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How the Perilous State of Our Nation's Infrastructure Threatens our Future

By Barry B. LePatner, Esq.

September 19, 2008

It has taken several disasters—the failed levees and floodwalls caused by Hurricane Katrina, the I-35W Bridge collapse, and (more) failed levees that caused the Midwest floods earlier this year—but the dismal condition of America's infrastructure is finally making headlines. It's an issue that has been simultaneously discussed in urgent tones by engineers and transportation experts and ignored by vote-hungry federal and state politicians. But we can no longer ignore the reality that large portions of our infrastructure haven't received the repairs and renovations they need. The resulting deterioration—including one in every four bridges across the nation which have been rated hazardous and hundred-year-old asbestos-wrapped steam pipes under our city streets—has become a daily danger to our citizens.

Quite simply, the nation's infrastructure system has been starved of attention for too long. It's a problem that's been decades in the making and that has now reached a critical tipping point. The safety, security, and economic wellbeing of the country are at serious risk—and the current, belated concern from Congress and some state governments, as well as occasional comments from the presidential campaign trail feel like “too little, too late” to the experts who've documented these serious issues in reports that have been largely disregarded.

The reality is that our roads, bridges and tunnels have deteriorated so severely that some

experts anticipate it will cost our nation tens of trillions of dollars to repair them. The magnitude of the problem was clearly laid out in the *Infrastructure Report Card 2005*, published by the American Society of Civil Engineers, the country's leading professional organization in the field. This most recent report card from the ASCE lists fifteen categories, none of which received a grade higher than a "C" and ten out of fifteen—including transit, navigable waterways, drinking water, schools and waste-water management—received scores in the "D" range. Shamefully, America's bridges have *never* scored higher than a "C".

The collapse of the I-35W Bridge in Minneapolis on August 1, 2007 offers a paradigm for evaluating the state of American infrastructure—how it has fallen into its present condition and the costs now being exacted by decades of neglect. The collapse of the bridge, a nearly seven-football-fields-long structure, was not due to a shortage of funds. Rather, it resulted from a misallocation of funds.

Minnesota taxpayers had been far from stingy. They had seen their state allocate highway costs of \$151 billion in 1991, \$217 billion in 1997, and \$286 billion in 2005. Yet these monies appear to have been set aside for transportation expansion projects far more frequently than for bridge and road remediating—despite the state's promise to repair its aging infrastructure, which had been in failing condition for years. No funds were set aside for repairs on the "structurally deficient" or "functionally obsolete" I-35W Bridge that carried 140,000 vehicles per day. What's worse, despite the devastation and loss of life caused by the bridge's collapse, over the next twelve months in 33 states and Washington, D.C., there was no significant new spending and little debate devoted to looking into the extent of the infrastructure problem.

The U.S. infrastructure system has been poorly managed and underfunded for decades. Currently, the U.S. government provides \$2 billion in maintenance costs annually for the 592,000 bridges that fall within its purview. This works out to a paltry \$3,500 per bridge! It doesn't take a genius to realize this sum doesn't cover an adequate bridge inspection, let alone the repairs caused by two or three decade's worth of neglect. And if you and I realize this, you'd better believe that your local politicians—who receive annual reports from their state transportation departments detailing the deterioration of the roads, bridges, and levees in their constituencies—realize it, too. But politicians learned long ago that spending money on infrastructure maintenance wins them no points in the fundraising game or the rush to reward their supporters.

Just as the melting of the glaciers and polar icecaps are finally providing tangible evidence that global warming is real, phenomena such as collapsing bridges, the relentless spread of traffic gridlock, and consistently poor safety ratings clearly signal a day of reckoning for our nation's infrastructure. Recent, well-publicized breakdowns in the infrastructure system should warn politicians that they can no longer try to brush the nation's infrastructure problems under the rug as they have for the past twenty five years. It's time to find solutions. And thankfully,

unlike the problem of global warming—whose solution will require the coordinated efforts of countries everywhere—inadequate infrastructure is one we can solve on our own. All we have to do is summon political action and commitment.

New York Times columnist Thomas Friedman recently wrote that after years of neglect have led to serious domestic problems we need substantial “nation-building” in the United States. He couldn’t be more right. And the good news is that America has a history of successfully engaging in the kind of collective problem-solving that nation-building and more specifically the infrastructure problem clearly requires. Consider, for instance, the way the United States confronted the need for a system of roads to move the military around the country and to aid in evacuations in the event of a nuclear attack in the early years of the Cold War. The result was President Dwight D. Eisenhower’s proposal of and subsequent construction of the National System of Interstate and Defense Highways.

Today, our reasons for addressing the state of the country’s infrastructure problem are just as urgent. Aside from increased security needs in an age of global terrorism, our ground transportation infrastructure must also serve the economic needs of a country facing rapid population growth over the next half-century and significant challenges to its global economic competitiveness. Just as the Interstate Highway System spurred the greatest economic boom the country has ever known, investing in a renewal of our aging infrastructure can be a key factor in sparking future American prosperity.

As the handful of politicians who have tried to grasp the enormity of the problem have discovered, the scope of this problem is beyond the ability of any one state or federal official. There are no simple solutions. And as we stare down a huge budget deficit—not to mention a recession waiting in the wings—the federal government will surely tell us that there is no money for this national problem. Yet the harsh truth is that our infrastructure is riddled with ticking time bombs that could go off with sporadic regularity as bridges and roads built 50 to 100 years ago exceed their life expectancy and fail.

This problem *can* be solved, but only through a major national effort that involves both the public and the private sectors and is completely insulated from the partisan warfare and involvement of the special interests that now have a stranglehold on the American political process. In order for such an effort to succeed, decision-makers and citizens alike must grasp the full scope of the issue: technical, economic, financial, and—perhaps above all—political.

How can we start the reform process? By imploring our politicians to show some backbone and take a leadership role in solving this life-threatening problem. Unfortunately, at the present moment, few are discussing this subject despite the lives lost in the bridge collapse in 2007 and despite the lives, homes, and businesses lost in the wake of the failed levees in the Midwest and post-Katrina New Orleans. We must make sure our politicians understand that it is a question of “when” not “if” there will be another infrastructure-related disaster—and that they will be held responsible if action isn’t taken.

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Barry B. LePatner is the founder of the New York City-based law firm LePatner & Associates LLP. For three decades, he has been prominent as an advisor on business and legal issues affecting the real estate, design, and construction industries. He is head of the law firm that has grown to become widely recognized as one of the nation's leading advisors to corporate and institutional clients, real estate owners, and design professionals.

Mr. LePatner is widely recognized as a thought leader in the construction industry. His new book, *Broken Buildings, Busted Budgets: How to Fix America's Trillion-Dollar Construction Industry* (The University of Chicago Press), which was reviewed in the *Wall Street Journal*, has created a national debate among owners, designers, and other key stakeholders. Mr. LePatner has been featured in *BusinessWeek*, the *Boston Globe*, the *New York Times*, *Crain's New York Business*, the *Chicago Tribune*, and other prestigious publications. His articles and speeches on the perilous state of our nation's infrastructure have garnered him widespread attention. He has appeared on many television and radio broadcasts, including a CNBC appearance and several National Public Radio segments. A November 2007 *Governing Magazine* article stated, "If there's a guru of construction industry reform, it's LePatner."

A nationally recognized speaker, Mr. LePatner has addressed audiences on topics central to trends affecting the real estate and construction industries at recent events sponsored by: The International Economic Forum of the Americas, the Real Estate Board of New York; FIATECH, the National Realty Club, the Construction Owners Association of America, the Construction Management Association of America, the Construction Financial Management Association, MC Consultants Inc.'s Construction Defect and Construction Law Conference, and Skire, Inc.'s Owner Alliance Roundtable. He also routinely presents CLE-accredited courses to other law firms and organizations on how the construction industry actually works and how they can best protect their clients from the vagaries of the construction process.

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A Historical and Political Overview of Our Failed Policy on Infrastructure

By: Barry B. LePatner, Esq.

November 20, 2008

America's bridges are falling down at an alarming rate. In fact, more than 500 bridges in the United States have failed since 1988—a rate of 25 per year. Few of these structural failures make it into the national news and none of them received the amount of attention focused on the I-35W Bridge collapse in Minneapolis back in August 2007—a calamity that killed 13 people, injured 145, and shattered misplaced confidence in what had been one of the top-rated state transportation departments in the country.

Because highways, subways, and railroads are not subject to the sudden, spectacular failures that cause bridges to come crashing down, we generally experience their deterioration not with scenes of mayhem and mourning but in quieter, less traumatic ways. Their failures manifest in hours lost in traffic jams, slowdowns, and service delays; in wear and tear on vehicles and nerves; and, perhaps, in the gnawing sense that the United States—which a century ago was creating the most advanced infrastructure in the world for both private and public transportation—now has a transportation infrastructure system that increasingly resembles the systems found in underdeveloped countries.

It's time for a wakeup call for the American public and many of its political leaders. Though the problem may seem small in comparison to the wars in Iraq and Afghanistan or the breakdown of the country's financial system, our crumbling infrastructure threatens public safety as well as our economic and national security. And yet, despite the catastrophe of the I-35W bridge collapse and the attention it received from the nation's media and citizens, the issue received only passing mention in the 2008 presidential campaign. Unfortunately, no matter how long the politicians continue to dance around it, the problem is not going away. Deteriorating bridges, roads, and rails do not heal themselves. And as long as we go on neglecting them, bridges will continue to fall down, roads and rails will continue to buckle, and the United States will continue to fall behind countries that understand the importance of infrastructure to their futures.

According to the American Association of State Highway and Transportation Officials, there are approximately 21,000 "high-volume" bridges in the United States, each with more than 40,000 vehicle crossings per day. This means that a conservative guess would have tens of millions of Americans traveling to and from work every day on bridges that are classified as

“structurally deficient” or “functionally obsolete” and that are probably receiving insufficient maintenance.

Since the dawn of the automobile era in the early years of the twentieth century, automobile infrastructure in the United States has been financed almost exclusively by public funds. Thus the question of how we have arrived at our present pass can be answered by considering a long series of public decisions, at the federal, state, and local levels, concerning infrastructure for automobiles and trucks as well as for the modes of transportation they to a large extent replaced—i.e., railroads and local transit systems.

To understand the current state of our infrastructure, we must trace the early history of the building and financing of roads. We must start with the first efforts by states to replace private toll roads and turnpikes with public roads and continue on to the passage of the Federal Highway Acts of 1916 and 1921. Certainly we must not forget the extensive road building activity of New Deal agencies during the Depression, which led to the creation—initially with the passage of the Federal Highway Act of 1944, and then the enactment of the Federal-Aid Highway Act (or National Interstate and Defense Highways Act) of 1956—of today’s 47,000-mile Interstate Highway System.

President Eisenhower championed the interstate as both a means of defense for moving military forces around the country, evacuating cities in the event of a nuclear attack, and, not incidentally, encouraging a permanent dispersion of population from the cities to the suburbs for the sake of civil defense and a spur to economic growth.

From 1932, when Congress first enacted an excise tax on gasoline, until the passage of the Federal-Aid Highway Act of 1956, revenue from gasoline taxes went into the government’s general fund. In 1956, new legislation created the Highway Trust Fund for the construction and maintenance of the interstate system and other federally-supported roads. Federal gasoline taxes would make up 90 percent of the Fund while the remaining 10 percent would come from the states. This system of financing—the basis of all federal funding of highway transportation projects to this day—not only paid for the construction of the interstate highway system but helped states to fund the building and maintenance of secondary roads as well. Federal policy also encouraged the design and building of bridges, roads, and tunnels with tight standards for ensuring their structural integrity and dedicated funds to maintain them.

As the decades passed, however, politicians in Washington came to view the Highway Trust Fund not as a way of financing the construction, repair, and maintenance of critical infrastructure but as a source of earmark funding for pet projects, sometimes only marginally related to highways or transportation. In the mid-1960s, the rise of the environmental movement and of urban activists opposed to routing expressways through inner-city neighborhoods began to challenge the political consensus that had endorsed highway construction as a matter of national policy. The result was a gradual shift of power over highway policy, at both the federal and state

levels, from transportation professionals to politicians acting in response to new political pressures.

One consequence of this power shift was a gradual diversion of the money in the Highway Trust Fund to the aforementioned pet projects during the 1970s, '80s, '90s, and into the present. Finally, with the passage of the Transportation Act of 2005, the federal government essentially abandoned its role of establishing standards for the construction and maintenance of roads, bridges, and tunnels and overseeing how HTF funds were spent.

Beginning in the early 1980s, as a result of overall reductions in domestic spending by the federal government as well as congressional poaching of HTF funds, federal support for road construction and maintenance started to decline in relation to state funding for this purpose. This left the states burdened with expenses that, in many cases, they were ill-equipped to meet. The resulting budget pressures at the state level, coupled with the shift of political power away from transportation professionals, led inexorably to the erosion of systems and resources for the inspection and maintenance of roads, bridges, and tunnels.

In particular, budget cuts in state transportation departments reduced the number of trained engineers able to perform critical inspections, ultimately diminishing the time spent on mandated inspections and causing the need for critical repair work to be missed by officials. Just as importantly, reductions in the number of highly qualified engineers in transportation departments helped tip the balance between professional culture and bureaucratic culture in these organizations in favor of the latter.

The patterns of federal funding described above, and the larger political trends that they reflect, have had dire consequences for the maintenance of the nation's roads, bridges, tunnels, and other ground transportation infrastructure. The years of neglect resulting from these ill-advised decisions have led our country to its present state of infrastructure instability and the now imperative need to revamp our political perspective on spending.

Expert Opinion: Crumbling For Good?

December 19, 2008

America's bridges are falling down at an alarming rate. In fact, more than 500 bridges in the United States have failed since 1988 – a rate of 25 per year.

Few of these structural failures make it into the national news and none of them received the amount of attention focused on the I-35W bridge collapse in Minneapolis in August 2007 – a calamity that killed 13 people, injured 145, and shattered misplaced confidence in what had been one of the top-rated state transportation departments in the country.

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It's time for a wakeup call for the American public and many of its political leaders. Though the problem may seem small in comparison to the wars in Iraq and Afghanistan or the breakdown of the country's financial system, our crumbling infrastructure threatens public safety as well as our economic and national security. And yet, despite the catastrophe of the I-35W bridge collapse and the attention it received from the nation's media and citizens, the issue received only passing mention in the 2008 presidential campaign.

Unfortunately, no matter how long the politicians continue to dance around it, the problem is not going away. Deteriorating bridges, roads and rails do not heal themselves. And as long as we go on neglecting them, bridges will continue to fall down, roads and rails will continue to buckle, and the United States will continue to fall behind countries that understand the importance of infrastructure to their futures.

According to the American Association of State Highway and Transportation Officials, there are approximately 21,000 "high-volume" bridges in the United States, each with more than 40,000 vehicle crossings per day. This means that a conservative guess would have tens of millions of Americans traveling to and from work every day on bridges that are classified as "structurally deficient" or "functionally obsolete" and that are probably receiving insufficient maintenance.

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As the decades passed, however, politicians in Washington, D.C., came to view the fund not as a way of financing the construction, repair and maintenance of critical infrastructure but as a source of earmark funding for pet projects, sometimes only marginally related to highways or transportation. In the mid-1960s, the rise of the environmental movement and of urban activists opposed to routing expressways through inner-city neighborhoods began to challenge the political consensus that had endorsed highway construction as a matter of national policy. The result was a gradual shift of power over highway policy, at the federal and state levels, from transportation professionals to politicians acting in response to new political pressures.

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The patterns of federal funding described above, and the larger political trends that they reflect, have had dire consequences for the maintenance of the nation's ground transportation infrastructure. The neglect resulting from these ill-advised decisions has led our country to its present state of instability and the need to revamp our perspective on spending.

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Expert Opinion: Financing the Nation's Infrastructure

Infrastructure

February 26, 2009

The downturn in our nation's economy has renewed focus on the importance of getting a handle on how we will finance our infrastructure in the years ahead. Infrastructure has an importance far beyond our daily comforts. We rely on our infrastructure to provide improved productivity, to maintain our safety as we cross bridges to take our children to school and to make transporting our goods to shopping centers or ailing patients to hospitals easier.

Yet, the United States has, for the past several decades, turned its back on funding our infrastructure facilities. The lack of commitment from state and federal governments to this sector of the economy is dramatically contrasted with how nations around the world are viewing the importance of making a major commitment to their own infrastructure needs. Currently, the United States spends 0.6 percent of its gross domestic product (GDP) on infrastructure funding compared with China, which spends 9 percent of its GDP; India, which spends 8 percent; and Japan, which spends 10 percent.

Growing Problem

To grasp the nature and extent of how large and difficult the subject of funding our nation's infrastructure will be, it is perhaps best to understand the problems currently being addressed by several of the states in our nation. A recent study by the Texas Transportation Institute (TTI) ranked Los Angeles as the city with the slowest commute in the United States; in second place is the San Francisco-Oakland region, tied with Washington, D.C.

According to a July 2008 survey by the American Council of Engineering Companies of California, "Decades of hard and relentless use – combined with neglect and a lack of adequate investment since their initial creation – have taken an extreme toll on these vital arteries, which simply cannot support the needs of today's users."

TTI estimates that in the San Francisco Bay Area, traffic congestion costs each commuter \$1,121 in lost wages and 47 gallons of wasted fuel annually. According to the same study, traffic gridlock nationwide consumes 4.2 billion of valuable labor hours annually, which translates to a \$78 billion loss for the U.S. economy.

The needs of the state are enormous. California faces a \$16 billion annual shortfall to upgrade its roads. Considering the critical value of California to our nation's economy and its place in the global flow of commerce, there is no question that a failure to keep the state's transportation infrastructure in top condition imperils our nation's future. The need to fund these growing transportation requirements has caused many states to look beyond government funding for infrastructure projects.

Coming Around

Since 2005, eight more states have enacted legislation that would permit their government officials to sell or lease highways or other transit infrastructure to private investors, bringing the total to 25 states giving their approval to the concept of public private partnerships or P3s.

States that have begun to realistically assess their infrastructure needs have come to similar realizations. Arizonans have been advised that it will take new infrastructure investment in the area of \$500 billion over the next 25 years if that state wishes to keep pace with its growth, or face dire consequences for the business community.

According to a recent study from the L. William Seidman Research Institute at Arizona State University, “The state will need between \$417 billion and \$532 billion between 2008 and 2032 to improve its infrastructure.” That will include improvements in transportation, utilities, water, wastewater and telecommunications. “If we do nothing, the state in 25 years will be an absolutely appalling place to live,” said Tim James, director of research and consulting for the institute.

In Pennsylvania, the imperative to pursue financing for its major toll road was too compelling to turn down a lucrative offer from the venture capital world. Pennsylvania selected a consortium comprised of several of the world’s top investment and infrastructure companies to lease and manage the Pennsylvania Turnpike for the next 75 years. The bid to privatize the toll road totaled \$12.8 billion.

On average, 35,000 vehicles per day stop at its 57 tollbooths and 20 service plazas, which generate annual revenues of more than \$600 million.

The Pennsylvania Turnpike system covers 359 miles and traverses one of the most highly developed regions in the United States. Pennsylvania legislators, pressured by the trucking industry and others, rejected the proposal.

The issue of financing the future cost of our failing infrastructure cannot be understood unless we also examine who is lining up on each side of the issue. The venture capital interests will be high-priced lobbyists and former governmental officials will be paid handsomely for their ability to sway public opinion and, most of all, government.

What Motivates Leases?

“One reason is that there is so much investment capital available,” according to former Colorado Governor Bill Owens. “There may be as much as \$175 billion in global capital, which – when leveraged with debt that’s an obligation of the investments means potentially \$700 billion in capital available to state and local governments for infrastructure and other capital purposes.”

For Pennsylvania Gov. Edward Rendell, the payoffs that warranted turning to a P3 included a turnpike that would be upgraded where it otherwise would continue to degrade as well as assurances that tolls charged by the P3 would be no higher than the turnpike commission would have charged. Road repair throughout the state would be accelerated, and a proposal to impose tolls on Interstate 80 could be canceled. Most of the \$12.8 billion lease payment from the consortium would be committed to road and bridge repair and the support of 73 public transit agencies.

Although more than \$160 billion in such funds have been raised by a Wall Street still reeling from the sub-prime lending mess of the past few years, this new sector of the financial world still appears to have its problems. No longer accessible to cheap credit, many of these infrastructure funds have had to borrow money at increasingly higher rates.

Financing Alternatives

In addition to the P3 approach, several other financing alternatives exist to provide state governments with different approaches that could fund their infrastructure needs. Because infrastructure funding comes from appropriated dollars – often with bonds sold by state or quasi-governmental entities against future revenues – it is imperative that public officials consider alternative financing models or innovative contract approaches.

A fundamental aspect of undertaking any large-scale construction project is the ability to have a realistic sense of the full scope of the project, an accurate and complete set of design documents that can result in a true, fixed price for the work that will be done and a bidding process that ensures that the best, most efficient contractors perform the work on budget and on schedule. As simple as that may sound, it all too often has not been the case.

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Just How Much is Needed For Remediating our Infrastructure and Where Will It Come From?

By: Barry B. LePatner, Esq.

March 24, 2009

Americans have a long history of neglecting the maintenance of their roads and bridges. From our earliest colonial days to the growth of the a U.S. as a superpower during the 20th Century, we built massive road networks, invested in our ports, built power grids, water systems and airports that were the envy of the world. Yet today, China invests 10% of its GDP on infrastructure but the U.S. only about 1.2%. We continue to fall further behind in remediating an aging system that is long past its original lifespan. As a result, our nation puts the safety of its citizens at risk each day as they travel over dangerously patched up bridges and on congested roads, costing our nation \$78 billion a year in wasted fuel and human toll, and threaten our competitiveness on the world stage.

How did we get to this deplorable state? In colonial times, the upkeep of post roads was the responsibility of local government and local residents were required to provide the labor for maintaining them. After the American Revolution, traffic on what was still a small network of roads began to increase and existing maintenance efforts proved ineffective. To deal with the heightened demand, state governments chartered private turnpike companies that were given the right to build roads and charge tolls for their use; in the absence of government standards, the quality of the turnpikes varied considerably from place to place.

After 1800, many states used tolls to pay for the upkeep of major roads while continuing to use statute labor for maintaining local ones. As the country expanded in the first half of the nineteenth-century, much debate centered around the issue of federal funding for road construction and improvement, which Congress provided in only very limited amounts.

In 1822, President James Monroe vetoed a bill authorizing federal imposition of tolls to raise money for road maintenance as an “unwarranted extension of federal power.” This set a precedent of states being responsible for maintaining roads that would survive until well into the twentieth century.

By the 1920s and ‘30s a boom in road construction in the United States led to the first federal gasoline tax in 1932. These revenues went into the federal government’s general fund, to the great consternation of the automobile lobby.

Clearly the nation’s roads were showing signs of neglect even before the creation of the interstate highway system in the mid-1950s. When the Federal-Aid Highway Act of 1956 made the interstate system, which was first planned twelve years earlier a reality, it was estimated that the interstate system would be completed in twelve years, and providing for its maintenance was not a pressing concern for either the federal government or the states, who eagerly took the federal funds (ninety percent of the cost of new construction was paid for out of the new

Highway Trust Fund, which was funded by dedicated revenues from the federal gas tax) that it made available.

The expansion of the national highway system represented by the interstate quickly fed on itself, as demand for new roads only increased in response to a number of related phenomena: greater numbers of vehicles and miles driven; growing congestion in metropolitan areas (a problem that predated the post-WWII era); taxation, housing, and land-use policies that subsidized sprawl; and the by now well-established policy of undercharging motorists and truckers for their use of the roads.

“By the 1970s,” as a Federal Highway Administration historian has noted, “the Interstate System was showing signs of wear and tear. Part of the problem was that pavements built in the 1950s and early 1960s were reaching their design life (the number of years a pavement is expected to last, with proper maintenance, based on estimates of the loadings it will absorb during that time, particularly truck loadings). Because the Interstates were carrying more and heavier traffic than predicted, many segments absorbed 20 years of wear and tear in far fewer years than expected.”

With construction of the interstate highway system well advanced, and recognizing the need to protect the federal taxpayers’ sizeable investment in that system, the federal government began to shift the emphasis in its funding. In an assessment of road conditions around the country initiated by the federal government, 44 states had reported a decline in the quality of their highways between 1970 and 1975, while as of 1975, as an article in *U.S. News & World Report* (titled “America’s Highways Going to Pot”) would later relate, “42 percent of all paved highways and 27 percent of the interstate pavement were rated either ‘fair’ or ‘poor.’” As engineers came to realize, pavement classified as fair may seem smooth to many motorists and can hide defects for years as it deteriorates—and then seem to collapse overnight. The same *U.S. News* story reported that a “recent government inventory” had found that nearly one-fifth of the country’s 564,000 highway bridges were “inadequate or unsafe.”¹

The *U.S. News & World Report* Special Report quoted above, published in July 1978, not only reported on the deteriorated state of American roads and bridges but also noted that “the cost of upkeep and renovation [for highways and bridges], estimated at \$329 billion between now and 1990, is so enormous that nobody knows where enough money can be found.”

By 1995, approximately half of all federal highway spending was for rehabilitation and reconstruction. The Transportation Equity Act for the 21st Century (TEA-21), enacted in 1998, guaranteed \$23.8 billion for highways and bridges through 2003 but, in another indication that Congress was losing its focus on repairing and maintaining the national highway system, also

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expanded the program for uses including “new interchanges, new rest areas, additional noise walls, etc.”²

Such flexibility was further extended by the 2005 federal transportation legislation, which authorized \$25 billion for the over five years and \$21.6 billion for the bridge program and allowed the use of federal funds for preventive maintenance for bridges.

Today the scope of what is needed for remediation is enormous. Consider that our nation is home to 4,000,000 miles of roads, approximately 1,000,000 miles of water mains, and 600,000 bridges, one in four of which are either rated “structurally deficient” or “functionally obsolete”.

Public (Federal and state) expenditures on infrastructure have grown by 1.7% per year from 1956 to 2004 and in recent years, have been growing even more rapidly, rising by 2.1% per year, after adjustment for inflation. This rate of growth translates into a constant fraction of GDP, about 1% to 1.2%, being spent on infrastructure. The Congressional Budget Office reported that Federal and state governments spent \$67 billion on highway infrastructure and \$28 billion on drinking water and wastewater infrastructure in 2004.

We will need vast sums of money to build the new roads, bridges and other infrastructure facilities that will be needed by the population increase of 100 million new citizens by the year 2040. We will need, according to the ASCE’s latest infrastructure report card, over \$2.2 trillion to remediate all of our aging, underdesigned and deteriorated facilities to make them safe for our nation and to bring them up to modern day standards.

As we look ahead past these capital constrained times, we will need to rededicate ourselves and our national leaders will need to make finding the funds needed to shore up our infrastructure a priority. Any failure of leadership here will be met by a growing intensity of fear that more and more of our competitiveness—not to mention our personal safety—will become increasingly jeopardized by any failure to act.

Whether it is through the establishment of a National Infrastructure Bank, or an increase in the federal gasoline tax, or through the careful implementation of public private partnerships, we will need to bring the ideas from the “best and the brightest” to bear on this issue that will come to far transcend many of the pressing issues of today.

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"Two Major Challenges: People and Technology."

By: Barry B. LePatner, Esq.

May 19, 2009

I was reading a recent article from the *McKinsey Quarterly* on innovation and setting goals. In the article there was a discussion on how to disseminate ideas to an organization that has never been introduced to a new way of thinking. So I thought about the National Transportation Safety Board and the Federal Highway Administration, which are charged with overseeing how our roads, bridges and other transportation systems are designed, built and maintained and the way these organizations have been approaching bridge inspections in order to avoid failures.

The article suggested that getting a "hard count", meaning the metrics e.g. knocking on doors to learn the true facts in electoral polling or by counting the number of hospital beds to determine how to go about saving 100,000 lives with new procedures, are what is needed to change behaviors. Then the discussion turned to introducing checklists as a means of changing behaviors and the fact that while hospitals are not used to checklists, the aviation industry -- an industry that truly cannot afford any failures -- has always used checklists.

An article by *McKinsey* recently stated, "We are built on a 2,000 year old culture, where we are expected as clinicians not to make mistakes. This was true with the FAA until the 1950s, when they started asking, 'Why are we crashing so many planes?' If your safety systems are built on the expectations that your pilots and your doctors won't fail, then you are going to have no safety net when they do. The FAA figured out pretty quickly that they were better off designing a system that expects the pilots to fail and then prevents that failure from causing a disaster -- the failure does not have to cause a disaster. We are just beginning that journey 50 years later in health care."

The advent of the 21st Century has brought about major advances in the use of technology for the design and construction of our nation's buildings. The latest technology looks to employ systems that adapt our commercial and residential structures to act in a manner akin to a living organism, one that addresses changes in a multitude of conditions. From *Wired*, "A building that mimics a living system would be able to sense and respond appropriately to exterior conditions like varying winds, temperature swings or changing sunlight. Inside, the building might change to accommodate crowd flow or better circulate warm air."³

A 2008 article from the Foreign Policy Research Institute stated:

"Innovation" is not just inventions; it is a *process* of making changes by introducing valuable new methods, ideas, or products. "Innovations" are the things themselves—the

³ "Smart Buildings Make Smooth Moves", *Wired*, Lakshmi Sandhana August 31, 2006, p.1

ideas, methods, and processes. It's not simply that better mousetrap; it's different ways of thinking and doing. Innovations may of course be inventions, but they may also be beliefs, organizational methods, and discoveries. An innovation is a value-creation mechanism. It is the way we humans manage to extract more value, generate more economic surplus and therefore more leisure time, and manage to get away from just hunting and gathering.⁴

As building management systems (BMS) that control heat, air conditioning, lighting and other building systems continue to get more sophisticated, architects and engineers are designing controls that an owner can utilize to manage a building to meet the needs of its users. Emerging standards now enable data sharing between building systems that improve efficiency as well as provide real-time control over building operating costs.

Only a fraction of these technology advancements have trickled down to the transportation infrastructure world. As a result, our nation has a long way to go to bring prevailing and developing technology to serve our nation's roads, bridges and tunnels in ways that will save tens, if not hundreds, of millions of dollars annually

A report prepared by the nationally regarded consulting firm HNTB cites a National Cooperative Highway Research Program estimate that we will need \$293 billion for our surface transportation system if our nation is to meet the future needs of our growing economy.⁵ This will leave a financial gap of \$50.7 billion in funding to maintain our systems and a gap of \$105.3 billion if we seek to improve them. By 2017 it is anticipated that these gaps will widen to \$66 billion and \$133.9 billion respectively. Accepting that our nation will have no choice but to finally address this growing problem, one solution is to seek to slow the growth of the costs to remediate our ailing roads, bridges and tunnels by utilizing state-of-the-art available technology to inspect and establish new methods for repair.

As Congress noted in Title 23 of the U.S. Code, "research and development are critical to developing and maintaining a transportation system that meets the goals of safety, mobility, economic vitality, efficiency, equity, and environmental protection." At present, however, most Federally sponsored transportation research is approved without clearly defined anticipated payoffs. Much of this research is redundant with other efforts and the research quality is often totally worthless. Too often, Federal research funds are the product of the political earmarking process.

⁴ Foreign Policy Research Institute, "From Stone to Silicon: A Brief Survey of Innovation", Lawrence A. Husick, October 2008, <http://www.fpri.org/footnotes/1325.200810.husick.stonetosilicon.html>

⁵ *Reducing Infrastructure Construction Costs*, August 2008, p. 1.

As the National Institute of Standards and Technology recently reported, “Innovation is critical to the future of U.S. competitiveness and for enhancing our quality of life. This is increasingly important as political and technological changes open access to the global economy—producing both new markets and increased competition.”⁶

A recent report by the National Surface Transportation Infrastructure Financing Commission noted that “New technologies, such as electronic transponders, video recognition tolling, and satellite based payment systems, are creating new options for funding the transportation system that simply have not been available before. Although none of these options is in wide use yet across the country, these technological advances offer the promise of providing policy makers with new opportunities to not only raise needed funding but also improve energy efficiency, mitigate congestion, protect the environment, and improve safety.”⁷

The commission recognized the importance of using the latest technology “to improve the Nation’s ability to measure project performance data, including research into improved traffic, safety, environmental, and energy modeling. Improved tools for benefit-cost analysis and other forms of economic analysis for projects would also be another priority.”

Available technology should be able to make our infrastructure act just as a “smart building” and report on the inception of cracks in critical structural members, identify early formation of potholes when small pinholes appear and can be fixed for minimal cost, or warn when a bridge span is being overloaded and the early threat of a collapse can be addressed.

Bringing “smart building” technology to our nation’s bridges is a long way off. Simply stated, while research has been proceeding for many years in this area, the actual implementation of new technology to advance the antiquated methods for bridge inspection has hardly begun. As we will see below, even the federal government has undertaken surveys to begin to understand how state engineers perform needed inspections and has acknowledged that visual inspections are neither consistent nor reliable.⁸ As a result, many of the ratings of our “structurally deficient” and “functionally obsolete” bridges – ratings that determine how much federal aid for remediation will flow annually to the states – are inaccurately set by inspectors who choose to take a more conservative approach rather than rate an older bridge as needing less repairs.

⁶ National Institute of Standards and Technology, Fact Sheet, September 24, 2008, http://www.nist.gov/public_affairs/factsheet/strengthen_economy_safety.htm

⁷ Final report of the National Surface Transportation Infrastructure Financing Commission entitled “Paying Our Way: A New Framework for Transportation Finance.”, January 2009

⁸ [cite FHWA survey]

Almost all bridge engineers would prefer to see regular monitoring of bridges. Relying upon a network of sensors located at critical junctures along a bridge, the information adduced therefrom can guide engineers in making recommendations for early attention to bridge problems long before they transform themselves into major structural flaws -- and years before they become apparent to the average bridge inspector. According to Mohammed Attouney, a principal in New York City-based Weidlinger Associates, a firm with lengthy experience in the design and remediation of bridges, "No matter what we do, there are limits to the human sensing capabilities. We can't see hidden cracks, we can't feel the erosion after a flood." But available technology "can make the difference in a major disaster, a costly retrofit, or a minor retrofit."⁹

In January, 2009 the National Institute of Standards Testing (NIST), announced a series of grants to study new technology to advance the nation's ability to monitor bridge stresses. Based on studies completed and reported on in June, 2008, NIST found that:

- As the economy grows, we become even more dependent upon larger and more complex networks of civil infrastructure that require ever increasing expenditures to maintain their safety and security. Each year Federal, state, and local governments spend billions of dollars to upgrade and repair transportation systems and water resources.

- Public (Federal and state) expenditures on infrastructure have grown by 1.7% per year from 1956 to 2004 and in recent years, have been growing even more rapidly, rising by 2.1% per year, after adjustment for inflation.[2] This rate of growth translates into a constant fraction of GDP, about 1% to 1.2%, being spent on infrastructure.

- Despite these large expenditures the nation continues to suffer staggering consequences from infrastructure decay. Examples such as the August 2007 collapse of the I-35W bridge in Minneapolis, Minnesota that cost 13 lives and economic losses to the city's economy of close to \$200 million; the Environmental Protection Agency (EPA) reported that there are 240,000 water main breaks per year in the nation and the Washington Suburban Sanitary Commission, which manages a pipe system about twice the length of the U.S.-Mexico border, in suburban Washington, D.C., recorded 2,129 pipe breaks in 2007 and where leakages and breaks in water distribution systems are estimated to waste up to 6 billion gallons of drinking water each day.

- Damaged infrastructure also directly impacts the daily lives of a large number of Americans. The American Society of Civil Engineers (ASCE) estimates that Americans spend \$54 billion each year in vehicle repairs caused by poor road conditions.¹⁰

That current infrastructure condition and quality inspection practices are highly inaccurate has been studied and reported. In the most recent study of principal bridge inspection methods the

⁹ *Smart Roads, Smart Bridges, Smart Grids, Wall Street Journal*, February 17, 2009, p. __

¹⁰ *Advanced Sensing Technologies for the Infrastructure: Roads, Highways, Bridges and Water*, Technology Innovation Program, National Institute of Standards and Technology, Gaithersburg, MD 20899, June 2008, pp. 2-4

FHWA concluded that the condition ratings that these standards generate are “subjective, highly variable, and not sufficiently reliable for optimal bridge management.” The FHWA also reported that in-depth inspection, assigned for structurally deficient bridges, might “not yield any findings beyond those that could be noted during a routine inspection.”

Acknowledging the lag in developing and utilizing technologies that could be saving substantial federal and state remediation funds, the NIST report found that “There are currently no cost-effective, field-deployable sensing systems that are capable of providing continuous data with which to prioritize repair and renovation schedules and that provide sufficient warning of impending catastrophic failure.”¹¹

The age of reliance on purely visual inspection of our nation’s infrastructure should be brought to an immediate end. Technology investment and implementation must be given the highest priority. Until then, what would be wrong with developing provable checklists for bridge design, operation and maintenance to bring potential disasters that we no longer can afford down to a minimum?

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¹¹ Ibid., p. 5.

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A NEW PRESCRIPTION

Remedies for our ailing infrastructure

When it comes to our nation's ailing infrastructure, we can't simply throw money at the problem. Everything must change, from how we build it to how we manage it to how we fund it. We can no longer ignore the problems plaguing our roads, bridges, airports, power grid and levees. Nor can we move forward with a plan that allows us to merely fix the problems without including a plan to prevent them from sliding back into deterioration in the future.

To address the current needs and make the necessary structural changes in our system, we need to educate our politicians and our citizens about the critical state of our nation's infrastructure. We need to apply the latest available technology. And, we need to completely overhaul how we oversee the trillions of dollars of assets under our nation's transportation inventory.

Here are few things to consider moving forward:

1. Find resources and do better with them. According to the American Society of Civil Engineers, \$2 trillion is needed to fix and sustain our nation's infrastructure. That is a daunting amount that cannot be summoned up piece by piece. Finding the appropriate amount of funding will require that the federal government take a more active role in finding funding solutions and develop relationships between the public and private sectors. Most importantly, our nation's politicians and citizens need to recognize just how urgent the situation is. In order to meet the "need to maintain" level, the annual amount of federal highway and transit spending required is \$78 billion. Estimated average annual



By Barry B. LePatner

transportation revenues generate approximately \$32 billion, resulting in an annual revenue gap of \$46 billion (in 2008 dollars). To meet the "need to improve" level, the amount needed climbs to \$96 billion. That means a shortfall of \$64 billion (in 2008 dollars).

According to a study prepared by the National Surface Transportation

Infrastructure Financing Commission, when it comes to funding our nation's new project and infrastructure repair needs, there is no "silver bullet." But whatever solutions are developed, the study shows, the following steps should be taken:

- (a) set new priorities that accomplish national and regional, as opposed to state-specific goals; (b) identify more specific objectives for those seeking funding from national resources; (c) revise the mechanisms for funding and distributing transportation monies to the states by eliminating the discretionary use of federal funding for transportation needs solely determined by state and local politicians; and (d) apply new technology in design and construction to ensure we save costs up front and, more importantly, minimize the need for repairs and replacements that are currently draining our resources.

2. Develop a federal infrastructure bank. The challenge in today's economy is finding cost-effective ways to maintain, upgrade, and replace our aging infrastructure.

One potential solution is a national infrastructure bank.

During his presidential campaign, President Obama proposed a national infrastructure reinvestment bank that would invest \$60 billion over 10 years and multiply into almost half a trillion dollars of additional infrastructure spending, while generating nearly 2 million new jobs. But just as President Eisenhower used gas taxes to ensure his national road network paid for itself, a similar payback mechanism must be built into the plan for a national infrastructure bank.

Unfortunately, at present, proponents of the bank have made no assertions that repayment mechanisms, such as toll roads, will be included in the plan. If the goal of the federal government is economic growth, pumping billions of dollars into an infrastructure bank with no plan for replenishing those funds as they are used may fall short of being a fully operational idea.

3. Create a national clearinghouse for remediating our national bridges. Through the Federal Aviation Agency, the airline industry has alerts that immediately advise all airlines of problems with an aircraft and require immediate attention before similar planes can go back into service. A similar database should be created to require the Federal Highway Administration and the National Transportation Safety Board to alert all state transportation departments of any bridge failure in the nation and include methodologies for remedial design as well as alerts for maintenance problems for all of America's 600,000 bridges.

Of course, for such a system to work, we first need to make sure the information feeding into it is accurate. And that means updating the way we inspect our bridges. In testimony before a U.S. House of Representatives Committee on Science and Technology, bridge safety expert Mark E. Bernhardt explained that visual inspections - the most common form of inspection used today - are inadequate records of a bridge's true structural condition.

Similar to other experts in the field, Bernhardt recommended the installation of sensors and monitors onto bridge components, which enable transportation officials to remotely analyze how the bridge is performing at any point in time. By utilizing systems such as strain gages, weigh-in-motion systems, fiber optics, cameras, corrosion sensors and acoustic emission equipment, which are connected to central servers, bridge owners have the equivalent of a cardiograph for all critical structural members on a 24/7 basis. If

a national clearinghouse database was created, these findings could feed directly into it, keeping the public informed at all times. The information in the database could also be used to prioritize transportation budgets where bridge and road repairs and replacements are concerned.

4. We need a new federal strategy for infrastructure remediation. When President Eisenhower laid out his plan for a national highway system in the National Interstate Highway and Defense Act of 1956 he outlined clear goals: He wanted the federal government to become the strategic planner of a nationwide (as opposed to a state-centric) system of roads that were funded predominantly by a federal gasoline tax.

To ensure success, we need to develop a framework for a national policy on transportation that links our metropolitan areas and allocates funding where it can best be used to fulfill objectives.

Today's national transportation policy fails to provide such goals. Instead, hundreds of billions of dollars in transportation funding are distributed annually, and state politicians determine how and where such monies are used within their state borders. Basically, states get to choose whether they apply their funds to remediating aging infrastructure or building new projects. All too often, new projects win out.

Why do we need a coordinated national, as opposed to local, transportation strategy? Simply put, because the way we are operating now isn't working. When President

Eisenhower pushed through the National Interstate Highway and Defense Act of 1956, he tied the nation together under a plan governed out of and largely financed at the federal level. Today, there is no such national strategy, and our nation's infrastructure is suffering as a result.

THE ROAD AHEAD

What would a national transportation strategy look like? Our nation's continued economic growth is becoming increasingly dependent on how we choose to handle growth over the next 30 to 50 years. During this first half of the 21st century, our country will grow by more than 100 million people and we will be building more than 427 billion square feet of new and rehabilitated homes, offices, hospitals, hotels and schools, as well as roads, bridges and airports.

Without overarching vision, goals or guidance, we will inevitably make costly mistakes in the planning and execution of that growth. To ensure success, we need to develop a framework for a national policy on transportation that links our metropolitan areas, identifies needed flows of goods and traffic to minimize congestion, and allocates funding where it can best be used to fulfill our national and regional objectives.

It is time for our nation to begin treating our infrastructure system as a top priority rather than one that comes second or third on the list. Failure is no longer an option. Not only is public safety at issue, but failing to act now will forever mark the national destiny and heritage that we are creating for the future.



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