R&D Tax Credits for the Architecture & Engineering Industry

R&D Tax Savers
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R&D Tax Credits provide excellent opportunities for innovation in the Architecture & Engineering industries.

A&E firms are in a great position to claim federal and state Research and Development (R&D) Tax Credits. As one of the most R&D intensive industries in the nation, A&E is also one of the most far reaching. The architectural industry is connected to over 18 percent of the US GDP and 20 percent of all American jobs. Many of the activities required to design and construct a new building, expand and improve an existing structure, asses the suitability of land and soil conditions, and provide general consulting and engineering services often qualify for R&D Tax Credits.

Most activities performed by project architects, engineers, and other design consultants are R&D intensive under the current tax law guidelines. Developing new or improved designs, assessing designs through various forms of modeling and computational analysis, structural engineering, and design of MEP systems are all activities that generally qualify R&D Tax Credits.

Other activities that typically qualifying include the consideration of different building materials, the selection of equipment, and the improvement of construction processes for increased efficiency and reliability. R&D Tax Credits are available to help support and stimulate innovation for architectural and engineering firms engaging in activities such as these.

The Research & Development Tax Credit

Enacted in 1981, the federal Research and Development (R&D) Tax Credit allows a credit of up to 13 percent of eligible spending for new and improved products and processes. Qualified research must meet the following four 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. On December 18, 2015 President Obama signed the bill making the R&D Tax Credit permanent. Beginning in 2016, the R&D credit can be used to offset Alternative Minimum Tax and startup businesses can utilize the credit against $250,000 per year in payroll taxes.

State R&D Tax Credits

As of 2015, 40 out of 50 states in the U.S. offer their own R&D Tax Credits to encourage new job creation and business growth.

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These state incentive programs are in addition to federal R&D Tax Credits and often mirror the federal benefit – with some states offering even higher incentives.

Structural Engineering

Structural engineering focuses on the framework of structures and designing those structures to remain safe, stable, and secure throughout their useful life. When designing buildings, bridges, roads and tunnels[i], engineers must take into account the conditions of the terrain, wind, water, and traffic volume.[ii] All of these factors provide technical uncertainty about the feasibility of a given design. A structural engineer conducts a number of activities on a daily basis which tend to qualify for R&D Tax Credits. These activities generally include:

- Analyzing blueprints, reports and topographical data
- Considering the cost, quality and quantity of materials
- Determining how those materials will perform under various conditions
- Conducting studies to assess the feasibility of an unlimited number of variables
- Computing load and grade, stress factors, and water flow requirements
- CAD modeling and the creation of architectural models
- Design and alteration of architectural drawings

A&E firms are in a great position to claim federal and state R&D Tax Credits as many of the typical industry activities are credit eligible.

The entire process of structural design and engineering requires not only conceptual thinking but also requires the research of codes and by-laws, principles of physics and the consideration of risks. Despite recent technological advancements, engineers still rely on experience and judgment in daily decision making processes. In addition, framing plan alternatives must be considered and designed to compare the individual material fabrication/erection costs to identify the most efficient and economical design for the structure. Most of these activities are federal and state R&D Tax Credit eligible.

Seismic Engineering

A&E firms must design buildings that follow safety codes and are built strong enough to withstand any natural weather events that may occur. The main natural hazards that can affect buildings are hurricanes, earthquakes, tornados and flooding. Generally, architects and engineers have a responsibility to ensure that the most optimal design is created to prevent a large amount of damage from occurring during these events.

Certain locations that are prone to earthquake activity require specially designed buildings to withstand shear forces. The Federal Emergency Management Agency (FEMA) has established a guideline for designers to follow when designing building plans for structures located in potential areas where earthquakes may occur. When designing a building in a common earthquake zone, for example, one strategy is to design with flexible aspects and using reinforcements. Additional important factors to consider are the strength, stiffness, force distribution, stress concentration and ductility of a building.[iii]

Strength and stiffness are particularly important considerations in designing a building. The strength of a building is significant because a structure has to be able to support certain loads that may be produced from seismic activity. A designer should create a building with enough stiffness to ensure that the foundation won't bend under load but enough flexibility so that it won't crack under seismic conditions. To prevent any torsional forces (rotational movement) from occurring, a structure should be as symmetrical as possible because in the event that forces are pushed against the building they will be evenly distributed. Time spent considering such factors and designing with different alternatives in mind is generally R&D Tax Credit eligible activity.

Energy Efficient & Sustainable Design

Architectural design activities conducted in connection with energy efficiency improvement measures also tend to qualify for federal R&D Tax

Credits. Utilizing a sustainable design philosophy encourages decisions at each phase of the design process that aim to reduce negative impacts on the environment and the health of building occupants. These activities can range from researching federal, state and local code requirements to evaluating fixtures and equipment to Building Information Modeling (BIM).

Buildings are the largest energy consuming sector in the world, and account for over one-third of total final energy consumption. Achieving significant energy and emissions reduction in the buildings sector is a challenging and technological process that involves the consideration of alternatives, technical uncertainty and in most cases a process of experimentation. The following activities affect the energy performance of a building, and are qualifying R&D activities:

- Conducting research aimed at reducing a building's energy consumption
- Designing building component alternatives
- Evaluating building component alternatives
- Designing, constructing and testing prototypes
- Evaluating and experimenting with new building material
- Evaluating new fixtures & equipment
- Designing to obtain LEED points
- Building Information Modeling
- Paying outside consultants to conduct any of the above activities

Environmental Engineering

Design and engineering activities conducted in connection with Brownfield Redevelopment, remediation design, solid waste system design and drainage system design all tend to qualify for R&D Tax Credits. Remediation efforts can range from large, expensive projects such as the BP oil spill in 2010, to smaller, less costly projects, such as cleaning up a highway accident in which oil, asphalt, or other contaminant is spilled. Based on this wide range of projects, individual spills can present their own technical issues based on factors such as size, site, required remediation, specific chemicals, and contaminants.

A recent Federal Tax Court case involves a dispute over R&D Tax Credits, the Eleventh Circuit court elaborated on the type of activities that will generally qualify for R&D credits in this sector[iv]. These activities include the following:

1. Site studies
2. Design work, including site design;
3. General services, including permit applications and construction drawings;
4. Preparation of an operation and maintenance manual;
5. Construction-related services, including on-site supervision and quality assurance monitoring;
6. Post-construction services, including as-built drawings and a project completion report; and
7. Additional analyses, modeling, and testing.[v]

MEP Design & Engineering

Design and engineering activities conducted in connection with HVAC systems, electrical systems and piping and plumbing systems are also R&D credit qualifying activities. The redesign of existing systems for building renovations, retrofitting facilities to meet updated codes or to support new uses, and the design of new building systems all involve technical uncertainty and the consideration of alternative design patterns. Certified professionals create comfortable and energy efficient buildings by designing, installing, and commissioning new facilities and investigating, analyzing, trouble-shooting, and commissioning existing systems.

High tech facilities such as research labs, hospitals and manufacturing plants demand precise air and temperature control environments. Achieving the correct combination and interaction of many variables, in relation to each unique facility is an iterative process. Engineers developing these projects routinely alter designs, conduct studies, and assess system performance using Computer Aided Design (CAD) and Building Information Modeling (BIM) systems.

During each project, state-of-the-art MEP systems are tailored to meet each individual client's needs. The sizing and selection of high-performance equipment involves an in depth technical analysis. In many systems, the latest technology is utilized to harness free energy from simple methods such as daylight harvesting, photovoltaic collectors and geothermal heating. This combination of natural occurring and mechanically generated energy involves dynamic and sophisticated interactions among many variables.

Civil Engineering

Civil engineering involves analyzing land, grade and soil conditions; traffic management analysis; utility design; pavement & sidewalk design; and wastewater management system design. Civil engineers design bridges, docks, tunnels, dams and airport runways as well. Many of these projects involve significant Research and Development. For example, modern software programs are typically used by port designers and naval architects for planning and managing vessel moorings. Mooring arrangements can be very complex, putting dynamic strain on dock piles, vessels and nearby structures.[vi] In designing ports and other water-based structures, many variants must be considered. Tidal current, wind conditions, pile strength, pile depth and soil conditions must all be evaluated and used as inputs. With the use of software, naval architects can discover optimal techniques for arranging and tending to mooring lines. This often involves a technical process of experimentation that is aimed to reduce uncertainty in port design.

Green Infrastructure

Incorporating green infrastructure within cities is beneficial because there isn't a lot of nature that exists in these locations. Large cities, such as Philadelphia and New York City, have decided to create green infrastructure plans and invest a large amount of money to implement these plans. Philadelphia's plan is expected to cost $1.2 billion to complete the whole project. Once completed 1.5 billion pounds of carbon dioxide will be prevented from traveling into the air therefore improving air quality.[vii] New York City's plan will create a healthier city by decreasing the amount of carbon dioxide and energy usage resulting in improved air quality and property value.

Green infrastructure can provide many advantages to an existing environment. Green infrastructure includes permeable pavements, bioswales, bioretention devices and vegetated buffers.[viii] Implementing these types of green infrastructure is environmentally friendly, prevents storm water runoff, creates a more aesthetic community, lowers building energy usages, reduces air pollution and can even act as a form of safety for pedestrians.

NYC's Lowline

James Ramsey and Dan Barasch collaborated to design a plan for a future underground park in New York City.[ix] Their vision was to transform an abandoned area and create an open space that could be utilized by individuals year round in the city. The planned Lowline is set to be completed by 2021 if enough funding is collected and the proposed timeline for the project is followed through.

The urban space will hold various types of plants that would be able to survive by collecting sunlight from solar panels[x] which would travel underground through tubes. Currently, the owners have opened Lowline Labs, which is a warehouse showcasing a smaller version of the future Lowline to demonstrate the potential success of implementing an underground park within a city.

Skyscrapers

With the introduction of highly advanced elevators and strong steel frames, A&E firms have been able to design increasingly taller skyscrapers. One of the difficulties of designing skyscrapers is that tall buildings are prone to swaying due to their massive size. Dampers are a type of material that is normally utilized in skyscrapers to prevent a large amount of movement occurring due to high winds. Dampers consist of 300-800 ton steel components that are attached to chains at the top of the building. These huge devices assist in balancing out wind patterns to stable the tower.[xi] [xii]

Wind is a huge factor to consider when designing tall buildings. There are times when the highest elevation of a building may have to withstand strong winds of 100 miles per hour (mph). To create an effective design, the shape of a building is usually round or contains notched corners to break up the wind and can have open gaps to let wind pass through the building.

Architects and engineers work together to create an aesthetic yet cost effective building. Utilizing materials to reinforce the building can be expensive, but creating an exoskeleton for a building is an option that allows designers to cut down on costs while maintaining an aesthetic design.[xiii] An exoskeleton essentially consists of a continuous shape in the form of triangles or the letter "X" to create a structurally stable exterior.

Healthcare

One of the largest projects for A&E firms consists of designing healthcare facilities, which can include hospitals[xiv], nursing homes, psychiatric facilities and outpatient clinics. Facilities are always being renovated and updated due to utilization of new technology and an increasing number of patients. In particular, hospitals are an important part of communities and require specific designs.

A building should provide a hygienic environment for individuals in order to prevent any diseases from spreading. One of the most critical elements when developing a facility is designing an efficient ventilation system. Having the proper air ventilation is important because it allows for circulation of sanitized air and can prevent any infectious diseases from spreading. Special materials, such as antimicrobial surfaces, should be implemented within rooms to maintain a sterile environment.

Hospital designs follow the most regulations compared to other buildings. State & Local building codes have to be followed which are based on the International Building Code (IBC).[xv] Occupational Safety and Health Administration (OSHA) standards are adhered to as well which provide a safe environment. Although meeting these building codes and standards can be challenging, A&E firms utilize modern concepts and technology to develop designs.

BIM Technology

It is important for architects and engineers to ensure that a building is properly designed and planned before beginning construction. Utilizing computers and software technology allows designers to create the most optimal building structures. Building Information Modeling (BIM) software is a tool that is utilized by many A&E firms to assist in creating accurate and efficient building designs. BIM programs offer companies the availability of tools to examine a design and determine if there are any potential conflicts that can be avoided.

Building Information Modeling technology is 3-D modeling software that allows designers to receive the most accurate and detailed model of a proposed structure. This design software program can be utilized to analyze architectural designs, civil and structural engineering, urban and smart city designs, highway and tunnel designs and much more.[xvi]

Ultimately, a 3-D model is created by combining layers of design plans and detailed information to create the final structure. Information can range from building costs to the building's estimated lifespan. Implementing detailed data into one model gives architects and engineers the tools to fully analyze a design and any potential effects that may occur to the building and its surrounding environment.

One of the most beneficial aspects of a BIM model for designers is they are able to detect if there are any existing conflicts within the design. This is important because any clashes that are discovered can be prevented and modified to create a new functional design. For instance by looking at a model, designers can see where certain clearances are and determine if there are any electrical, plumbing or HVAC systems that may possibly interfere with one another.

Conclusion

Architecture and Engineering firms are in a great position to claim federal and state Research and Development (R&D) Tax Credits. Energy efficient sustainable design, MEP systems design, engineering, environmental engineering, structural engineering, and civil engineering are all sectors that rely heavily on R&D activities. R&D Tax Credits can help support and stimulate innovation within the A&E industry.

[i] See "The R&D Aspects of Modern Tunnel Design and Construction." Commercial Construction & Renovation Magazine. Charles R. Goulding, Michael WIlshere and Andrea Albanese. December 2015. Available at: http://ccr-mag.epubxp.com/i/614058-nov-dec-2015/158

[ii] See "The R&D Tax Credit Aspects of Infrastructure Innovation" by Charles R. Goulding, Andressa Bonafe and Charles G. Goulding, available online at: http://www.rdtaxsavers.com/articles/Infrastructure-Innovation

[iii] "Earthquake Effects on Buildings." Christopher Arnold. FEMA. Available at: http://www.fema.gov/media-library-data/20130726-1556-20490-0102/fema454_chapter4.pdf

[iv] U.S. Courts of Appeals – Geosyntec Consultants Inc. v. United States, 776 F.3d 1330 (Eleventh. Cir. 2015), Available at: http://media.ca11.uscourts.gov/opinions/pub/files/201411107.pdf

[v] See "The R&D Tax Credit Aspects of Environmental Remediation" by Charles R. Goulding, Michael Wilshere and Jennifer Reardon, RDTS Publishing, Available online at: http://www.rdtaxsavers.com/articles/Environmental-Remediation

[vi] See "The R&D Tax Aspects of Coastal Protection Infrastructure." by Charles R. Goulding, Andressa Bonafe and Charles G. Goulding, October 2014. RDTS Publishing. Available at: http://www.rdtaxsavers.com/articles/Coastal-Protection-Infrastructure

[vii] "Green Infrastructure: Cities." The American Society of Landscape Architects. Available at: https://www.asla.org/ContentDetail.aspx?id=43535

[viii] "Sustainable Transportation and Storm water: Green Streets." The American Society of Landscape Architects. Available at: https://www.asla.org/sustainabletransportation.aspx#GreenStreets

[ix] "The Lowline, the World's First Underground Park, Is Coming to New York City." Kevin J. Ryan. July 13, 2016. Available at: http://www.inc.com/kevin-j-ryan/lowline-underground-park-coming-to-nyc.html

[x] See "The R&D Tax Credit Aspects of Solar Photovoltaic Development" by Charles R. Goulding, Andrea Albanese and Andressa Bonafe, RDTS Publishing, Available online at: http://www.rdtaxsavers.com/articles/Photovoltaic-Developments

[xi] "The Engineering Tricks Behind the World's Super Tall and Super Slender Skyscrapers." Patrick Sisson. Vox Media, Inc. September 24, 2015. Available at: http://www.curbed.com/2015/9/24/9917752/the-engineering-tricks-behind-building-slender-taller-towers-and

[xii] See "The R&D Tax Aspects of Super-Tall Skyscrapers" by Charles R. Goulding and Lara Tomiko, Commercial Construction and Renovation Magazine, pending publication

[xiii] "How to Keep a 1,500 Foot Skyscraper from Falling Over." Sophia Chen. Wired. July 27, 2015. Available at: http://www.wired.com/2015/07/keep-1500-foot-skyscraper-falling/

[xiv] "Healing Havens: The R&D Tax Credit Aspects of Hospital Design and Construction." Charles R. Goulding and Lauren Chin. Commercial Construction, & Renovation Magazine July-August 2016. Available at: http://ccr-mag.epubxp.com/i/715479-jul-aug-2016/120

[xv] "Hospital." Robert R. Carr. National Institute of Building Sciences. April 21, 2011. Available at: https://www.wbdg.org/design/hospital.php

[xvi] "BIM 101: What is Building Information Modeling." Erin Green. ENGINEERING.com, Inc. February 3, 2016. Available at: http://www.engineering.com/BIM/ArticleID/11436/BIM-101-What-is-Building-Information-Modeling.aspx