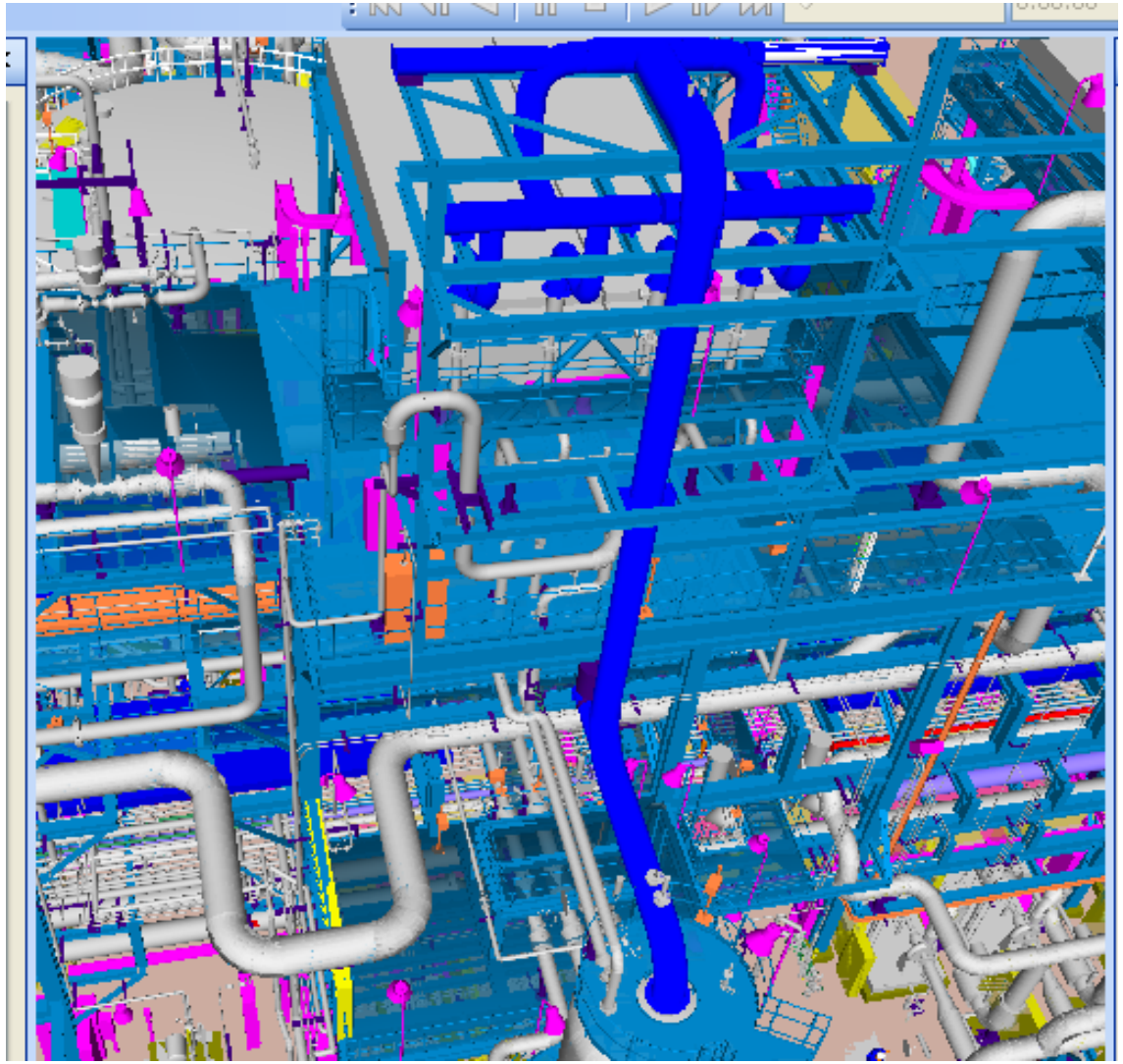


Transforming Piping spooling process

Presentation by

ICM Next, Chennai

Spool marking present process

- Engineering office develops 3D modelling of piping in SP3D/E3D software platforms. At 60/90% model review stage, issues to site line wise isometric (ISO) sheet break ups in IDF file format.

- Construction site sets up spooling software like Spoolgen and uploads ISO sheet files in the system. Checks for data capturing from model is complete and appends missing data in the ISO drawing.

- Site engineer marks the spools by selecting the field joints and numbering spools/joints in the ISO drawings and obtains spool wise BOQ, joint details and drawing. Excel files of BOQ and joint details are uploaded into piping construction software.

- Piping modelling goes through customer reviews and revision of drawings comes up. Revised ISO Sheet files in IDF are transmitted to site.

- Site incorporates the revisions and obtain revised BOQ and spool drawings. Site checks the status fabrication already done for the previous revison drawings and reports on modification/rework.

Demerits of present process

- There is lack of synergy between 3D modelling at Engineering office and spool marking at site in terms of location and software systems. Conversion into IDF files, transmittal and uploading and checking/ appending in spooling software requires lot of care to maintain data integrity.

- ISO Sheet concept restricts the selection of field joint marking. By default , ISO sheet terminal joints(start and end) are considered field joints. It may not be the ideal case always. Configuring a spool may require keeping the ISO sheet terminal weld joint as shop joint and considering the field joint in the following conjunction ISO sheet.

- Revision communication and incorporation at site takes place in time shift, making revision management liable for mistakes.

- Marking of spool is done outside the 3D plant model. Does not take advantage of model information like field joint location with respect to platform/support. Misses critical study- accessibility, erection ease, scaffoldability, methodology etc. Pipe support modelling is left out.

Spool marking in 3D model itself

- Model walkthrough of a given pipeline is carried out reviewing weld joints position for clearances with respect to structures/ pipe support etc.
- Spool marking is done by selecting the field joints in the ISO model, checking out of welding ease, transportability and erectability in line with spooling philosophy agreed with site team. Spool marking is done for the entire line in one shot.
- Once spool marking and numbering of spools and joints are completed, ISO sheet breakups are generated for erection team. Generates Spool/ISO Sheet wise drawings, Spool/ISO sheet wise BOQ and weld joint master in excel.
- Spool/erection ISO drawings and excel reports are transferred to site for direct work turnover.
- Revisions are flagged on the spool drawings then and there.

Benefits to piping team

- No need for mobilising spooling software and trained spooling operator personnel at every site. 3D model platforms will extend to spooling process and achieve higher utility. Site will get piping drawings and uploads directly from engineering. site becomes unburdened.

- Eliminates work flow of conversion into IDF files, transmittal and uploading and checking/ appending in spooling software which requires lot of care to maintain data integrity. The seamless data flow, process simplification and automation can translate into saving of time and cost.

- Spooling in 3D environment aids in proper selection of field joint and spool sizing contributing to erection productivity and minimising rework. Line wise spool marking makes the spooling and ISO sheet breaking up processes more productive. Minimise document management.

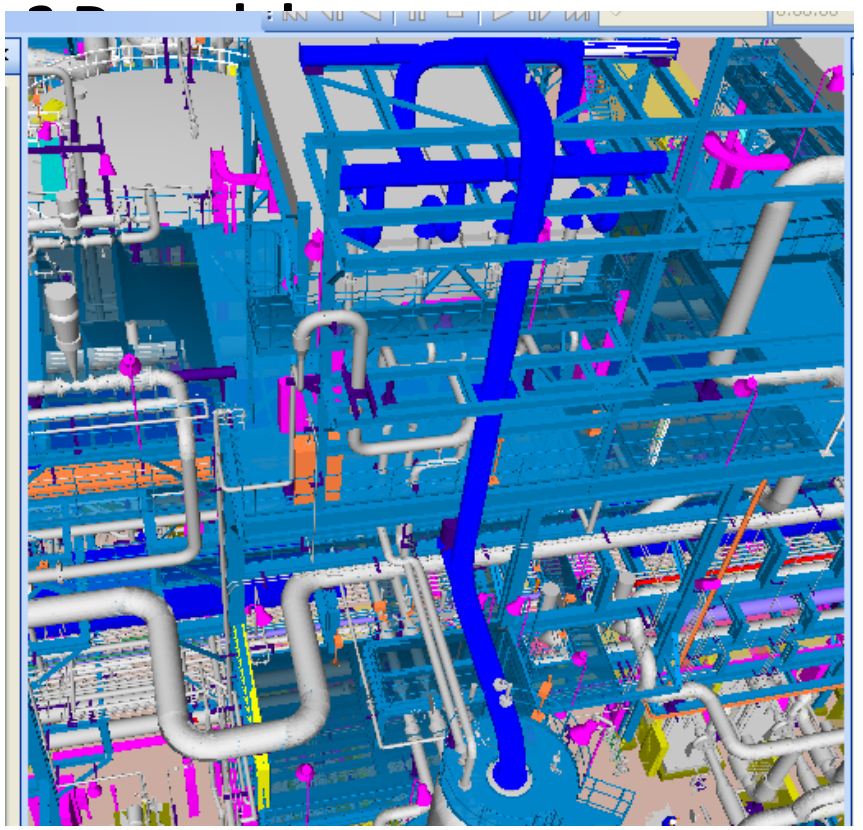
- Revisions are flagged on the spool drawings then and there. Dedicated team carries out revision changes in spool drawings on priority thereby eliminating communication time gap and consequent rework.

- As built model drawing preparation with spool breakup and weld joint details is inbuilt.

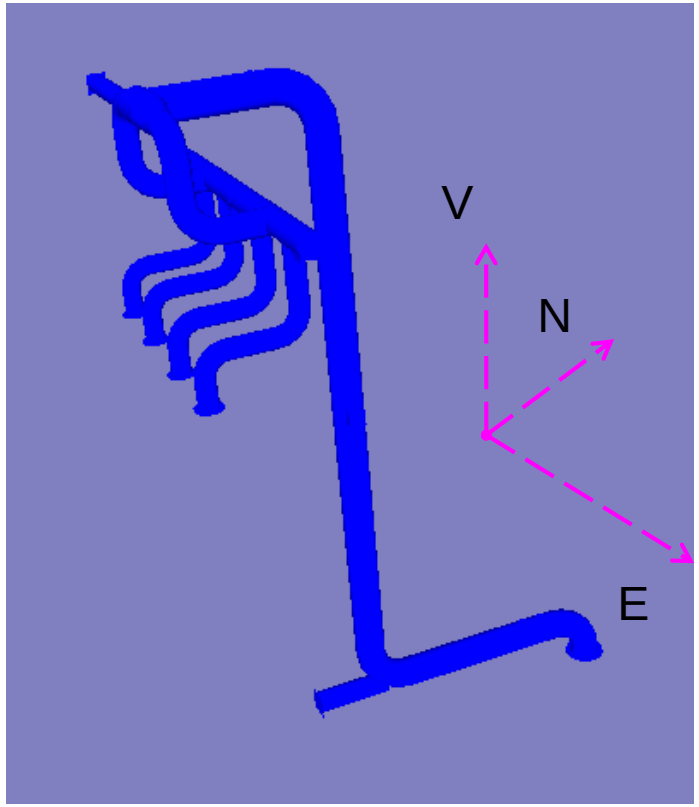
3D Model for Field Joint Marking- Illustration

Equipment to Air fin cooler piping line is studied at a go.

- Distribution of field joints along three axis.
- Ease of Erection and scaffoldability is studied
- Clubbing with Field welds of Trunnions / Supports for optimized scaffolding

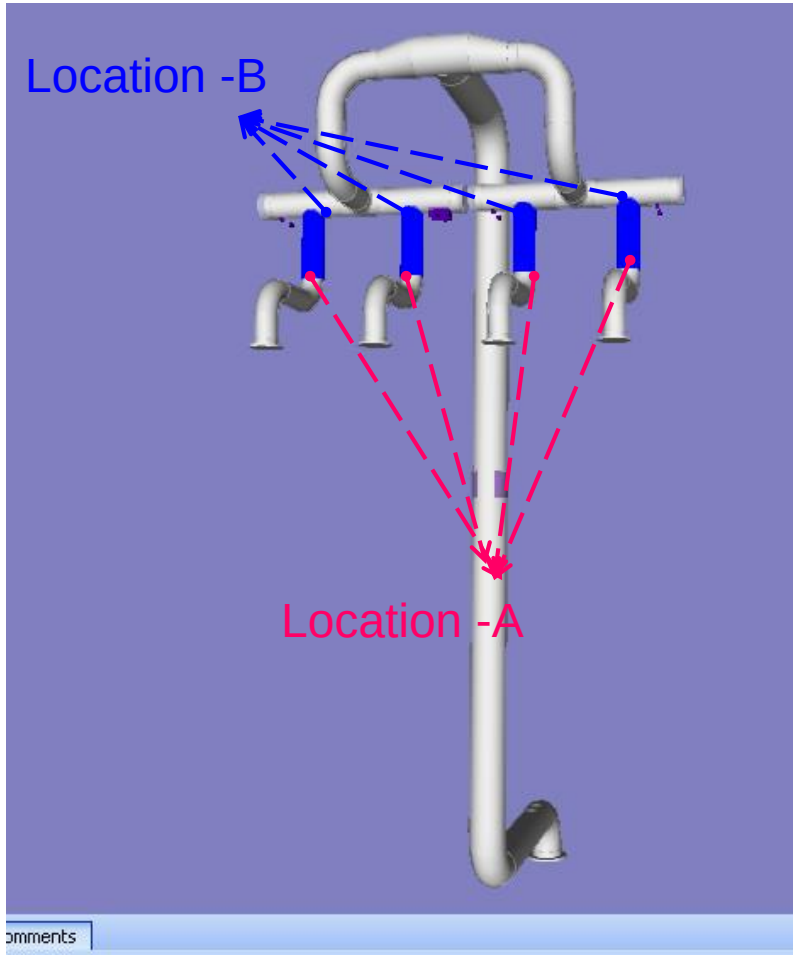


Example – Air Fin Cooler Connection



- Snap from 3D Model
  - Vessel Nozzle to Cooler Nozzle captured
  - 3 Axes:
    - N-S Direction
    - E-W Direction
    - Vertical
  - Distribute Field joints along all 3 axes
    - Minor Modifications

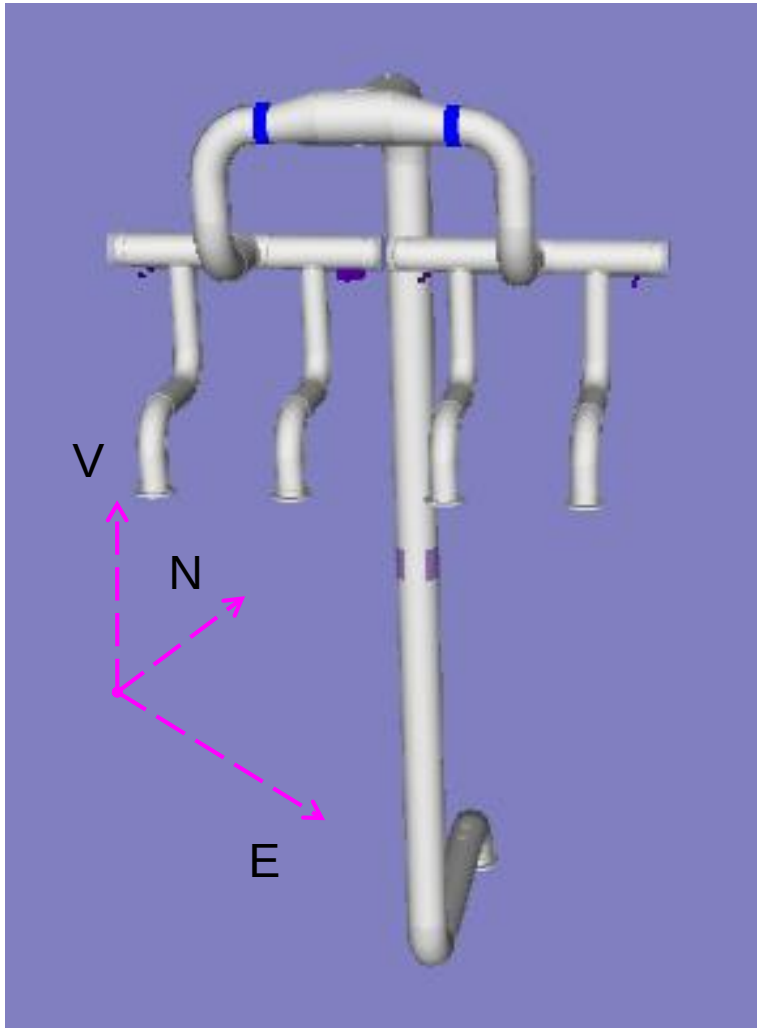
Vertical



- To accommodate variation in Elevation of Cooler
- First Field joint in Vertical
- Alternatives- Location A /B
- B- Ease of Scaffolding

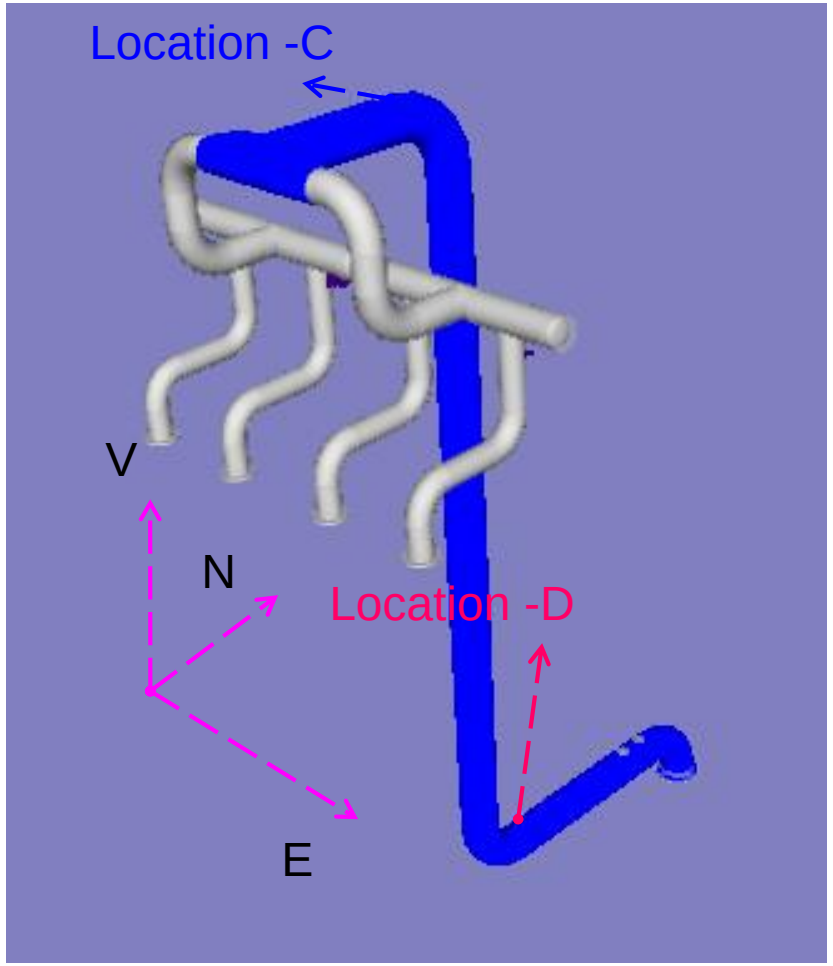
E-W Direction

- 2nd Field Joint in E-W Direction
- Excess length of 100 mm + in each field joint used to accommodate site variations



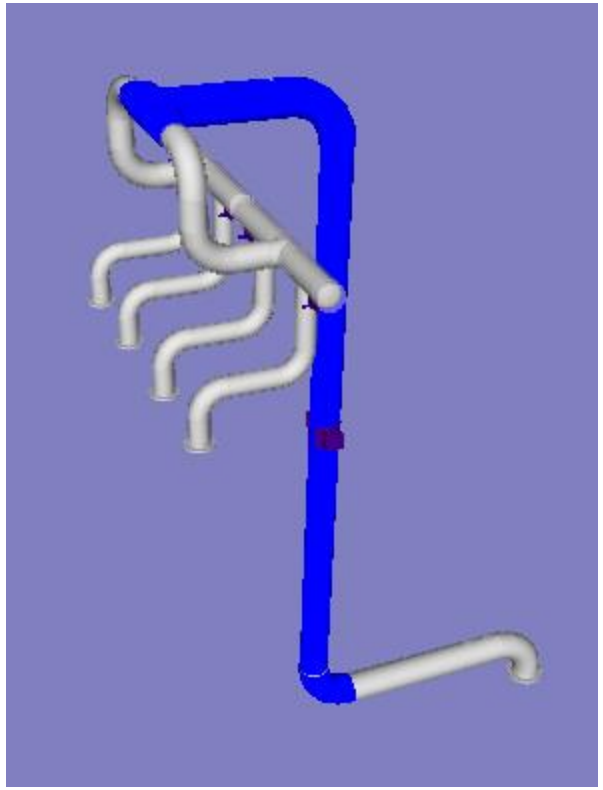
Ease of Erection

- Balance part of line highlighted
- Field joint in N-S direction – Alternatives: C / D
- Field joint at D facilitates insertion of Spool from Top

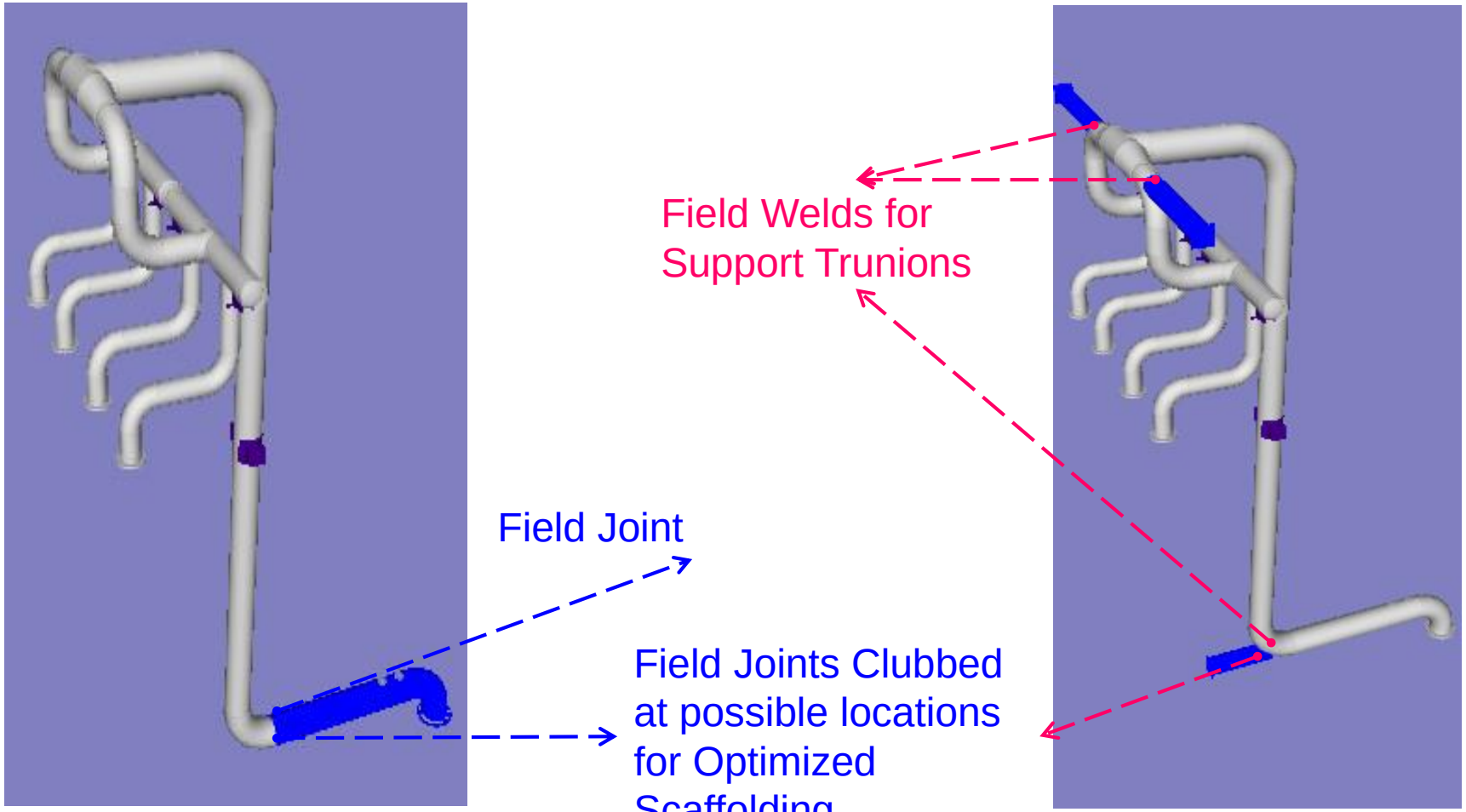


Ease of Erection

- Elbow has been included in the spool so that filed joint in N-S Direction is not compromised
- Further same can pass through the bracket structure also

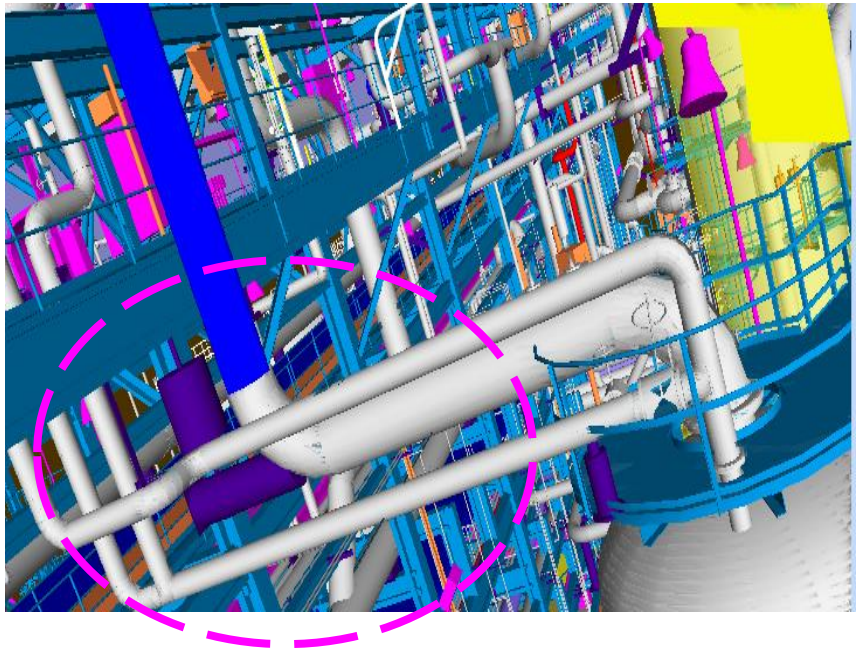


Clubbing Field Welds



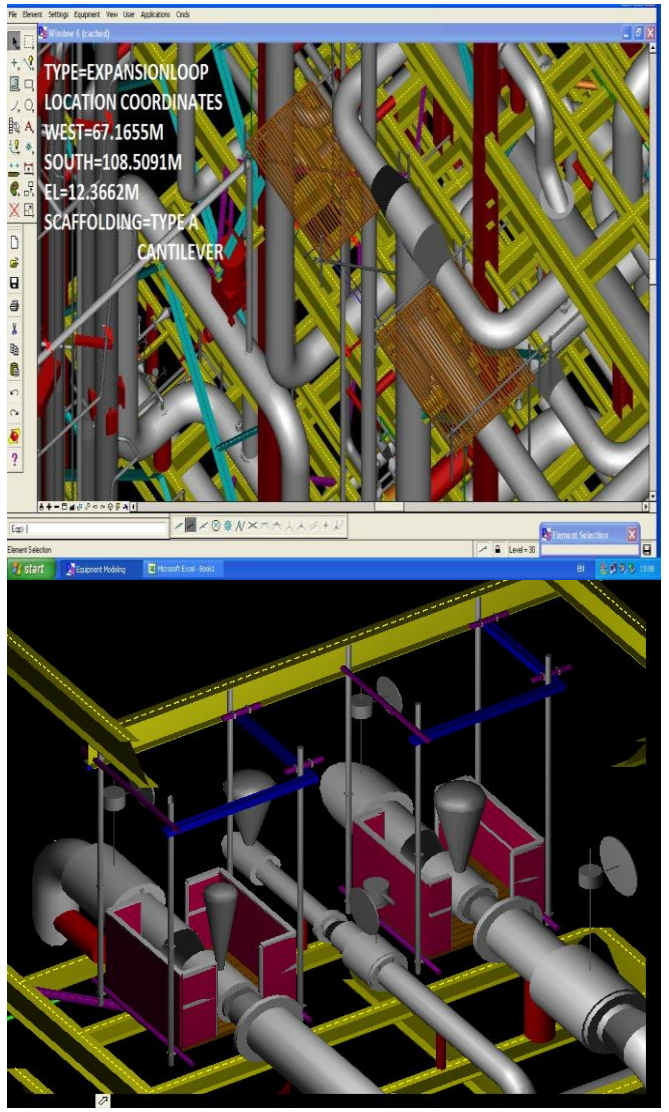
Scaffolding

- Field joints must be chosen at accessible locations where minimum scaffolding is sufficient
- Close to Structural members



Scaffolding Plans

- Using PDS for Scaffolding Plans
  - Avoid repetition of scaffold in one location
  - Accurate understanding of the scaffolding arrangement at sites during planning stage itself
  - Automatic quantity calculation can be done
  - Creation and modification can be done easily as it gives instant visual feedback
  - High level of productivity – This is used to speed up the work in site since the platform locations are planned well in advance
  - Walkthrough can be generated including platform locations



Augmented reality takes BIM from desktop to the real world!

Augmented Reality (AR) understands the physical environment and overlays contextual digital content BIM that enhances our real-world experiences.

It’s a hybrid experience where the Physical and digital worlds co-exist and compliment each other in a useful manner.

AR is typically powered by mobile applications, headsets, and other smart devices that superimpose digital objects into the real world.

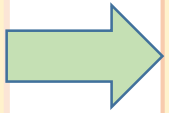
AR projects 3D images on a person’s physical surroundings as they walk through with a mobile device or special helmet.

Using GPS and cameras, AR can present real-time data geospatially, updating and displaying the necessary information as the user moves throughout a building space. Information such as schedules, operational details, and structural plans are easily accessible, allowing users to automate the construction process and make decisions on-site.

Process change over in 3D spooling

OUTSIDE 3D MODEL

- ✓ Spool marking isometric sheet wise
- ✓ ISO sheet creation by Engg followed by spool marking
- ✓ ISO sheet creation/consistency check by Engg
- ✓ ISO sheet IDF conversion/transmittal
- ✓ ISO sheet revision drawing transmittal
- ✓ Spool/joint details incorporation in model



INSIDE 3D MODEL

- ✓ Spool marking isometric line wise
- ✓ Spool marking followed by ISO sheet creation
- ✓ By Spooling agency
- ✓ Not required. Spooled drgs/database uploading by agency
- ✓ Not required. Line list revision update will do
- ✓ As built is updated by regular uploading spooler database

Real-Time project Information to site crew:

Before taking up erection, Piping crew can see at the erection site the digital vision of piping spools with supports secured by steel and concrete structures true to position and scale. Crew recognise work location, levels and alignment with respect to already completed physical structures and mismatches if any.

Crew can take field measurements, physically mark the alignment of piping and location of supports etc and visualise the path of spool shifting from stacking, scaffolding plan and lifting spools to the final position, the access for crane and crew and safe working at the location.

Concurrent working with Design team

- In global server working, designer and detailer can work concurrently in their respective modules of E3D.
- Access control can be exercised to permit detailer working on spooler module without disturbing design module working.
- Detailer R/W access to Design module is limited to creation of shop/field joints and pipe breakup joints.
- Design changes are captured in 3D model and 3D Data consistency check is performed.

FUTURE OF 3D MODEL PIPING CONSTRUCTION

- Automated spool marking
- Scaffolding plan for field joint fitup/welding
- Spool erection schemes with animation
- Augmented reality
- Digital survey and layout
- 4D planning

THANK YOU

contact us @bashyamp@gmail.com