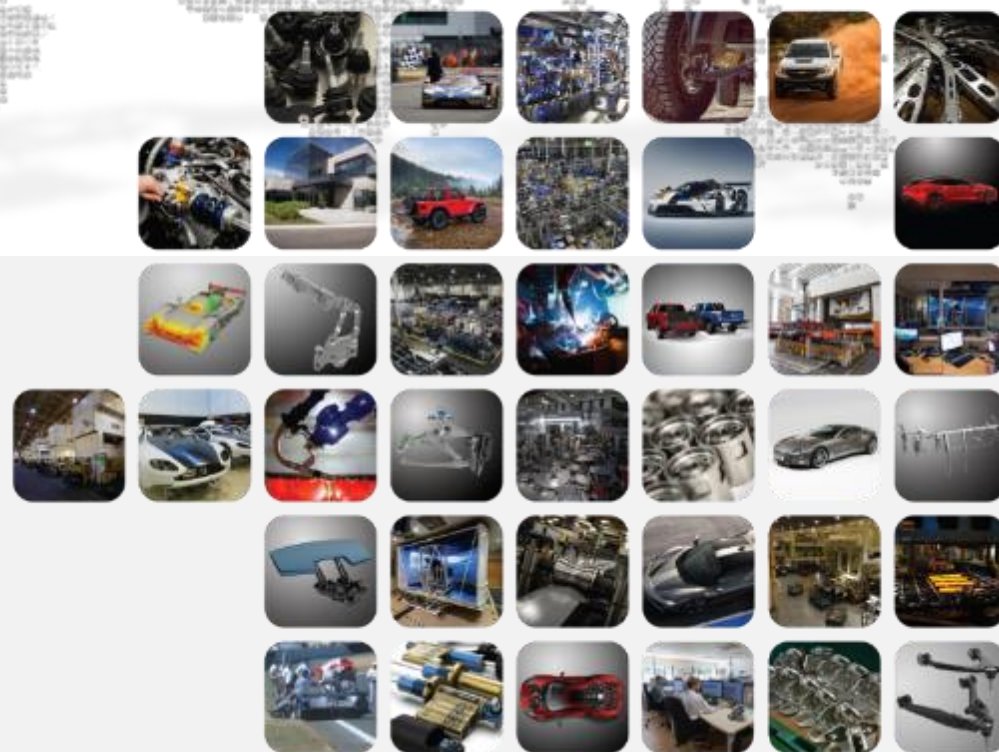




DiM Based Development Skeptic to Believer

**2023 Zero Prototypes Summit
Sept 20 2023, Novi DIM Center**

Murray White

Introduction



Multimatic is a supplier that delivers manufactured products and engineering services to the global automotive industry at any volume level. Headquartered in Toronto, Canada with facilities in North America, Europe and Asia.

Low Volume Production

High Volume Production

Suspension Products



Structural Products



Mechanism Products

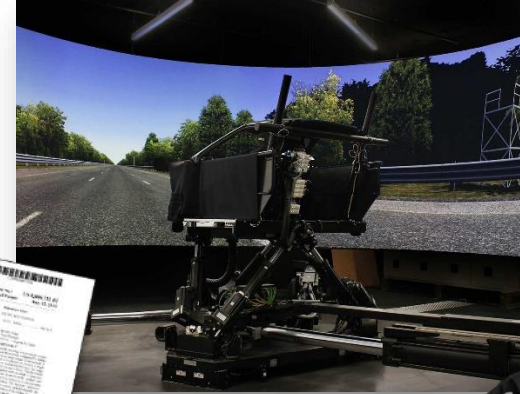
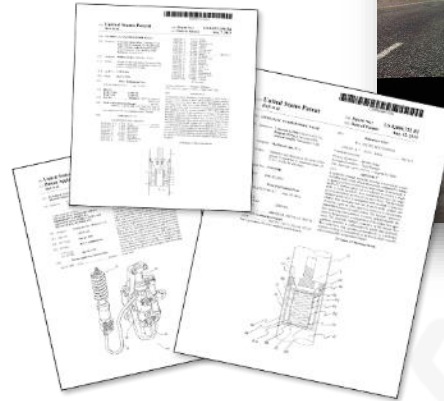


Multimatic Engineering



Multimatic Engineering delivers integrated design, analysis, prototyping, testing, validation and R&D activities for products ranging from individual components to complete vehicles

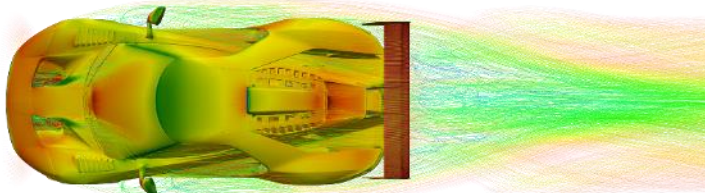
Research and Development



Vehicle Dynamics

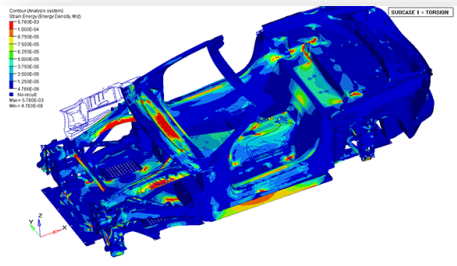


Testing



Advanced simulation

Component and system engineering



Multimatic's Simulator Timeline



Daytona Prototype
Parameter Car



Camaro Z/28



Mazda B12/80 LMP2



Aston Martin
Vantage Race Car



Ford GT Road and Race Car

MTCe DIL



Luxury Sedan

2010

2011

2012

2013

2014

2015

2016

2017

2018

2019

2020

2021

2022



MTCDIL

(Driver-In-The-Loop)



Level 5 Prototypes



Level 5 D-Sports Racer



Viper ALMS GTS-R

Mazda DPi
RT24-P



Mustang GT4



Truck/SUV



Detroit SimCenter

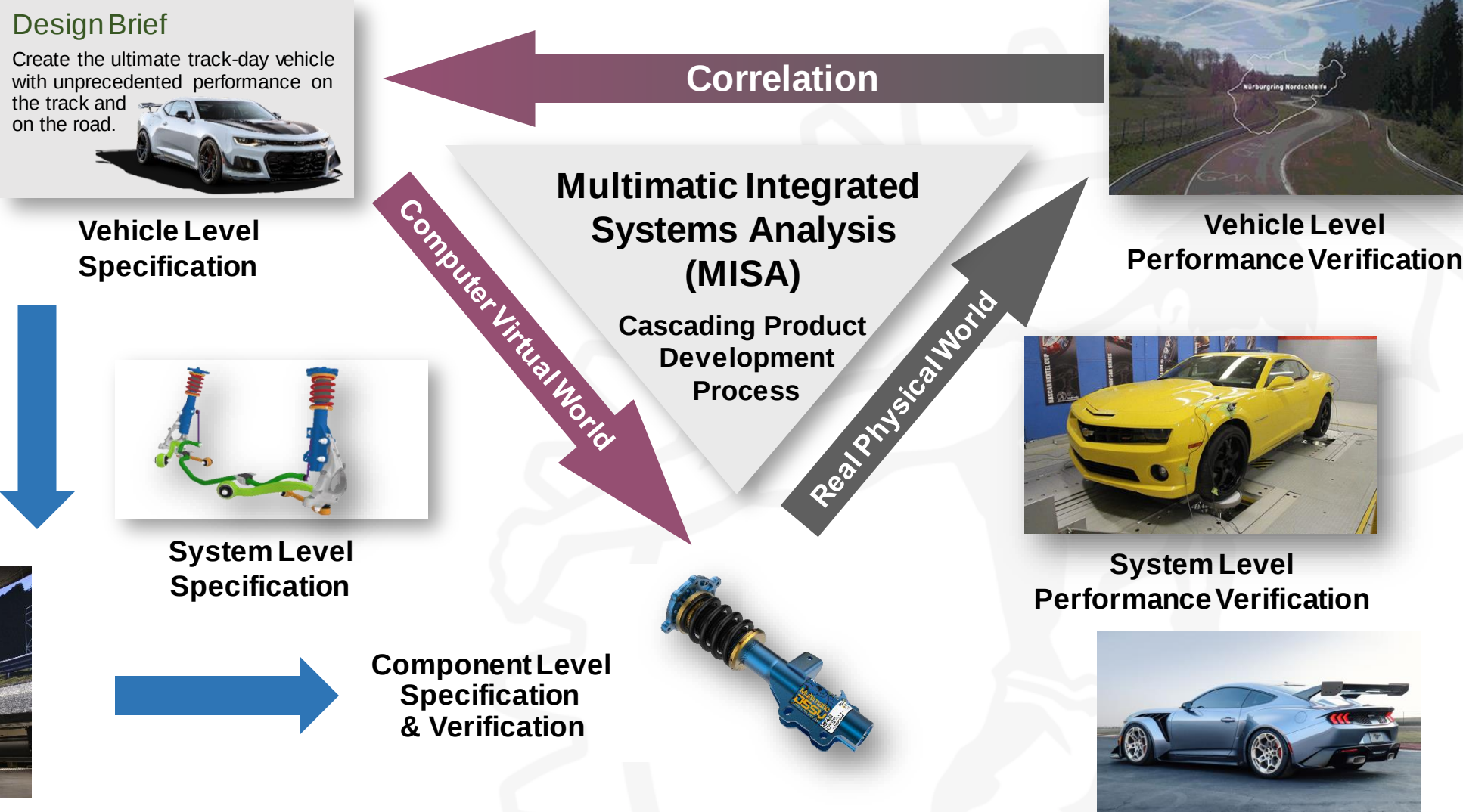


An Integrated Development Approach



MISA is an approach applied throughout Multimatic. It allows for the translation of vehicle level design briefs into components that achieve those goals.

Our driving simulators are a critical part of this process. DIL validation bridges the gap between the analytical and the subjective and integrates the driver into the MISA process. This has allowed us to reduce total development timelines by over 50% in some cases.



General Progression of Capabilities



- Motorsports Focused – successful use for chassis and aero development, improving correlation to on-track performance

Evolved motorsport use into development of more complex systems – DRS, state-based traction control etc

DIM improved all aspects of fidelity, particularly evaluation of various damper systems



- Road Car – Z28 Camaro DSSV damper supply – Nurburgring & VIR circuit tuning activities. Limit handling work showed reasonable correlation. Attempts at ride development largely unsuccessful

Expanded track simulation work to include active aero systems and electronic chassis control algorithm development – still primarily a 'limit handling' tool



Major enhancement of capabilities on the ride evaluation side of the equation – development and calibration of adaptive and active suspension control algorithms enabled

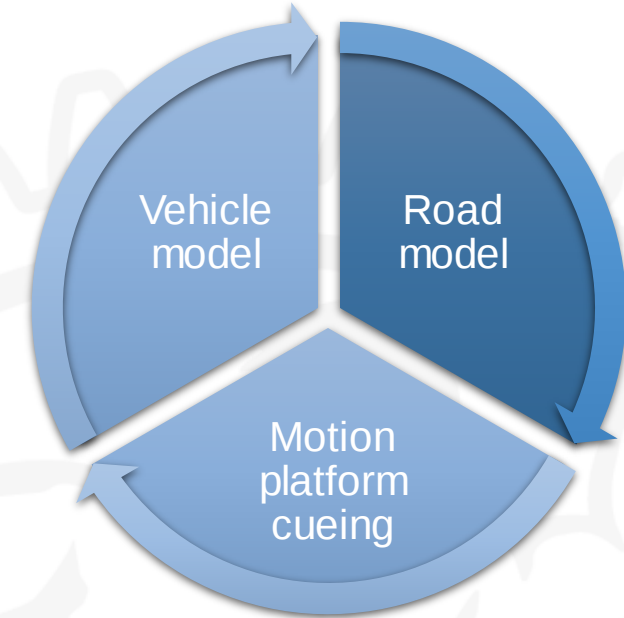


DiM Ride Development – Methodology

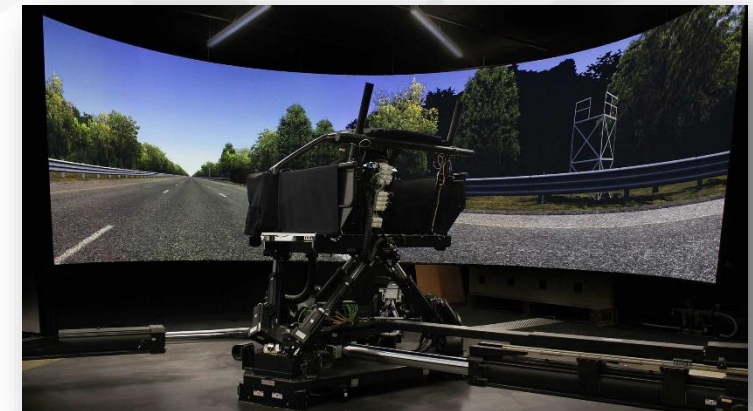


These achievements would not have been possible without several key elements which have proved essential to evolving our capabilities:

1. *Virtual vehicle model*
2. *Virtual road model*
3. *Motion platform cueing*
4. *Cockpit layout – windshield view, ergonomics, seat, wheel*
5. *Well-known ride evaluation environments*



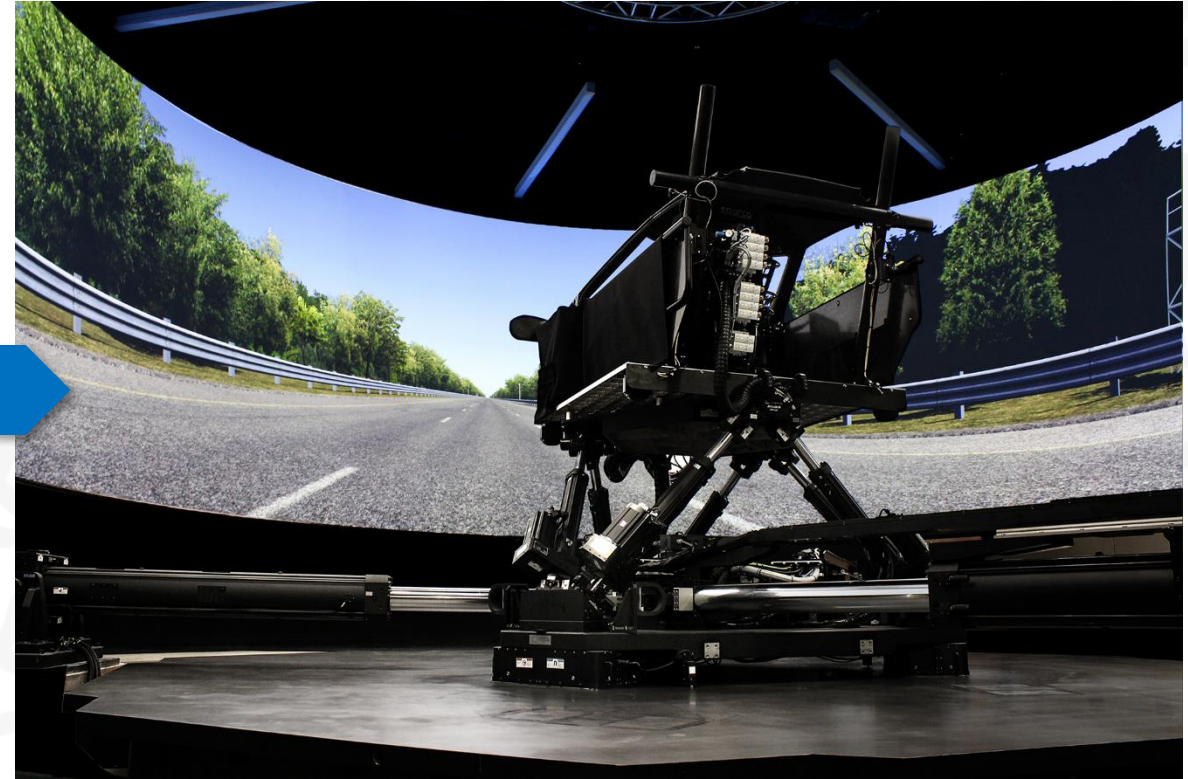
Accurately reproducing our real-world testing environments on the DIM proved essential for us. It provides the opportunity to evaluate virtual vehicles on a variety of surfaces that we consider important and know very well. We understand how vehicles in various classes need to behave on these surfaces.



DiM250 Simulator – Modular Cockpit



- Due to the wide range of projects and vehicles Multimatic is involved with, a **fully reconfigurable cockpit** was designed and built.

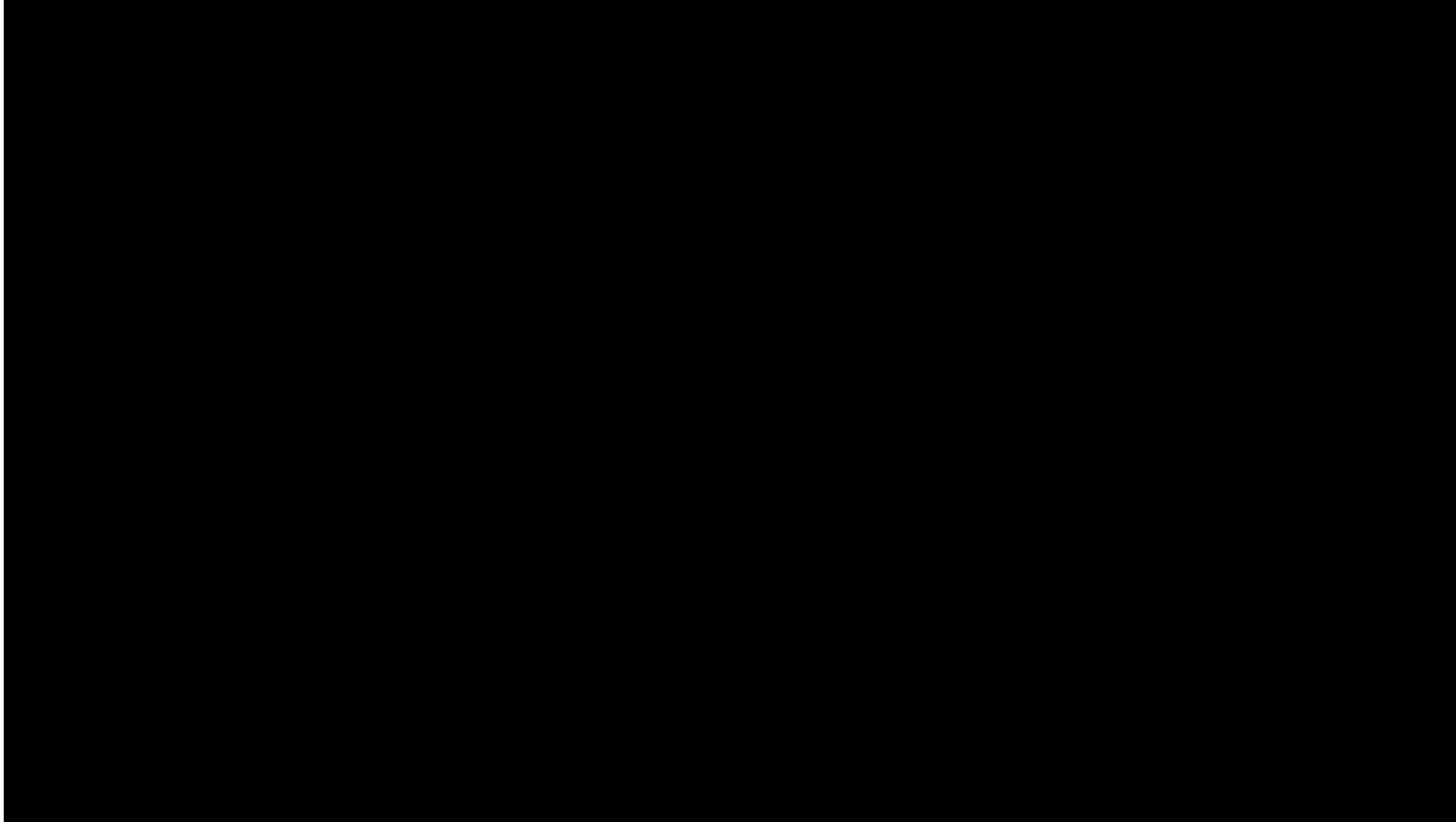


Example of road car shell from OEMs, tire manufacturers, etc.

Multimatic modular cockpit (weight ~200kg)



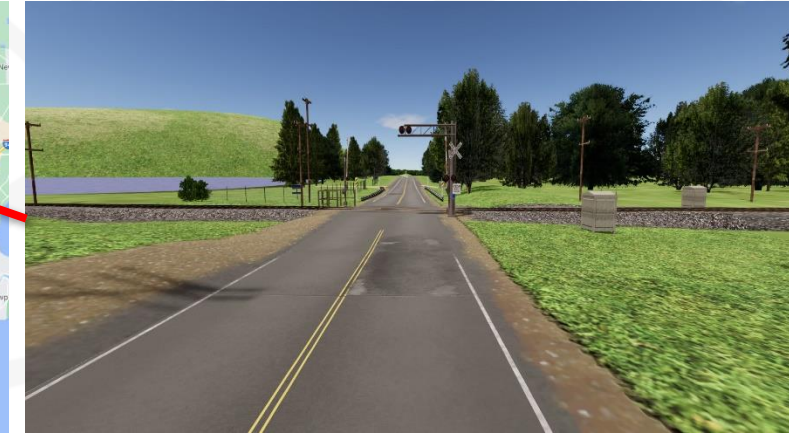
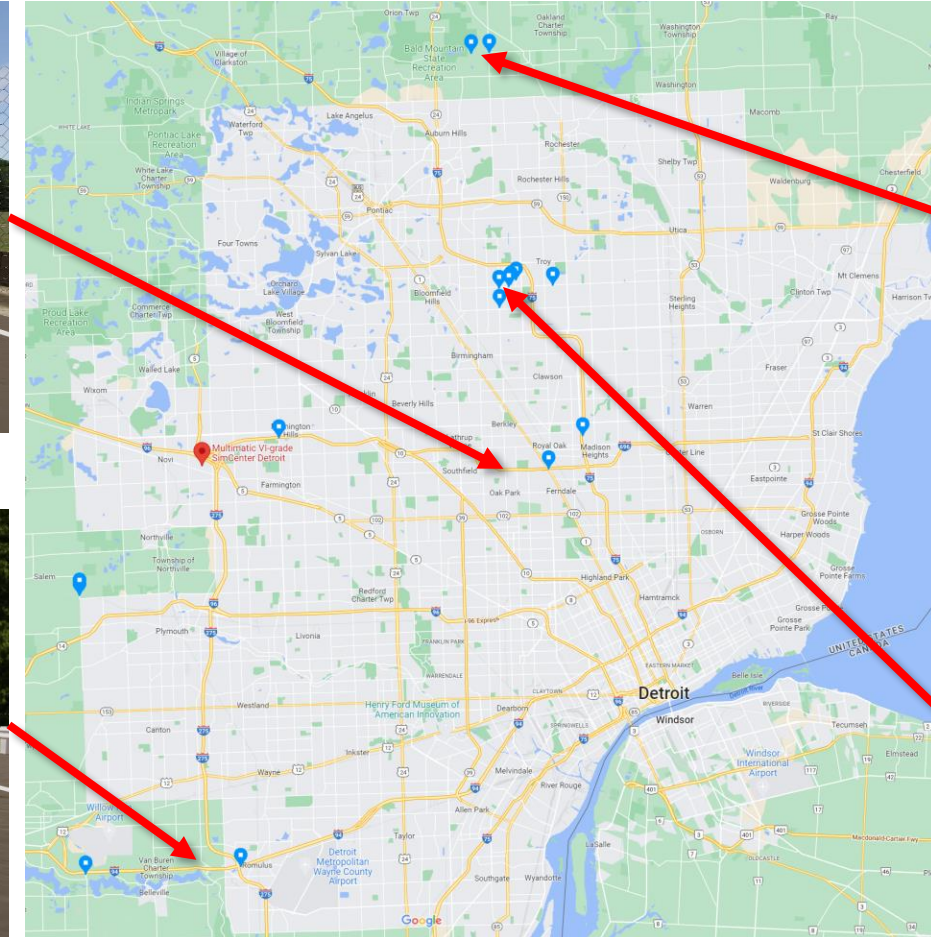
UK Ride Route Example



Virtual Ride Roads (Michigan, US)



A series of roads in Michigan used for our subjective evaluation including smooth/rough roads, highways and obstacles (railroad crossing, speed bumps, etc.) have been scanned and rendered.



Ongoing Challenges

- We have already had a lot of success in developing our ride capabilities on the DIM.
- Further enhancements on the following areas are critical to ‘filling the toolbox’
 - Audible ride content – very influential on impact harshness perception
 - ‘Enveloping tire models’ – the tire is the first layer of isolation so clearly needs to be represented as accurately as possible. Essential for accurate secondary ride evaluation.
 - In the off-road vehicle arena, tire-to-deformable-surface modelling enhancements and understanding how to best utilize the available vertical travel
- All these issues are well known and the evolution of techniques is constant so a year from now we expect considerable further improvement in all aspects of vehicle evaluation on the DIM.
- 5 years from now – who knows?!



Presentation Information



Audience: 2023 Zero Prototypes Summit Attendees

Date: Sept 20, 2023

Location: Novi, Mi

Presenters: Murray White, Aiden Wagner

Title: Sceptic to Believer – Simulator based Development

Abstract: Multimatic has been using driving simulators for dynamics development for over 10 years. Only recently have we had success in developing ride-comfort on the DIM. This has lead to greatly increased confidence in these techniques

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