Miles to go...

Inside the R&D Tax Credit

By Charles R. Goulding, Jennifer Pariante & Jacob Goldman

The Highway Trust Fund, funded by a tax on the volume of gas consumed, recently faced imminent depletion and was expected to exhaust its resources last August. That's why President Obama repeatedly urged Congress to pass legislation for increased infrastructure funding. Without congressional action, the Federal Highway Administration wouldn't be able to maintain its same-day payments to reimburse states for infrastructure projects.

Last August, Congress agreed to provide $11 billion to prevent a 28 percent reduction in federal highway and mass transit spending. The Senate passed a House-written bill to boost federal gas and diesel fuel taxes for keeping the federal Highway Trust Fund solvent through this May. One silver lining in the oil price plunge is that increased gasoline sales will return a modest amount of capital back into the Highway Trust Fund. Government contractors that use the following innovations may be eligible for substantial federal and state R&D tax credits.

The Research & Development Tax Credit

Enacted in 1981, this allows a credit of up to 13 percent of eligible spending for new and improved products and processes. Qualified research must meet the following criteria:

- New or improved products, processes or software
- Technological in nature
- Elimination of uncertainty
- Process of experimentation

Eligible costs include employee wages, cost of supplies, cost of testing, contract research expenses and costs associated with developing a patent. Last December, President Obama signed the bill extending the credit.

The Infrastructure Gap

The *World Economic Forum's Global Competitiveness Report* for 2012-2013 ranked U.S. infrastructure fell to 14th in the world. The change can be explained by the country's aging infrastructure.

The estimated infrastructure needs predominantly will be generated by surface transportation systems, such as roads and bridges, as shown in the "Who Needs Them" chart on page 106.

In addition to threatening safety and well being, degrading infrastructure generates unquestionable inefficiencies and, consequently, higher costs to businesses and households. The result is higher prices for national and imported goods, fewer jobs and lower incomes. This would have major impacts on productivity, competitiveness, innovation and consumer spending. From a macroeconomic perspective, it's safe to say the infrastructure gap would severely compromise long-term economic development.

Surface Transportation

The condition of surface transportation infrastructure is key to economic vitality. The country's investment in roads is far behind many other countries, as portrayed in the "Cumulative Infrastructure Needs by System" chart on page 106. Productivity losses, higher operating costs for vehicles, decreased reliability, and bigger expenses with environmental and safety concerns are just a few examples of how deficient surface infrastructure impact a country's economic performance.

University Infrastructure Research

In response to the previously mentioned critical scenario, a growing number of universities and research centers are engaging in infrastructure R&D. Their efforts speak to the importance of this line of research and set the basis for innovation from the private sector. Universities such as Columbia, Harvard and MIT, among others, are researching and developing methods, processes and tools to improve America's infrastructure.

Innovation in Surface Transportation Infrastructure

The following sections present innovative solutions that promote efficiencies, reduce risks, accelerate delivery schedules, and cut costs of infrastructure projects involving bridges and highways.

Bridges

The U.S. Department of Transportation's Accelerated Bridge Construction (ABC) program uses innovative technologies to reduce the time of bridge planning and construction efforts. With new methods, designs and materials, the initiative aims to construct safer and more cost-effective bridges. Technologies include:

1. **Prefabricated Bridge Elements and Systems (PBES)** are structural components of a bridge built offsite or adjacent to the alignment. PBES reduces onsite construction time and mobility impact time.

Source: *The Economist*, America's crumbling infrastructure: Bridging the gap, June 28, 2014

Cumulative Infrastructure Needs by System Based on Current Trends Extended to 2020 and 2040 *(Dollars in $2010 billions)*

	2020			2040		
INFRASTRUCTURE SYSTEMS	TOTAL NEEDS	EXPECTED FUNDING	FUNDING GAP	TOTAL NEEDS	EXPECTED FUNDING	FUNDING GAP
Surface Transportation	$1,723	$877	$846	$6,751	$3,087	$3,664
Water/Wastewater	$126	$42	$84	$195	$52	$144
Electricity	$736	$629	$107	$2,619	$1,887	$732
Airports*	$134	$95	$39	$404	$309	$95
Inland Waterways & Marine Ports	$30	$14	$16	$92	$46	$46
TOTALS	$2,749	$1,657	$1,092	$10,061	$5,381	$4,681

*Airport needs and gaps include anticipated cost of NextGen: $20 billion by 2020 and $40 billion by 2040.

Source: American Society of Civil Engineers, Failure to Act Report, 2013

2. **Slide-In Bridge Construction** is a cost-effective technique for deploying PBES or quickly replacing an existing bridge. A new bridge is built on temporary supports parallel to an existing bridge. Once construction is complete, the road is closed and the existing bridge structure is demolished or slid out of the way. The new bridge is slid into place, tied into the approaches and paved within 48 to 72 hours.
3. **Geosynthetic Reinforced Soil – Integrated Bridge System (GRS-IBS)** is a construction method combining closely spaced geosynthetic reinforcement and granular soils into a new composite material. The method is used to construct abutments and approach embankments that are less likely to settle and create a bump at the end of the bridge. The GRS-IBS is easy to build and maintain and 25 percent to 60 percent more cost-effective than conventional construction methods.

These innovative methods enhance motorist and worker safety throughout bridge construction, lessen the environmental footprint involved, and constitute an alternative for climate-controlled and environmentally sensitive areas.

The preservation of existing bridges also is an important innovation field. The FHWA recently published a *Bridge Preservation Guide* that urges state DOTs to strategically manage their bridge assets in order to maximize their lifespans. The accurate monitoring of bridges' conditions is crucial to preservation. To this end, innovative, sensor-enabled systems can provide objective, actionable information to support decisions involving structural maintenance, repair or replacement.

Highways

The U.S. highway system is faced with daunting challenges – accommodating more traffic and higher loadings; reducing traffic disruptions during construction; meeting more stringent environmental, community and safety requirements; and continuing pressure to reduce costs.

These challenges require a continued commitment to innovation. Examples include simple, yet ingenious solutions, such as glowing lines, which consists in using luminous paint that glows for up to 10 hours through the night enhancing safety in remote, non-illuminated roads. Paint also can be used to warn drivers about the condition of road surface. Temperature sensitive paint can feature snowflake symbols when it drops bellow freezing.

The use of sensor-enabled systems also is a promising field for highway innovation. Interactive lighting systems can save power by detecting cars as they approach and switching on the lights up the road. Highway weather sensors provide highly accurate, real-time information on pavement temperature, amount of chemical, and surface friction or grip, enabling informed decision-making and enhanced safety for drivers. Sensors can also be used to monitor surface quality, detecting anomalies, such as potholes and speed bumps.

The condition of surface transportation infrastructure is key to economic vitality.

Cutting-edge technologies also have enabled faster, more accurate and efficient highway projects. For example, three-dimensional (3D) modeling provides geospatial visualization of intricate design, offering 3D viewing from multiple perspectives. It further enables the running of simulations prior to construction aimed at detecting potential flaws.

When it comes to increasing road durability, it's critical to avoid the premature cracking and crumbling of pavement. Innovative intelligent compaction (IC) rollers have contributed to improving the quality, uniformity and long-lasting performance of pavements. Such rollers are equipped with control systems that collect, process and analyze compaction data in real time, allowing operators to monitor and perform eventual corrections to the compaction process. In comparison with traditional static rollers, IC ones can compact greater amounts of pavement with fewer passes and in shorter periods of time, yielding cost and fuel savings. **CCR**

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