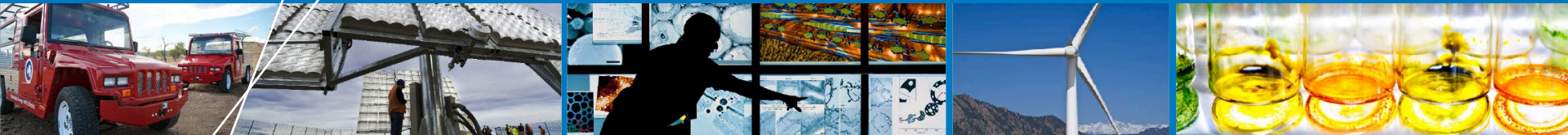


Harnessing Vehicle Automation for Public Mobility – ... An Overview of Ongoing Efforts



**9th University Transportation Centers
Spotlight Conference: Connected and
Automated Vehicles**

Stanley E. Young
Washington, D.C.
November 5, 2015

Why Public Mobility?

- **Global Urbanization**

- Over 50% of the global population live in cities – projected to be 66% by 2050
- Cities emit 70% of greenhouse gases

- **Access Trumps Ownership – Kevin Kelly**

- If a car cannot be manually driven, is there any reason (or motivation) for private ownership?

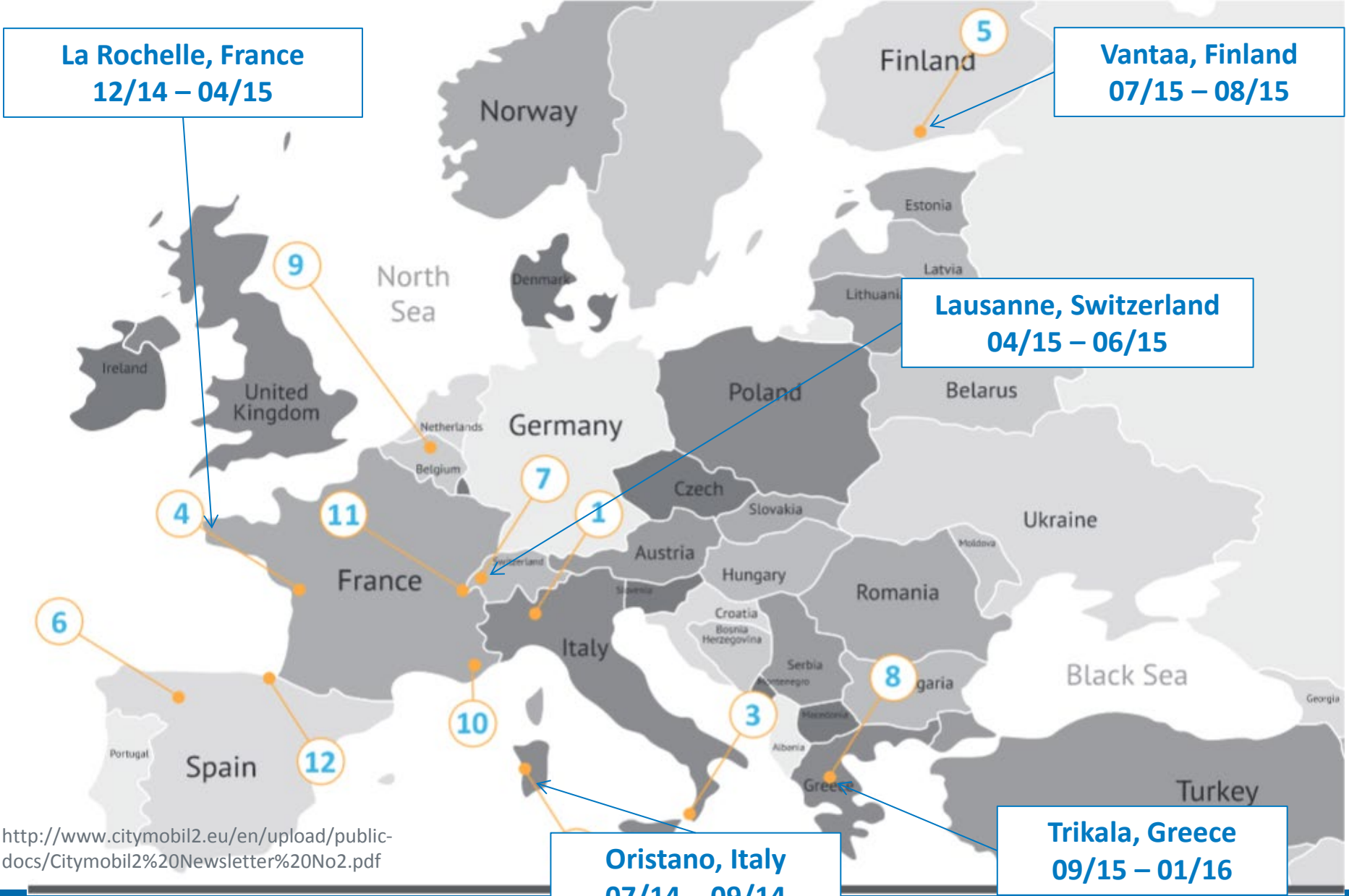
- **Something Everywhere vs Everything Somewhere**

Why Public Mobility?

The quality of life in cities has much to do with systems of transport, which are often a source of much suffering for those who use them. Many cars used by one or more people circulate in cities, causing traffic congestion, raising the level of pollution, and consuming enormous quantities of non-renewable energy. This makes it necessary to build more roads and parking areas, which spoil the urban landscape. Many specialists agree on the need to give priority to public transportation. Yet some measures needed will not prove easily acceptable to society unless substantial improvements are made in the systems themselves, which in many cities force people to put up with undignified conditions due to crowding, inconvenience, infrequent service, and lack of safety.

Pope Francis

CityMobil2



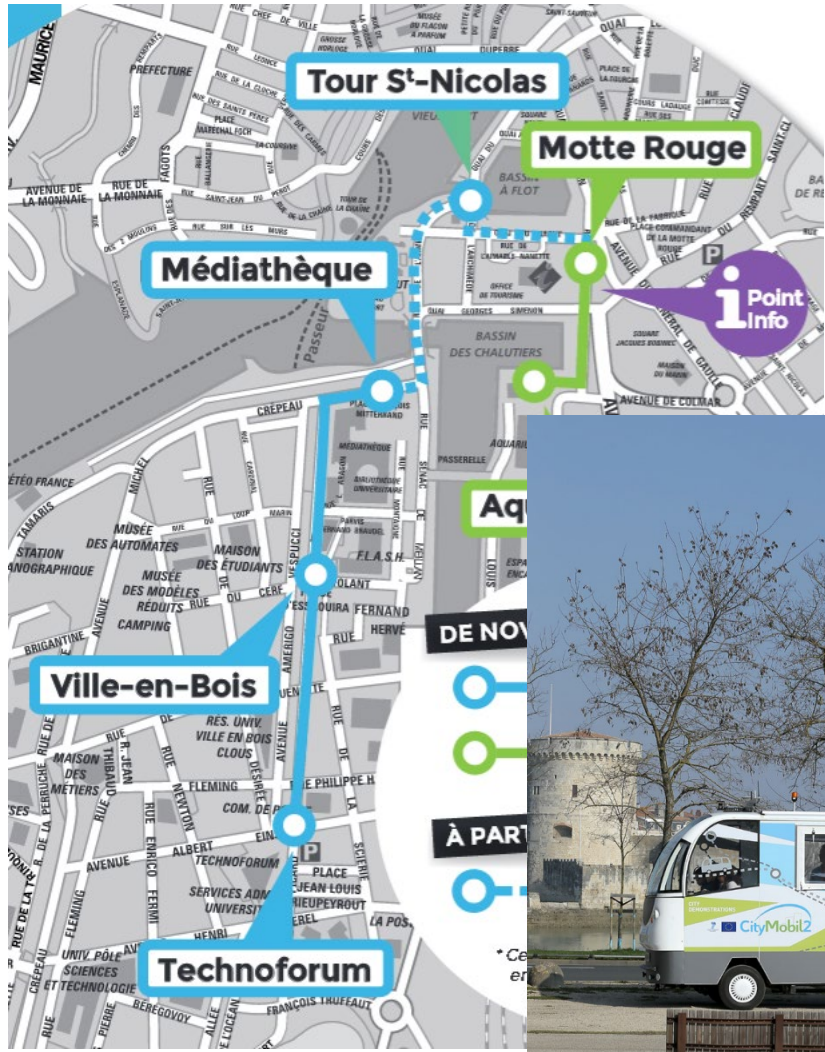
<http://www.citymobil2.eu/en/upload/public-docs/Citymobil2%20Newsletter%20No2.pdf>

La Rochelle, France – City Centre

- Dec 2014 – Apr 2015
- 15,000 passengers in four months of operation
- Robosoft vehicles
- 70 people used on a regular basis

Objectives

- Legal framework to allow driverless vehicles to circulate and provide transport
- Public reaction / social response to use of robotic vehicles providing public transport
- Technology demonstration/ safety



<http://www.citymobil2.eu/en/Downloads/Pictures/>
Copyrights: ©Frédéric Le Lan - Communauté d'Agglomération de La Rochelle

Lausanne, Switzerland – College Campus

- April 16 – June 30 , 2015
- Five months
- **Integrated smartphone app** – 1k users
- 7k passenger boardings over 5 months
- Bestmile vehicles
- Four shuttles served six stops on a 1.5-km itinerary
- 7:45 a.m. to 10:00 p.m., Monday to Friday



http://www.citymobil2.eu/en/upload/Dissemination_materials/citymobil2%20newsletter%205-v03.pdf

- **Linked “traditional” public transport axis, on the Southern and Northern edges of the campus**
- **Manned – “grooms”**
- **Heat wave required AC, which drained batteries**
- **Fleet management software**

Small-Scale Demonstrations

[http://www.citymobil2.eu/en/Downloads/Pictures/Trikala demonstration](http://www.citymobil2.eu/en/Downloads/Pictures/Trikala%20demonstration) - Copyrights: City of Trikala - CityMobil2

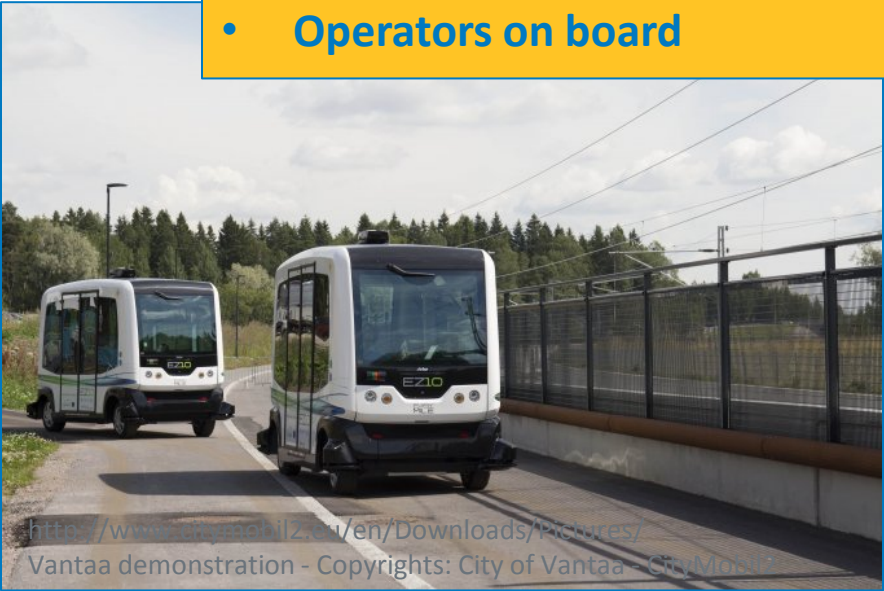


Vantaa, Finland – Housing Fair

- July 10 – August 9, 2015
- Four EZ-10 Vehicles
- 10 passengers: 6 seated, 4 standing
- 1 km (final mile), 5 minutes, 12 kph (40 kph max)
- 1,100 people on the weekend
- Test technology and people’s reaction
- Electric propulsion
- Over 19,000 for the month
- Operators on board

Oristano, Sardinia – Sea Front Promenade

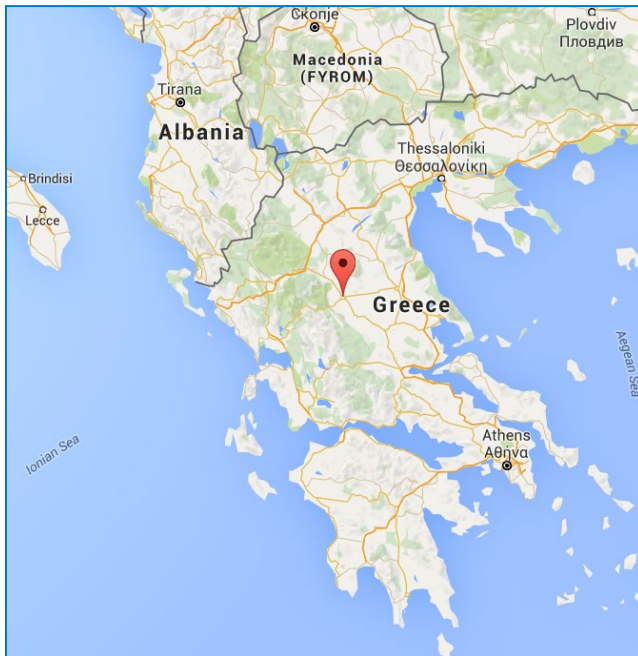
- July – Sept 2014, 6 weeks
- Two vehicles, 1.3 km, 7 stops
- Intense pedestrian traffic and crossing service vehicles



[http://www.citymobil2.eu/en/Downloads/Pictures/Vantaa demonstration](http://www.citymobil2.eu/en/Downloads/Pictures/Vantaa%20demonstration) - Copyrights: City of Vantaa - CityMobil2

Trikala, Greece

- September 2015 through February 2016
- Dedicated asphalt lane
- National Law for Automated Transport
- Six vehicles – 2.5 km
- Main city road network
- Driverless buses
- Robosoft vehicles



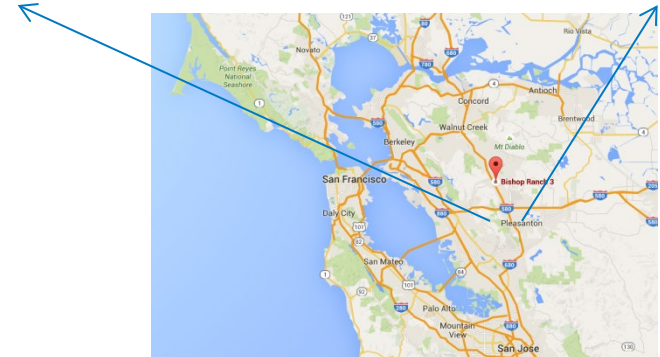
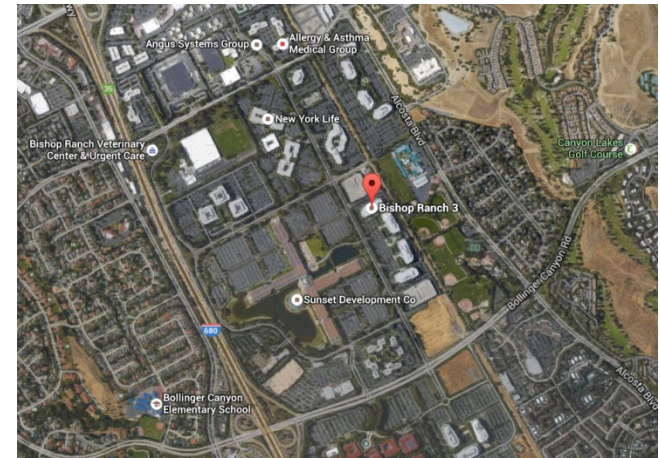
[http://www.citymobil2.eu/en/Downloads/Pictures/Trikala demonstration](http://www.citymobil2.eu/en/Downloads/Pictures/Trikala%20demonstration) - Copyrights: City of Trikala - CityMobil2

Significance of CityMobil2

- **Emphasis on legal framework, not technology**
- **Social acceptance of robotized shuttles intermixing with pedestrian and vehicles**
- **Applications: City center, last mile, extending transit ridership shed, campus, and recreational area.**
- **Technology sufficient, with room for improvement**

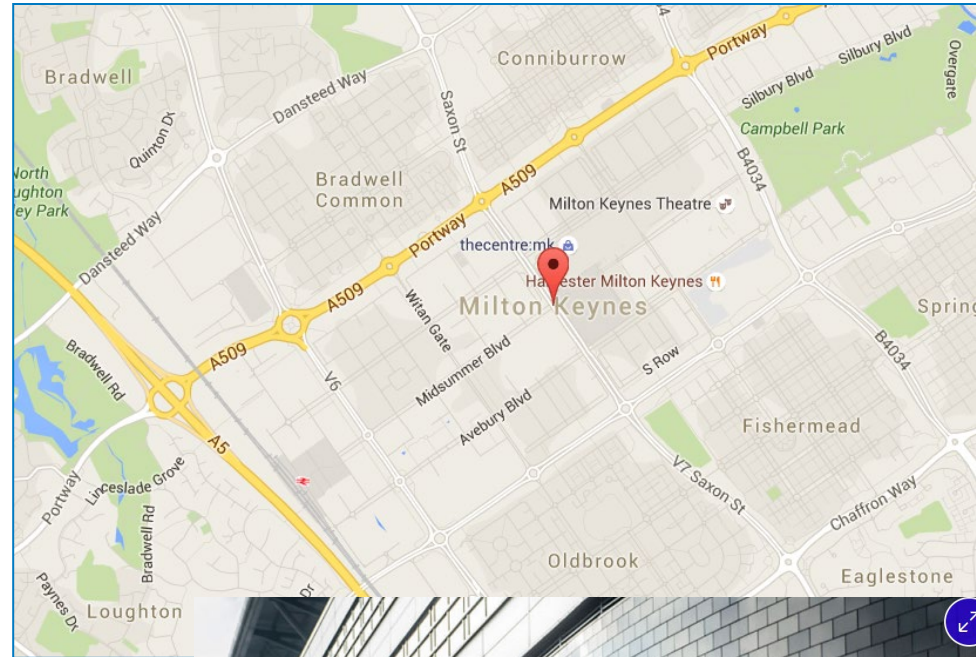
Coming soon to an office park near you...

- October 2015
- EasyMile comes to Silicon Valley Office Park
- Partnership with GoMentum Station, CCTA's Concord testing ground for autonomous vehicles
- Target – Bishop Ranch, a 585-acre office park
- Two shuttles in 2016



UK – Milton Keynes

- Electric Lutz Pathfinder
- 15 mph, two people
- Mercury – Oxford's Mobile Robotics Group
- Part of 5-year, 120M-pound project by UK to lead in self-driving vehicles
- Project a 40-car fleet, target mid-2017
- Two pounds/ride
- Separate lanes to avoid pedestrians
- Automated/connected vehicle and smart phone integrated



Other efforts in the news

- **Driverless robot taxis to be tested Japan – Oct 2015**
- **Yutong rolled out the world's first driverless bus – Aug 2015**
- **SkyTran / CyberTran**

AVs: the 21st Century's Race to the Moon



First-Last Mile



Closed Course / Open road

Robots – Start your ... uh, pods, vehicles, or whatever.



Stanford / CM / Oxford



Pods / ATN/Public Transit



Google / Baidu



UK/EU/China/US/Japan



GM / Mercedes / Volvo



Uber / Tesla

2015

The Revolutionary Track ... no steering wheel

1975 – Morgantown PRT



Stan Young / PRT Scanning Tour

1999s – Rivium PRT



<http://www.advancedtransit.org/advanced-transit/applications/rivium/>

2010s – Heathrow/Masdar PRT



<http://www.advancedtransit.org/advanced-transit/applications/heathrow/>

2016 – ??????????



www.google.com

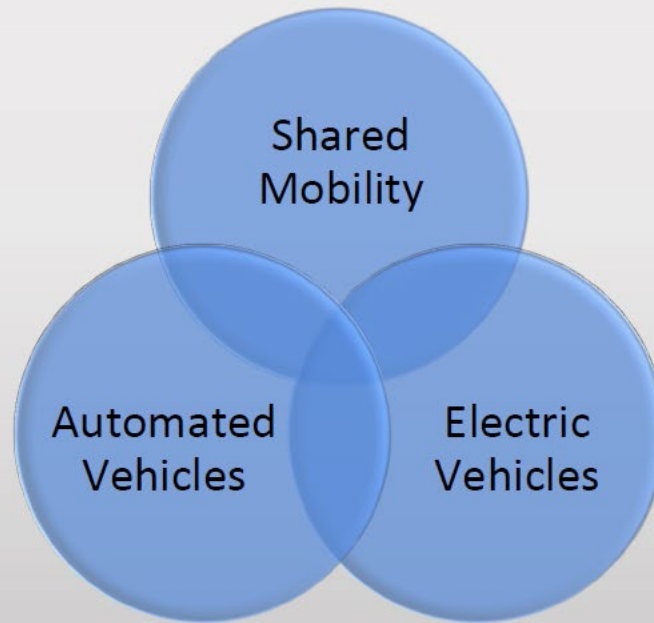
Why Public Mobility?



Forward-Looking Issues / Ideas

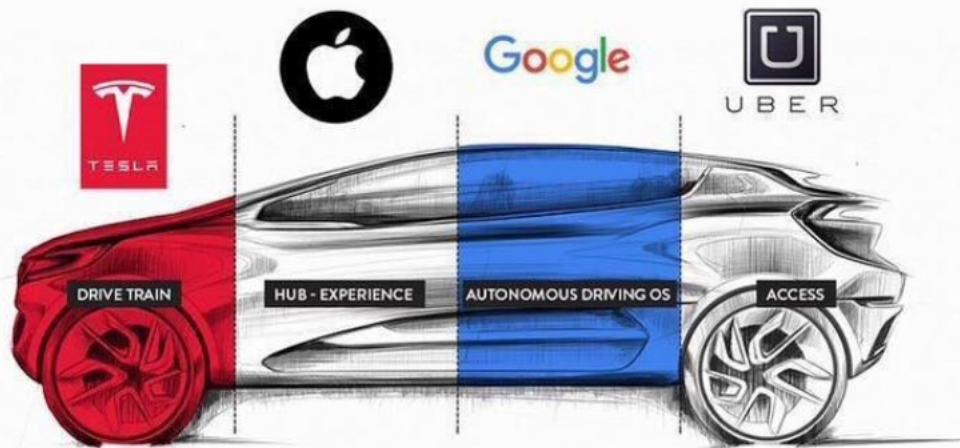
- **Can automated shuttle/vehicle service within a confined service district ...**
 - Increase effectiveness of transit access?
 - Increase car/vehicle sharing opportunities?
 - Complement vehicle access and ease parking?
- **Will autonomous vehicle security concerns necessitate car-free zones within campuses?**
- **Will “full automation somewhere” provide significant mobility and energy benefits?**

Future: Confluence of Trends



Shaheen, 2015

© UC Berkeley, 2015



VALUE CHAIN DISRUPTION
THIS IS YOUR CAR IN 2020

CAR SKETCH BY PRATHYUSH DEVADAS PRATHYUSHDEVADAS.WORDPRESS.COM

© UC Berkeley, 2015

CityMobil2

Large-Scale Demonstrations

- **La Rochelle, France, 12/14 – 04/15**
 - 15,000 passengers, City Centre
- **Lausanne, Switzerland, 04/15 – 06/15**
 - College Campus
- **Trikala, Greece: 09/15 – 01/16**
 - City circulator

Small-Scale Demonstrations

- **Oristano, Italy: 07/14 – 09/14**
 - Seafront promenade of Torre Grande
- **Vantaa, Finland, 07/15 – 08/15**
 - Last mile from train station



2 automation strategies



“something everywhere”

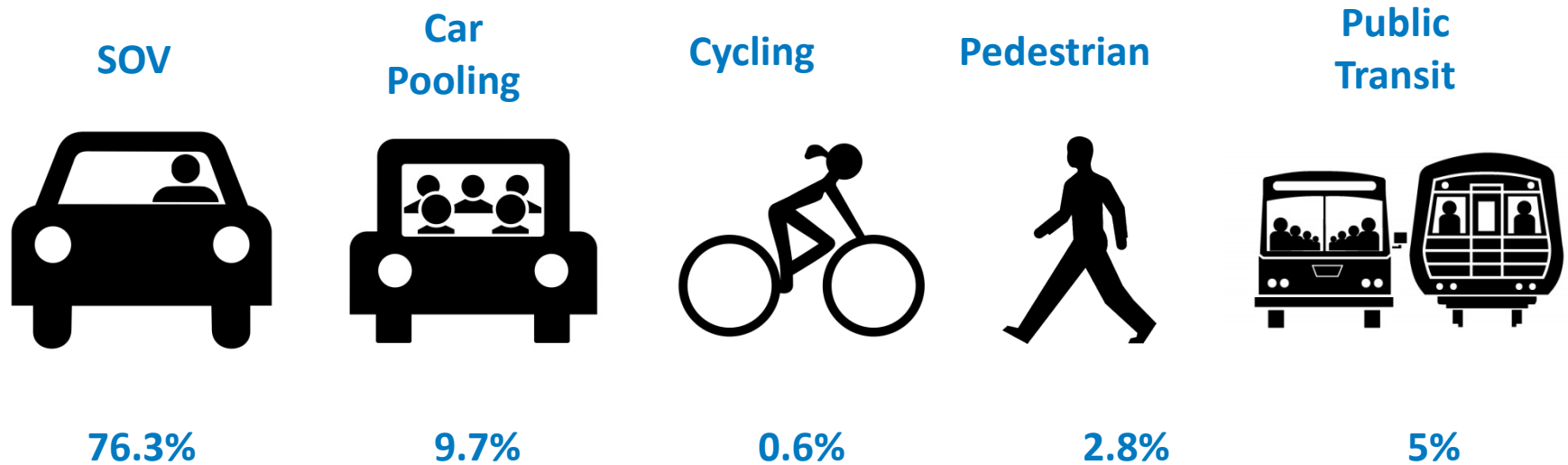
Improve the automated driving systems available in conventional vehicles so that human drivers can shift more of the dynamic driving task to these systems.



“everything somewhere”

Deploy vehicles without a human driver and gradually expand this operation to more contexts.

Current Spectrum – 2012



Spectrum 2020



SOV



Car Pooling



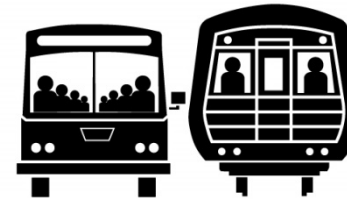
Walking



Cycling



Public Transit





Source: Wikipedia.org, 2009
System: Vancouver Skytrain



Source: Wired.com 2008
System: PATH Experimental Bus

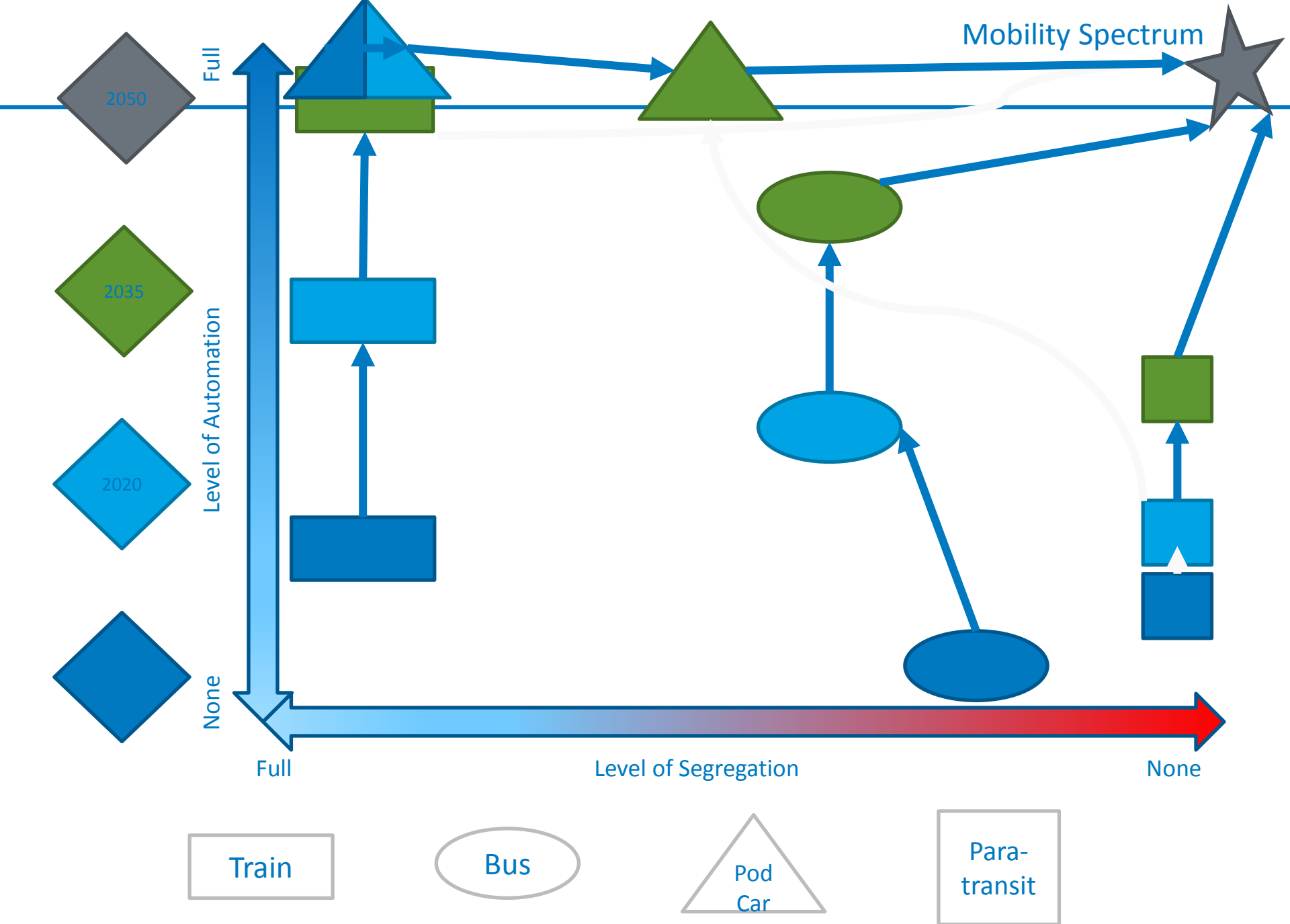


Source: Time Magazine, 2011
System: Masdar City PRT



Source: Des Moines Area Regional Transit, 2014
System: Paratransit





Mobility Spectrum



Full

Level of Seclusion

None



Suburban

Urban