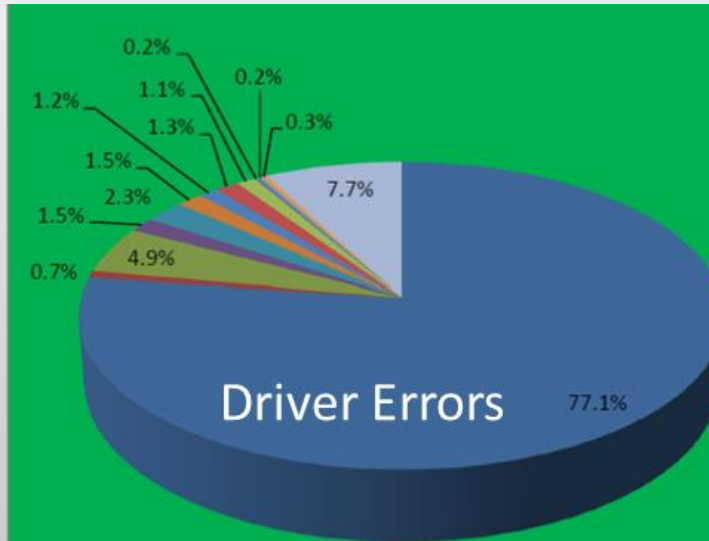


ADAS /AV work at ARAI

SAFETY GOALS.. THRU ADVANCED DRIVER ASSIST (ADAS)

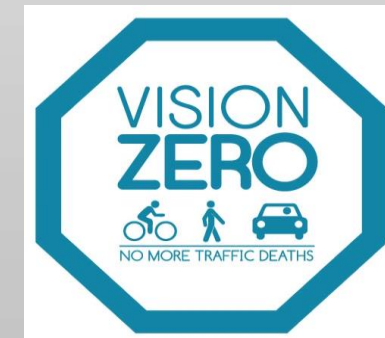
Focus to reduce road accidents/fatalities by 50%

- India ranks 3rd in terms of deaths due to road accidents
- There is one death every four minutes due to a road accident in India.



- Around 80% of accidents are due to Driver errors
- Can driver be assisted .. To minimize errors...

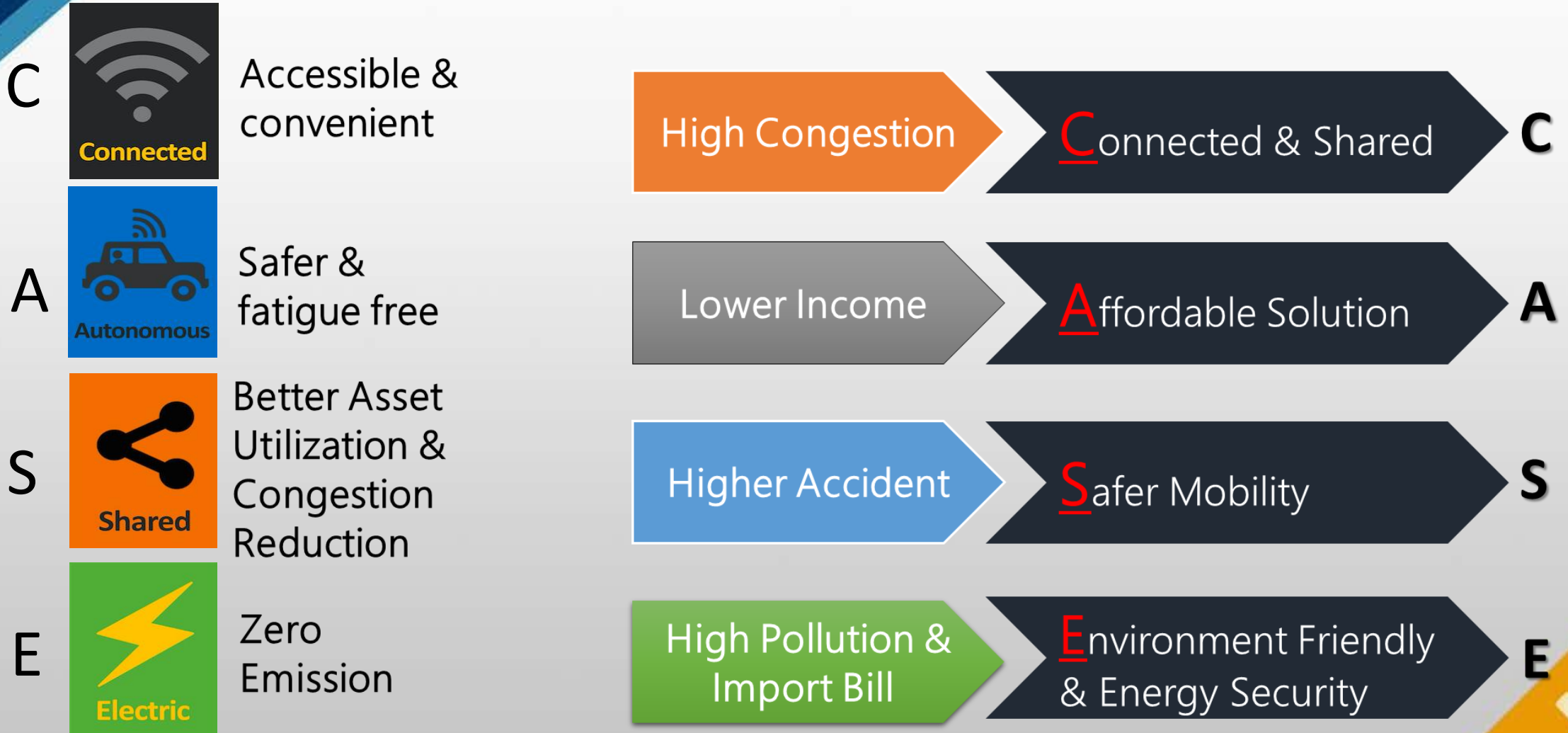
Long term goal of



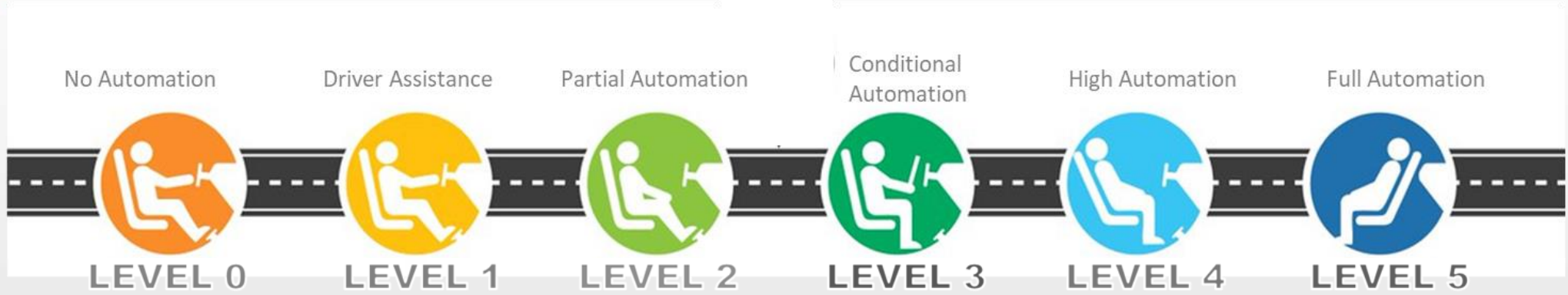
Source : Road Accidents in India 2018 : MoRTH India



MOBILITY CASE .. GLOBAL VS INDIA



SAE Levels of Automation and Functions



- 1. Forward Collision Warning
- 2. Automatic Emergency braking
- 3. Blind Spot Detection
- 4. Night Vision
- 5. Driver Monitoring
- 6. Tire Pressure Monitoring
- 7. Rain Sensing Wiper
- 8. Lane Departure Warning System

- 1. Lane Keeping Assistance
- 2. Adaptive Cruise Control
- 3. Collision Avoidance
- 4. Anti-lock Braking
- 5. Traction Control

- 1. Lane Keeping Assistance and Adaptive Cruise Control simultaneously

- 1. Traffic Jam Assist

- 1. Local Driverless Taxi
- 2. Pedals/steering wheels may or may not be installed

- 1. Same as level 4, but feature can drive everywhere in all conditions



FOCUS FEATURES FOR INDIA

360 deg view

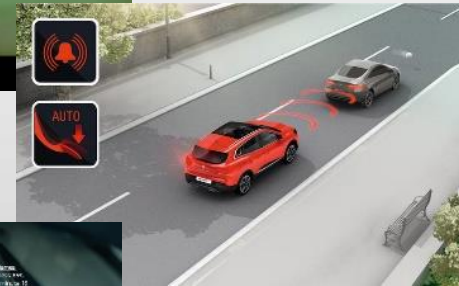
•Forward Collision Warning

Electronic Stability Control

Parking Assist



Automated Emergency Braking



Drowsiness/
fatigue Alert

Forward Collision Assist

Blind spot detection



Adaptive Cruise Control

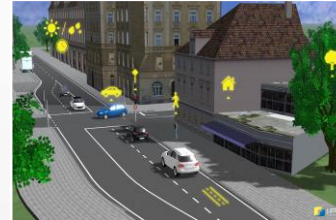
Driver Monitoring



BUT, INDIAN USE CASES ARE DIFFERENT..



Complexity of Automated Driving Functions



Variation of scenarios and parameters



Climate/Weather uncertainties



Challenges due to vast road population:

- Vehicle-to-everything (V2X) communication
- Amount of data to be handled



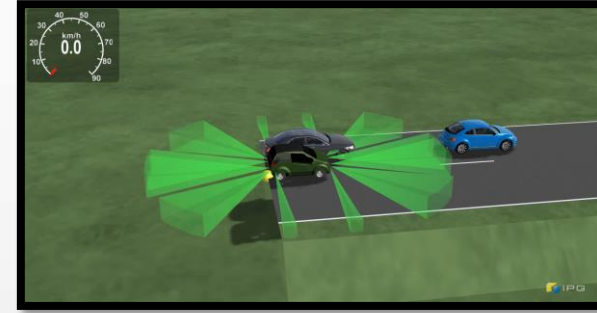
Traffic behavior



Poor road infrastructure



ARAI .. FOCUS TO ENABLE & ENGINEER TECHNOLOGY SOLUTIONS



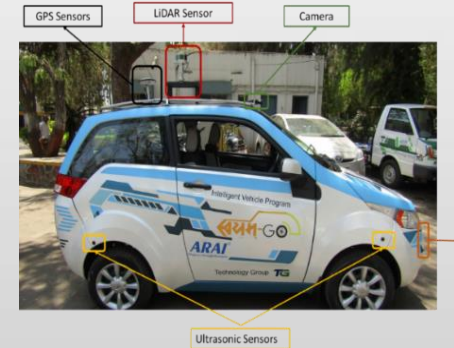
AI/ Machine Learning



Indian traffic signs and vehicles annotation



Solutions for Indian Use Cases



Real World tests

on Road Assessment .. infinite use cases

Physical Certification Tests

Selected few standard tests

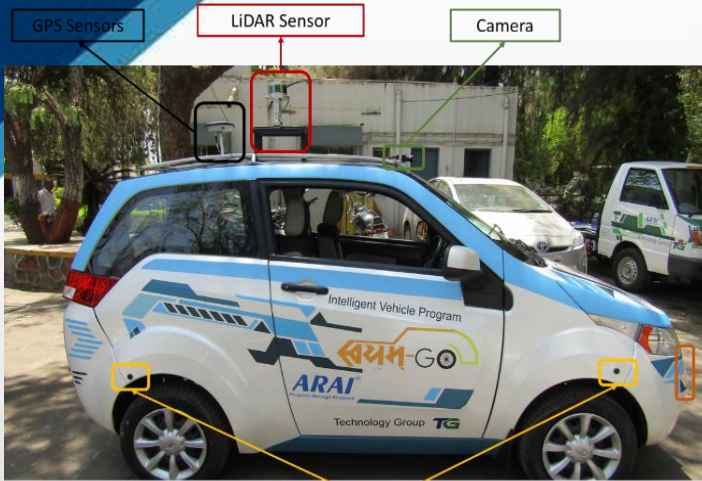
AUDIT & ASSESMENT

Simulation Based Testing & Validation
..Driver in Loop (DIL) +HIL

Virtual and Experiential V&V Methods



INTEGRATED TESTING & VALIDATION APPROACH



Ultrasonic Sensors

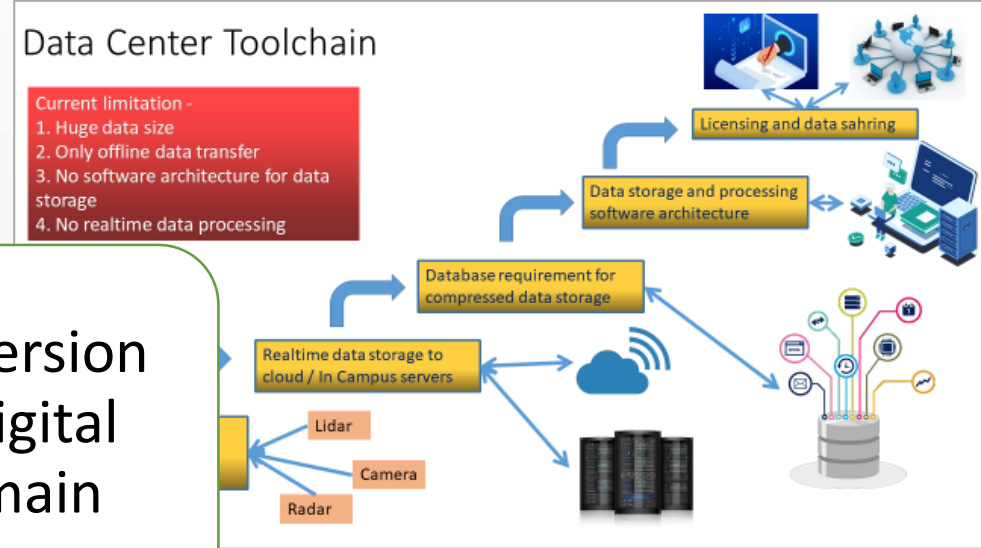


Indian Database & Use case

Conversion to digital domain

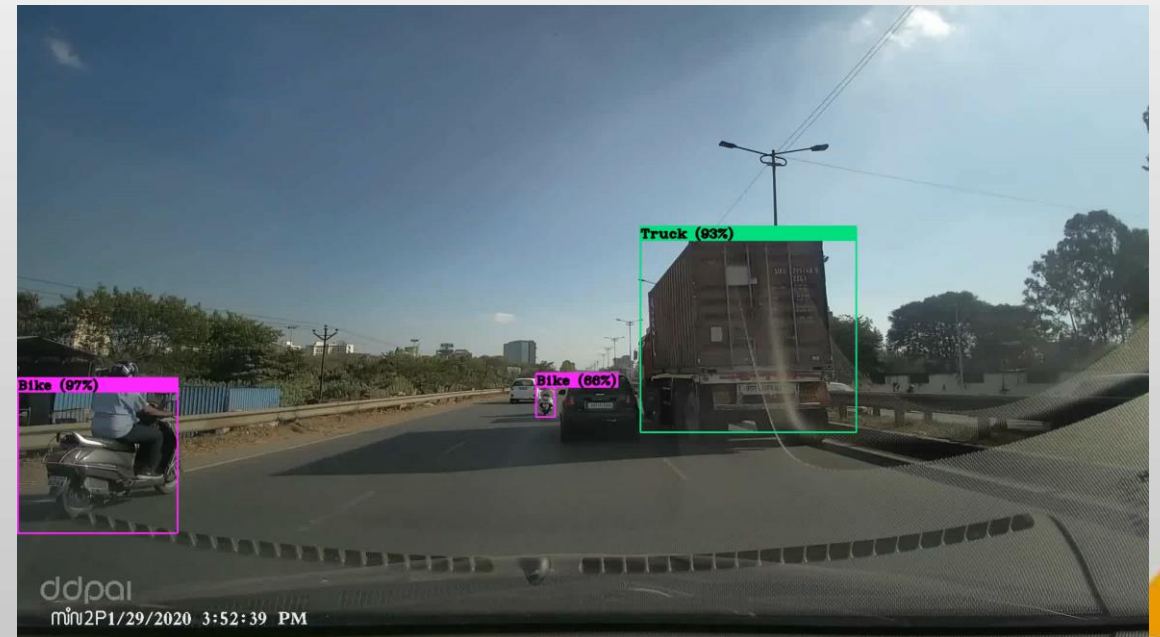
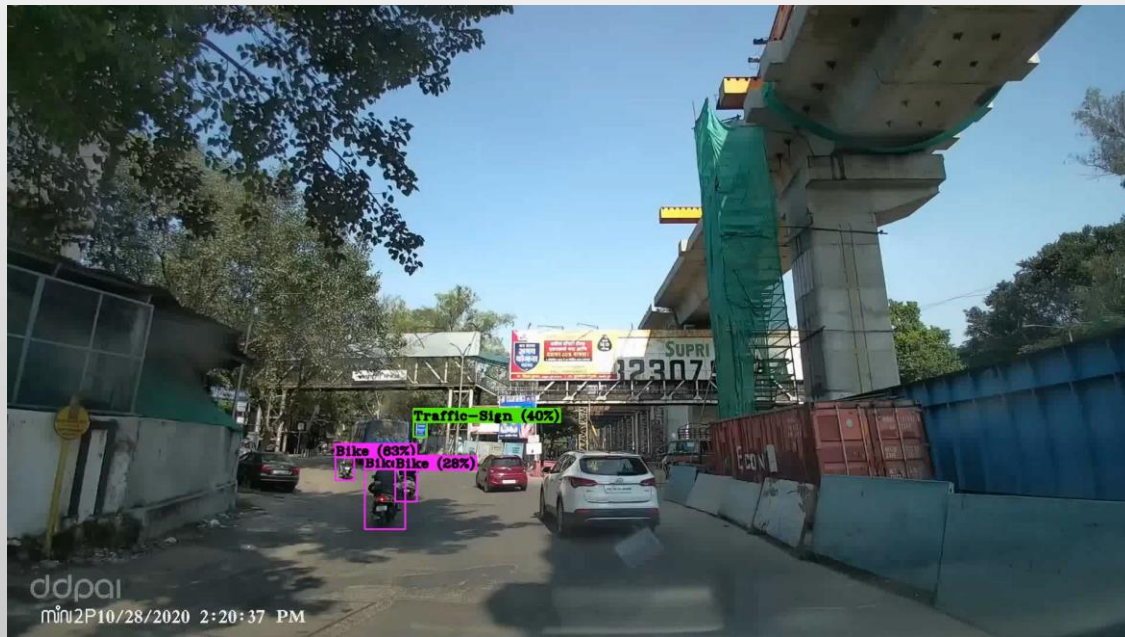
Vehicle Testing

Lab level V&V with DIL

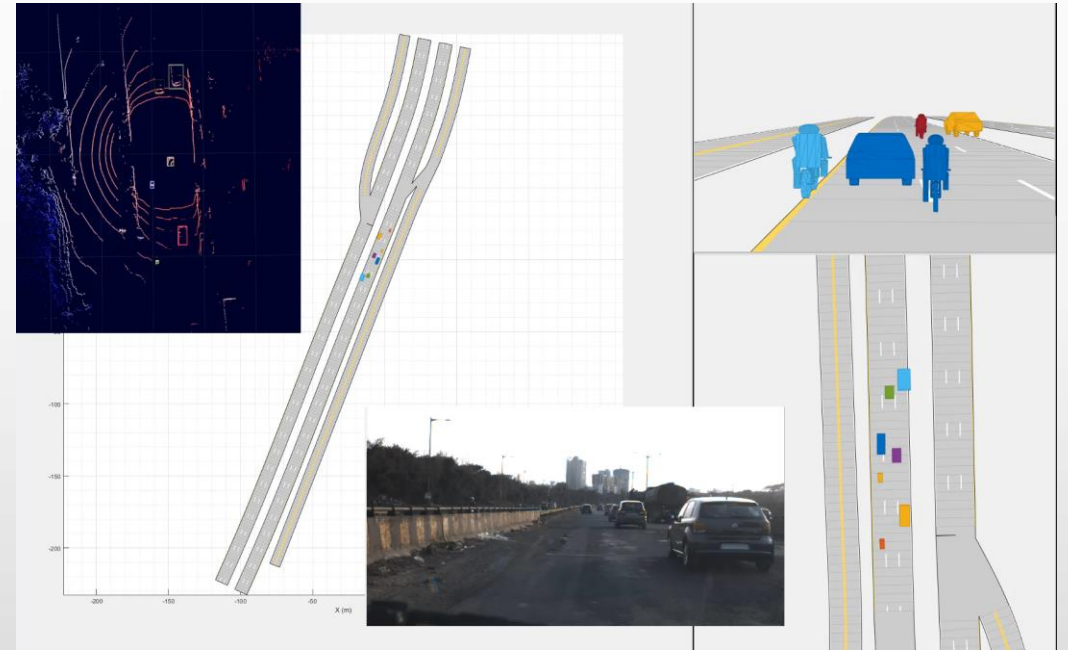


INDIA SPECIFIC DATA GENERATION

- Synchronous data from various sensors... camera, lidar, radar, IMU,..
- AI & ML algorithms with Indian data base.. To recognize india specific vehicle classes and traffic & infra signs



- Synthetic Scenario Generation from real traffic data
- Simulation based Verification and Validation



Scenario from Accidental data



Actual footage

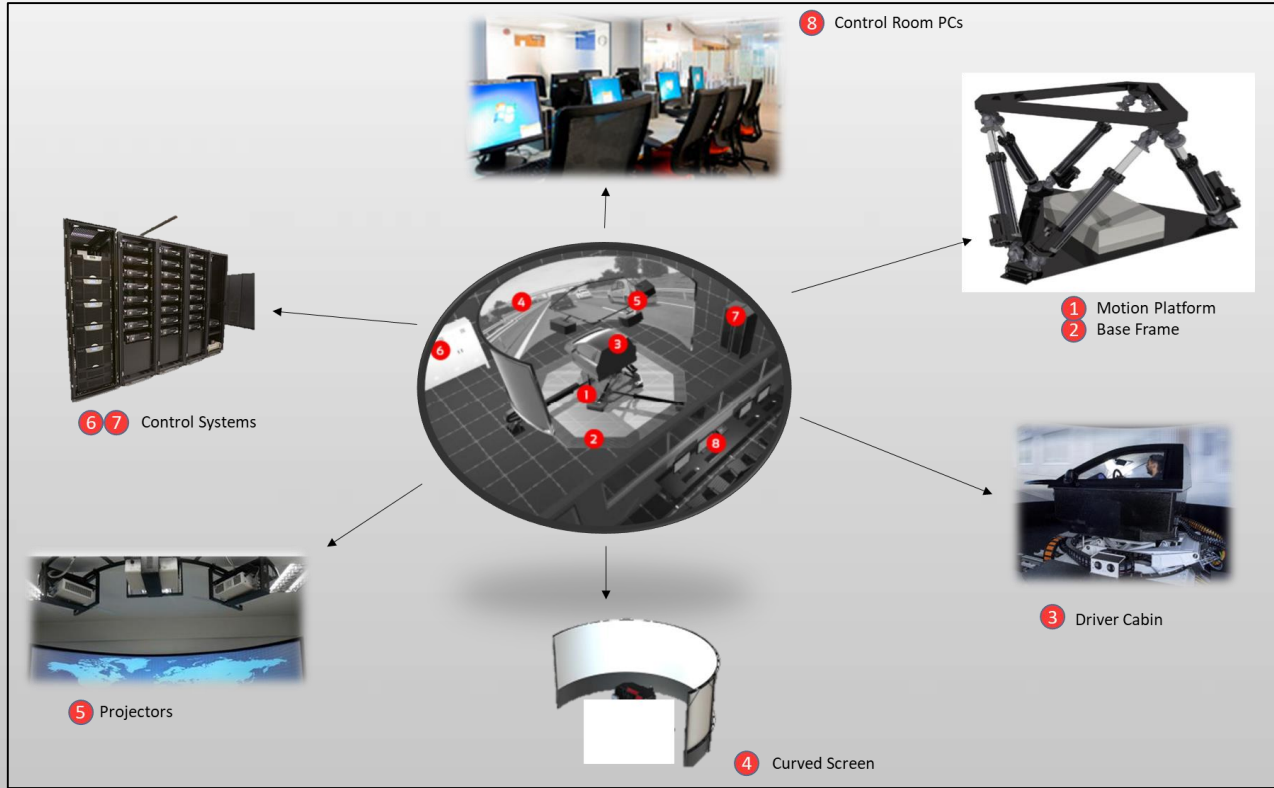


Digitalized scenario



DRIVER IN LOOP (DIL) SYSTEM

Scenarios ..Road.. Vehicle... in Lab.. ADAS
ECU in Real.... And How Driver Responds?



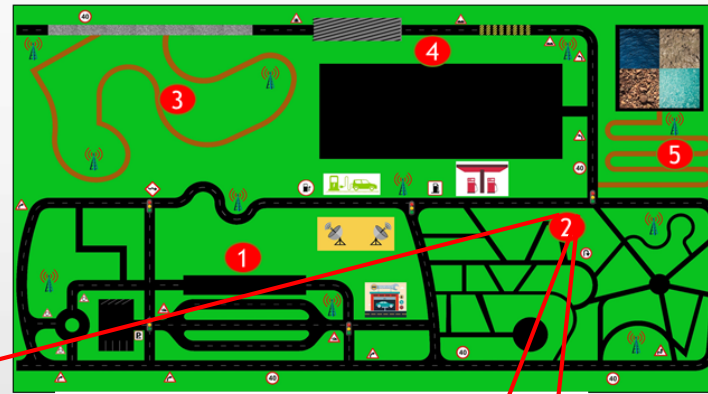
ADAS TRACK FOR VEHICLE LEVEL TESTING- A TYPICAL INDIAN CITY

Facility for vehicle testing

- ✓ Dedicated track
- ✓ Build modular/movable infrastructure for ADAS
- ✓ Test dummies with Auto control

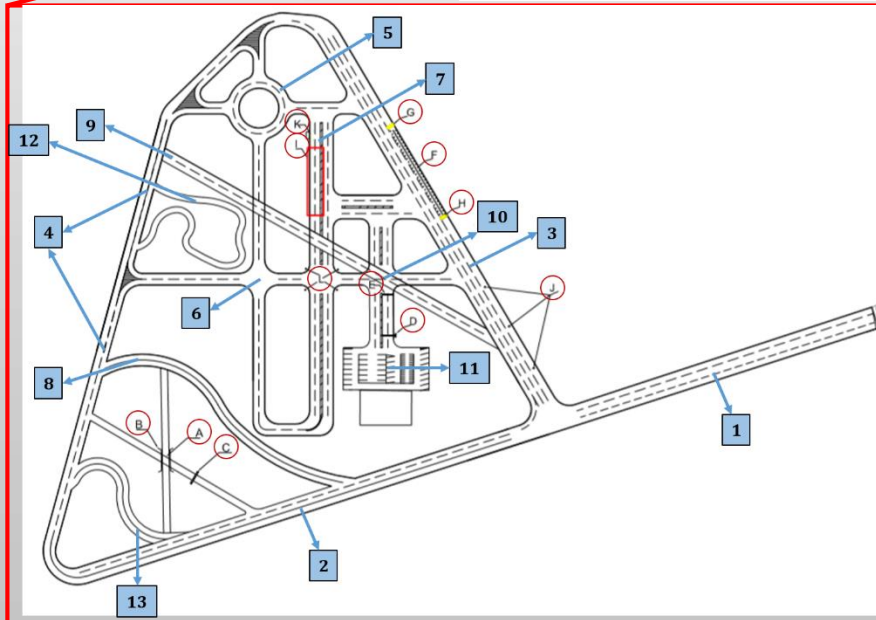
Conceptualization of track for Indian scenario

- 1 Regulatory/Certification ADAS tests zone
- 2 Smart city zone
- 3 Rural roads zone
- 4 Dynamics tests zone
- 5 Agriculture test zone



ARAI has published this concept in SAE international paper -2019-26-0100

Area of track = 80,000sq.m = 20 Acre



Track features	
Annotation	Name
1	
2	3-lane road with varying lane markings
3	
4	Inner city road
5	Round-about junction
6	Euro NCAP Junction
7	4 lane road
8	S curve
9	Flyover
10	4-way junction
11	Parking lot
12	Rural road
13	Mini S curve
A	Under Pass
B	Iron Bridge
C	Over Head Barrier
D	Boom Barrier
E	Drain Mesh
F	City Pot Holes
G	Detachable Speed Breaker
H	Single Speed Breaker
I	Inflatable Tunnel
J	Man hole covers
K	Bus stop
L	Traffic Signals

Indian City Scenario

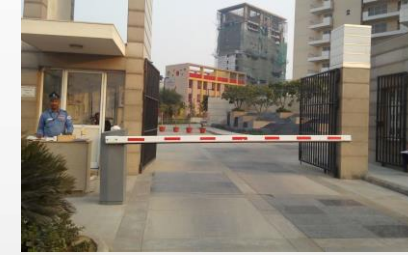
Height Constraint Barrier



UNDER PASS



Boom Barriers



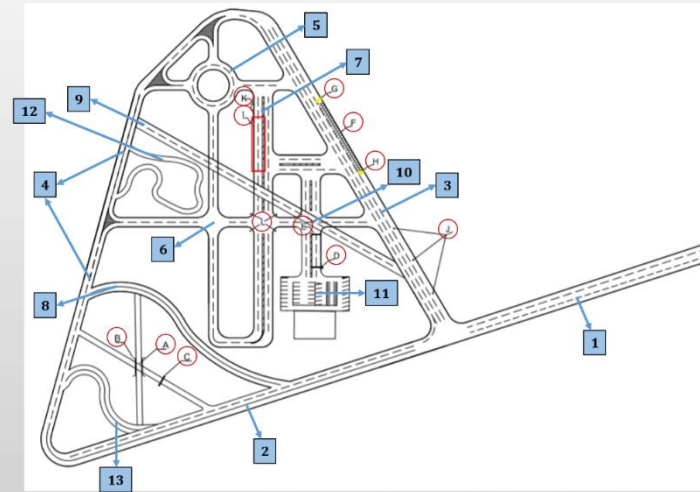
Drainage meshes on road



Broken Drainage meshes on road



Manhole Below Road Level



Narrow Iron Bridge



Paved Road Patch



Indian City Scenario

Flooded Roads



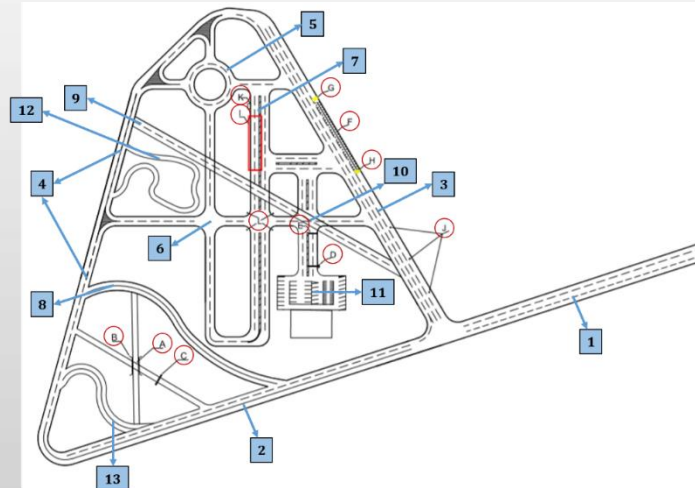
Speed breakers without markings



Speed breakers bigger than ground clearance



Speed breakers with missing Sections



Broken Road Signs



Bus Stops Very Close to road



Malfunctioning signal Lights



3 d painted speed breakers



Modular ADAS Test Track Equipment



Guided Soft Target- M1 category vehicle soft target with motion platform



Network/ communication & Positioning equipment



Cyclist Target

Adult dummy

Child Dummy

Moped Target

Motorcycle Target

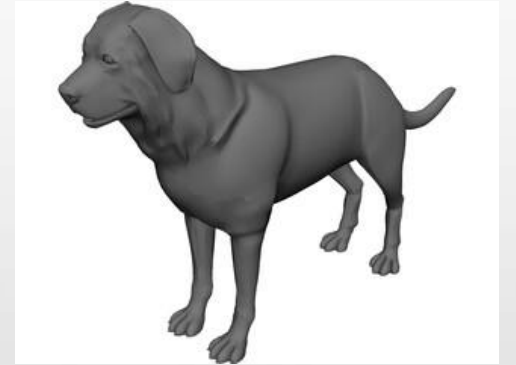
Launch Pad- Vulnerable Road User soft target with motion platform



India specific Dummies



3 wheeler



Dog



Cow



VMAD SG 1 informal documents on Road Scenario

67

VMAD-SG1-11-03

CETRA



Scenario Categories for the Assessment of Automated Vehicles

Version 1.7 from January 21, 2020

Erwin de Gelder (TNO), Olaf Op den Camp (TNO), Niels de Boer (NTU)



Left-hand traffic

133

Type 7: Other

70 parking vehicle	701 A B	702 A B	703 at car park P		
71 backing up	711 A B	712 A B	713 A B	714 A B	715 A B
72 u-turn	721 A B	722 A B	723 A B	724 A B	725 A B
73 not fixed object	731 load A	732 other A			
74 broken down vehicle	741 accident A B	742 break down A B			
75 animal	751 wild animal A	752 unattended domestic anim. A	753 attended domestic anim. A		
76 sudden physical disability	761 falling asleep A	762 dizzy spell A	763 other (no alcohol) A		
77 sudden vehicle damage	771 tyre A	772 windshield A	773 brakes A	774 steering A	775 other damage A

Japanese proposal for the traffic Scenario - In progress

Catalogue of Functional Scenarios (GERMANY)

India specific scenario

Categories of Scenario

1. Scenarios on straight road
2. Scenarios on Curved Road
3. Scenarios on Signalized junction
4. Scenarios on Non Signalised Junction
5. On Roundabout

[Click here for Indian scenario catalogue](#)



Thank you



“Together We Can”

