

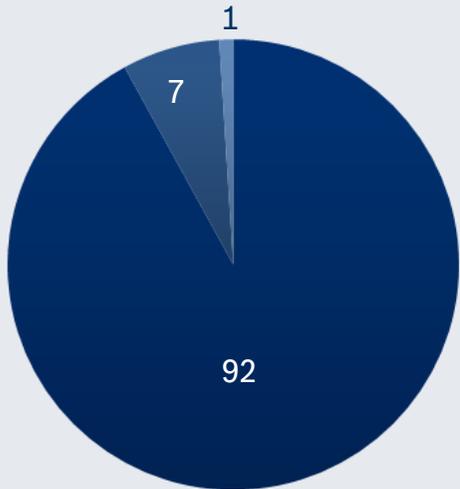
Building Smart Cities and Communities with Bosch



Building Smarter Cities and Communities

Bosch Global Footprint - Four business sectors

Shareholders



1 Robert Bosch GmbH
 7 Bosch family
 92 Robert Bosch Stiftung

4

Business sectors and divisions

- Mobility Solutions
- Industrial Technology
- Consumer Goods
- Energy and Building Technology

Mobility Solutions



World's largest supplier of cutting-edge automotive technology

Industrial Technology



Leading in drive and control technology, packaging, and process technology

Consumer Goods



World's largest power tool manufacturer
 Leading the field in household appliances

Energy and Building Technology



Leading manufacturer of thermo, and building security technology; World's largest supplier of heat pumps



approx. **410,000** associates

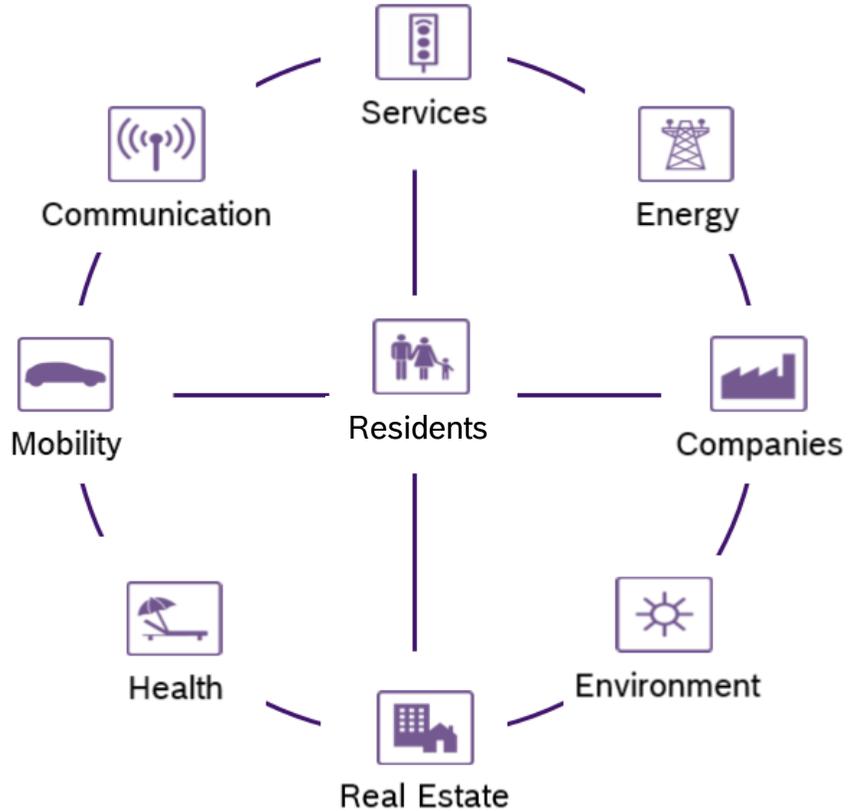
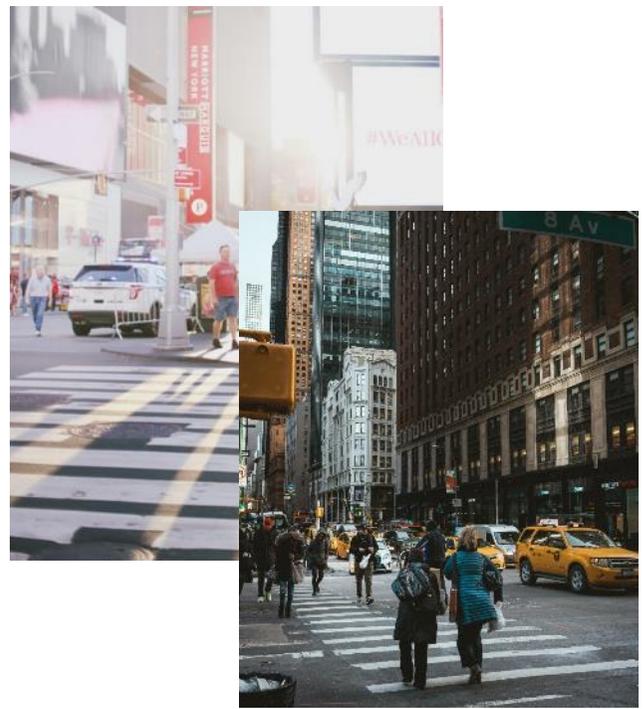
89.2 billion dollars in sales in 2018

Building Smarter Cities and Communities

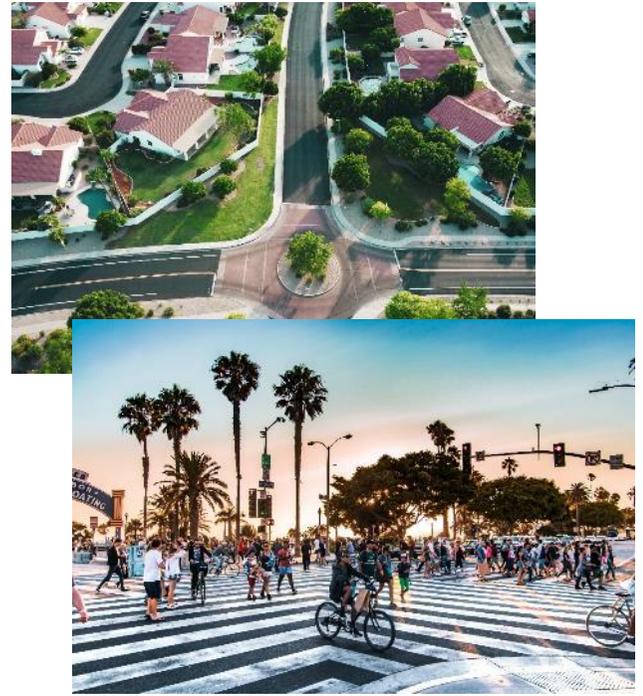
Smart City and Smart Community

Our **vision** for a smart city is to create an **interconnected ecosystem** that works to optimize **performance**, increase **efficiency**, and to enhance **quality of life** for all.

Smart City



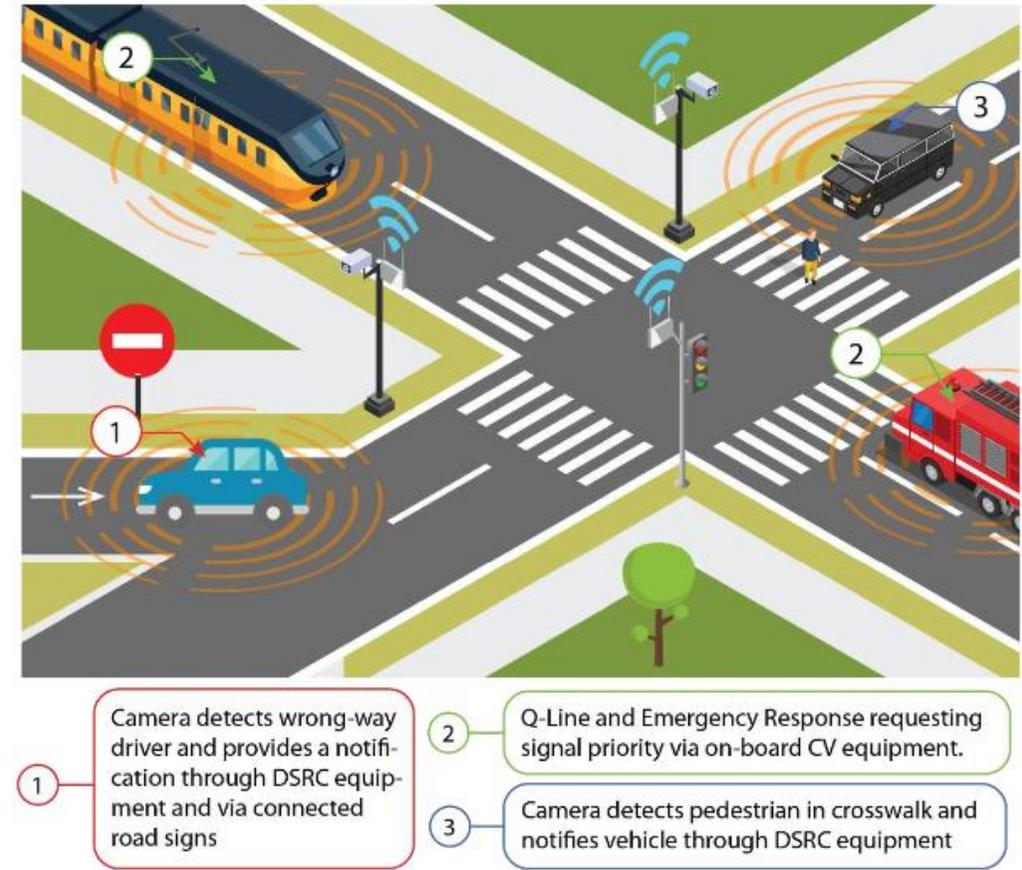
Smart Community



Intelligent Traffic Systems

ITS example – US DOT ATCMTD submission

- ▶ Pedestrian detection, prioritization, and alerts
 - Improved pedestrian and vehicle safety
- ▶ Traffic intersection preemption and signal priority for authorized vehicles
 - Reduced response times for emergency vehicles
 - Improved on-time arrivals for public transportation
- ▶ Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communications
- ▶ Transportation system optimization through data analytics and edge computing
- ▶ Wrong way driver detection and alerts
- ▶ Incident and near miss detection



Transportation
Research Center
East Liberty

Marysville

Dublin

Columbus



US-33 Smart Mobility Corridor

the **MIDWEST'S** *proving ground*
for smart mobility technology

Bosch is partnering with DriveOhio to test intelligent video sensing solutions along the US-33 Smart Corridor and in Marysville that have the ability to increase safety.

Fast Facts

- Project led by ODOT and DriveOhio
- 35-Mile Smart Mobility Corridor
- Prepares Ohio roadway infrastructure for the future of connected and automated vehicles
- Bosch is collaborating with partners to deploy smart mobility solutions
- Bosch's intelligent video sensor helps improve safety

Cross Traffic Warning	Warn drivers at intersections where cross-traffic is hard to see.
Curve Speed Warning	Alert drivers approaching exit ramp at too high speed.
Pedestrian Safety	Inform connected vehicle drivers of pedestrian presence near or in the roadway.
Exit Ramp Queue Warning	Inform drivers of approaching exit ramps of queues or stopped cars.
Red Light Violation Warning	In combination of Cross-Traffic Warning, inform connected vehicle of probable violation.
Work Zone Warning	Identify late merge of distracted driver, audio and visual alerts to inform driver and workers.
Wrong Way Driver	Detect and notify drivers of hazard, track wrong driver with pan-tilt-zoom camera.



Autonomous Mobility Services

US DOT grant award – Truck Platooning

- ▶ Ohio Department of Transportation (ODOT) and DriveOhio to Test and Deploy Automatic Driving System Technology in Ohio
- ▶ Bosch is a sub-awardee on this project as a technology provider for level 1 & 2 autonomous functionality to enable truck platooning.
- ▶ Benefits of truck Platooning
 - Improved road safety
 - Decreased fuel consumption
 - Improved freight logistics efficiency resulting in positive economic impact



Bosch eBike Systems

eBike Pedal-assist System



- ▶ **Pedal-assist:** Electric motor engages only when pedaling, allowing precise assisted speeds of up to 20 or 28 mph, no throttle needed and either hand is free
- ▶ **Power and range:** the 350-watt motor is powered by a 500 Wh lithium-ion battery for up to 100 miles per charge
- ▶ Fast, full charging in 4.5 hours using a standard 110V wall outlet
- ▶ Available on over 30 different bicycle brands in North America



Bosch eBike Systems

Bosch 'n Blue Program



Columbus, OH



Laguna Beach, CA



Tucson, AZ



Detroit, MI & Wayne State University

- ▶ Over a dozen police departments across the country have taken advantage of what eBikes provide
 - ▶ Increased range, higher speeds, incredible flexibility,
- ▶ Over 60 test riders (police officers)

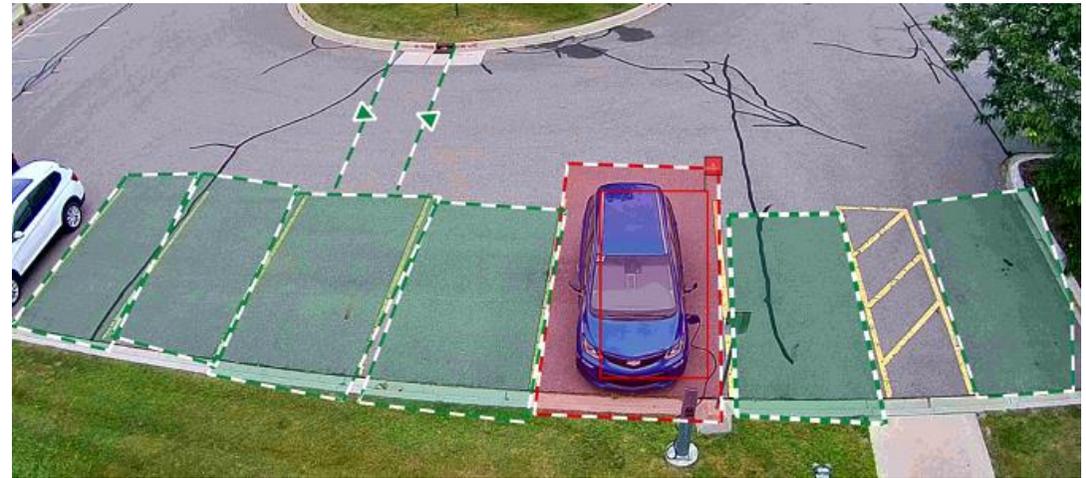
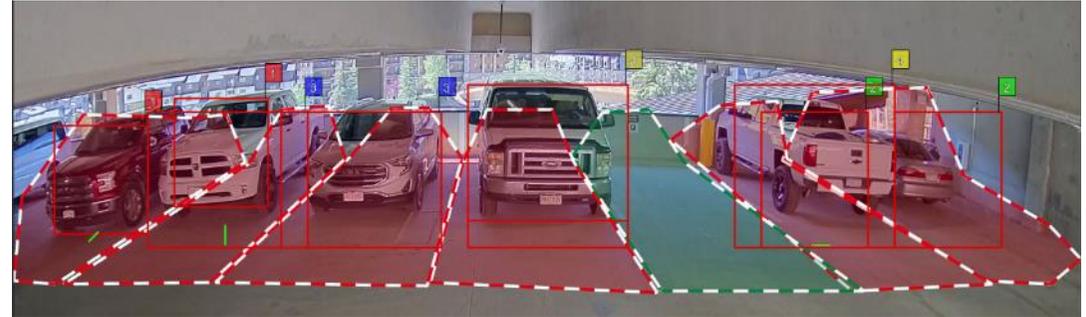


Royal Oak, MI

Smart Parking Solution

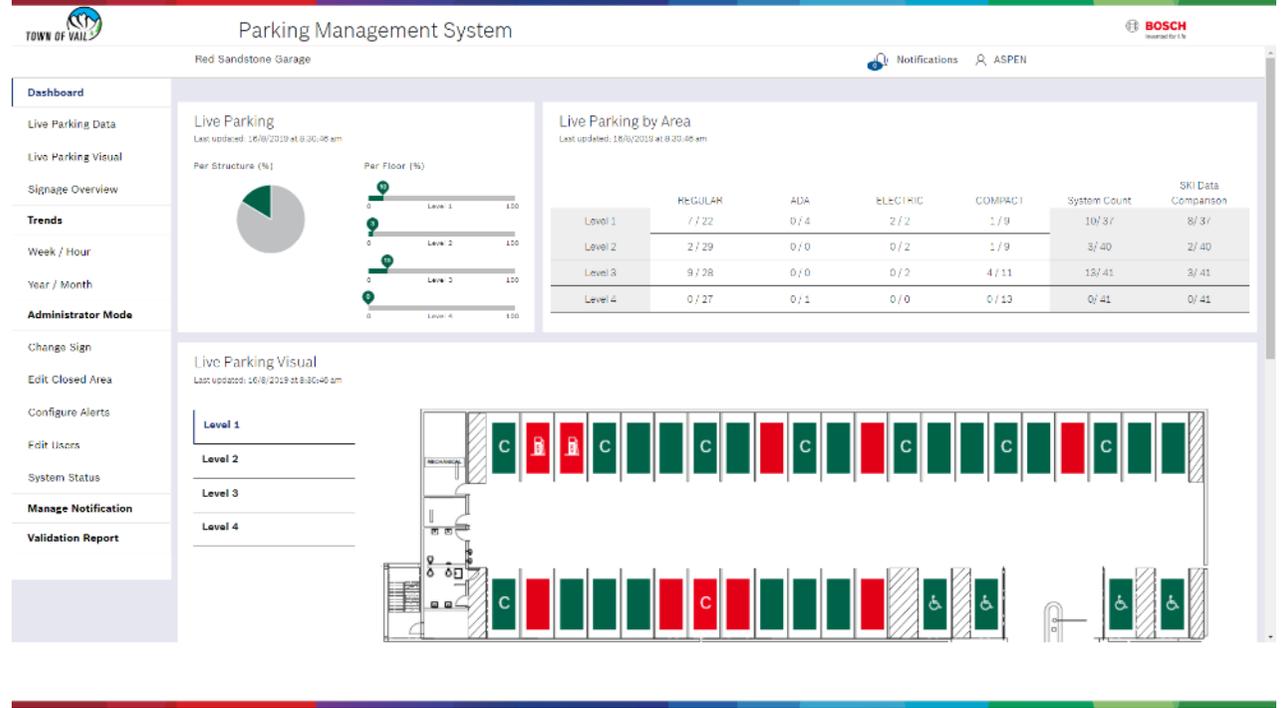
Key Functionality

- ▶ Parking availability via ground sensors or cameras' on-board intelligent video analytics
- ▶ Cameras provide security video and/or vehicle count metadata of parking lanes, decks or lot.
- ▶ License plate recognition-based access control
- ▶ Parking availability data can be provided to signage or customer specific apps
- ▶ Dashboard for visualizing data analytics and parking space management
- ▶ Parking Management Software



Smart Parking Solution Benefits

- ▶ Reduced vehicle traffic and emissions from drivers circling the block looking for a parking spot
- ▶ Improved driver experience leading to greater return customers and improved parking spot utilization rates
- ▶ Detection and notification of vehicle overstays
- ▶ Meta-data stream (object identification /classification) preserves privacy while also reducing back-end communication bandwidth requirements (on-camera edge intelligent video analytics processing compared to full video stream)



THANK YOU!



<http://cds.bosch.us/smart-city>

