



cavnue

The future of roads.

**NCHRP 20-24(128) Cooperative Automated Transportation
June 28, 2021**

The Future of Roads



CARS ARE GETTING SMARTER

Vehicles with
increasing ADAS¹
capability are
reaching scale

¹Advanced Driver Assistance Systems.

Accelerating the Benefits of Autonomy

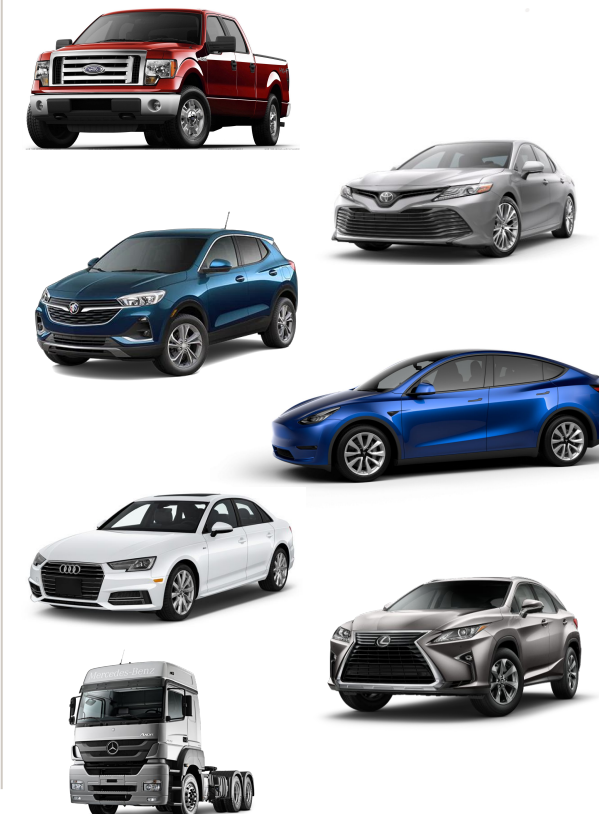


Cavnu enables...

...a better experience for all vehicles



...today's semi-autonomous vehicles to operate more safely and efficiently



...an environment ready for tomorrow's fully autonomous vehicles



Anticipated ADAS Model Launches

Intro year

Models by 2025 ¹

	Ford <i>Co-Pilot 360 2.0</i>	2020	11
	General Motors <i>Super Cruise</i>	2020	22
	Tesla <i>Autopilot</i>	2020	5
	Volvo <i>Pilot Assist</i>	2020	2
	Volkswagen <i>Traffic Jam Assist</i>	2020	12
	Nissan <i>ProPilot Assist 2.0</i>	2021	2
	Toyota <i>SafetySense 2.5</i>	2021	46

¹Based on current evaluation of compatibility with Cavnu technology including (1) adaptive cruise control and (2) lane keep assist.

Penetration of Sales and Parc by CAV capability

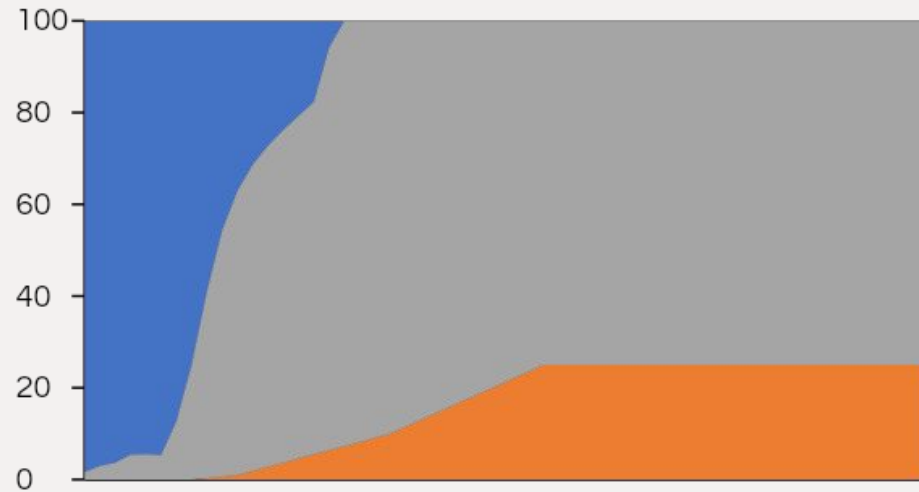


■ <L2 Capable
 ■ L2+ Capable
 ■ L4 Capable

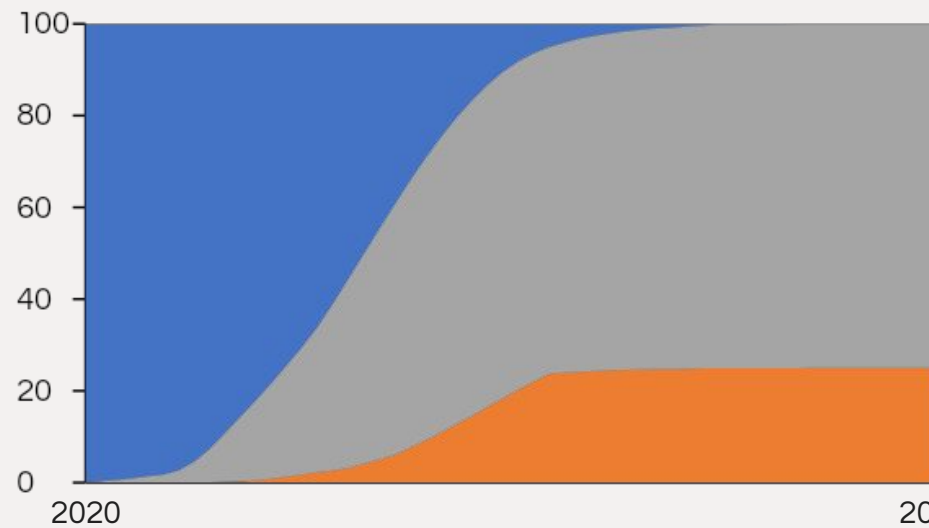
CAV penetration, % share

Downside

New Vehicle Sales



Vehicle Parc

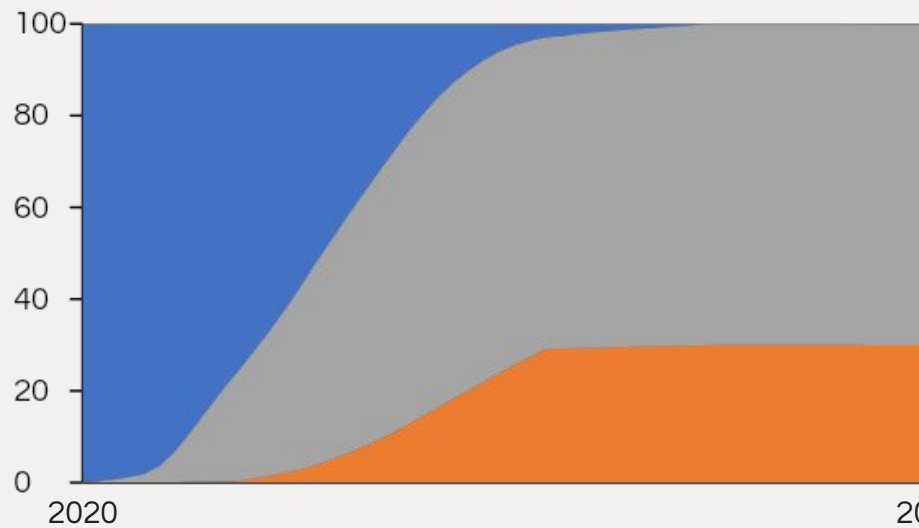


Base

New Vehicle Sales

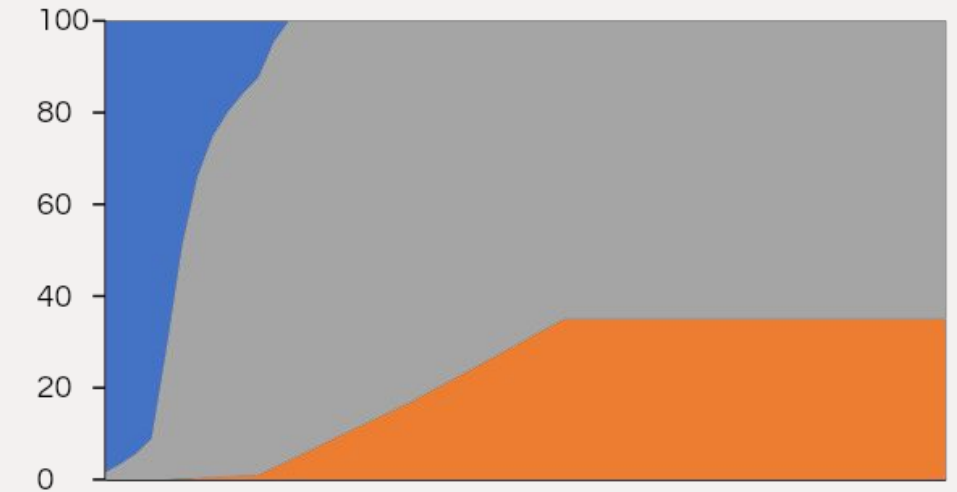


Vehicle Parc

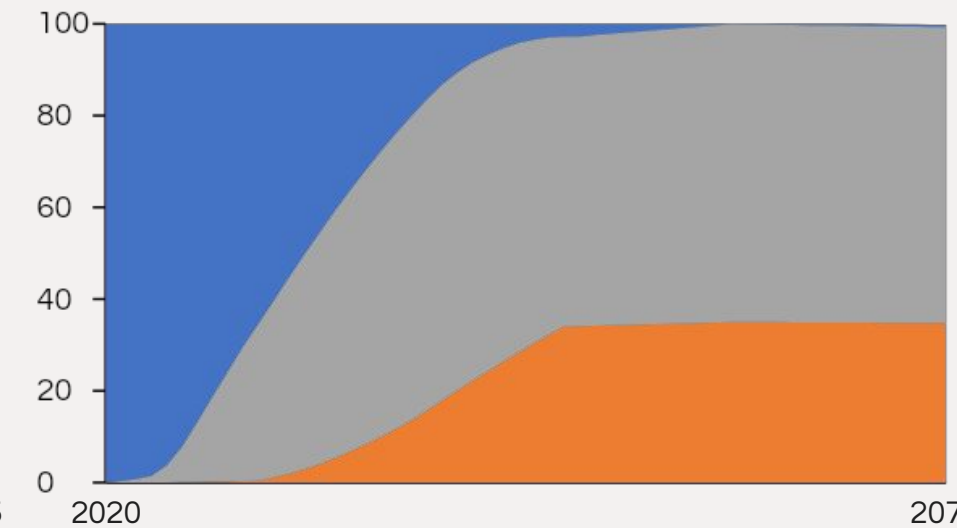


Upside

New Vehicle Sales



Vehicle Parc



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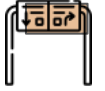






























ROADS HAVE NOT KEPT UP

Road infrastructure is woefully inadequate to achieve these vehicles' full potential

¹Advanced Driver Assistance Systems.

Today's roads present a complexity problem to AVs

Operational design domain

Environment	Road configuration		Road actors	Driving maneuvers
 Weather	 Ramp	 Driveway	 Car	 Follow lane
 Lighting	 Interchange	 Roundabout	 Truck	 LH turn
 Road condition	 Bridge	 Stop sign	 EMS	 RH turn
	 Tunnel	 Unprotected	 School bus	 Lane change
	 Shoulder	 One-way	 Motorcycle	 Merge
	 Crosswalk	 Crosswalk	 Bicycle	 Pull over
	 Bike lane	 Parking lot	 Pedestrian	 Park
	 Traffic lights	 Garage	 Wheelchair	 Swerve
			 Objects	 Emergency

"Scene" risks

"Scenario" risks

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SMART CARS NEED SMART ROADS

The future of roads will be safer and more efficient



cavnue

¹Advanced Driver Assistance Systems.

Creating Value for All Stakeholders



Drivers & Passengers

Improve safety, give time back, & expand access to transportation



OEMs / AV Companies

Enhance existing ADAS offerings and ship fully autonomous systems faster



DOTs & Policymakers

Save lives, increase throughput, and meet environmental goals



Road Operators

Drive operational efficiencies, provides new insights & new revenue sources



Cavnue Management Team



Tyler Duvall
Chief Executive Officer

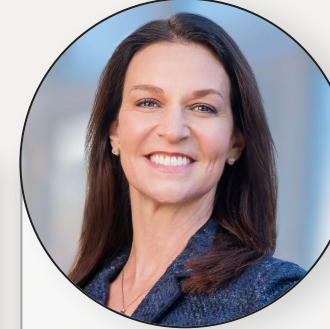
Nationally recognized leader in transportation

McKinsey & Company



Jaime Waydo
Chief Technology Officer

Former Waymo Chief Systems Engineer; most recently led Apple's autonomous systems efforts



Nicole Nason
Chief Safety Officer,
Head of External Affairs

Former Administrator of both FHWA and NHTSA



US DOT
FHWA



Mark de la Vergne
Project Development

Former mobility lead for City of Detroit

Sam Schwartz
Transportation
Consultants



Dave Clifford
Strategic Innovation and
Analytics

Former head of AI/ML at General Motors



Dino Nardicchio
Automotive & AV
Partnerships

Former Global VP of R&D Magna International



Pete Kenny
General Counsel

Former multi-vertical legal lead at HP and VP/DGC at Perspecta



David Kiley
Business Development

Former managing director of municipal finance at Piper Sandler



Christopher Hoover
Hardware Engineering

Former lead of Google AR/VR hardware and Hardware Lead at Google Geo





Michigan Project Overview

Launch

- Launched Cavnue in August 2020 in Michigan



- Announced flagship project with key partners in government and private sector



Bill Ford and Mayor Duggan at announcement

Co-development

- Signed exclusive Master Developer agreement with Michigan Department of Transportation



Controls the right of way



cavnue

Funder and Master Developer

Co-lead

Management committee

Working groups

- Kicked off process to scope project



Technology and infrastructure
Prototyping / requirements



Policy and regulation
Legislative / regulatory needs



Community engagement
Public support + econ dev



Finance + Operations
Viable project business case



Planning + Design
Viable project business case

Robust network of partners

- Engaged a broad / growing set of local partners



Stage

Initial Discussions

Feasibility Analysis

Execution

Agreement
by late
2021

OEM Partnerships



Cavnue helps OEMs...

- .Ship + scale faster.** There has been \$100B+ invested in AV / ADAS to date without clear ROI timeline.
- .Ensure a single standard.** Multiple smart infrastructure architectures adds complexity to integration.
- .Provide value-added services for all users.** Lane-level monitoring on Cavnue corridors improves overall road-user experience, beyond CAV benefit.

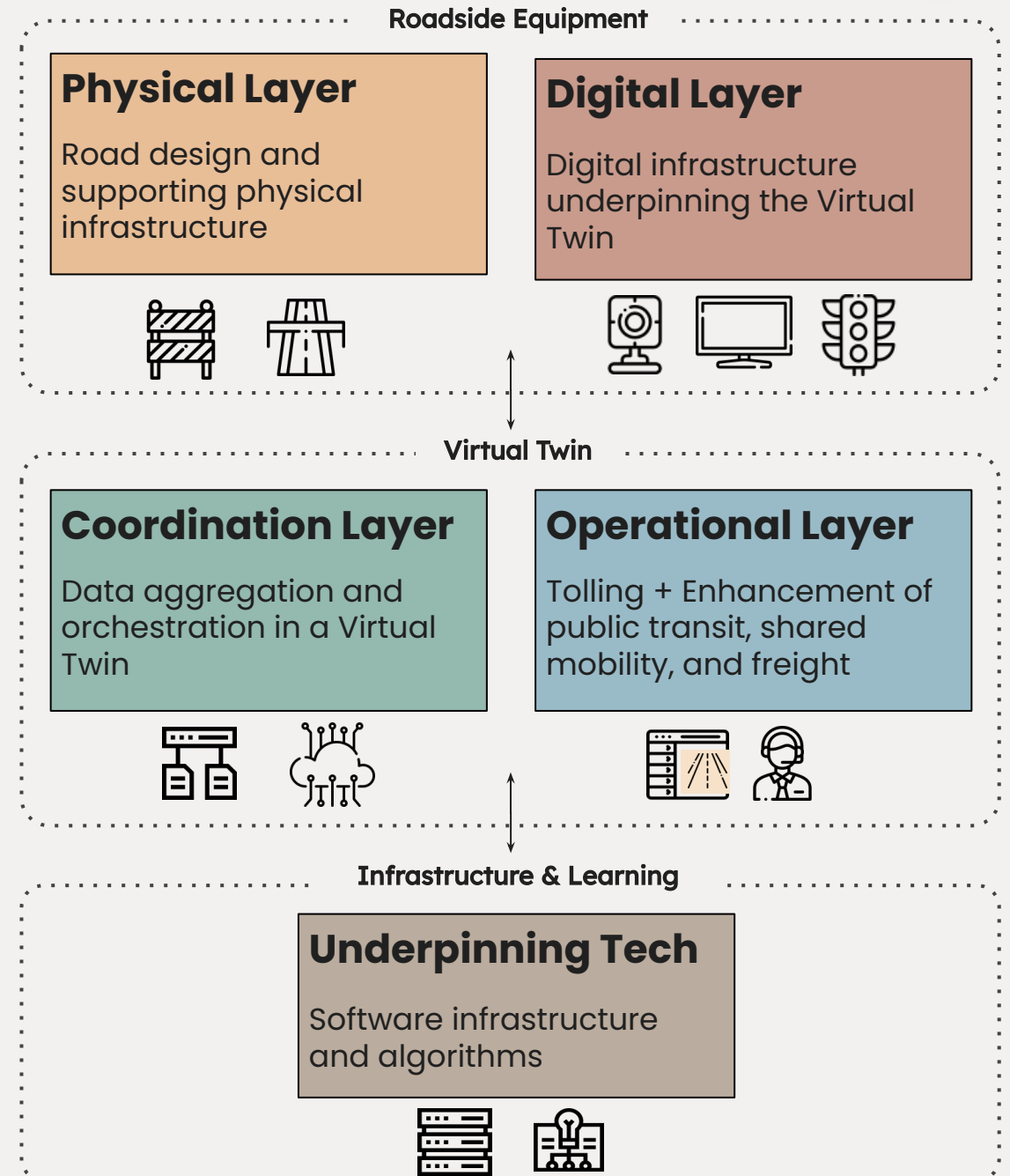


“Providing safe, well-maintained infrastructure that is consistent (both internally and with other roadways) and avoids deviations (in road design, signage, traffic signals, and other key elements) is a critical part of enabling advanced ADAS systems and forward-looking autonomy.”

The Roads of the Future



Cavnue is integrating hardware and software to ensure that the roads of the future are safer and more efficient

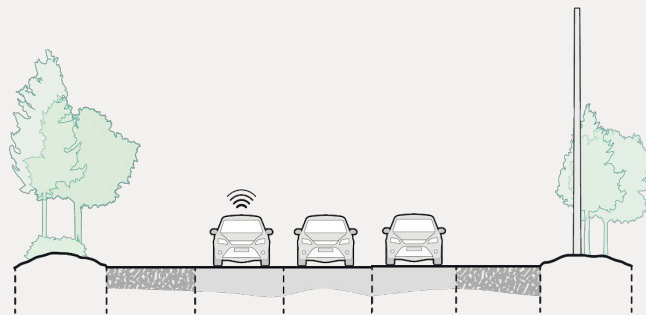


Technology Development Timeline

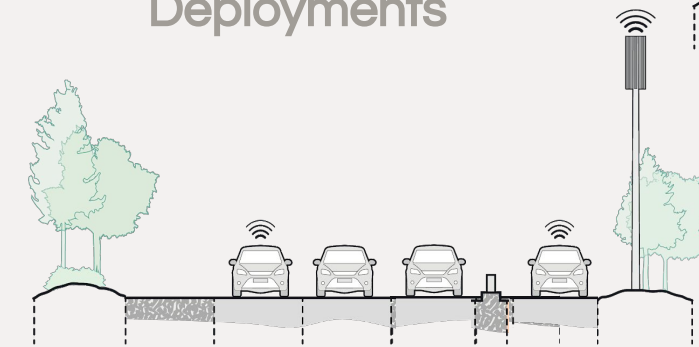


Cavnue's deployment framework provides flexibility and optimized operations both during early stages of Level-2+ (L2+) introduction and as CAVs reach higher penetration levels.

1950s to Today: Regular Vehicles on Regular Roads



From 2022: Cavnue Tech Deployments



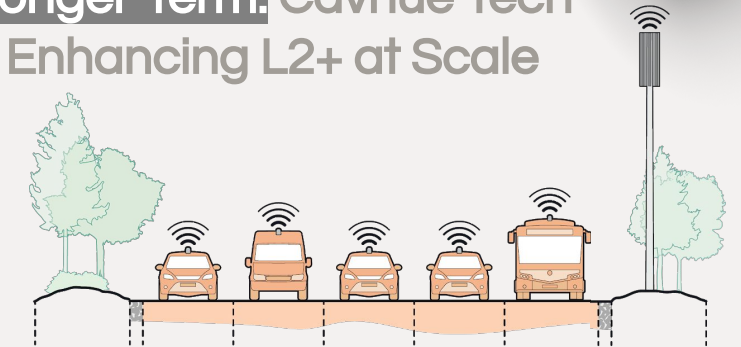
Deploy Cavnue hardware and software in mixed traffic conditions to create a safer road, reduce valuable edge cases and create digital enhancements.

From 2023+: Cavnue Tech Accelerating L2+



As L2+ CAV utilization increases, deploy a CAV lane that allows for mixed traffic operations but provides hands-off/eyes-off experience to CAV vehicles.

Longer-Term: Cavnue Tech Enhancing L2+ at Scale



As CAV penetration continues to rapidly increase, additional features of Cavnue's technology enable enhanced CAV operations such as coordinated driving and platooning.