

## Spider Web Inspired Geogrids for Better Roads

Emanuel Peralta, Sona Javadi, Michael Brooks

Mentors: Dr. David Frost, Jiaoujun (June) Liu, Emre Duman, Candas Oner

2023 Research Experiences for Undergraduates, Georgia Institute of Technology

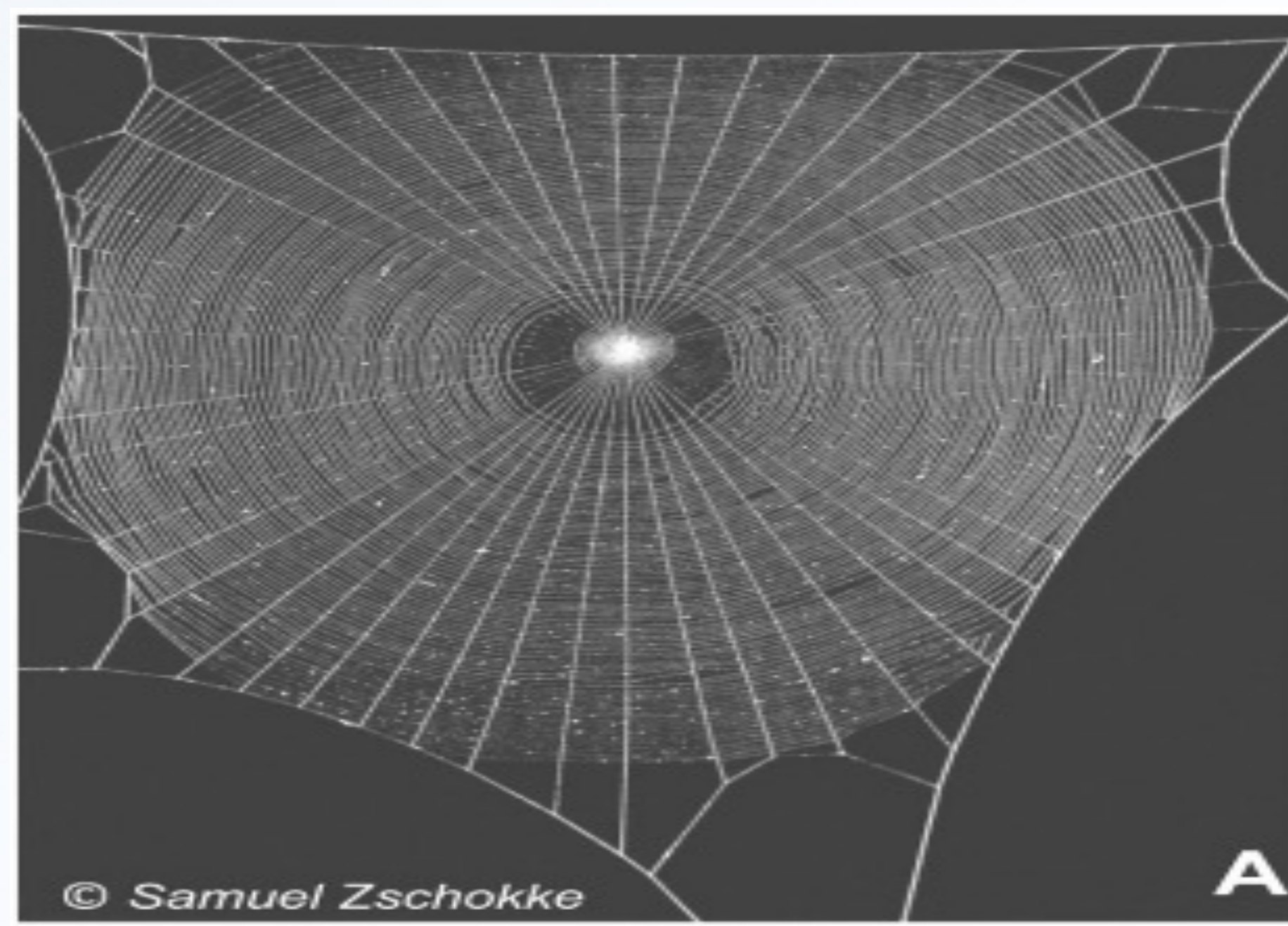
### Background & Rationale

- We are looking to solve road rutting, which is permanent road deformation (bumpy roads or pot-holes).
- A geogrid is a human-made polymer grid structure used to treat unfavorable soil conditions.



### Research Objectives

- To design spider web-inspired geogrids that can perform better than road rutting reduction.
- We plan to study the geometry of real spider webs ("Y" structure), from our findings we plan to create a new geogrid and test their performance.

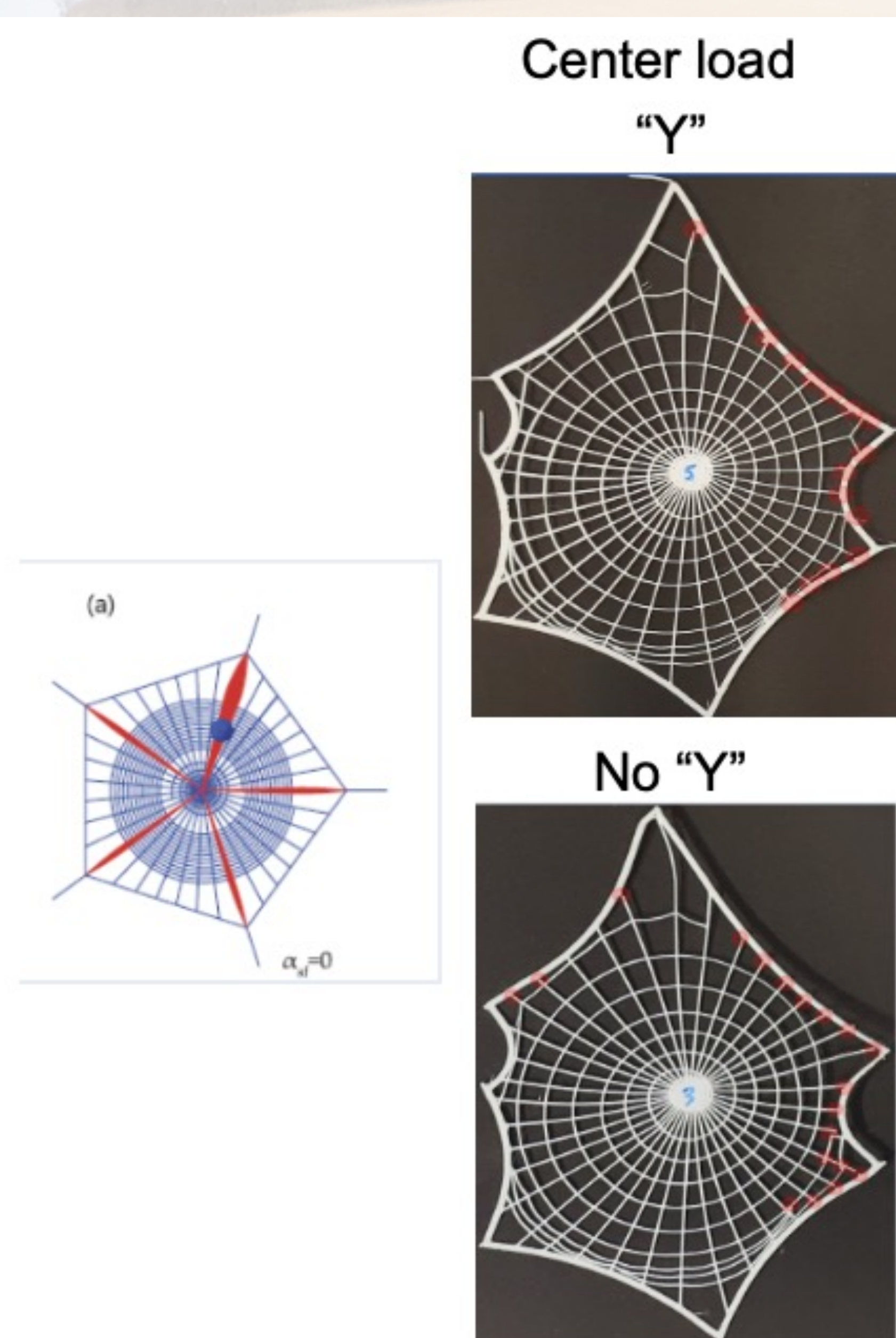


### Methods & Materials

- To test the performance of our spider web-inspired geogrids, we used a 3-D printer to print the geogrid.
- We then tested it on our lab-scale road model.
- Lastly we used 3-D scanning technology to study the rutting done after our test.



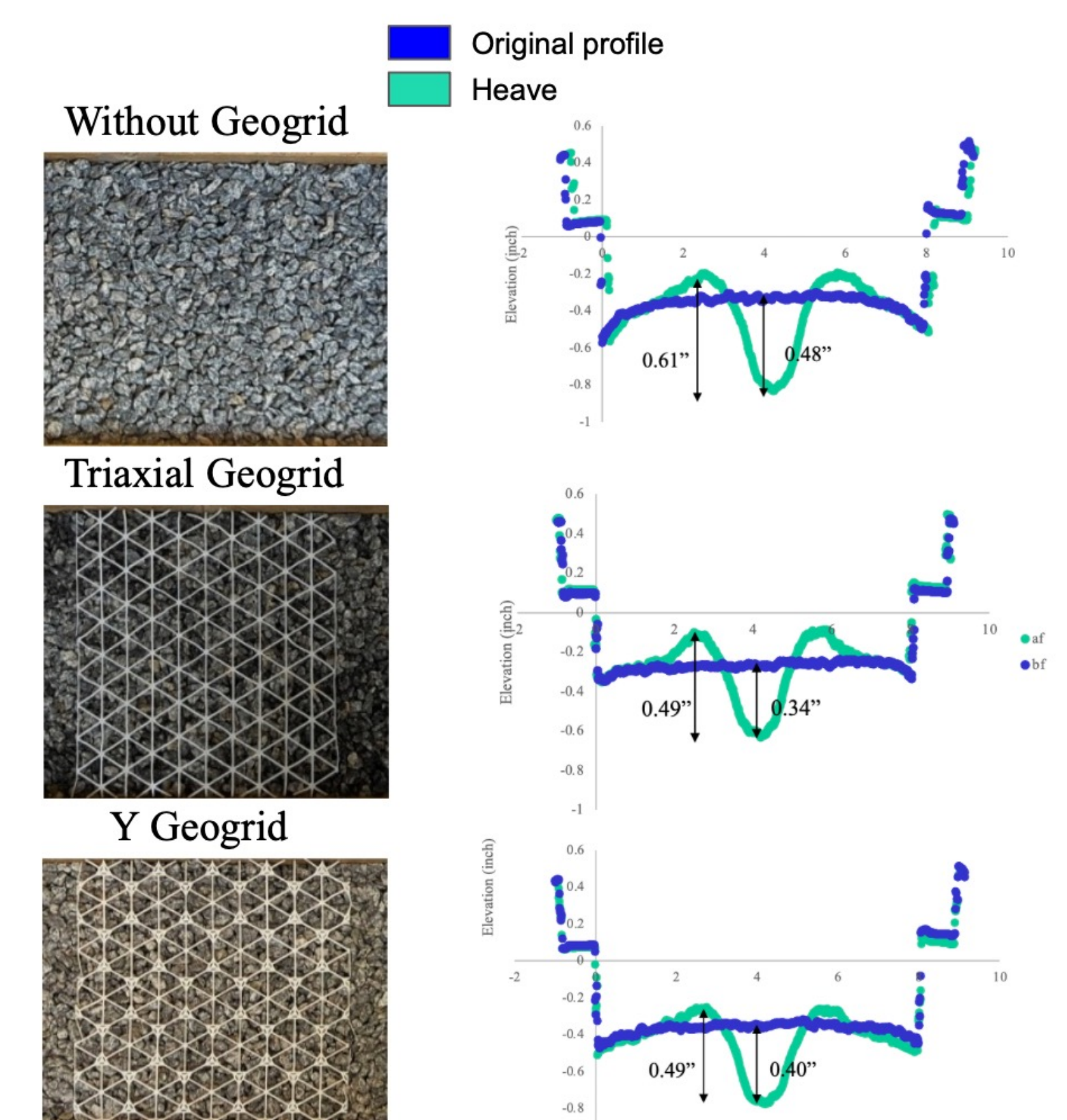
### Experimental Results



- We were curious about the effect "Y" structures had on spider webs, so we conducted a puncturing test to see how it reacted to load.
- We had two spider webs one with a "Y" structure and one without, we then loaded the spider webs in two loading locations.
- We placed a load on the center of the web and on the bisector of the web which is bounded by two "Y" structures.
- Throughout the test we noticed that without the "Y" structure the radial thread in the web took the majority of the load.

### Conclusions

- The "Y" structure tested in the spider web, concluded that with its implementation it can help distribute the load better.
- The "Y" structure can reduce the heave in road rutting shown in the graphs below.



**Acknowledgement** This material is based upon work primarily supported by the Engineering Research Center Program of the National Science Foundation under NSF Cooperative Agreement No. EEC-1449501. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect those of the National Science Foundation.