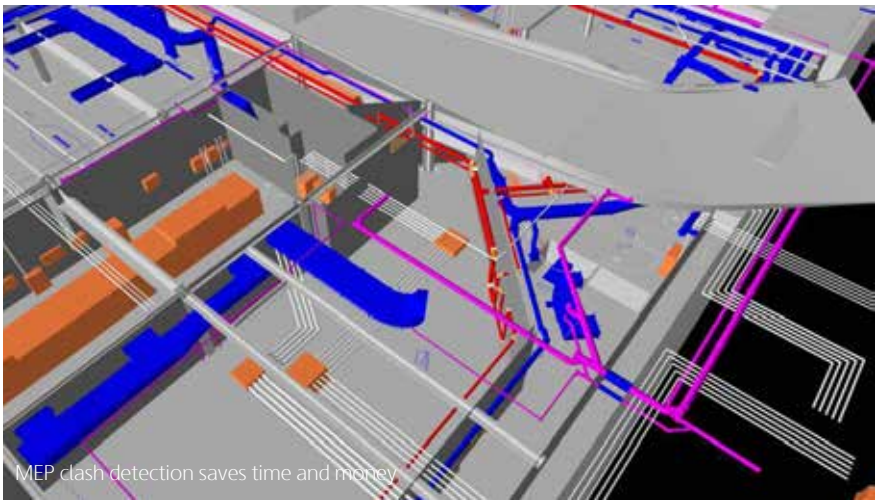
U.S. HealthRealty Delivering BIM Real Estate Developments with Skanska USA



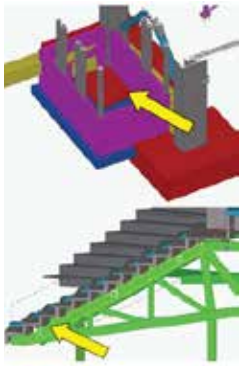
MEP clash detection saves time and money

U.S. HealthRealty, with it's Skanska USA alliance, can provide the most technologically advanced innovations as part of our standard operating procedures on every project that we undertake. The various systems detailed below are proven to provide our clients with faster delivery, higher quality and better communication on all of our projects. We will be implementing these systems on all of our development projects.

Building Information Modeling (BIM)

The emergence of Building Information Modeling (BIM) technologies has transformed the construction industry and is reshaping how we deliver projects. At Skanska, BIM has been implemented during every phase of the project life cycle, from conceptual design through facility management. Recognizing that BIM affords benefits during the entire delivery process, Skanska has adopted the broader term, Virtual Design and Construction (VDC), when referencing BIM. VDC is the sum of the processes; BIM is the data that supports these processes.

Skanska has implemented VDC on many projects and has realized a variety of benefits including improved communication amongst project stakeholders, enhanced efficiencies, greater certainty for both schedule and cost conformance, and reduced risk. When working with Skanska, VDC affords us the opportunity to deliver a higher quality product to our clients, and we are dedicated to implementing VDC for every function that offers benefit to a given project.



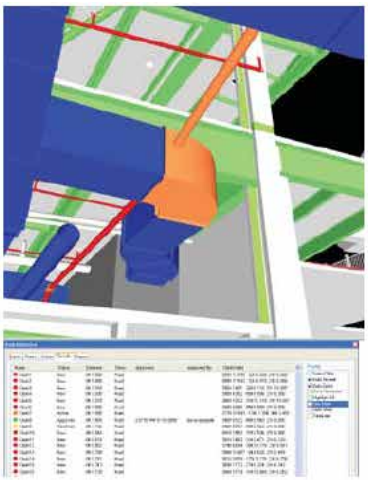
Design Structural Coordination
New Meadowlands Stadium

3D Design Coordination

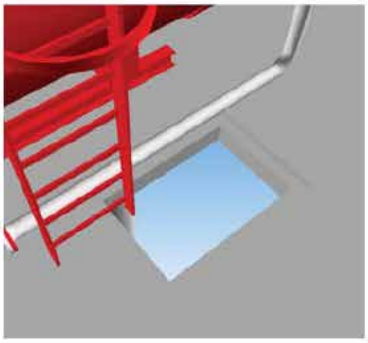
Used in conjunction with traditional design coordination, VDC Processes can yield improved results from visual examination and through rules based clash detection. Each designer prepares their model using their own design authoring programs. The reviewer is then able to utilizes the native design soft ware for review, and/or assemble the specific models into a federated model for review in NavisWorks Manage, Bentley Project Wise or other 3D coordination soft ware. The design can be analyzed system by system. A federated model can be for an area, a floor or an entire building. Successful design coordination is a result of the collaboration process as much as the technology and tools employed.

3D MEP Trade Coordination

3D MEP Coordination is currently the most prevalent use of VDC/BIM among contractors. 3D trade models are superimposed into an architecture and structure background model for coordination. The concept is to build the building and systems virtually, and coordinate virtually. This reduces the likelihood of unseen errors in the field due to poor coordination or unforeseen conditions. Additionally if the model is adhered to as a construction document then the trades will have confidence they can pre-fabricate their systems off site and they will fit correctly. This has many positive effects including reducing waste and accidents on site, quicker installation times, and higher quality. Models created and used for 3D MEP coordination may also be used for other VDC processes, such as 4D sequencing, visualization, and safety planning. Here are some key elements to 3D MEP Coordination:



Interference Check (Rules Based Clash Report)
NavisWorks is used to run automated clash reports between different trades. For example, sheetmetal above is checked against the sprinkler system. Clashes are indicated in the report and visually by color coding within the model.



Visual Check (Virtual Snagging)
NavisWorks is the software used to run clash reports, and also to examine the model for "virtual snags", that would not appear in a rules based clash report.

Interactive Whiteboard
Meeting with mechanical subcontractor on Virginia Tech ICTAS project

WBS - Work Breakdown Structure
Above is an example of the WBS employed at the Meadowlands, where the project was broken into 27 distinct areas. 3D MEP coordination followed this format, by floor.

Coordination Schedule and Order

A coordination schedule is created by the GC, with input from the subcontractors. This information should be included as part of the overall construction schedule and encompass submittal milestones, review times, fabrication times and delivery lead times.

Generally the best success for 3D MEP coordination is attained by following the typical 2D coordination process, with a single trade (usually sheetmetal) coordinating first with architecture/structure. The next trade then has a clash free starting point for coordination. The order is usually Sheetmetal > Plumbing> Mechanical Piping> Fire Protection> Electrical. This is a rolling cycle, so that at any one time there may be 5 or more areas being coordinated, with each individual area primarily being coordinated by one trade at a time. Co-location and creating a collaborative environment is helpful here as concurrent input from several trades is oft en required to produce an optimal result.

WBS - Work Breakdown Structure

Break up large projects into smaller, more manageable portions and then create a schedule for area coordination, ideally aligned with the construction schedule.

Backgrounds

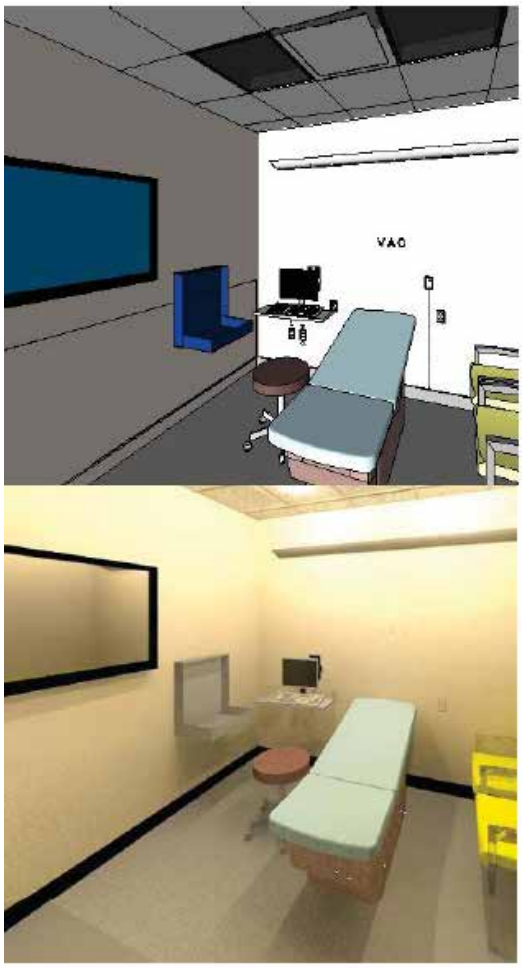
Architectural and Structural backgrounds to conform to the WBS. The backgrounds are provided in .dwg or agreed upon universal format so that the trades can import into their CAD systems and begin coordinating their respective scopes. Trades may also import other trades models to include in their backgrounds.

Whiteboards and Collaborative Environment

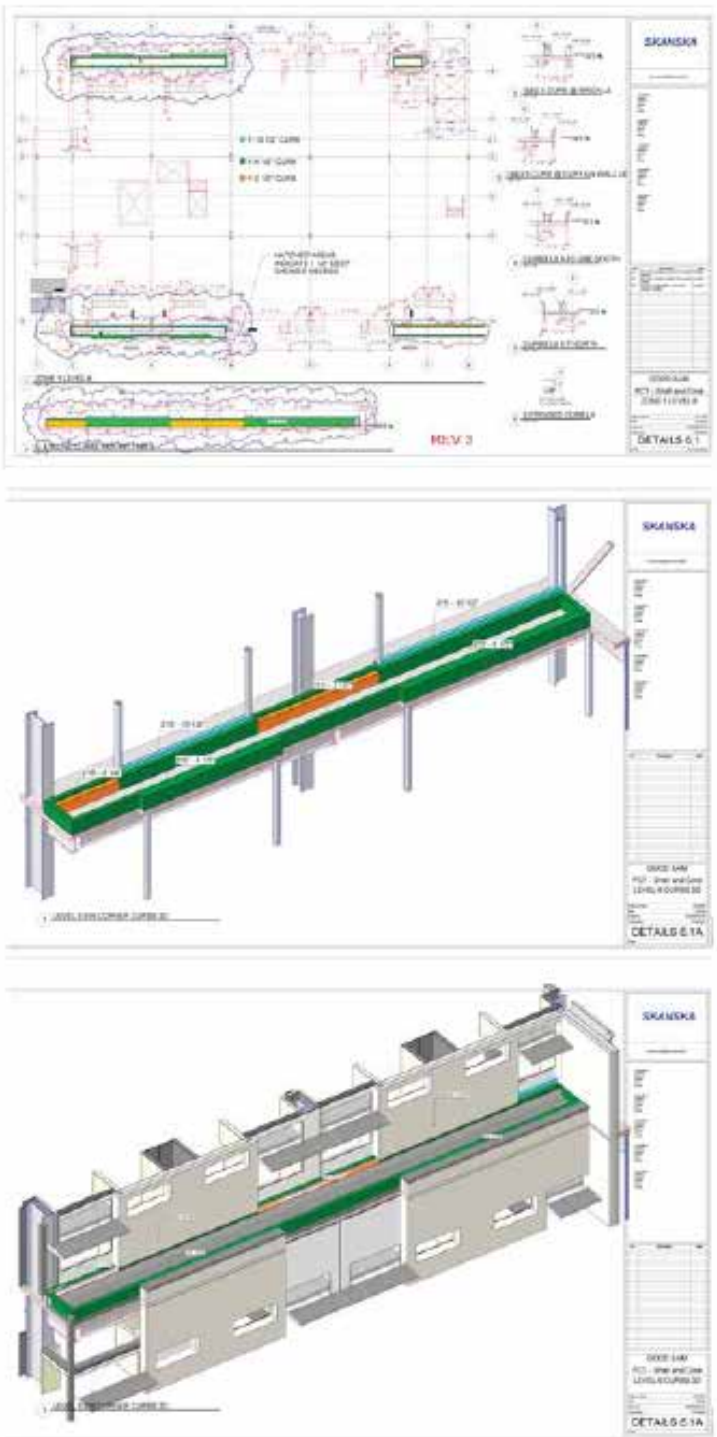
Weekly or as needed the entire MEP team should meet in a collaborative environment to review problem areas and clashes. A Smart Board is ideal in this situation, allowing team members to interact, mark up and comment on the projected image in real time.

Virtual Mock-ups

A 3D mock-up can be created similar to an actual mock-up of a selected region of a building. Virtual mock-ups can be created prior to physical construction of complex or uncertain areas, and then used to study constructability and construction details, verify appearances, explore alternatives and to communicate to project stakeholders. Virtual mock-ups can be created from 2D documents, or from 3D models by isolating and enhancing the areas of concern.



Interior Mock-up
Mock-up of multicare room to show layout. Lower image is a rendering to show finishes and lighting.



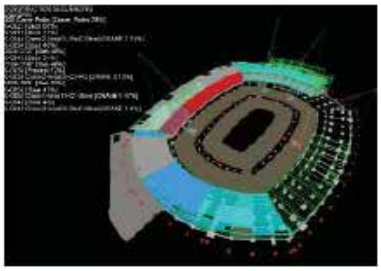
Exterior Mock-up
Mock-up to show how windows, exterior skin and curtainwall fit together

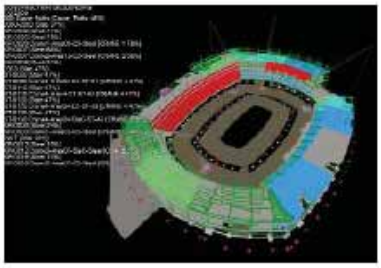
4D Planning

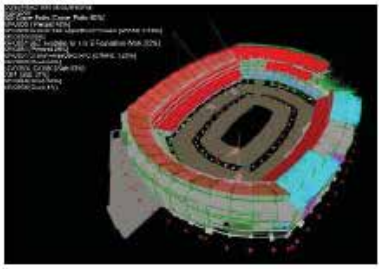
4D planning (4D sequencing) combines the design and/or trade contractor models with the sequencing information from scheduling soft ware such as Primavera Project Planner. 4D Planning is effective for the following tasks:

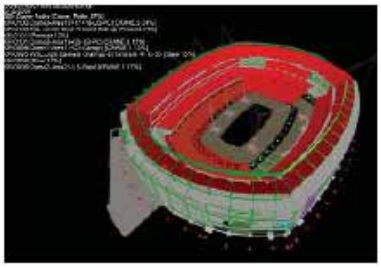
- Identify construction sequencing issues and spatial conflicts before we encounter them on site
- Project management can iteratively re-sequence activities rapidly when necessary while reducing the risk of spatial conflicts when doing so
- Communicate schedules clearly to all stakeholders – everybody on the same page
- Solicit input to the schedule early on
- Understand relationship between various tasks
- In general, minimizing risk by facilitating planning early on and thinking about processes, constructability

NavisWorks is the most common sequencing soft ware used, and Synchro and Vico control may also be used. Schedule information can be manually input or linked to a Primavera or MS Project schedule. The initial link to the schedule can be laborious, however subsequent updates to the schedule are automated and alternate schedules can be easily tested. Features in NavisWorks soft ware allow for flexible color coding to indicate various construction states (ex. Demolition, pour slabs etc) and actual vs planned schedule dates color keyed so that they stand out when played back in an animation or timeline sequence.

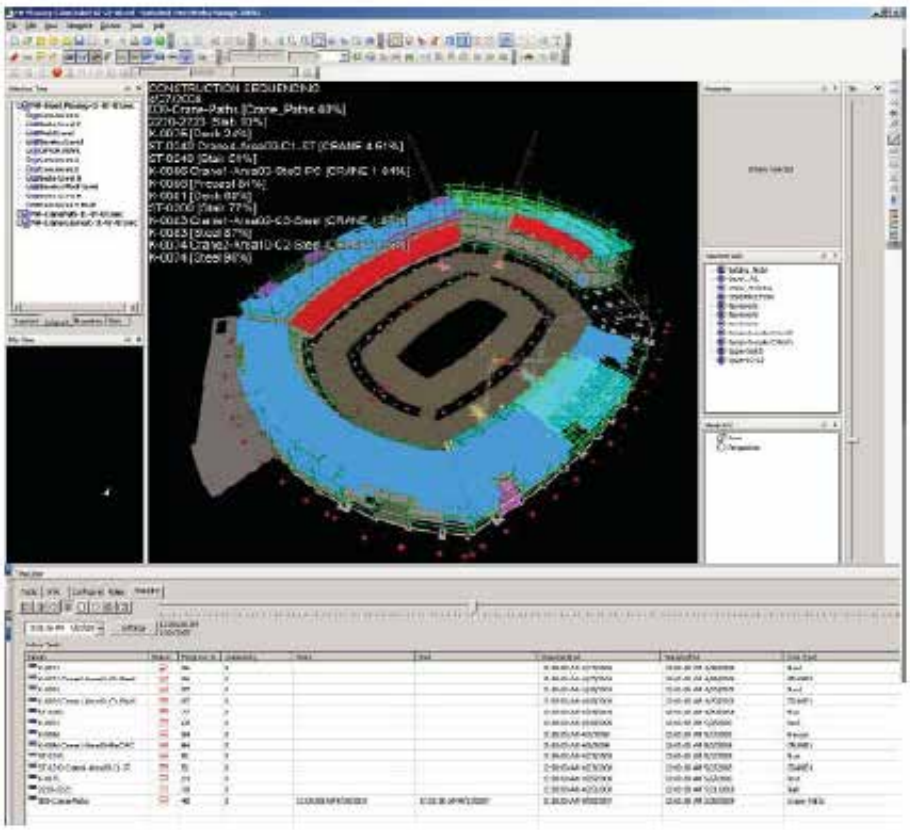


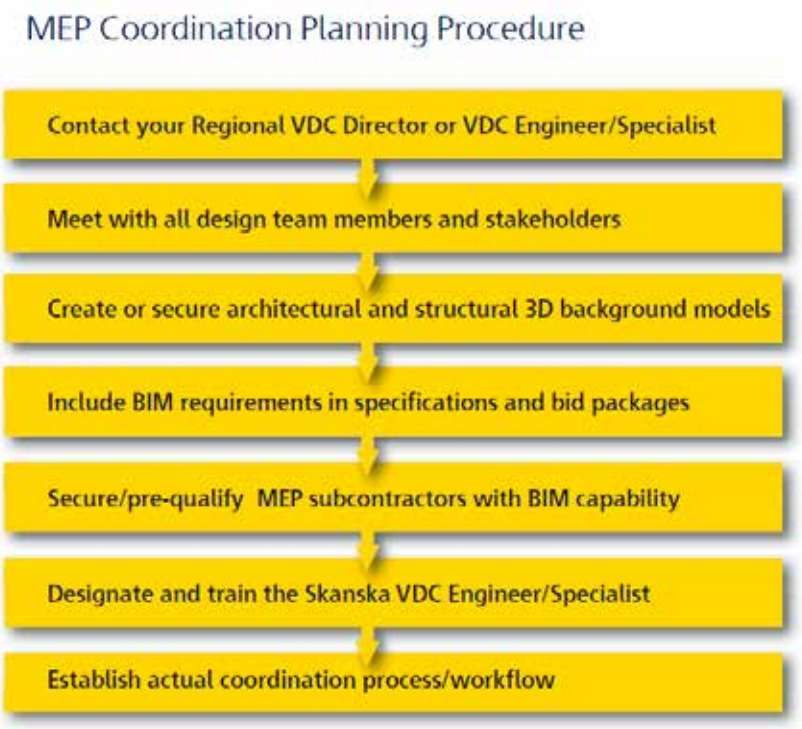






4D Structural Sequencing
New Meadowlands Stadium, NJ





MEP Coordination Planning Procedure

Below is an outline of the procedure for implementing 3D MEP coordination on a project. There are several great industry references and guidelines to assist in planning the coordination. Generally the procedures and specifications are tailored for each particular job. Your local VDC support staff can help with identifying and tailoring the process to meet the project requirements.