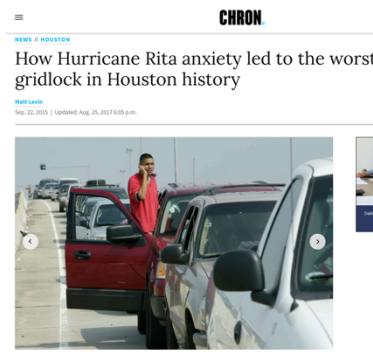


**Improving the Equity and Resilience of Houston’s Road Infrastructure to Flooding with Better Engineering and Policy**

Faculty advisor: [Arlei Silva](#), Assistant Professor of Computer Science, Rice University

Houston has been impacted by several major floods in the past decades, such as during Hurricanes Rita (2005) and Harvey (2017) and Tropical Storm Imelda (2019). These events have disproportionately impacted underserved communities, including Black and LatinX, in their ability to evacuate, access healthcare, and shelters. Recent advances in computational modeling, including hydrology and climate, allow us to simulate these flooding events and assess how they impact transportation infrastructure across the city. Moreover, census data allow us to compare how different communities have their mobility impacted by these floods. However, these models and data are imperfect and do not tell the full story. In this project, students will be challenged to combine computational modeling with field studies to provide a more accurate picture of the equity and resilience of Houston’s road infrastructure to flooding.

Hurricane Rita was the most intense tropical cyclone in Gulf Coast’s history. Residents in coastal Texas were urged to evacuate before Rita made its landfall, leading to the largest evacuation in US history when 2.5-3.7 million people attempted to leave the area. However, the road infrastructure was insufficient to handle the traffic, creating a gridlock that lasted 24 hours and killed approximately 107 people (similar to the hurricane itself). On the other hand, during Hurricane Harvey, Houstonians were recommended not to evacuate and, as a result, many were under health and life threat due to the quick rise in the water levels. A \$9B expansion of Interstate 45 by the Texas Department of State has as one of its goals to improve evacuation routes from Houston but many community groups have argued that the project will negatively impact LatinX and Black communities. This is an example of the need for good engineering and public policy to improve the equity and resilience of our infrastructure.



*Matt Rourke, STF/Associated Press/Texas Observer.*

This project will be part of the 100K-Google ExploreCSR [IFCE-Rice-SENAI Program](#) on Artificial Intelligence for Urban Sustainability and Resilience to Natural Disasters in the

Americas, which is a US-Brazil collaboration funded by the Partners of the Americas and Google Research. Rice and Brazilian students will have opportunities to exchange experiences in addressing climate-related challenges in the United States and Brazil. Project results will be presented as part of a workshop to be held at Rice as part of the 100K-Google ExploreCSR program.

During the Spring semester, the students will:

- Engage with the community partner to understand how different communities in Houston have been impacted by flooding and how the past and ongoing projects have improved their conditions;
- Simulate historical floods in Houston using the LISFLOOD-FP simulation software;
- Identify road segments closed due to flooding;
- Associate Houston areas with demographic data;
- Apply a mobility model to assess how different communities have their mobility impacted by flooding using different points of interest, such as the Texas Medical Center, the Convention Center (used as shelter during Harvey), and possible evacuation routes;
- Visit major impacted sites and obtain additional data to support or improve the conclusions based on the modeling, including pictures, videos, and interviews;
- Collaborate with the community partner to develop a policy report to assist the city and the state to increase Houston's resilience to flooding in an equitable fashion;
- Design a poster and presentation summarizing the main findings from the project.

**Relevant student skills and experience to be practiced/acquired:** computational flood modeling, computational traffic modeling, data science, environmental justice, community engagement, data visualization, storytelling, professional writing, and public presentations.

**APPLICATIONS ARE DUE Sunday, January 7th at 11:59 pm**

[Apply Here!](#)

To inquire or apply contact Dr. Verónica Reyna [vr33@rice.edu](mailto:vr33@rice.edu)  
For more about Rice's HART Program, visit: <http://ccl.rice.edu/hart>