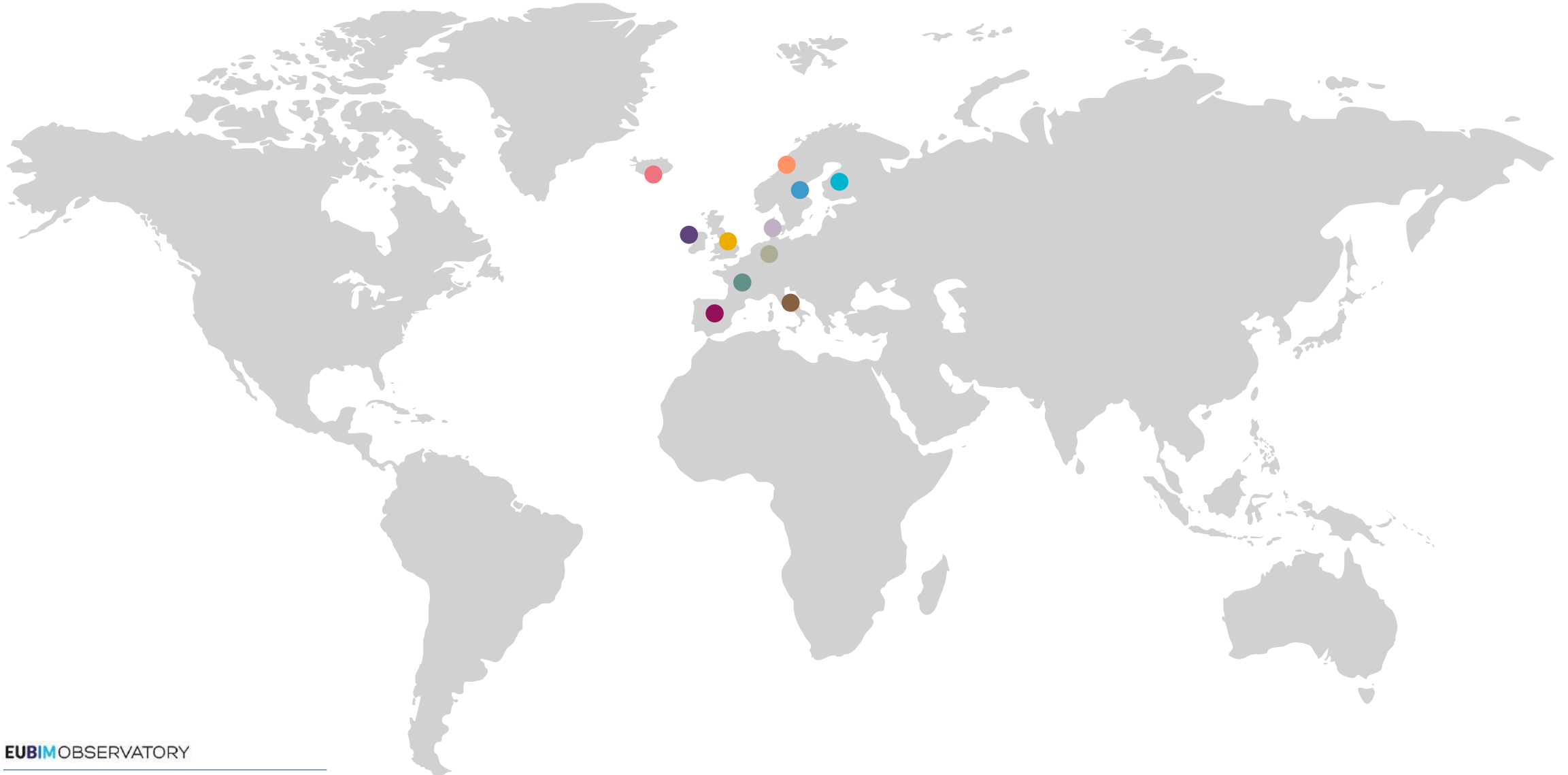
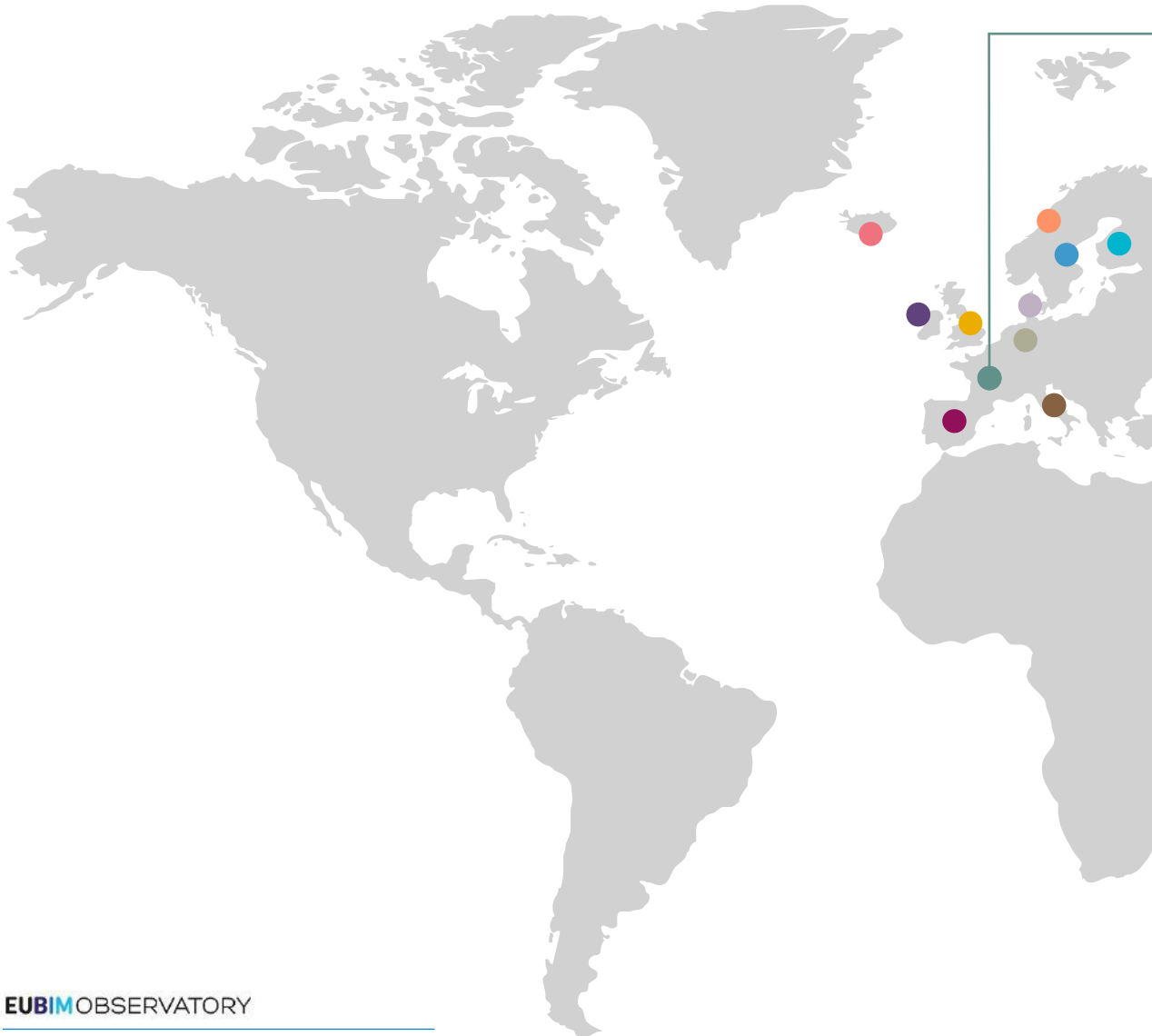


# EUBIM

OBSERVATORY







# FRANCE



France has launched a BIM strategy supported from two ministries with the aim to be directly applied in big building projects as well as in big infrastructure projects.

Its BIM strategy is developed within a national program for the digital transition of the industry where it wants to support both the electronic and construction area.

It is noteworthy that France is developing the largest infrastructural project in Europe, the Grand Paris Express.



In France, the PNTB-Plan Transition Numérique dans le Bâtiment was launched in 2014 and mandatory in 2017 with a financial support of 20M euro.



**PHILARMONIE DE PARIS**  
Budget: 234,5 millions € / Duration: 2012-2015

**EUROPE CITY**  
Area: 800.000 squared meters / Duration: 2012-2021



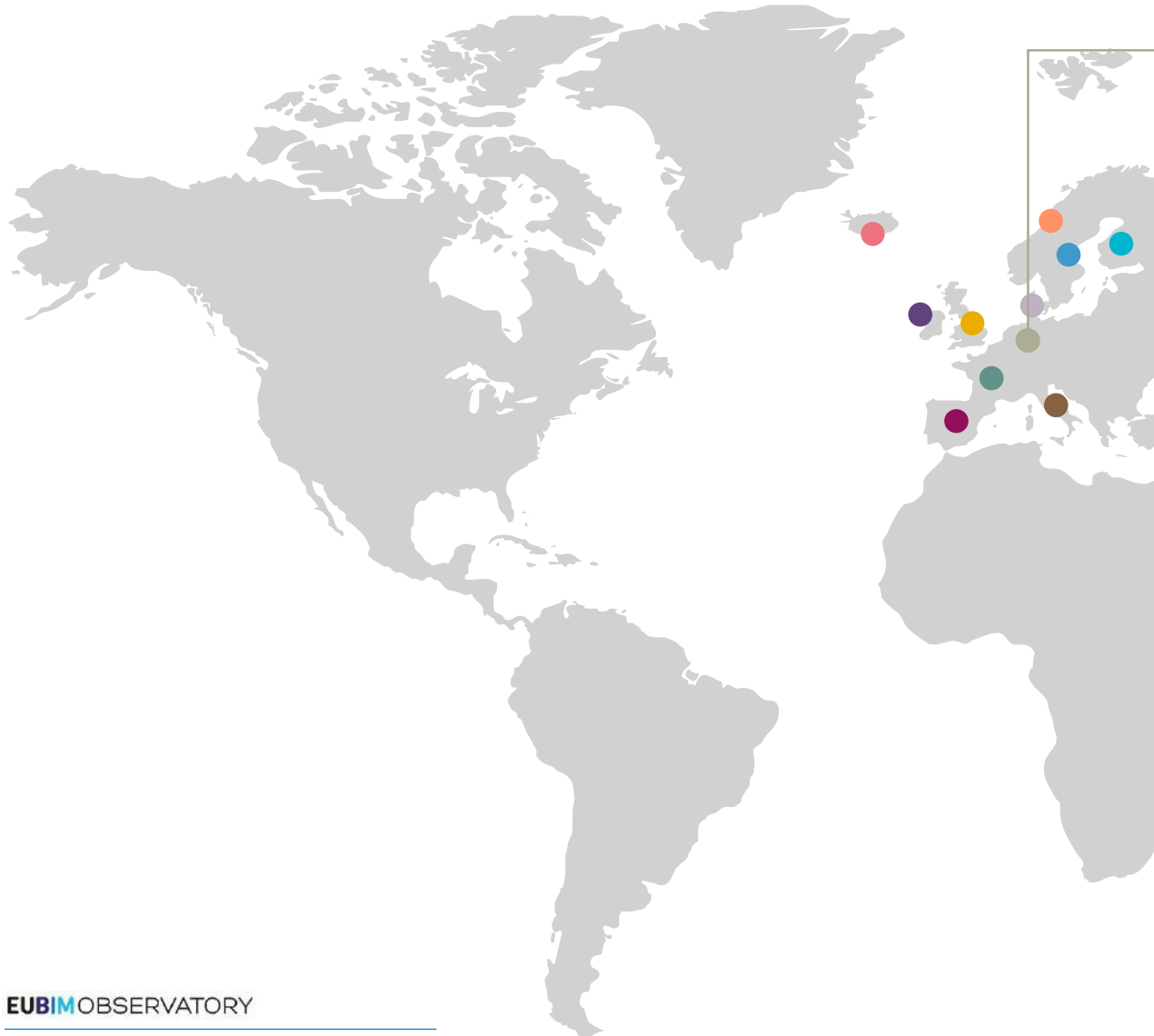
**GRAND PARIS EXPRESS**  
Budget: 22 billions € / Duration: 2013-2030



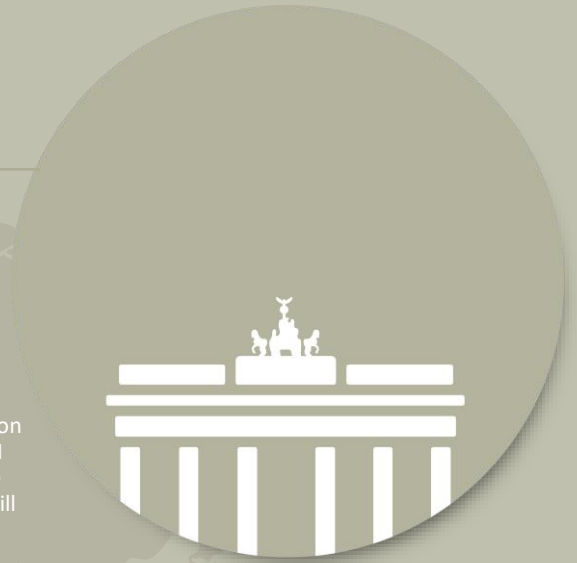
**Buildings / Infrastructures** There are no BIM obligations.



EduBIM



# GERMANY



Germany has based its strategy on a bottom-up movement where associations and clusters have pushed for a national strategy called Stufenplan Digital Planen und Bauen in 2015 with the support of the Ministry of Infrastructure and Digital Construction.

The strategy is based on the implementation of pilot projects to test the benefits of BIM environments until 2020, when a mandate resulting from the different experiences will be applied.

The Federal Ministry of Transport and Digital Infrastructure collaborates in the pilot projects with an economic endowment of millions of euros.



On December 2015 in Germany took place the launch of the roadmap for digital design and construction (Stufenplan Digitales Planen und Bauen 4.0) and that will be applied compulsory in 2020 by the Federal Ministry of Infrastructure and Digital Construction.



**FUTURIUM BERLIN**  
Budget: 58 millions € / Duration: 2015-2019



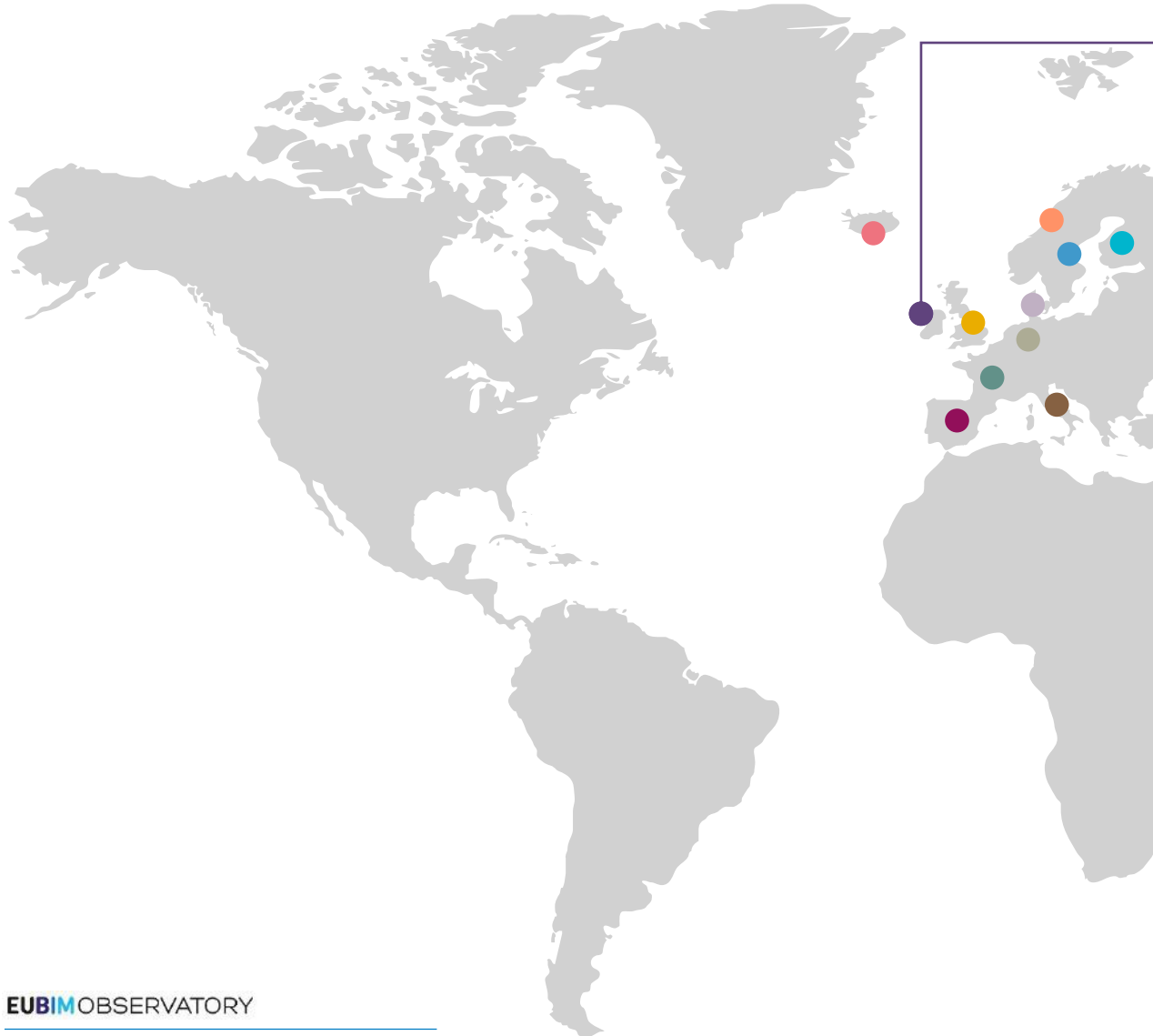
**RASTATT TUNEL**  
Budget: 450 millions € / Duration: 2016-2022



**Buildings** From 2017 to 2020, paragliding, with a budget of more than 5 million.  
**Infrastructures** As of 2020 for all government infrastructures that start with transportation projects.



It is not an official group of academic institutions.  
Various BIM master and certification courses



# IRELAND



In Ireland, despite the absence of a BIM mandate, the conviction and commitment of the Irish Government is absolute. Both from the economic point of view -with the financing of projects and institutions- as well as by the transforming capacity on the labor and technical fabric, BIM affects all the academic and training levels.



In Ireland, the National BIM Council and its Construction 2020 Strategies were opened and public in May 2014.



**NEW CHILDREN HOSPITAL**  
Budget: 1 billion € / Duration: 2016-2020



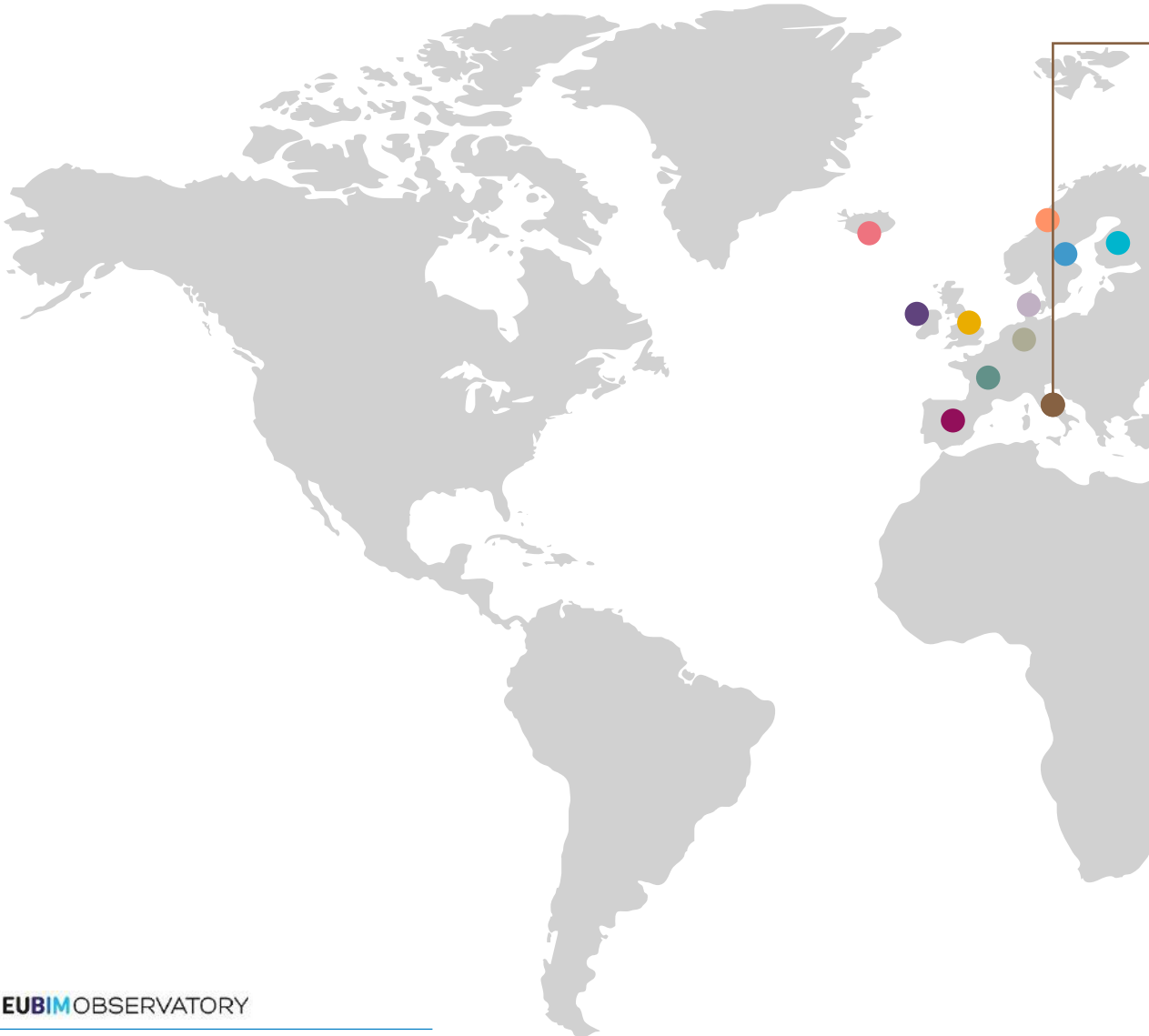
**CORRIB ONSHORE GAS PIPELINE COMPOUND**  
Budget: 3,5 billion € / Duration: 2011-2016



**Buildings / Infrastructures** No government BIM mandate only some publications supporting the adoption of BIM.



Institute of Higher Education (HEI) 15 institutions.



# ITALY



Italy aims to apply a BIM mandate between 2019 and 2022 for public building and infrastructure, foreseeing in that way from 1st of December the necessities that construction market urges in a European level.



The Ministry of Infrastructures and Transport under the signature of the "BIM Decree" and the UNI 11337 Digital Information Process standards, is implementing BIM in four chronological phases with construction budget distinctions.



### **NEW BULGARI MANUFACTURE**

600 square meter interior courtyard, 15000 square meters total area, building with LEED Gold Certification.



### **GULF TERMINAL OF LA SPEZIA**

**Budget: 85 million € / Duration: April 2018-September 2023**

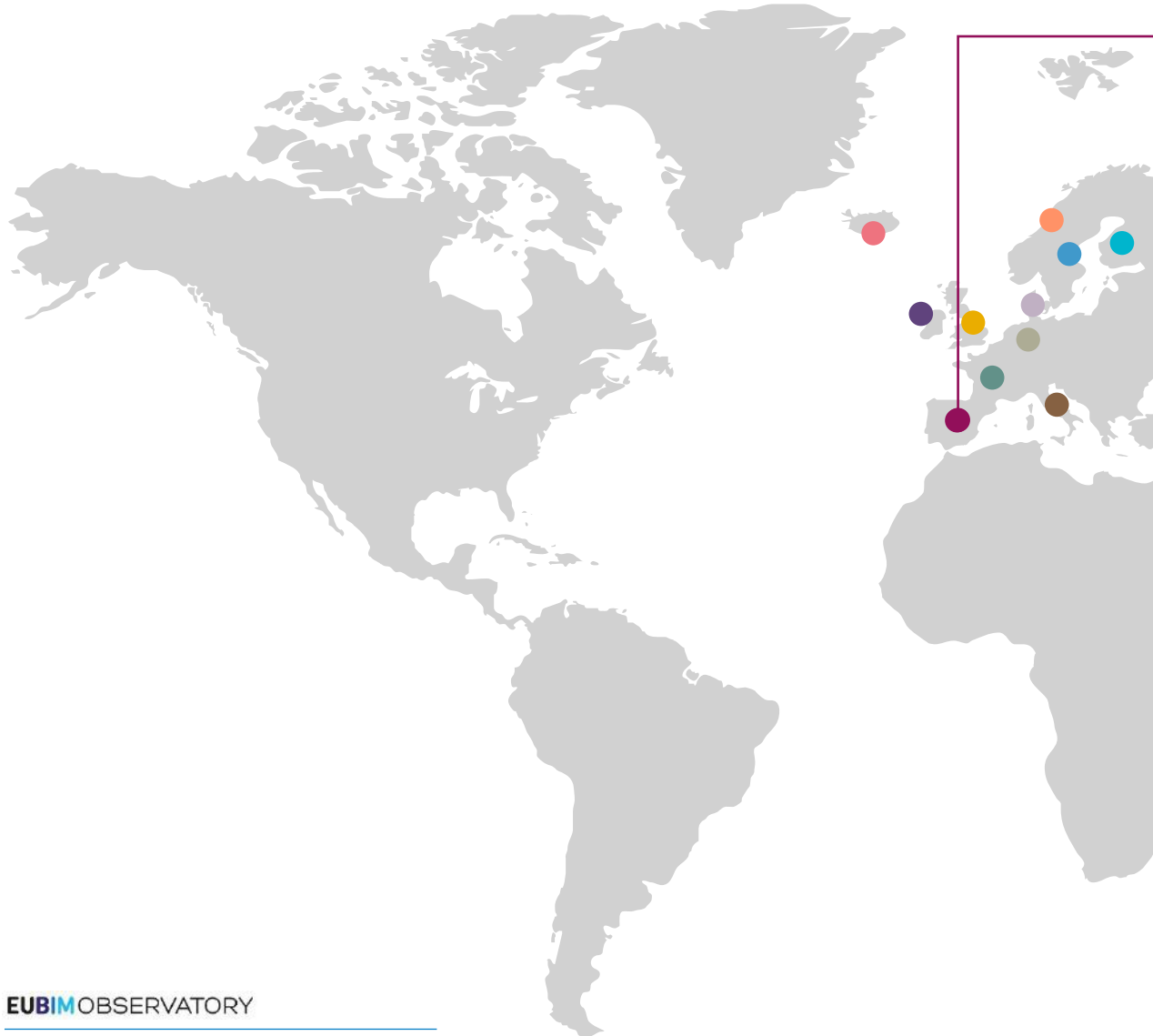


**Buildings** Whole implementation during the period of 2019 to 2025 in four phases.

**Infrastructures** From 2019-2022 there will be a BIM mandate for transportation projects of up to 100 million.



It does not have an official group of academic institutions only individual offers.



# SPAIN



Spain has quickly integrated a high level of BIM adoption by technical agents and designers. In 2019 the total inclusion of the construction sector aligned with the Digital Agenda of Public Administrations is expected.



In Spain, the BIM National Strategy esBIM starts in 2015, serves as a guide for the public building sector and the infrastructure sector.



**BBVA City**  
Budget: 620 million € / Duration: 2009-2015



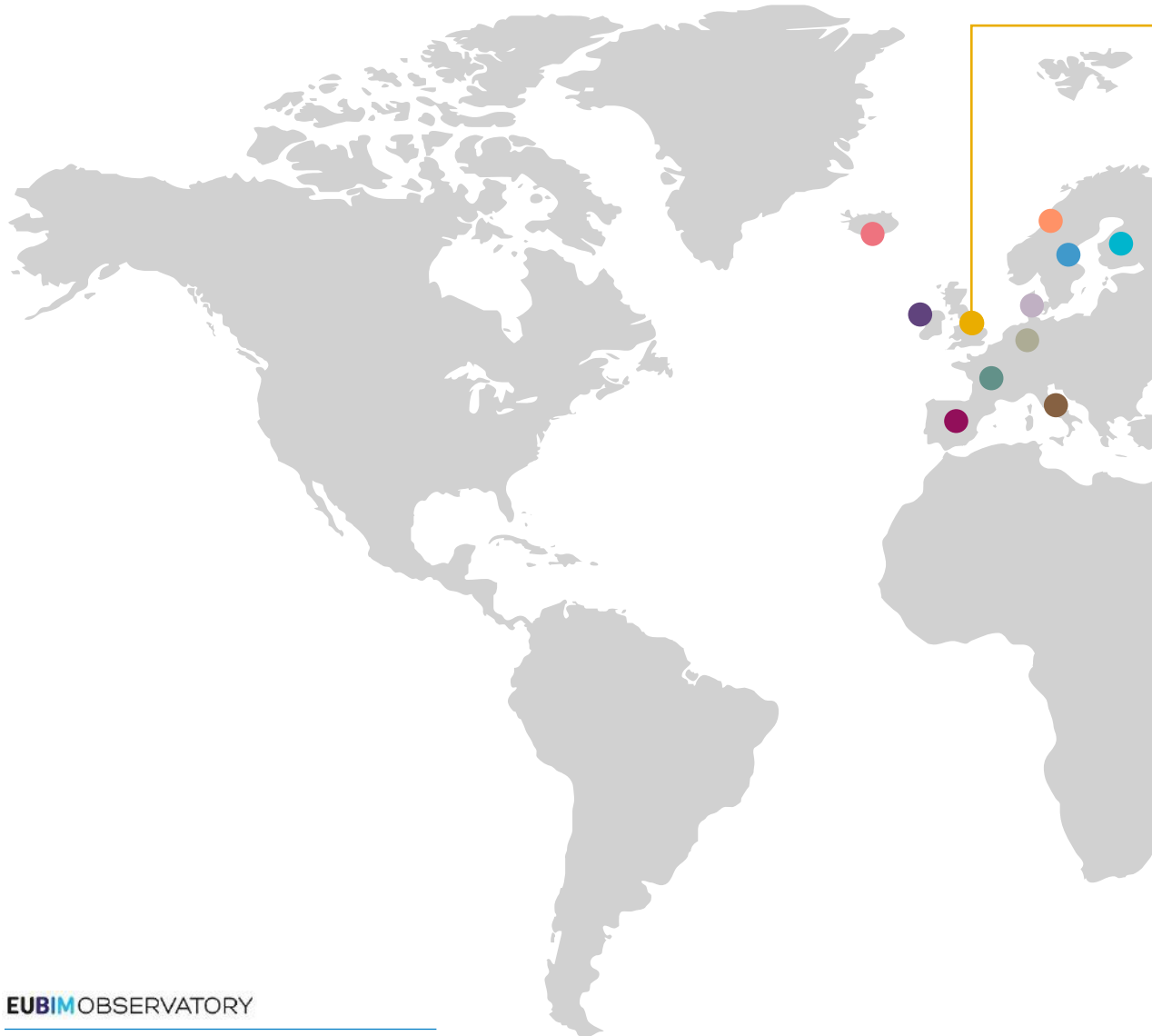
**ESPAI BARÇA**  
Budget: 600 million € / Duration: 2017-2021



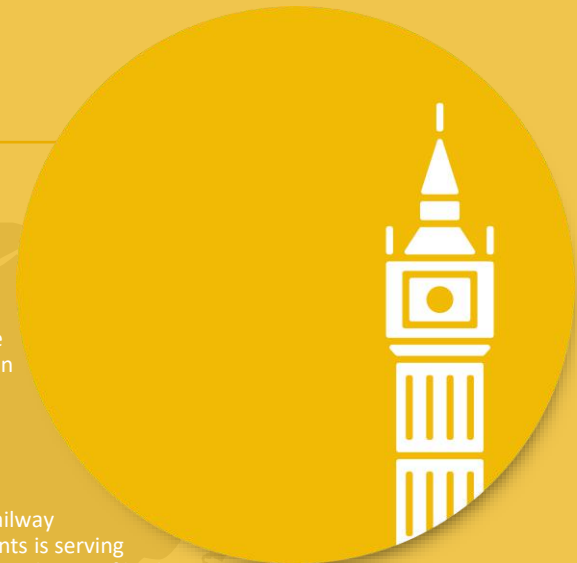
**Buildings** From March 2018 to 17 of December 2018 the BIM mandate applies to public projects.  
**Infrastructures** From 26 of July 2019 for public infrastructure projects.



esFAB  
14 Institutions



# UK



The United Kingdom has become the country that leads the BIM processes in Europe, as proposed in 2011. Its graphs on the BIM levels (BIM Levels of Mark Bew), the continuous linkage of BIM concepts to metrics and indicators of the sector and the correlation between public vectors identified the response of the private sector certify this massive implementation in the majority of states.

The firm commitment to develop large railway infrastructure projects in BIM environments is serving as a benchmark for innovation and rapid evolution of both new applications of software, as well as academic and labor-professional programs.

The United Kingdom has made clear the relationship of BIM as a tool for the digitization of the sector and is the driving force behind the industrialization of construction (called off-site / modular construction).



In April 2016, the UK approves a legislative decree applying BIM to all public procurement.



**MANCHESTER CITY COUNCIL**  
Budget: 100 billion £/ Duration: 2010-2014



**CROSSRAIL**  
Budget: 14,8 billion £/ Duration: 2009-2019

**HIGH SPEED 2**  
Budget: 65 billions / Duration: 2017-2033

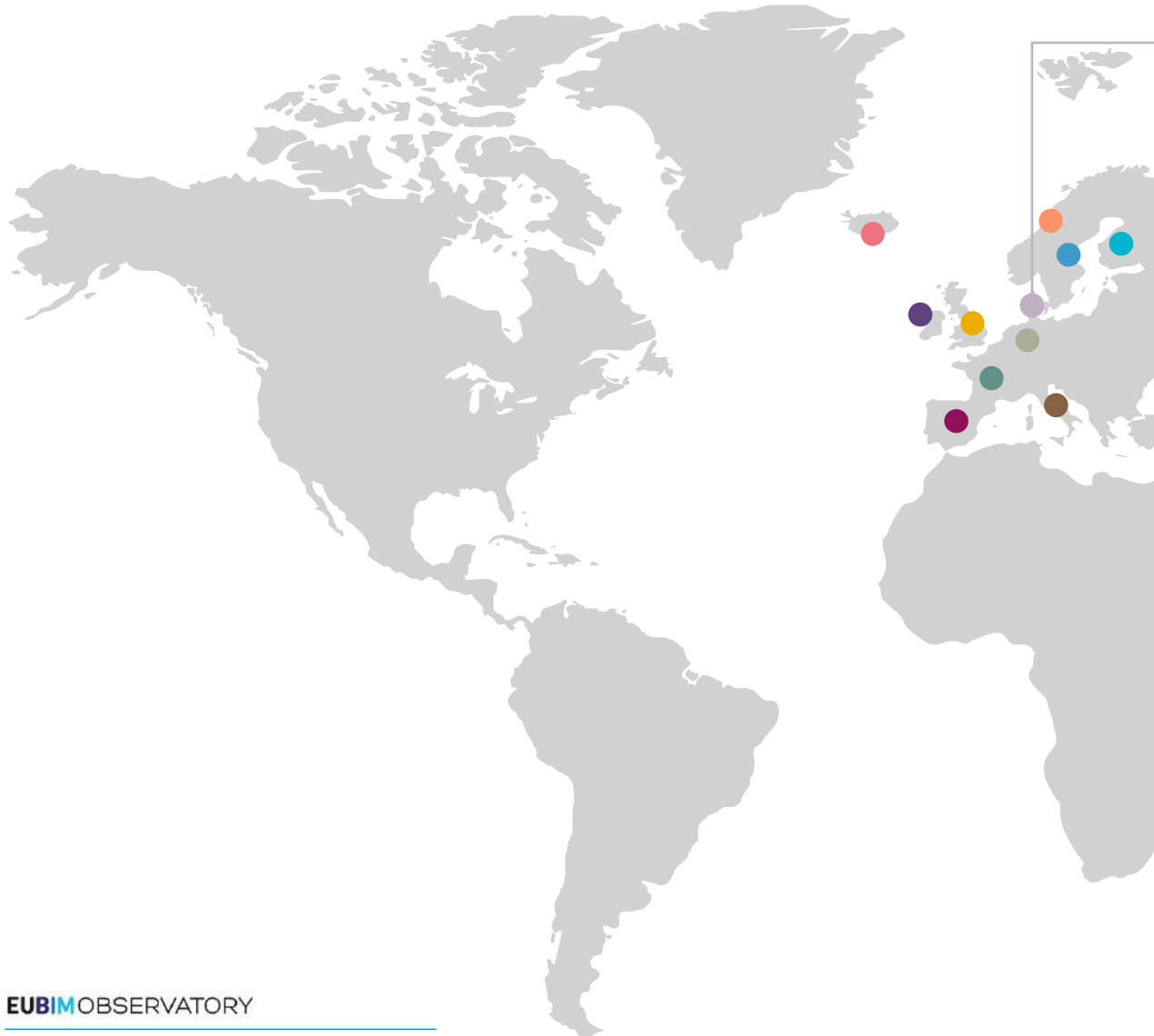


**Buildings / Infrastructures** From 4/4/2016 BIM mandate for public projects.



BIM Academic Forum  
25 institutions



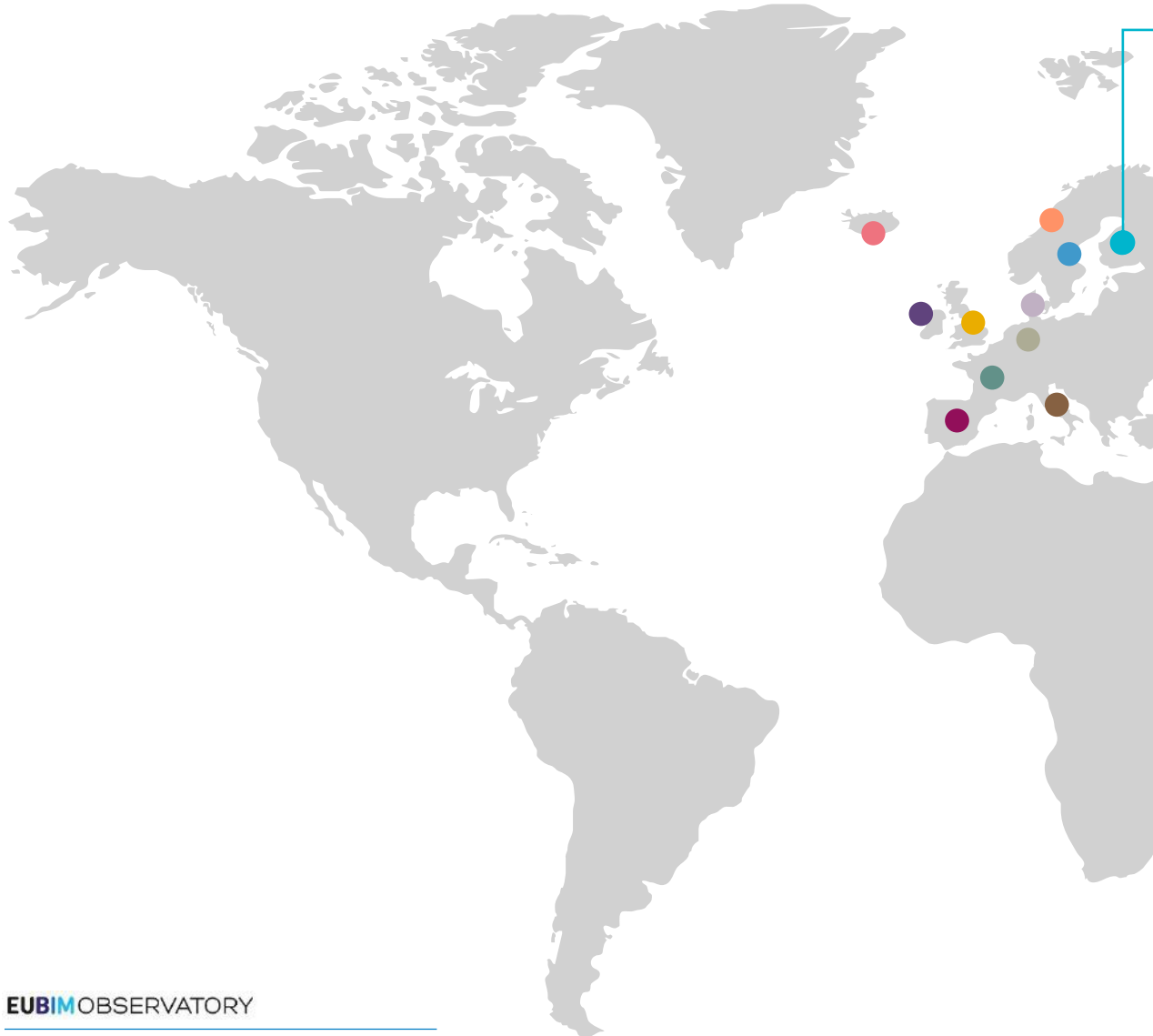


# DENMARK

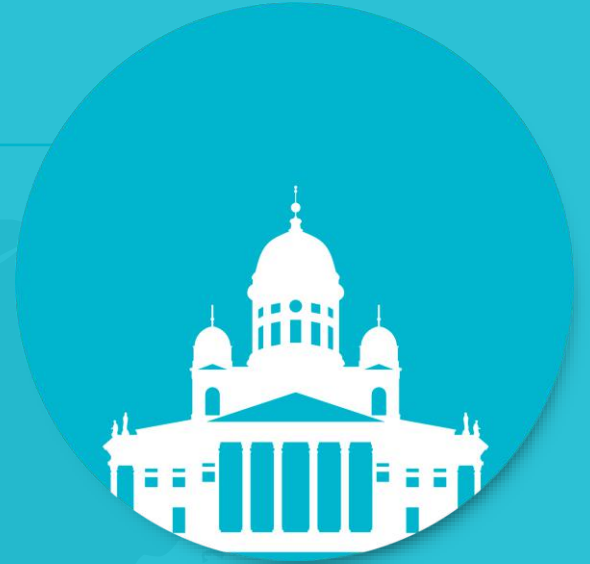
One of the most developed countries worldwide regarding the digital construction sector. The first country to ever mandate BIM back in 2007. Since then complex infrastructure and building projects has been serving as paradigmatic case studies for the industry. BIM is also integrated into the Academic fields as PhD and MSc programs, even with the absence of an official group supporting the BIM implementation in academic programs.



- ⚙️ The Digital Construction (Digitalt Byggeri) M€ 2.5 project was carried out between 2003-2006 in order to shape a BIM Implementation Strategy for new and buildings with a total cost of more than M€ 5. The mandate was introduced in 2007.
- 🏢 **BISPEBJERG HOSPITAL**  
**Budget: EUR 610 million**  
**Area: 217,000 square meters**  
**Duration: 2018-2023**
- 🚉 **NEW DUAL-TRACK, ELECTRIFIED RAILWAY BETWEEN RINGSTED-FEHMARN**  
**Budget: €1.2 billion**  
**Area: Approximately 60km-long and build for speeds up to 250km/h**  
**Duration: 2015 – 2021**
- 🔨 **Buildings** Since 2007 with for minimum Budget of 0.8M after 2013  
**Infrastructures** No mandate applied
- 🎓 Various MSc and PhD programs in Academic area but no active national group supporting BIM implementation in education.



# FINLAND



Finland sets an example in the digital construction industry. Even there is no official national strategy as in other case (Denmark, Germany, France, UK etc.), Finnish construction sector has developed a great efficiency into digital and interoperable processes.



No official National Strategy for BIM implementation in Finland.



**TRIPLA MALL**  
Budget: €1 billion  
Area: 355,000 sqm  
Duration: 2013 - 2021



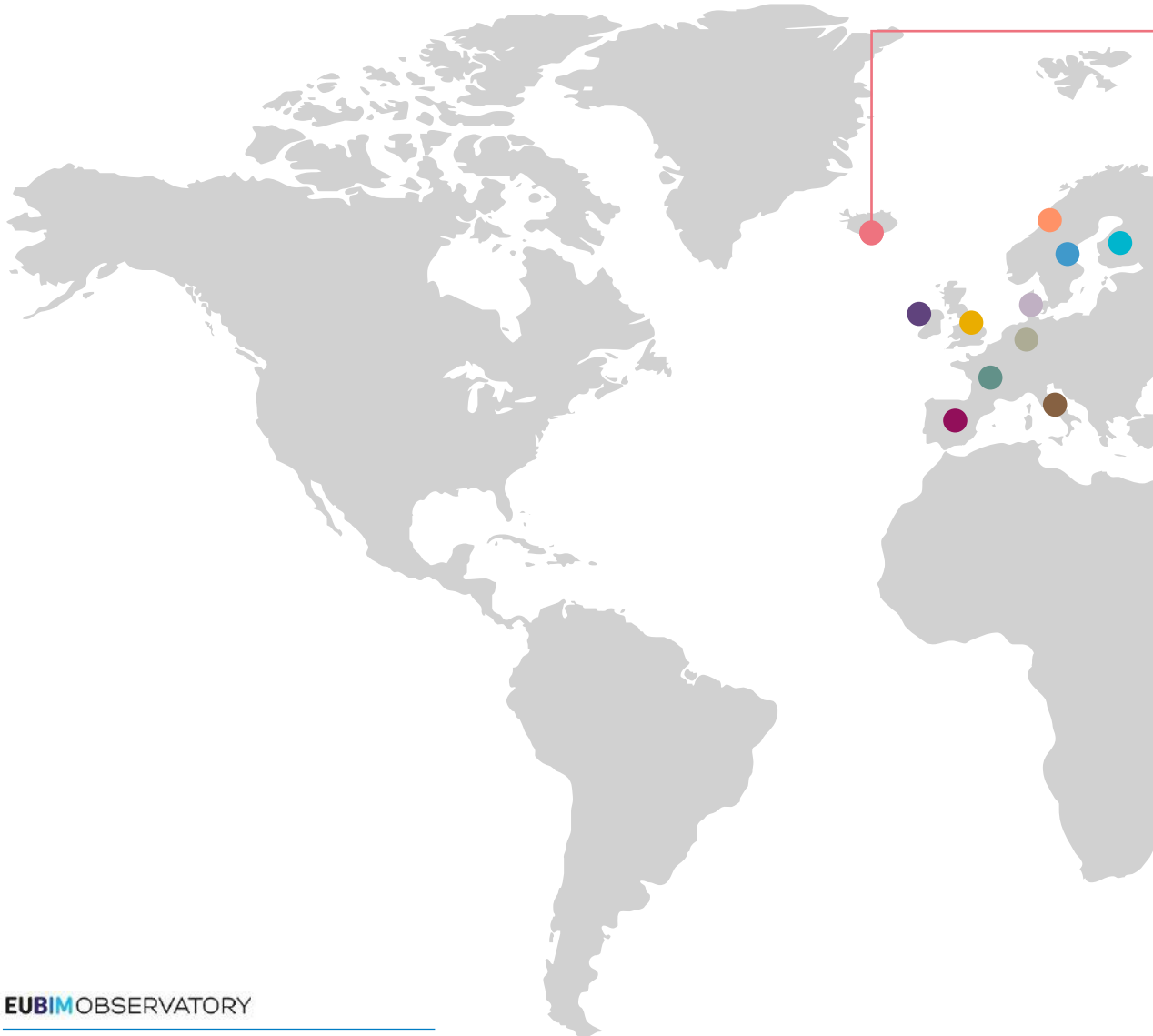
**WEST METRO**  
Budget: It is estimated that the first phase will cost 1,800million EUR and the second stage will cost 801million EUR.  
Area: 21klm of underground lines  
Duration: 2013 - 2020



**Buildings** 2007  
**Infrastructures** 5 of May 2015



No active national group supporting BIM implementation in education.



# ICELAND



One of the challenges that Iceland had to face through its BIM adoption process, is adjusting the implementation model from bigger industries to its own minimized scale. Government Construction agency led this process with the first mandates for open standards use to be planned and confirmed from 2008 to 2011.



The Government Construction Contracting Agency (GCCA) in collaboration with the Ministry of Finance, set a council of public producers called BIM Iceland in order to develop the BIM Implementation.



### **NATIONAL UNIVERSITY HOSPITAL**

**Budget: 393 million euros**

**Area: 106.543 m2**

**Duration: 2015-2023**



### **BURFELL II HYDROELECTRIC POWER PLANT**

**Budget: 121 million euros**

**Area: Extension of 100MW of capacity to the existing 270MW**

**Duration: 2015 - 2018**

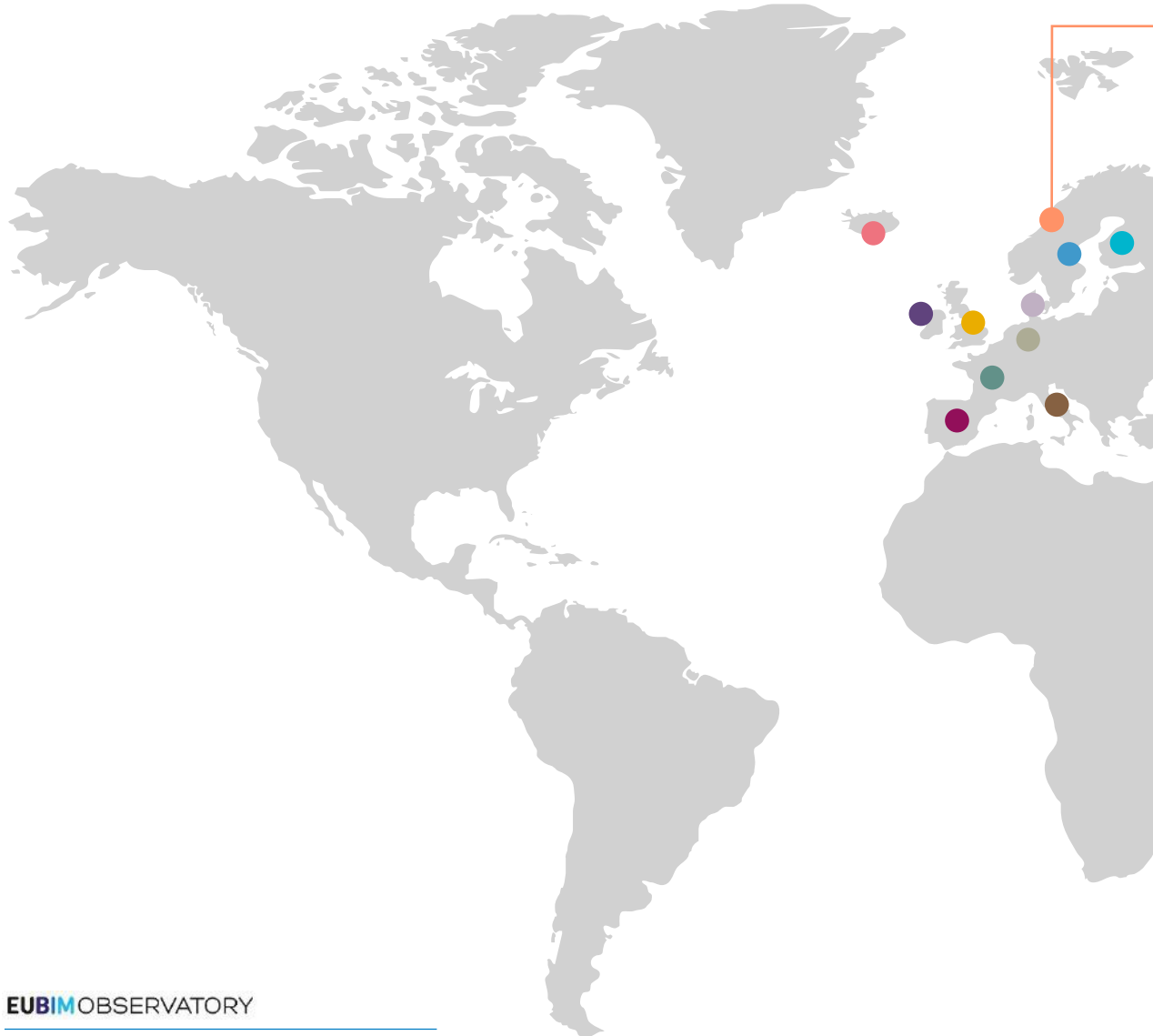


**Buildings** Government Construction Contracting Agency with the support of the Ministry of Finance mandate use of BIM in government funded building projects of more than 3.5 million euros.

**Infrastructures** There is no mandate for BIM in public infrastructure projects.



No active national group supporting BIM implementation in education.



# NORWAY



Definitely one of the top players in the Digital transformation journey of the sector. Statsbygg, the biggest public owner if the country was leading the process with the first strategic guidelines to be published on 2009. By launching the first paperless project (Vamma 19 Hydropower project) to construct a mega infrastructure project of 42bn euros (E39 coastal highway), Norway justifies why is considered one of the leaders in the field.



Statsbygg BIM Manual was released on 2009 (first edition) as a national BIM guideliness.



**MJØSTÅRNET TIMBER BUILDING**

**Budget:** Turnover of more than 1 billion Euros

**Area:** 85 meters tall with around 8000 metres of space on 18 floors

**Duration:** First sketch February 2015 - delivery spring of 2019



**E39 COASTAL HIGHWAY**

**Budget:** 42 bn euros

**Area:** 1100 klm

**Duration:** delivery 2026

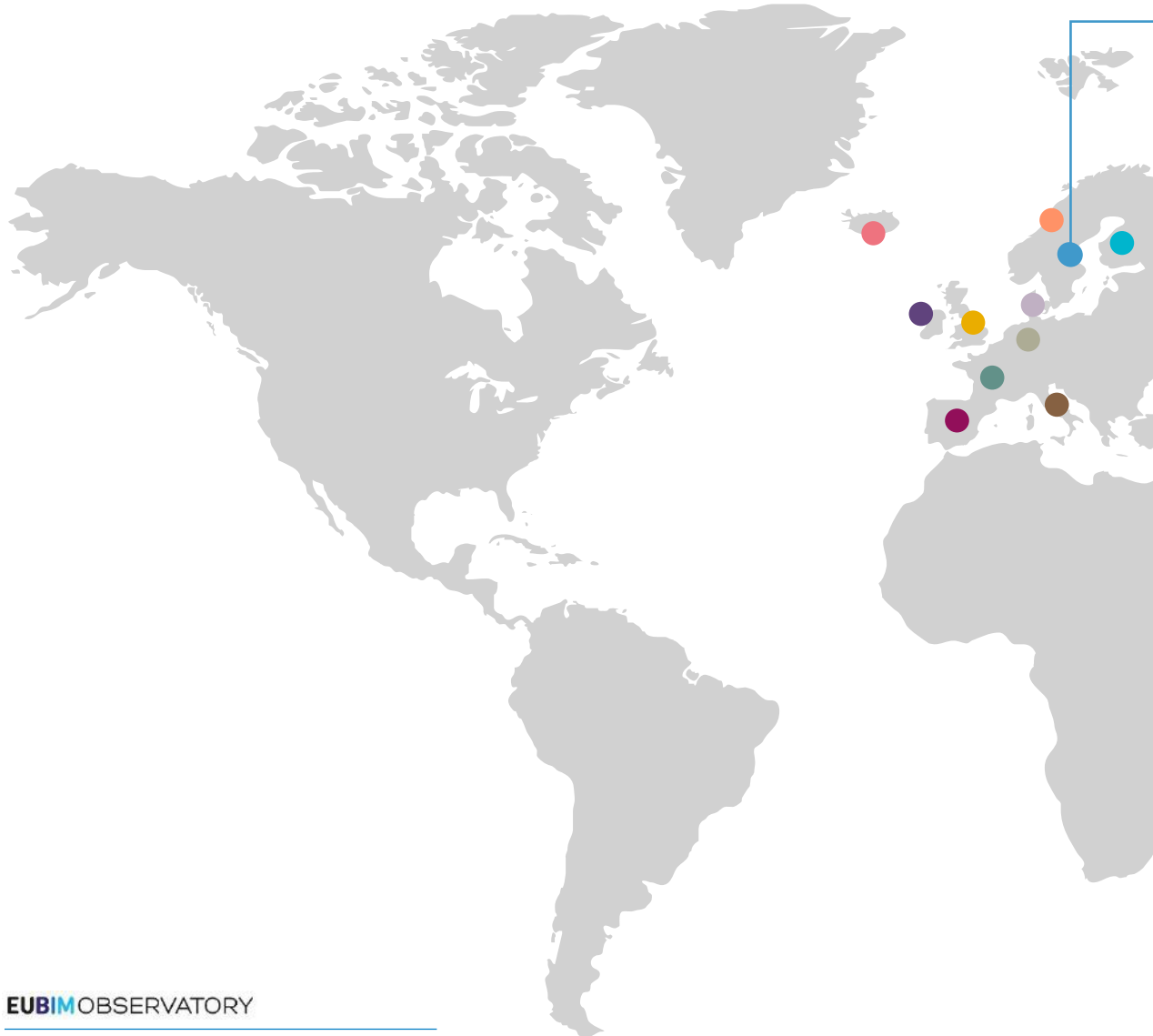


**Buildings** Norwegian Homebuilders Association, Statsbygg

**Infrastructures** SENHRA, Statsbygg




Various MSc and PhD programs in Academic area but no active national group supporting BIM implementation in education.





# SWEDEN





With very complex infrastructure projects (E4 Stockholm Bypass) and some large scaled building projects (world largest public private hospital project) Sweden shows some similarity to the Finnish model. Without a clear national strategic leader but a very strong public-private bond, a set of advanced companies achieves to work harmonically with public administrations, developing that way the pathway that construction sector follows.

 No official National BIM Strategy.

 **NEW KAROLINSKA HOSPITAL**  
**Budget:** overall investment of \$3.0 billion (including \$1.6 billion for construction)  
**Area:** The hospital – which will cover 320,000 square meters – will have over 12,000 rooms, 35 operating theatres and 17 magnetic resonance imaging (MRI) units.  
**Duration:** 2010 - 2017

 **E4 THE STOCKHOLM BYPASS PROJECT**  
**Budget:** 3.1bn euro  
**Area:** 21klm (18klm de tunnels)  
**Duration:** The initial study was made back in 2001, the first construction work started on 2005 and opening is planned to 2026

 **Buildings** No clear BIM building mandate  
**Infrastructures** Swedish Transport Administration

 BIM Academy by Swedish BIM Alliance.



France has launched a BIM strategy supported from two ministries with the aim to be directly applied in big building projects as well as in big infrastructure projects.

Its BIM strategy is developed within a national program for the digital transition of the industry where it wants to support both the electronic and construction area.

It is noteworthy that France is developing the largest infrastructural project in Europe, the Grand Paris Express.



The BIM Strategy in France is called PTNB launched on 2015 - Plan de Transición Digital en la Edificación.

The object of PTNB (financed with 20 million euros) is to support the transition of all construction sector's bodies that participate in this technological and cultural change towards BIM and begins with a plan to build 500.000 new houses.

It is important to mention the national project MINnD - Modélisation des Infrastructures Durables coordinado by IREX- which includes almost 60 national partners (companies, engineer schools, ...)



Europa City is a French planned development set of Paris, for completion during the 2020-2021 year. It was introduced to the public as an international invited competition for design of an 800,000 square metre cultural, recreational, and retail development located in the Triangle de Gonesse region of France. The main purpose of the project is to combine dense urban development with open space. The winner, announced in Spring 2013 is the architectural group Bjarke Ingels Group.

Europa City is set to be the "largest cultural, commercial, and leisure destination in Europe". This enormous development will cost around \$2 billion to construct and will consist of somewhere around 500 shops, hotels, amusement parks, and a water and snow recreational facility. It is estimated that the development will lead to the creation of at least 17,500 permanent jobs and will attract up to 30 million visitors per year.

**Philharmonie de Paris**, 39.642 m2.

Architect Jean Nouvel. Duration: 2012-2015. 234,5 million €



**Grand Paris Express** is a 200km long high-speed metropolitan railway project with 68 new metro stations built in the region of Île-de-France en Paris. It has been awarded with the BIM d'Or 2017 for its library of 400 digital objects, the integration of users from the beginning and its prenormalization processes.



**BIM Mandate in Building** In France, there is no BIM mandate only initiations through the Digital Transition Plan of Construction ( PTNB in french).

**BIM Mandate in Infrastructures** There is neither BIM mandate in infrastructure sector



**EDU BIM**

EduBIM is a network of university professors and teaching instructors in BIM with the objective to bring together different educational institutions in the construction sector: engineering schools, architecture schools, universities, secondary schools etc. Also participants in this network come from the business sector such as engineering, construction companies, contractors BIM software companies, etc.

EduBIM annually celebrates a congress of BIM academic trainers.



Germany has based its strategy on a bottom-up movement where associations and clusters have pushed for a national strategy called *Stufenplan Digital Planen und Bauen* in 2015 with the support of the Ministry of Infrastructure and Digital Construction.

The strategy is based on the implementation of pilot projects to test the benefits of BIM environments until 2020, when a mandate resulting from the different experiences will be applied.

The Federal Ministry of Transport and Digital Infrastructure collaborates in the pilot projects with an economic endowment of millions of euros.



The roadmap - called **Stufenplan Digitales Planen und Bauen**, financed by the Ministry with 200,000 euros - was announced on February 20, 2015 by the Commission for the Reform of Major Construction Projects - Reformkommission Bau von Großprojekten.

This road map defines a common concept of what the BIM method means and establishes in 2017 the requirements that the Federal Ministry of Transport and Digital Infrastructure will require for the digital models and their collaborative processes in the period 2017-2020. It introduces a pilot phase to acquire experience through the use of BIM in several main projects.



**Futurium Berlin** is one of the reference projects in BIM. Promoted by a public-private partnership, Bundesanstalt für Immobilienaufgaben, it has been built by BAM Deutschland AG and conceived by Richter Musikowski GmbH. It covers an area of 8,000 m<sup>2</sup> and a budget of 58 million euros. It started in March 2015, the handover of keys was made in September 2017 and will be completed in 2019.



Four pilot projects have been chosen as models to experience BIM environments. The largest of these is the Rastatt tunnel that serves as a key section of the railway connection between Karlsruhe and Basel. Two single-tube tunnels with a length of 4.7 km are built with two tunnel machines 11 meters in diameter. Its budget is 450 million euros. The start of its work was in 2016 and the forecast of its completion is in 2022.



**BIM Mandate in Building Sector.** For any public building with an investment of more than 5 million euros, the application of BIM methods must be considered through a regulation approved in January 2017.

**BIM Mandate in Infrastructures.** From December 2015, it should be applied to public infrastructure projects. From of December 2020, all government infrastructure must be carried out with BIM-5D technologies.



The German Association of Computing in Civil Engineering (GACCE-German Association of Computing in Civil Engineering) defines the training content that universities in the AEC sector (Architecture, Engineering and Construction) must offer.

There is a high level of academic research activity in BIM for its scientific publications.



In Ireland, despite the absence of a BIM mandate, the conviction and commitment of the Irish Government is absolute. Both from the economic point of view -with the financing of projects and institutions- as well as by the transforming capacity on the labor and technical fabric, BIM affects all the academic and training levels.

In 2013 Forfás Ireland's Construction Sector published the Outlook and Strategic Plan 2015 specifically mentioning BIM.

In 2014, the Construction 2020 Strategy published by Enterprise Ireland appears and sets a stimulation fund for the construction of 200 million euros, including an allocation of 50 million euros for the improvement of regional and local road projects and another 50 million euros to provide for social housing with the aim of creating 60,000 new jobs in the sector.

NBC Ireland is the strategic council that will provide vision, leadership and a collective voice for the advancement of digital design for the successful implementation of BIM Level 2 and beyond..They launched the most recent document on the 7th of December called "The RoadMap for Digital Transition in Ireland's construction industry"

Meanwhile, CitA-Construction IT Alliance has developed a study on BIM in 2017



The **NHC-New Children Hospital** is the largest, most complex and significant investment project ever undertaken in the health sector in Ireland. Its BIM model offered the opportunity to visualize the space, improve the use of the underutilized areas, as well as being used and shared by all the technical team.

Budget: 1 billion euros. Duration: 2016-2021



The construction of the tunnel for the **Corrib Onshore Gas Pipeline Compound** started in 2011 and ended in 2016. The project was awarded as the Engineering Project of the Year 2016. It is a critical infrastructure of the national energy facilities as it will cover the needs of the next 20 years.

Cost: 3,5 billion €. Made for Shell by RPS Group Ltd, Roadbridge Ltd, BAM and W & F.



**BIM Mandate in Building Sector.** Government is to be asked to note the benefits that BIM can bring to the public capital programme and the challenges associated with it. Government will be asked to decide to mandate the adoption of BIM across the public service on the basis of a high level strategy that is summarised in this section. It is envisaged that the mandate will have a twofold purpose 1) to ensure that public bodies invest the necessary resources to adopt BIM in line with the strategy and 2) to impose standards for delivery across the public sector. In the absence of EN or Irish Standards, Government support for the strategy is necessary to implement a consistent approach in procuring BIM across the public service.

**BIM Mandate in Infrastructures.** Without a BIM mandate for infrastructure in Ireland, different sectors have introduced it in their way of operating. The OPW-Office of Public Works working within the EU BIM Task Group, the Transport Infrastructure Ireland (TII) - explaining the use of BIM for the North Metro-, Irish Water, Dublin Airport Authority are already using BIM processes.



The Higher Education Institutes have responded quickly to the demand for BIM education and training programs by the industry despite the absence of a national BIM mandate.

BICP has established the BAFI-BIM Academic Forum Ireland in 2016 with 15 HEIs Irish universities, technology institutes and private colleges.





Italy aims to apply a BIM mandate between 2019 and 2022 for public building and infrastructure, foreseeing in that way from 1st of December the necessities that construction market urges in a European level.



In Italy the UNI 11337 standards shaped for the first time on 2013 reshaped on January 2017 and about to be revised at the end of 2018, are the backbone of the national strategy for the "digital management of information processes" divided into 10 parts each one concerning a specific aspect.

The Italian strategy has got underway since the publication of the new Procurement Code. It provides for the progressive adoption of BIM (even if there is no clear reference to BIM, specific electronic methods and tools, such as those for the building and infrastructure modelling, to rationalize the design activities and the related tests). Furthermore, has recently been approved and signed the "BIM Decree", which provides for the mandatory application of the BIM methodology, starting from 2019.



#### **New Bulgari Manufacture facilities**

Manifattura Bulgari is a design by Open Project. With a total area of 15,000 square metres, it is composed of two buildings with completely different architectural characters, so as to create the perfect bridge between innovation and tradition.



#### **"Gulf Terminal of La Spezia"**

Location: La Spezia, Italia  
Area of the Land: 120,000 square meters  
Cost: 85 million euros  
Duration: April 2018-September 2022

#### **The maintenance of the curves of the Carrai and Acquabona SS12 of Bertrand and Brenner.**

Budget: 6,9 million euros  
Duration: 2017-2019



**BIM Mandate in Building Sector.** 'Minister of Infrastructures and Transport signed the "Baratono Decree BIM" on December 1st after an initial consultation phase concluded in July 2017 concerning the obligation to use progressively specific methods and electronic tools for the construction and infrastructure.

The phases of the introduction of this decree will be:

Until 2019, the obligation to adopt the BIM methodology will be linked to particularly complex works of more than 100 million euros.

From 2019 to 2021, the criteria will be related more to the issue of complexity than to the amount. BIM will be used for strategic work with special safety standards and a high number of people.

Finally, from 2022, the BIM will be introduced at full capacity, becoming mandatory for all ordinary works, except for residential work and not presenting any particular problems related to security.

In 2025, the process will be digitized for all projects, more or less complex, up to amounts of less than one million euros.

**BIM Mandate in Infrastructures.** At the moment there is no distinction between the infrastructural part and the building one. There is a unique text, which provides for the adoption of BIM without distinction of works.



There are various training offers about BIM. Universities are promoting individual courses about the use of the software and about the approach to the processes regulating the activities in BIM. As post-graduate activities there are several master's degrees, the same is for the doctoral programs. Basically the academic offer is conforming with the market demand.



Spain has quickly integrated a high level of BIM adoption by technical agents and designers. In 2019 the total inclusion of the construction sector aligned with the Digital Agenda of Public Administrations is expected.



#### esBIM, National Strategy BIM

Started in 2015, it will be implemented in 2018 for the construction of building projects and in 2019 for infrastructure projects.

At the regional level, there is a BIM Roadmap in Catalonia initiated in 2015 by the Comissió Construir Futur of ITeC. In 2017, 88 actions to be carried out were approved.

The Basque Country started in 2016 its BIM strategy led by the Eraikune construction cluster. Known as BIM Eraikal will be launched in the period 2020-2022. In 2017 the document "BIM Implementation in the Company" was presented.



The **BBVA City** is a complex construction project of 114,000m<sup>2</sup>, 19 floors and 93 meters height.

Designed by Herzog & De Meuron, with BIM methods and the LEED Gold environmental certification and ISO 14001.

Duration: 2009-2015

Budget: 620 million €



**Espai Barça** is a Barcelona Football Club's project to redevelop the Camp Nou together with its surrounding facilities.

40,000 square meters will be reformed and the whole work will have a total cost of 600 million euros.

Duration: 2017 / 18-2020 / 21



**BIM Mandate in Building Sector.** Planned mandate for approval on 17th of December 2018.

**BIM Mandate in Infrastructures.** Planned mandate for approval on 26th of July 2019.



esFAB, the BIM Spain Academic Forum, is a non-profit academic network focused on promoting the use and good practices of the BIM methodology and the innovation opportunities it offers in the academic, training and research fields. The network consists of 14 universities.

Although there has been no activity of esFAB beyond its creation and the survey carried out.



The United Kingdom has become the country that leads the BIM processes in Europe, as proposed in 2011. Its graphs on the BIM levels (BIM Levels of Mark Bew), the continuous linkage of BIM concepts to metrics and indicators of the sector and the country and the correlation between public vectors identified the response of the private sector certify this massive implementation in the majority of estates.

The firm commitment to develop large railway infrastructure projects in BIM environments is serving as a benchmark for innovation and rapid evolution of both new applications of software, as well as academic and labor-professional programs.

The United Kingdom has made clear the relationship of BIM as a tool for the digitization of the sector and is the driving force behind the industrialization of construction (called off-site / modular construction).



In March 2011, the BIS-Department for Business, Innovation and Skills launches the government initiative of the Cabinet Office. The document established a period of five years to structure a strategy for the improvement of four objectives: cost of construction, delivery time, increase in exports and reduction of CO2 emissions.

In 2013 the Construction 2025 Strategy report was published, which is configured as the basic and key tool for the development of the BIM in the country.

On 4 of April 2016 is established the mandate that the Cabinet Office and the Infrastructure and Projects Authority presents on March 23 as the Government Construction Strategy: 2016-2020. Its objective: to increase productivity and to support 20,000 new ones projects in this period. BIM and the Digital Construction are an important part of this strategy and for this they establish the BIM maturity level in three levels. BIM Level 2 is the starting level (collaborative projects) and BIM Level 3 (integrated projects) is marked as the goal to achieve in 2020.



The **MCC-Manchester City Council** began in 2010 and finished in 2014 the redesign of the extension of its municipality and central library.

Cost: £ 100 million



**Crossrail** is a railway line of 118 kilometers (73 miles) that crosses the subsoil of London. It includes 38 stations of which nine are underground.

Budget: 14,8 billion pounds / 18 billion euros

Duration: 2009-2019

#### **HS2-High Speed 2**

The government has launched a second high speed major project to link London with Birmingham and Manchester with Leeds. The magnitude of the project has created 25,000 jobs generating a flow of economic benefits of 103 billion pounds in the country.

Budget: 65 billion pounds

Duration: 2017-2026 for the 1st phase, 2033 for the second phase.



**BIM Mandate in Building Sector.** Since April 4, 2016, BIM is mandatory for public projects.

**BIM Mandate in Infrastructures.** From April 4, 2016, BIM is mandatory for public infrastructure projects.



**BAF-BIM Academic Forum**, created in 2011, brings together 25 universities and educational institutions in the United Kingdom.

BAF focuses on the development of a 'BIM academic framework'. Its essence is to propose a roadmap towards a longer term vision of incorporating BIM learning at the appropriate levels within undergraduate and postgraduate education.



One of the most developed countries worldwide regarding the digital construction sector. The first country to ever mandate BIM back in 2007. Since then complex infrastructure and building projects has been serving as paradigmatic case studies for the industry. BIM is also integrated into the Academic fields as PhD and MSc programs, even with the absence of an official group supporting the BIM implementation in academic programs.

The Digital Construction (Digitalt Byggeri) M€ 2.5 project was carried out between 2003-2006, in which a public mandate for BIM was developed for new and retrofitting of state buildings with a total cost of more than M€ 5. The mandate was introduced in 2007 and been revised in 2010 and 2013. Currently, the mandates have to be used by all public building projects and in social housing.

Denmark has mandated its state clients, including Palaces and Properties Agency, the Danish University Property Agency and the Defence Construction Service, to adopt BIM practices. Several private organizations and universities are also conducting R&D work in BIM in Denmark.

Since 2011 BIM is mandatory for all local and regional projects costing more than EUR 2.7 million and for government buildings starting from a volume of EUR 677,000 already



The New Hospital Bispebjerg in the City of Copenhagen is a major merger between Frederiksberg Hospital and Bispebjerg Hospital. Also being built on the site is a new Mental Health Centre. The construction project has a total budget of around € 610 m of which € 400 m is financed by the Danish Government's Quality Fund (Kvalitetsfonden). The Capital Region (Region Hovedstaden) will provide € 140m for the Mental Health Centre sub-project. The new super hospital, which is scheduled to be in use by 2023, must operate at full capacity during the whole construction period. Therefore, the construction process has been planned thoroughly and will be executed by using the newest construction knowhow and technologies. When completed, the hospital will bring together modern hospital functions, advanced hospital logistics, innovative architecture and cutting-edge technologies, providing more than 450,000 citizens with highly specialized treatment. Around 5,000 employees will work at the New Hospital Bispebjerg.



The **Ringsted-Fehmarn rail link project** was initiated by Denmark and Germany to connect the fixed link across the Fehmarnbelt by 2021. The Fehmarnbelt will connect Puttgarden on Fehmarn Island, Germany, with Rødby on the Danish island of Lolland. For this project there was a mandate for geometry driven BIM higher than seen before in large-scale infrastructure projects. The Ringsted-Fehmarn rail link is expected to improve the infrastructure linking Scandinavia to the rest of Europe, and will reduce travel times between Copenhagen and Hamburg. It is expected to provide an effective alternative to road traffic for freight and passenger transportation, as well as reducing CO2 emissions. The project will be operated by Danish state-owned railway company Banedanmark.



**Buildings:** The BIM mandate was introduced in 2007 in state projects with M€ 2 in retrofitting, and M€ 5 in new construction as the minimum project budget. The mandate was modified in 2010 and updated in 2013, and since 2013 the mandate is also applied to municipalities, regions, social housing in addition to the state. The minimum project budget was reduced to M€ 0.8

**Infrastructures:** No, but the main public clients are involved in a project developing BIM requirements that will be implemented as required by the national infrastructure clients.



BIM is part of BSc. and MSc. educations in Denmark. There are two MSc. educations in Denmark focusing on ICT and project management. There are PhD courses in BIM. There is no active national group supporting BIM implementation in education.



Finland sets an example in the digital construction industry. Even there is no official national strategy as in other case (Denmark, Germany, France, UK etc.), Finnish construction sector has developed a great efficiency into digital and interoperable processes.



There is no official National Strategy for BIM implementation in Finland. However, there has been a long-term vision about the importance of BIM in the construction industry shared both by the industry and the research community. It was established already in 1996 when Tekes initiated a national BIM R&D programme (VERA 1997-2002) and most of the key players in the industry committed themselves in the implementation of BIM. For example, the Confederation of Finnish Construction industries included BIM in the core of their technology strategy in 2002 and the governmental building owner, Senate Properties, tested the use of BIM in a number of pilot projects 2001-2006 and as the result made use of BIM mandatory in their projects in 2007. Because of this, the use of BIM is “business as usual” in Finland at least in all major projects, and also in some relatively small and simple project. It has also led to the development of many advanced BIM software products in Finland. In 2012 the Senate Properties BIM guidelines were developed into the Common BIM Requirements (COBIM 2012) and BIM requirements for the infra sector were published in 2015. In 2016 the Finnish Government started a new KIRA-digi programme which is aiming to wider digitalization of the construction sector, where BIM is only a part of a bigger picture.



Tripla is the result of cooperation between international and Finnish planners and experts. The client is the construction company YIT. In the very beginning of the project, the client stressed that all designers must follow Common BIM Requirements by buildingSMART Finland, level 3. The project’s BIM coordinator created a detailed BIM execution plan for the entire project to fulfil CoBIM requirements and convey how specific information should be produced and maintained in the models. To manage the workflow of this large scale project as a whole, the overall BIM coordination was handled by a separate company. IFC communication has played a major role in information exchange for cost estimate on this particular project. All project files are stored in one repository (cloud) and any file exchange happens through this portal. There are over a hundred designers from different disciplines working on this project. In addition, there are client’s personnel and organizations of the city of Helsinki and the state, which make over 300 individuals all together.



The **West Metro project** is the biggest infrastructure project in Finland, extending Helsinki’s metro network to the city of Espoo. In the project’s first phase, eight new stations will be constructed with a further five built during the second phase. The metro will operate on 21km of underground lines in two parallel tunnels constructed through tough rock infrastructure. Total volume of the section to be implemented in units is circa 40,500 m<sup>3</sup>. The station includes cast-in-place structures, such as the platform tunnel connecting its east and west ends, retaining walls, and waterproof structures and foundations. The location is challenging and the schedule is tight. BIM helped the contractor and precast element fabricator make sure that parts of the station were feasible to build from units.

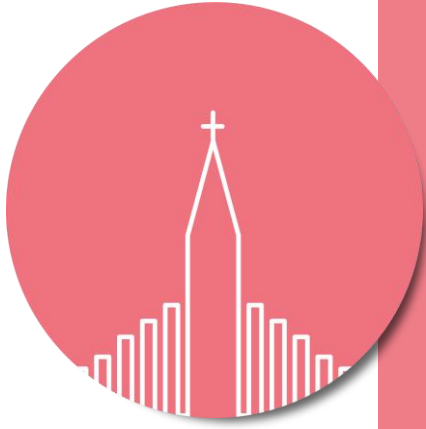


**Buildings:** the governmental owner, Senate Properties, made the use of BIM mandatory in their projects in 2007. From October 2007 to April 2009 it was mandatory only for architects, but since April 2009 to the whole team. The requirement is mandatory in projects costing over 1 million euros, but BIM has been used also in smaller projects. In 2012 the Senate Properties’ BIM Guidelines were updated to national Common BIM requirements, but the implementation is dependent on the client. However, according to an EU report practically all, 99%, BIM projects in Finland use COBIM. Most large contractors are demanding the use of BIM in their own projects, but only few private clients have made it mandatory.

**Infrastructures:** Infra sector published their BIM requirements in 2015 (Common InfraBIM Requirements YIV 2015, both the Road and Railroad Administrators require BIM at least in major projects.



Even in Finland there is no active national group supporting BIM implementation in education, BIM education is a part of the normal AEC education both on the bachelor and masters level. In PhD studies there are various student groups researching BIM.



One of the challenges that Iceland had to face through its BIM adoption process, is adjusting the implementation model from bigger industries to its own minimized scale. Government Construction agency led this process with the first mandates for open standards use to be planned and confirmed from 2008 to 2011.



In 2008 The Government Construction Contracting Agency (GCCA) signed the “Statement of Intention to Support Building Information Modeling with Open standards” initiated by international public real estate owners. Following the commitment, the Ministry of Finance instructed that building projects by Ministries and their institutes should implement BIM processes in design and construction.

BIM Iceland, a council of public procurers, was established to develop vision, strategy and common guideline for advancement of BIM in public projects. Initial strategy included BIM guidelines and pilot projects. In 2017 the scope of BIM Iceland was broadened to include a broad range of industry stakeholders working towards common interests, requirements and standards on national level and digitalization in general in the construction industry.



**The new National University Hospital (2015-2023)**, The project began in 2010 with an open architect competition. The project consists of 4 buildings, the patient hotel 4.258 m<sup>2</sup>, completed in 2018, main hospital building 65.476 m<sup>2</sup>, research and laboratory building 15.550 m<sup>2</sup> and office and parking structure 21.259 m<sup>2</sup>. BIM is a contract requirement in the project.



Burfell II, 121 million euros, underground hydroelectric power plant, a 100 MW extension to Burfells existing 270 MW capacity is the first infrastructure project designed and constructed using BIM. No BIM requirements came from the owner, the National Power Company, but from its engineering and client consultants “Verkís”, who coordinated the BIM workflow of a team of international engineers, systems suppliers and contractors. The project generated 42 construction models, 7 civil and 4 point clouds for as built, including access, inlet and outlet tunnels and canals.



**Buildings:** There is no BIM mandate for public building construction. Government Construction Contracting Agency with the support of the Ministry of Finance mandate use of BIM in government funded building projects of more than 3.5 million euros. This mandate is further committed with signing of “Statement of Intention to Support Building Information Modeling with Open standards” from 2008 and reconfirmed in 2011, a statement of international public real estate owners.

**Infrastructures:** There is no mandate for BIM in public infrastructure projects. Public infrastructure companies have been lagging in adopting BIM compared to the building construction sector. Public infrastructure companies have initiated some pilot projects, mostly by influence and initiative of their engineering consulting companies, but not by design or contractual obligation. The first full BIM infrastructure project Burfell II hydroelectric power plant completed in 2018.



The universities have introduced introductory level courses in the BIM process and individual courses in using CAD/BIM software. More and more graduate and master-theses focus on BIM that involve BIM research. Some BIM training courses are offered in post-graduate and continued education, but still lagging market needs. Most fluent BIM professionals have received their education in the Nordic countries and Europe where BIM is part of the curriculum.



Definitely one of the top players in the Digital transformation journey of the sector. Statsbygg, the biggest public owner if the country was leading the process with the first strategic guidelines to be published on 2009. By launching the first paperless project (Vamma 19 Hydropower project) to construct a mega infrastructure project of 42bn euros (E39 coastal highway), Norway justifies why is considered one of the leaders in the field.



The purpose of SBM is to describe Statsbygg's requirements in respect of Building Information Models (BIM) in the open Industry Foundation Classes (IFC) format— both generic requirements and discipline specific requirements. The requirements may be supplemented or altered during operational projects. The main target audiences for SBM are design teams, client project and facility managers, and domain practitioners involved in BIM processes.

SBM may also be relevant in order to provide guidance for software application providers. It is intended that any supplements will be merged into or appended at the end, published as numbered amendments.



Mjøstårnet by Voll Arkitekter in Brumunddal, Norway, has been verified as the world's tallest timber building by the Council on Tall Buildings and Urban Habitat. The 85.4-metre-high tower was built using cross-laminated timber (CLT), a pioneering material that allows architects to build tall buildings from sustainable wood. It has taken the title of world's tallest timber building from the 53-metre-high Brock Commons Tallwood House in Vancouver, which has a hybrid wood and concrete structure. Treet in Bergen, Norway, which is 49 metres high, used to be the tallest all timber building until Mjøstårnet completed in March 2019. Using timber will reduce the carbon footprint of the structure - which is set to contain offices, flats and an indoor swimming pool - by some 30% as compared to a more conventional concrete construction.



Approximately 1100 km long, the route runs through six counties and fifty municipalities. Travel time today is around 21 hours, and road users need to use seven different ferry connections. The E39 runs past the eastern edge of Europe's deepest lake at the village of Grodås, close to the border of Sogn og Fjordane and Møre og Romsdal counties.

The lake is pictured at the top of this article. Grodås is at the south-eastern end of the 6.5km-long Kviven tunnel, opened in 2012 and an example of the improvements planned for the rest of the route.

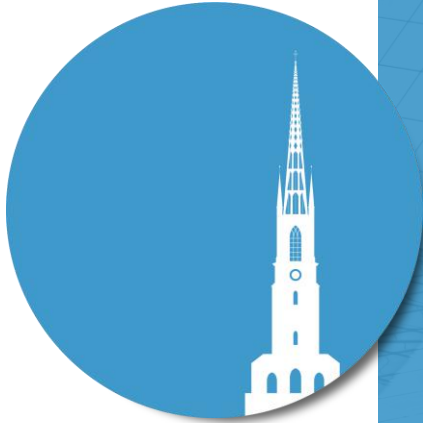


**Buildings:** Statsbygg requires BIM in all projects since 2010

**Infrastructures:** From 01.01.2014 all information that architects, engineers, contractor's etc. produce in their domain model has to be able to be exported to openBIM. All information has to be stored on the current version of the open BIM format IFC. All domain systems has to be able to import all information stored in openBIM (IFC)



BIM is part of BSc. and MSc. educations in Norway. There are PhD courses in BIM. There is no active national group supporting BIM implementation in education.



There is no National Strategy on BIM, but there are a number of initiatives regarding digitization. In Sweden the different departments of the government have their own BIM strategies. For example, the Swedish Road Administration has one in which BIM is mandatory since 2017.



The New Karolinska Solna (NKS) Hospital project is considered the world's largest public-private partnerships, involving an overall investment of \$3.0 billion (including \$1.6 billion for construction). The contract mandated the use of building information modelling (BIM). Mindful of the project's vast size, complexity and tight deadline, Skanska adopted an advanced BIM model across the entire lifecycle, creating a single data platform on which designers, contractors and eventually facility managers could collaborate (BIM Level 2). Starting with entering the design specifications and performance requirements, the architects and designers create 3D designs; every object is then digitally stored in the model, with its key attributes and exact location. Once completed, the object list will contain about one million items. The project has shown how the BIM model and prefabrication can boost the speed and quality of construction and commissioning, and has taken a certified leading role in sustainability.



E4 Stockholm Bypass is a giant infrastructure project to lead the traffic past the city center of Stockholm. This giant investment is described as "one of the biggest infrastructure projects in Stockholm of all time" and is now highly ongoing.

The initial study was made back in 2001 and opening is planned to 2026. When the link opens for traffic it will be one of the longest road tunnels in the world. By 2035, the Swedish Transport Administration (Trafikverket) estimates that The Stockholm bypass will be used by approximately 140.000 vehicles per day.



**Buildings:** No clear BIM building mandate

**Infrastructures:** Trafikverket, the Swedish Transport Administration decided in 2015 that BIM was to be used in all their investment projects. In order to implement this, they conducted extensive BIM training to 600 people who work in the projects.



There are a number of BIM educational programs and courses available.

The Swedish BIM Alliance with a special group called BIM Academy is supporting these programs.

With very complex infrastructure projects (E4 Stockholm Bypass) and some large scaled building projects (world largest public private hospital project) Sweden shows some similarity to the Finnish model. Without a clear national strategic leader but a very strong public-private bond, a set of advanced companies achieves to work harmonically with public administrations, developing that way the pathway that construction sector follows.



## Participants in the EU BIM Observatory

**José Antonio Cuba Segura**, MAP Aria CNRS/MCC Laboratory - *FRANCE*

**Souheil Soubra**, Chair of EU BIM Task Group - *FRANCE*

**Sylvain Riss**, Director of BIM Management Society for Grand Paris - *FRANCE*

**Joaquin Diaz**, Professor at Technische Hochschule Mittelhessen - *GERMANY*

**Stefan Hahnfeld**, Total BIM Consulting S.L. - *GERMANY*

**Alan Hore**, Dublin Institute of Technology - *IRELAND*

**Davide Barbato**, BIM-Lab.net - *ITALY*

**Francesco Paolo Lamacchia**, Vice president of Institute of BIM - *ITALY*

**Alberto Cerdán**, Technical Coordinator Master BIM UPV - *SPAIN*

**Ignasi Pérez Arnal**, Director BIM Academy - *SPAIN*

**Sergio Muñoz**, buildingSMART Spain - *SPAIN*

**Mark Bew**, Chairman PCSG, Chairman UK Government BIM Task Group - *UNITED KINGDOM*

**Jan Karlshøj**, Gravicon Aps - *DENMARK*

**Arto Kiviniemi**, University of Liverpool - *FINLAND*

**Gudni Gudnason**, Government Construction Contracting Agency - *ICELAND*

**Rogier Jongeling**, Technical Expert BIM Alliance - *SWEDEN*

# EUBIM

OBSERVATORY

