**Sub-system Requirements for Control and Dynamics – VDPC 1**

**CRQ 1.2 -> Target speed must be 10 to 15km/hr.**

RQ 1.2.4 -> The controller shall handle a target speed greater than the critical speed (vc).

RQ 1.2.5 -> The scaled-down bicycle model shall receive a target velocity as a virtual input to enable speed regulation by the controller.

**CRQ 1.6 -> Scaled down Bicycle simulator shall be self-balancing.**

RQ 1.6.1 -> The scaled-down bicycle model shall not be stable during the inital state of motion.

RQ 1.6.2 -> The scaled-down bicycle model and controller shall process input signals from sensors and provide corresponding output signals computed by the controller.

RQ 1.6.2.1 -> The scaled down bicycle model shall use Roll Angle as an input for the Controller.

RQ 1.6.2.2 -> The scaled down bicycle model shall use Steering Torque as an input for the Controller.

RQ 1.6.2.3 -> The scaled down bicycle model shall provide the lateral and vertical position (Roll and Yaw angle) as output from the controller.

RQ 1.6.2.4 -> The scaled down bicycle model shall provide the lateral and vertical velocities (Yaw rate) in all axis as output from the controller.

RQ 1.6.3 -> A motion response shall result from a vehicle model derived from a real bicycle’s geometry and imposed boundary conditions.

RQ 1.6.3.1 -> Steering shall not exceed 45 degrees.

RQ 1.6.3.2 -> Steering rate Shall be less 45 degrees/s.

RQ 1.6.3.3 -> Roll angle shall not exceed 20 degree.

RQ 1.6.3.4 -> Lateral displacement shall not exceed 0.5 m.

RQ 1.6.4 -> Controller shall satisfy certain performance requirements.

RQ 1.6.4.1 -> Computational time of the controller shall not exceed bicycle falling time.

RQ 1.6.4.2 -> Overshoot of the response shall not exceed 500 %.

RQ 1.6.4.3 -> Settling time shall be lower than 5 s.

RQ 1.6.4.4 -> Controller shall be robust to +-10% parameter variation.

RQ 1.6.5 -> The scaled down bicycle model shall consist of 2 rigid bodies - rear-frame and front-fork.

RQ 1.6.6 -> The simulator shall provide the degrees of freedom necessary to lateral balancing of the bicycle.

RQ 1.6.6.1 -> The scaled down bicycle model shall allow rear-frame roll, yaw, lateral motion, and front-fork steer to remain free to move.

RQ 1.6.7 -> The scaled down bicycle model shall exclude surge, heave and pitch roll motion which is beyond our scope of study.