We all have an interest in public safety and have created governmental agencies to act on our behalf – airline safety (FAA) --- food and drug safety (FDA) – highway safety (DOT/FHSA). Bridge safety (BTS/FHA). And yet most of us never think about bridge safety until there is a disaster such as the Florida bridge collapse in 2018 that killed six (<https://www.usatoday.com/story/news/2018/11/15/ntsb-miami-bridge-collapse-design-errors/2012020002/>) or the Silver Bridge collapse in Ohio (1967) that killed 46 (<https://en.wikipedia.org/wiki/Silver_Bridge>). The National Bridge Inventory maintained by the FHA lists 616,087 bridges. 7.63% are rated “structurally deficient.” (47052/616087) and need urgent repairs. Estimated cost to complete all needed bridge work is $171 Billion. <https://artbabridgereport.org/>

Americans cross these deficient bridges 178 million times a day. (<https://artbabridgereport.org/reports/2019-ARTBA-Bridge-Report.pdf>).

The FHA (Federal Highway Administration) National Bridge Inventory is huge:

Over 600,000 rows

Over 100 attributes

Most attributes have several codes.

As you can see, there are a lot of bridges and a lot of data. Most reports are like the ones mentioned above where they tell you how many or what percentage or the cost and may give a simple prioritization to the bridges. I will survey this data and apply several statistical tests to better understand the true state of our bridges. In particular, I would like to rank the bridges that are ‘structurally deficient’ because funding will not arrive in time to fix them all at once. In other words, a more granular prioritization/ranking is needed.

So, how does a bridge get rated as “structurally deficient?”

“Structurally deficient” is based on the primary **CONDITION RATINGS**: **Deck, Superstructure, Substructure –** used to evaluate every bridge.

Labeling a bridge as “structurally deficient” is the result of getting a low rating on just one of the conditions – though you may get a low rating on more than one.

The **DESIGN LOAD** is an abstract number. It is a max load based on the design, the “as-built” condition as opposed to the “live” (in-use) condition ratings. The codebook states the following about the relationship between the Design Load and Condition Ratings: “Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition … The load carrying capacity will not be used when evaluating condition items. The fact that a bridge was designed for less than current legal loads and may be posted shall have no influence upon condition ratings.”

In other words, there should be no relationship between the Design Load and the Condition Ratings. But is this true? If it is, great. If not, then it needs to be factored in. Ratings could change and with that repair rankings.

My hypothesis is that the mean values of the primary **CONDITION** **RATINGS**: **Deck, Superstructure, Substructure –** used to evaluate every bridge --are the same for each **Design Load.**