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THOUGHT LEADERSHIP

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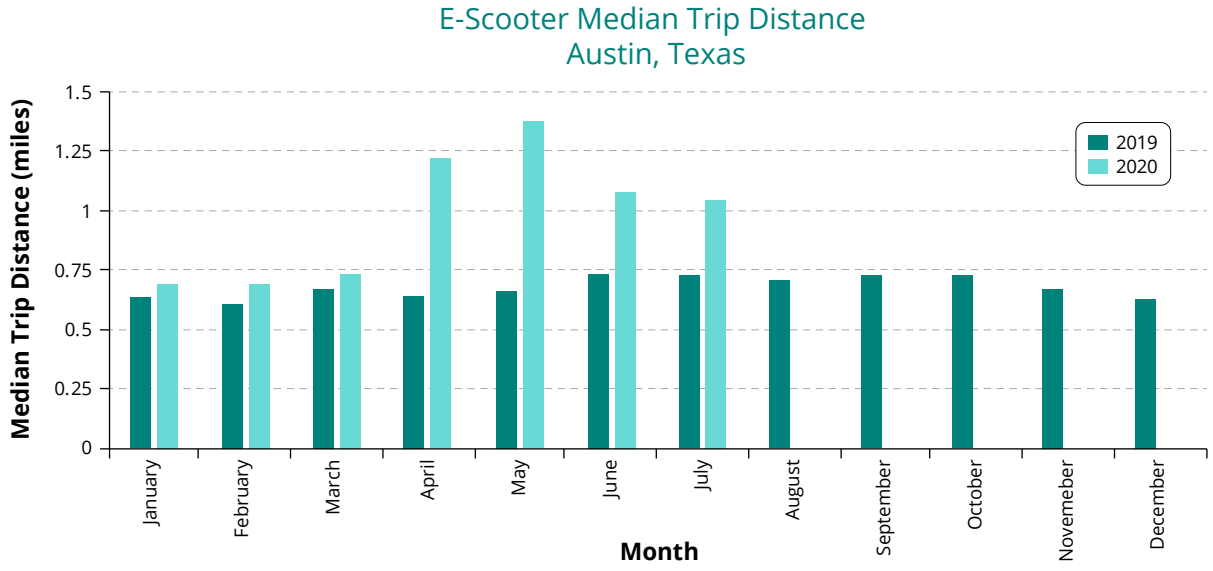
Going Beyond the "Last Mile"

Re-Evaluating Micromobility Vehicles for Changing Usage during COVID-19

July 23, 2020

As commuters around the world emerge from shelter-in-place restrictions, their micromobility usage shows a clear trend: the average rider is now taking *longer* trips than before.[1] While the reason for this recent development is still being investigated, it could be that commuters unwilling to take public transportation in the current climate are now using micromobility vehicles—like shared bikes and scooters—for their whole commute. This contrasts with previous usage patterns showing that micromobility options were only being used for the "last mile" following use of a car or public transit. Whatever the reason, the data indicates that commuters are reconsidering their habits, and their increased usage can have profound effects on the vehicles and riders themselves.



Note: July 2020 data through July 13, 2020

[1] https://data.austintexas.gov/Transportation-and-Mobility/Shared-Micromobility-Vehicle-Trips/7d8e-dm7r
https://usa.streetsblog.org/2020/05/11/lime-just-became-the-biggest-micromobility-company-in-the-world/
https://sifted.eu/articles/scooter-europe-lockdown/
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https://medium.com/sharing-the-ride-with-lyft/changes-in-bike-and-scooter-travel-behavior-during-covid-19-3b1444ab99cd

Vehicles

Micromobility modals (such as scooters, shared bicycles, and other similar vehicles) were initially designed for multiple, relatively short, trips per day. However, as usage shifts towards longer (and potentially fewer) trips per day, the demands placed on the vehicles will also change. Commensurate modifications to vehicle design and capabilities will be required to meet these new demands.

For instance, mechanical systems will need to accommodate longer continuous use periods. Enhanced vehicle durability will be needed if the new roads now used by riders increase wear and tear on the vehicles and the opportunities for between-rider maintenance and troubleshooting decrease. A rise in usage may also lead to a faster accumulation of fatigue cycles and thus potential accelerated vehicle degradation. Furthermore, data indicates that average trip speed is also increasing, a phenomenon that has been shown to decrease product lifespan.

Whether meeting these challenges requires increased maintenance frequency or a complete design overhaul, appropriate review, modification, verification, and testing processes must accompany these changes to ensure vehicle performance and safety.

Battery Pack

To accommodate increased vehicle range, modifications to the battery and power delivery system may be necessary. Increasing the available energy in the battery pack is one straightforward solution, and there are several ways to accomplish this, each with tradeoffs.

Many e-bikes and e-scooters are designed with the battery pack seamlessly integrated into the frame. While expanding the range is most easily achieved by adding more cells to the battery pack, there may not be enough space to maintain this design. Any form factor or location change may alter the mechanical vulnerability and durability requirements of the battery pack. A change in weight or weight distribution could also impact user experience.

Another option is to use more energy-dense cells within the battery pack, either through a change in cell design or cell chemistry. Typically, choices of cells in a battery pack come with trade-offs of energy density, power capabilities (i.e., speed), and thermal and mechanical properties. The consequences of these choices can affect time-to-charge, overall battery lifetime, and performance characteristics of the vehicle, among other things.

Enhancing current battery performance may even be possible through increasing the usable voltage window or changing parameters in the battery management unit (provided they stay within the supplier's specifications). A software update may be an efficient approach but would also require a full understanding of the impact on battery health and safety.

Appreciating the complex factors at play with each choice and applying efficient and rigorous testing is crucial for making these decisions during a rapid market adjustment.

Users

With increased trip frequency and duration, the risks associated with micromobility use for riders also have the opportunity to grow. Riders traveling longer distances may have a greater need to rely on app-based route guidance, creating the temptation to engage in distracting or inattentive behaviors while riding. Longer trips may also affect riders in ways they don't anticipate, such as physical fatigue from riding that can increase the risk of crashes and falls. Bumpy road conditions, avoiding potholes, dodging other road users, and maintaining balance can all wear riders down more than they realize when riding for longer periods. Faster speeds than riders are accustomed to can also increase crash risk if rider reactions to unexpected events are too slow.

The increased crash risk also means increased injury risk. Recent observational studies[2] show the riskiest behavior of e-scooter riders is not wearing helmets. Not surprisingly, injury data from 2018–2019 show that nearly half of e-scooter injuries are head injuries.[3] For e-bikes and manual bikes alike, the observational data show that riders go against the flow of traffic more than advisable. The injury data for e-bikes shows greater incidence of chest and lower extremity injuries compared to manual bikes,[4] suggesting that the higher speeds afforded by e-bikes may lead to higher risk of injury. Longer rides equals greater risk exposure, regardless of modal type. Ensuring rider safety and comfort for these long trips may require additional warnings, safety features, and training.

Micromobility platforms alone may not be solely responsible for these changes, but there are opportunities to leverage current societal trends to increase helmet use among e-scooter riders, which is currently very low (about 10%). Innovative ways to connect the self-protection behavior of helmet use with the current need for people to wear face masks, also a self-protective device, may yield higher rates of helmet use among micromobility riders. Any increase in helmet use will reduce head injuries.

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[2] https://www.sciencedirect.com/science/article/abs/pii/S0001457515001992
https://www.sae.org/publications/technical-papers/content/2019-01-1007/

[3] https://www.austintexas.gov/sites/default/files/files/Health/Epidemiology/APH_Dockless_Electric_Scooter_Study_5-2-19.pdf
https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2722574
https://www.ajemjournal.com/article/S0735-6757(19)30297-9/pdf

[4] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6649777/pdf/rmmj-10-3-e0017.pdf

How Exponent Can Help

Exponent’s multi-disciplinary team of engineers, battery scientists, and human factors professionals, among others, have broad expertise in all aspects of micromobility modals. They stand ready to evaluate and inform decisions related to the necessary modifications that will be required to support changing rider habits.

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