3.5 SQA activities: Defect Detection

3.5.1 Throttle Control:

Original: The system shall control the throttle for regulation of vehicle speed.

Revised: The system shall control the throttle to regulate vehicle speed within a range of 0 to 120 km/h, adjusting for road conditions and traffic regulations.

Requirement	Check List Point	Defect
The system shall control the throttle for regulation of vehicle speed.	Verifiability: Is each requirement testable or verifiable?	The requirement lacks specifics on the range of speed control and conditions under which speed regulation should be adjusted.

Table 3.5.1 | Inspection Table 1

3.5.2 Steering Control:

Original: The system shall control the vehicle's steering to follow the planned trajectory accurately.

Revised: The system shall control the vehicle's steering to maintain a maximum lateral deviation of 0.5 meters from the planned trajectory under normal conditions.

Requirement	Check List Point	Defect
The system shall control the vehicle's steering to follow the planned trajectory accurately.	Clarity: Are the requirements stated clearly so there is only one interpretation?	The term "accurately" is vague and not quantifiable.

Table 3.5.2 | Inspection Table 2

3.5.3 Route Calculation:

Original: The system shall calculate the most efficient route i.e. shortest path from the vehicle's current location to the driver-specified destination.

Revised: The system shall calculate the most efficient route i.e. shortest path from the vehicle's current location to the driver-specified destination

Requirement	Check List Point	Defect
The system shall calculate the most efficient route from the vehicle's current location to the driver-specified destination.	Verifiability: Does each requirement use concrete terms and measurable quantities?	"Most efficient route" is not defined; efficiency could refer to time, distance, fuel consumption, etc.

Table 3.5.3 | Inspection Table 3

3.5.4 Path Smoothing:

Original: The system shall apply path smoothing techniques to reduce jerkiness and ensure passenger comfort.

Revised: The system shall apply path smoothing techniques to limit acceleration changes to within 0.3 m/s^2, ensuring a smooth ride for passengers.

Requirement	Check List Point	Defect
The system shall apply path smoothing techniques to reduce jerkiness and ensure passenger comfort.	Verifiability: Is each requirement testable or verifiable?	The requirement does not define what constitutes "jerkiness" or acceptable levels of passenger comfort.

Table 3.5.4 | Inspection Table 4

3.5.5 Lateral Deviation:

Original: The system shall minimize the lateral deviation from the path.

Revised: The system shall maintain a lateral deviation of no more than 0.5 meters from the planned path under normal driving conditions.

Requirement	Check List Point	Defect
The system shall minimize the lateral deviation from the path.	Clarity: Are the requirements written in user language? Do the users think so?	"Minimize" is not quantified; specific acceptable deviation limits should be stated.

Table 3.5.5 | Inspection Table 5

3.5.6 Longitudinal Deviation:

Original: The system shall minimize the Longitudinal deviation from the path.

Revised: The system shall maintain a longitudinal deviation of no more than 1 meter from the planned path under normal driving conditions.

Requirement	Check List Point	Defect
The system shall minimize the Longitudinal deviation from the path	Clarity: Are the requirements written in user language? Do the users think so?	Similar to lateral deviation, "minimize" is not quantified, and specific limits should be provided.

Table 3.5.6 | Inspection Table 6

3.5.7 IMU Data Usage:

Original: The system shall use IMU to provide orientation and acceleration data at some frequency.

Revised: The system shall use an IMU to provide orientation and acceleration data at a frequency of 100 Hz.

Requirement	Check List Point	Defect
The system shall use IMU to provide orientation and acceleration data at some frequency.	Completeness: Are all the inputs to the system specified including their source, accuracy, range of values, and frequency?	"Some frequency" is vague and should be specified clearly.

Table 3.5.7 | Inspection Table 7

3.5.8 Trajectory Planning:

Original: The system shall plan a smooth and optimal trajectory for the vehicle to follow based on the calculated route.

Revised: The system shall plan a smooth and optimal trajectory, based on destination specified by user.

Requirement	Check List Point	Defect
The system shall plan a smooth and optimal trajectory for the vehicle to follow based on the calculated route.	Verifiability: Is each requirement testable or verifiable?	"Optimal trajectory" needs to be defined more concretely, considering factors like time, energy consumption, etc.

Table 3.5.8 | Inspection Table 8

3.5.9 Destination Approach:

Original: The system shall precisely approach the driver-specified destination by following the calculated trajectory and waypoints accurately.

Revised: The system shall approach the driver-specified destination with a positional accuracy of within 1 meter, following the calculated trajectory and waypoints precisely.

Requirement	Check List Point	Defect
The system shall precisely approach the driver-specified destination by following the calculated trajectory and waypoints accurately.	Clarity: Are the requirements stated clearly so there is only one interpretation?	The terms "precisely" and "accurately" are subjective and need quantifiable measures.

Table 3.5.9 | Inspection Table 9

3.5.10 Stop at Destination:

Original: The system shall bring the vehicle to a complete stop upon reaching the designated destination, ensuring a smooth and safe arrival.

Revised: The system shall bring the vehicle to a complete stop within 1 meter of the designated destination, ensuring deceleration rates do not exceed 2 m/s^2 for passenger safety and comfort.

Requirement	Check List Point	Defect
The system shall bring the vehicle to a complete stop upon reaching the designated destination, ensuring a smooth and safe arrival.	Completeness: Does each function specify the data used in the function and data resulting from the function?	"Smooth and safe arrival" should be quantified in terms of deceleration rates or stopping distance.

Table 3.5.10 | Inspection Table 10