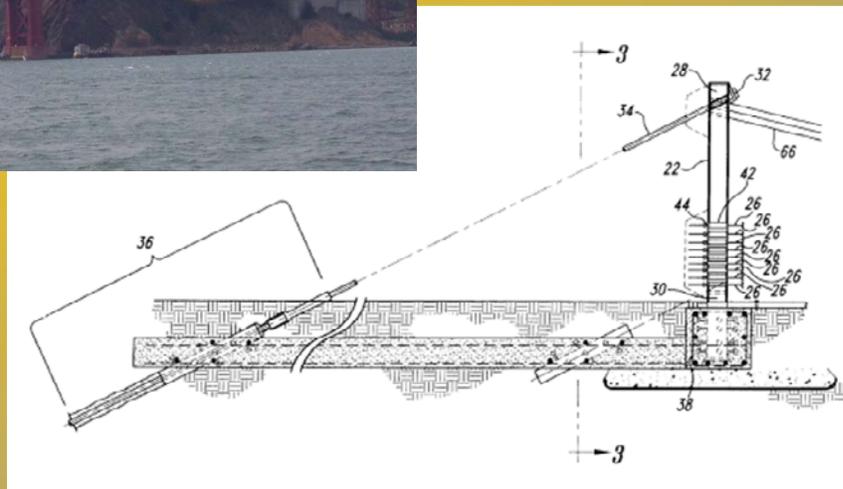


Civil Engineering Patenting *in the United States and the World*



2013
Report



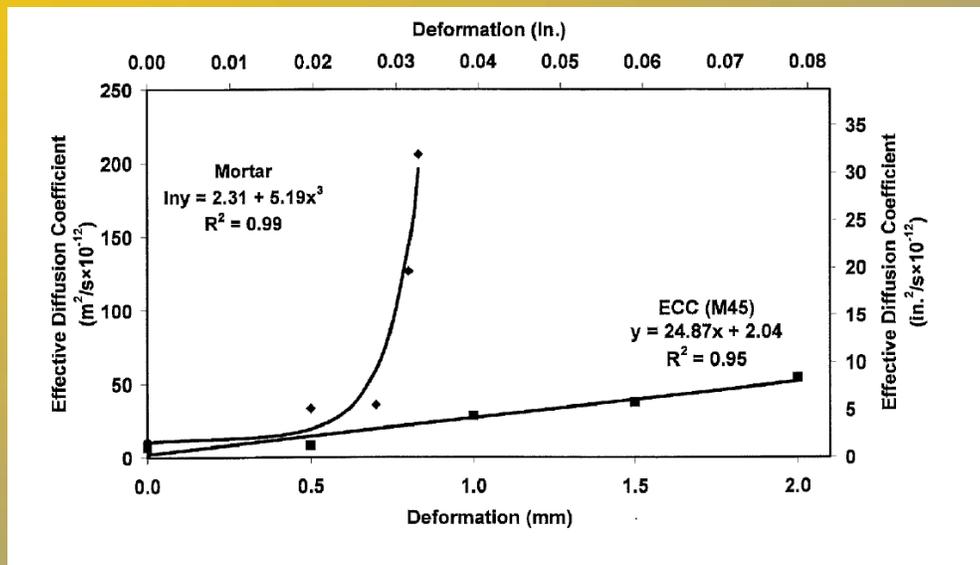
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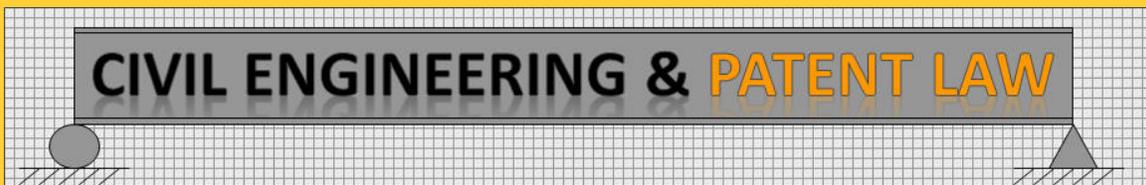
U.S. Patent No. 7,572,501, "Engineered Self-Healing Cementitious Composites," issued to Victor C. Li and En-Hua Yang of the University of Michigan

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who knows patent law ... and civil engineering*

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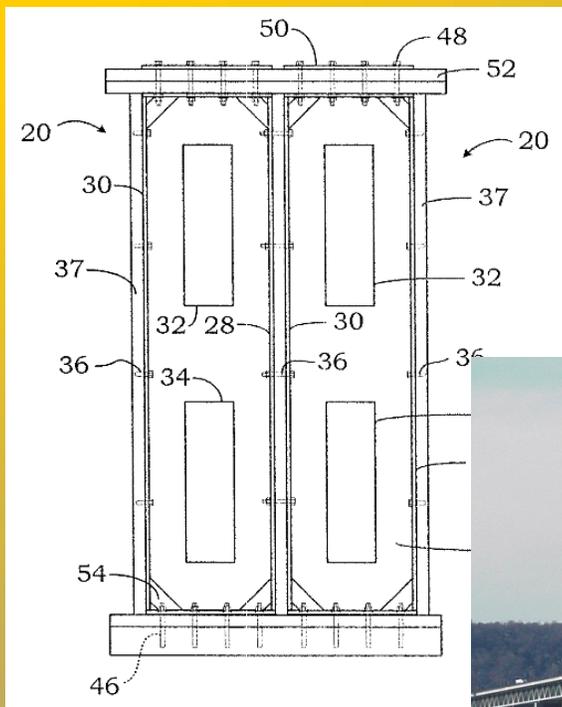
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Highlights

An estimated 1 out of 160 patent applications filed each year worldwide claims inventions that civil engineers would probably view as truly “civil engineering” subject matter. Inventions directed to structural engineering and geotechnical engineering account for most civil engineering patenting. The structural engineering areas of modular building systems and reinforcing techniques, and the geotechnical areas of retaining walls and pile-driving tend to lead patenting activity in civil engineering.

The top patenting entities in civil engineering in the United States generally comprise manufacturing corporations. Worldwide, the leading nations for acquiring civil engineering patent protection include the United States, Japan, Germany, and China.

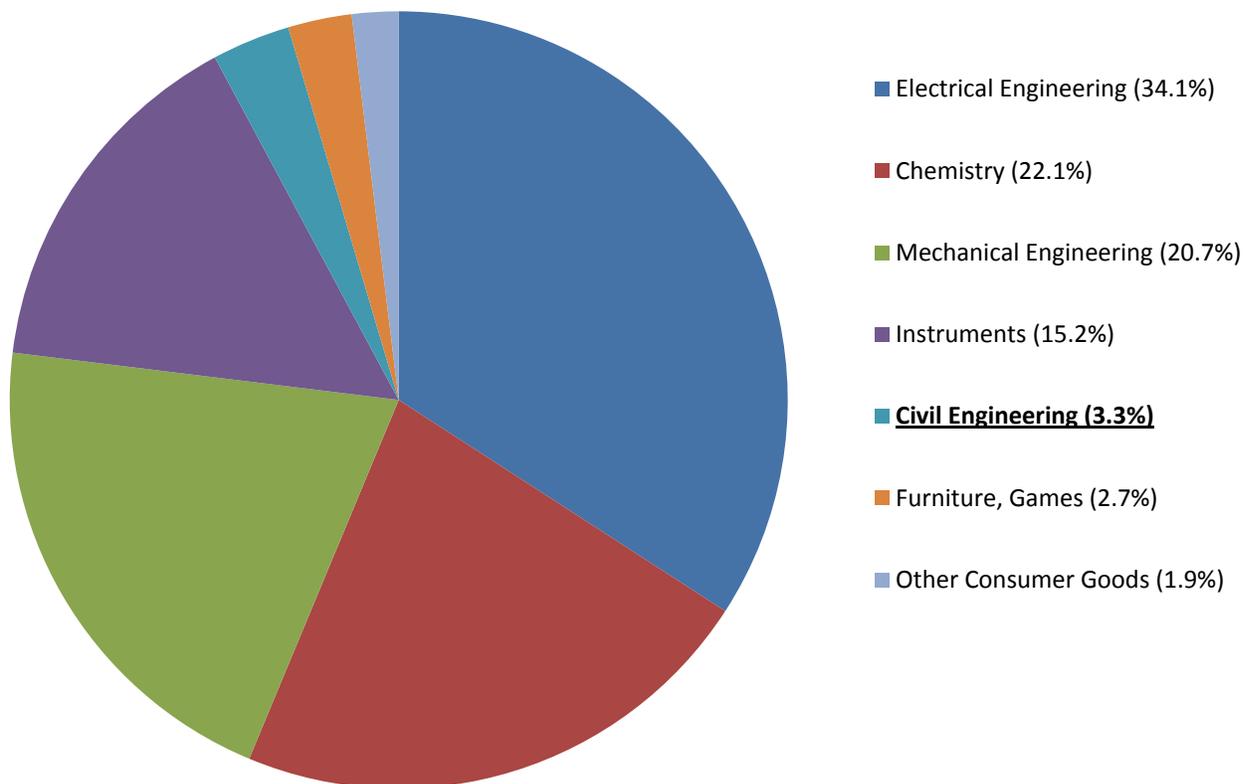


By the Numbers

Patenting authorities classify only slightly over 3% of worldwide patent applications filings as directed to so-called civil engineering subject matter. See Fig. 1. Globally, mechanical engineering patent applications outnumber civil engineering applications by a ratio of over 6 to 1, and electrical engineering patent applications outnumber civil engineering applications by a ratio of over 10 to 1.

Fig. 1: Worldwide Patent Applications Filings by Technology Area

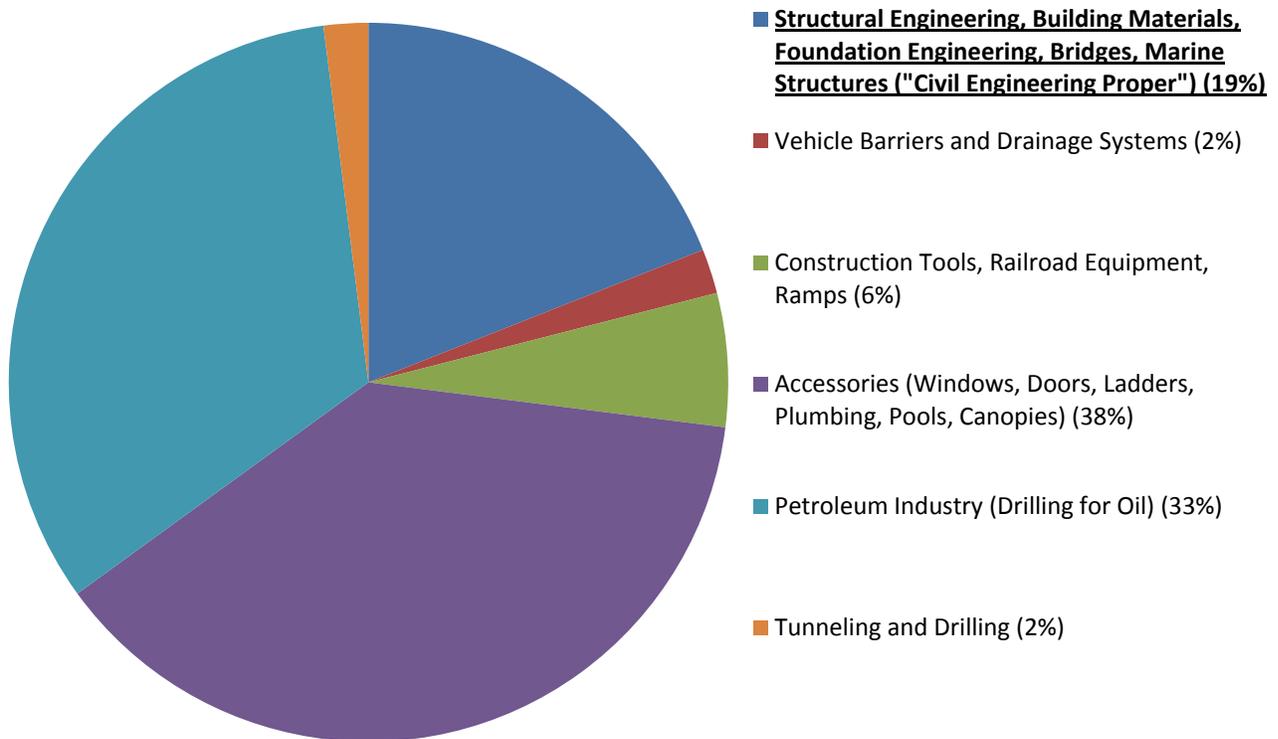
Based on Global Annual Average Filings from 2006-2010



Numbers are based on averages of World Intellectual Property Organization (WIPO) statistics for 2006-2010, published by WIPO in 2012 (most recent data available).

By the Numbers *(continued)*

Fig. 2: Civil Engineering Patent Subject Matter
*Based on Numbers of U.S. Patents in Force in Civil Engineering
Patents Classes*



Numbers are estimates of U.S. patents currently in force and assigned to civil engineering patent classes. "Civil Engineering Proper" includes patents classified into International Patent Classification Codes E01D, E02B, E02D, E04B, and E04C.

Looking more closely at what patenting authorities consider "civil engineering" subject matter further sharpens the contrast between civil engineering filings and other disciplines. In addition to core areas such as structural engineering and geotechnical engineering inventions, patent authorities such as the United States Patent & Trademark Office and the World Intellectual Property Organization also group somewhat far-flung subject matter into the category of "civil engineering." This broader concept of civil engineering also includes subject matter such as windows, doors, plumbing, vehicle barriers, construction tools, and tunneling. See Fig. 2. Petroleum industry inventions such as, for example, drilling and extracting oil, also fall into the civil engineering category and account for about one-third of all "civil engineering" patent applications filed worldwide.

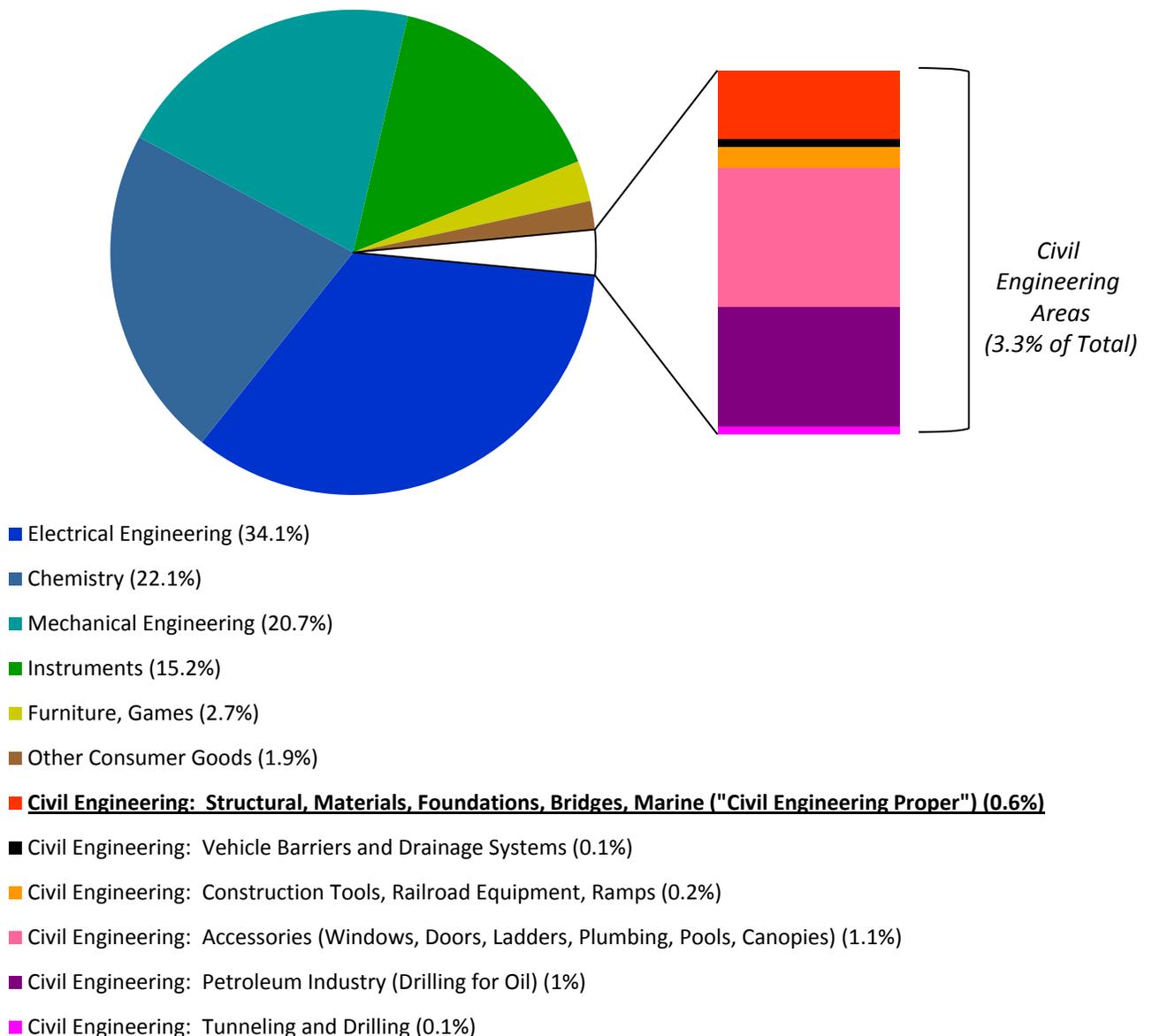
By the Numbers *(continued)*

This broad definition used by patent professionals results in many of the inventions classified as "civil engineering" likely falling outside of many civil engineers' conception of what constitutes civil engineering. In fact, many civil engineers would arguably only find about one-fifth of the inventions categorized as "civil engineering" by patent organizations to actually qualify as civil engineering, based on typical structural and geotechnical civil engineering university curriculum. See Fig. 2 ("Civil Engineering Proper" as only 19% of U.S. patents in force classified by patenting authorities as civil engineering).

Assuming that the subject matter breakdown of U.S. "civil engineering" patents in Fig. 2 roughly corresponds to the subject matter of patent applications filed worldwide in Fig. 1, the actual percentage of overall patent applications directed to what many civil engineers consider as civil engineering drops well below the World Intellectual Property Organization's official total of 3.3% depicted in Fig. 1. As shown in Fig. 3, only an estimated 0.6% of overall patent applications filed worldwide probably fall into subject matter civil engineers would consider as "civil engineering." See Fig. 3 on the next page ("Civil Engineering Proper" as only an estimated 0.6% of overall worldwide patent filings). Therefore, only an estimated 1 out of 160 total patent applications filed worldwide, including all disciplines, likely qualifies as a civil engineering invention based on typical civil engineering university training.

By the Numbers *(continued)*

Fig. 3: Worldwide Patent Applications Filings by Technology Area
Based on Global Annual Average Filings, 2006-2010, with Civil Engineering Estimates



This Figure combines data from Figures 1 and 2 to provide a rough estimate of civil engineering patent application filing worldwide, relative to all patent subject matter. An assumption of this estimate is that the data from Figure 2 for U.S. civil engineering patents in force roughly corresponds to trends in worldwide patent application filing in civil engineering. The purpose of this estimate is to provide the reader with a rough idea of the number of worldwide patent application filings directed to "Civil Engineering Proper" subject matter. Numbers may not add up to 100.0% due to rounding.

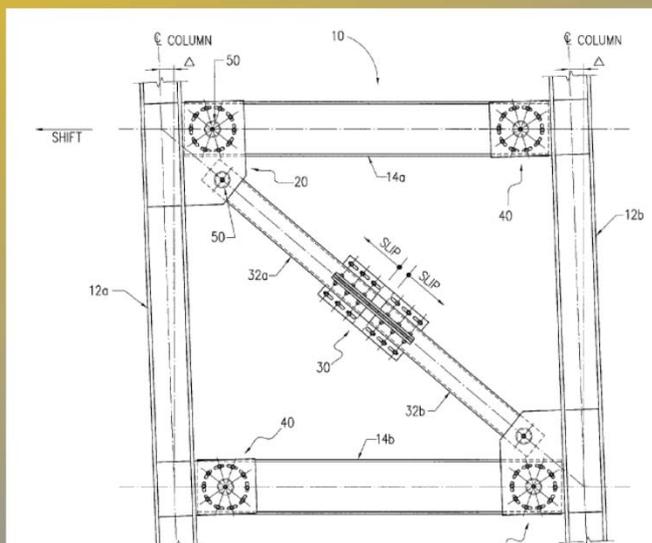
Subject Matter

Patented subject matter at the core of civil engineering primarily encompasses structural engineering and geotechnical engineering, and also to a lesser extent bridge engineering and hydraulic engineering. The discussion below sets forth some relatively concentrated areas for civil engineering patenting in the United States. Although U.S. Patent and Trademark data supplies the basis for the below discussion, many of these patents originate from foreign national patent applications or international patent applications. Accordingly, worldwide civil engineering patenting trends probably roughly mirror activity in the United States.

Structural Engineering

Modular building systems probably lead the structural engineering area in volume of patenting activity, including patented inventions on structural building panels, insulated wall panels, and modular wall blocks. Related to modular building, the area of **precast concrete building systems** also sees relatively heavy patenting. **Anchor systems** and **reinforcing systems** for both concrete and masonry applications also experience relatively high levels of patenting activity, including patents directed to prestressed concrete, reinforced concrete, and masonry anchoring. The structural engineering areas of **seismic design** and vibration isolation also experience relatively elevated patenting levels. **Expansion joint systems** also number among the relatively densely patented subject areas of structural engineering. Another patent-heavy area involves **structural connections** such as moment connections and steel-concrete connections.

Additionally, patenting activity occurs in most other areas of structural engineering, though perhaps not to the extent of the activity in the structural engineering areas listed above. For example, additional patented areas include innovative steel members, lightweight elements, truss systems, building frame systems, new types of joint connections, and novel structural materials.



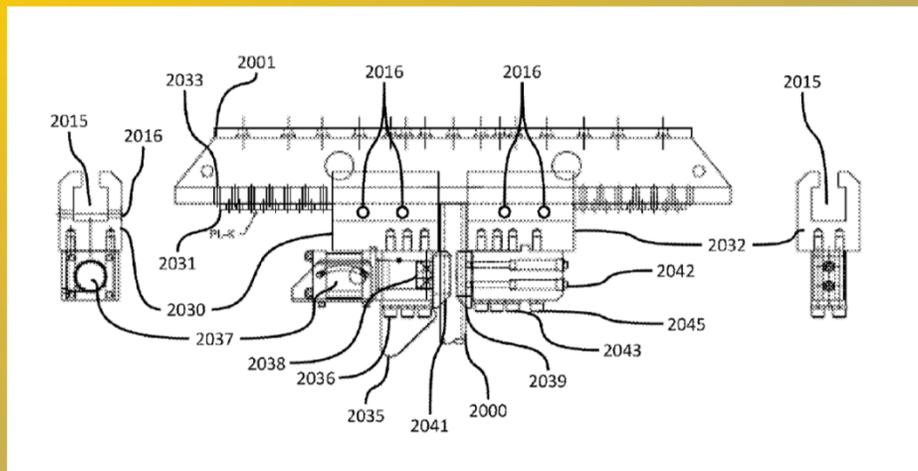
*Structural Engineering Example
Patent: US Patent No. 8,353,135 to
Mark P. Sarkisian and assigned on
its face to Skidmore Owings &
Merrill LLP, "Seismic Structural
Device," issued January 15, 2013*

Subject Matter *(continued)*

Geotechnical Engineering

Leading patenting areas in geotechnical engineering include technologies involving **retaining walls**, **ground anchors**, and **piles and pile-driving**. **Sheet pile** technologies and **soil reinforcement** methods also see a significant amount of patenting activity in geotechnical engineering. Concentrations of patenting also exist in foundation engineering, particularly in **wind turbine foundations**.

Less significant patenting activity, at least in terms of volume, occurs across a wide range of other geotechnical engineering areas. Some of these additional areas include patented inventions related to, for example, culverts and geosynthetics.



Geotechnical Engineering Example Patent: US Patent No. 8,425,157 to Kelly P. Goranson and assigned on its face to American Piledriving Equipment, Inc., "Clamp for Pile Driving," issued April 23, 2013

Subject Matter *(continued)*

Bridge Engineering

Because of the overlap of bridge engineering with structural engineering and geotechnical engineering, many of the technologies used in bridges also appear above. The U.S. Patent & Trademark Office does, though, specifically categorize some civil engineering patents as bridge technologies. Some of the more significantly patented areas relating to bridge technologies involve **prestressed and post-tensioned concrete** bridge construction. Some other specific patented bridge technologies include modular bridge systems and bridge shoring systems.

Hydraulic Engineering

Subsea structures, including piles, and **erosion control systems** tend to lead patenting activity in hydraulic engineering. Other areas with less patenting activity include, for example, wave attenuation systems and spill barriers.

Leading Filers

Numerous enterprises hold significant U.S. patent portfolios covering civil engineering technology. The companies illustrated in Fig. 4 and described below have led activity in civil engineering patenting in the United States over the past few years in areas considered "civil engineering proper," as described above in Figs. 2 and 3. As described below, most of the top patenting entities in civil engineering in the United States generally comprise manufacturing corporations.

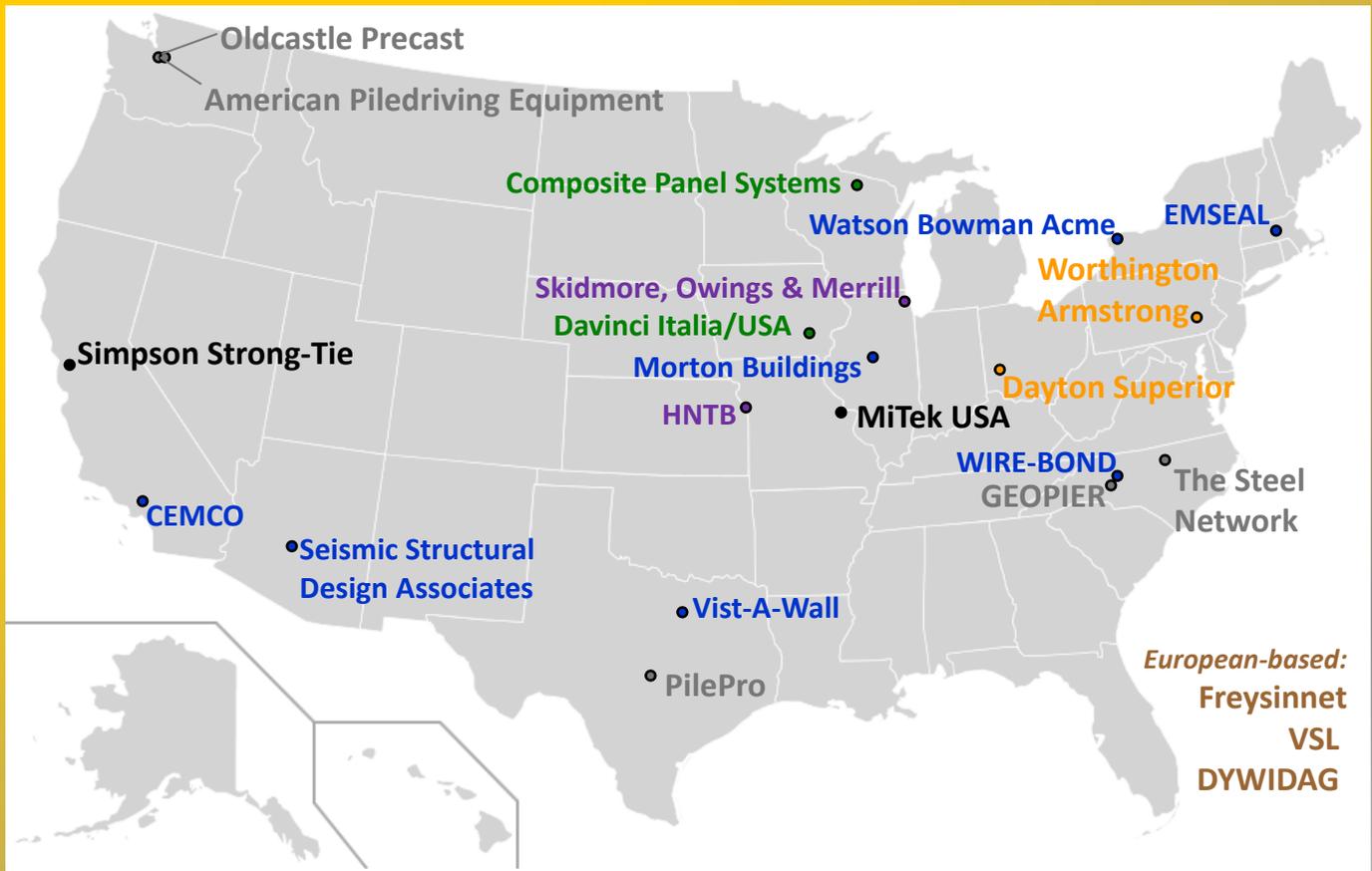


Fig. 4: Leading Entities for Patenting Civil Engineering Inventions

<u>Legend</u>	
Group 1	Group 4
Group 2	Group 5
Group 3	Group 6
Group 7	

Leading Filers *(continued from Fig. 4)*

Group 1. **Simpson Strong-Tie** Company, Inc. and **MiTek USA** lead the field of civil engineering patenting. Both companies hold hundreds of patents, many falling into solidly civil engineering patent classes.

Group 2. Though patenting in smaller numbers overall than the above companies of Group 1, the firms in Group 2 hold patent portfolios focused on civil engineering subject matter: **American Piledriving Equipment**, Inc., **GEOPIER** Foundation Company, Inc., **Oldcastle Precast**, Inc., **PilePro**, LLC, and **The Steel Network**, Inc. Pound for pound, these companies develop significant patented innovations in civil engineering.

Group 3. Although **Worthington Armstrong** Venture and **Dayton Superior** Corporation file significant numbers of patent applications and possess large patent portfolios overall, fewer of these firms' patents qualify as truly civil engineering technologies (i.e., most do not qualify as "civil engineering proper" as described in Figs. 2 and 3 above).

Group 4. Similar to the second group above, the fourth group of companies holds patent portfolios focused on civil engineering technologies, although in smaller numbers than the bigger filers in the first and second groups. This group includes **CEMCO** (California Expanded Metal Products Company), **Vist-A-Wall** Systems, **EMSEAL** Joint Systems, LTD, **WIRE-BOND** (*Masonry Reinforcing Corporation Of America*), **Morton Buildings**, Inc., **Seismic Structural Design Associates**, Inc., and **Watson Bowman Acme** Corporation.

Group 5. Few civil engineering design consultants patent their innovations. The two companies of this group, **HNTB** and **Skidmore Owings & Merrill** LLP, comprise the exception by owning significant patent portfolios. Although HNTB's portfolio seems to tend more toward mapping and business methods, Skidmore Owings & Merrill's portfolio appears to focus on areas qualifying as "civil engineering proper" above, such as structural engineering inventions.

Group 6. While most patent owners are either manufacturing or design corporations with patent portfolios covering their products or individual inventors owning just a few patents, this group includes two apparent nonproducing entities (NPEs) holding significant civil engineering patent portfolios: **Composite Panel Systems**, LLC, and **Davinci Italia/USA** Group, LLC. Patent critics sometimes label NPEs as "patent trolls" when these type of entities initiate patent litigation against manufacturers (note: at the time of this writing, no patent cases were found involving either Composite Panel Systems, LLC, or Davinci Italia/USA Group, LLC).

Leading Filers *(continued from Fig. 4)*

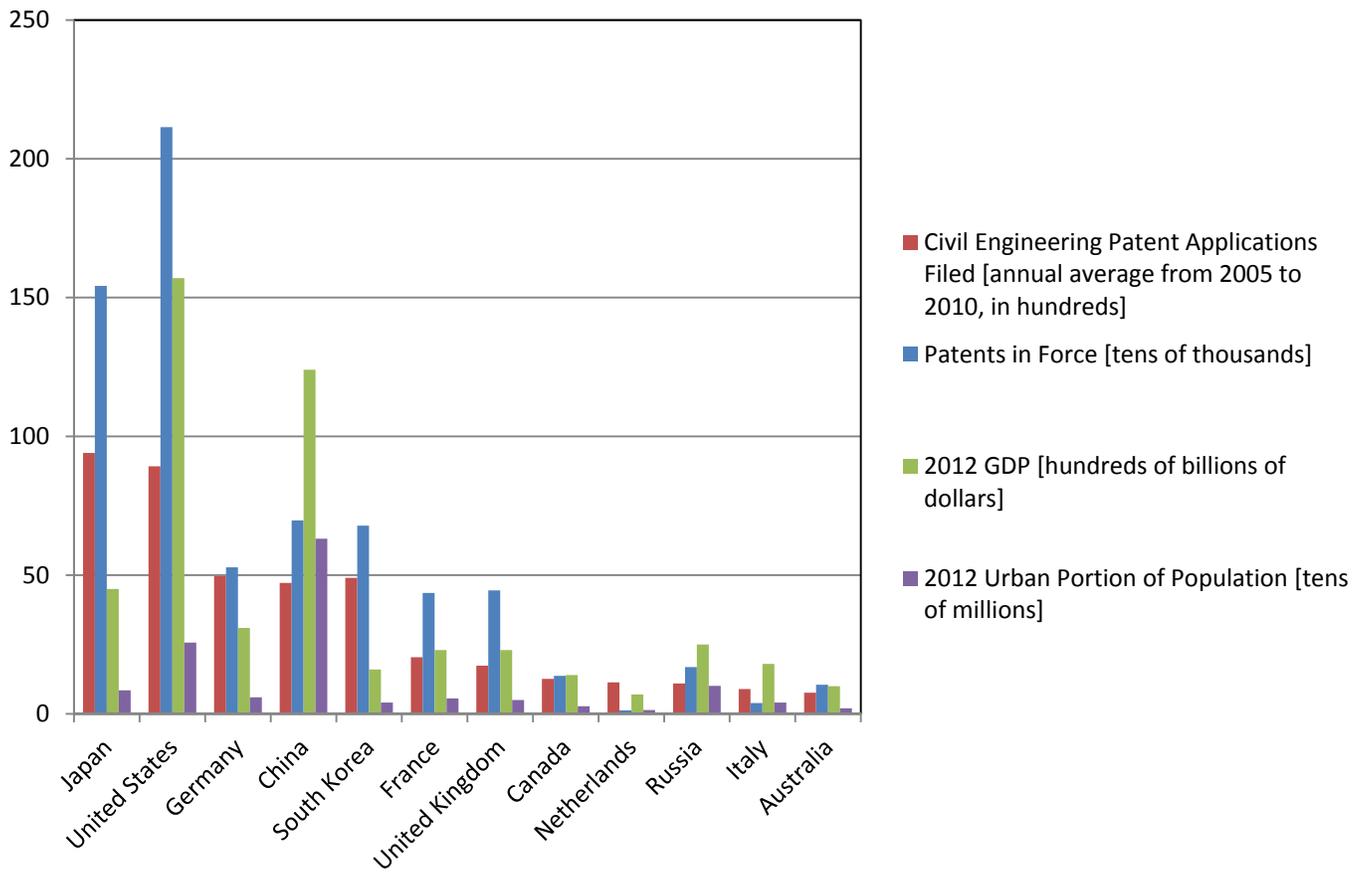
Group 7. The three European-based firms in this group, **Freysinnet** Group, **VSL** International Ltd., and **DYWIDAG**-Systems International (DSI), specialize in high-tech equipment supporting prestressed concrete and post-tensioning operations. In this patent-heavy area of civil engineering, each of these companies maintains a significant number of U.S. patents as part of their respective global patent portfolios.

Though U.S. universities possess significant research and testing capabilities in civil engineering, these entities, at least in the aggregate, do not patent significantly relative to manufacturing corporations in the field.

By Nation

Fig. 5 illustrates the top origin nations for filing civil engineering patent applications. Though patent applicants often file the same application in numerous patent offices around the world, Fig. 5 considers only the first filing location for a given civil engineering patent applicant. Therefore, as shown below, Japan has generated the highest number of civil engineering patent applications in recent years, on average, in the world. In general, the United States, Japan, and Germany have led total patenting activity across all technology areas over the past few decades, though China is poised to enter that group as well.

Fig. 5: Leading Nations for Patenting Civil Engineering Inventions



The numbers for "Civil Engineering Patent Applications Filed" are based on World Intellectual Property Organization (WIPO) statistics for 2005-2010, published by WIPO in 2011 and 2012 (most recent data available). The numbers for "Patents in Force" are based on WIPO statistics for 2011, published by WIPO in 2012 (most recent data available). The numbers for "2012 GDP" are based on the CIA World Factbook estimates for 2012 gross domestic product (purchasing power parity). The numbers for "2012 Urban Portion of Population" are also based on 2012 CIA World Factbook estimates (note: this estimate reflects the urban population of a nation, which is less than the nation's total population).

By Nation *(continued)*

As Fig. 5 shows, applications filed first in Western Europe, developed Asian nations, and the United States account for the majority of the world's civil engineering patent applications.

When additionally considering market size and patent system strength (e.g., see patents in force, gross domestic product, and urban population in Fig. 5), the **United States, Japan, Germany, and China** provide the best target markets, in general, for acquiring patents to protect civil engineering technology. Absent other factors affecting business decision making, civil engineering technology enterprises should file in those nations first. In general, after filing in the U.S., Japan, Germany, and China, civil engineering technology applicants should then file in **South Korea, France, and the United Kingdom**. For additional filing suggestions and strategies, please see a more complete discussion at the "Patenting Worldwide" webpage of www.civilengineeringpatentlaw.com.

Looking Forward

Although civil engineering has remained relatively predictable, with generally stable numbers of patents filed in the same nations and technologies in recent years, the potential for change remains. The rise of China in patenting may affect the field, as well as increased patenting from somewhat dormant patenting entities in civil engineering such as U.S. universities.

In view of overall trends in patenting and in the global economy, the number of civil engineering patent applications filed stands to increase in the coming years.

About the Author

Stephen L. Keefe earned a bachelor's degree in Civil Engineering and graduated with the Class of 1995 from the U.S. Military Academy at West Point. After serving his five year commitment in the Army, he joined the civil engineering field as a bridge design engineer in New York City. While in New York, he completed his master's degree in Civil Engineering at Columbia University, and became a Professional Engineer. He relocated to the Washington, D.C. area to attend the George Washington University Law School while working as a patent examiner and later as a patent agent. After gaining several years of experience at the intellectual property law firm of Finnegan, Henderson, Farabow, Garrett & Dunner, he now practices as a patent attorney with Rabin & Berdo, P.C., in Washington, D.C.

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