





Humpty Dumpty Infrastructure

By *Bob Prieto*

The challenge facing the United States today is very much about the future it desires as a nation and the level of economic competitiveness that future requires. We must set an expectation for the quality of life we wish for ourselves and our children that is affordable and sustainable within the context of U.S. economic competitiveness. This future must provide us, as a nation, with the ability to respond to new challenges, man-made and natural. It must be built upon the hopes and dreams of our children, who must have the knowledge and tools to improve the world within which we live. It must be a future that inspires us and has a strong foundation.

Today, a key element of the foundation of U.S. market leadership is in crisis: The nation's infrastructure is crumbling!

What is infrastructure? In its simplest form, it is the veins and arteries of human society or, more explicitly, the underpinnings of the built environment that our society has created. Its purpose is to keep that society efficiently supplied with power, water, and information and to transport society's people and supplies with ever greater efficiency over a wide range of distances.

In order to meet the challenges the future holds, we must first address our failing infrastructure. This requires a broad and inspiring vision such as those set in 1929 in the first New York regional plan, in 1956 with the dawn of the Interstate era, and in 1962 when President Kennedy challenged the nation to put a man on the moon by the end of the decade. That vision entails putting in place by 2025 a world-class critical infrastructure system that provides a solid foundation for the nation's health, safety, and well-being.

To achieve this vision, we must conceive new ideas and use new frameworks and approaches. We must act in a concerted way over a sustained period as a nation. Failure to put in place the strong foundation represented by a world-class set of integrated and efficient infrastructure systems will slowly sap our economic competitiveness and deny us the economic resources we as a nation require to be the leader we aspire to be.

Today, as our infrastructure disintegrates, that of our competitors around the world is being enhanced for

competitive advantage. The time for us to act is now.

Dimensions of Change

What must we do to achieve this vision of establishing a world-class critical infrastructure system by 2025? Change must occur at all levels, and in all elements, of what constitutes such a system. The dimensions of this change include:

- **Leadership**—At the national, state, and local levels. By the executive, legislative, and judiciary branches. By the public and private sectors. By



“I was pushed! ... by a lack of vision and leadership, congressional earmarks, deferred maintenance, antiquated contracting and financing methods, and general apathy.”

business, academia, and the citizenry. It is not someone else's duty to lead; collectively, it is all of ours.

- **Education**—As a nation, we do not understand the severity of the crisis. The story has not been adequately told. The imperative has not been made clear. The American public, its leaders, and its children must understand that the need is not just about future “success” but very much about survival, of our way of life at the very least and, in the longer term, of much more. Our future is not assured and our prospects will only grow more dire the longer we wait to address the problems facing us.
- **Vision**—The nation's leaders must articulate this vision, support it, and, most importantly, drive it home. It's not a vision about concrete and steel; rather, it's about the jobs we can work, the privileges we can enjoy, the quality of life we can live, and the quality of the environment in which we will eat, drink, and breathe every day.
- **Decisiveness**—Decisions in the 21st century must recognize that the silos of the past are barriers to the infrastructure of the future. More holistic approaches, such as the regional approach first employed in the New York regional plan of 1929 or the national perspective embodied in the Pershing Map that underpinned the Interstate Highway System, are

required. Perhaps more than ever, however, we must recognize that inaction can carry an unacceptable penalty. We must put in place the governance frameworks that 21st-century society needs.



- **Innovation**—The future requires new solutions and bolder applications of the technologies we currently have. We must invest in being a leader in how we plan, deliver, and finance the strong foundation we wish the nation's infrastructure of 2025 to be.
- **Stewardship**—We must be honest with ourselves about the cost of deploying and sustaining a world-leading infrastructure upon which the nation's success can be built. We must recognize the impact of our choices and make those that improve the efficiency and effectiveness of our quality of life and the environment we all share.

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A Message for “Joe the Plumber”

No great change can occur until those most directly and adversely affected by the status quo understand the true impact it is having on their lives and their children’s future.

In the United States today, “Joe the Plumber’s” family is facing a current bill for deferred infrastructure maintenance that is approaching \$20,000, a cost that continues to grow as we continue to disinvest. Inefficient infrastructure (wasted time and wasted fuel) costs Joe and his family another \$1,200 annually, and this is on top of the nearly \$5,000 a year he’s already paying to use the nation’s infrastructure, an infrastructure that is falling further behind each day.

And all of these costs ignore the costs that greenhouse gas emissions, exacerbated by our nation’s inefficient infrastructure, will cost Joe and his family in the future.

One out of every four bridges the average American drives across daily is structurally deficient or functionally obsolete. And, increasingly, that American’s livelihood will be challenged by foreign competitors made stronger by their own, efficient national infrastructure systems.

Although Joe’s outlook on economics is much more personal, he would clearly understand that our current annual spending of 2 percent of gross domestic product in infrastructure



investment—half of what it was when Joe was born—is lagging Europe’s 5 percent and China’s approximately 10 percent. Certainly he is aware that France’s high-speed trains, Japan’s state-of-the-art airports, and South Korea’s high-bandwidth Internet won’t be available to Joe and his family anytime soon.

Joe the Plumber and his family are surrounded by an infrastructure that, like a cancer, silently and slowly saps his and the nation’s vitality and condemns it to an uncertain future. This cancer of benign acceptance and neglect, however, can be stopped dead in its tracks if only Joe has something to rally behind. This is the opportunity we now face.

A Feasible Path Forward

Waiting for the “other guy” to make a move and complaining when he doesn’t act or, worse, complaining when he acts in ways we feel miss the boat, isn’t very constructive. More difficult is to suggest a path forward that one believes will yield the desired outcome. When seeking to tackle big issues or engender great change, timidity isn’t a good starting point.

What follows is a feasible four-point program for taking such a path. Together, these points address leadership (and its obligation to educate), provide a two-pronged competitiveness plan, underpin that

plan with the human and intellectual capital it will require, and establish a funding mechanism that will not only facilitate mobilization of the required capital but, of equal importance, also promote the transformational practices that will ensure that investments made today won’t subsequently be allowed to decay.

1. Professional Engineering Society Leadership

To ascribe actions to others without first identifying one’s own actions is not a hallmark of true leadership. Today, our professional engineering societies have a leadership opportunity or, perhaps better said, a leadership imperative to help the U.S. achieve a world-class infrastructure. Simply, this entails two core activities:

- Educate Joe the Plumber, and
- Create action-oriented technical standards.

Educate Joe the Plumber

The nation’s professional engineering societies have an obligation to educate Joe the Plumber, as they are the subject-matter experts. They shouldn’t just talk to each other about how bad the situation is and how it’s getting worse every day.

Joe is the user of our nation’s infrastructure, but does he really know what it is? Does he really understand how



inefficient and dangerous it's becoming? Does he understand what is possible? Can he see the forest for the trees?

Infrastructure is invisible to Joe. Our professional societies must therefore shine a bright light on it and sound a clarion call. What this means is that professional societies must educate Joe like there's no tomorrow, because for Joe's children, there may not be, at least from a competitiveness standpoint.

In this effort, let us not confuse lobbying with education. With a strong commitment to education, others will step forward to lobby. Rather, we must define the battlefield. To do this, our nation's professional societies need to create and fund a national infrastructure education program. This isn't just another nice idea but is essential to the competitiveness of U.S.

engineering and our country. The time is now to act with one purpose and one voice. The professional societies must lead by example, not just define and applaud leadership.

Create Action-Oriented Technical Standards

Today, technical societies such as the American Society of Civil Engineers (ASCE), the Institute of Electrical and Electronics Engineers (IEEE), the American Society of Mechanical Engineers (ASME), and others develop with great care and diligence the technical standards that guide the design and engineering of the nation's infrastructure.

Our technical societies are also increasingly defining the measures for determining the condition and

functionality of our infrastructure systems after they're deployed. An example would be ASCE standards that lead to the definition of a bridge as "structurally deficient" and "functionally obsolete." Technical standards shouldn't stop at defining something as unsatisfactory, however; they must go one step further and lay out the methodology to determine in what time frame the substandard conditions must be brought up to a satisfactory level, based on full consideration of the risks they represent or associated inefficiencies.

2. National Infrastructure Competitiveness and Independence Plan—Today's Marshall Plan

Modeled in many ways after the Marshall Plan, which rebuilt European industry and infrastructure after World War II, a national infrastructure competitiveness and independence plan would be founded on two core visions:

- Energy independence, and
- Infrastructure competitiveness.

As in the Marshall Plan, the emphasis would be on implementing today's technologies while tomorrow's are being developed. And like the Marshall Plan, investments that promote U.S. competitiveness and ideals would take precedence. Investments would come with very clear and very self-serving national strings, just as with the Marshall Plan.

Energy Independence

Simply put, this component would initially reduce and ultimately eliminate our dependence on foreign oil. Initial efforts would be focused on establishing the institutional frameworks to expedite and consolidate approvals for energy independence projects and provide financial incentives for the deployment of these projects.

Projects could include:

- Deployment of a national high-voltage DC (HVDC) grid along existing infrastructure rights of way, including existing transmission, rail, and National Highway System corridors as well as new super corridors developed as part of the infrastructure competitiveness vision (see below);
- Creation of regional energy-generation centers in the vicinity of these new HVDC corridors;



- Prudent siting of solar- and wind-power facilities on federal lands in the Southwest United States and Great Plains, where these resources are prevalent;
- Increasing use of indigenous coal and gas resources, in a carbon-neutral manner, until other, more sustainable technologies become economically competitive;
- Utilization of our offshore energy resources, including oil, gas, and wind;
- Replacement and expansion of our existing nuclear-power generation capacity to the maximum extent possible at existing sites, at appropriately licensed new sites, and at existing federal lands that are conducting nuclear-related energy or defense activities;
- Establishment of fleet- and new-vehicle sale standards for transition to a hybrid vehicle fleet and the financial support of industry infrastructure conversion costs; and

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- Implementation of congestion pricing nationally to reduce fuel waste, and concomitant investment in expanding transportation links from the suburbs to urban cores in our nation's 20 largest metropolitan statistical areas (MSAs).

Infrastructure Competitiveness

Our nation's physical infrastructure together with the education and skills of our people are the key determinants of our long-term competitiveness. In addressing our decaying infrastructure, we have an opportunity to not just slow or stop the decay but, most importantly, to transform our infrastructure into an economic juggernaut that will provide a sustained competitive advantage.

This infrastructure competitiveness vision must be founded on new principles that include:

- A comprehensive systems and life-cycle perspective, unconstrained by election cycles, political boundaries, or definitions of different infrastructure systems;
- A true understanding of the implications of sustainable practices such that our infrastructure systems are responsibly managed, operated, and maintained financially, socially, and environmentally throughout their complete life cycles; and
- A willingness to recognize and provide for the true cost of the



infrastructure systems we require while acknowledging that, as with all valuable resources, the cost allocation must be prioritized to maximize the benefits it provides.

A series of projects would characterize the earliest stages of this new infrastructure vision:

A national system of transportation super corridors. These would be deployed in the largest civil infrastructure program since the Interstate Highway System. These super corridors would build on existing infrastructure system rights-of-way and would incorporate:

- High-speed intercity connections between the nation's 20 largest MSAs;
- Elimination of bottlenecks, added highway capacity, high-occupancy toll (HOT) lanes, and dedicated truck HOT lanes;

- Advanced intelligent transportation system (ITS) technologies to improve vehicle and system performance and create smart corridors linked with the major supply-chain service providers in our major cities, providing true just-in-time delivery of goods and people;
- Infrastructure provisions required by a new generation of hybrid electric vehicles; and
- Integration of HVDC transmission corridors and other long-haul infrastructure systems through consolidated corridor development agencies.

Consolidation of all surface-transportation–infrastructure ownership within each of the top 20 MSAs. Such a program would aim to improve overall investment efficiency and project prioritization, and capture the efficiencies gained from common ownership and management. As part of this enhanced



focus on network efficiency in our largest MSAs:

- Transit ridership would be doubled within 20 years;
- Greenhouse gas emissions would be measurably reduced below today's levels, even after considering anticipated population growth;
- Infrastructure deficiencies would be addressed such that all structurally deficient or functionally obsolete systems would be fully replaced or returned to a condition of good repair; and
- Investment plans would fully address ongoing maintenance and renewal costs.

Creation of consolidated infrastructure-service–distribution and customer-service organizations within the largest MSAs. These organizations would own, operate, and maintain the networks within the top MSAs to distribute power, water, gas, and

wastewater. Under this plan, process operations such as power generation, HVDC transmission to the MSA distribution network, water treatment and distribution, wastewater processing and disposal, and gas generation, storage, and processing would remain with traditional industry providers, and new “urban utilidors” (pictured below) would improve the efficiency of infrastructure service delivery. (Utilidors are shared infrastructure corridors that may be operated by a common infrastructure service provider.)

This infrastructure competitiveness vision would require professional engineering societies to work closely together to create the new joint engineering standards that such an integrated system would require. These standards must incorporate life-cycle and sustainability considerations and establish acceptable maintenance and condition regimes.

The cross-cutting nature of these new infrastructure systems would also require the creation of new legal frameworks to deal with pan-political infrastructure systems. Additionally, the achievement of our national infrastructure vision must be founded on the principle of unconstrained innovation, whether that be in technology, programs, or project delivery. Innovative delivery and ownership must be enabled, not constrained.

3. National Infrastructure Education Act—The New GI Bill

The competitive future of our nation is linked not only to our capital base but, more importantly, to our nation's knowledge base. At an earlier time in our history, the GI Bill provided broad segments of our society with access to an education they couldn't otherwise afford. The result of those efforts was an expansion in the number of engineers, scientists, and skilled workers the likes of which our nation had never seen. This was the workforce that designed and built our Interstate Highway System, built much of our current power grid, and sent a man to the moon.

We are now at another point in our history when such a focused educational effort to meet the infrastructure needs of the 21st century is called for. A national infrastructure education act would provide interest-free loans to

U.S. students attending an accredited undergraduate U.S. college and studying a curriculum with a core infrastructure track that included relevant math, science, and sustainability-related courses. Students could repay loan principal over 10 years following graduation or could reduce the principal they owe for each year of approved national service they undertook. Military veterans who entered an educational institution within a defined period after their tour of active duty would be able to apply that military service time toward principal forgiveness. A national infrastructure education act could also provide for merit-based graduate scholarships on a competitive basis.

4. United States Infrastructure Reconstruction Bank

This point in the four-point program would entail creating a self-financing, broad-based, independent infrastructure reconstruction bank. The bank would be capitalized by an initial capital contribution of \$200 billion (10 percent of the total backlog of deferred maintenance for U.S. infrastructure, now approaching \$2 trillion) by the federal government, with the states opting to participate based on an initial membership fee determined by their populations.

A U.S. infrastructure reconstruction bank would make loans to

state-sponsored infrastructure projects, as well as privately financed infrastructure projects, and would obtain necessary capital by issuing long-dated U.S. infrastructure reconstruction bank bonds. This source of financing would not be a substitute for tolls or other user fees but rather a means of providing additional leverage for more rapid deployment of revitalized infrastructure.

The bonds could be secured by debt instruments from public and private borrowers of the bank and credit-enhanced by underlying capital contributions and retained earnings. States would need to commit specific revenue sources to repayment, with emphasis being placed on predictable, value-capturing user fees. These

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bonds could be used in conjunction with either for-profit or not-for-profit public-private partnerships (including so-called performance-based public-private partnerships, which utilize availability-payment-type structures) in order to fully capture the benefits associated with private-sector delivery and operation of infrastructure systems.

Bond interest would be tax exempt at the federal level and in all states



opting to participate. Bond interest would also be excluded from any state- or federal-level Alternative Minimum Tax-type calculations. Depreciation rights would be transferred pro rata to the bank with the bank's share of total project capital; the bank would then bundle the depreciation rights with issued bonds. Bundled depreciation could be used by bondholders as a refundable federal tax credit.

The U.S. infrastructure reconstruction bank would replace state private activity bond use related to eligible infrastructure as well as other federal-level loan and finance support programs, such as TIFIA (Transportation Infrastructure Finance and Innovation Act), related to infrastructure. The loans would set standards for establishing appropriate reserve funds as well as sinking funds to pay for maintenance, repair, and replacement of funded infrastructure to promote responsible life-cycle project financing.

Profits generated by the U.S. infrastructure bank would be used to cover its own costs, expand its

capital base commensurate with the nation's infrastructure capital needs, and subsidize state senior debt borrowing costs, if possible, to further promote investment in the nation's infrastructure.

The Challenge Is Great

The challenge ahead is great, but we are a great people. The journey will be long, certainly longer than the two-, four-, and six-year election cycles that have governed many of our more recent decisions on meeting this growing infrastructure challenge. The cost will be great, certainly more than the tens of billions some have suggested. But failure is not an option. We can succeed if we take action and stop waiting for the next guy to do it.

We have the most fundamental tool required for success: the strength and determination of the American people when they rally behind a great goal. This is the opportunity for us to control our own destiny much as those who founded this great country made even greater sacrifices to control their own.

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