

SKILLS WANTED FOR SUSTAINABLE INNOVATIONS

CIVIL ENGINEER

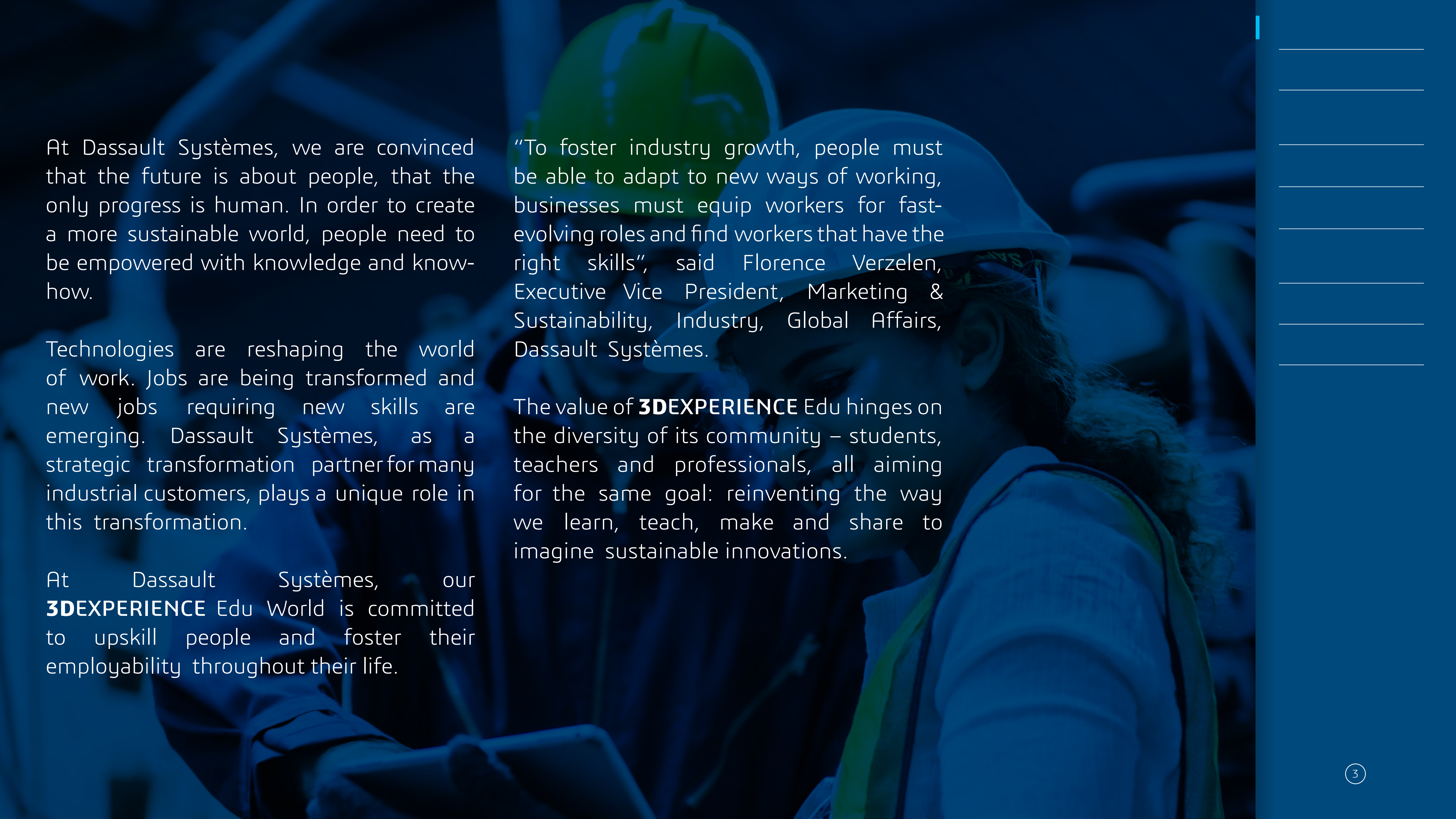
EBOOK





We're experiencing a global Industry Renaissance today, bringing new ways – real and virtual – of seeing the world, inventing, learning, producing and trading. Tomorrow's game-changers will not be those with the most automated production systems, but those who build a culture of knowledge and know-how to reveal and train the Workforce of the Future, able to solve the challenges of a planet lacking sustainable solutions.

BERNARD CHARLÈS
Vice Chairman of the Board
and Chief Executive Officer



At Dassault Systèmes, we are convinced that the future is about people, that the only progress is human. In order to create a more sustainable world, people need to be empowered with knowledge and know-how.

Technologies are reshaping the world of work. Jobs are being transformed and new jobs requiring new skills are emerging. Dassault Systèmes, as a strategic transformation partner for many industrial customers, plays a unique role in this transformation.

At Dassault Systèmes, our **3DEXPERIENCE** Edu World is committed to upskill people and foster their employability throughout their life.

“To foster industry growth, people must be able to adapt to new ways of working, businesses must equip workers for fast-evolving roles and find workers that have the right skills”, said Florence Verzelen, Executive Vice President, Marketing & Sustainability, Industry, Global Affairs, Dassault Systèmes.

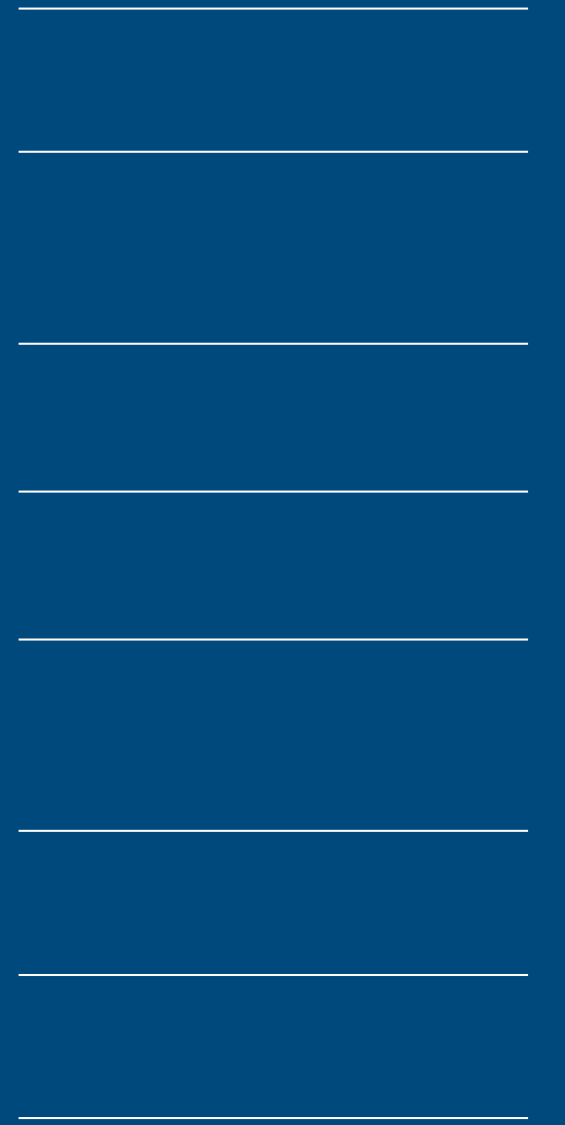
The value of **3DEXPERIENCE** Edu hinges on the diversity of its community – students, teachers and professionals, all aiming for the same goal: reinventing the way we learn, teach, make and share to imagine sustainable innovations.

We are very pleased to share with you this publication of **3DEXPERIENCE** Edu, whose missions include fostering collective intelligence on key emerging roles and skills. It is the second in a publication series called “Skills wanted for sustainable innovations” that will share the views of **3DEXPERIENCE** Edu and our ecosystem on the evolution of the key roles and skills for the Industry Renaissance. This publication is about the role of **Civil Engineer**.

Today, the world is under pressure to provide adequate infrastructure to support its growing urbanization needs. This is creating challenges for civil engineers to build sustainable and resilient infrastructures quickly and efficiently.

2D drawings were replaced by the advent of 3D virtual mock-ups and integrated digital models that suddenly allowed any construction project to be designed, documented and simulated, even before any stone is cut!

In this ebook, we will explore how the increasing use of technology and the implementation of new business processes in complex construction projects have transformed the missions of civil engineers and their skills.



INTRODUCTION

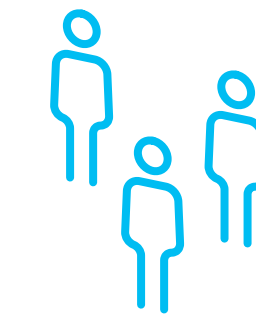
Before we deep dive into the civil engineer role, we will give a little context, sharing some key facts about civil engineering.

From Egyptian pyramids and Roman aqueducts to today's huge bridges and giant skyscrapers, civil engineering is one of the oldest engineering disciplines.

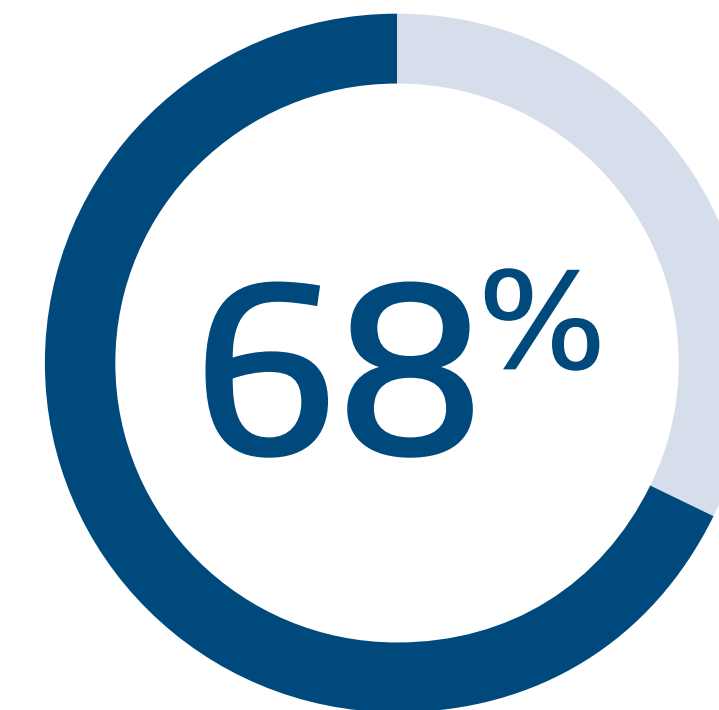


Civil engineer terminology was introduced by English engineer, John Smeaton, founder of the "Society of Civil Engineers" in the 18th Century. During the first industrial revolution at the beginning of the 19th Century, the civil engineering discipline became specialized and many sub-domains of that discipline were created.

The United Nations project that 68% of the world population will live in urban areas by 2050. This development growth challenges civil engineers to take into account the increasing need to develop building assets, transportation, energy systems and other infrastructures.



by 2050



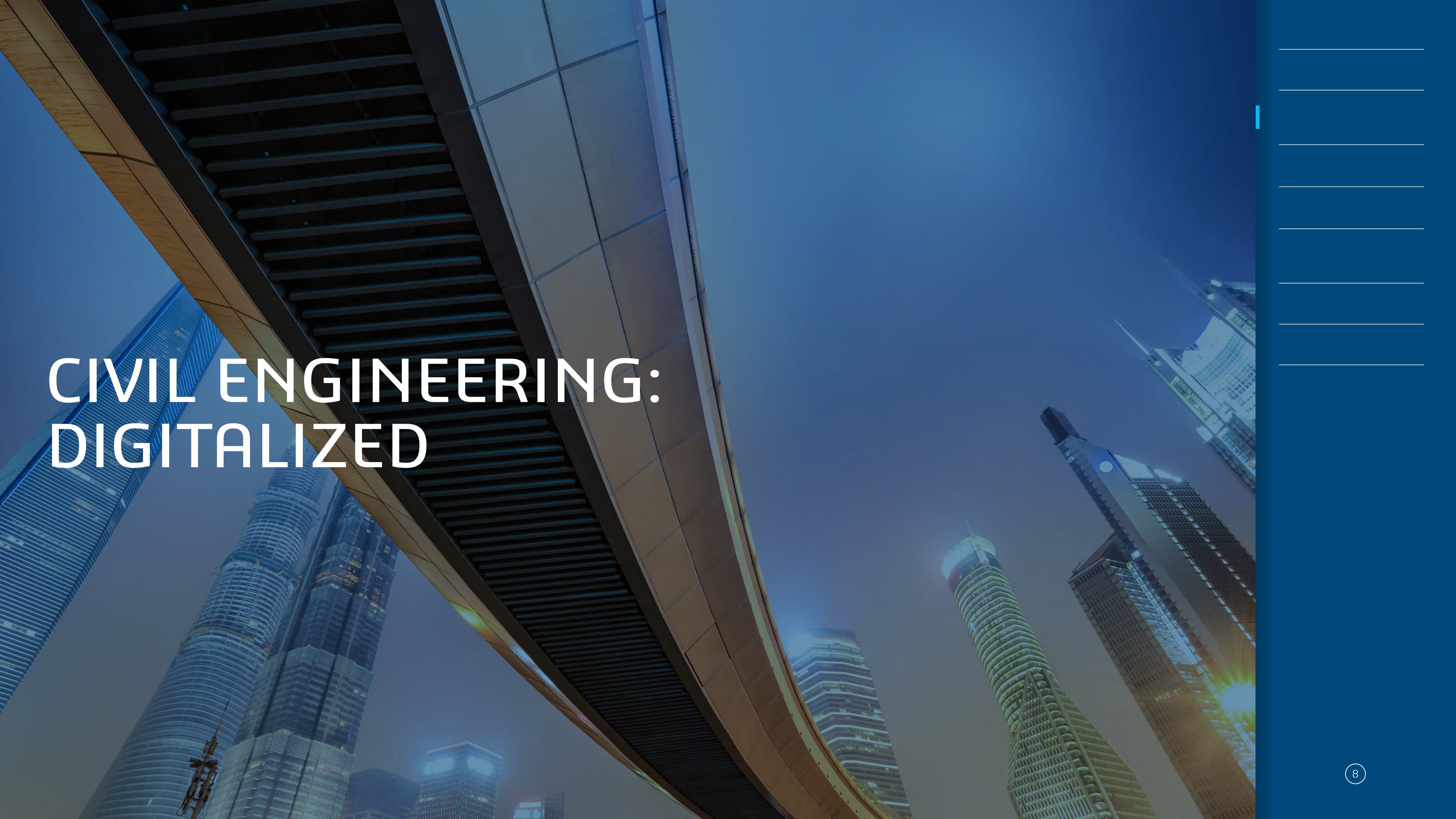
of world population
will live in urban areas



The Institution of Civil Engineers (ICE), a professional membership body, estimates that civil engineer is the “best profession to tackle the issue of how to manage the demands of a growing population”. It also determines that “the construction and civil engineering domain have a hugely important role to play in delivering the infrastructure for a sustainable future.”

Civil Engineers today tackle those challenges using cutting-edge technologies such as Collaboration on the Cloud, Digital platforms, 4D simulation, automation, Cloud computing, Building Information Modeling, Virtual Design Construction (VDC), Virtual Twin and digital continuity, to transform the way they handle our built environment.





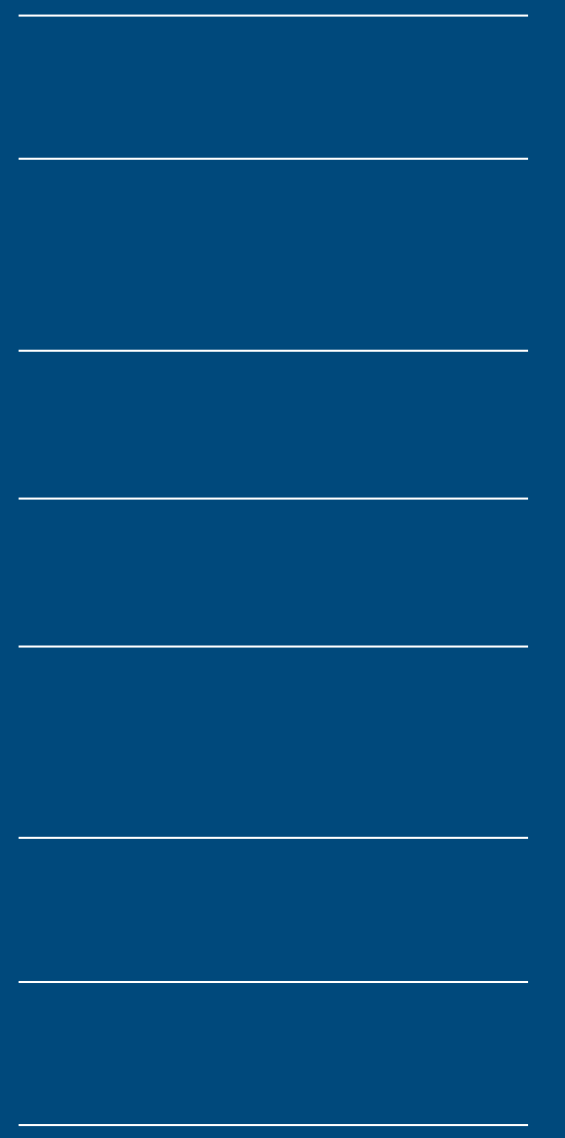
CIVIL ENGINEERING: DIGITALIZED

Today, civil engineers plan, design, supervise and maintain large construction and infrastructures around us, including buildings, roads, bridges, airports and water systems.

Because of the complexity of the projects, job segmentation, and the productivity challenges, digitization in construction has progressed slowly. When implemented, however, digital transformation of the job enables substantial advances in construction processes.

Previously, the various teams involved in a project would each use their own software. This created problems of waste and conflicts due to inconsistent information, which were common issues for the construction industry. All actors now need new ways of collaborating and innovating.

Today, traditional processes are evolving into a science of construction in which the built environment is considered as a whole. This approach allows engineers to anticipate changes in temperature, understand key properties of materials (expansion and contraction), facilitate better utilization of captured energy, and improve acoustics and comfort for users of the buildings.



A digital transformation: from BIM to virtual twin

Building Information Modeling (BIM) is the process of creating and managing digital information about a built asset. BIM software has helped to improve productivity in the design phase due to its ability to visualize designs and create 3D images of a building, as well as automate creation of drawings, quantity take-offs, analysis, simulations, etc. Since the late 2000s, BIM has been increasingly introduced to global design companies, contractors and material manufacturers.

Nowadays, thanks to the use of a unified framework of cross-disciplinary information, as well as a simplified interoperability with other software, virtual twins are now currently taking over the traditional methods for infrastructure development, operation and maintenance. They optimize the whole building management and guarantees predictive maintenance and performance of the construction, all through its lifecycle.

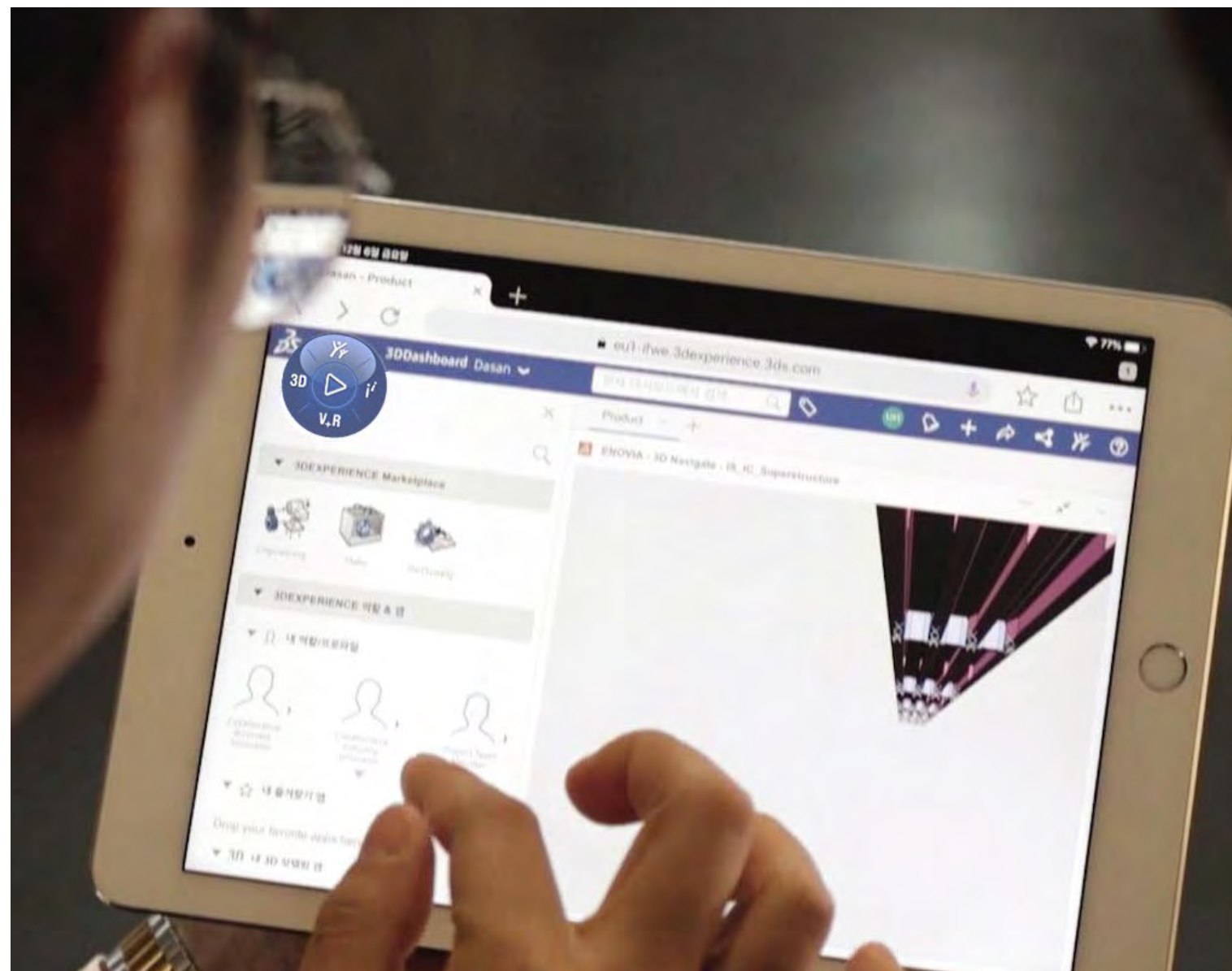
DID YOU KNOW?

Virtual twins are also contributing to design, construction and capital efficiency. Using virtual twins in Construction allows all industry players of the project to adopt infrastructure lifecycle management. One of the benefits of a virtual twin is that it is not only used in the design and construction phases, but also for the asset's operation and maintenance.

Digital collaborative platforms allow engineers to work cohesively in multidisciplinary teams, managing the complexity of their projects. These platforms, commonly referred to as common data environments, eliminate silos of people, information, and processes over an infrastructure asset's entire lifecycle.

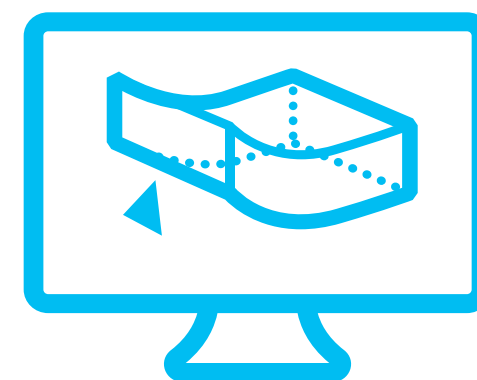


The Dassault Systèmes' **3DEXPERIENCE** platform combines the use of a common data environment, with BIM and real-time simulation and data-driven decision-making to become the virtual twin for infrastructure.



Construction professionals are now focusing on how they can make a better ecosystem for the cities' infrastructures at the start of any project. Virtual twin of cities and infrastructure are utilized for future cities and territories developments. There are business opportunities for civil engineers for urban development leveraging infrastructure projects.

Virtual twins provide the core foundation of a long-term data strategy for built assets: better sustainability for projects while providing more efficiency.



Towards more sustainable principles

Rising urban population, climate change and widespread resource scarcity require civil engineers to anticipate more sustainable approaches. The growing demand for connected buildings, smarter materials, smart cities, modular buildings and digital habitat require civil engineers to innovate more and more.

Simon Huffeteau, Vice President for Construction, Cities and Territories at Dassault Systèmes declared “The surest way to sustain high performance of infrastructure and buildings is to engineer with sustainability principles in mind.”



Construction’s future will be more sustainable when engineers rethink a process to avoid demolition and deconstruction. “We need to think about new methods of construction in which new recycled and less polluting materials are at the heart of the process”, says Lorris Millet, BIM Manager at Bouygues Construction. “If we rethink cities in a more global way (eco-neighborhood, city center, suburbs) we will make them more sustainable, he concludes.



CIVIL ENGINEER ROLE

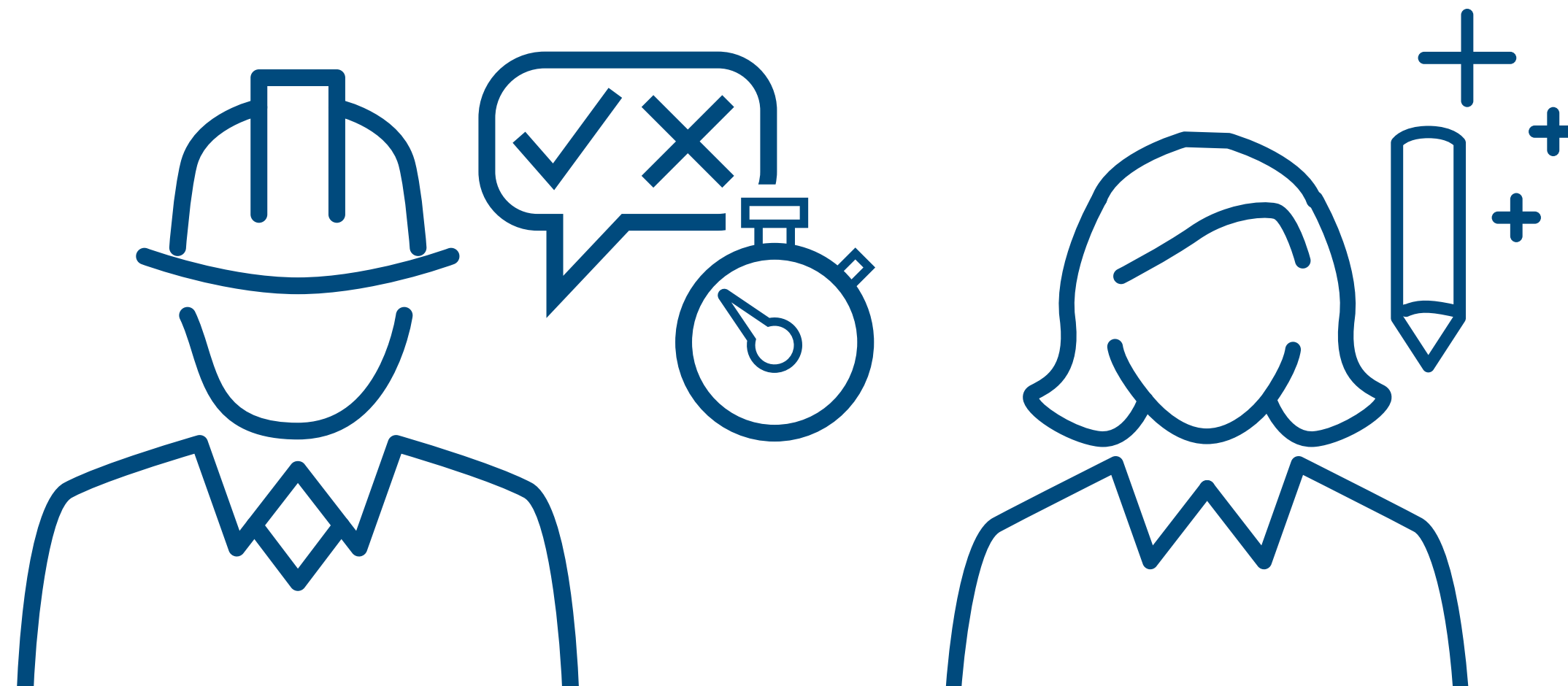


What does a civil engineer do?

We explained in the previous sections the need for civil engineers to understand how digital technology influences the way they work and the challenges it creates for them.

Civil engineers are indeed challenged to consider constantly changing conditions, such as population growth and climate changes and digital habitat. Natural disasters are another topic that civil engineers must consider for safeguarding lives and restoration after damages.

In their daily jobs, civil engineers must meet regulatory standards, prioritize safety, consider environmental risks, the endurance of materials and anticipate costs for the construction as well as long-term maintenance. Civil engineers work closely with architects to determine the best options for harmonizing the surrounding environment and ensuring sustainable practices.



Population growth

Climate changes



REGULATORY
STANDARDS



LONG-TERM
MAINTENANCE



**Civil
engineers'
challenges**



SAFETY



CONSTRUCTION
COSTS



ENVIRONMENTAL
RISK

Digital habitat

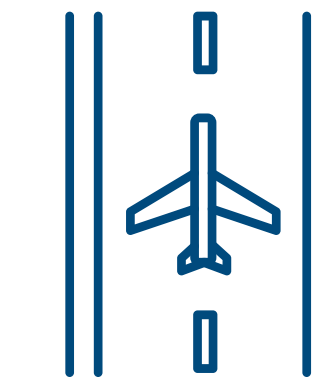
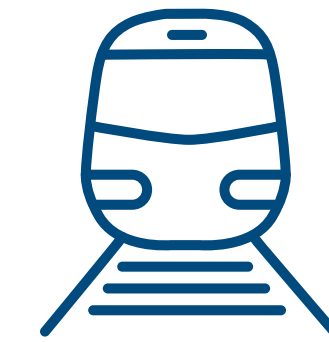
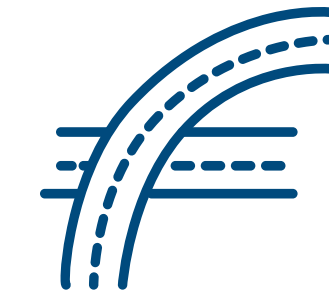
Natural disasters

According to O*NET OnLine, the United States Standard Occupations Classification (SOC) program, a civil engineer “performs engineering duties in planning, designing and overseeing construction as well as maintenance of building structures and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, water and sewage systems”. ESCO (European Skills/Competences, Qualifications and Occupations) describes civil engineers’ missions as “conduct research, advise on, design, and direct construction; manage the operation and maintenance of civil engineering structures; or study and advise on technological aspects of particular materials.”



Civil engineering may lead to multiple jobs, and engineers may specialize into one of them. For example, construction engineers manage large construction projects, geotechnical engineers ensure the solid foundation of engineering projects, like tunnels and buildings, while structural engineers design and evaluate planning of major buildings, bridges or dams and ensure they are built to last. Finally, transportation engineers plan roadway construction and maintenance, as well as design airports, subways and railways systems.

Civil engineering offers a large variety of missions with a very high potential for evolution because of the huge number of sub-domains.



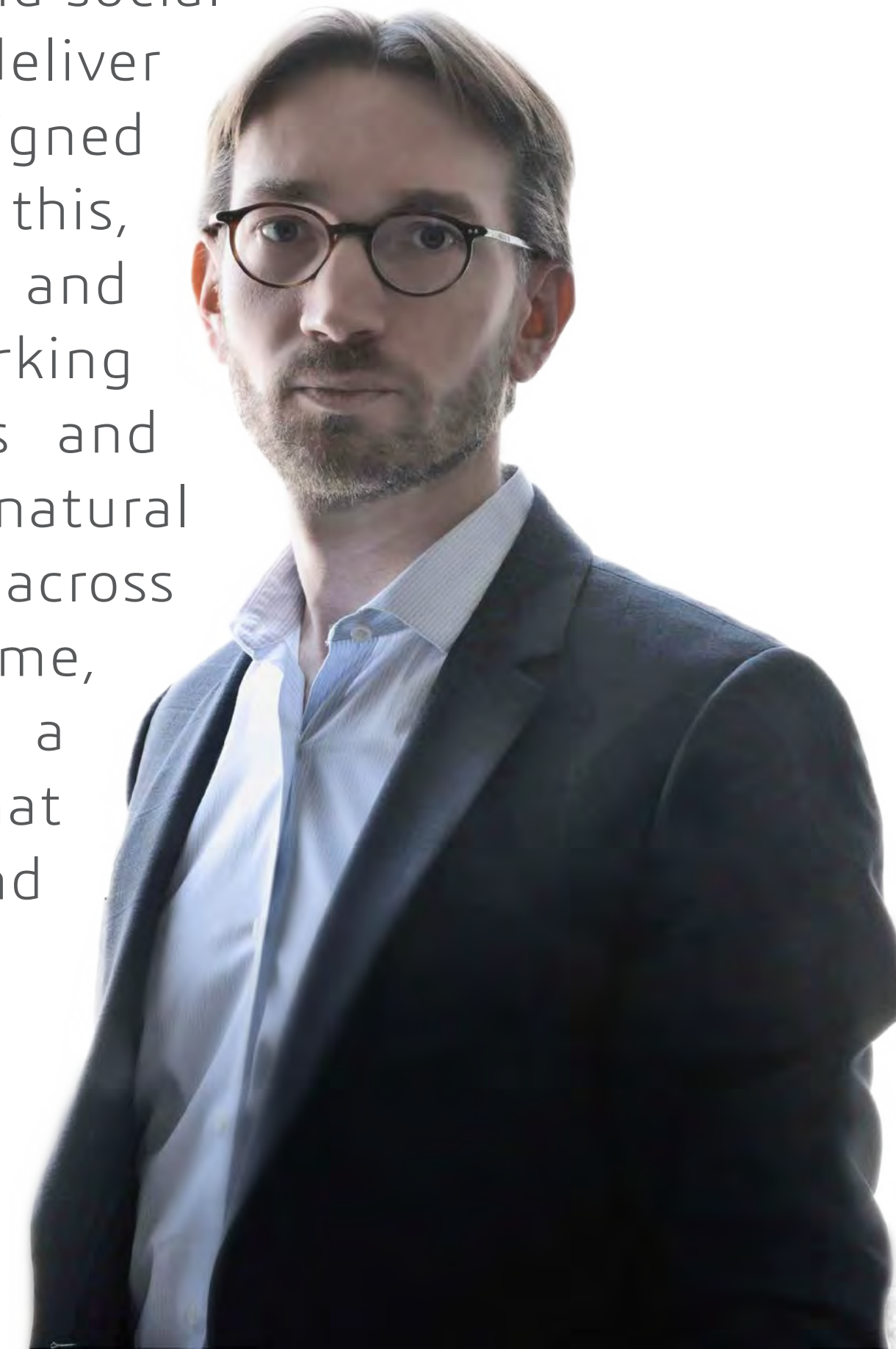
DID YOU KNOW?

Civil engineers are experts when it comes to:

- Structures and Foundations
- Construction Techniques
- Mechanics of Materials
- Geography and Land-Use Practices
- Fluid Mechanics
- Hydrology and Climate
- Soils and Geology
- Transportation Systems
- Environmental Protection and Remediation

Civil Engineer, a critical role for sustainable innovations: **Simon Huffeteau**, Vice President for Construction, Cities and Territories at Dassault Systèmes recently declared “The surest way to sustain high performance of infrastructure and buildings is to

engineer with sustainability principles in mind. Civil engineers have this critical responsibility. They will increasingly need to take into account the entire asset lifecycle, ensuring that minimal economic, environmental and social resources are needed to deliver and operate the asset, designed for resiliency. To do all of this, they need to take creative and innovative approaches to working with the laws of physics and reality of the built and natural environment, to collaborate across many disciplines in real time, and to master working in a virtual twin in an approach that is simultaneously holistic and data-driven.”



“

Civil Engineering designs the world and digital Engineering designs civil engineering.

Civil engineering requires a very high level of responsibilities and very good technical and human skills. It is a rewarding, creative and fun job!

In the shoes of Lei, Civil Engineer in the Construction Industry



LEI
Civil Engineer in Construction
industry, Railway Specialist

Lei's background and experiences

In 2005, Lei obtained a **Master's Degree in Civil Engineering** from Tsinghua University in Beijing.


After a few years working in the construction industry in Beijing, he decided, to specialize further around new technologies. Lei re-entered the School of Civil Engineering at Tsinghua University to attend a graduate program that offers outstanding professional skills, entrepreneurship and strong leadership in the field of civil engineering.

Lei's missions

With 15 years of experiences in structural design and research and development in civil engineering, Lei today works on a tunnel construction project in a major railway project by a Chinese railway company in Shanghai.

On this new tunnel project, Lei's missions are to contribute to the overall work activities in collaboration with other engineers working on the tunnel sites. Thanks to digital tools he uses and the integration of digital models, he collaborates with other onsite teams more easily to facilitate better decisions during the design and engineering phase.





For example, Lei needs to consider the available information that comes from the structural engineers, like the conflicting goals from different teams involved, professional ethics, financial responsibilities and safety concerns when making decisions.

For this, he creates detailed Building Information Models (BIM), in accordance with the construction industry standards and with plans and specifications, to generate visual representations of the tunnel construction process.

The company he works for uses Dassault Systèmes' applications: Lei uses Civil Engineer role from CATIA brand to create a 3D parametric representation of the tunnel based on company knowledge and know-how, and Construction Planner from DELMIA brand to define how the tunnel elements will be built and assembled.

In addition, he uses SIMULIA brand Finite Element Analysis (FEA) that enables engineers to create simulations of how the tunnel boring machine (TBM) excavation would impact surrounding areas with physical effects like vibration and fluid flow. As the tunnel construction progresses, the 3D model with simulation enables Lei and other engineers

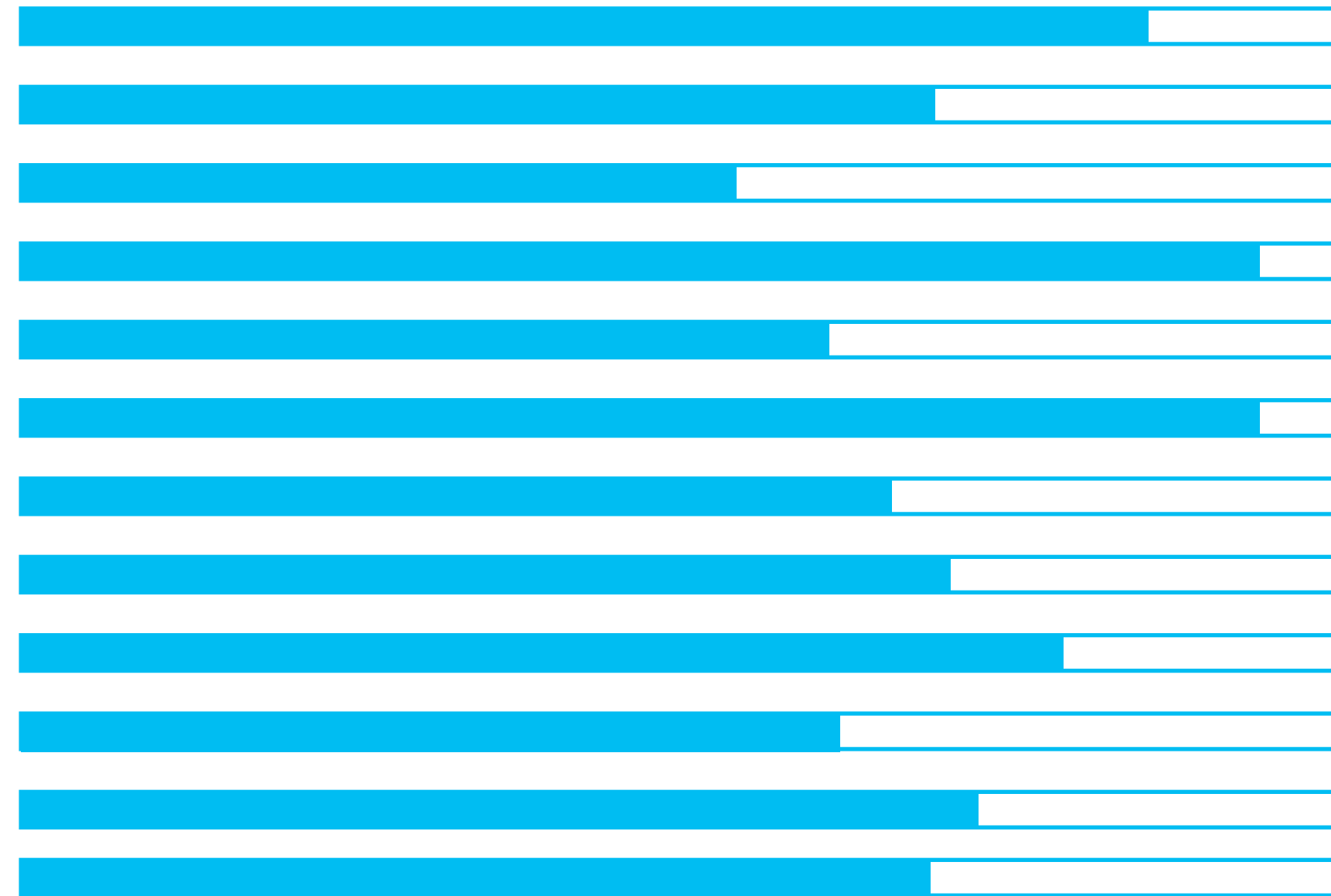
to predict the behavior of each element and the overall impact on the surrounding areas and resolve problems in advance.

Lei mostly works outdoors at construction sites to monitor progress and troubleshoot any problems that come up, with the responsibility for resolving worksite issues.



Lei's skills

- Construction Management
- Infrastructure Lifecycle Management
- Structural Engineering
- CAD Software (CATIA, SOLIDWORKS)
- Virtual Twin
- BIM software
- Modeling
- Building Integrated Design
- Decision making
- Design Thinking
- Complex problem solving
- **3DEXPERIENCE**



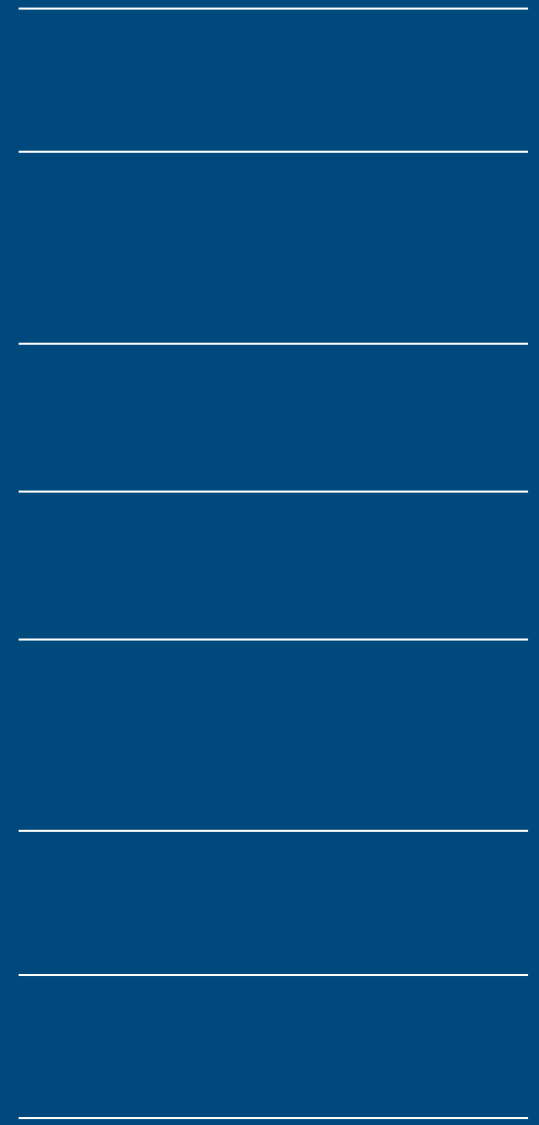
Virtual Experience Twin

The Virtual Experience Twin powered by the **3DEXPERIENCE** platform brings together raw data from disparate sources onto a unified platform, contextualizing near real-time data into spatial and visual representations. Through this Virtual Experience Twin, built asset businesses are empowered to make calculated decisions derived from virtual-world simulations to optimize real-world operations.

Lei uses Virtual Experience Twins. It is not just a 3D simulation of the final project, but includes simulations of all the processes used to build the project. That way, civil engineers first can simulate everything in a virtual environment, and forecast all the issues and risks they might face in the field. If an error is made in the digital environment, it is easier to fix, and the cost to fix it is much lower. They can make sure that the real construction can be successful the first time.



JOB OUTLOOK



Infrastructure development is forecast to see phenomenal growth worldwide. By 2030, the global construction market is projected to grow by 85% to US\$17.5 trillion, according to Global Construction 2030, the fourth construction forecast study sponsored by PricewaterhouseCoopers.



Gender Diversity

According to Data USA, 85% of the workforce is male and 15% female

1. Workforce

In September 2020, about 7.2 million people worldwide have declared having the “Civil Engineering” skill on their LinkedIn profile. According to Data USA website, in the United States, there was a total workforce of 366,000 professionals in the discipline in 2019.

Discover job opportunities connected to your Dassault Systèmes’ skills and get inspired with success stories from power users. Visit the **3DEXPERIENCE Edu Job Place**.

To see jobs related to Civil Engineering in your region, visit our website here

<https://edu.3ds.com/en/job-place>



people worldwide

7.2
million

have declared having the “Civil Engineering” skill on their LinkedIn profile.

2. Skills

Many professionals having civil engineering on their LinkedIn profiles also have “construction”, “SOLIDWORKS”, “engineering”, “construction management” or “structural engineering” listed as additional skills. According to the American Society of Civil Engineering, a civil engineer is knowledgeable about technical and professional competencies, as well as socio-economic topics. ESCO says that essential knowledge for a civil engineer is “civil engineering, engineering discipline, engineering processes, mining, construction and civil engineering machinery products, and technical drawings.”

Data USA specifies that civil engineers require important skills like “decision



making, leadership, mathematics, organizational, problem solving, speaking and writing skills.” However, those may differ according to the discipline in which they work. Among all the skills, the top three are reading comprehension, mathematics and critical thinking. As explained in previous chapters, mathematics is a hard skill that civil engineers must have.

In addition, in coming years, the work of civil engineers will be needed for renewable-energy projects as well. As these new projects evolve, civil engineers will be further involved in overseeing the construction of structures such as wind farms and solar arrays. Thus, the job will require new technical skills related to those domains.



3. Job market & openings

As infrastructure continues to age, civil engineers will be required to manage projects, like rebuilding bridges, repairing roads and upgrading structures, meaning that the job will still be in demand.

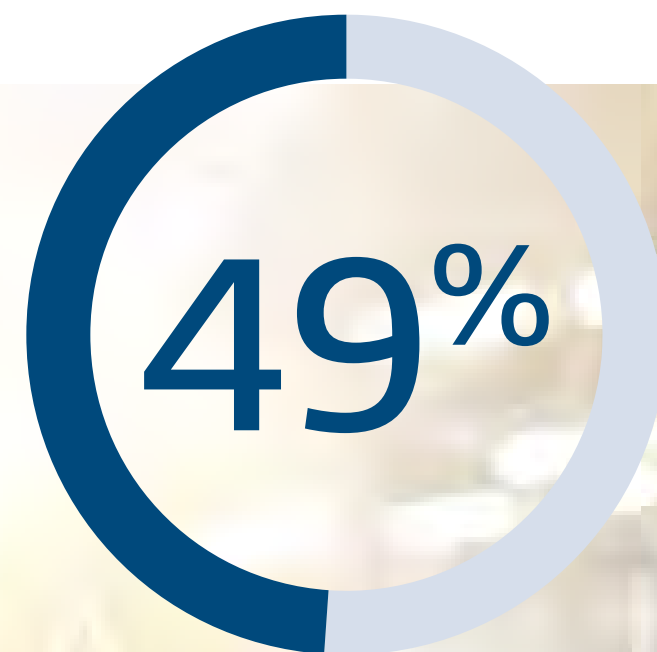
In 2018, O*NET OnLine, projected employment of civil engineers to grow by 6% by 2028. Between 2018 and 2028, the projected job openings could reach 28,300 in the US.

According to LinkedIn, in September 2020, more than 110,000 job posted to the site worldwide refer to civil engineer or civil engineering.

According to Engineers Australia, civil engineering vacancies have consistently dominated the Australian engineering employment landscape. The awarding of major civil infrastructure projects has generated business for associated industries, boosting the demand for civil engineers.

DID YOU KNOW?

The largest employers of civil engineers in the US are the engineering services (49%).



In France, the discipline is one of the top employment categories. French Building and Public Works industries are expected to create 68,000 jobs by 2024. Recruitment opportunities are very high, mainly for operators, team leaders and managers. Important upcoming events like the 2024 Summer Olympics and the “Grand Paris Express” project (a major European railway project) are offering many opportunities in those industries at the moment.

Overall, considering the growth of digital tools and 3D modeling, digital experts are going to have very attractive talents. The hiring demand is High.

French Building and Public Works industries are expected to create

68,000 jobs **by 2024**

Here are the **10** best cities for civil engineers to find a job according to an article published in **NewEngineer.com**

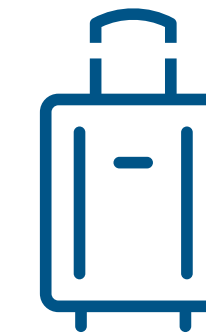


4. Work Environment

The Civil engineering discipline can be broadly divided into two areas: engineers who spend more time on project design prior to construction, and engineers who spend more time onsite during construction. For design-oriented engineers, most of their day is spent in an office or with customers, performing calculations and developing plans, as well as addressing issues to ensure a successful project that meets the needs of the customer.

Construction-specialist civil engineers spend most of their days at the project site, outdoors, collaborating with the contractors who carry out the physical work and monitoring operations or answering questions, solving onsite problems as they occur.

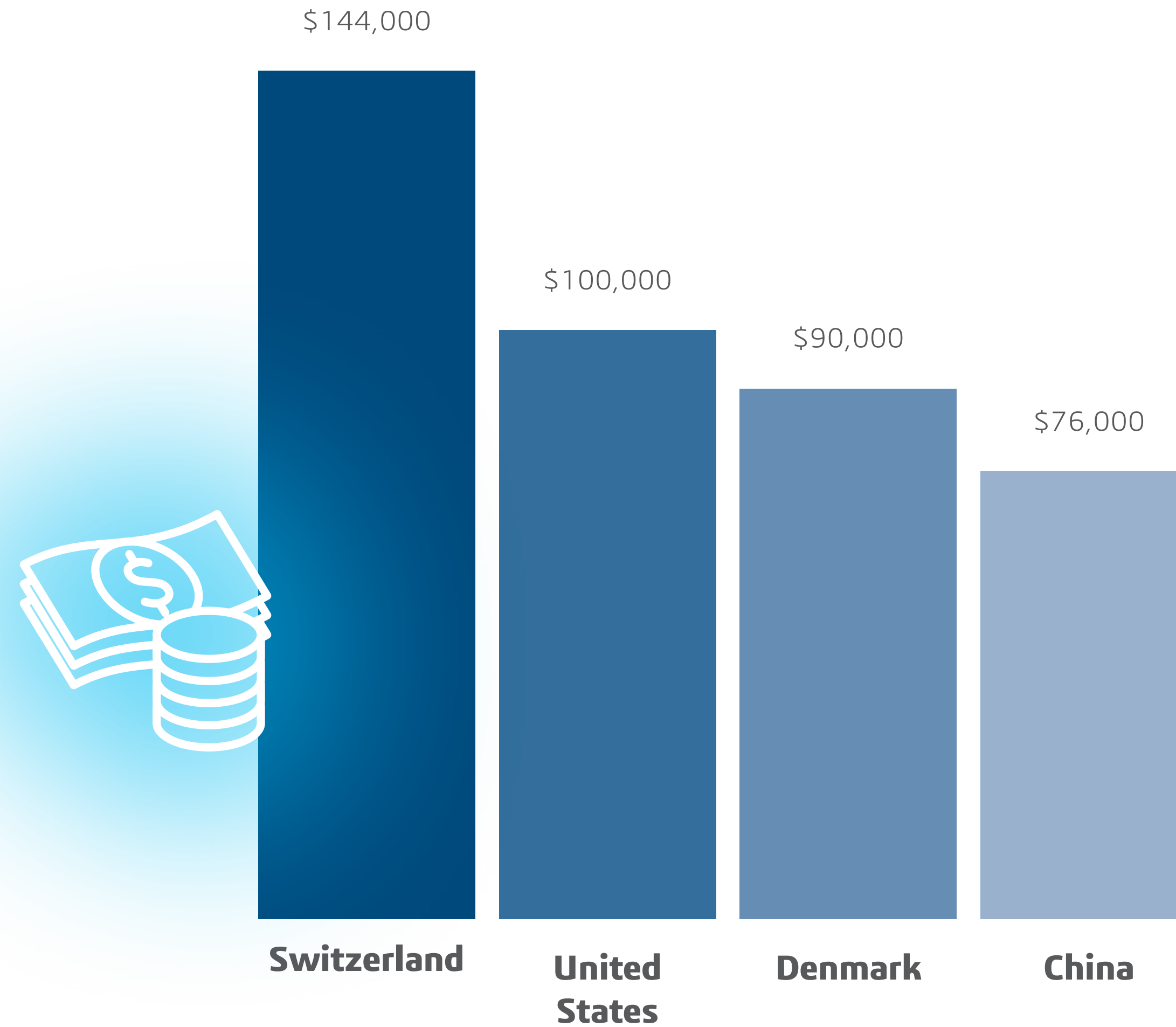
Occasionally, civil engineers travel abroad to work on large engineering projects.



5. Annual wage

As per a LinkedIn article, the country where civil engineers earn the highest annual wage is Switzerland with a salary of US \$144,000; then come the United States (US\$100,000) and Denmark (US\$90,000).

In China, in 2020, the average salary for a Civil Engineer is US\$76,000.



6. Key figures



347,300

projected civil engineer employment in the US by 2028



7.2 million

civil engineer professionals worldwide



+6%

job growth by 2028 in the US

7. Education

According to the US Bureau of Labor Statistics, “Civil engineers need a Bachelor’s degree in civil engineering, in one of its specialties, or in civil engineering technology.”

According to an Indeed.com article, 86% of US civil engineers have a Bachelor’s degree, and 10% a Master’s.

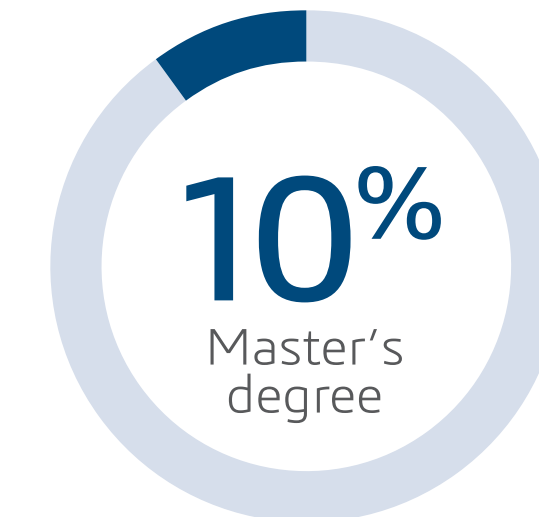
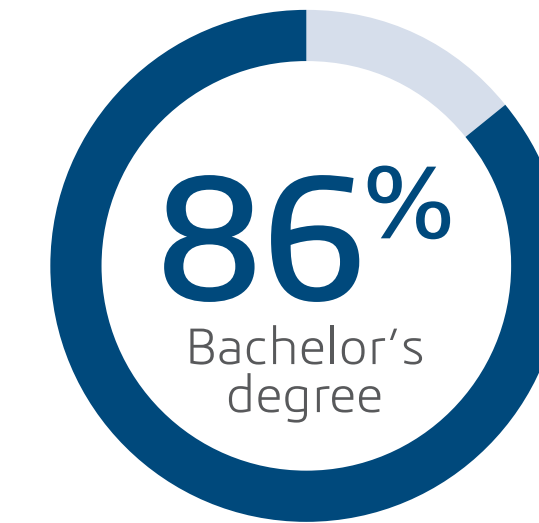
Worldwide, “Bachelor’s civil engineering programs consist of major study areas such as structural engineering, soil mechanics and foundations, environment resources, hydraulics and ocean engineering, transportation and construction engineering. Programs in civil engineering technology include

courseware in mathematics, science, statistics, engineering mechanics and systems, and fluid dynamics, depending on the specialty. Courses include a mix of traditional classroom learning, practical hands-on applications, work in laboratories, and fieldwork”.

According to **Professor Scott Smith**, from the University of Adelaide:

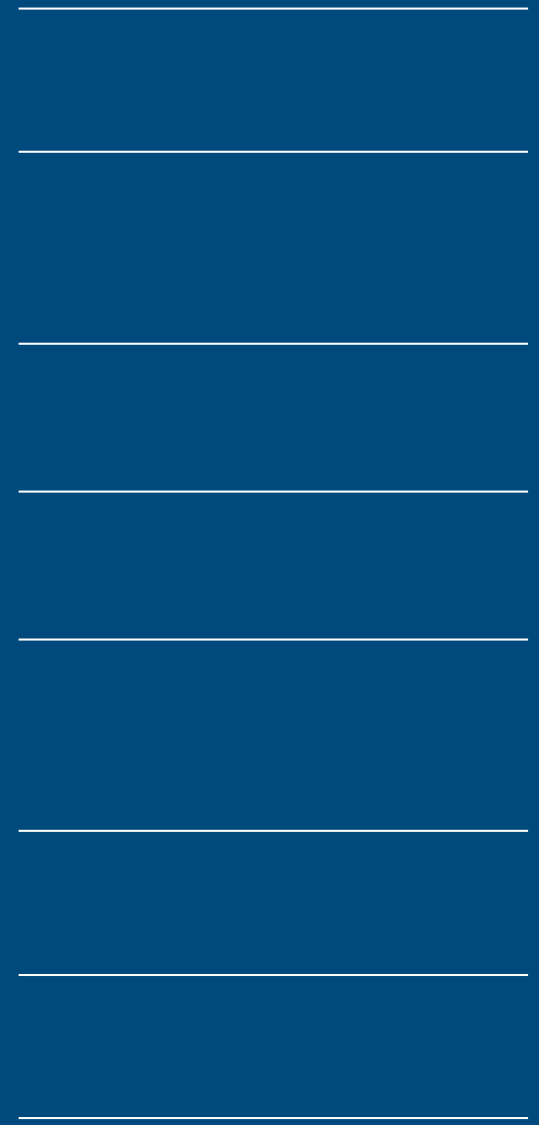


US civil engineers

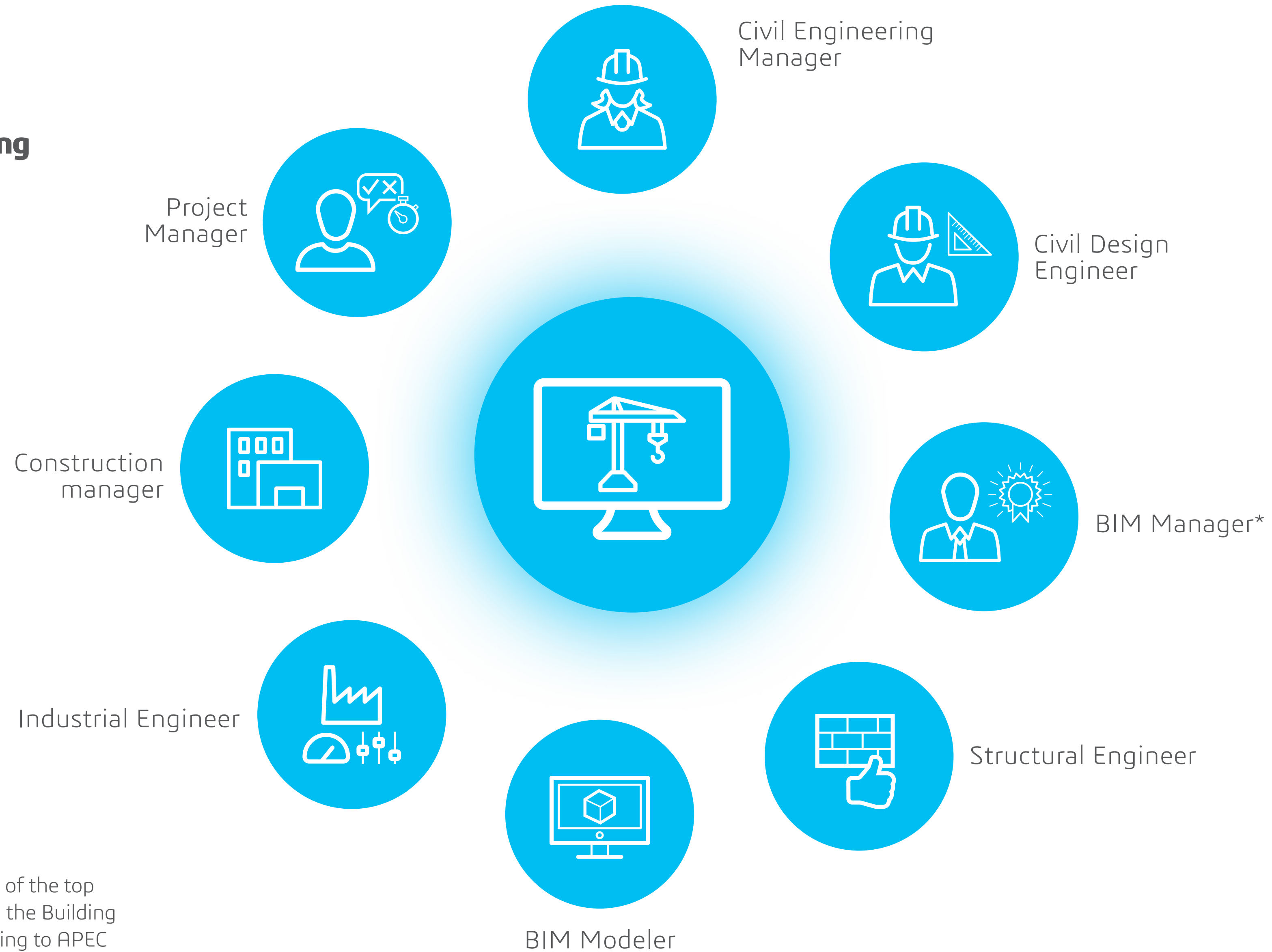


8. Certification – Global Adoption

With the launch of a Professional Certification Program, buildingSMART, the international organization driving the digital transformation of the built asset industry, provides “an international benchmark for individual training and certification in BIM. buildingSMART supports learning organizations to educate and qualify individuals according to a recognized global learning framework. It is a proof of competence for professionals working with BIM. Qualified and Certified professionals can demonstrate their knowledge, consistent with international standards and best practices.”

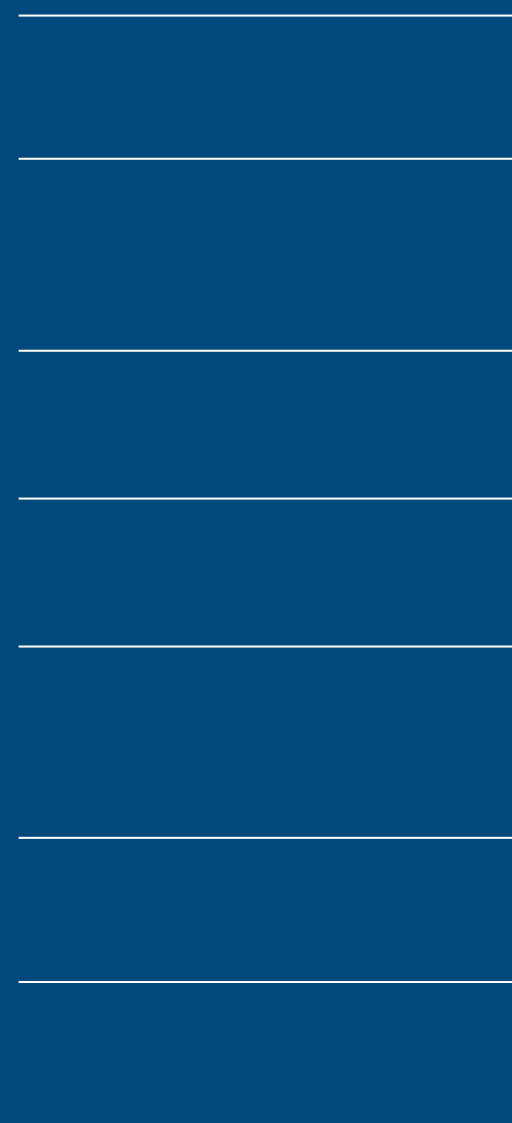


9. Jobs related to Civil Engineering



*Selected as one of the top trending jobs in the Building Industry according to APEC

LEARNING EXPERIENCES FOR CIVIL ENGINEERING





In 2020, Dassault Systèmes started to develop a new portfolio of Learning paths that combine domain knowledge and know how, to empower the workforce of the future.

To learn more about our Learning Path dedicated to civil engineering, “Perform as a Civil Engineer”, visit **3DEXPERIENCE** Edu Space website at: <https://eduspace.3ds.com>

In this learning path, you will learn about the civil engineer role, in the context of terrain surfaces for roads, bridges and rail design.

Upon completion of the course, you will be able to prepare terrain and geo-locate the construction projects and allocate the position of geo-located construction projects on the terrain. And create 3D alignment and cross section profiles for roads and railways.





TESTIMONIALS

Experts share their views about civil engineering job, and the skills needed today and in the future.

Marion Schenkwein

Civil Engineer | InfraBIM specialist, FTIA, Finland

Marion started as a civil engineer in 2004, and she says some missions that she is in charge of today remain the same, but others changed a lot – for example, new solutions for designing, visualization and data transfer are emerging. Thanks to Artificial Intelligence (AI) and machine learning, some tasks will be automated in the future. Through the use of BIM technology, it has been possible to optimize the design and construction processes significantly in her organization.

In terms of skills a civil engineer should have, she tells us a civil engineer needs to have some decision making skills. In addition, he/she “has to get the skills and ability to analyze and make high-quality decisions” as he/she cannot only rely on the solutions and technologies. He/she also needs to keep his/her ‘old-fashioned’ civil engineering skills, but in parallel, be agile enough to learn fast and be able to make the most of different technical solutions.” Overall, according to her, “Open-minded graduates are keen on learning the new technologies that are going very fast, even if those have not been taught at school.”



There is high hope in BIM and standardization for a productivity boost. This is a near future change.

Civil engineer is definitely a key job for the future.

According to Marion, a key rule today is to get as rich information content as possible, because the reuse of information in the future is uncertain. As data and asset management is representing the biggest part of the civil engineering job in Infrastructure, this must be anticipated.

“There will be a more complex shift towards digitalization in the future”, she is saying. There will be also a shift related to tendering processes, future procurement methods and quality documentation.

For a civil engineer, environment impacts also play a key role on the way she works: “Environmental impacts require civil engineers to address and try to solve problems”, she is saying. In Finland, climate changes with shorter frost periods are currently impacting the environment a lot (like durability of the road); so, digital twin technology would be able to take into account those impacts. This is, therefore, making a shift in the way civil engineers think and work.

A civil engineer who is part of multidisciplinary teams should have the ability to address any type of problems with other actors, like thinking about some solutions to reduce carbon emissions. With the growth of international projects, language skills are going to be required. “It is important for a civil engineer to read the culture to allow a fruitful collaboration between all international stakeholders”, Marion said.

“

Digital twins are making a shift in the way people work and think. Earlier, a civil engineer was designing, building and managing the maintenance; now, with digital twins, a civil engineer can, in addition to this, rethink the whole process and collect information related to the environment he works on, and better prepare it for the future.

Lorris Millet

BIM Manager | Bouygues Construction, France

Lorris is a BIM manager for Bouygues Construction group in France. He is responsible for managing the digital model of a huge European Railway project in Paris, and which involves leading production and verifying formwork plans for the construction site and the studies from the 3D model. His missions are to guarantee conformity of his project with the real construction, so that the customer inherits a complete model and a picture of the construction site.

According to Lorris, an engineer needs to have calculation, collaboration and decision making skills to work in civil engineering disciplines. In addition, he mentions the ability to master CAD and 3D modeling software, as well as understanding all the technical phases, and organizational skills to coordinate all the stakeholders. BIM has great potential and will continue its expanding deployment.



Lorris studied at ESTP engineering school in France, which defines itself as a gold-standard international school for sustainable construction. According to him, “sustainable construction includes an environmental part, in which recycled and less-polluting materials are at the heart of the environmental impacts; for example, aggregate for concrete or bituminous coating can be derived from plastic recycling, or wood construction for structural designs.”

Civil engineers need to rethink their construction methods and avoid massive demolitions and deconstructions that still occur today, as well as “isolated and partitioned neighborhoods that are subject to mutation and further changes.” A response to those problems inside cities could be eco-neighborhoods or city centers’ construction in order to improve people’s comfort and quality of life.



In 10 years from now, BIM will be much more developed in public construction works and also required in the building phases in order to save time in design, execution and operations phases.

It’s a rich and exciting job that brings a lot of satisfaction.

Christophe Segarra

BIM Modeler | SNC
Lavalin, Canada



SNC • LAVALIN



Christophe is a BIM Modeler working in Railways Industry. He gives us his insights regarding the digital transformation of the industry. He says the BIM model “is useful from the very start of the study by

identifying more easily the challenges that could not be anticipated with 2D. BIM acts as a decision facilitator to convince a client, thanks to the use of virtual and augmented reality.”

According to Christophe, thanks to BIM, all sub-disciplines are now interconnected and actors can now coordinate together through the 3D model, which definitely improves the overall collaboration between the teams: “ENGINEERS are more and more designing in 3D in order to easily coordinate the concepts and reduce the iterations, TECHNICIANS are drawing directly on the 3D model, SURVEYORS are able to extract the quantities directly from the model, and MANAGERS can interact with them all and give their comments through the 3D model.”

Scott Smith

Deputy Dean | Interim Head of Civil, Environmental and Mining Engineering, University of Adelaide



“Certainly digitalization in construction has been a slow mover, but the time is really right for a disruption.” He sees “digitalization finding its way into design, construction, operation, and also into decommissioning of structures.

The way we are using technology to communicate and work together has got to be something that we need to incorporate into our education programs moving forward.”

The University of Adelaide is discussing how universities could collaborate with Industry partners to prepare Australia’s workforce for the future of construction and create major opportunities for curriculum for graduates from the construction Industry.



As construction evolves utilizing sustainable methods, the next generation of civil engineers with digital skills will be crucial to developing more efficient buildings.

buildingSMART International



At **3DEXPERIENCE** Edu, we interviewed a leader from buildingSMART association. Discover the full interview here:

- *How did the civil engineering job/discipline change over the past years?*

Civil engineering is a career that has undergone many positive changes in the last few years. The importance of civil engineering has never been more obvious. Digital applications have changed the way the role has been defined and offers unique opportunities for the value it will create. Demand for better data in early phases of a project that is needed for operations and maintenance is becoming an important role for engineers that need to make that data more accessible.

- *Will it still be evolving in the upcoming years?*

There will be changing demands in many vocations in the coming years. The need for interoperable data delivered by engineers is already becoming a reality. The role of technology will enhance

with more simulation and gaming-type software being part of the job. You can already deliver added-value in many civil engineering projects by using enhanced software to better plan, build and construct assets. This will only get more advanced.

- *How do virtual twins transform the job?*

Twins are clear accelerators for the industry today. They will allow companies to span new domains, develop new partnerships and business models and connect to data not previously imagined. For civil engineers, this could mean different ways of working and new ways of delivering value to clients. Areas like data science and data mining can enable optimization of workflows and best practices and lead to significant opportunities for civil engineers when technologies are applied.



The future of civil engineering job is very exciting and it's probably more critical than ever!

- *What are the main technologies transforming the job today? Which have the most impact?*

Some technologies are quite simple, such as delivering data models to construction field crews. Making sure construction field crews have accurate data is critical and something that has not been widely achieved. Other technologies like drone capture technology is changing the way surveying and engineering is done. Having quick and accurate data models captured by drones is enabling new ways of managing and monitoring assets. Sensor data is also becoming mainstream, with the ability to continually manage and monitor site conditions is of real value.

- *What are the main skills a civil engineer should have today?*

A good balance between technical and technology is key. I would also say an understanding for the need for open digital standards – this would help the industry tremendously!

- *Are graduates who are recruited today in the industry skilled enough on the new technologies?*

I would say many of the current and future graduates will have a natural grasp of technologies. What is taught needs to be agile, so that graduates can roll with the changes.

- *Can we say that civil engineer will be a key job in the future and why?*

It's probably more critical than ever and the future is very exciting!



In civil engineering, the role of technology will enhance with more simulation and gaming-type software being part of the job.



Jonathan Riondet

Technical Solution Director | Construction, Cities & Territories, Dassault Systèmes

According to Jonathan, there is currently a business transformation change. New roles and standards have emerged. Consequently, the civil engineer's job is being transformed, mainly through the introduction of BIM methodology in the building industry. Nowadays, civil engineers "spend more time on 3D modeling applications that become the main source of information for all elements attached to a project."



Infrastructure projects are also part of multiple systems that need to be considered as large-scale projects. Cloud-based apps also help stakeholders to collaborate on the same referential. Jonathan tells us the **3DEXPERIENCE** by Dassault Systèmes serves as a real influencing tool, being a real-time collaborative platform.

Jonathan is convinced civil engineers can contribute to a more sustainable world as the industry is moving towards more sustainable design approaches. "Traditional 2D paper documents are being replaced by virtual drawings from 3D reference models", he said.

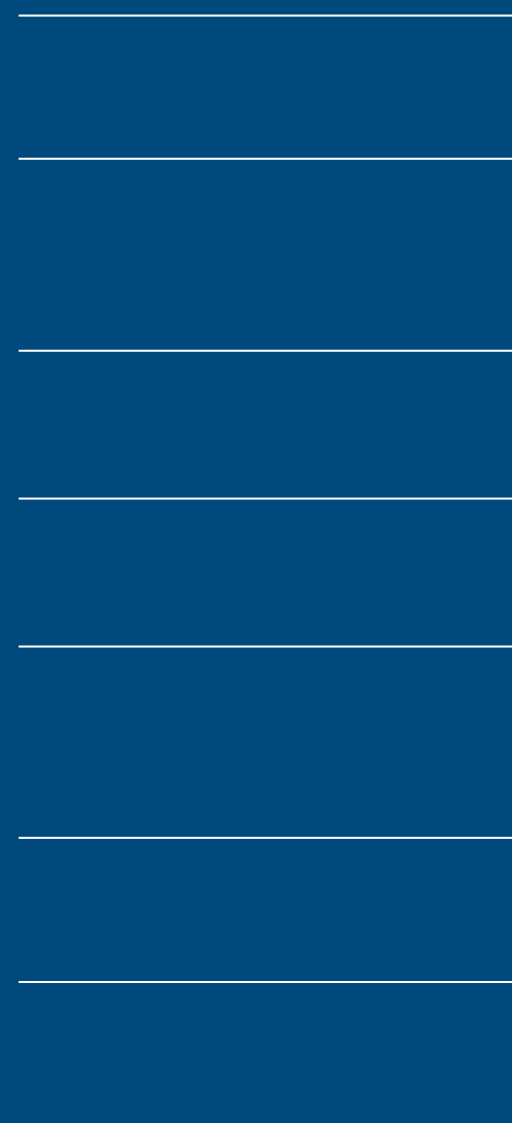
Finally, the shift in the discipline will continue towards a more "unified reference that will guarantee the traceability of the built asset over decades," he concludes.



A civil engineer has to adapt to new collaborative tools.

As the construction market has one of the highest worldwide GDPs, the discipline will continue to offer many job opportunities.

CONCLUSION

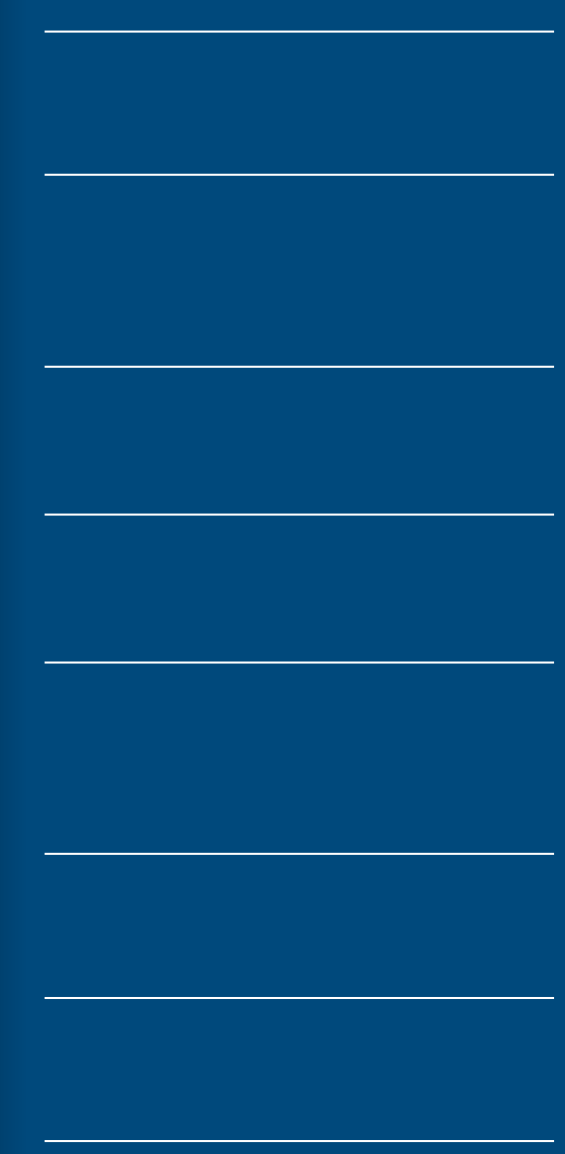
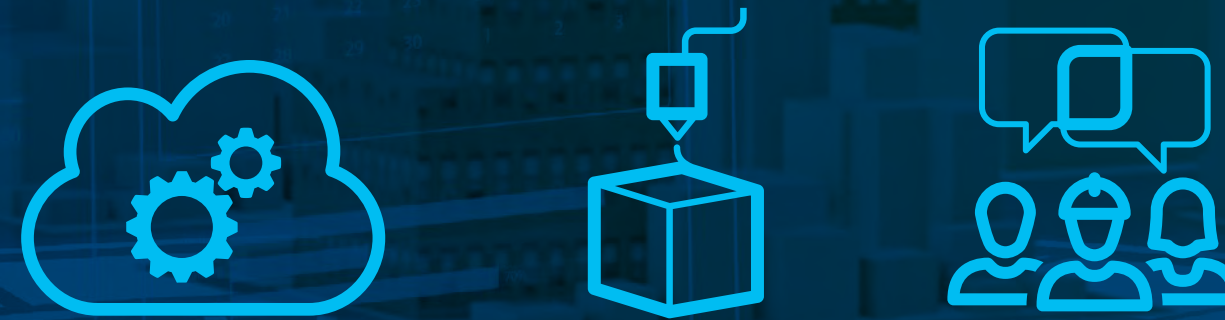


Digital innovation clearly demonstrates great potential to revolutionize the profession. Cloud-based apps, BIM, virtual twin models, Virtual Reality and even 3D printing are currently re-inventing the way we build the world around us, so the real worlds meet the virtual worlds.

Civil engineers have the experience and knowledge necessary to collaborate effectively and in a fast-paced and creative work environment, across many disciplines.

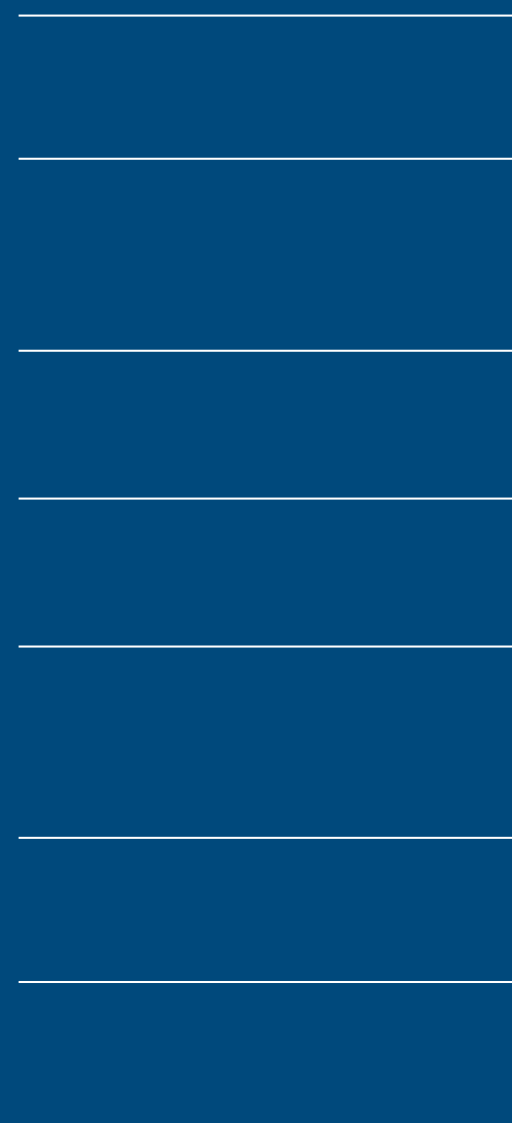
Civil Engineers are keystones in every building and infrastructure project. As those projects will continue to grow at a large scale, engineers will be in high demand to strengthen the foundation of a more sustainable world.

Civil engineering is and definitely remains a discipline of the future!





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