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The Future of Infrastructure: Walls, Bridges, Tunnels, Airports and Roads

I. President Trump's "Trillion Dollar" Infrastructure Plan

The Administration's Vision

It is rare that a presidential campaign does not come with promises of improved infrastructure to benefit the American taxpayer. In the 2016 election, President Trump touted the idea of investing a trillion dollars in infrastructure over a ten year period. When the plan was released in June, 2017, however, according to some sources, that plan only called for $200 billion in direct federal funding over the next decade. Of these amounts, only $5 billion has been earmarked for the 2018 fiscal year.

While it would seem that this falls far short of the trillion dollar campaign promise, the administration has touted that changes in regulation to save costs, state and local government contributions, as well as private industry, will be called on to contribute the remaining amounts.

Goals of the Infrastructure Plan

The primary goal of President Trump's infrastructure plan is to overhaul how infrastructure is handled through a reduction of Federal rules, regulations, oversight and mandates on such projects. According to the White House, the Federal Government contributes only 20% of funding for infrastructure investments while 80% comes from other sources. Based on these percentages, President Trump will seek to transfer the responsibility for these projects to the States.

The Key Principles in the plan is to:

1. Make more targeted federal investments solely to projects that are regional or national in nature
2. Encourage state and local governments to make their own decisions about infrastructure.
3. Shift certain infrastructure functions to non-federal and private entities.
4. Leverage the private sector for public-private partnerships

As with a number of other administrative changes that President Trump seeks, the goal is to shrink the size and footprint of the federal government by reducing regulatory oversight and involvement.

Infrastructure Impacts

The result of this reduction will likely be that states and localities will be required to fund their own infrastructure projects, possibly through the use of incentivized funding or matching of federal dollars with the preferred oversight of such activities to occur through oversight by or partnership with private entities. With these responsibilities being shifted to state, local or private entities, the question arises of who would be responsible for the failures of aging American infrastructure.

II. The Current State of Infrastructure

Infrastructure Historically

Historically, infrastructure has been the topic of discussion in politics, the news, or classrooms following front-page worthy failures or catastrophes. These failures and catastrophes resulted in property loss, economic repercussions, injury, and even death. Subsequently, everyone plays Monday morning quarterback as to how any or all of these could have been prevented.

The American Society of Civil Engineers (ASCE) has issued an "Infrastructure Report Card" every four years for the last 20 years, with the most recent report card issued in 2017. The report is a comprehensive assessment of America's infrastructure from the viewpoint of the civil engineering profession which is integral to its planning, designing, constructing, and operating. The infrastructure report card assesses 16 categories including: aviation, bridges, dams, drinking water, energy, hazardous waste, inland waterways, levees, parks and recreation, ports, rail, roads, schools, solid waste, transit, and wastewater. Grades are given to each of these categories as follows: A ("Exceptional, fit for the future"), B ("Good, adequate for now"), C ("Mediocre, requires attention"), D ("Poor, at risk"), and F ("Failing/Critical, unfit for purpose"). Cumulatively, America's infrastructure grade was a D+, which was unchanged since ASCE last issued a grade in 2013; the individual grades are as follows:

Aviation – D	Inland Waterways – D	Schools – D+
Bridges – C+	Levees – D	Solid Waste – C+
Dams – D	Parks/Recreation – D+	Transit – D-
Drinking Water – D	Ports – C+	Wastewater – D+
Energy – D+	Rail – B	
Hazardous Waste – D+	Roads – D	

Investment in improving America's infrastructure has been thrust into the spotlight thanks in part to catastrophes domestically and abroad through studies such as the 2016 economic study completed by the ASCE, "Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future." In this report, the following were estimated:

- "$3.9 trillion in losses to the U.S. [Gross Domestic Product] GDP by 2025;
- $7 trillion in lost business sales by 2025; and

- 2.5 million lost American jobs in 2025."

Infrastructure in the News

The sub-par state of American infrastructure can be linked back to the lack of necessary spending across the board coupled with the lack of public perception of the degraded infrastructure itself. This realization aligns with the approach that the U.S. has taken in recent history, notably reactionary rather than proactive. A reactionary approach is most notable in the following three exemplary infrastructure failures in recent history.

New York City Retaining Wall Collapse (May 12, 2005)

- A 150-foot section of a 1,500-foot long, 75-foot high stone retaining wall that was originally constructed in 1908 partially collapsed and caused a landslide of earthen materials to bury a section of the Henry Hudson Parkway in New York City. The wall was privately owned by a five building apartment complex (Castle Village) located behind/above the wall. The partially collapsed wall closed down the highway and caused damage to a nearby building, resulting in evacuation of approximately 250 residents. Additional buildings, within 50 feet of the collapse, were vulnerable though not damaged from the collapse.
- In the aftermath of the collapse it was revealed that city officials, residents, and engineering professionals had warned of such an occurrence could/would happen. Repairs had been occurring to the wall through the years, including earlier in 2015 prior to the collapse. Reportedly, displacement and bowing of the wall was observed on the day of the collapse, though engineering professionals did not signify the severity.
- The Department of Buildings and New York City Department of Transportation (NYCDOT) were notified of repairs to be completed to the wall in 2015; however, the threat of collapse was not conveyed and/or recognized by their authorities, including the threat to cause damage and disruption to the Henry Hudson Parkway, which served 64,000 vehicles per day, as well as the nearby George Washington Bridge which connected New York and New Jersey.
- Subsequent to the collapse of the wall, the New York City Department of Transportation (NYCDOT) retained an engineering firm to inspect and report on the condition of over 600 walls they owned/maintained with the city limits. Notably, there were over 2,000 retaining walls located within NYC, most of which were located on private land – such as the Castle Village retaining wall.
- Lessons learned – professionals had opined on the vulnerability of collapse of this specific retaining wall. Though a privately-owned wall, the city did not recognize the potential impact a collapse would cause to the city's infrastructure. Furthermore, a published article in January of 2015, entitled "Condition Assessment of Old Stone Retaining Walls," spoke to this type of collapse happening.

I-35W Bridge Collapse (August 1, 2007)

- The I-35W Mississippi River Bridge, known as Bridge 9340, was an eight-land, steel truss arch bridge that crossed the Mississippi River in Minneapolis, Minnesota. The bridge was constructed between 1964 and 1967 – during a period of infrastructure spending in the developing the Twin Cities freeway system.
- During the evening rush hour, the bridge collapsed into the Mississippi River and killed 13 and injured 145.

- At the time of the collapse, the bridge was the third busiest bridge within Minnesota serving approximately 140,000 vehicles per day.
- The cause of the failure was determined to be a design flaw, specifically gusset plate(s) that were found to be too thin. Gusset plates are steel plates that connect the horizontal, vertical, and diagonal sections of the bridge trusses. The inadequately-sized plate tore along the rivets. Furthermore, the plates were undersized for the intended loads subjected to the bridge, with those loads increasing over time. Subsequent investigations identified eight (8) plates in the wreckage that had fractured/failed.
- A University of Minnesota student completed a doctoral thesis on the failure of this bridge, with the failure analysis used in the investigation following the collapse. Of note, bowed gusset plates were first observed to the bridge in 2003.
- Lessons learned – The National Transportation Safety Board (NTSB) immediately started an investigation, with assistance from many private firms retained for various parties including the Minnesota DOT. Within days of the collapse, bridge inspections across the United States were increased and expedited. Within two months of the collapse, the US Secretary of Transportation called on states to immediately inspect all similar (steel truss arch bridges). Investigations revealed that the concrete on the bridge deck had been increased by 2 inches through the years, adding 20% additional static loading. Furthermore, construction equipment and material stored on the bridge at the time of the collapse (as part of resurfacing operations) totaled approximately 578,000 pounds was located just over the weakest point of the bridge.
- Referring to the ASCE Infrastructure Report Card, approximately 1 in 11 bridges is "structural deficient."

<u>Oroville Dam (February 11, 2017)</u>

- The Oroville Dam is an earthfill embankment dam on the Feather River east of the City of Oroville, California. The dam was constructed by the California Department of Water Resources (DWR) between 1961 and 1968. The dam's purpose is for water supply (retaining Lake Oroville), hydroelectricity generation, and flood control.
- Precipitation in Northern California during the winter of 2016/2017 was the wettest in over 100 years. In February of 2017, the main and emergency spillways failed leading to the evacuation of over 180,000 residents living near and downstream of the dam's spillways. Subsequent to the dam levels dropping and stabilization of the dam's spillways, the evacuation order was lifted.
- Prior to the 2017 failure, cracks in the dam's spillway were first observed in 2013; the cracks were repaired in 2015 though follow-up inspections were minimal and not comprehensive.
- Evaluations on the dam failure revealed multiple potential causes of failure including deficiencies with the concrete placement, drainage design, and corrosion of the concrete rebar.
- The spillway was shut down in May 2017 for summer to allow repairs to commence. Repairs to the dam are estimated to exceed $400M; the
- Lessons learned – The Oroville Dam Reservoir Regulation Manual (Dam Manual) that was in-force at the time of the dam's failure was last updated in 1970 with discharge charts and runoff projections based on climatology at that time. The

outdated manual did not account for the 2016-2017 winter, floods in 1986 and 1997, or potential effects from climate change over the past 47 years. Environmental advocacy groups filed motions with the Federal Energy Regulatory Commission (FERC) in 2005 calling for upgrading the emergency spillway (due to fears of failure as were experienced in 2017) and to update the Dam Manual. The FERC did not call for such improvements.

- Referring to the ASCE Infrastructure Report Card, as of 2015, approximately 15,500 dams in the US are classified as high hazard potential.
- In addition to the Oroville Dam repair, the State of California is undertaking a 43 billion dollar infrastructure program to address maintenance of highways and roads, expand public transit, and support critical trade corridors. This program also seeks to plan for future needs resulting from the impacts of climate change.

Responsibility for Damage & Resulting Insurance Claims/Litigation

Public authority responsible for maintenance

- Government agencies routinely perform inspections and assessments of their property (i.e. walls, roads, etc.).
- Outside engineering and/or construction firms often are retained by governmental (i.e. federal, state, local) agencies to complete detailed assessments.

Engineering Consultations

- Professional engineers typically perform the structural inspections due to specialized experience and qualifications.
- Example – NYC retaining wall was assessed through the years. A lawsuit was brought against the engineering firm that had assessed the wall just prior to its collapse, including recommendations to the Board of Engineers for disciplinary action against the professional engineers involved.
- Example - I-35W Bridge was reviewed and assessed through the years. A lawsuit brought against the engineering firm (URS Corporation) that had performed fatigue analysis on the bridge for the Minnesota DOT (MnDOT) was settled; a settlement of $52.4M was paid by URS and its insurers.

Original Designer(s)

- Statutes of limitation/repose vary from state-to-state.
- Multiple entities typically involved – architects, engineers, and consultants.
- Example - I-35W Bridge was constructed in 1967 and following its collapse in 2007, the US Supreme Court did not release the original design firm of fault. The lawsuit was brought against the original design firm (Sverdrup & Parcel – later purchased by Jacobs) for deficiencies in the original design; the US Supreme Court turned down an appeal by Jacobs who argued a statute of repose. Jacobs (and its insurers) paid an $8.9M settlement without admitting wrongdoing.

Contractor(s)

- Responsibility linked to original construction and/or most recent contractor involved with project (i.e. recent repairs).
- Litigation typically brought against all involved parties.

III. Anticipated Changes in American Infrastructure

Governmental Influence and Lack Thereof

In the above scenarios, government has traditionally been responsible for claims made relating to infrastructure failures. What type of claims can be brought against governmental entities varies greatly by whether the claims are being made against a federal, state or local entity based on what level of governmental, discretionary or statutory immunity exists in that jurisdiction. While the federal government allows for liability of its employees based on the Federal Tort Claims Act, many states have much more restrictive immunity statutes. If discretionary functions such as oversight, engineering or inspection/maintenance are passed to private entities, however, the claims and exposure for private companies will differ greatly when not protected by governmental immunity.

State and Local Jurisdiction Impacts

From a fiscal standpoint, as American infrastructure degrades, can we, as a country, rely on states and localities to be able to fund, inspect and maintain projects? There are many core concerns with providing minimum commitment in American infrastructure, evidenced by historic RFPs and contract awards. Contracts are presented by state and local jurisdictions on infrastructure projects; engineering firms bid to inspect and assess bridges, roads, dams, etc., while contractors bid to complete maintenance and repairs to the same.

An example would be a state requesting proposals from engineering firms to inspect over 6,500 bridges, located across the state with various spans, structural configurations, and details, typically absent of any construction drawings with minimal historic maintenance records. The contract is awarded to a firm on the scale of $1.3M – a very large contract – however, this equates to less than $200 per bridge. There are many questions to come out of this contract, including how an engineering firm could possible provide proper inspection, analysis, etc. for less than ONE billable hour. Typical standard of care to inspect and assess an average bridge structure would take much more time – the agreed-to-contract would miss travel to get to the bridge, properly documenting the existing conditions, taking measurements, documenting the small details, etc. An investment of $1.3M may be a large amount, but it would be nowhere close to being sufficient to complete the requested task.

From a claims standpoint, however, an engineering firm could protect itself from claims relating to errors and omissions in its inspections and assessments, as well as limiting their liability, by sticking to the core principles of the practice of engineering. Specifically, engineering firms should avoid offering to do work that would not be physically or fiscally possible just to obtain a contract for work. Engineers are held to the ethics imposed by their professional license – in short, engineers practice under a standard of professional behavior to protect public health, safety, and welfare. Providing disclaimers in reports are often required due to unknowns; however, you can't disclaim your way out of poor engineering practice, negligence, or knowingly putting yourself in a situation that you couldn't perform up to a recognized standard of care.

Arising Claims

Catastrophes typically spawn public outcry, insurance claims, and litigation. There are concerns with the jurisdictional responsibility with these cases. As exemplified previously, all of the infrastructure failure case studies discussed, there were retained experts or advocate groups that had observed and/or warned of a catastrophic failure.

Liability Issues

Changes in what entity constructs, inspects and maintains infrastructure will lead to a number of questions in how those claims will be handled. There is question whether state/public immunity will be granted to engineers or companies performing traditionally public functions – such as the inspection, analysis, and maintenance of infrastructure. Claims and litigation are brought against private companies at a much higher rate than those against government jurisdictions. It would be anticipated that the amount of claims and lawsuits filed against private firms doing work that formerly had been handled by government entities would increase. Private companies may jump at the work, but many may give pause due to fear of potential litigation, especially in the context of America's aging public works. Private companies doing the work could potentially see insurability issues as they look to protect their firms and work product.

History is bound to repeat itself, as with all construction booms, comes construction defect claims and litigation. Defects in infrastructure projects run the risk of costing the government exponentially more money per job given the risk of inadequate insurance coverage or liability concerns if the private company dissolves. Infrastructure is unlike a private building that requires replacement windows or cladding, as roadways need to be in good working order, power plants need to be generating and supplying power to all, and bridges need to connect communities. Private buildings can remain with defects present without impairing public safety while in litigation – repairs to public infrastructure would be fast-moving. This would mean funding would most certainly be done by the government while litigation ensued – if that private company dissolves or has insufficient insurance coverage, the government would find itself holding the bag.

The same discussion applies to how well a private firm would react if their work was called out for failure and/or defect on a large infrastructure project – the lack of state/public immunity or limits to recoverable damages could potentially start with a public lynching. Insurance coverage for contractors and engineering professionals generally varies, with coverage limits existing only up to a certain dollar amount. There is question how the damages would be recovered in a large business interruption case, or catastrophic loss. There are also problems with risk transfer given imposed restrictions on indemnity provisions. The liability for the private sector doing government work is not apples-to-apples, as with the government doing its own work.