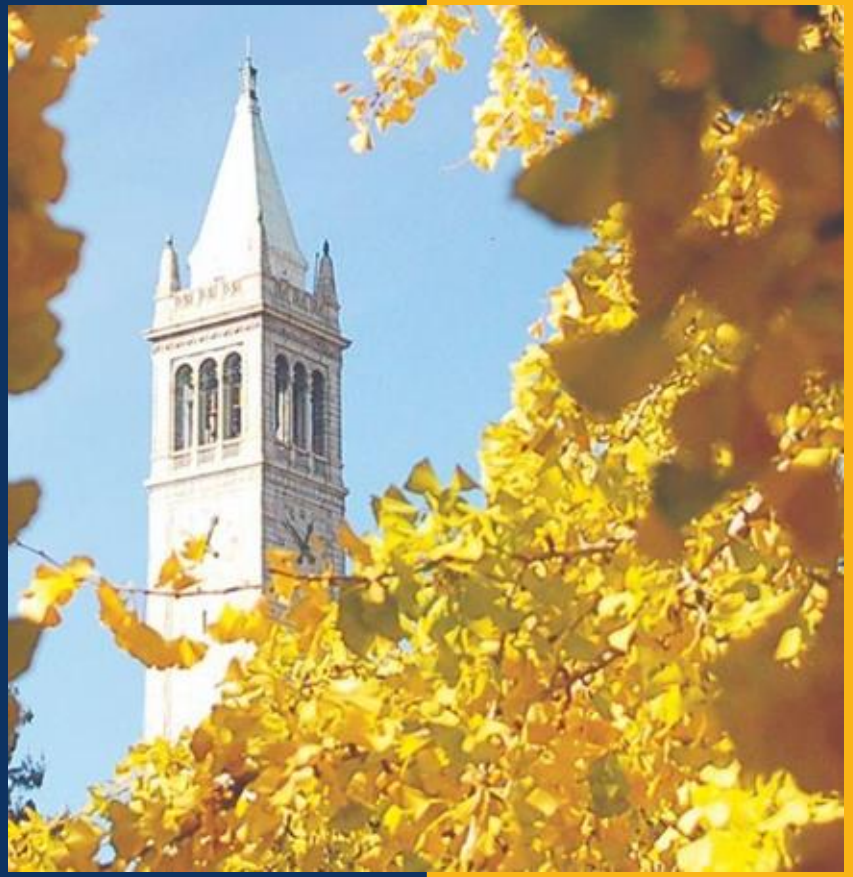
UC Berkeley

Dhaka, not Dallas:

Why Developing Asian Countries are Ideal Adopters of Autonomous Technologies



ESCAP Region Conference on AVs
September 8, 2026

James Fishelson: jfishelson@berkeley.edu
PATH Executive Director

PATH and CAVs

- **World's first large-scale AV demonstration, 1997:** the Automated Highway Systems project, covering platooning, buses, and trucks
- **Continued work over 30 years:** automation and connectivity, together and separately, with an infrastructure focus in partnership with Caltrans
- **Biggest hurdle — chicken or egg:** many CAV technologies need meaningful penetration on both the infrastructure and the vehicle side
- **Key lesson:** always think about viable deployment pathways, especially at early stages, and keep stakeholders engaged



Two Takeaways

1. The biggest social upside is in the rapidly developing world

- Safety, access, and affordable mobility gains are largest where the need is greatest
- Need and opportunity still overlap there, as they no longer do across much of the West

Farmers were the Model T's earliest mass adopters.

By 1920, 1 in 3 U.S. farms had a car — 2.1 million in all — when only 13% of rural roads were hard-surfaced.

1954 U.S. Census of Agriculture; Richmond Fed

2. International coordination and collaboration are needed

- Developing AVs is EXPENSIVE
- SF is full of Waymos because Alphabet is there, not because SF suits AVs better
- Coordination among peer countries is the only affordable path

The capital sits in the global north.

Waymo raised $16B at a $126B valuation in 2026; GM closed Cruise after $10B, citing capital costs. Paid service runs in six US metros, with London and Tokyo next.

CNBC, TechCrunch, Forbes, 2026

Uber Has Always Been Wrong About AVs

“India will probably be the last country in the world to get autonomous cars.”

— Travis Kalanick, then Uber CEO, in 2016 after a trip to New Delhi

- **Partly correct**
  - India and similar middle-income Asian cities *do* present unique challenges
  - But AVs will have a bigger impact in these places
- **Overlap of need and opportunity**
  - The West is already built out; existing infrastructure roughly matches future needs
  - Cities like Bangkok cannot afford to stand still
  - New technologies have been, and will be, rapidly adopted



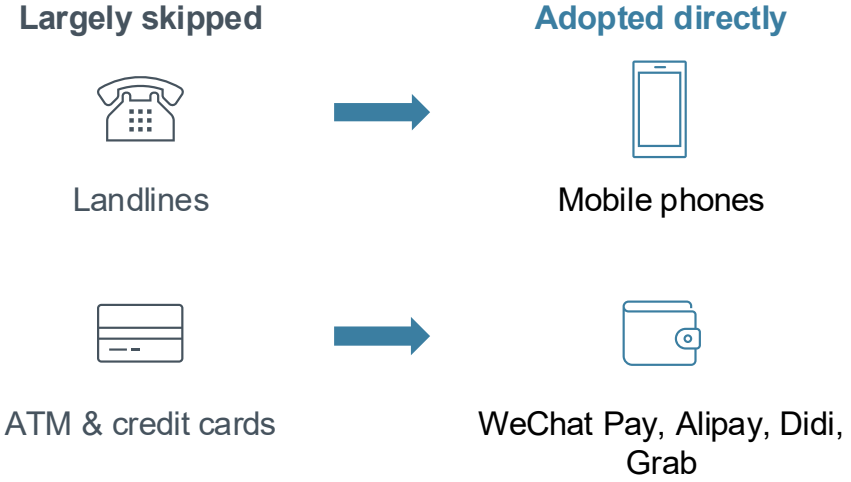
2014: First Metro Line Opened in Mumbai
2024: 4 Lines Open, 8 Under Construction, 5 Planned
1938: 2nd Ave Subway in New York Delayed
2026: Still Behind Schedule

Benefits of Starting from a Lower-Tech Place

- **Developed world:** Legacy technology — loop detectors, fixed signal plans, centralized control centers.
- **Backwards compatibility:** Newer tools — camera detection, cloud platforms, connected vehicles — struggle to fit the old systems.
- **Developing cities can leapfrog:**
  - Digital infrastructure instead of physical
  - Link MRT with autonomous shuttles
  - Build on existing multimodal travel habits
  - Avoid car dependency before it sets in
  - Tie transport to real estate: autonomous parking, delivery robots

The same opportunities exists in rural transportation.

Leapfrogging in practice, across much of Asia



Transportation infrastructure can follow the same path.

Considerations for Developing Asian Cities

- **Mixed-mode traffic:** US roads carry mostly cars and heavy vehicles, while Bangkok and its peers carry far more bikes, scooters, motorbikes, even livestock
- **Limited traffic control:** fewer signals, and most run on fixed timing; fewer road markings, and those that exist are often ignored; heavier reliance on tacit rules, such as honking when overtaking
- **Lower speeds:** a product of roadway conditions, congestion, and mixed modes
- **Developing AVs is highly specific:**
  - The US, Europe, and China are leaders, developing AVs for their cities and applications
  - A US-trained driving model cannot simply be transplanted to Tajikistan or Bangladesh
  - High cost of AV development makes it even harder



Dhaka, Bangladesh

Deploying AVs in Cities like Dhaka

- **What are the biggest challenges facing transportation in your cities and countries?**
- **What types of AV services would best address them?**
- **How will AV development and deployment be funded (e.g., via real estate)?**
- **AVs in Dhaka may NOT look or act like Waymos or Teslas:**
  - Low-speed robots
  - Automated BRT
  - Different vehicle controllers and sensors for different needs





Deploying AVs in Rural Countries like Tajikistan

- **One of the most mountainous countries in the world:** over 90% of the land is mountain, and most routes climb through high, narrow passes
- **A limited manufacturing base:** vehicles, parts, and technical capacity are largely imported
- **The core challenge is movement itself:** moving goods and people across a sparse network of treacherous roads
- **AV research has concentrated on cities, not rural roads**
  - Almost certainly a mistake: rural corridors are where travel is costliest, most dangerous, and hardest to serve
- **We are part of a rural autonomous vehicle grant —** more to share soon



Extra Slides

Lessons Learned



History of PATH and CAVs

Lessons Learned

Reccomendations fo CAVs in an Indian Context

- **Leverage Indian Benefits**
  - Focus on cell-phone-based communications and applications
  - Focus on low-cost and mixed-mode solutions
  - Consider CAVs and smart city concepts with ALL new infrastructure
  - Link with other emerging technologies where possible: AI, blockchain, eVTOLs, etc.

- **Create Viable Deployment Pathways**
  - Focus on early wins
  - Identify users with highest need
  - Explore specialized use cases and locations (ports, campuses, etc.)
  - Support existing infrastructure plans (e.g., Can CAVs support last-mile services to expand reach of the Metro? What about combing the metro with automated bus rapid transit?)

- **Recognize the Importance of Stakeholders:** Government, industry, and academia can and should collaborate every step of the way

Automation Since 1997

- **More Autonomous than Automated:** Most current companies (e.g., Waymo) do NOT rely on infrastructure support or connectivity – this simplifies the political problems, but exacerbates the technical ones
- **99% Self-Driving is Easy, 99.9999% is Hard:** Edge cases continue to create problems, both technically and societally
- **Emerging Real-World On-Road Applications:** Waymo/Cruise taxis, middle mile automated freight (e.g., Aurora), but limited viable business models
- **Specialized Applications Show Promise:** Farming machinery, delivery robots, campus shuttles, etc.
- **Apprarant Consumer Demand for L2/3 Vehciles:** Tesla's Full-Self Driving obviously, but most OEMs offer something





Current State of AV Technology

- **Academia Cannot Work Separate from Industry:**
  - Industry hires best PhDs
  - Electronic control units (ECUs) make retrofitting vehicles difficult
- **Importance of Redundancy for L4:**
  - Typically rely on multiple sensing technologies (lidar, radar, cameras, etc.)
  - L2 may only depend on cameras (e.g., Tesla)
  - Redundency required for safety (i.e., safer than human drivers)
- **Data Intensive – Consumption and Production**
  - Require detailed and accurate 3D maps that must be regularly updated
  - Road closures, work zones, etc., remain a challenge
  - AV sensors create a massive amount of data – important for AI
- **Unclear Standards:** No federal standards for testing, deployment, reporting, etc., in the US, varies massively from state to state





Current State of C-V2X Technology

- **Direct Communications: Moving from DSRC to C-V2X**
  - Big shift in the US
  - Continued safety focus
  - Super low latency and accuracy, but require high investments for both vehicle and infrastructure
  - Most attractive in locations with high demand and fleets of vehicles
- **Increasing Interest in Cloud-Based Solutions**
  - Cellular communications do not require OBUs or RSUs, only cell phones, but have higher latency and more dropped messages
  - Not sufficient for safety-critical or AV-control communications
- **OEM Involvement is Critical**
  - No C-V2X mandate in the US (likelier in Europe/China)
  - Different OEMs have different approaches to connectivity
- **Future is Unclear:** Lots of excitement and investment, but no obvious applications that will definitely happen

Testbeds

Approach for Success in an Indian Context



Testbed Goals

- **Accelerate Progress from Lab to Deployment:** Provide real-world but controlled conditions
- **Flexibility:** Able to test a wide variety of scenarios
  - Different roadway types, vehicles, infrastructure support, etc.
  - Focus on edge cases (e.g. bad weather, blind sports for cellular, etc.)
  - Realistic facsimiles where appropriate: fake building, dummies represent people and animals, etc.
- **Forward Looking:**
  - Backwards and forwards compatible wrt ITS technologies
  - Tailored to the country/region's long-term goals
- **Highly Utilized**
  - Mix of academia, government, and industry users
  - Heavy use is both a revenue opportunity and a mechanism for coordination and collaboration between stakeholders

Key Testbed Decision

- **Closed vs. Open**
  - Closed: More protected and flexible, harder and more expensive to get space
  - Open: Closer to real-world conditions, utilize existing roads
- **High Speed vs. Low Speed**
  - High speed (> 80 kph): representative of driving conditions, but requires lots of space (e.g., 1.5 km radius loop)
  - Low speed: Cannot do extensive high-speed testing, but far less space is required
- **Heavily Instrumented vs. Lightly Instrumented:** Basically a cost issue



Gomentum Station: A closed, high speed, lightly instrumented testbed near Berkeley

Even at ~1,000 hectares, can only support short stretches of highway speeds

Reccomended Starting Point: Closed, Heavily-Intrumented, and Low-Speed

- **Long-Term Vision:** A network of Indian CAV and Smart City testbeds with different strengths and weaknesses
- **Why Closed, Heavily-Instrumented, and Low-Speed?**
  - Achievable on the IIT Campus
  - Able to test the widest variety of different use cases and vehicles
  - Oriented towards both research and deployment
- **Indian Context**
  - Mixed traffic vehicles and dummies
  - Variable road markers
  - Variable roadway types and conditions
  - Large perimeter loop



Richmond Field Station: UC Berkeley's 125-acre research campus for developing and testing of ITS technologies, including roads and a fully-instrumented test-intersection

What Makes a Successful Testbed?

Build a Strong Team

- **MORE THAN JUST ENGINEERS AND RESEARCHERS!**
  - Marketing, Communications, Outreach, and Publicity
  - Operations Management (e.g., scheduling and pricing)
  - Strategic Vision
- **International Partnerships**
  - Collaborate with other Testbed Operators
  - Considers standards, laws, etc., especially in an Indian context (e.g., importance of Euro NCAP)

Stakeholder Enagement

- **Government**
  - National Ministries (e.g., Transportation)
  - Local Government
- **Hardware/Software Companies**
  - OEMs (e.g., Tata Motors, Bajaj)
  - ITS Tech Companies
- **Transportation Providers**
  - Freight/Logistics
  - Public Transit
  - Others (e.g., Ola)
- **Data/Communications**
  - Cellular Providers (e.g., Reliance)
  - Big Data/AI
- **Travelers/Community Groups**

Business Model Importance

- **Testbed Business Model**
  - What type of revenue will it generate?
  - How will it charge (per use, partnership model, etc.)
  - Stakeholders are more invested with “skin in the game”



- **Smart City Business Model**
  - Gather stakeholder feedback on what business models and use cases to test
  - Inform testbed development and growth
- **Transportation benefits everyone for a long time, but:**
  - Benefits do not occur immediately, and often come with short-term pain
  - There are always people/groups who benefit from the existing system
  - Many failures: congestion pricing, reducing free parking, encouraging sharing, etc.



- **Need “Early Wins”**
  - Is there a product/service people will pay for?
  - Is there a pathway to profitability?
  - Can we encourage public-private partnerships?



Questions, Discussions, and Next Steps