

# ViCon Dimensions

Autumn 2015



**HOCHTIEF**

ViCon

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# Build digitally first.

## Company Profile

### HOCHTIEF ViCon

HOCHTIEF ViCon is a leading service provider and consultant for virtual construction and Building Information Modeling (BIM).

BIM is a method for optimizing planning, execution and operation of buildings with the help of 3D computer models and the associated databases.

According to our principle "Build digitally first", HOCHTIEF ViCon advises and assists its clients in the use of intelligent 3D computer models in

order to minimize risks early on, communicate more effectively, and save costs.

In the areas of building construction and infrastructure projects, ViCon assists developers and projects with sophisticated hardware and software solutions, training, tried-and-tested processes, and the provision of project specific standards. As BIM consultants, we are involved in various projects in Europe, Qatar, Australia and Egypt.



## Foreword

# To the executives of the digital construction industry: Re-invent yourselves.

Dear Reader,

BIM goes business? Is the construction industry the last one to go digital? Do manufacturers, traders, designers, construction companies, building contractors, authorities and operators provide and use information that is machine-readable and entirely digitalized? Will a fragmented market become a lean market where excessive capacities are recognized and inefficient processes are eliminated? Does digitalization apply to me and my company?

So many questions...are creating a climate of fear. Some market players have said: „If you do not take action now, you and your company will vanish soon.“ I have also noticed that I often advise my clients to move faster. The speed of change, often only verbally announced, is too fast for the construction industry. We are used to sitting it out, weathering the storm and ducking down for a minute, as most notions within our industry pass us by in the blink of an eye. E-procurement, e-government, digital building permits and joint work on 3D models – all these things have so far proceeded much slower than announced.

Everyone agrees that something substantial is going to happen soon. But what is the right strategy? What exactly do I have to do? Taking the right steps, becoming aware of your own strengths and implementing them in digital processes – that is the key to success. Which digital information determines my business? To whom do I offer real added value? Take your time to position yourself and to realize which contributions make you valuable to your customers. These will be the core values which you should strengthen to re-invent yourself and your company by means of digitalization! That is exactly what being an entrepreneur is about - getting a head start while making use of cultural, legal, market-related or technical changes intelligently and with foresight.

We look forward to a promising digital future!

Yours,



Dirk Schaper  
Managing Director  
HOCHTIEF ViCon GmbH



## Project Update

# Metro Green Line Doha Underground

## BIM delivered: Implement & Go

How do you build a new railway system in a growing metropolis with ongoing construction on every corner and the fastest growing population in the region? Hopefully digitally first.

Qatar has over 2.3 million people, most of them live in the capital Doha. It is Qatar's fastest growing city and it is also the economic center of the country. It is therefore not surprising that the city needs a new transportation infrastructure to move people and goods around.

### An ambitious project

The Doha Metro project is part of Qatar's Integrated Railway Project, an ambitious endeavour to link the Kingdom of Saudi Arabia, Kingdom of Bahrain and Qatar with a network of freight and passenger transport systems. The Doha Metro will be one of the most advanced rail transit systems in the world.

The Metro Green Line also known as the Education Line, which has both underground and elevated and at-grade sections, will connect the Education City with the Heart of Doha. The Metro Green Line Underground project consists of approximately

15 km of bored twin-running tunnels and six underground stations and was awarded to the PORR/Saudi Binladin/ HBK- JV.

In order to meet Qatar Rail's (BIM) requirements the JV called for HOCHTIEF ViCon to offer a wide range of BIM services during design and construction phases of the project. From the beginning ViCon's approach concentrated on the establishment of a functioning BIM team within the JV.

### "Implement & Go" strategy

According to ViCon's Five Components, which have been widely adapted and followed by industry players and competitors, the BIM implementation plan was developed and tailored to specific project needs. It focused mainly on people, but also created a common understanding of the contract conditions, deliverables and project-wide guidelines. ViCon also provided a BIM Manager as key personnel within the JV.

BIM trainings were a crucial part of the scope of works. The client's team was instructed by ViCon's specialists on the technical aspects as well as the backbone processes of all

BIM deliverables. Trainings covered 3D coordination, 4D simulation and model-based quantity take-off. 3D models prepared by the design team served as a basis for coordination meetings and continuous effort to improve the quality of design and ultimately construction. 4D simulations offered a unique opportunity to analyze the constructability of the proposed design. Scheduling errors were successfully eliminated and all involved stakeholders gained a clear understanding of the construction process.

### Independent BIM team

ViCon left the project after a successful implementation and training that allowed the client to move from little BIM know-how to an independent BIM team. This "Implement & Go" strategy was combined with a structured BIM road map which has served at Qatar Rail as a blue print for all metro projects to come.

BIM Certificates handover ceremony at the Metro Green Line offices with ViCon's Project Manager, the Design Manager and the team.

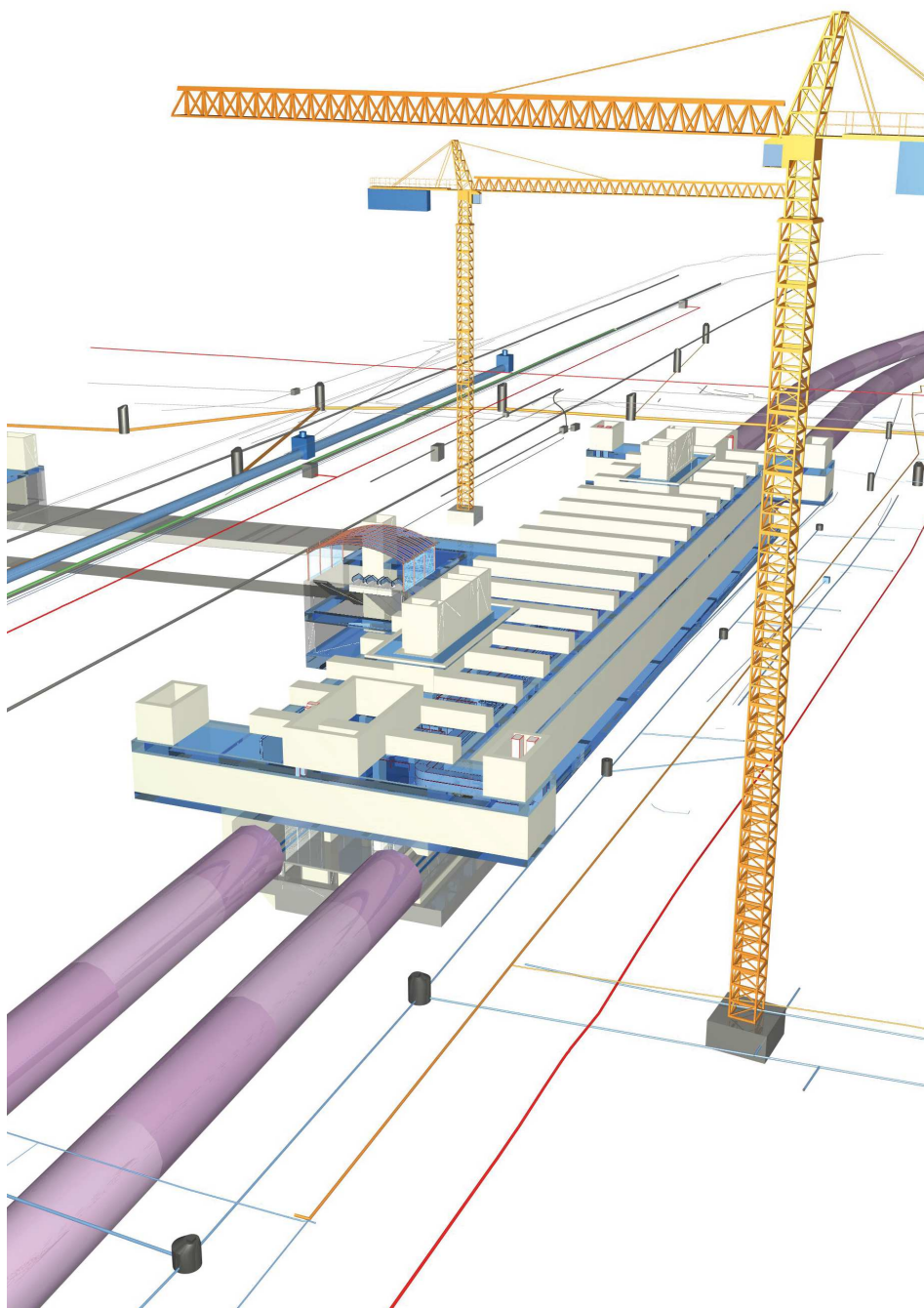


"I appreciated the individual approach for our project. ViCon understood our individual requirements and acted accordingly. The team is knowledgeable and flexible, they definitely stand out."

**Mr. Attila Vidra, BIM Manager**

"HOCHTIEF ViCon provided the BIM support we needed to achieve our goals whilst training our staff for future BIM projects. I am highly impressed with the ViCon services. The staff they have are absolutely top notch people with proper BIM experience."

**Mr. Bernhard Sachs, Design Manager**



### Project key facts

#### Type of project:

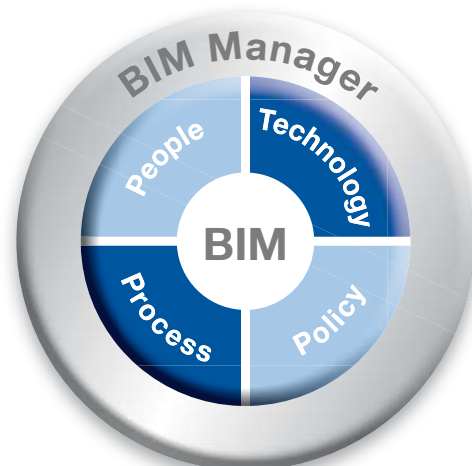
Rail public transport system

**Location:** Doha, Qatar

**Client:** PSH Joint Venture  
(PORR / Saudi Binladin / HBK)

**Project size (contractor):**  
approximately QAR 9 billion

**Duration:** 2013 –2015



### ViCon's 5 Components of BIM

methodology. The four core components to successfully implement BIM: process, people, technology and policy, supported by the management component to enable all to work in unison.

| BIM Implementation                                                                                                                                                                                                                                                                                                                                                          | BIM Management and Training                                                                                                                                                                                                                                                                                                                                                              | BIM Training                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>— Creation of BIM implementation plan to define BIM standards and processes</li> <li>— Creation of BIM guideline to standardize model creation</li> <li>— Setup of BIM design process (drawing production)</li> <li>— Definition of QA/QC processes and checklists</li> <li>— Creation of a training and development plan</li> </ul> | <ul style="list-style-type: none"> <li>— Coordination of BIM on behalf of the JV with staff integrated in JV design team</li> <li>— Control and monitoring of BIM processes</li> <li>— Ensuring the integrity of the Building Information Model</li> <li>— Training for BIM management, 3D coordination, 4D simulation and model-based quantity take-off and data integration</li> </ul> | <ul style="list-style-type: none"> <li>— 3D clash detection and documentation in database</li> <li>— 4D construction modeling based on design models and contractors schedule</li> <li>— Quantification from design models as per project BoQ</li> <li>— Integration of time with quantities to provide distribution over time for analysis of construction</li> </ul> |



## Service Focus

# Mobile Viewer for Asset and Facility Management

A city in your pocket – that was the ambitious goal of our product developers for the Qatari urban development project „Lusail“ and its expected 200,000 inhabitants. The result? A Mobile Viewer for management of assets in the planning, construction and operation phases – a tool for asset managers, property managers and facility managers as well as proprietors and municipal authorities.

In its BIM strategy, Lusail has considered the complete life cycle of the city from the very beginning. Relevant information and circumstances collected during the planning and construction phases can be used to support city operations. Lusail introduced the first 3D model-based building permit process in the Middle East. The 3D infrastructure models, which include wet and dry utilities, gas, district cooling and roads, are handed

over to the project developers of the different construction areas. They in turn create schematic 3D models of their respective designs aligning the main interfaces. In return, Lusail receives the schematic building model and major key figures relevant to speed up the approval procedure. ViCon checks the 3D model for compliance with building regulations in a semi-automated process. Until now, „Lusail City“ owns one of the largest and substantial 3D city models of the world – and it expands every day.

For the first time, digital data of infrastructure and buildings are collected and presented on such a scale. ViCon defines the processes, structures, models/data and provides them in a mobile viewer. ViCon colleagues in Qatar are thus able to support the operation of Lusail's primary infrastructure.

What works on the large scale for the operation of a complete infrastructure of a city can easily be applied to smaller areas or individual buildings. However, it requires consistent data collection with BIM methods. If this is realized during the construction phase, the 3D model can serve as a pool for as-built data and be re-used for maintenance and operation as well as for asset data management. The model content of the „3D asset model“ will be adjusted to the need of operation and maintenance.

An essential aspect for accuracy and topicality of data is the provision of all data on a mobile device. This helps to enter data „on site“ and to promptly use it for subsequent maintenance and operation. Standardized forms are used to record photos and data on a mobile device. The subsequent allocation of pictures or transfer of notes is no longer necessary. Digital data is embedded in processes/work flows and provided to various user groups such as management or field engineers for assessment and use. Thus, the field engineer has access to current information live and on site for maintenance and repair management. At the same time, the management is provided with current asset data for efficient control of operation, for reporting purposes and for analysis. For all these activities, ViCon has developed a system, the Mobile Viewer.



## What are the advantages of this Viewer?

- Linkage of geometry, data and documents in a central database
- Simple search and selection of project information
- Project-specific configuration
- Holistic documentation of construction progress
- Digital collection of data during construction onsite
- Easy access to data on mobile devices and desktop computers
- Navigation on the construction site via GPS connection
- Integrated reporting

A BIM Manager ensures that the advantages of integrated data management can actually be used. The BIM Manager installs defined processes and coordinates all activities related to the 3D model. Moreover, he evaluates the quality and topicality of data and trains employees on site.

## Figures:

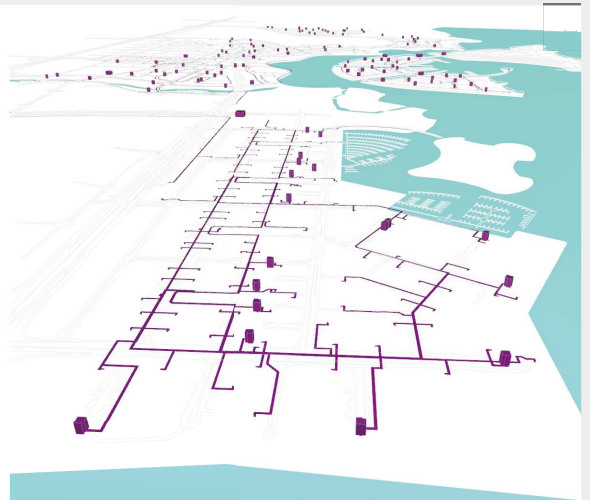
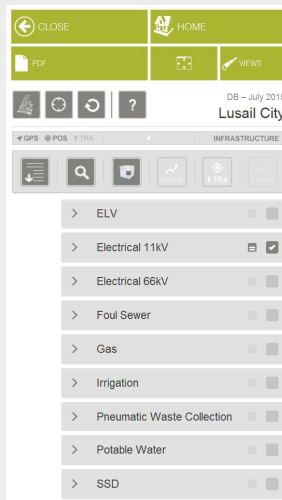
**1**—Project overview of supply networks. The catchment areas of the respective supply stations are visible. For example, an electric transformer station (11 kV) supplies 4-7 properties.

**2**—Detailed information about the properties (owner, construction requirements/key figures), design, availability and completion of supply networks, environmental ranking and progress of construction.

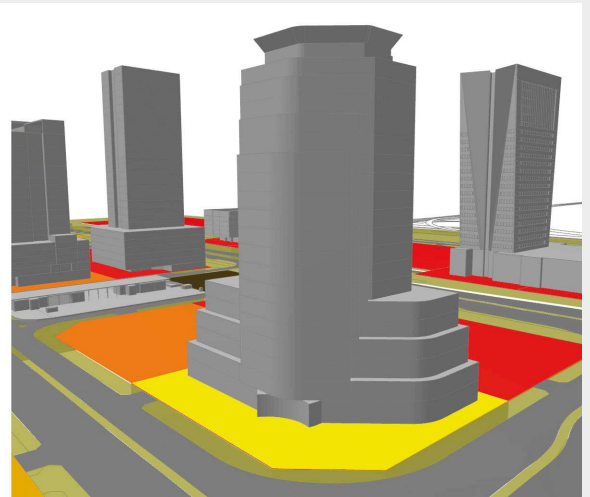
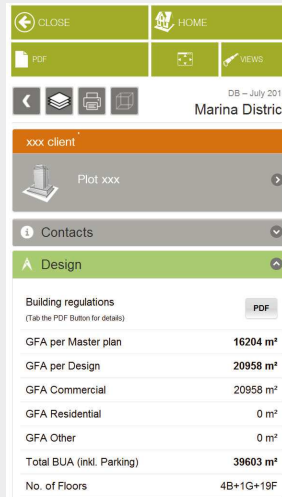
**3**—The tunnel system in the 3D city model.

**4**—At building level, aspects relevant for safety, such as staircase cores, are shown.

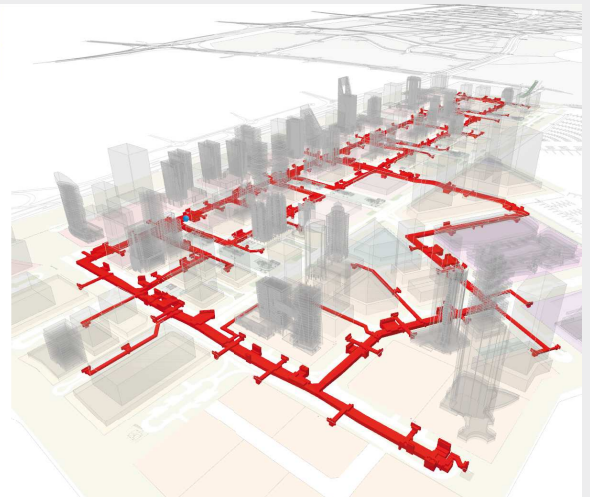
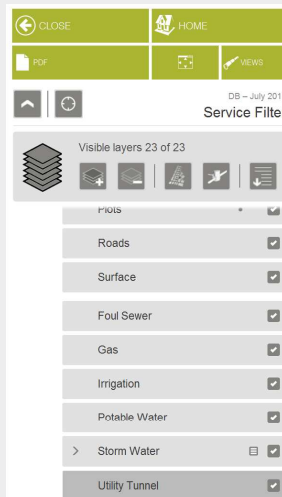
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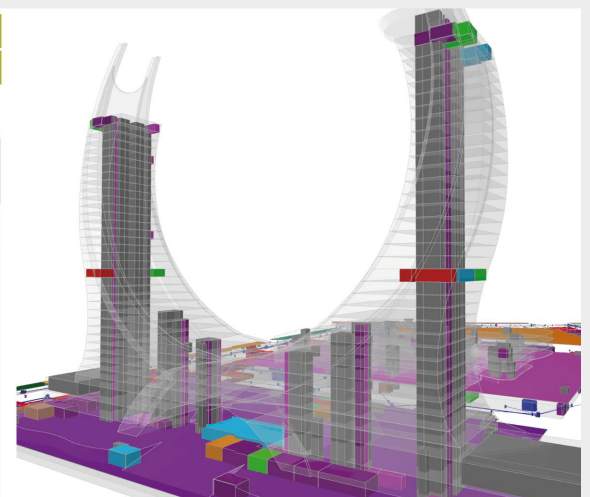
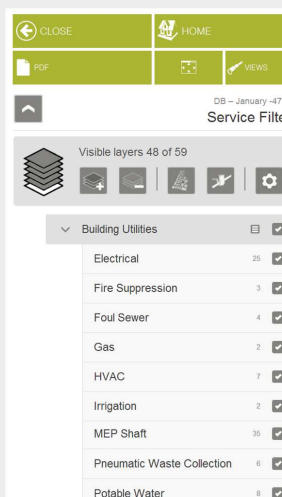
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3



4



## BIM Definitions

## Level of Development (LoD)

The Level of Development (LoD) describes requirements for model elements in five successive levels of detail. The LoDs aim at BIM use cases. If, for example, quantities are to be determined from the 3D model, the model elements must at least correspond to LoD 300. For key figure-related aspects, LoD 100 or 200 is sufficient.

The parties involved in the project take the LoDs as a basis for defining the degree of completion of all model elements. A complete project-related definition of the LoD often comprises a table with several hundreds of lines. The chart on the right relates the ViCon definition of LoD to various planning disciplines in a simplified manner. The 3D models feature different model elements and contents.

The ViCon definition is guided by the LoD definition of the American Institute of Architects (AIA, G202-2013) and reflects ViCon's project experience of the past ten years. The LoD is anchored in the ViCon 3D model types.

Besides the term "Level of Development", the term "Level of Detail" is also commonly used in Great Britain. Sometimes, „Level of Detail“ refers to the level of data that is contained in the model but not released. In contrast to this, the „Level of Development“ is defined as the level of completion, the parties involved in the project can rely on for further processing (data released).

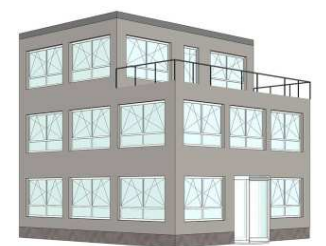
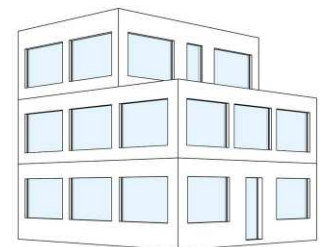
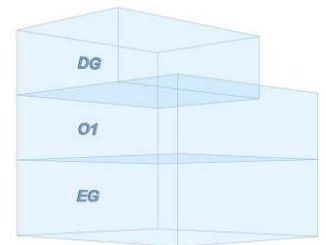
In line with the respective level of detail, the 3D model is itemized and completed with information. This relates to the progressively more detailed geometry of model elements as well as the addition of alphanumeric data (attributes) for such model elements as the project proceeds.

From the planners' perspective, LoD 100 mainly relates to the draft, gross floor areas, space allocation plans, structural and building services concepts. This is refined on the subsequent levels. In LoD 300, the models will have reached a high level of geometric completeness.

As from LoD 400, supplements are mainly made on the data level, e.g. for clarification of quality and makes of fit out and equipment components. After completion of the project, the BIM model ought to contain all relevant information from execution planning as well as – depending on the scope of BIM use during the actual construction – further information that form part of the building documentation.

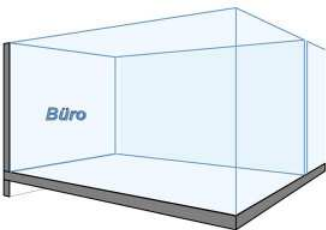
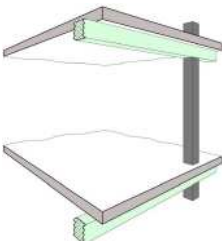
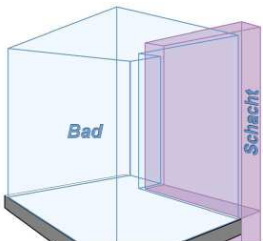
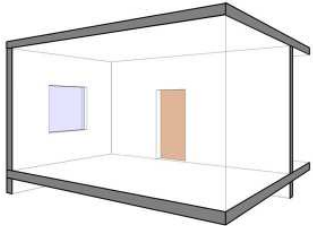
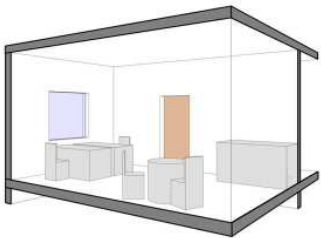
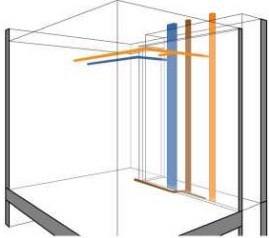
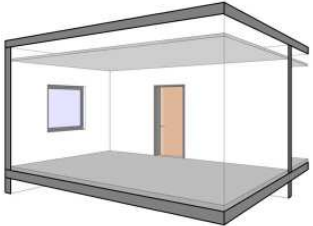
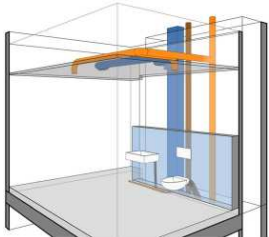
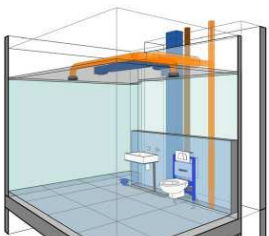
The „Levels of Development“ do not correspond to the typical planning phases. For instance, some model elements might be available in LoD 300 and others in LoD 400. In many cases, it is not necessary to mold model elements down to the last detail. This produces unnecessary data volumes without creating additional value. The appropriate level of detail of model elements is defined in the BIM Implementation Plan for the defined BIM use cases.

| LoD | Architecture façade                                                                                                 |
|-----|---------------------------------------------------------------------------------------------------------------------|
|     | Design, construction, façade, material cladding, safety, noise protection, makes, maintenance intervals (operation) |
|     | 100                                                                                                                 |
|     | 200                                                                                                                 |
|     | 300                                                                                                                 |
|     | 400                                                                                                                 |
|     | 500                                                                                                                 |





ViCon definition of the Level of Development (LoD) in the different planning disciplines (simplified chart with schematic examples)

| Architecture rooms                                                                                                 | Architektur equipment                                                                                                      | Supporting structure                                                                                                        | Building services                                                                                               |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Design, use, gross capacity, GFA, effective area, room name, room type, rental space, office occupancy (operation) | Room name, room book, fire protection class, type and quantity of equipment, warranty periods (construction and operation) | Grid, dimensioning, strength class, details, fire protection, performance characteristics (evenness, deformation, surfaces) | Systems, heat loads, air exchange rates, lines, affiliation to control/supply circuits, maintenance information |
|                                    |                                           |                                           |                              |
|                                  |                                         |                                         |                            |
|                                  |                                         |                                         |                            |
|                                  |                                         |                                         |                            |
|                                  |                                         |                                         |                            |

## ViCon Teams

# ViCon's Clash Men The Design Coordination Team

Design coordination is the flagship of BIM within the construction industry and clash detection is the major exercise within a 3D model based design. During the last 10 years ViCon has established a strong team that operates in different branches on two continents - inspecting 3D models of buildings, infrastructure, tunnels and healthcare projects for design collisions.

### Advantages of design coordination:

- enabling early detection of design collisions between individual disciplines
- reducing construction errors on site
- saving time and reducing cost during the design and construction phase.

The advantages are obvious: as buildings become more complex and planning periods even tighter, the coordination of different design disciplines gains increasing importance. To be able to coordinate such complex designs,

3D models become essential. That is when our Clash Men step in. BUT how do they actually do it?

Clash detection is a process combining a number of consecutive steps, which has been automated by the Clash Men as much as possible. In order to identify the clashes within a design, all existing 3D models need to be consolidated first. Defining clash rules according to previously agreed and set parameters enables the Clash Men to handle thousands of clashes.

For the last decade the team has developed a 3D Design Coordination System (DCS) based on extensive project experiences. This system completes the process from finding clashes to coordinating them with involved design consultants and tracking the solving process throughout the project.

The 3D models will be tested in several clash runs until no conflicts are present in the model. At the end of every clash

run a report is created. The duration of the clash detection process depends on the complexity of the building and the accuracy of the provided 3D design models. The outcome of the design coordination process and the efforts of the team is a “clean” ready-to-build 3D model.

ViCon's Clash Men also provide trainings to clients' BIM teams. They form a creative and collegial team with a lot of responsibility within projects, constantly improving the current processes. Design coordination is the flagship of BIM within the construction industry, and certainly one of the pillars of ViCon's BIM services.



“It's impressive to see the responsible design coordinator running straight out of the meeting to immediately stop the machines in the construction pit to avoid terrible mistakes, he realized due to our clash reports.”

**Jan-Derrick, Clash Man**

“In a perfect world there's a perfect 3D model, but for now there's our clash team.” **Dora, Clash Woman**

“When the designers change their actual design according to our clash analysis, we did well.”

**Anne, Clash Woman**

“Knowing that for every issue which we identify, we are directly contributing to savings on site - not only in terms of \$\$\$, but just as importantly in terms of time, makes the job truly important.”

**Gerard, Clash Man**

## Market News



### New BIM book, Germany

This September Springer in Germany will publish a highly anticipated BIM book: „Building Information Modeling- Technologische Grundlagen und industrielle Praxis“. So far only available in German language, the book will concentrate on the fundamental presentation of all BIM related information technology principles. HOCHTIEF ViCon contributed four chapters: BIM at HOCHTIEF Solutions, BIM-based production systems, BIM Manager and BIM as support for engineering planning. ISBN 978-3-658-05606-3



### British standards, UK

In 2011 the Government Construction Strategy mandated the use of Level 2 BIM on all public sector projects by 2016. The Digital Built Britain strategy takes the next step in integrating these technologies and transforming approaches to infrastructure development and construction. The main goals are to make fully computerized construction the norm and ensure that the benefits of these technologies are felt across the UK and the rest of the world. [www.digital-built-britain.com](http://www.digital-built-britain.com)



### BIM Research, Qatar

The 3-year research project named “Development of a whole life cycle information flow approach enabled by BIM modeling protocols and technologies for Qatar construction industry” began in may 2014 funded by Qatar Foundation. The involved partners Teesside University, Qatar University and HOCHTIEF ViCon aim to develop whole lifecycle BIM protocols/ standards for easier interaction and adaptation of processes for all stakeholders within BIM-based projects. [www.qatar-bimproject.org/](http://www.qatar-bimproject.org/)

## BIM Network



### BIM Show Live, UK

This year's ViCon's BIM Show Live presentation covered the 4D and 5D modeling for the purpose of progress monitoring and quantity take-off for underground metro projects. The topic was selected due to the good experiences ViCon made on several underground projects in the Gulf. The presentation concentrated on the BIM Level 2 experience from the construction phase for 4D and 5D modeling in order to showcase the preparation of the hand over to the operation phase. [www.bimshowlive.co.uk/](http://www.bimshowlive.co.uk/)



### Bautechniktag, Germany

The perception and interest in BIM has been increasing significantly in Germany. Technical experts and players from the construction industry met at the German construction industry conference „Deutscher Bautechniktag 2015“ in Düsseldorf. HOCHTIEF ViCon's Managing Director spoke at the expert forum „Building Information Modeling“ and presented „Effects of BIM on the planning and implementation of major projects - Are we on the brink of a new era?“. [www.betonverein.de/bautechniktag.php](http://www.betonverein.de/bautechniktag.php)



### 5th BIM User Day, Qatar

The 5th Qatar BIM User Day will be held on Thursday, 5th November 2015. The topic of the day will be: “BIM Implementation and Management” and will cover all five BIM components: Management, People, Process, Technology and Policy. Qatar BIM User Day – a unique series of events - aims to establish a knowledge platform with government, research and industry experts in the gulf region. To register please visit the website: [www.bimuserday.com](http://www.bimuserday.com)



## HOCHTIEF ViCon dates in 4th quarter of 2015

|       |                                                                                        |
|-------|----------------------------------------------------------------------------------------|
| 05.10 | Expo Real 2015, Exhibitor, Munich, Germany                                             |
| 19.10 | 12th International Conference on Product Lifecycle Management, Speaker, Doha, Qatar    |
| 05.11 | 5th Qatar BIM User Day, Organizer, Doha, Qatar                                         |
| 19.11 | BIM Symposium, Speaker, Dortmund, Germany                                              |
| 20.11 | International Planning Design and Construction Conference, Speaker, Innsbruck, Austria |
| 08.12 | IBR seminar: BIM and legal framework, Speaker, Berlin, Germany                         |

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