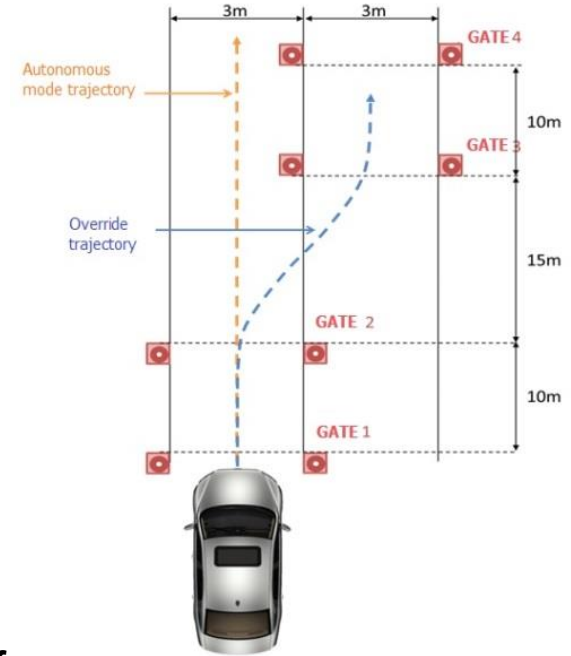
Braking override

- **Procedure:**
  - **75% max speed - 200m straight in automated mode**
  - **Apply max. 300N brake pedal**

- **Success if:**
  - **Vehicle started in automated mode**
  - **The vehicle braked when pressed (certain min and average values)**
  - **The automated mode is disabled**

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Throttle override

- **Procedure:**
    - 30kph 200m straight in automated mode
    - Target detected and vehicle brakes
    - Press throttle pedal
- **Success if:**
    - Vehicle avoided impact in automated mode
    - The vehicle accelerated when throttle pressed
    - The vehicle impacted the target
    - The automated mode is disabled

Emergency button override

- **Procedure:**
    - 30kph 200m straight in automated mode
    - Target detected and vehicle brakes
    - Press emergency button
- **Success if:**
    - Vehicle avoided impact in automated mode
    - The automated mode is disabled when pressing the button
    - The vehicle impacted the target
    - The automated mode is disabled

Longitudinal and lateral control

Longitudinal control

- **Evaluate the ability of the vehicle to maintain the longitudinal control and to brake in an emergency.**

- **Target vehicle as defined in Euro NCAP AEB protocol**

- **VRU targets optional if the vehicle is going to be tested in interurban and urban environments**

Lateral control

- **Evaluate the vehicle capacity to stay in a lane**
  - **With visible road markings**
  - **With one or two lines painted**

- **The vehicle shall be able to stay in the defined lane under different test conditions**

Tests based in UNECE regulations and Euro NCAP protocols

Spain's AD testing procedure

- **First one to define a test matrix publicly available and known by the applicant of the license**
- **Closer to certification rather than guidelines and best practices**
  - **Stronger control from the traffic authority point of view**
  - **Independent evaluation by accredited laboratories (with their own requirements)**
- **Continuously evolving → SotA performance evaluation**
  - **Based in existing and well known procedures for the automotive industry (Euro NCAP)**
- **The vehicle under test always at least as safe as the solutions already in the market (safest vehicle in a mixed environment)**
  - **Demonstrate a minimum (safety) performance**
- **The applicant shall also show its commitment and best practices being followed in different topics: cybersecurity, EMC, version control, functional safety.**

Thank you very much for your kind attention

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