TOWARDS VIRTUAL DESIGN AND CONSTRUCTION FOR SUBSTATIONS

by Antun Foskulo, M.Sc.E.E.

KONČAR
ZAGREB – REPUBLIC OF CROATIA
PRESENTATION SUMMARY

- Use of traditional Computer Aided Design / Draft (CAD) in practice
- Advancement towards 3D and its uses and benefits
- Detected limitations, lessons learnt and objectives
- Virtual Design and Construction (VDC) as a solution and its uses
- 4D sequencing applied on the current substation project
- Quantification, estimation (5D introduction) and laser scanning
- VDC approach benefits and impacts
- Added value, main focus, mission and an unique approach
TRADITIONAL CAD / PRACTICE
RECENT ADVANCEMENT TOWARDS 3D, USES AND BENEFITS

- Once modelled an object can be reused in future
- Concepts are easier to communicate in 3D or in 2.5D
- Faster familiarity with exotic switchyard concepts
- Clearances checked in 3D

- Sections and views obtained from 3D model
- „Idea compression” issues no longer involved
- Reduced inconsistencies due to geometry verification (improved accuracy)
DETECTED LIMITATIONS, LESSONS LEARNT AND OBJECTIVES

DETECTED LIMITATIONS:
- CAD models don’t have intelligence

LESSONS LEARNT:
- Modelling phase is the hardest and take most of time
- High degree of unstructured data

OBJECTIVES:
- Towards intelligent substation model
- Establish single joint substation model
WHY CHANGE OR UPGRADE THE PROCESS?

- Economic reasons
- New collaboration methods
- Need for an uninterrupted information flow
- Regulatory requirements
- Facilitate knowledge transfer
- Pursuing automation in construction
- Need for improving efficiency and productivity
- Need for integration and improving quality
VIRTUAL DESIGN & CONSTRUCTION AS A SOLUTION

• Virtual Design = facility design activities performed in a virtual environment
• Virtual Construction = build such a design in a virtual environment
• Building Information Modeling (BIM) as a source for VDC

Has an impact on:
• product (design / construction facilities)
• work processes
• organization (design / construction / operation teams)
DOCUMENTATION & ANALYSIS
VISUALIZATION / STILL IMAGE & ANIMATION

LINK: 3D fly-over animation

www.eapicforum.com
CLASH DETECTION / MODEL COORDINATION

- Hard clashes
- Easy clashes
- Inside the same model
- Between various models (i.e. Arch. vs Struc. or Elect. vs. Civil model)
4D SEQUENCING / BASICS

- 4D = 3D + time

- Linking 3D objects with tasks

- 3D CAD objects
- Detailed 3D model
- Series of images
- Animation
- Tasks
- Time plan
4D SEQUENCING / CURRENT PROJECT EXAMPLE

S/S 400/110/20 kV ZEMBLAK, REPUBLIC OF ALBANIA

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4D SEQUENCING RESULT

LINK : 110 kV switchyard sequence (800x600)
LINK : 400 kV switchyard sequence (800x600)
LINK : 110 kV switchyard sequence (1920x1080)
LINK : 400 kV switchyard sequence (1920x1080)
QUANTIFICATION (QUANTITY TAKE-OFF)

OBJECTS

FULL OR PARTIAL 3D MODEL

BILL OF QUANTITIES
ESTIMATION (5D) AND PLANNED ADVANCEMENT

- Defining resources
- Updating resources
- Optimizing resources
- Unit prices
- Usefull parameters
- Integrating scheduling with cost estimation
- Utilize what-if scenarios

5D = 4D + cost
WHAT’S NEXT? / LASER SCANNING

- More accurate models
- Scanning parts under voltage
- Accurate as-built substrates

Images taken from Nederveld web page
VDC APPROACH BENEFITS

Virtual design and construction approach helps:

- Improve productivity
- **Improve documentation accuracy**
- Improve coordination and thus collaboration
- Reduce the number of design interferences
- Maintain information flow uninterrupted

- Deliver better substation solutions faster and for less money
- Provide added value for an owner
ADDED VALUE AND BENEFITS FOR OWNERS

- **Virtual model is an added value**
- **Enhance virtual model for operation & maintenance**
- **First step towards creating a substation simulator (personnel training)**
- **Collision-free and accurate as-built documentation model**

- **Design assessment early and often**
- **Reduce energy consumption through energy analysis**
- **Optimize operation and maintenance**
- **Asset management**
MAIN FOCUS ON ALL OF OUR PROJECTS

• Good engineering
• Leading-edge design
• Ensuring fully coordinated designs throughout different disciplines
• Giving an owner a quality project
• Customer-oriented approach by providing tailor-made solutions
• Providing added value on each project
MISSION AND AN UNIQUE APPROACH

- Employ VDC techniques on all current and future substation projects
- Designing, constructing and refurbishing complex facilities
- Applying equipment and services from our Group’s companies
- Applying equipment from other respected manufacturers
- Applying know-how acquired from more than 60 years on substations
- Pass-on first-hand knowledge through collaboration and education
- Constantly raising the bar
SOME OF OUR RECENT REFERENCES

- 400/220/110 kV S/S (Zerjavinec, Croatia)
- 220/110/10 kV S/S (Prizren 2, Kosovo)
- 220/110/35 kV S/S (Tirana 1, Albania)
- 400/110 kV S/S (Ernestinovo, Croatia)
VDC AFTERMATH

- 220/110/10 kV S/S (Fierza, Albania)
FINAL WORDS

When communicating project impacts / design intent to the audience / project participants …

3D is Easy
2D is Hard

THAT’S WHAT CONCLUDES MY PRESENTATION.
ANY QUESTIONS ?

THANK YOU AND PLEASE VISIT US AT OUR BOOTH N407 !