

EXPOSURE



REGIONAL RESEARCH, GLOBAL IMPACT

A transportation investigation

Story by [Fresno State](#)

November 13th, 2020

While social distancing in some public areas may be effective in slowing the spread of COVID-19, when it comes to public transportation, Dr. Aly Tawfik and a team of researchers have found that distancing is not enough.

In May 2020, Tawfik, associate professor of civil and geomatics engineering at Fresno State, spearheaded an interdisciplinary research project that analyzed air circulation on public transportation, particularly on public buses, and compared strategies for virus mitigation in order to improve the safety of both passengers and drivers.

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“First objective is, can we understand how air travels inside the bus so that we can track the movement of the virus inside the bus?” Tawfik says. “Second objective is, how can we kill the virus, mitigate the virus in the AC? Because once the virus gets sucked by the AC, we want the air coming out to be clean.”

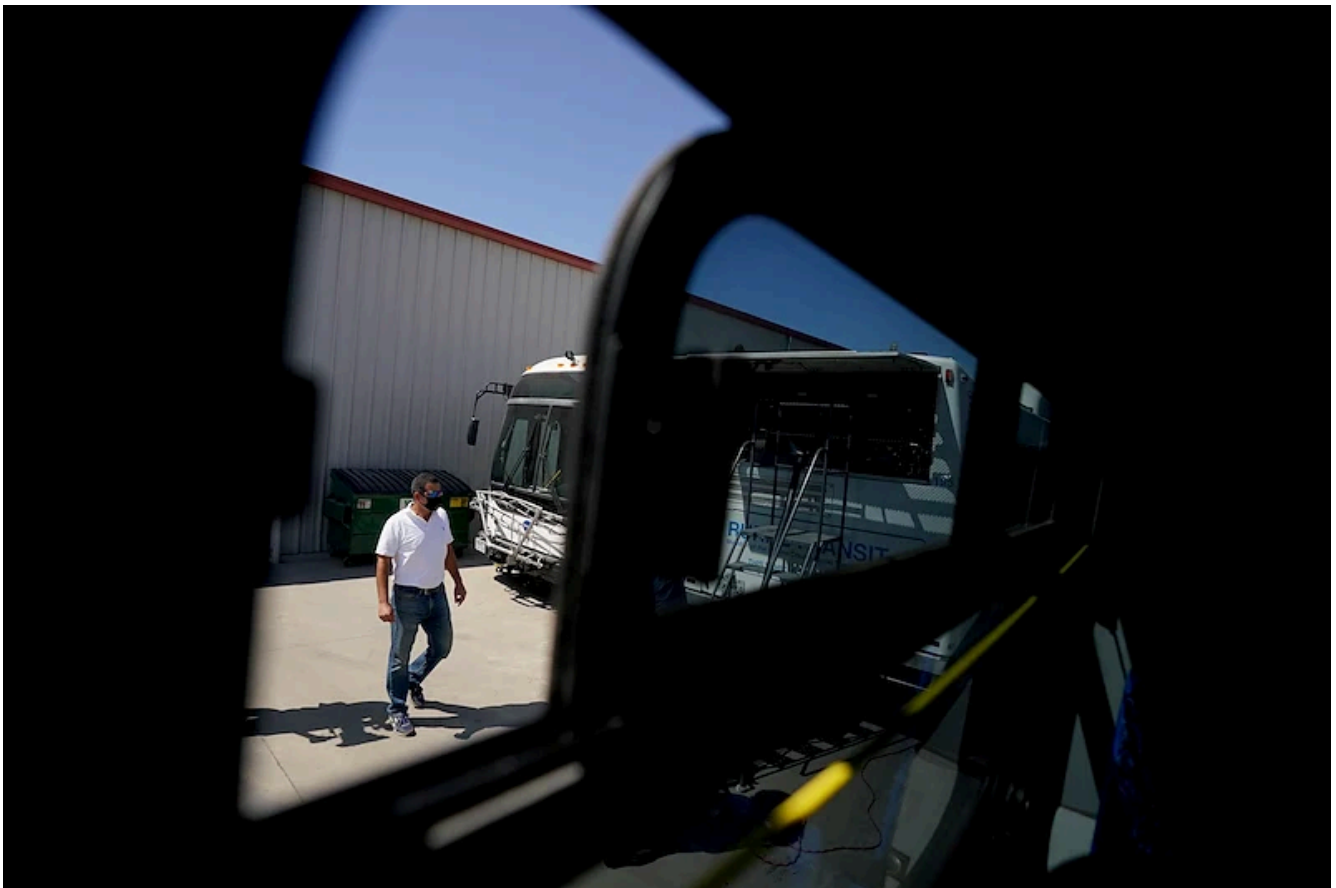
With passenger safety potentially on the line, Tawfik recruited an impressive team of students, scientists and industry partners who all committed to producing critical, real-time research that will have significant impacts for local, national and international communities.

“We believe that this is crucial. We think that this is actually going to save lives,” he says.

Regional research, global impact



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IMMEDIATE IMPACT

The research team, including students and professors across multiple disciplines from both Fresno State and University of California, Merced, partnered with heating, ventilation and air conditioning (HVAC) industry leaders and local transportation organizations to bring their experiments out of the lab and into the field.

First, the team tested steam and colored smoke throughout the bus to simulate air circulation, finding that the airborne viruses tested (which are similar to COVID-19) spread throughout the entire cabin in just 11 seconds. With this in mind, Tawfik and the team worked to test various strategies for virus mitigation, including placing ultraviolet light and photocatalytic oxidation inserts within the HVAC system.

The researchers emphasize that masks should always be worn as the first line of defense since the technologies will not eradicate the viruses until they reach the HVAC system. Nonetheless, the results indicated that once the contaminated air passed through the system, the UV-C light eliminated almost 98% of all the viruses tested while the photocatalytic oxidation inserts eliminated 99% of all the viruses tested. Along with the mitigation of the COVID-19 virus, these technologies also have the potential to eliminate viruses such as the common flu.

Furthermore, the researchers found that physical separation of the driver paired with positive pressure inside the driver's cabin is another solution that can significantly lower the risk of infection for drivers.

"This is an example of a finding that we think many agencies can start implementing fast, and that can save the drivers," Tawfik says.



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COLLABORATIVE SOLUTIONS

This project is housed under the Fresno State Transportation Institute. The institute's mission includes education, research, technical service and public outreach. As the founding director of the institute and a firm believer in the power of interdisciplinary work, Tawfik ensures every project is collaborative and committed to improving the region's transportation systems.

"Everything in life is connected," he says. "I deeply believe that we can always get better solutions, and we can always improve our existing system better by the diversity of perspectives, by the diversity of knowledge."



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Did you know? The Fresno State Transportation Institute is a collaboration between the Lyles College of Engineering, College of Social Sciences, Craig School of Business and the 15 cities within Fresno County to improve transportation in the region.

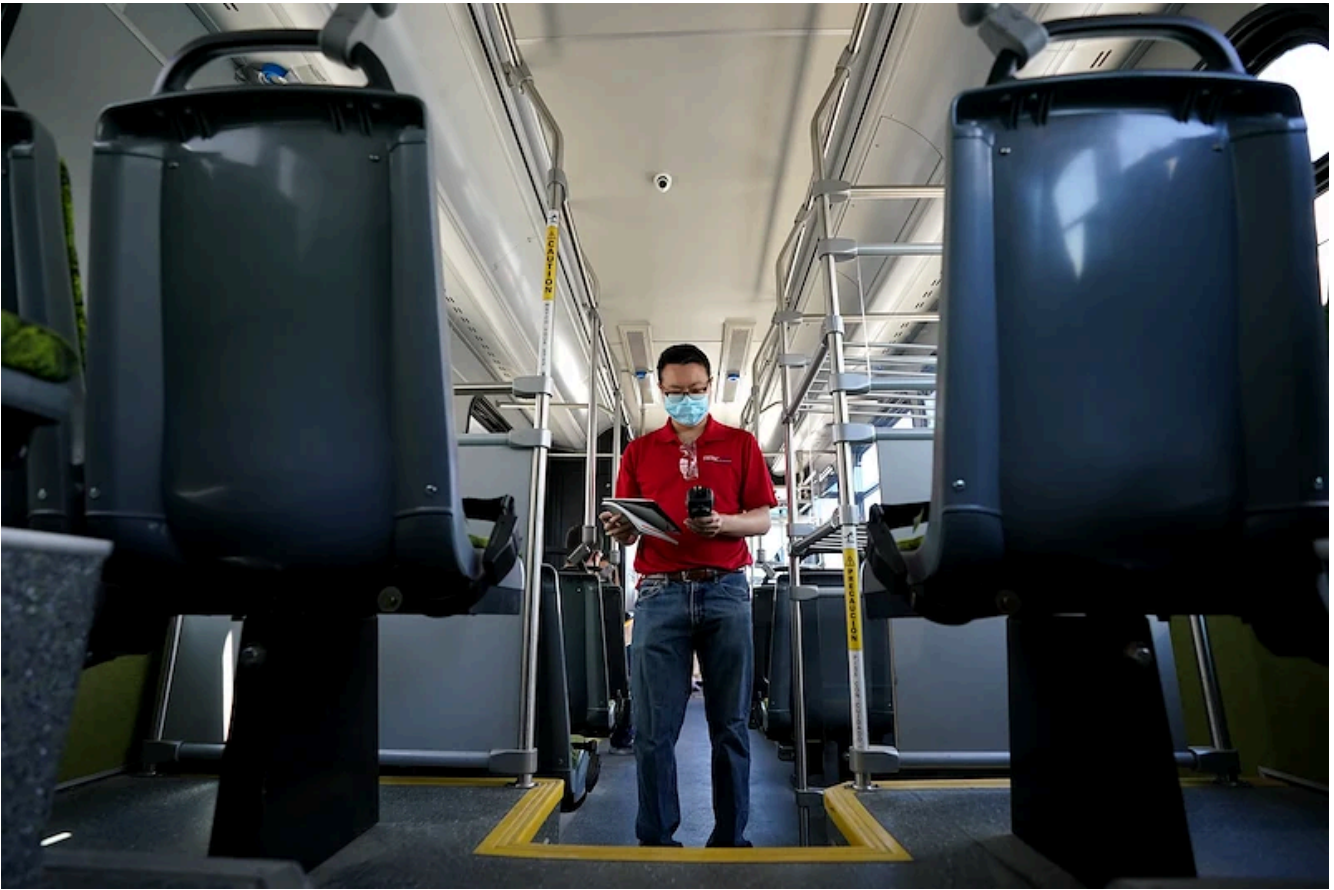
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In two years since its founding, the institute has championed multiple research, service and outreach projects, many of which have students at the forefront.

“[Students] are not only our future, I think they're our hope,” Tawfik says. “I think it's an obligation for us to transfer all the knowledge that we have, both good and bad, all the lessons that we learn, to them and to try and encourage them and inspire them to be themselves and be innovative and try to fix the solutions without making the same mistakes.”

Alyssa Nishikawa, a civil engineering graduate student with an emphasis in transportation, has been instrumental in the air circulation and transportation project. Her role in data processing ensures the team has accurate video footage of the field experiments to further assess the air circulation.

With Tawfik's guidance, Nishikawa realized her impact as a transportation engineer can reach beyond her own community.

“It's really a good opportunity for [students] to realize that we not only have a role in what we can contribute to our jobs, but also how we can solve problems across the world,” she says. “This is one of the biggest problems that I've ever faced, that many people of our generation have faced, and for us to be able to come together and work on this, it's what we become engineers for, to solve problems.”

Tawfik hopes others will follow suit, facing challenges head-on and producing creative

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takes immense pride in the compassion, drive and grit of those who have planted their lives here. He admires the region's vast potential for continued innovation and problem-solving on both a regional and global scale.

"We hope that our work inspires others to do more good work," he says. "I think there's lots of great qualities and great opportunities in this region, and I really think that we can be better and make a difference. And this project is just an example, a drop in the sea, as a demonstration that it is possible."



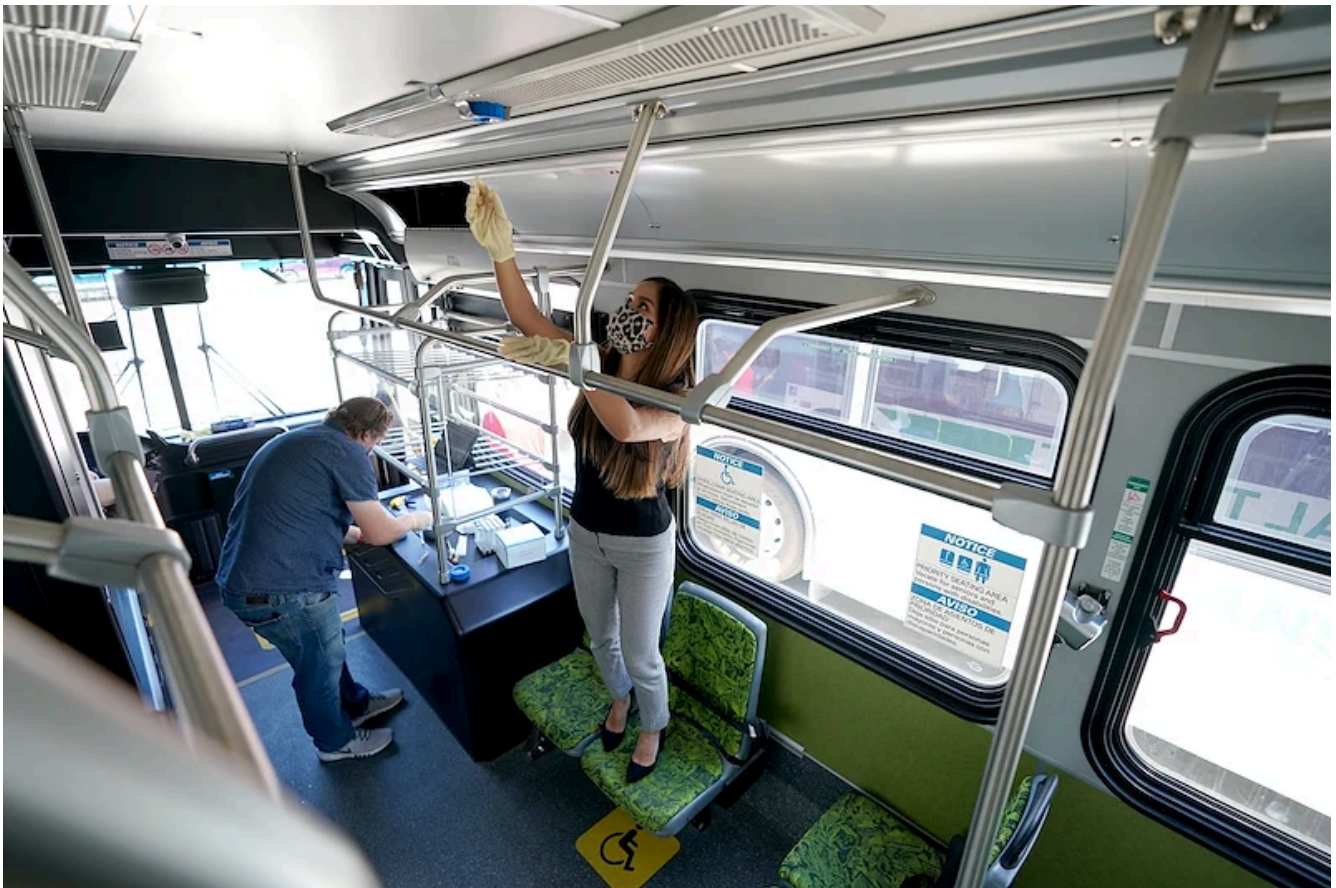
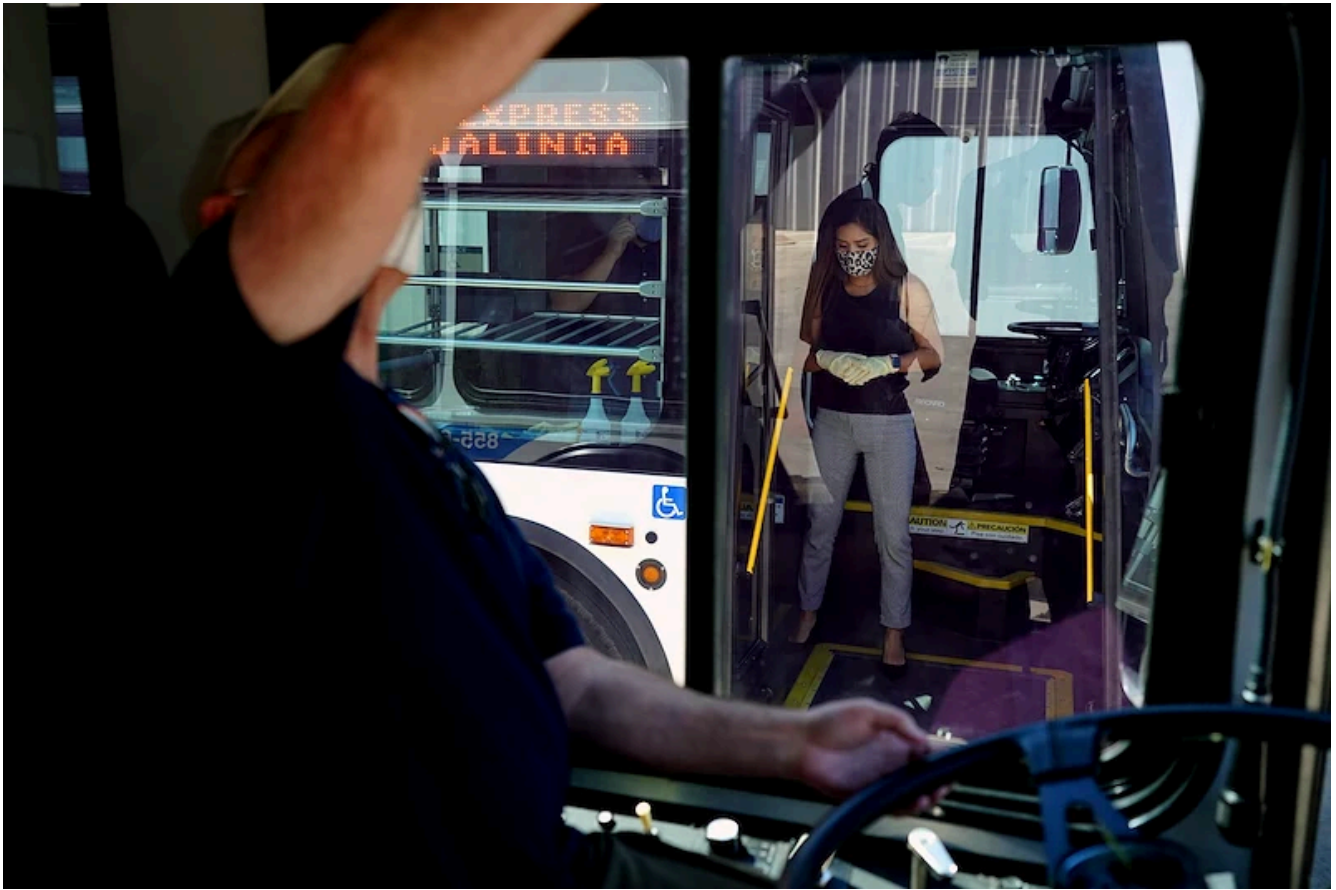
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In September 2020, the COVID-19 Public Transportation Air Circulation and Virus Mitigation Study was honored by the American Society of Civil Engineers San Francisco Section as Research Project of the Year.



For more details on the research findings, please visit

fresnostatenews.com

Footnote: *Photos by Cary Edmondson, Story by Victoria Cisneros, Video by Domenick Satterberg — University Brand Strategy and Marketing*

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