AUTOMATING ROUTE MAPPING FOR PBS VEHICLES

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INTRODUCTION

1. **Revolutionary PBS Route Tool:** DSG's cutting-edge mapping tool for PBS vehicles—automated, bespoke maps, transforming route planning.

2. **Precision in Seconds:** Operators input vehicle details, get unique IDs, and dynamic maps instantly. Adaptable for diverse networks, especially unladen operation.

3. **Future-Ready PBS Networks:** Tool anticipates Level 3B vehicles, considers geometry, and LSSP performance. GIS methodology reshapes the landscape of heavy transport.

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BACKGROUND

1. **Tasmanian Road Transport Overview:** Overview of road transport landscape in Tasmania.

2. **Existing SPV Mapping Tool:** Enables transport operators to input vehicle specifics into an online portal, generating a unique ID and bespoke network map, facilitating state-approved access. Multiple IDs support diverse network usage, especially unladen operation.

3. **Motivation for PBS Tool:** Leveraging SPV tool success, DSG aims to optimize PBS vehicle routes for enhanced efficiency and adaptability.

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RESEARCH QUESTION & GOALS

- **Research Question:**
  - Can we develop a robust, scalable route assessment methodology for detailed swept path analysis of bespoke PBS heavy vehicles, codified into GIS for dynamic route maps?

- **Specific Goals:**
  1. Validate attributes for automated GIS road network mapping.
  2. Optimize and document route assessment for time efficiency.
  3. Minimize reliance on "engineering judgement" for objective, consistent, and scalable network assessments.

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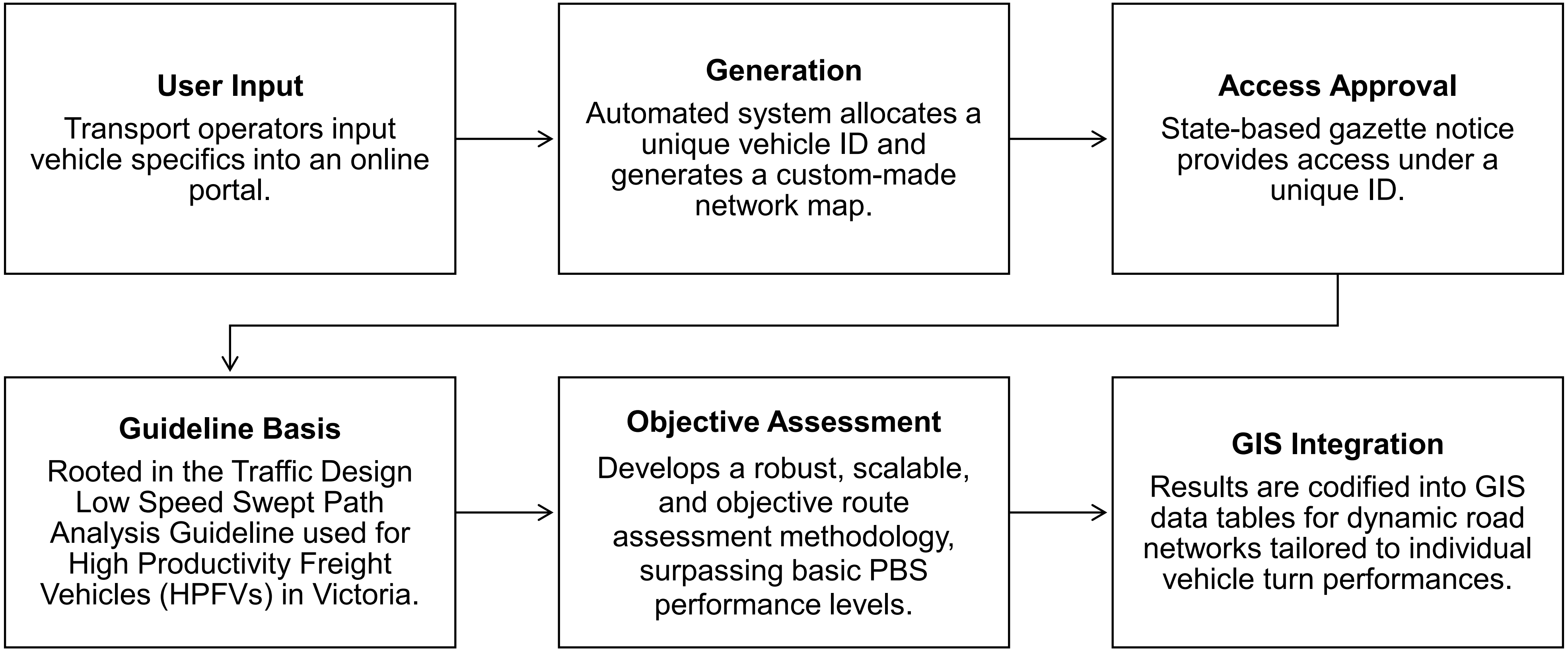
DYNAMIC ROUTE MAPPING FRAMEWORK



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METHODOLOGY

Developing LSSP reference vehicles

Refining and developing LSSP route assessment method

Refining and developing GIS attributes table

Assessing target intersections in Northern Tasmania

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LSSP REFERENCE VEHICLES

- Achieved 0.1m swept path granularity for PBS assessments by developing vehicles from 5.4m (PBS Level 1) to 10.6m (PBS Level 3).
- Considered Austroads design (e.g., 12.5m trucks, 13.5m buses) due to space constraints, especially on local roads.
- Used 2.6m wide vehicles for assessment, anticipating potential wider global standards and aiming for future-proofing.

Vehicle Combination	Configuration	LSSP (m)	Project Group
Truck/Bus	12	5.4: 6.5	Truck-Bus (LSSP: 5.4-6.5)
Prime Mover Semi	12s3	6.6: 8.0	Prime Mover & Semi-Trailer (LSSP: 6.6 8.0)
B-Double	12s3s3	8.0: 8.7	B-Double (12s3s3) (LSSP: 8.0-8.7)
A-Double	12s3-2s3	8.8: 10.6	A-Double (12s3-2s3): (LSSP: 8.8 10.6)

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ROUTE ASSESSMENT METHOD

- **Refinement Process:**
  - Adapted VicRoads guidelines for target intersections in Northern Tasmania.
  - Iteratively refined with DSG teams and local factors.
- **Structured Approach:**
  - Used risk assessment framework.
  - Collaborated with stakeholders for unique perspectives.
- **Consultation:**
  - Engaged DSG network access and geospatial teams.
  - Conducted desktop risk assessment for 2-3 intersections.

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GIS ATTRIBUTES

1. **Intersection ID:** A unique identifier for each intersection
2. **Turn ID:** The unique identifier for each turn within each intersection
3. **Description:** Describes the turn which outlines the road names and turn directions.
4. **Swept Path:** Result of swept path analysis. The theoretical capacity of the intersection.
5. **SP Access:** A Swept Path number DSG have applied to some vehicles based on experience.
6. **SP Current:** The current level of access provided, 7.4 m (PBS L1), 8.7 m (PBS L2).
7. **SP Target:** The desired level of access for the intersection.

Based on review of frameworks and tools like google map APIs, GIS data protocols, etc.

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INTERSECTION ASSESSMENT

- Used Spider Path with Near Maps aerial imagery on DSG's selection based on PBS Network demand and aerial imagery coverage
- Assessed vehicle performance for each combination and Mapped swept paths onto Tasmanian intersections

Item	Turn ID	Description	LSSP (m)
1	I1_A1_1	Stennings RdBass Hwy (North Bound)	6.5
2	I1_A1_2	Stennings RdBass Hwy (South Bound)	10.6
3	I1_A2_1	Bass Hwy (South Bound)	No Turn
4	I1_A2_2	Bass Hwy (South Bound)Stennings Rd	9.6
5	I1_A3_1	Bass Hwy (North Bound)Stennings Rd	8.7
6	I1_A3_2	Bass Hwy (North Bound)Stennings Rd !CrossLanes!	10.4
7	I1_A3_3	Bass Hwy (North Bound)	No Turn

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INTERSECTION ASSESSMENT

Simple 4-way Intersection – Bass Hwy / Reservoir Dr, Wynyard	Complex 4-way Intersection -Bass Hwy / Edwards St, Burnie
	

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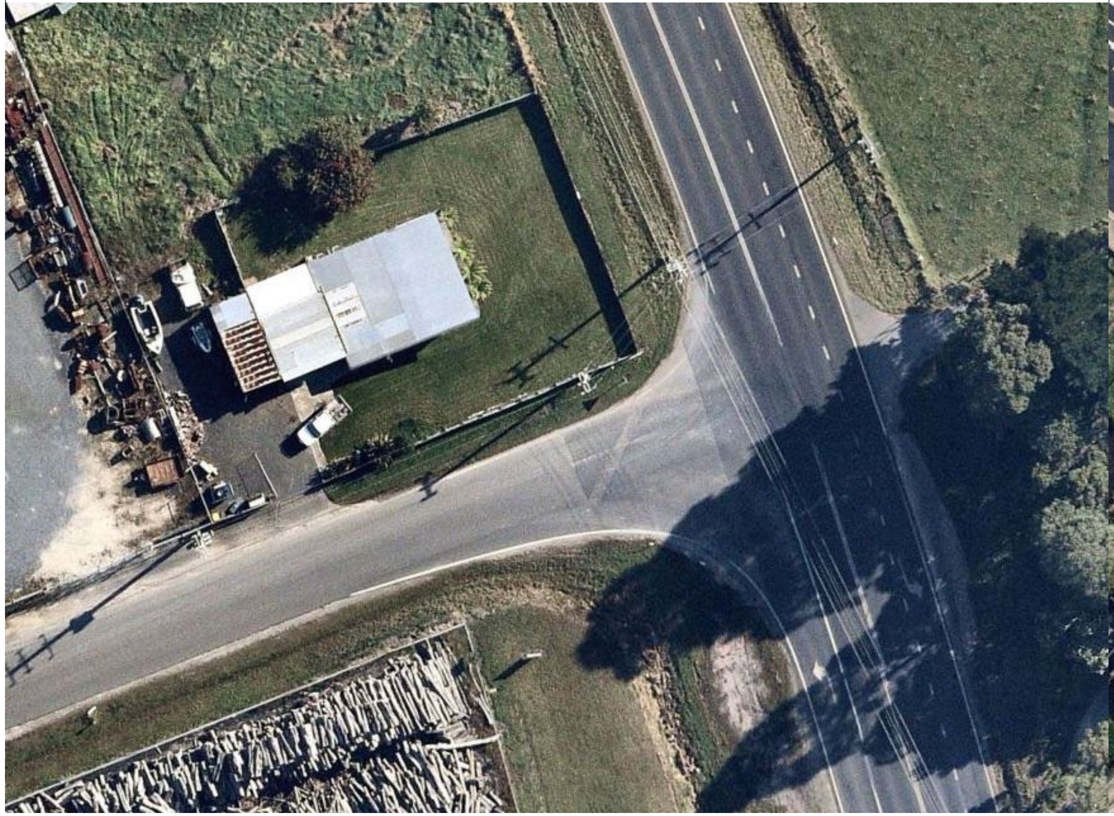
INTERSECTION ASSESSMENT

Simple T intersectionBass Hwy / Stennings Rd, Wynyard	Complex T IntersectionBass Hwy / Brickport Rd, Cooee
	

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INTERSECTION ASSESSMENT

RoundaboutBass Hwy / Calder Rd / York St, Wynyard	Bass Hwy / Maskells Rd / & weighbridge site, East Ulverstone

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COLLISION BOUNDARIES

- **Development:** Designed as a route assessment tool, emphasizing encroachment.
- **Objective:** Enables quick, objective judgment and measures LSSP encroachment.
- **Visuals:** Flashing lines illustrate mid-turn collisions; purple points indicate encroachment.
- **Automation Base:** Vital for LSSP assessment automation, foundational in the existing process.
- **Implementation:** All drawn lines treated as wall-to-wall; optimal path drawn with LSSP 10.6m vehicle.
- **Enhancements:** Introduces soft boundaries for precision, considers roadside objects for realism.

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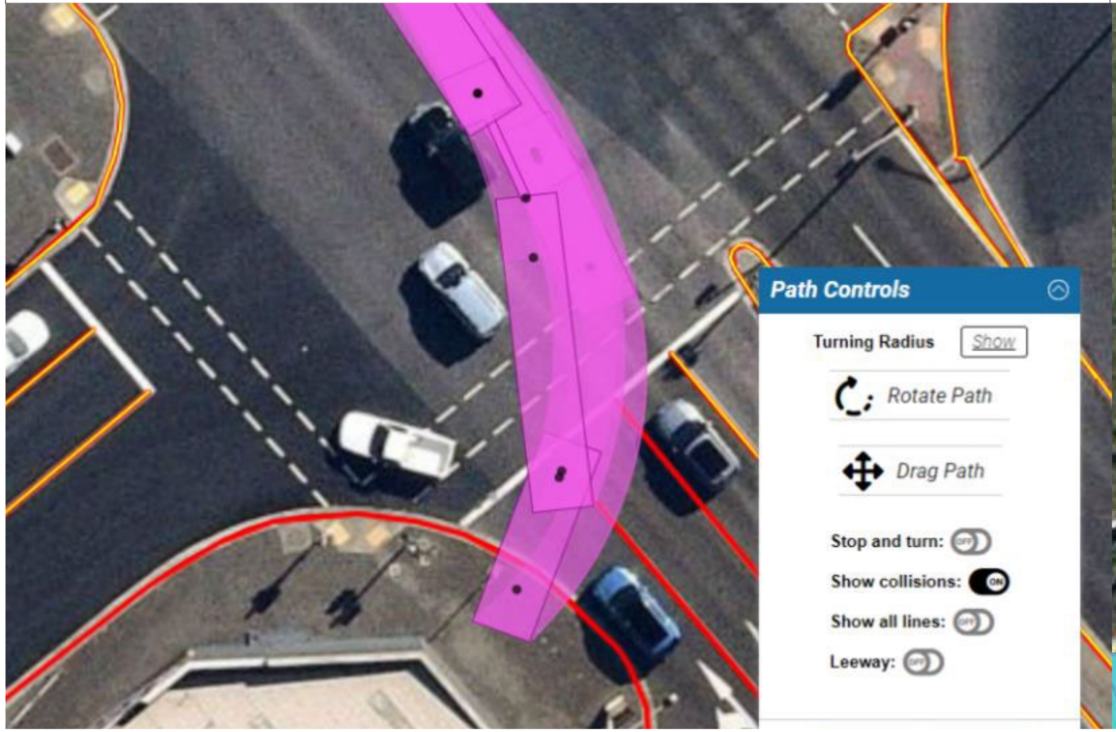
COLLISION BOUNDARIES

Collisions represented with red line flashes mid turning	Collision points (purple) visualise the degree of obstruction encroachment



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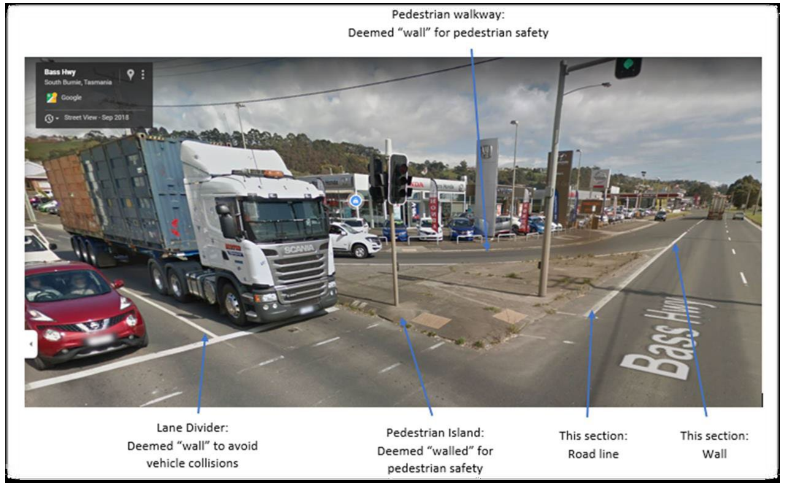
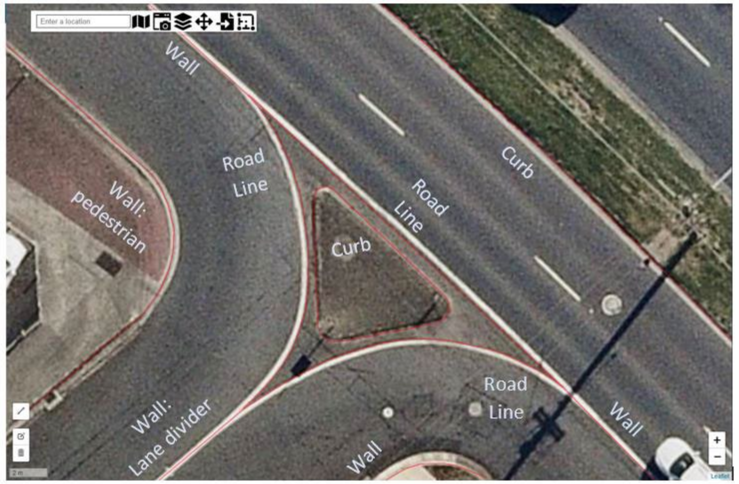
COLLISION BOUNDARIES





Category	Description	Examples
Road Lines	Defined by common vehicle road rules (realistically encroached by trucks)	• Solid road lines
Curbs (Soft Constraint)	Frontal /Tail Swing may spill over this area, but tyres cannot (i.e. non-mountable)	• Curb islands (non-pedestrian & without fences) • Grass patches, roundabouts
Walls (Hard Constraint)	No part of the vehicle may encroach this area	• Fences/barriers/tall obstacles • Solid lane dividers in busy intersections • Pedestrian walkways, pedestrian Islands

EFFECT OF FRONTAL SWING AND S-DIMENSION

- **Front Overhang (FOH) for PBS Compliance:**
  - FOH maximized to meet PBS Frontal Swing limit of 0.85 m which resulted in larger FOH than practical expectations.
- **Comparison Vehicles:**
  - Both with 5.6m LSSP but differing FOH (0.85m vs. 0.7m); adjusted by increasing/decreasing S-Dimension.
- **Outcome:**
  - Despite increased S-Dimension for reduced FOH, comparable road space required.
  - Validates LSSP as a consistent metric across varied FOH and frontal swing characteristics.

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ROADSIDE FURNITURE AND CURB ASSESSMENT

- Considered assessing curb-to-curb rather than wall-to-wall analysis.
- Frontal swing could pass over the top of a curb boundary and provide a more realistic assessment of the vehicles in-service capability
- Enabling vehicle frontal swing to overlap curbs would be dangerous if curb adjacent obstacles or Roadside Furniture (RSF) are not taken into consideration
- RFS was proposed to be categorized as a separate boundary entity – like a wall but it can be added or removed
- Road managers can manage inconstant RFS and keep maps up to date.
- Use of scalable and droppable template shapes such as circles, squares or rectangles to represent RFS

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ROADSIDE FURNITURE AND CURB ASSESSMENT

Classic Swept Path

Frontal Swing Over Curb

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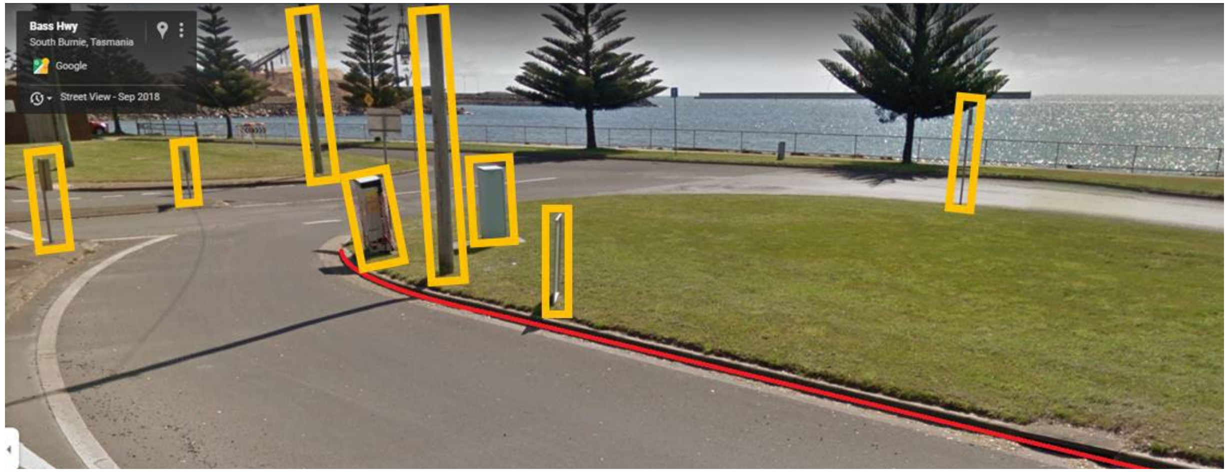
ROADSIDE FURNITURE AND CURB ASSESSMENT



Boundary Category	Height (m)
Road lines	0
Curbs	0.1
Walls	∞

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CONCLUSIONS

- **Combined Concept for Accurate LSSP:**
  - Integration of curb and roadside furniture concept.
  - Enhances accuracy and detail in LSSP assessments.

- **Representation of Road Line Type Boundaries:**
  - Allows for the representation of road line type boundaries.
  - Filters out unrealistic vehicle dynamics for precision.

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FUTURE WORK

- Development of additional tyre steer path visualisation to be able to properly allow for front/rear overhangs leeway for curb-to-curb assessment while not allowing for steer tyre-boundary collision.
- Additional development on boundary attributes to group them into separate categories (e.g wall or curb) to better be able to represent the vehicular interactions/collisions with each boundary.

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THANK YOU

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