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The Stormy Politics of Building

By HENRY PETROSKI

DURHAM, North Carolina — New York City's experience a year ago with Hurricane Sandy, in which subway tunnels and skyscraper basements in Lower Manhattan were flooded, demonstrated the mistake of locating critical infrastructure where it can be inundated and rendered inoperable. In New Jersey, coastal communities were devastated, raising the old question of why people build so close to the ocean.

In Sandy's wake, more than a few people asked why engineers and regulators allowed such seemingly irrational behavior, as if they were to blame for the hurricane's devastation. Better engineering could have saved America billions, we're told. But the question is much more complex. Decisions about design and engineering are informed by a host of factors, not all of them obvious — but all of them quite rational.

The first thing to realize is that any sort of cost-benefit analysis involves more than money and greed. Benefits can include such intangibles as aesthetics and quality of life. Some people are simply willing to accept the risks that go with keeping the machinery in the basement and having the benefits of an ocean or river view. In fact, the latter may even build their houses less substantially, recognizing that they may have to rebuild someday.

The phenomenon is not restricted to the domestic scale. Take trains. In Manhattan, the earliest rail-based mass transit were elevated lines. These rickety structures were relatively cheap and did not flood, providing what seemed like a win-win on one cost-benefit scale.

But that perspective soon changed: Elevated tracks and their support structures were unsightly, put streets and sidewalks in the shadows and exposed pedestrians and people in nearby buildings to loud noise. Putting the rails in tunnels was a costly investment, but the benefits were obvious. The risk of flooding was rationalized away by designing drainage capacity into the subways.

But how much drainage capacity is enough? Engineers can rely on the historical record to quantify how much water will flow down through entrances and sidewalk gratings, and design accordingly. The problem is, of course, that the worst-case condition may not have been recorded or yet occurred.

Scientists fill in such lacunas with geological and meteorological analysis. Today, engineers deal with water volume by considering storms that models say recur once every 100 or 1,000 years. But designing a drainage system for a heavy rain or sea surge that may or may not occur in the lifetime of a structure means increased construction cost.

It is at this point that cost-benefit thinking becomes reframed as risk-benefit analysis. An underdesigned system will risk physical damage and possibly human life, but it comes with the benefit of costing less money and thus leaving unspent capital available for other beneficial projects. In other words, the decision is not an engineering but a political one.

Moreover, decisions on infrastructure projects fall into different categories depending in part on the source of financing. When private enterprise is involved, as it was with the early New York subways, some investors seek to keep costs down to increase their return.

For a government project, where those spending the financial capital are not risking their own money and where the benefits may be more about political gain than user satisfaction, the risk-benefit analysis can be skewed. An infrastructure project in San Francisco Bay is a case in point.

After the Bay Bridge — actually a beautiful suspension bridge and a workaday cantilever bridge that met on a midbay island — was damaged in the 1989 earthquake, the California Department of Transportation did some analysis. Since the difference in cost between upgrade and replacement was insignificant, so the argument went, why not give the Oakland side of the bay a bridge as distinctive as what San Francisco had?

In time, though, the initial estimate escalated as decisions were informed by politics, civic pride and jealousy — emotions rather than dollars and sense.

Construction of the new bridge began in 2002 and was supposed to be completed in 2007, but it didn't open until last month. The original cost estimate of $1 billion has ballooned to over $6 billion, and the project has been plagued by embarrassing setbacks. The latest involves steel bolts that broke upon being tightened, further delaying the opening.

Public works projects have a way of falling behind schedule, but it does not have to be that way. The Hoover Dam, the most ambitious infrastructure project of the Great Depression, was finished ahead of schedule and under budget. Its near-contemporary, the Empire State Building, while not a publicly funded project, is famous for the speed and efficiency with which it was built.

One might say, when comparing the Bay Bridge overruns with the Hoover Dam's efficiency, that they simply don't build them like they used to. But that puts too much blame on the engineers, and not enough on the political and economic decisions that define the parameters they work within.

It has been said, by engineers themselves, that given enough money they can accomplish virtually anything: send men to the moon, dig a tunnel under the English Channel. There's no reason they couldn't likewise devise ways to protect infrastructure from the worst hurricanes, earthquakes and other calamities, natural and manmade. It is not engineering that must change to keep up with the changing global climate, but how decisions are made based on cost- and risk-benefit analyses.

Engineers can perform those analyses — up to a point. What policy makers and politicians do with the results will make the difference. Analyses are not decisions, and so often it is a climate of another kind, the political climate in which deciders decide, that needs to change.

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Global warming will increase intensity of El Nino, scientists say

By Matt McGrath
Environment correspondent, BBC News

Scientists say they are more certain than ever about the impact of global warming on a critical weather pattern.

The El Nino-Southern Oscillation (ENSO) occurs in the Pacific Ocean but plays an important part in the world's climate system.

Researchers have until now been unsure as to how rising temperatures would affect ENSO in the future.

But **this new study** suggests that droughts and floods driven by ENSO will be more intense.

The ENSO phenomenon plays a complicated role in the global weather system.

The El Nino part of the equation sees a warming of the eastern and tropical Pacific, while its cooler sister, La Nina, makes things chillier in these same regions.

Impacts across the world
Like water in a bathtub, the warmer or cooler waters slosh back and forth across the Pacific Ocean. They are responsible for rainfall patterns across Australia and the equatorial region, but their effects are also felt much further away.

During the Northern Hemisphere winter, for example, you can get more intense rainfall over the southern part of the US in a warmer El Nino phase.

For years, scientists have been concerned about how this sensitive weather system might be changed by rising temperatures from global warming.

Now, in this new paper, published in the journal Nature, researchers give their most "robust" projections yet.

Using the latest generation of climate models, they found a consistent projection for the future of ENSO.

According to the lead author, Dr Scott Power from the Australian Bureau of Meteorology, global warming interferes with the way El Nino temperature patterns affect rainfall.

"This interference causes an intensification of El Nino-driven drying in the western Pacific and rainfall increases in the central and eastern equatorial Pacific," he said.

Models in agreement
According to Dr Wenju Cai, a scientist at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), who was

not involved with the study, the paper is "significant".

"Up until now, there has been a lack of agreement among computer models as to how ENSO will change in the future," he explained.

"This paper is significant in that there is stronger agreement among different climate models in predicting the future impact.

"This study finds that both wet and dry anomalies will be greater in future El Nino years. This means that ENSO-induced droughts and floods will be more intense in the future."

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