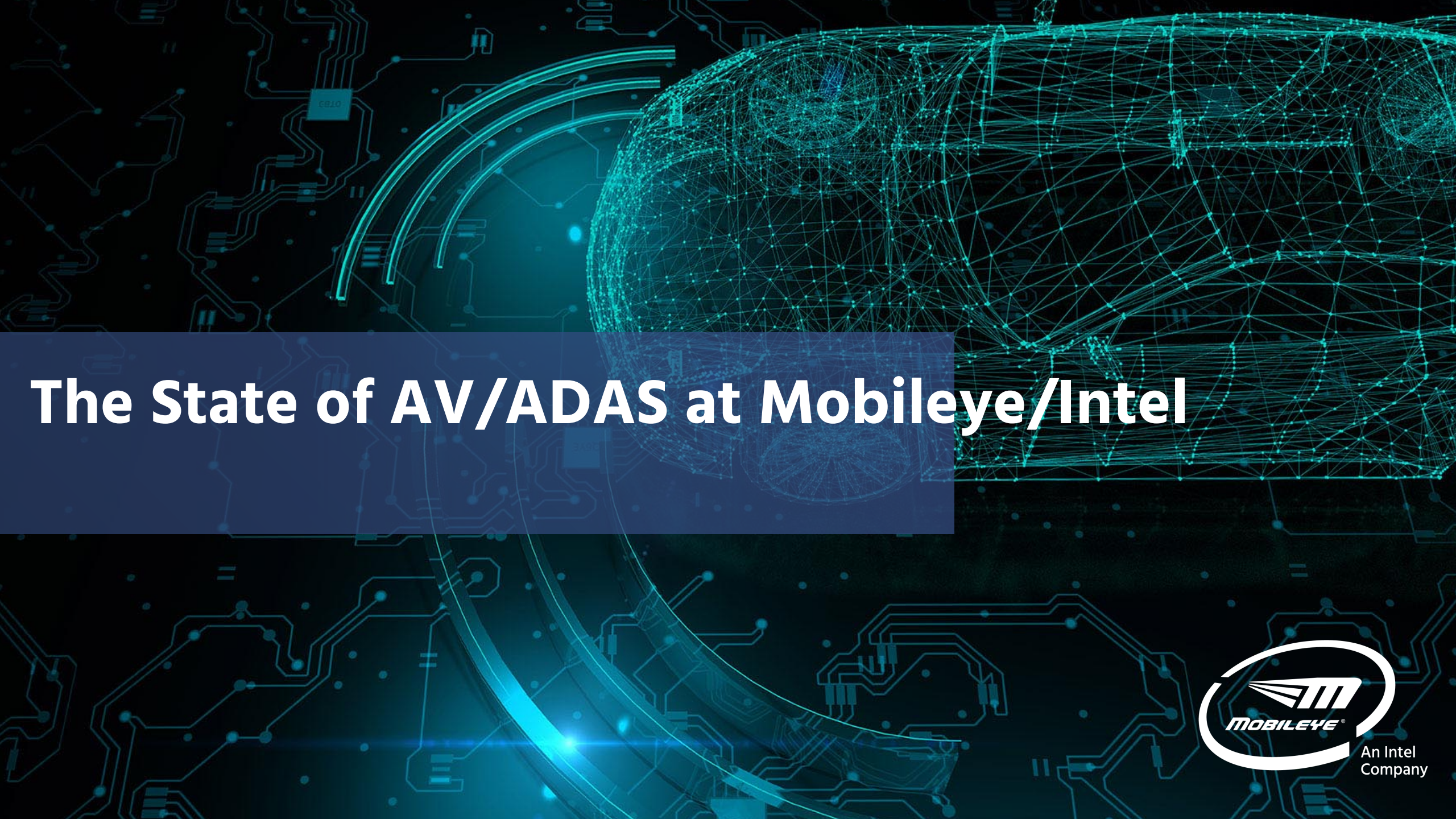

The State of AV/ADAS at Mobileye/Intel

MOBILEYE®
An Intel Company

Risk Factors

Today's presentation contains forward-looking statements. All statements made that are not historical facts are subject to a number of risks and uncertainties, and actual results may differ materially. Please refer to Intel's most recent earnings release, Form 10-Q and 10-K filing available for more information on the risk factors that could cause actual results to differ.

If any non-GAAP financial measures are used during the presentation, you will find on Intel's website, intc.com, the required reconciliation to the most directly comparable GAAP financial measure.

MOBILEYE
An Intel Company

2018 In Numbers

28

New design wins

- 24 OEMs
- 8 Tier 1s

20

Programs launches with 78 vehicle models

- 16 OEMs
- 5 Tier 1s

7

Vehicle models launched with EyeQ4

- EyeQ4 Mid Mono
- EyeQ4 High Tricam

56

Vehicle models with advanced functionalities

- 38 with ACC support (fused or vision only)
- 26 lane centering
- 20 traffic jam assist / pilot
- 15 road profile
- 2 newly designed EV (Audi E-Tron, NIO ES8)

MOBILEYE
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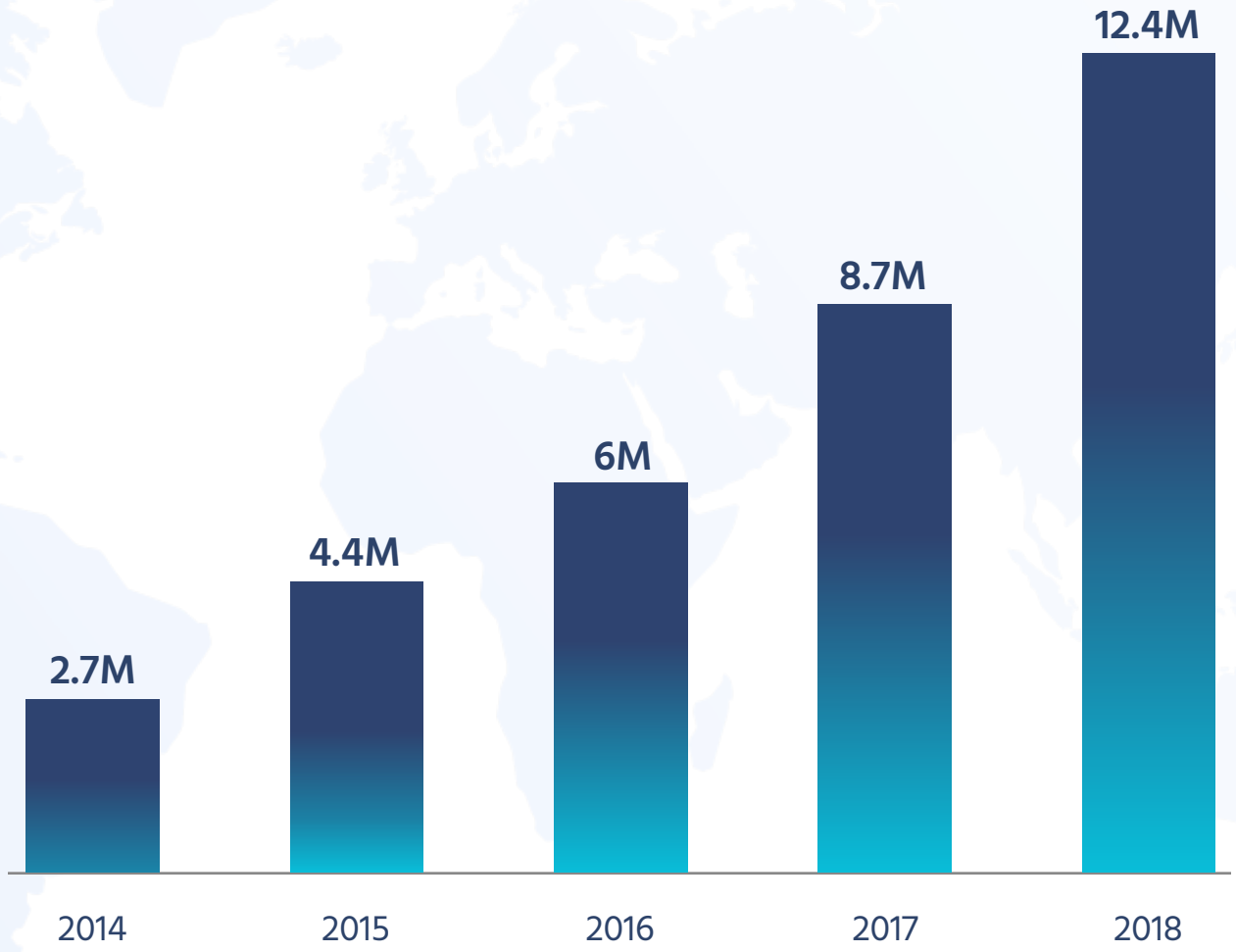
EyeQ® Shipped 2014-2018



32M
EyeQs shipped to date

42%
YoY growth from 2017

46%
CAGR from 2014

Euro NCAP 5-Star 2018 Models

Make and Model	Mobileye inside	Safety Equipment	Overall Rating
Volvo XC40	✓	Standard	★★★★★
Lexus ES		Standard	★★★★★
Peugeot 508	✓	Standard	★★★★★
Mercedes Benz A-Class		Standard	★★★★★
Audi A6	✓	Standard	★★★★★
Volvo S60	✓	Standard	★★★★★
Volvo V60	✓	Standard	★★★★★
Audi Q3		Standard	★★★★★

Make and Model	Mobileye inside	Safety Equipment	Overall Rating
Mazda 6	✓	Standard	★★★★★
Hyundai NEXO	✓	Standard	★★★★★
Hyundai Santa Fe	✓	Standard	★★★★★
VW Touareg	✓	Standard	★★★★★
Jaguar I-PACE		Standard	★★★★★
BMW X5	✓	Standard	★★★★★
Nissan LEAF	✓	Standard	★★★★★
Ford Focus	✓	Standard	★★★★★

Leading the Way With High-end ADAS Features

Launched in 2018 with 2 OEMs – Mobileye's TriFocal & EyeQ® 4

Wider FOV and further range FOV enabling:

- Enhanced detection capabilities/ranges for all features
- Red Light warning, Stop sign/ no entry warning
- Cross traffic/ peds/ cyclist warning
- AEB turning scenarios- TAP

EyeQ® 4 features for the first time:

- 3D VD, 3D motorbikes
- Hazard detection
- REM harvesting

BMW X5: First Ever Maximum AEB VRU Score (12/12)

Leading the Way With High-end ADAS Features

New Partnerships

Volkswagen

VW and Mobileye are continuing their efforts to materialize a L2+ proposition combining the front camera and Roadbook™ technologies

- Leveraging the harvested data from VW series production vehicles
- The ongoing development activity is targeting a broad operational envelope L2+ product addressing mass market deployment
- Enhancing ACC & LKA by HD maps:
  - Foresight of road geometry and road semantics used to optimize control decisions
  - Navigation through unmarked/ill-marked road sections , including junctions
  - A redundant road-geometry source under adverse visibility conditions

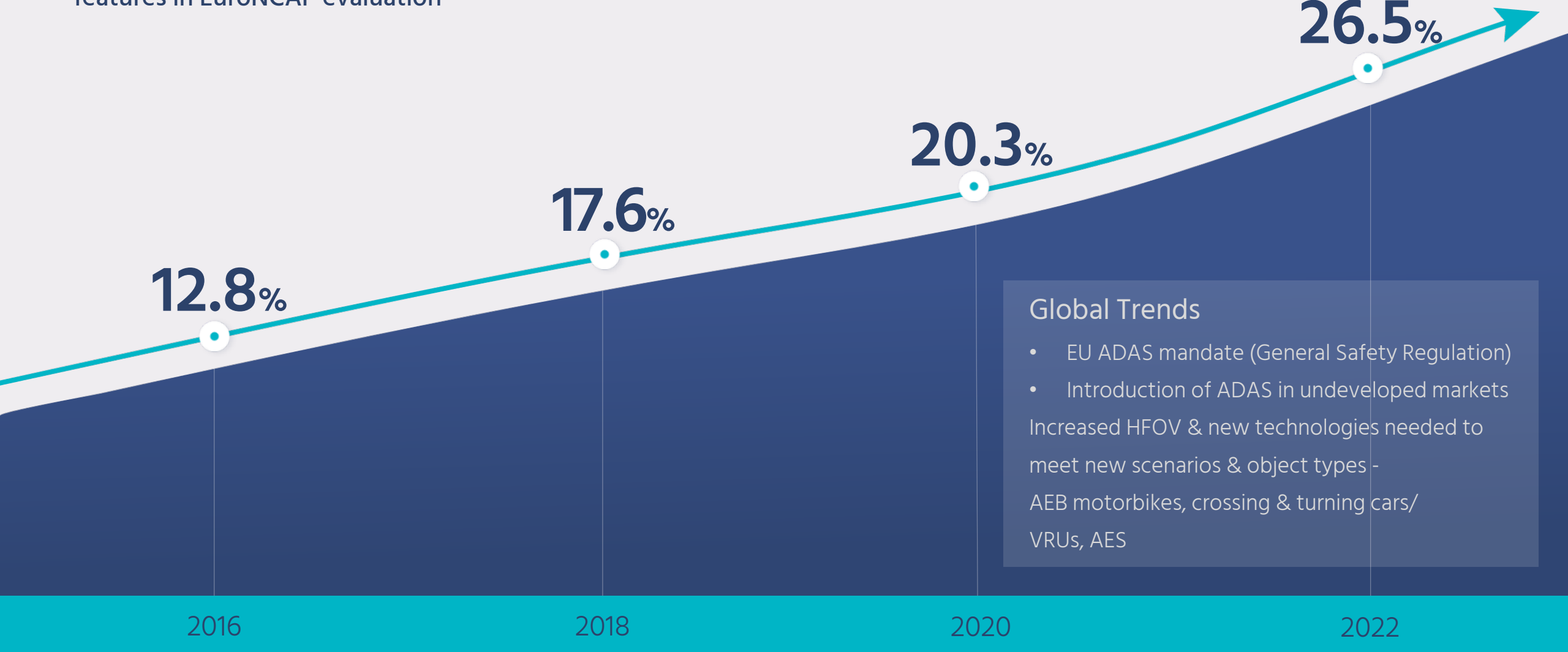
Engaging in a strategic collaboration with Great Wall Motors

长城汽车 Great Wall

- Great Wall Motors, a leading domestic automaker in China, to fit ME based L0 to L2+ ADAS systems
- Targeting SOPs in the next 2-6 years; lifetime volume of 7.3M over 6 car models
- Joint development of higher autonomy (L3 and above) systems
- Deepening our footprint in China- 16 programs sourced in 2018

Growing Emphasis on ADAS in Safety Ratings

% of points awarded for ADAS features in EuroNCAP evaluation



Global Trends

- EU ADAS mandate (General Safety Regulation)
- Introduction of ADAS in undeveloped markets

Increased HFOV & new technologies needed to meet new scenarios & object types - AEB motorbikes, crossing & turning cars/ VRUs, AES

The AV/ADAS Strategy

The Building blocks of

Autonomous Vehicles

- Sense / Plan / Act
- Perception computer vision
- Other sensors processing
- Mapping

Revolution in **Transportation**

Component Qualification

Transition of Technologies

The Building blocks of

ADAS

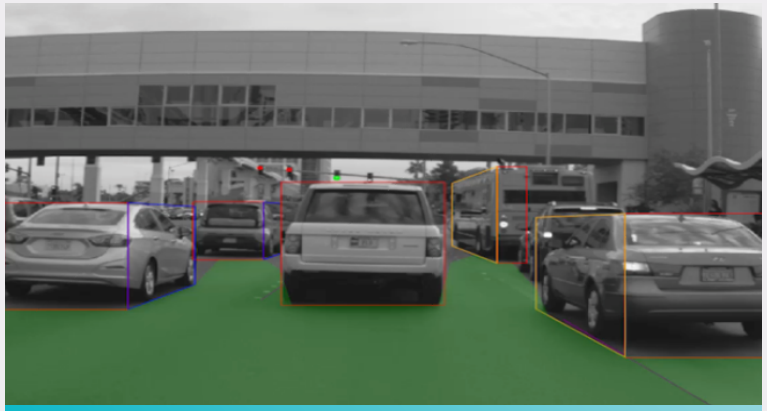
- Front sensing
- Wide-angle front sensing
- Surround perception
- Mapping

Making “Vision Zero” a reality

Revolution in **Saving Lives**

Integrated Solution

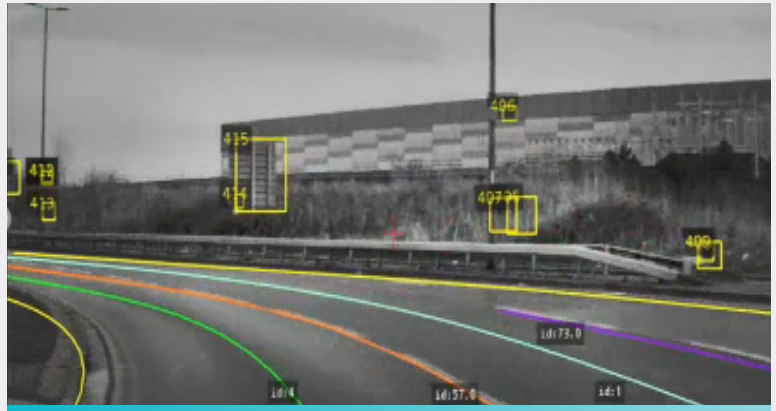
Mobileye/Intel Core Assets



Visual Perception and Sensor Fusion

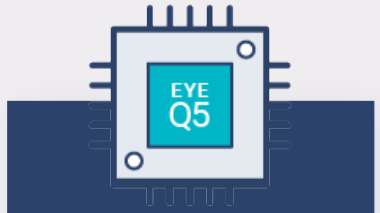
Compute platform

Driving Policy and RSS



Dynamic mapping- REM

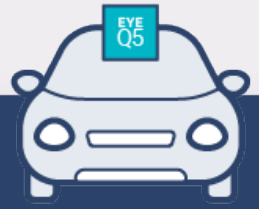
Mobileye Solutions Portfolio



Open EyeQ5

Plug & Program

Silicon

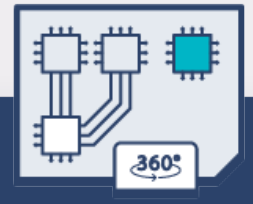


Closed EyeQ5

Plug & Integrate

Silicon

+ Perception Software
+ Mapping - REM



Surround Vision

Plug & Integrate

Silicon

+ 360 Vision
  Perception Software
+ Mapping - REM

AV Series

Plug & Drive

Silicon+ Multi domain control

360 Vision
Perception Software

+ Mapping - REM
+ Policy & Control
+ Fusion
+ Fail Operation
+ Other sensors

Optional subsystems

AV Series + MaaS platform

Plug & Move People

Silicon+ Multi domain control

360 Vision
Perception Software

Mapping- REM

Policy & Control

Fusion

Fail Operation

Other Sensors

+ MaaS Software Platform

ADAS/ Autonomous Platforms

Autonomous Platforms

Visual Perception

Visual Perception Approach

The Goal

To achieve True Redundancy for Avs:

- Cameras enable a comprehensive end-to-end operation
- Other sensors added for redundancy

The Means

Pushing computer-vision sensing envelope

To empower cameras to deliver end-to-end AV performance

The Challenge

Extracting 3D information from cameras

The easiest thing to do - using indications
from other sensors already in the low-level stage

The Outcome

“The right AV”

With true redundancy

Cost-optimized ADAS

Relying on cameras- cheap and versatile

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Current AV Setup

End-to-End AV powered by Camera-only

Separate sub-system of Radar/ Lidar (“true redundancy”) will be added in the future

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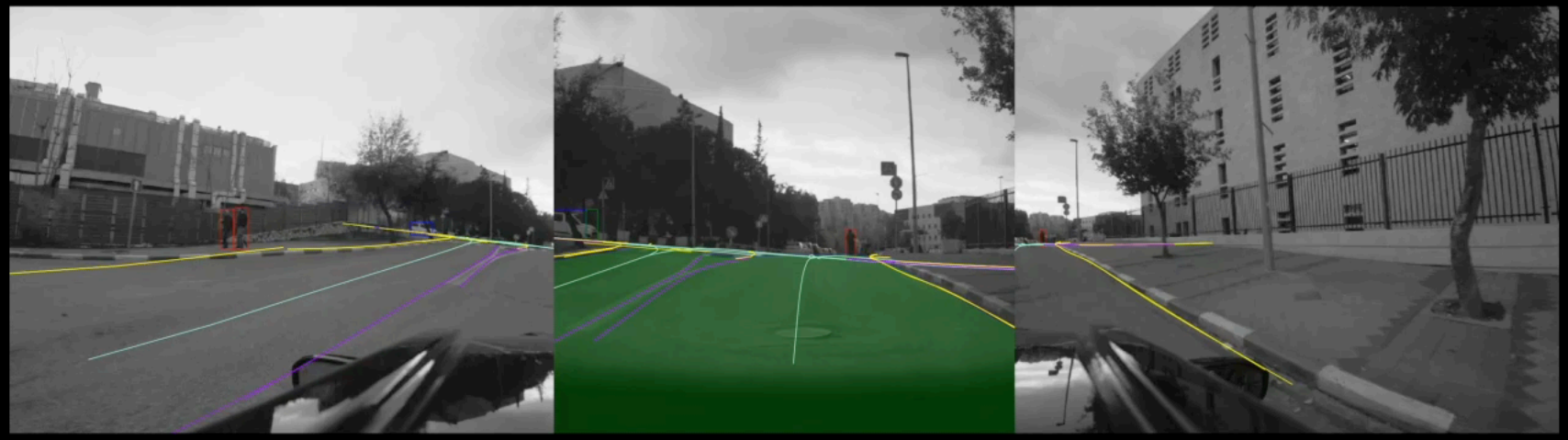
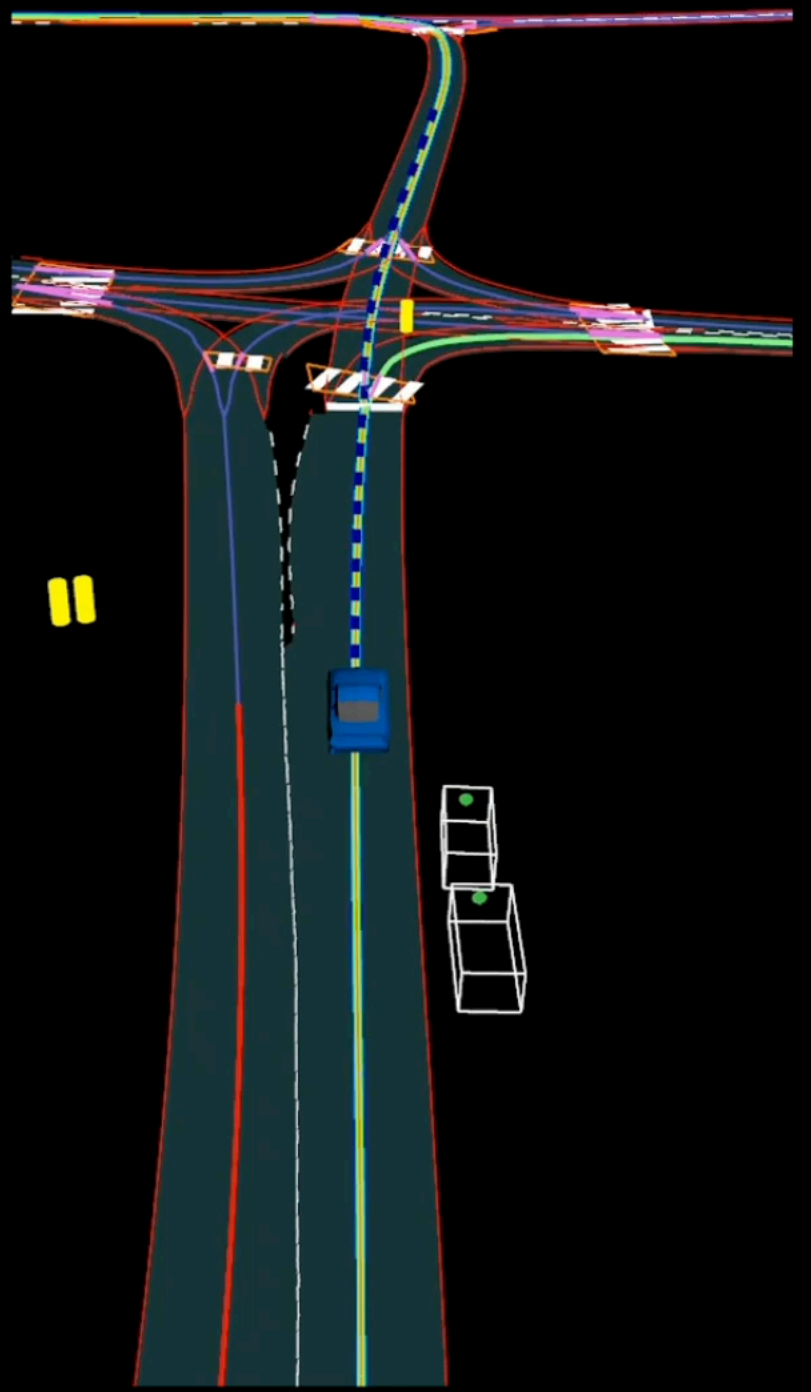




Compute Platform

SoC Leadership

The EyeQ® Family

EyeQ® 3

4 x VMP+ 4 x CPU, 40nm, series prod since 11/2014

0.25 TOPs @ 3W

EyeQ® 4

6 x VMP + 2 x PMA + 2 x PMC + 4 x CPU, 28nm, series prod from 3/2018 launches by 4 OEMs in 2018, 12 OEMs in 2019 & onwards

2.5 TOPs @ 6W

EyeQ® 5

7nm, 1st silicon 12/2018

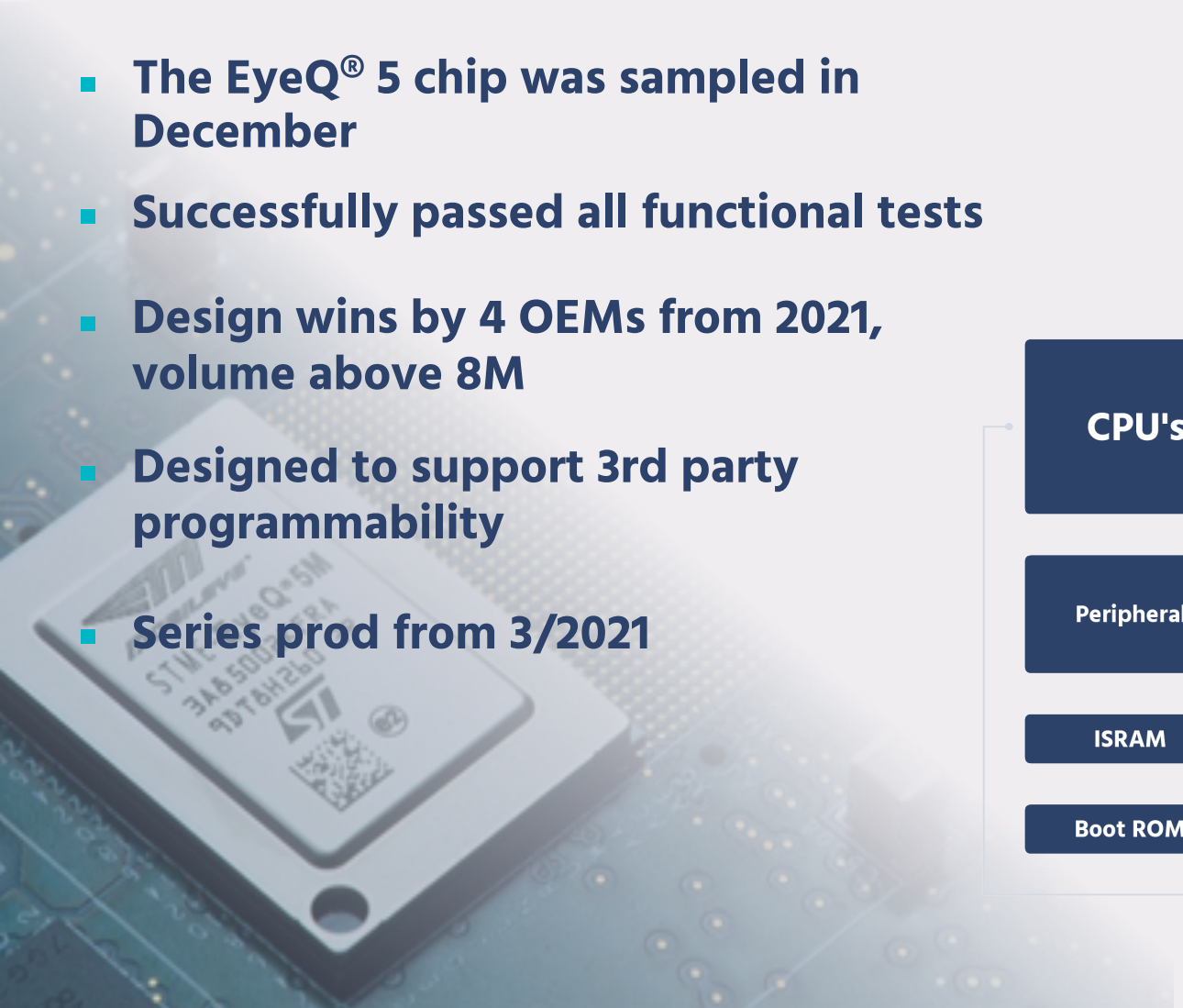
24 TOPs @ 10W

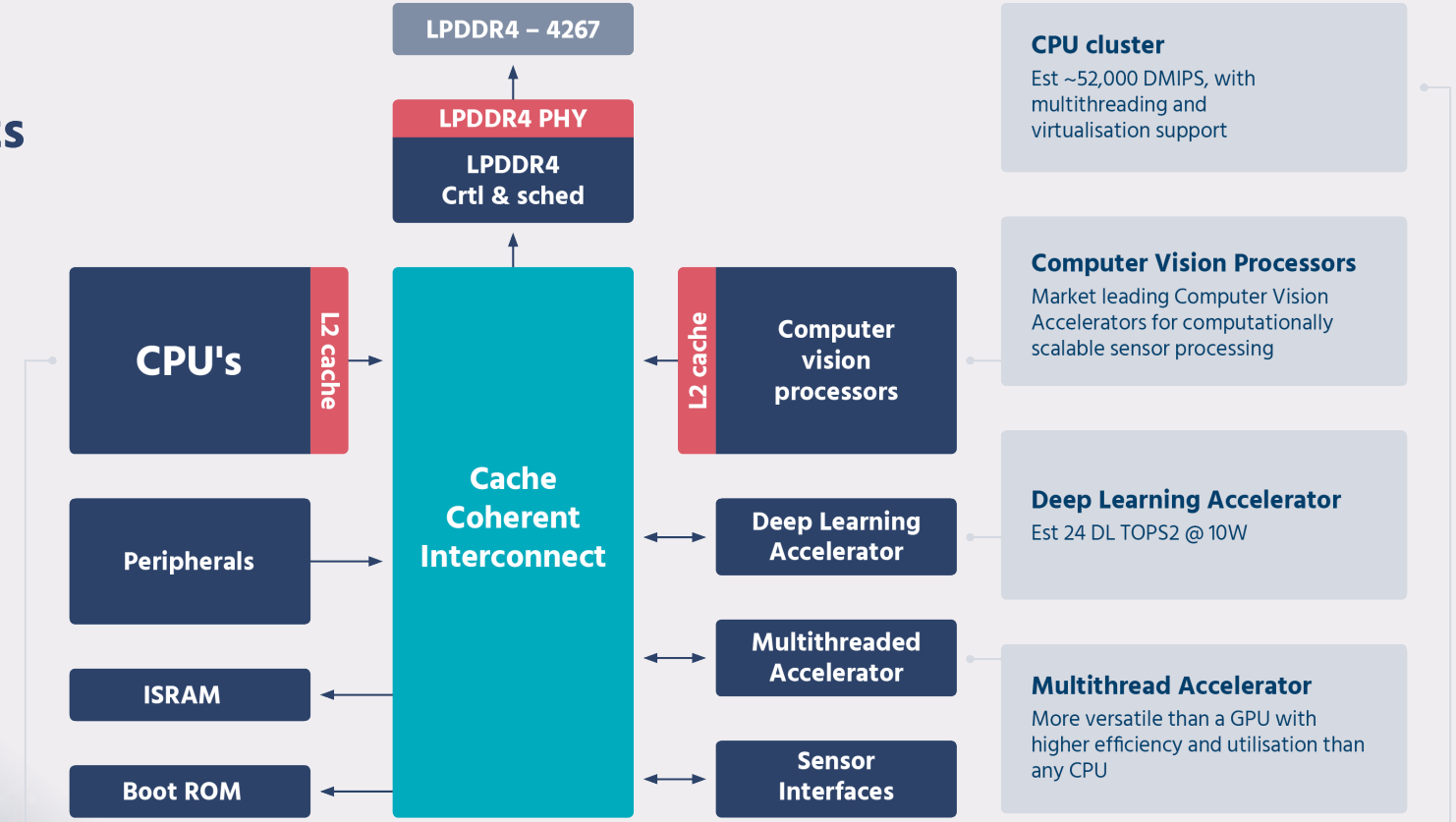
Tight co-design of SW and HW yields cutting edge capabilities

The EyeQ® 5

Enabling high-end functionalities for ADAS and AV

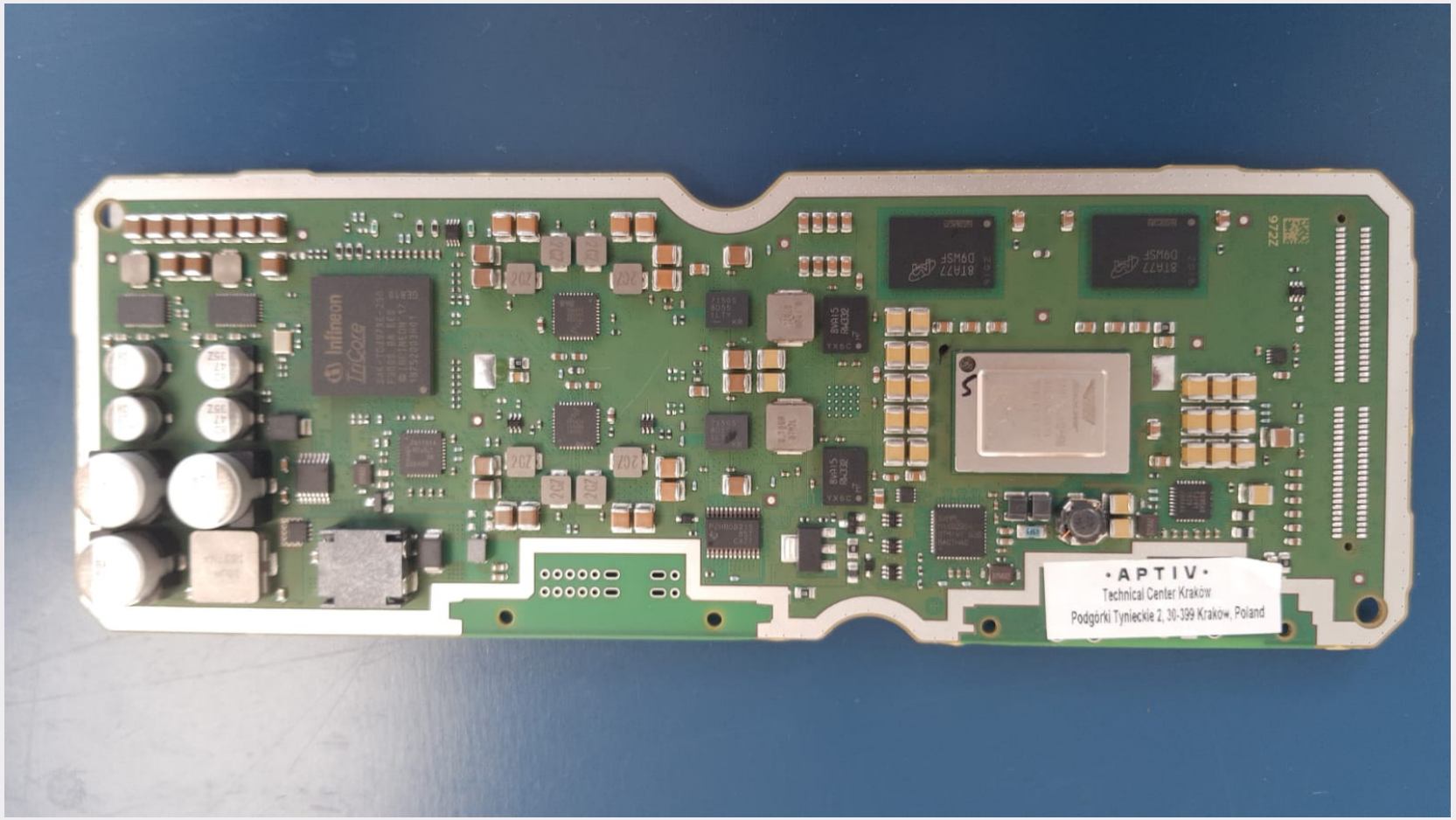
- **The EyeQ® 5 chip was sampled in December**
- **Successfully passed all functional tests**
- **Design wins by 4 OEMs from 2021, volume above 8M**
- **Designed to support 3rd party programmability**
- **Series prod from 3/2021**





The EyeQ® 5

Enabling high-end functionalities for ADAS and AV



Boards for BMW 2021 series production with Aptiv

Driving Policy and RSS

Fundamental Issues

Safety

Nominal
(design should not cause accidents)

Functional (FuSa)
(secondary channel, fail operational, ASIL)

Safety vs. Agility?

Acceptance by Society?

How to define and Validate?

Scalability

- Tech that is transferrable for generating new markets
- Agents of Proliferation (across geographies):

  - HD-mapping
  - Generalizable and Agile Driving Policy
  - Cost of system in volume
  - Scalable test & validation across geographies

Fundamental Issues

RSS

A mathematical model, formalizing a “common sense" interpretation of what it means to drive “cautiously” while being agile.

- What is **a dangerous situation** ?
- What is the **proper response** to a dangerous situation ?
- What does it mean to be **reasonably cautious**?
- What **assumptions** a driver can make on the unknown behavior of other road users ?

- RSS is designed to optimize three axes: (i) sound, (ii) useful, and (iii) efficiently verifiable.

Driving Policy Logic

Strategy

Long term Semantic decision/planning

e.g. change lane, overtake

Tactics

Short term Semantic Decision/planning

e.g. how/when to overtake, give/take way

Path Planning

Plan the Trajectory to execute the Tactics decision

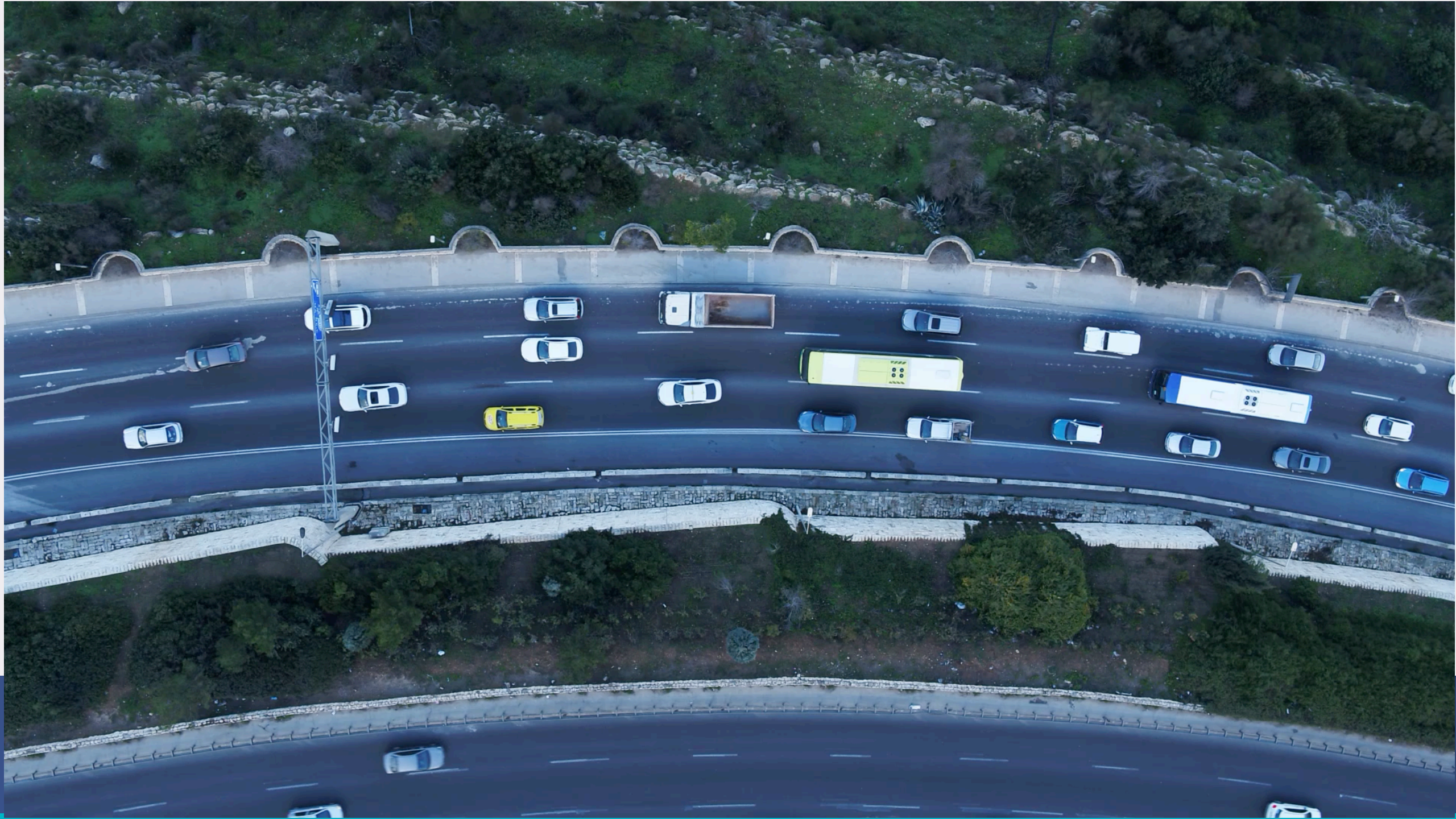
RSS

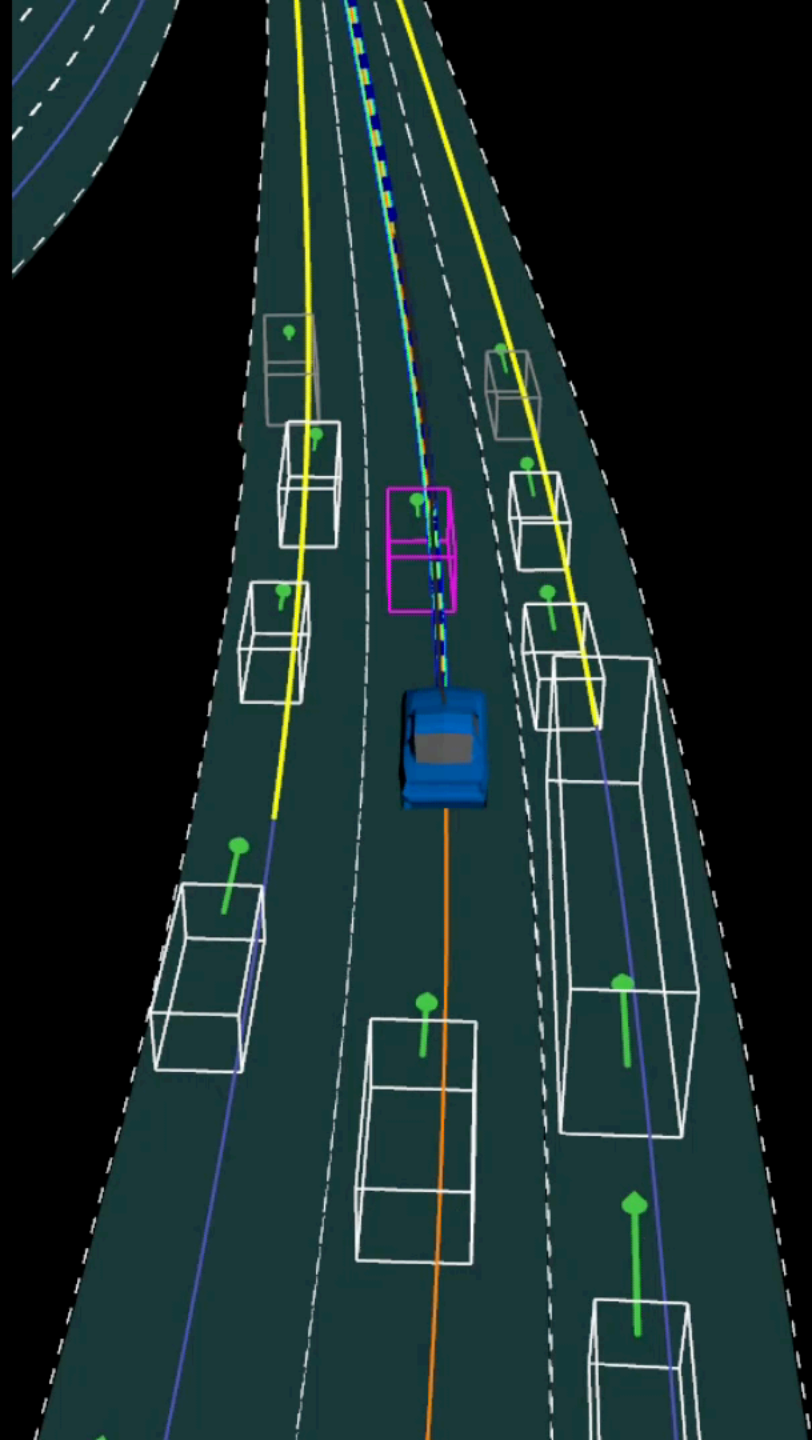
Proper Response

Control

Machine learning and classical control low level throttle and torque control

- Reinforcement Learning
- Semantic Space
- “Self Play” in reinforcement learning





Industry Acceptance

The RSS is gaining global acceptance as an Automated Vehicle Safety Standard

Auto technology supplier Valeo is the latest company to publicly embrace the RSS model for safe automated vehicle (AV) decision-making

Baidu - who earlier this year announced plans to adopt RSS for Project Apollo – reported the first open source implementation of the model

China ITS approved proposal to standardize RSS for the China market under **"Technical Requirement of Safety Assurance of AV Decision Making"** with RIOH, Tsinghua University, NIO, Autonavi, Huawei

We continue on getting momentum among governments and regulators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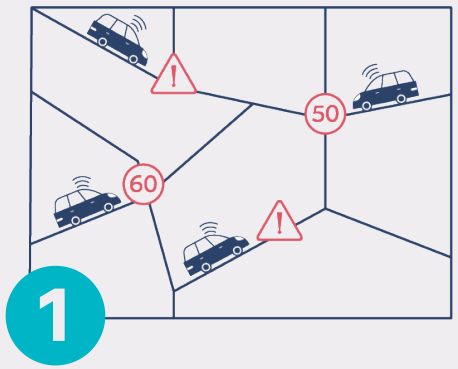
REM®
Mobileye's Mapping Technology

REM Process



1

HARVESTING

Collecting road and landmarks through EyeQ-equipped vehicles

Anonymising & encrypting REM data

2

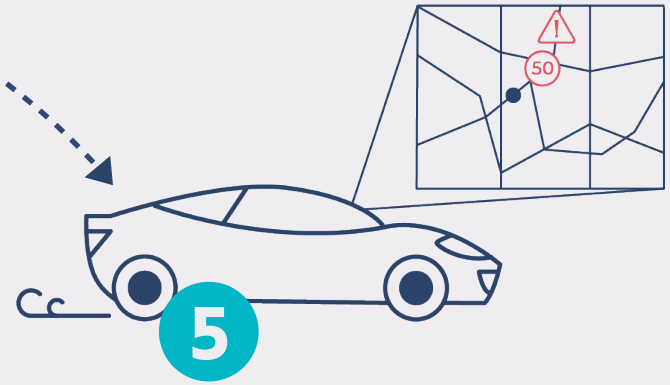
3

AGGREGATION

Generating HD crowdsourced road -book for the autonomous vehicle

Map tile distributed to the car

4



5

LOCALIZATION

Localizing the car within 10cm accuracy in the road book.

REM Process

RB data projected onto image space.

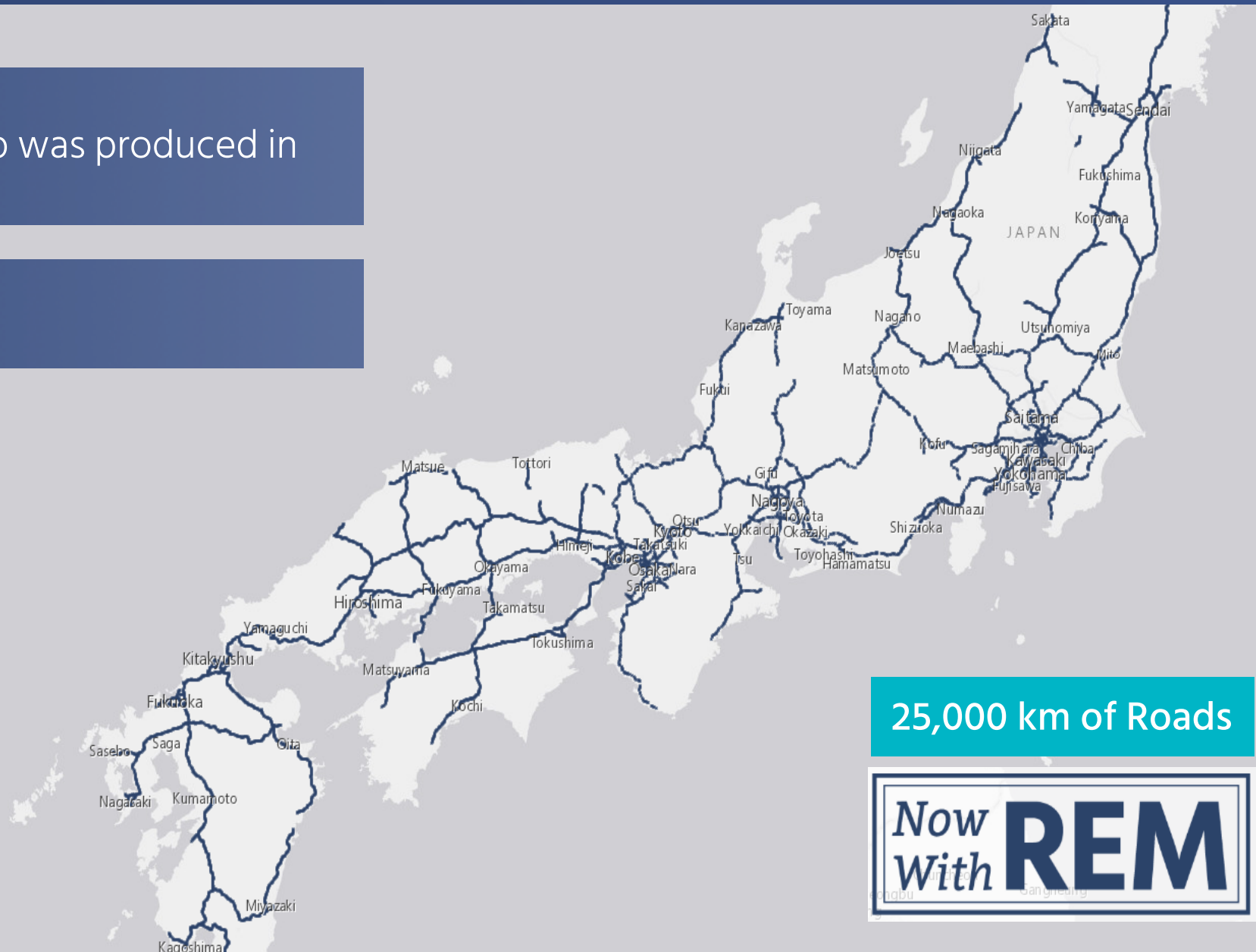
Road edge, lane marks, lane center, landmarks (in Yellow).

RB data projected onto Google Earth.

Mapping Japan Highways - Now Completed

Production at scale
Entire Japanese highway system map was produced in less than 24 hours

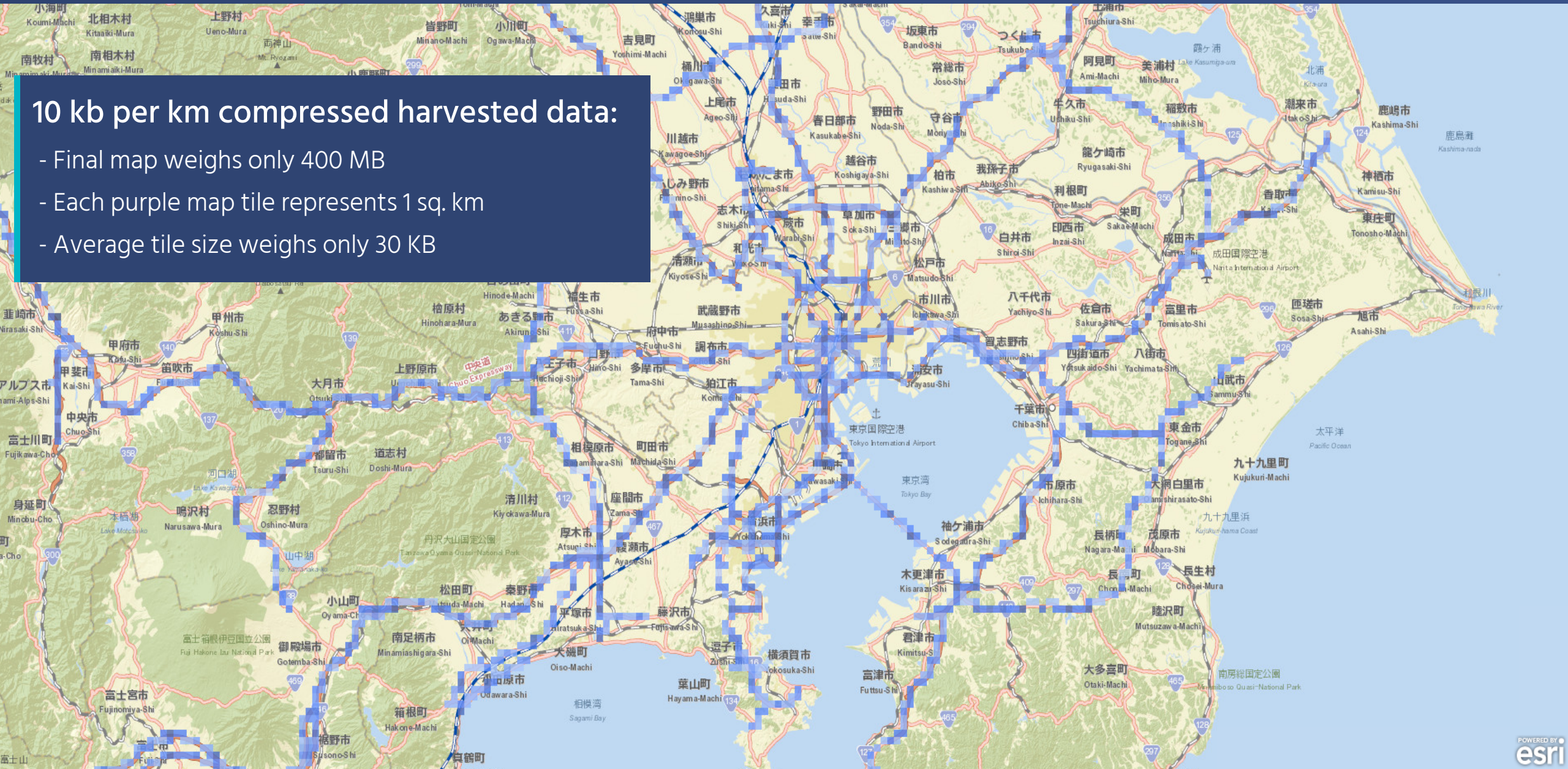
Map production is automatic
With the push of a button



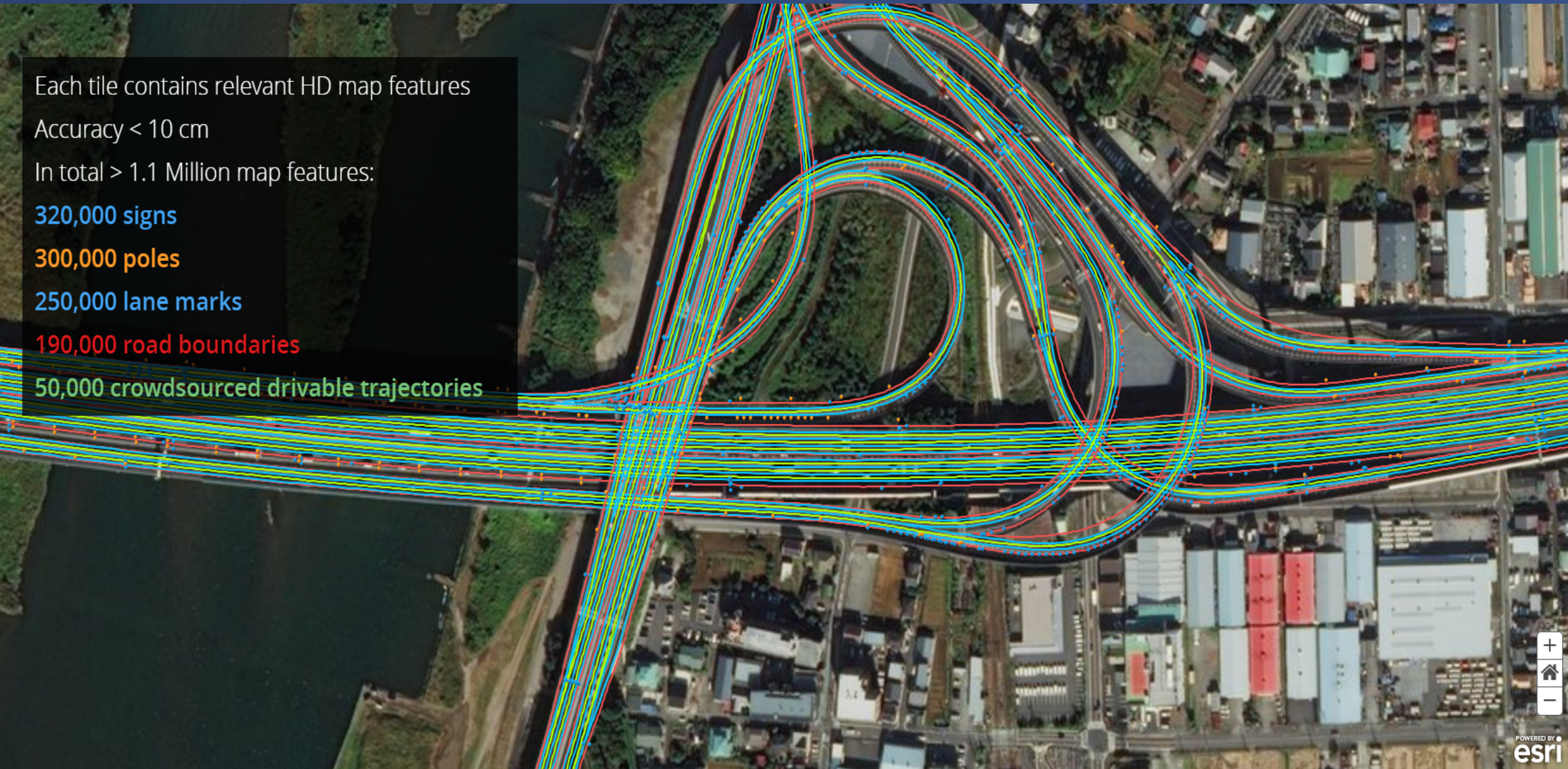
25,000 km of Roads

Now With REM

Mapping Japan Highways- Now Completed

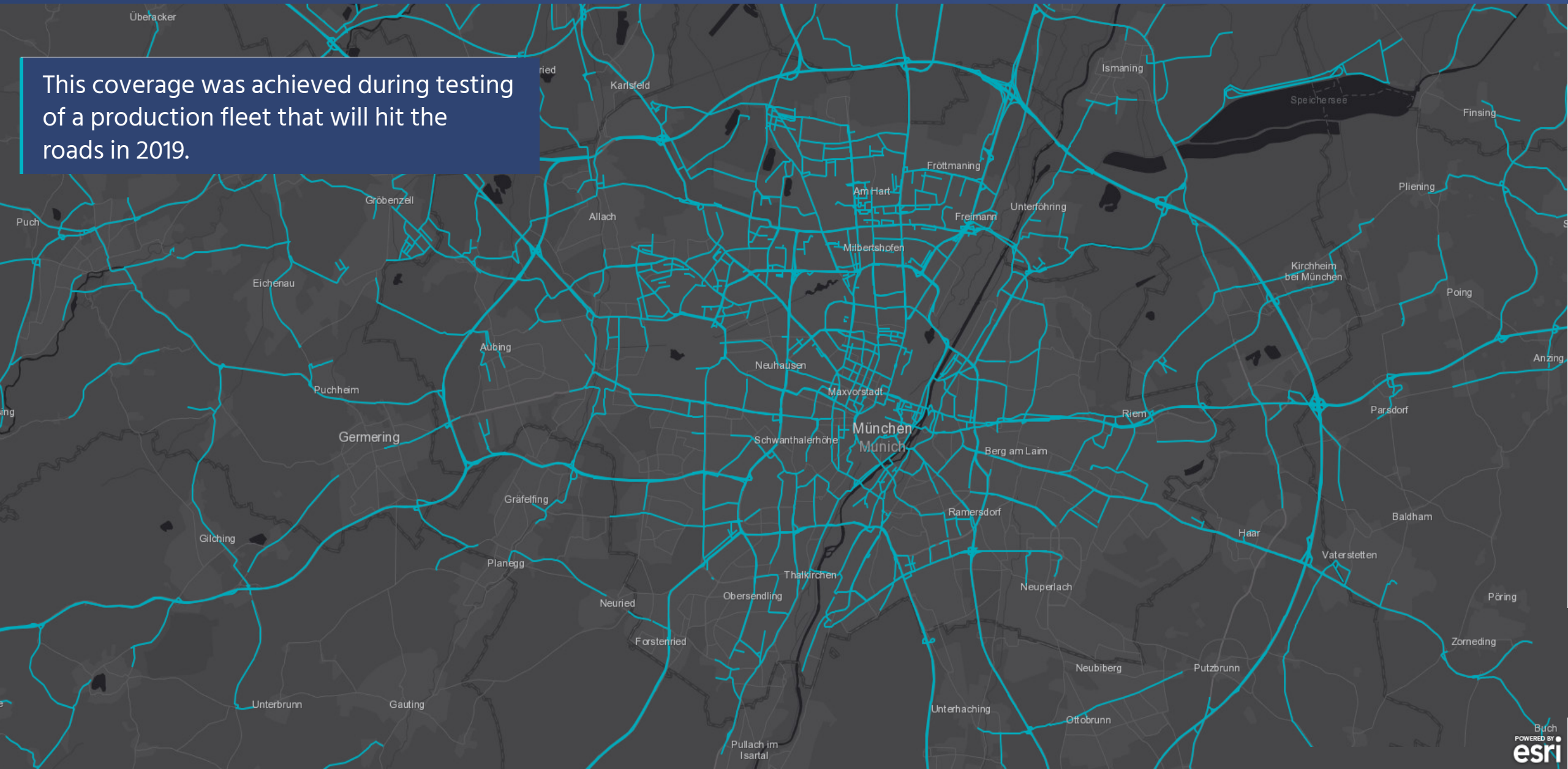


Mapping Japan Highways- Now Completed



RSD From BMW Production Vehicles

This coverage was achieved during testing of a production fleet that will hit the roads in 2019.



REM Utilizations

AV Maps

- Scalable solution for HD maps
- Ultra- high refresh rate with real time updates

L2+/3/4

- Enhancing today's ADAS with minimal cost

Non-Automotive

- Realtime data for "smart cities"
- Automatic infrastructure survey to aid city planning

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L2 Enhancement Through REM

Lane Centering

Areas without lane marks or with low quality lane marks
junctions, roundabouts, urban scenarios, newly paved roads

Availability in challenging weather conditions
fog, heavy rain, reflecting road, low sun, heavy snow

Late detection nearby unmarked highway exits

View range and availability on very sharp curves

ACC

CIPV decision at areas with low quality lane marks

Precise roadway elevation model for better control

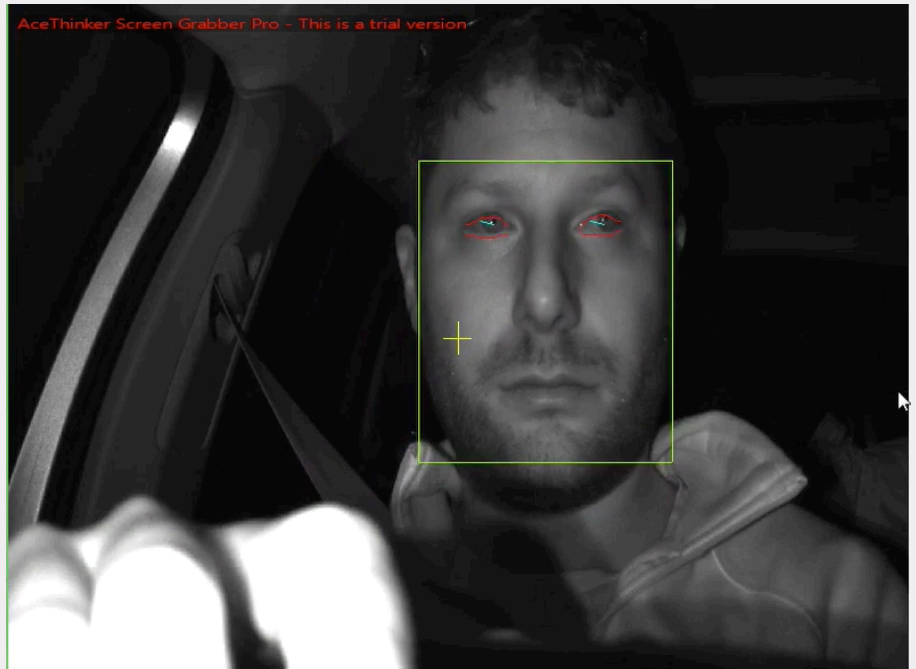
Continuing ACC at areas with traffic lights and stop signs
REM supports traffic lights relevancy and accurate position, high quality stop line detection

Map data on merges and exits for better planning and control

Open-EyeQ Eco-system

Open-EyeQ platform promotes an eco-system of automotive technologies , integrated as part Mobileye's AD/ADAS portfolio.

- Minimizing/Avoiding hardware overheads and its automotive integration and validation processes.
- Leveraging Mobileye's market access to proliferate cutting-edge AD/ADAS capabilities
- As an example – **Eyesight Technologies** have recently showcased a driver monitoring system running on EyeQ4, interfacing to ME's L2+ proposition.



REM in the Aftermarket

Mobileye 8 Connect | Project Status

Government

3 mapping agreements signed

Smart Cities

3 projects signed

Major Fleets

Europe, US

20,000 vehicles

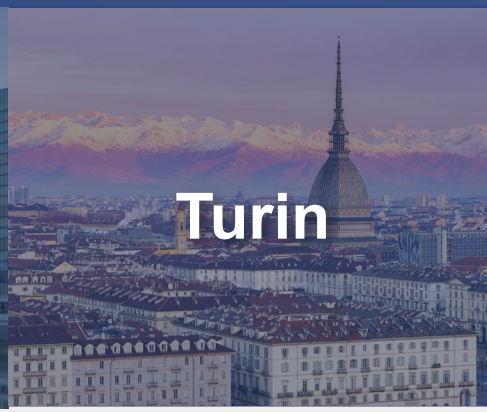
Mobileye 8 Connect | Strategic Initiatives

AUTONOMOUS READY™ Spain

BUGGY TLC Rentals and Leasing

THE HUNGARIAN GOVERNMENT

KoMo:D



TORINO SMART CITY

Berkshire Hathaway GUARD Insurance Companies

Ordnance Survey

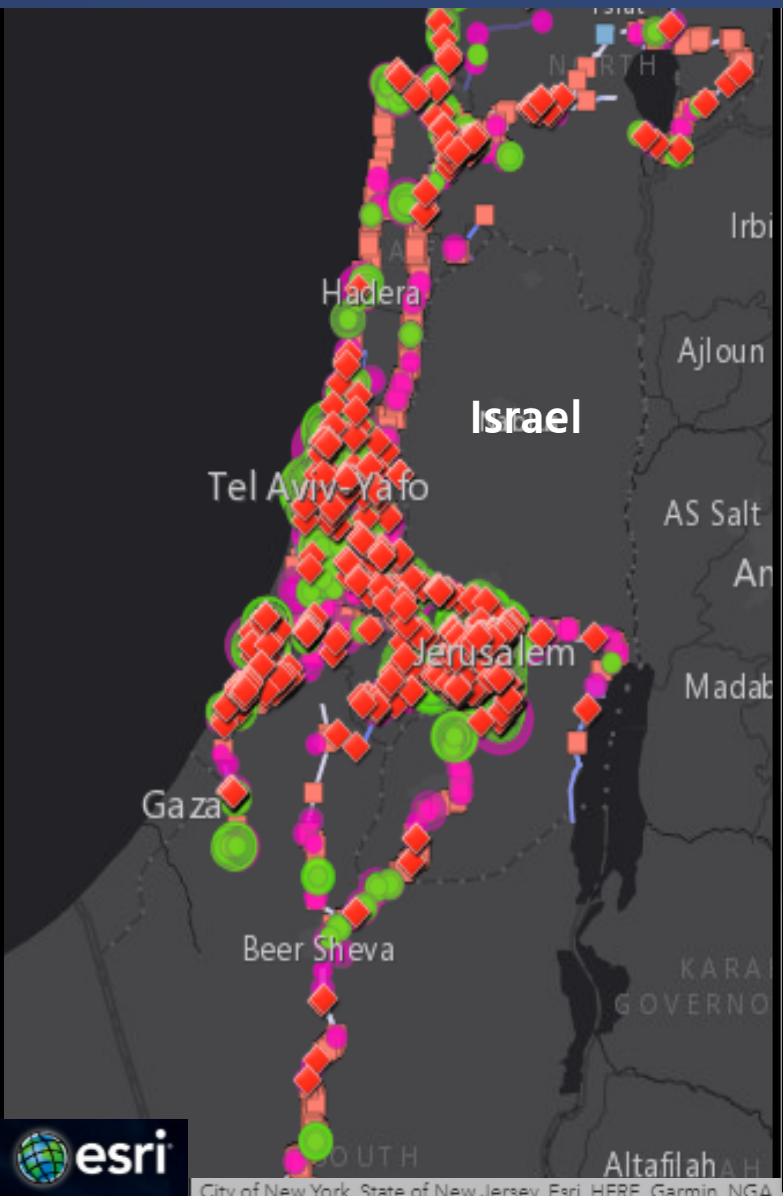
DAEGU

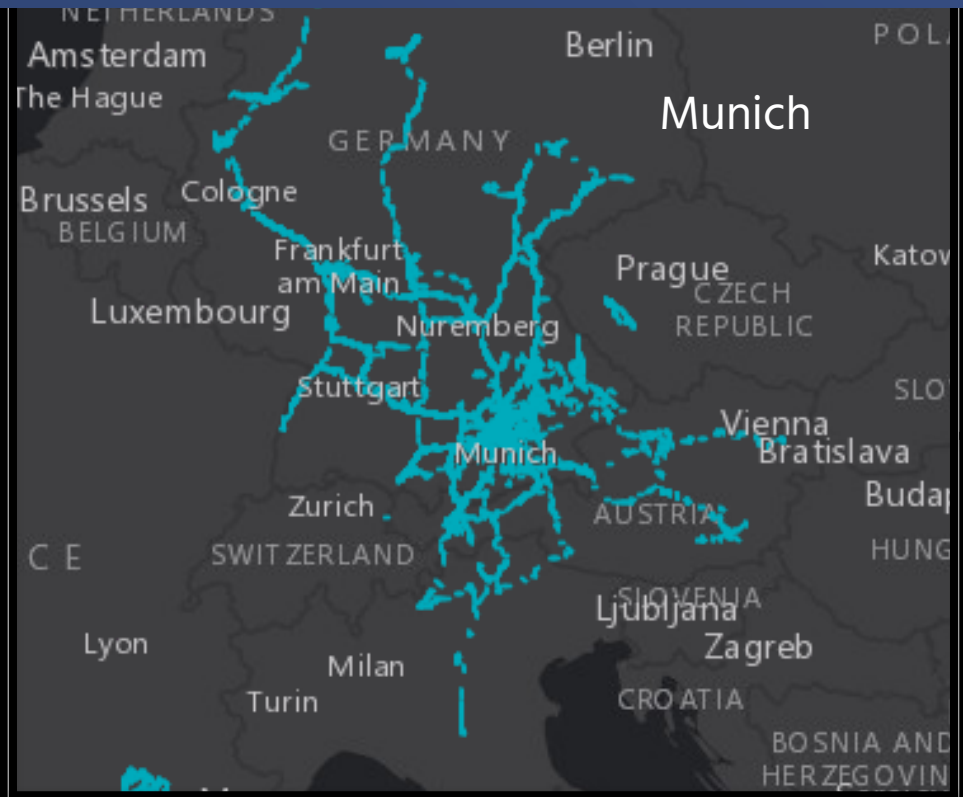
First RSD collected via Mobileye 8 Connect™

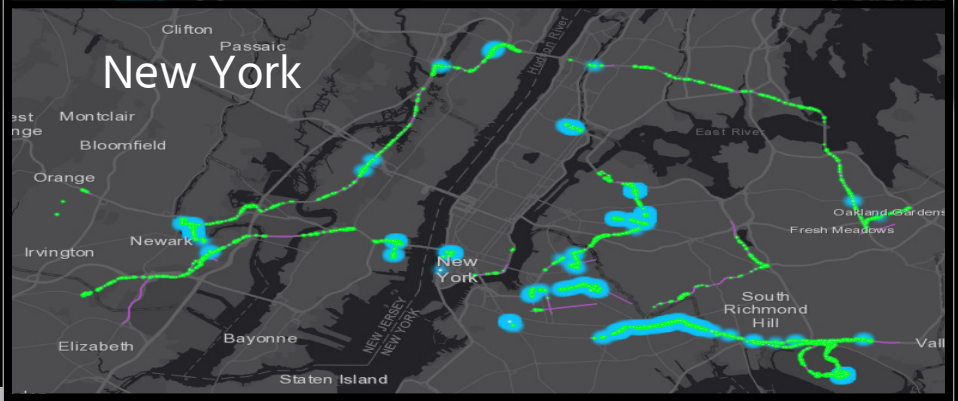
Passengers Waiting Near a Bus Station

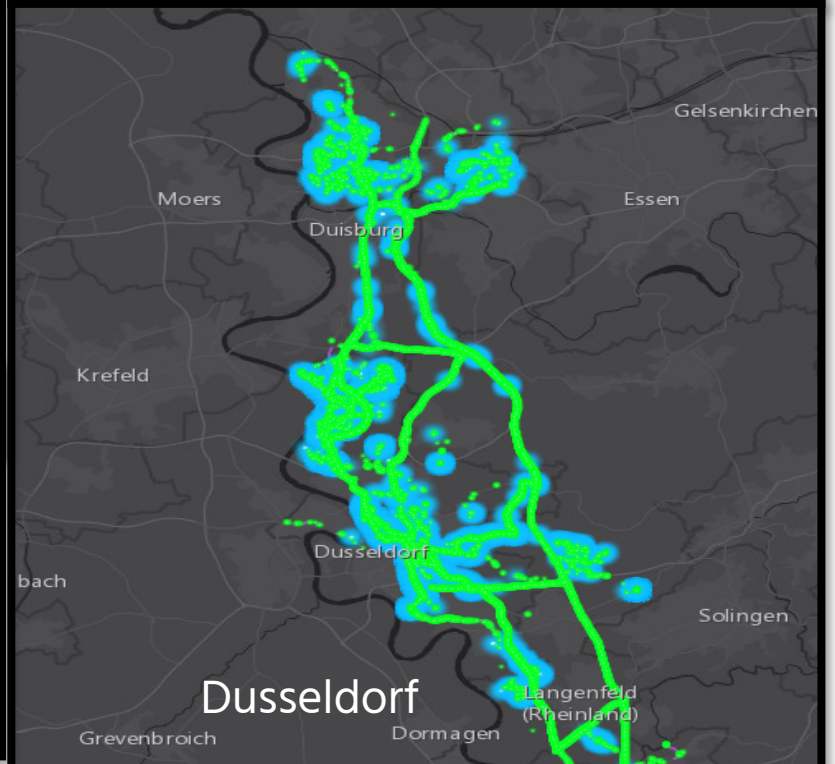
First RSD collected via Mobileye 8 Connect™

First Deployment Snapshots From Around the World









City of New York, State of New Jersey, Esri, HERE, Garmin, NGA

Mapping the UK by

Ordnance Survey

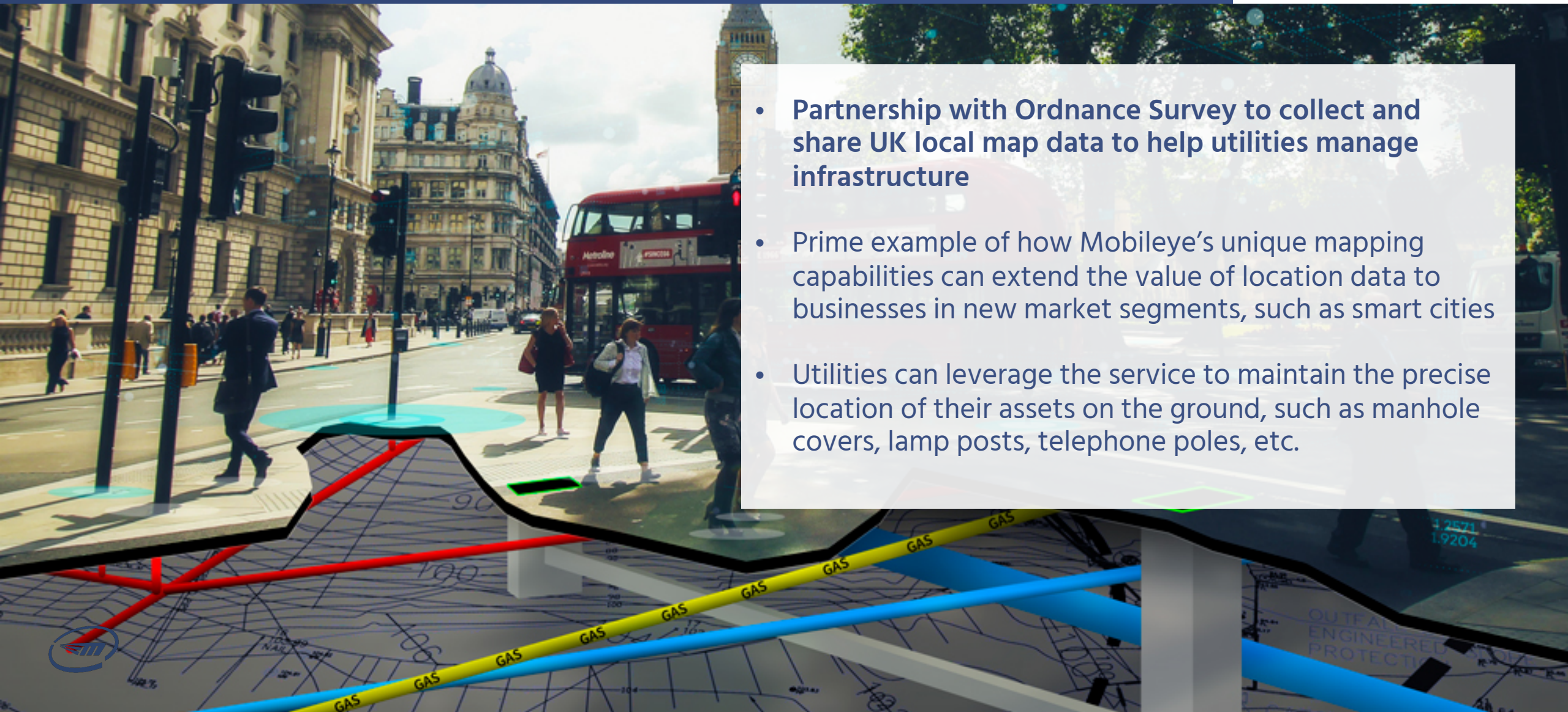
and

An Intel Company

Moving beyond automotive with REM data

Ordnance Survey

Location: UK



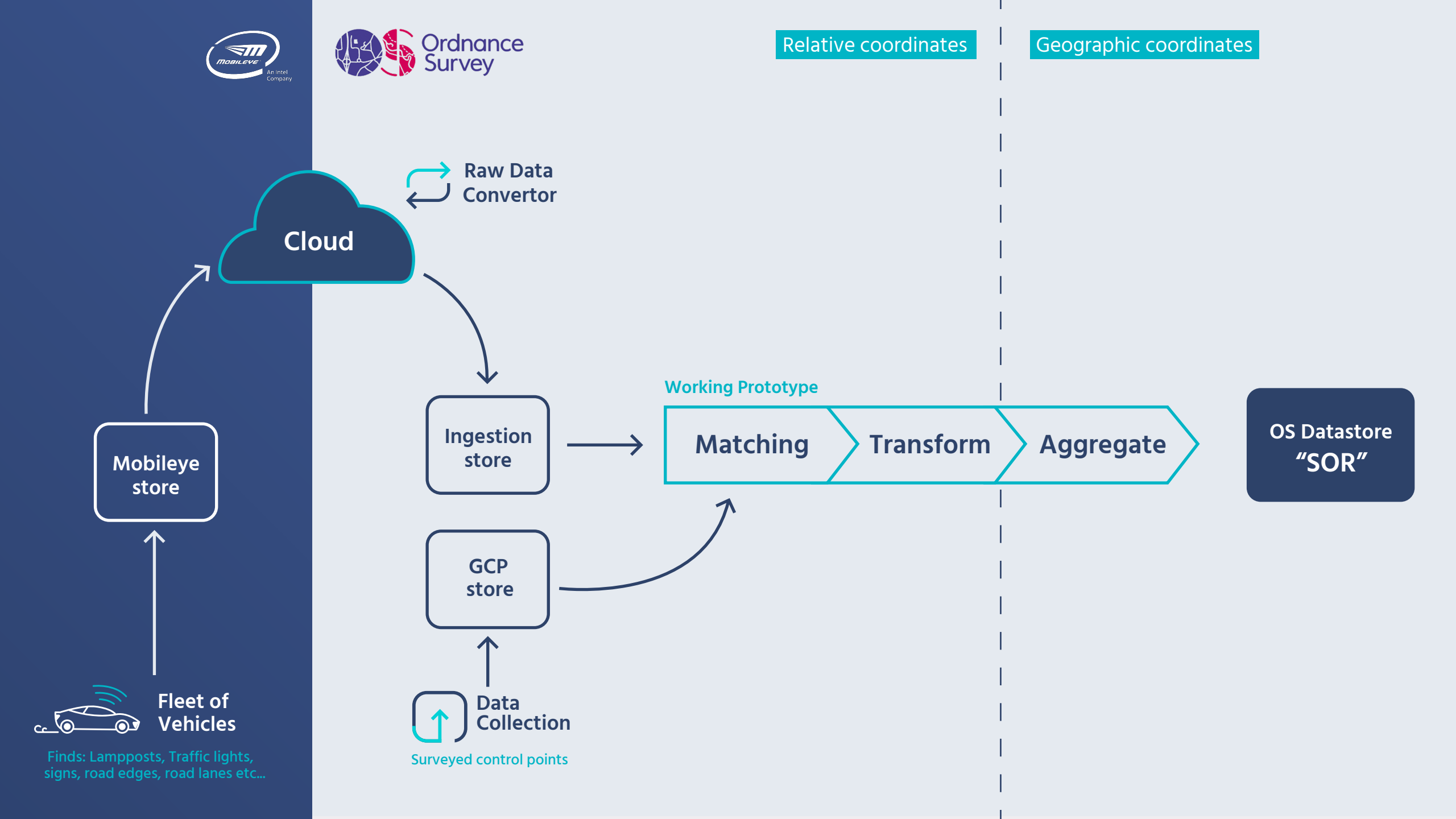
- **Partnership with Ordnance Survey to collect and share UK local map data to help utilities manage infrastructure**
- Prime example of how Mobileye's unique mapping capabilities can extend the value of location data to businesses in new market segments, such as smart cities
- Utilities can leverage the service to maintain the precise location of their assets on the ground, such as manhole covers, lamp posts, telephone poles, etc.

Mapping the UK with Ordnance

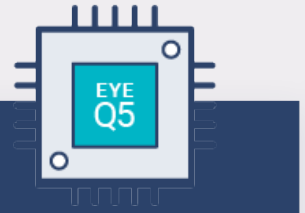
The Type of Data being Collected

Priority	Gas	Electricity	Water	Power Supply	Telco
1	Manholes	Manholes	Drain covers / grates	Overhead foliage	Telco cabinet
2	Pavement Service Covers	Pavement Service covers	Manholes	Overhead cable	Telegraph pole
3	Overhead foliage	Overhead foliage	Pavement Service covers	Power distribution pole	Manholes
4	Sign post/sign	Power distribution pole	Overhead foliage	Trees	Overhead cable
5	Trees	Overhead cable	Trees	Manholes	Pavement Service covers
6	Bushes	Trees	Sign post/sign	Street light	Overhead foliage
7	Drain covers / grates	Street light	Bushes	Sign post/sign	Trees
8		Sign post/sign		Bushes	Street light
9		Traffic light		Drain covers / grates	Traffic light
10		Bushes			Sign post/sign
11		Drain covers / grates			Bushes

Front-facing camera is an “intelligent agent”


Ordnance Survey
Relative coordinates
Geographic coordinates
Raw Data Convertor
Cloud
Mobileye store
Ingestion store
Working Prototype
Matching
Transform
Aggregate
OS Datastore "SOR"
GCP store
Data Collection
Surveyed control points
Fleet of Vehicles
Finds: Lampposts, Traffic lights, signs, road edges, road lanes etc...

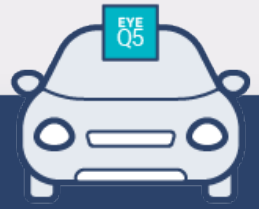
Mobileye Solutions Portfolio



Open EyeQ5

Plug & Program

Silicon

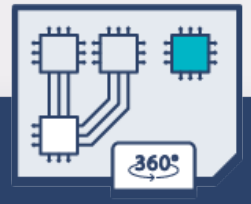


Closed EyeQ5

Plug & Integrate

Silicon

+ Perception Software
+ Mapping - REM



Surround Vision

Plug & Integrate

Silicon

+ 360 Vision
Perception Software
+ Mapping - REM

AV Kit

Plug & Drive

Silicon+ Multi domain control
360 Vision
Perception Software
+ Mapping - REM
+ Policy & Control
+ Fusion
+ Fail Operation
+ Other sensors
Optional subsystems

AV Kit + MaaS platform

Plug & Move People

Silicon+ Multi domain control
360 Vision
Perception Software
Mapping- REM
Policy & Control
Fusion
Fail Operation
Other Sensors
+ MaaS Software Platform

ADAS/ Autonomous Platforms

Autonomous Platforms

Mobileye, Volkswagen, and Champion Motors bring

Mobility-as-a-Service to Israel

MOBILEYE
An Intel Company

VOLKSWAGEN
AKTIENGESELLSCHAFT

CHAMPION MOTORS

Project Overview

Project PINTA is to create a JV with VW-group, Champion Motors and Mobileye for launching MaaS in Israel with commercial deployment in 2022

Cornerstones

Service Summary

- **Pilot Commercialization of Full-Stack MaaS offering**
  SDS, Vehicles, Fleet Operations & Fleet Control Center, Mobility Platform & Services, Content
- **Operational fleet of Self-Driving EVs until 2022**
- **First deployment in Tel-Aviv**
- **Scale up to cover all of Israel**

Project Timeline & Phases

Collaboration Layers

The project consortium partners across all layers of the layer model of Mobility-as-a-Service with self-driving electric vehicles

Layer 5
Content Providers

VOLKSWAGEN CHAMPION MOTORS

Layer 4
Mobility Platform & Services

VOLKSWAGEN CHAMPION MOTORS

Layer 3
Fleet Operations & Fleet Control Center

CHAMPION MOTORS

Layer 2
Self-Driving Vehicles

VOLKSWAGEN

Layer 1
Self-Driving System

MOBILEYE
An Intel Company

Project Phases

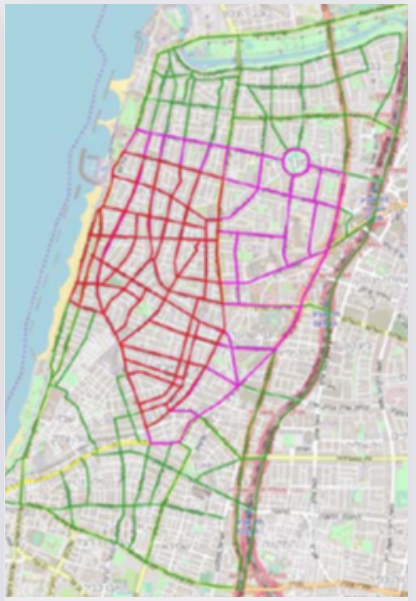
The service covers the most relevant urban area of Israel by 2022

2019 Phase 1
Pre-Development

15km

2020 Phase 1.1
Development

33km



2021 Phase 2 2022
Phase 3 Pre-Commercial

111km

(13,4 km²)

Scaling approaches

- Scale into Metropolitan area
- Increase granularity of existing area
- Add additional special routes

2023 Phase 4 Scaling

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Bringing Autonomy to China's Public Transportation

- Collaboration with Beijing Public Transport corporation and Beijing Beytai to commercially deploy autonomous public transport services in China
- Utilizing Mobileye's AV Series – a full turn-key hardware and software self-driving system validated for level-4 driverless
- Deployment expected 2022

北京公交
Beijing Public Transport

北太智能

The Revolution of ADAS

Unlocking “Vision Zero” with RSS for Humans

ADAS Evolution

ADAS Today

AEB, LKA | Emergency driven

ESC/ ESP | Prevention driven

Application of brakes longitudinally & laterally

ADAS Future Potential

AEB, LKA, ESC | All in one

Prevention driven system

Formal Guarantees

ADAS Evolution

Vision Zero: Can Roadway Accidents be Eliminated without Compromising Traffic Throughput?

Shai Shalev-Shwartz, Shaked Shammah, Amnon Shashua

Mobileye, 2018

Abstract

We propose a new economical, viable, approach to challenge almost all car accidents. Our method relies on a mathematical model of safety and can be applied to all modern cars at a mild cost.

1 Introduction

In 1997 the Swedish Parliament introduced a "Vision Zero" policy that requires reducing fatalities and serious injuries to zero by 2020. One approach to reduce the number of serious car accidents, which has been advocated by the "Vision Zero" initiative, is to enlarge the tolerance to human mistakes by combining regulative and infrastructure changes. For example, installing speed bumps in urban areas, which reduces the common speed from 50 kph to 30 kph, may make the difference between a mild injury and a fatality when a car hits a pedestrian. Another example is not allowing a green light for two routes at the same time (like "turn right on red" scenarios). The disadvantage of this approach is that it compromises the throughput of the road system — for example, reducing the speed limit from 50 kph to 30 kph increases traveling time by 66%.

Another approach to reduce the number of car accidents is to rely on Advanced Driving Assistant Systems (ADAS)

APB

A comprehensive plan for APB- **Autonomous**

Preventive Braking

1 RSS

- Braking profile of a robotic system
- Definitions of “dangerous” based on “safe distance” arguments
- Formal guarantees for zero accidents if:
  - Perception is correct
  - All road users follow “Proper Response”

2 Braking profile

- Generalize RSS to hold for ANY braking profile
- Propose a specific jerk-bounded braking profile
- Jerk-bounded braking profile prevents the car from entering a “Dangerous Situation” by longitudinal & lateral braking

3 Surround sensing

- If car is equipped with surround sensing (cameras) + REM, then if all cars have APB and perception is correct, there will be no accidents
- Definitions of “dangerous” based on “safe distance” arguments

Thank You!

Drive Safe