APPLICABLE NEVADA STANDARDS

ETS1.A - Defining and delimiting engineering problems - The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful.

ETS1.B - Developing possible solutions - A solution needs to be tested, and then modified on the basis of the test results in order to improve it.

ETS1.C - Optimizing the design solution - ...each test can provide useful information for the redesign process...
What does “autonomy” mean?

automatic
autonomous
The NHTSA Levels of Autonomy

- **Level 0**: the human driver does everything;
- **Level 1**: an automated system on the vehicle can sometimes assist the human driver conduct some parts of the driving task;
- **Level 2**: an automated system on the vehicle can actually conduct some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task;
- **Level 3**: an automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be ready to take back control when the automated system requests;
- **Level 4**: an automated system can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions
- **Level 5**: the automated system can perform all driving tasks, under all conditions that a human driver could perform them.
### SAE J3016™ Levels of Driving Automation

<table>
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<th><strong>SAE Level</strong></th>
<th><strong>Description</strong></th>
<th><strong>Features</strong></th>
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<td><strong>Level 0</strong></td>
<td>You are driving whenever these driver support features are engaged - even if your feet are off the pedals and you are not steering.</td>
<td>These features are limited to providing warnings and momentary assistance.</td>
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|               | You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety. | • automatic emergency braking  
• blind spot warning  
• lane departure warning |
| **Level 1**   | You are not driving when these automated driving features are engaged - even if you are seated in "the driver's seat". | These features provide steering OR brake/acceleration support to the driver. |
|               | When the feature requests, you must drive. | • lane centering  
• adaptive cruise control |
| **Level 2**   | These automated driving features will not require you to take over driving. | These features provide steering AND brake/acceleration support to the driver. |
|               | These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met. | • traffic jam chauffeur |
| **Level 3**   | You must drive. | These features can drive the vehicle under all conditions. |
| **Level 4**   | These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met. | • local driverless taxi  
• pedals/steering wheel may or may not be installed |
| **Level 5**   | This feature can drive everywhere in all conditions. | • same as level 4, but feature can drive everywhere in all conditions |
**Level 0**
There are no autonomous features.

**Level 1**
These cars can handle one task at a time, like automatic braking.

**Level 2**
These cars would have at least two automated functions.

**Level 3**
These cars handle “dynamic driving tasks” but might still need intervention.

**Level 4**
These cars are officially driverless in certain environments.

**Level 5**
These cars can operate entirely on their own without any driver presence.

*Source: SAE International*
What are a car's controls?

Possible Answers
Go Forward
Go Back
Turn
Stop
Faster / Slower

What are a Driver Senses?

Possible Answers
Sight: Stop Sign / Traffic
Sound: Siren / Horn
Smell/Taste: Smoke / Brakes
Touch: Curb / Acceleration

DRIVER EXPERIENCE!

What are the Inputs/Outputs?

- Throttle (velocity)
- Steering
- Forward/Backward

LEVEL 0

There are no autonomous features.
AUTOMATION LEVELS OF AUTONOMOUS CARS

**LEVEL 0**
There are no autonomous features.

**LEVEL 1**
These cars can handle one task at a time, like automatic braking.

**LEVEL 2**
These cars would have at least two automated functions.

**LEVEL 3**
These cars handle “dynamic driving tasks” but might still need intervention.

**LEVEL 4**
These cars are officially driverless in certain environments.

**LEVEL 5**
These cars can operate entirely on their own without any driver presence.

*SOURCE: SAE International*
These cars would have at least two automated functions.
These cars handle "dynamic driving tasks" but might still need intervention.
What does the human in the driver’s seat have to do?

- You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering.
- You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety.

What do these features do?

- These features are limited to providing warnings and momentary assistance.
- These features provide steering OR brake/acceleration support to the driver.
- These features provide steering AND brake/acceleration support to the driver.
- These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met.
- This feature can drive the vehicle under all conditions.

Example Features

- automatic emergency braking
- blind spot warning
- lane departure warning
- lane centering OR adaptive cruise control
- lane centering AND adaptive cruise control at the same time
- traffic jam chauffeur
- local driverless taxi
- pedals/steering wheel may or may not be installed
- same as level 4, but feature can drive everywhere in all conditions
**LEVEL 0**

There are no autonomous features.

**LEVEL 1**

These cars can handle one task at a time, like automatic braking.

**LEVEL 2**

These cars would have at least two automated functions.

**LEVEL 3**

These cars handle “dynamic driving tasks” but might still need intervention.

**LEVEL 4**

These cars are officially driverless in certain environments.

**LEVEL 5**

These cars can operate entirely on their own without any driver presence.

*Source: SAE International*
These cars are officially driverless in certain environments.
Vex IQ Sensors & Abilities
https://youtu.be/je_LJcpxtik