Using AVs to shield micromobility lanes

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What’s wrong with today’s urban bike lanes?

- Unprotected bike/scooter lanes next to high-speed auto traffic
  - 40 mph two-ton auto vs. 15 mph 30-pound bike: We all know who loses
  - In 2016, 840 cyclists died in crashes (71% on urban roads, 84% male)
  - Distracted driving, road hazards, and vehicular collisions

- 2018 U.S. Bicycling Participation Survey of 9,376 adults
  - 47% of adults in the U.S. want to ride bikes more often,
  - 50% worry about being hit by a car (#1 concern), and
  - 43% “more likely to ride if autos and bikes were physically separated

Conclusion: Micromobility lanes need more effective protection than a coat of green paint.
NACTO’s Urban Bikeway Design Guide

Option 1: Using curbside parking lanes as a border

- Advantages
  - Cheapest solution
  - Retains curbside parking
  - Less political push-back

- Disadvantages
  - No real barrier from high-speed auto traffic
  - Autos must cross the bike lane to park
  - Easy to get “doored” as drivers park then exit cars
  - Danger from turning cars
Parking as a bike lane traffic barrier

Option 2: Curbside bike lane, parking lanes as a traffic barrier

- **Advantages**
  - Retains parking, thus less political pushback
  - Parked cars are a good traffic barrier

- **Disadvantages**
  - Pedestrians must cross bike lanes to access cars
  - Cost of relocating meters from the curb
  - Need a wide door zone on auto passenger side
  - Danger from turning cars

Image by [Pittsburgh Post-Gazette](http://www.post-gazette.com), non-commercial educational Fair Use
Flex Post traffic barriers

Option 3: Flex Post barriers to protect bike lanes

- **Advantages**
  - Safer solution
  - Autos don’t drift into bike lanes
  - Moderate construction cost
  - Moderate maintenance cost

- **Disadvantages**
  - Flex posts can’t stop a distracted driver’s two-ton SUV
  - Lost parking? Political and business push-back
  - Pedestrians and jaywalkers may wander into bike lanes
  - Danger from turning cars

Image by CBC/Radio Canada, non-commercial educational Fair Use
Landscape traffic barriers

Option 4: Landscape barriers protect bike lanes

- **Advantages**
  - Safest solution
  - Autos won’t run over planters to park in bike lanes
  - Fender-benders seldom push across these barriers

- **Disadvantages**
  - Lost parking? Locals and businesses will push back
  - Sidewalk pedestrians and jaywalkers may wander into bike lanes
  - Higher construction cost
  - Highest maintenance cost
  - Danger from turning cars

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Dedicated dual micromobility lanes

Option 5: Dual lanes for parks and greenfield development

- Advantages
  - Two lanes are much safer than one
  - No autos competing for lanes
  - More space for sharing with scooters
  - Overpasses can eliminate dangerous intersections

- Disadvantages
  - Hard sell for most urban settings
  - Substantial right-of-way is required
  - High construction cost
  - Moderate maintenance cost
Cycle-friendly junction design the Dutch way

30% of US fatalities occur at street junctions

Here’s how the Dutch minimize this risk

Video and image courtesy of BicycleDutch, used under Creative Commons Attribution-ShareAlike 4.0 International License
The invasion of the *Delivery Robots*

- Billions are pouring into delivery robots
- They may soon begin arriving on our streets and sidewalks
- Sizes range from large street-legal mini-stores to small sidewalk crawlers
- As with the initial introduction of scooters, few cities or suburbs have given much thought to the problems they may create

*What opportunities might they bring as well?*
Nuro, 3.6 ft wide, recent $940 million venture

Neolix+Baidu, 3 ft wide, 100,000 units w/in 5

Robomart+Stop&Shop, 4.7 ft wide

Cleveron (Estonia): Package delivery

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Amazon’s Scout delivery

Starship-Mercedes

Eliport delivery AV + package storage unit

Boxbot-Toyota delivery AV

Marble package delivery AV

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EffiBot - DHL heavy delivery sled

Robby - PepsiCo Snack Fleet

Kiwi software + third-party robots

Postmates: Food, small packages

TeleRetail ThyssenKrupp delivery

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Small delivery robots will crowd urban sidewalks

- The problem
  - Even if deliveries were limited to a ten-block radius, the urban impact is significant
  - Imagine the lunch hour surge

- The opportunity
  - Create *toll lanes* into key urban and residential delivery zones
  - Pair delivery AV lanes with protected micromobility lanes
  - Use tolls to pay construction and maintenance costs
  - Consider small strategically located clusters of drone copters for small package delivery

There are currently over ten small delivery robots with many more under development

Image by startengine.com/eliport, non-commercial educational Fair Use
Two AV sled-serviced models:
1) electric autonomous sleds that deliver the last-mile delivery vehicles, or
2) electric autonomous sleds that deliver packages near small “drone ports”

Front View, as an AV Carrier

Side View, as a small package Carrier
Flex Posts and Cable Posts barriers

Flex Post barriers

- Flex posts are adequate barriers between bikes/scooters and AVs and are far safer than cable posts. Note that AVs are programmed to avoid collisions.

Cable Post barriers

- Cable post barriers with traffic-side rumble strips will deeply discourage motorists from entering AV lanes.
- A simple single waist-high cable post or rope barrier will discourage jaywalkers and prevent distracted pedestrians from wandering into bike lanes.

Minimize lane barriers based on need
Protect micromobility with an AV delivery/transit shuttle lane

Micromobility Lanes shielded from traffic by Autonomous Vehicles