Written Testimony
for the
Committee on Appropriations
Subcommittee on Transportation, Housing and Urban Development and Related Agencies

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Dear Chairman Price and Members of the Subcommittee:

Thank you for this opportunity to share our perspectives on the important topic of transportation infrastructure resilience. The following remarks are made on behalf of Rutgers' Center for Advanced Infrastructure and Transportation (CAIT), which is a USDOT University Transportation Center (UTCs) focused on addressing the challenges facing our nation's complex, interrelated transportation infrastructures.

Our focus on infrastructure and especially on transportation infrastructure is not accidental but grows out of the challenges inherent within our region. We are in the heart of the northeast corridor, and our local region, while geographically small, is home to nearly 10 percent of the population and jobs in the U.S. It is also home to a diverse and dense transportation infrastructure that includes some of the oldest and most heavily utilized in the country. And like other coastal regions, we find ourselves on the front lines of the growing threats associated with extreme weather events.

Before we delve into our perspective on how universities may help improve resilience, it is important to provide some context. Our transportation infrastructure system remains a wonder

of the world, but if we're honest, it only enters our collective consciousness when there is a failure or disruption. It is at the very center of our lives, it is the engine and a key transformative driver behind our ever expanding and evolving economy…and it is largely taken for granted. Perhaps this is understandable when you consider how reliable our transportation systems are on a daily basis, but it is not without consequences.

The slow, relentless, and inevitable degradation of our transportation infrastructure has been largely left unchecked for decades. Large portions of this system – a system so massive, complex, and critical to our lives that it is difficult to fully conceptualize or appreciate – have fallen into disrepair. At the same time, these systems are facing new threats, particularly associated with extreme weather events.

The resulting disruptions— whether due to the slow march of deterioration or more acute, extreme events — can cause large economic damages and severe cascading impacts on other infrastructure systems and the communities they serve. Over the last decade or so, this vulnerability has attracted significant attention, and progress has been made. Whether one looks at infrastructure improvements, the development and implementation of advanced technologies, new predictive and decision-making tools, or innovative infrastructure designs, it is clear that things are changing for the better. But the fact that we are sitting here discussing the need for improved infrastructure resilience means more needs to be done. From our perspective, there are three areas that deserve continued attention:

Development of a Uniform Resilience Metric – The old adage of "what gets measured is what gets improved" applies well here. Many of the higher-level guidance documents point out the need to operationalize resilience, and we believe one of the most effective ways is to develop a sound, uniform means of measuring resilience (or the lack thereof). Consider, for example, that in 2018 there were 54,259 structurally deficient bridges in the U.S, and in 2008 there were 72,868. I can tell you this because it is metric that is uniformly tracked. I can also tell you that the reason we have reduced the number of structurally deficient bridges by 25% is because every state, county, and municipality that owns bridges is actively engaged in minimizing this number (because we track it).

To date, there is no accepted and uniform means of measuring the resilience of our transportation infrastructure systems. To be sure, this is not a simple challenge. Measuring resilience by its very nature requires quantifying a number of diverse influences (beginning with the likely hazards and extending to the state of specific infrastructure systems, the redundancy of the networks in which they reside, and the capabilities, preparedness, and resources of the agencies that are responsible for their ongoing operations). Nonetheless, without such a metric, it is unlikely that resilience will ever be operationalized.

Collection of Performance Data – To better understand the many interrelated factors that lead to both good and poor performance, it is necessary to observe how our transportation infrastructure systems perform when they are under stress. Ideally this is done by establishing baseline performance, monitoring performance during extreme events, and then performing post mortem investigations when failures occur. While the latter are

becoming more common, without establishing baseline performance or understanding performance during extreme events, we are unable to learn all of the lessons available from past (and future) disasters.

Attracting and Educating Talent – Perhaps the most effective way our institutions of higher education can contribute to infrastructure resilience is through attracting the best and brightest to STEM fields, producing graduates with sound, relevant, and multidisciplinary educations, and training our current workforce in emerging technologies and paradigms capable of improving resilience.

In closing, I would again like to thank you for the opportunity to share some of our perspectives on infrastructure resilience, and in particular some of the roles that our nation's research universities are uniquely suited to play