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PLATFROM DESIGN IN NX / TC

Possibilities to Utilize NX/Teamcenter as a Platform Design Application

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TIIVISTELMÄ

Tekijä	Shahu Injal
Opinnäytetyön nimi	NX / TC:n hyödyntämismahdollisuudet alustan suunnittelun sovelluksena PDMS:ään verrattuna
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Ohjaaja	Juha Hantula

Hanke toteutettiin yhteistyössä asiakkaan ja Citec Oy: n kanssa.

Tutkimuksen tarkoituksena oli selvittää NX ja Teamcenter-sovelluksen sopivuus huolto-tasojen suunnitteluun. Tutkimuksessa vertailtiin NX ja Teamcenter-sovelluksen hyödyt nykyisessä käytössä olevan PDMS-sovelluksen kanssa. Tutkimuksen aikana listattiin NX ja Teamcenter-sovelluksen tärkeimmät edut PDMS-sovelluksen vastaan.

Tutkimus kokeet tehtiin sekä NX ja Teamcenter integraatiossa, että pelkästään NX sovelluksessa ilman Teamcenter integraatiota. Vertailutesti suoritettiin PDMS llä tehdyn huoltotasojen suunnittelun perusteella.

Tämän tutkimuksen päähavainto oli, että jotta voitaisiin käyttää NX ja Teamcenter-integrointiympäristöä, nykyinen järjestelmä vaatii suuria muutoksia ja tarvitsisi ennalta määritetyn uudelleenkäytön kirjaston standardikomponenteille.

Johtopäätöksessä korostetaan NX ja Teamcenterin integroinnin etuja ja puutteita, sekä huoltotasojen, että kaiteiden suunnittelussa. Näiden uusien ominaisuuksien käyttöönottaminen edellyttäisi kuitenkin laajaa järjestelmän uudelleenkonfigurointia ja lisäinvestointeja yrityksille. Siksi yrityksien tehtäväksi jää päätös näiden ominaisuuksien käyttöönottamisesta tuotannossa tulevaa kehitystä varten.

Avainsanat	NX / Teamcenter, PDMS alusta, kaide

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ABSTRACT

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	Possibilities to Utilize NX / TC as a Platform Design Application
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This project was done in co-operation between the Customer and Citec Oy.

The main objective of this thesis was to identify and check possibilities to utilizing NX /Teamcenter for service platform design. The found facts were compared with the presently used PDMS application to see the benefits of adapting these features from NX / Teamcenter. During the research key benefits of NX / Teamcenter application over PDMS application were listed.

The research was carried out to see the functionality of NX / Teamcenter for designing platform and handrails. The features were tested in Native NX and NX /Teamcenter integration. A comparative evaluation was carried out based on existing platform design made in PDMS.

The root finding of this research was that to be able to use the NX /Teamcenter integration environment, the current system requires a drastic change in the system configurations and would need a predefined re-use library for standard component and parts.

The conclusion emphasizes the advantages and deficiencies of platform handrail features in the NX/Teamcenter integration. However, adapting these features would require an extensive system reconfiguration and additional investment for the companies. Hence, it is up to business to make the decision to adapt these features in production for upcoming future development.

Keywords	3D Models, platform and handrail

CONTENTS

TERMS AND ABBREVIATIONS

CAD   Computer-Aided Design

3D-CAD   Three Dimensional-Computer Aided design

PDMS   Pipe Design and Management System, 3D Plant Design software

                        application by AVEVA Ltd.

NX   Siemens CAD software Application

PLM   Product Lifecycle Management

IT   Information Technology

STAAD   Structural analysis and CAD software application

PDF   Portable document format

DB   Data base

XML   Extensible Mark-up language, mark-up language that defines a set

                        of rules for encoding documents in a format that is both human-

                        Readable and machine-readable.

UDA   User Defined Attributes

UI   User Interface

GUI   Graphics User Interface

PTB   Part table file: contains a tabulated list of standard routing parts

                        with descriptor characteristics and applied characteristics that are

                        common to each part listed in the file.

APV   Application View file: To configure preferences in routing.

RCP   Routing Control Point.

LIST OF FIGURES AND TABLES

1 INTRODUCTION

In this fast-developing world several Engineering industries uses advanced technologies and latest design software applications to achieve its necessities and to get best results. One well-known industry is Product Development Manufacturing and Management. Many product development industries often use Computer aided design / Product lifecycle management (CAD/PLM) solutions. The CAD/PLM solution provider companies are Continuously developing and introducing new and improved functionalities to the industry.

1.1 Customer

Customer is a global leader in smart technologies and provides the complete lifecycle solutions for the Marine and Energy markets and has a solid background reference in power plants.

Customer has Research and Development Center and uses Computer aided design / Product lifecycle management (CAD/PLM) for effective Lifecyle Management.

Recent years Customer is using NX / Teamcenter as their main CAD/PLM (PDM) application for product development. However, Company also uses different CAD applications in other areas for specialized design requirement.

Also, Customer has plant design management system (PDMS) as CAD application tool for power plant. For 3D designing of piping and other steel structures including service platform and handrails.

In recent developments Customer started using NX / Teamcenter as 3D design application for other products areas such as auxiliary modules for power plant.

The NX application has different modules that are available for specific design purposes such as Master Modeling, Sheet Metal, Mechanical Routing, Electrical Routing and so on.

Likewise, NX has feature named PLATFORM AND HANDRAILS for designing of platforms and handrails. These features are based on mechanical routing.

Customer is looking forward for the possibility of switching of designing service platform From PDMS application to NX and Teamcenter application. Thus, it is important & crucial to check benefits of this change. Also, it must be tested and properly analyzed for its suitability & feasibility.

There are several criteria that can be taken into consideration before switching Platform design application from PDMS to NX / Teamcenter integration.

- Pre-requirements for features to perform functions in NX /Teamcenter integration.
- New Features and its design capability.
- Benefits from of platform, handrail features.
- Design efficiency between NX /Teamcenter vs PDMS.
- Possible change required in software. (configuration).
- Classification and re-use Library in NX /Teamcenter and its cost.
- What can be used from existing Design from PDMS.
- Output of design its drawing report's.
- Cost / Savings (license, Implementation, Manpower, PLM/IT support).
- Design freedom to end user.
- New features training for designers.

1.2 Citec

The Citec company was established in 1984. The real cooperation with Customer started when Customer outsourced its power plant Engineering to Citec in 2003. Since then Citec has become a preferred partner for engineering service provider in power plant engineering to Customer. In recent years Citec has expanded business by establishing new companies by acquiring many other engineering companies in Finland and many more countries. Citec's head office is in Vaasa Finland and it has offices in India, Sweden, Norway, UK, France, Germany, Russia and Saudi Arabia.

Citec's vision is to become a strategic partner in plant and product engineering and technical documentation. The company's mission is to provide high-quality engineering in a flexible, cost competitive, safe and sustainable way. /3/

Citec currently makes yearly turnover approximately around 70 Million euros. The company has approximately 1000 employee's experts in different areas. Citec provides multidiscipline engineering services in different sectors, such as: /3/

- Energy
- Oil and Gas
- Process plants
- Machinery and Equipment
- Building
- Transportation

1.3 Thesis Objectives

The main objective of the thesis is to:

1. To identify and study possibilities to utilize NX /Teamcenter as a platform design environment currently done in PDMS.
2. Make a study pilot project based on existing PDMS design project.
3. Study and analyse overall capabilities over existing PDMS tool.
4. Make a conclusion with a list of arguments for and against and final change recommendation.

1.3 Methodology

The thesis study research is based on the existing platform designed in the PDMS application. Similar type of platforms will be used as base for research purpose using NX / Teamcenter. The study approach is more of practical design thinking and more comparative with two 3D design applications namely PDMS and NX / Teamcenter.

This thesis is done in co-operation between Customer and Citec Oy in Vaasa.

Other practicalities such as using of equipment, software needed and writing, testing of NX /Teamcenter will be done in co-operation with Citec Oy Ab in Vaasa.

As a wish of client and due to confidentiality, this public thesis report contains general research project report data and does not contain any form of sensitive information relating to the organization.

2   ROUTING SYSTEM THEORY

Routing is a design process to create a Linear path or a Spine path which defines sets of Routing Control Points (RCP), Line segments, Corners, and elbows. The user can assign stocks to these paths, and place standard parts to connect the various pieces of stock in the overall assembly. The NX / Teamcenter routing system has a possibility to set routing characteristics, also known as routing attributes that maintain information about routing parts and stock and their intended use. The NX routing attributes are set from the Part Table File (PTB).

Some of commonly used Routing characteristics are:

- **Descriptor characteristics:** it contains part information such as its size, material, and color. The Value of descriptor characteristics are the same for all uses of a part.

- **Destination characteristics:** Destination characteristics are characteristics of the existing parts that must be matched when placing or assembling the part or assigned stock.

- **Specification characteristics**: specification characteristics are the characteristics defined by NX in the Application Part View (APV) file which must be adhered to when working under a particular specification.

- **Fabrication characteristics**: Fabrication characteristics are required or optional characteristics which specify how to attach the part to a component in a routing fabrication. The fabrication characteristics can be set when creating a routing fabrication component using the **Create Fabrication** command. NX defines fabrication characteristics for each discipline in the Application View.

- **Stationary characteristics**: Stationary characteristics are the characteristics which uniquely identify components, members, runs, and so on in any design.

- **Allowed Run Types characteristics:** Allowed run types is an optional characteristic which can be used when defining a run in Routing Mechanical or Routing Logical. It appears in the Define Run dialog box under the Properties group. The Allowed run types are defined in the ugroute_mech_metic.xml file.

- **Synonym characteristics:** Synonym characteristics are characteristics which are alternates for the same type of characteristics. For pipe diameter can be synonymous with outside diameter (OD) /4/.

Example of Routing attributes usage in design process:

- **Part Selection:** The Routing dialog box allows selecting parts and stock based on part characteristics.
- **Physical Properties:** Specifies physical properties of standard parts such as material, size, and pressure rating. These characteristics are used to identify the parts and stock. They can also be used by design rules or for analysis.
- **Operation Condition:** Set operating conditions such as expected operational pressure, temperature. These characteristics are used for design rules and analysis.
- **Part Identification:** Specifies parameters for identifying the part such as part number and name. These characteristics are used in the Bill of Material for purchasing and in a parts list for manufacturing.
- **Assembly Organization:** Specifies characteristics that are assigned to individual components and stock to group them into runs and spools.
- **General Information:** Specifies characteristics for other information such as the manufacturer or supplier. Almost any type of information can be associated with routing parts placed in the assembly /4/.

3 PROJECT BACKGOUND AND REQUIREMENTS

3.1 Current Design of Platform with PDMS Application

Customer uses many different design tool applications and also buys engineering services from several engineering consultant companies for fulfilling its engineering design requirement. In power plant engineering for several years Customer has mainly used the PDMS application as its design tool for designing various auxiliary modules and service platforms for plant piping.

Recent years, Customer has started to use NX / Teamcenter as a design application for auxiliary modules. As a part of this transition all existing modules in PDMS shall be migrated or newly made with NX / Teamcenter in near future. NX / Teamcenter could be the major design tool in the future. It is useful to find the benefits of all the functionalities that can be used for multiple design requirements that can be covered in the same application to achieve efficiency in a cost-effective way.

Citec is one of the engineering service providers for Customer in multidisciplinary engineering design. Citec has experts and specialized knowledge in delivering complete in power plant industry.

The PDMS Platform design project has been given to Citec. The project work process starts from design inputs, such as.

- Scope document
- Master layouts
- Unit drawings
- Safety standards to follow
- Interdisciplinary inputs if any

The design is performed on the basis of received inputs and it is ensure that it meets all quality level and standards of safety requirements such as:

- Material standards
- Safety Standards

- Accessibility and service space requirements on engine, units and piping components
- Checking with other stakeholder's design civil building and electrical
- Preferable prefabricated design to avoid site welding work
- Stress calculations done on critical steel structure using STAAD applications

Once the design is ready and approved, final deliverables are generated in different forms, such as drawings in the PDF format and reports in an excel sheets. These documents are stored and maintained in documentation system where they are officially checked and approved for further production and other needs. Examples such of documents:

- Assembly drawings
- Manufacturing drawings
- Prefab part list
- Material list

The platform design in PDMS is done in Design Modular.

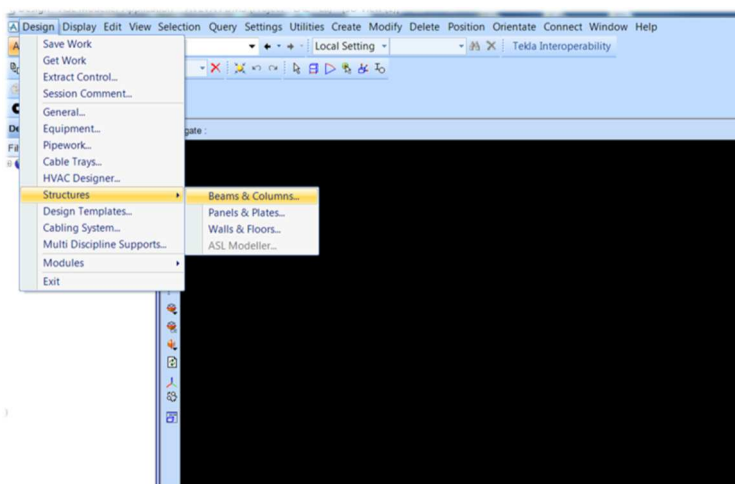Design module selection path in PDMS, Design -> Structures -> Beams and Columns.

Figure 1. Interface of steel structure design application in PDMS

3.2 Hierarchy in PDMS and Databases

Figure 2 below shows the design hierarchy in PDMS. The PDMS application designs a primitive type of complete three-dimensional model using computer-simulation techniques. It stores all the project design information, administrative or technical in a series of hierarchically specified databases. /11/.
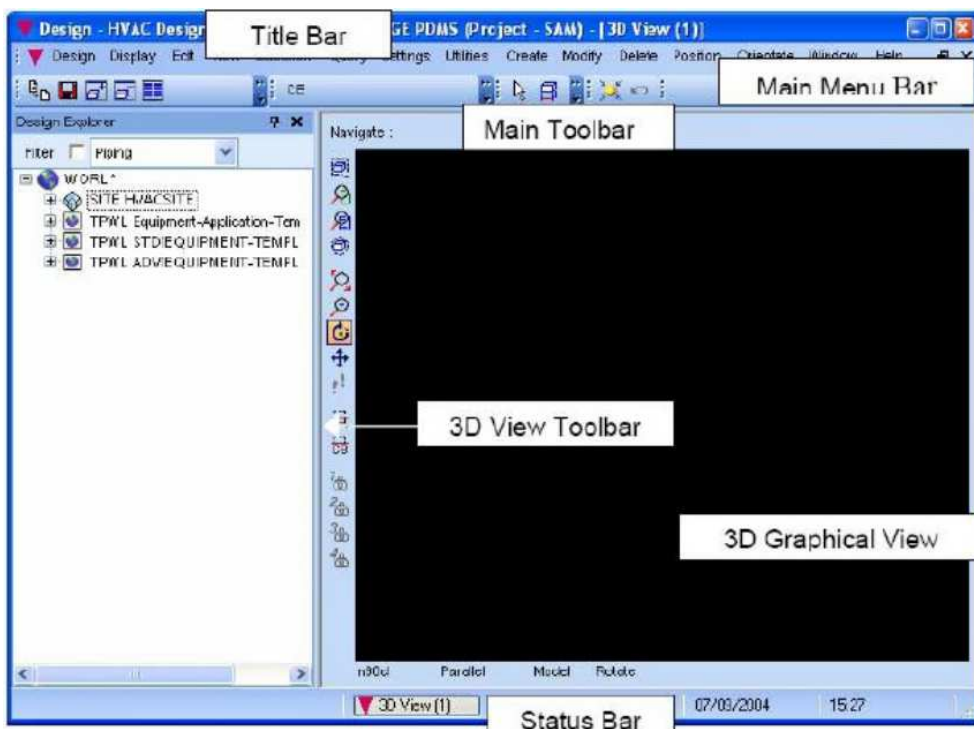

Figure 2. Hierarchy in PDMS: World, Site, Zone

There are different types of databases, all together makes up a complete project. Each of database contains specific information and supporting files and share information.

3.3 Design and Drawing Databases:

- DESIGN databases: contains information of 3D model design and this DB has references to all other DB's to access and share information.
- PADD database: Stands for Production of Annotated and Dimensioned Drawings
- ISOD database: contains all information of spool drawings produced by SPOOLER. It supports Iso-draft Module /10/.

3.4 Reference Database:

- CATALOGUE database: contains information of dimensional standards for nozzles, piping components and structural profiles/fittings and such, details of connection types, holding data and specifications.
- DICTIONARY database: contains definitions for User Defined Attributes
- PROPERTIES database: contains all Material property and data normally used for stress analysis /10/.

3.5 Administration Databases:

- SYSTEM database: contains all information about modules, databases, users, teams.
- COMMS database: contains all information on current users - for the Status and Systat commands.
- MISC database: contains all data for inter-user inter-db macros
- TRANSACTION database: enables the System Administrator to monitor the progress of Global commands, transaction messages are generated in the database each time the progress of the command changes /10/.

3.6 Facts of PDMS application

The PDMS application is mainly used for piping design and for example conceptual design of steel structures in power plants. PDMS is not made for product design, thus the application has many limitations to get exact 3D product details compared with the NX design application.

Some real facts that have been observed by engineers when working with PDMS applications are listed below.

- PDMS made design and drawings are not approved within PDMS. Today it is done in a different application document system by adding a PDF created from PDMS. No traceability of 3D and 2D design.

- In drawing Title box and most of information filling is manual work. For example, such as product type, weight, and other details.

- Revision Handling requires additional work. It should follow the same steps while uploading of PDF files to document system.

- In case of revision of the design only the PDF as a reference for the old design. (If the existing design need to be kept, copying is only option before modifying new changes).

- No integration between the PDMS design and the document management tool where it gets approved. No direct relation between 3D design and official used stored outputs (PDF's).

- PDMS is command and GUI based design application, engineers need to memorise commands in many occasions to use functionalities.

- Interoper-ability is poor in PDMS.

4 PLATFORM HANDRAIL DESIGN USING NX/TEAMCENTER

4.1 NX Platform Handrail Features and Its Functionality

Siemens NX/Teamcenter provides specific functionalities for different design aspects to enhance productivity by delivering complete life cycle management, such as HVAC Design, Electrical Routing cabling and NX platform handrail design.

With NX platform handrail functionalities equipment support structures, access ways, walkways, maintenance platforms and other similar structures can be designed. The use of application maximizes the productivity and meets the higher quality standard. Designing platforms, plating of platforms or sizing, reinforcements, can be easily modeled with predefine attributes, it is also possible to apply design condition and other checkmate functions can be developed and used for quality standards. /8/.
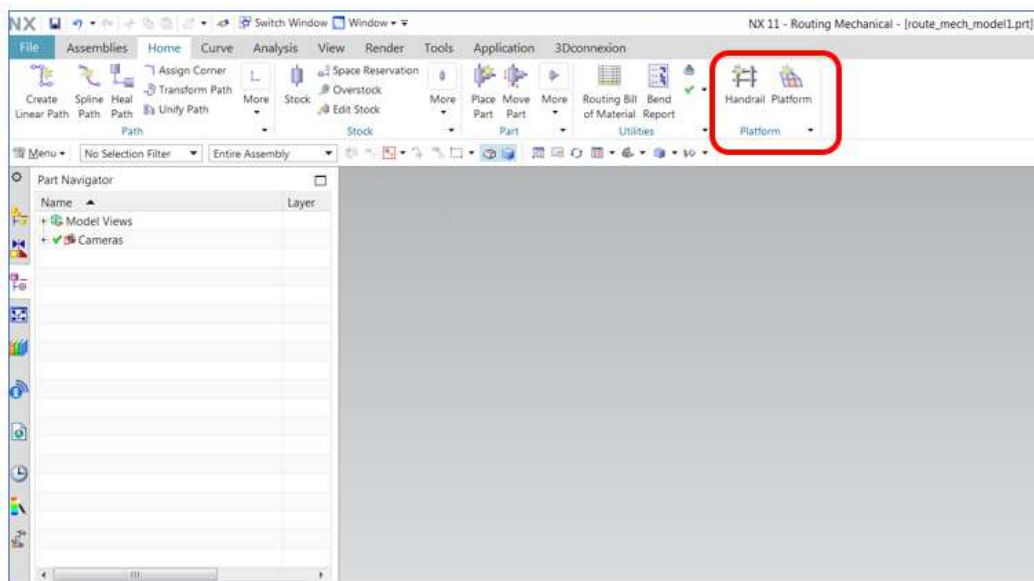

Figure 3. Interface of NX, handrail platform features

Examples of creating a platform, handrail and assign corner is given below.

4.2 Instruction for Design Platform in NX

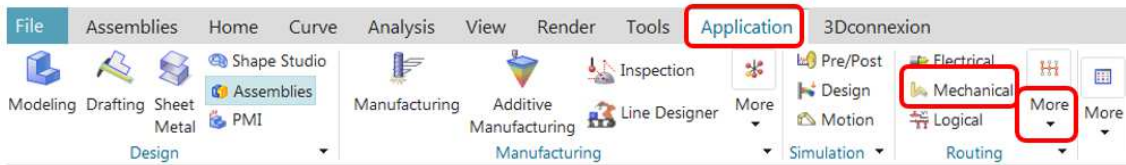Choose the application to Platform from application menu

Figure 4. Application menu

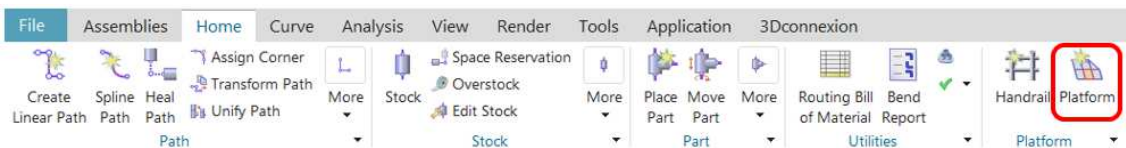Go to the Home menu and select Platform

Figure 5. Platform Tool bar

Selection of Platform will open the Platform creator window

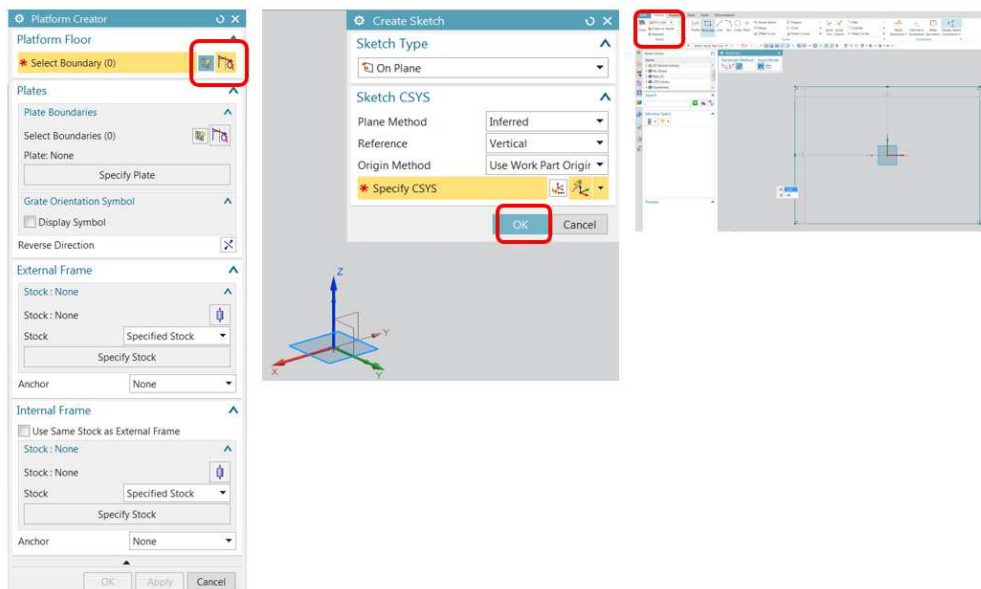Select Boundary by sketch here, press ok, draw sketch and finish the sketch

Figure 6. Platform creator, sketch

Select the Boundaries, press sketch, create sketch press ok, drawing sketch by adding number lines to plate in shapes.
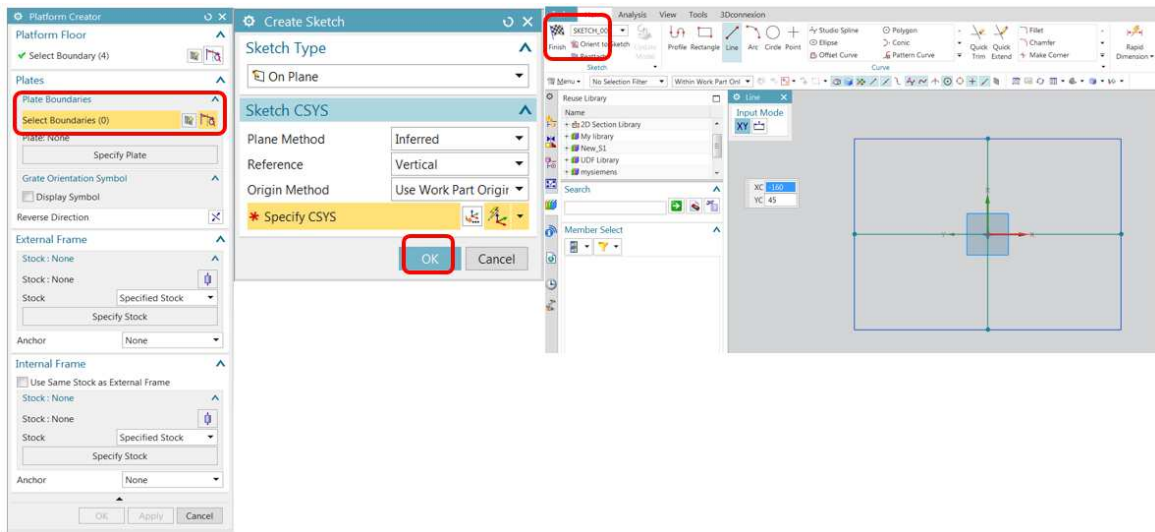
Figure 7. Platform creator Plate boundaries

Press Specify plate, Specify Item from reuse library by selecting plate stock, press ok

Specify Frame stock for External frame and Internal frame, if stock is same for both frames tick Use same stock as external frame icon press ok
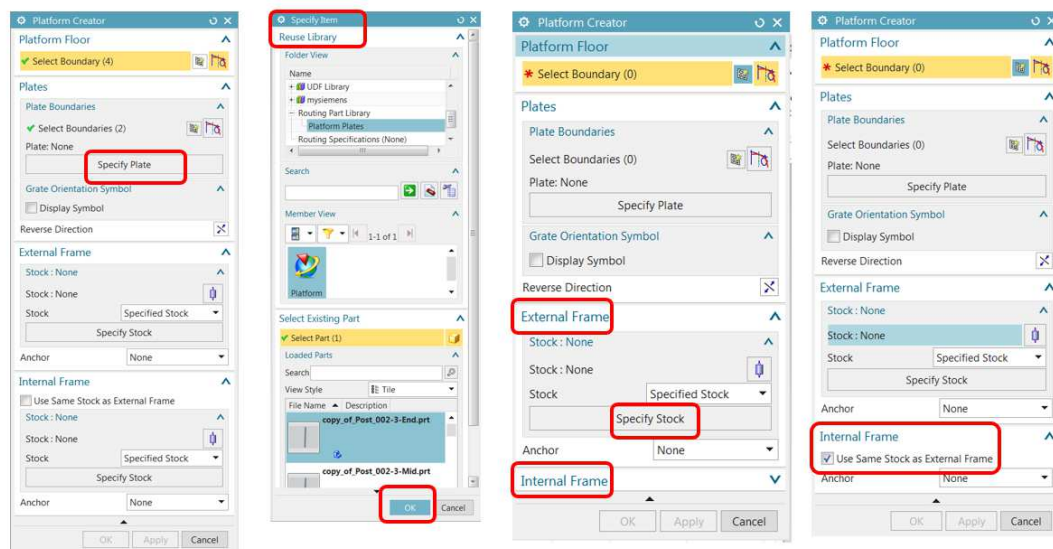

Figure 8. Platform creator Reuse library, external frame, internal frame
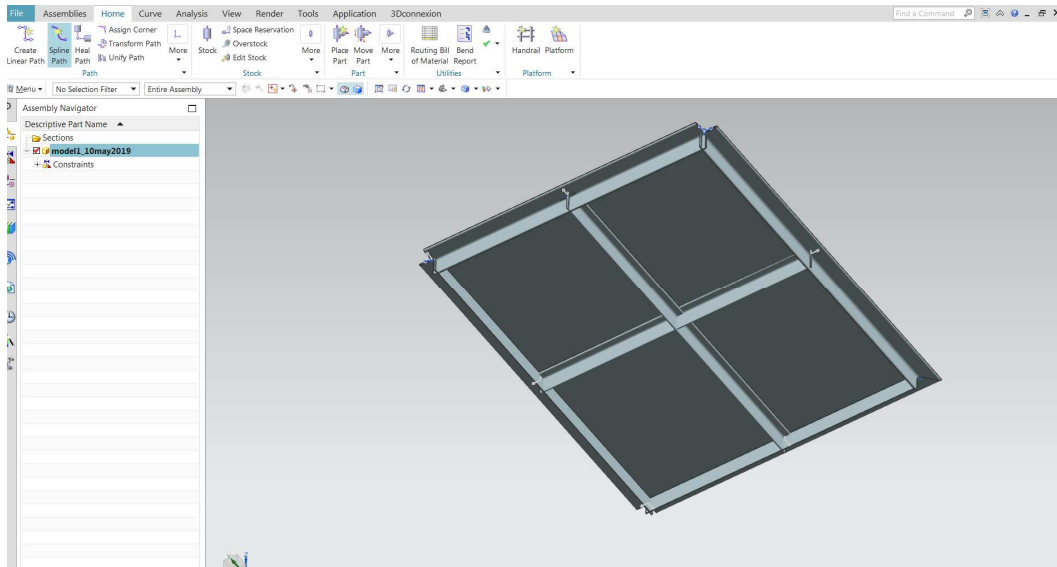
Figure 9. Platform three-dimensional model in NX

4.3 Assign Corner

Assign Corner, we can set a corner for the frame. This can be done in two ways. The first method is to, set a corner in routing preferences under paths as shown in figure below.
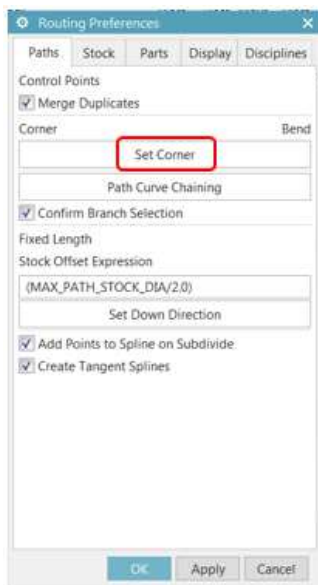

Figure 10. Routing preferences, Set Corner

The second method to, assign corner is to go the home page, select assign corner will open assign corner window.
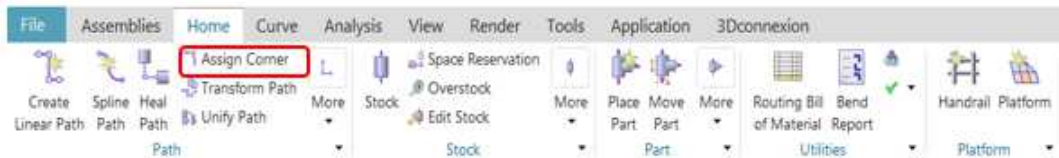

Figure 11. Assign corner

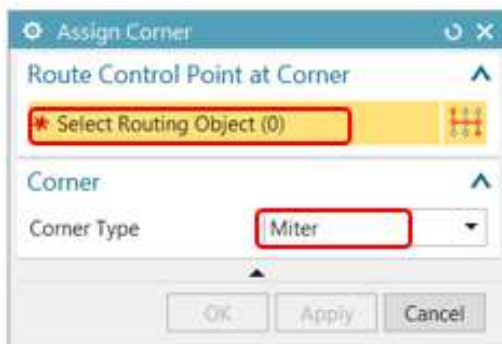Select routing object, routing control points at corner of the frame, set corner type to Miter and press ok.

Figure 12. Assign corner, selection of routing object

The open corners for the frame will get fully closed.
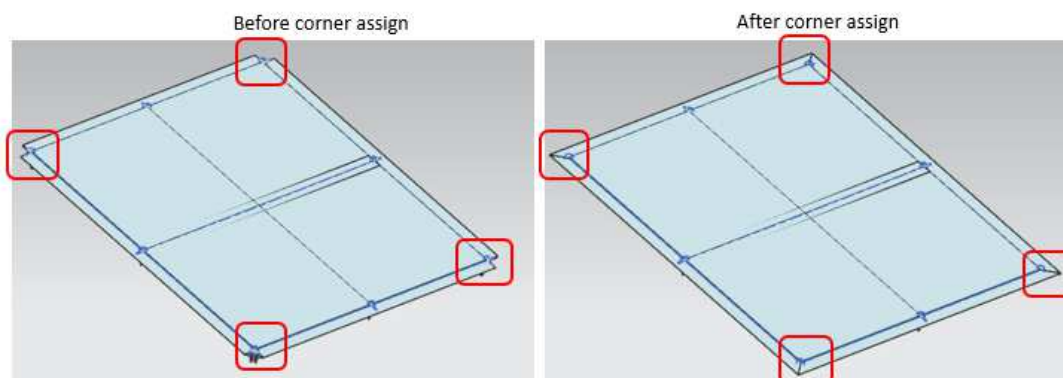
Figure 13. Assign corner, Before, After

4.4 Instruction for Designing a Handrail in NX

From the routing preference set discipline to Handrail

Figure 14. Routing preferences, Discipline handrail

Go to the Home menu and select Handrail,

Figure 15. Handrail Menu bar

Open the Handrail creator, select handrail will open the routing reuse search window, the filter library gives the available predefined handrails to select type of handrail to use or place, in this exercise used sample handrail that are readily available from native NX.
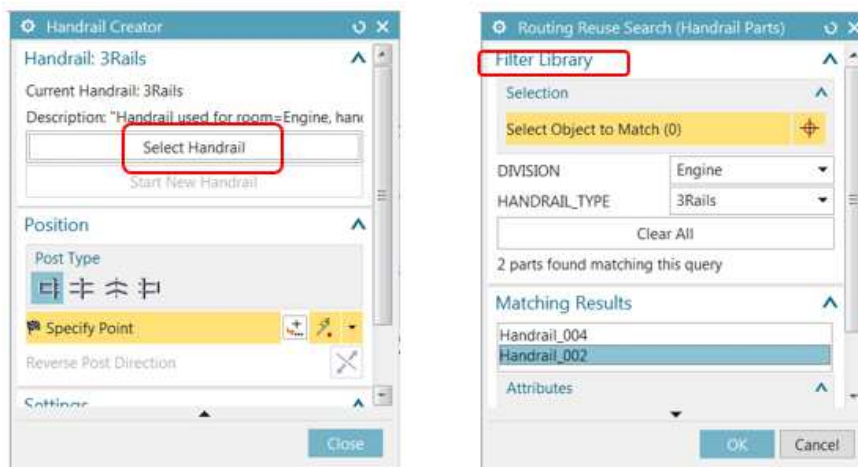
Figure 16. Handrail creator, filter library, selection of handrail
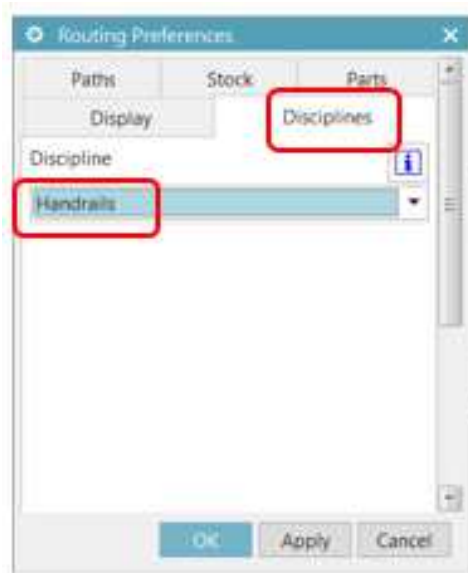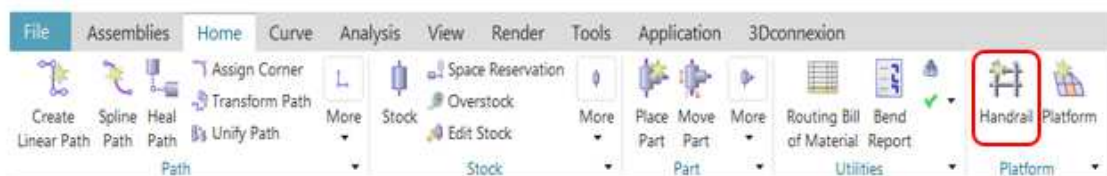
After the selection of handrail, select the post type from position field and select routing control point in the model to place the start post and select intermediate post after it closes post for closing the handrail, else add any number of intermediate posts or No post also is possible by adding specific corner bends. This is helpful in case of change in the elevation of two meeting rails.

From settings, options can be selected to create a closed handrail and create stock.

Selecting create closed handrail will close the segment to start post ones after placing of end post.

Create stock option gives a possibility to choose stock of your own rather than inserting from preference.

Figure 17. Handrail creator, Position, settings

5   PILOT PROJECT REPORT

5.1 Objective

The objective of the pilot project is to check the 3D model design assembly and to draw of the platform using handrail pla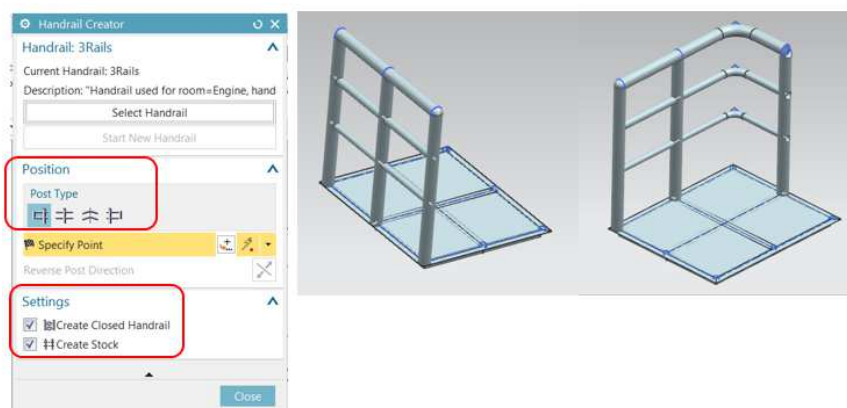tform features in NX /Teamcenter. In addition, the aim is to evaluate the overall capabilities of these features comparable to PDMS Application.

During the research study the focus is given to these points.

1. Design process
2. Key benefits of features
3. Design efficiency
4. Productivity
5. Graphic user interface (User friendly)
6. Interoperability
7. Integration design and data

The platform handrail features are a part of advanced license package of NX application. Today both organizations Customer and Citec use these packages of licenses. but it has never been used for these features. These features are based on mechanical routing. However, when these functionalities were tested in the NX /Teamcenter integration environment it was found difficult to perform all the design steps and it was noticed that it would need predefined qualified components from the reuse library to perform the design steps. With the native NX all steps were successfully tested and performed to build a handrail and a platform by using standard sets of components from sample part libraries.

The figure below illustrates the design process of Platform Handrail in NX /TC application.

- The first column shows three boxes inside the dotted border indicating the qualifying parts to enable to use them in routing application for design Platform Handrails.
- The second column and first box in the third column indicate the performing of design with platform handrail and building up an assembly in NX.

- Two boxes in the third column inside the dotted boarder indicates the preparation of Change Notice, filling data and getting approval by starting the approval process in Teamcenter.
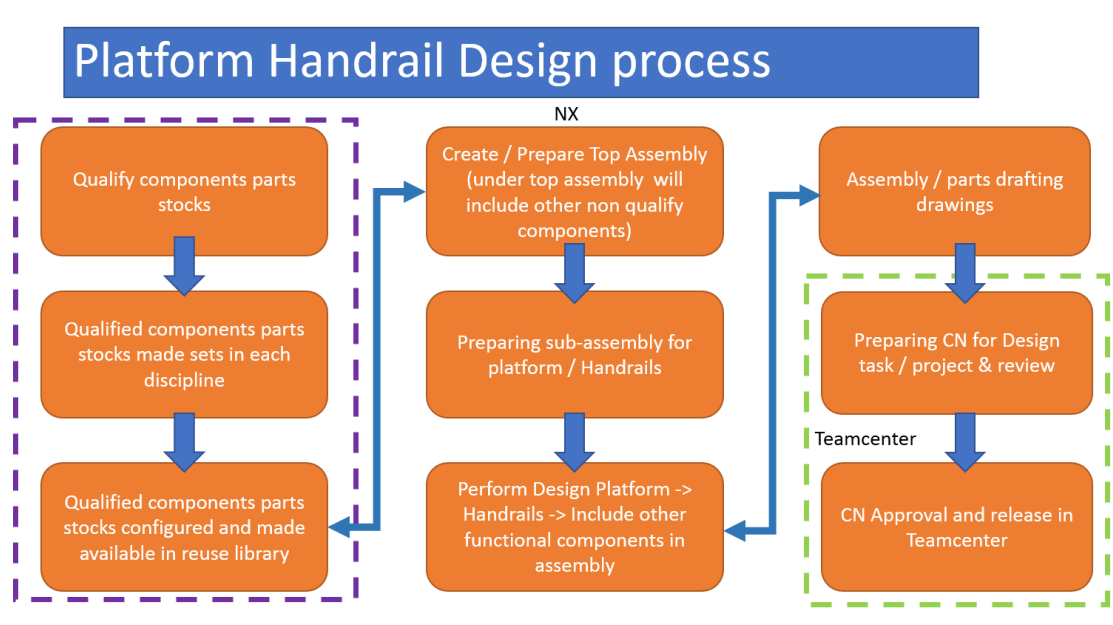
Figure 18. Design process of Platform Handrail in NX/TC

5.2 Qualification Part

The qualification of parts are required to able to use parts in routing design application. Qualifying a part, means to add a specific data to the part, which dictates how NX places the part in a routing assembly, how the part relates to other parts and how the part behaves during routing operations. This data includes characteristics and routing objects such as Ports and Anchors /14/.

Ports define how the part connects to other parts or stocks when the designer adds the parts in the routing assembly. The following types of ports are available depending on its intend of use while placing the part in routing assembly.

A fitting port defines the connection between two or more routing parts or between routing parts and stocks.

A fixture port allows the placement of a part on a routing path without affecting the stock assigned to the path. It does not make connections with other ports. This means that the stock parts do not end at the fixture port but go through the port. This is useful when having clamps and holders in between two connection points to prevent positional movement.

Fixture ports can be with or without Stock Offset Point (SOP). NX adds a symbol to a fixture port to indicate SOP. A spline path is created on the fixture port of a mounting part that has no SOP. The spline path goes through the mounting part along an invalid path, meaning the stock clashes with the mounting part. In such cases, a fixture port with SOP ensures that the spline is positioned correctly with respect to the mounting part by Offsetting stock.

A multiport defines a single connection point for multiple pin connections of a connector. This is useful in electrical routing were a connector is connected to multiple wires.

Port with no SOP   Port with SOP

Fitting port   Fixture port   Multi port
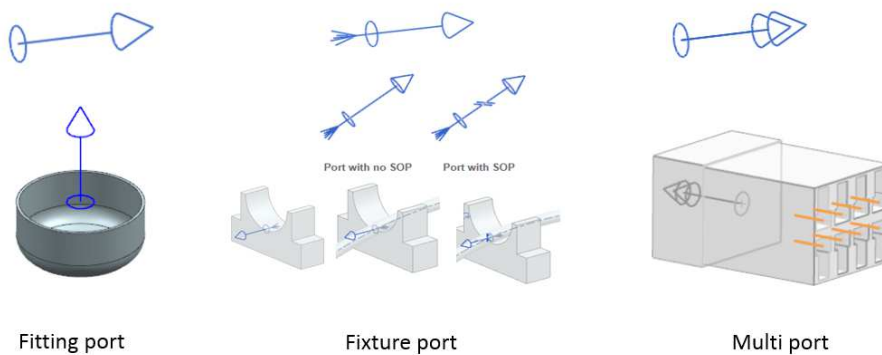
Figure 19. Types of Ports

Anchors are used to define the alignment of the profile curves with the path on the XY plane of the stock part. By default, it can be aligned to the origin of the stock part with the path. Optionally, it is possible to define any number of stock anchors. The following figure shows an example of a stock anchor to define the alignment of the profile curves with a path segment.

Stock anchors

Figure 20. Stock anchors

Terminals, build-in paths and cross section curves are used in electrical routing, thus not considered in platform handrail functions.

Figure 21. Qualify part

5.3 Creating Top Assembly in NX

The top assembly or parent assembly in NX is done in a similar way as any other assembly in the Assembly Navigator. Under the parent assembly t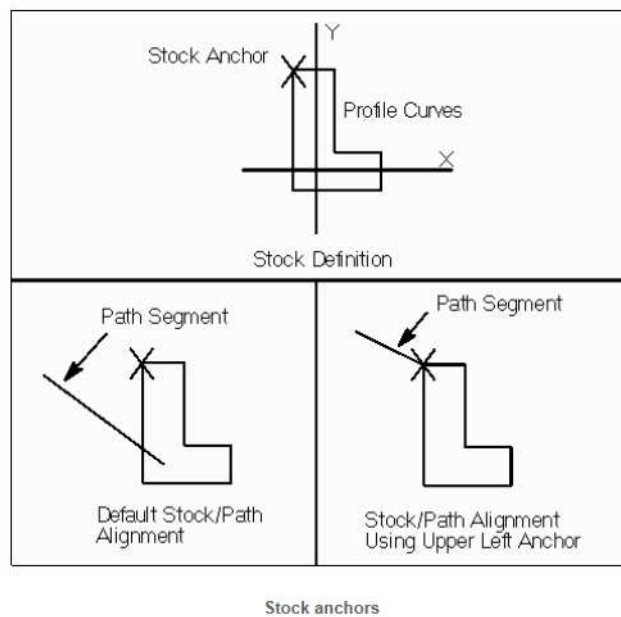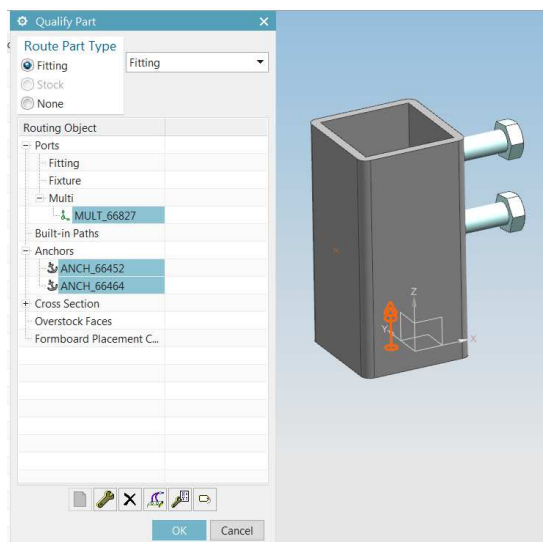here can be several assemblies known as sub-assemblies. One or more components can be under sub-assembly or parent assembly depending on design conveniences. The assemblies build the product structure which can be created with top down or bottom up approach.
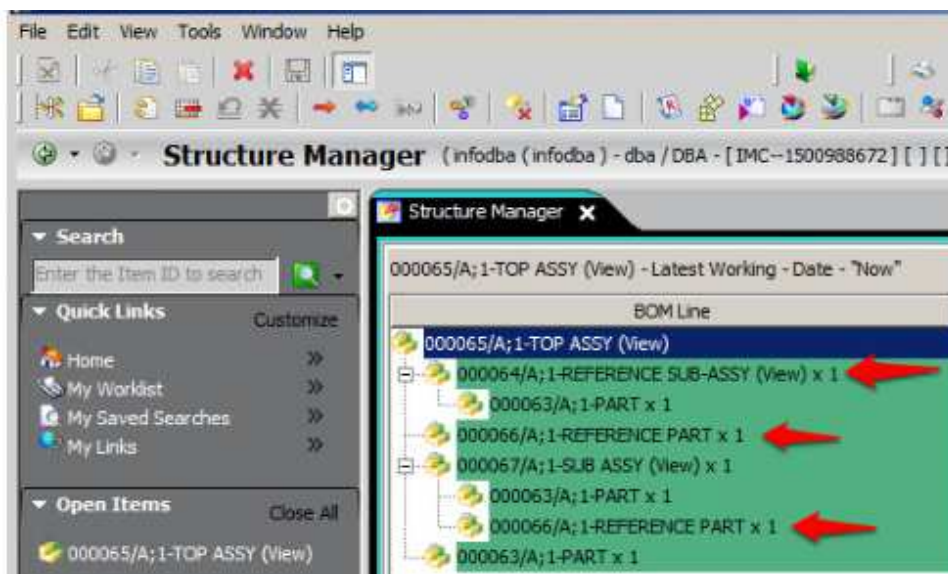
Figure 22. Structure of Assembly

5.4 Terminology

Figure 9 below shows an example for design of platform and handrails using NX Platform Handrail Features. This model is done and tested in Native NX, during the test it was found that using these features would need predefined qualified parts, such as start post, intermediate post and end post and railing with stock. The platform needs to have qualified external, internal frame stocks and grating plates to perform these functions.

This means ready Library of qualified parts is needed to able to perform the design using NX / Teamcenter integration. Today Customer uses classification root libraries and eventually they will have most of the components available for the platform handrail, but they are non-qualified, and they would need to be qualified properly to be able to use them

through the discipline. Therefore, a proper configuration of routing application for the respective discipline is needed.

The ready reuse library is the most important requirement that must be prepared or done before using these features for designing platform and handrail.
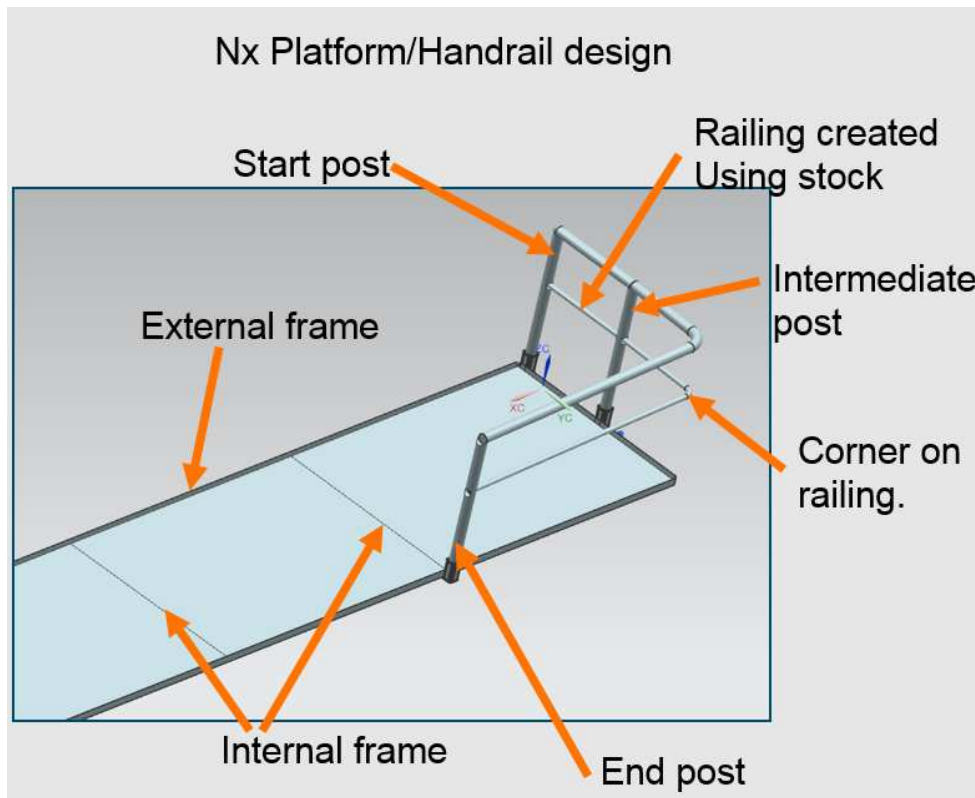
Figure 23. Terminology

5.5 Reuse Library

The reuse Library gives the access to reusable objects and components in a model or in an assembly. Reuse library can be used in native NX or in Teamcenter Integration mode. In Teamcenter Integration, Classification groups are also available from the reuse Library. In Teamcenter Integration, it is preferable to use Teamcenter classification and classification groups to organize and access reusable objects, It is also possible to store the libraries in Teamcenter folders or outside of Teamcenter /13/
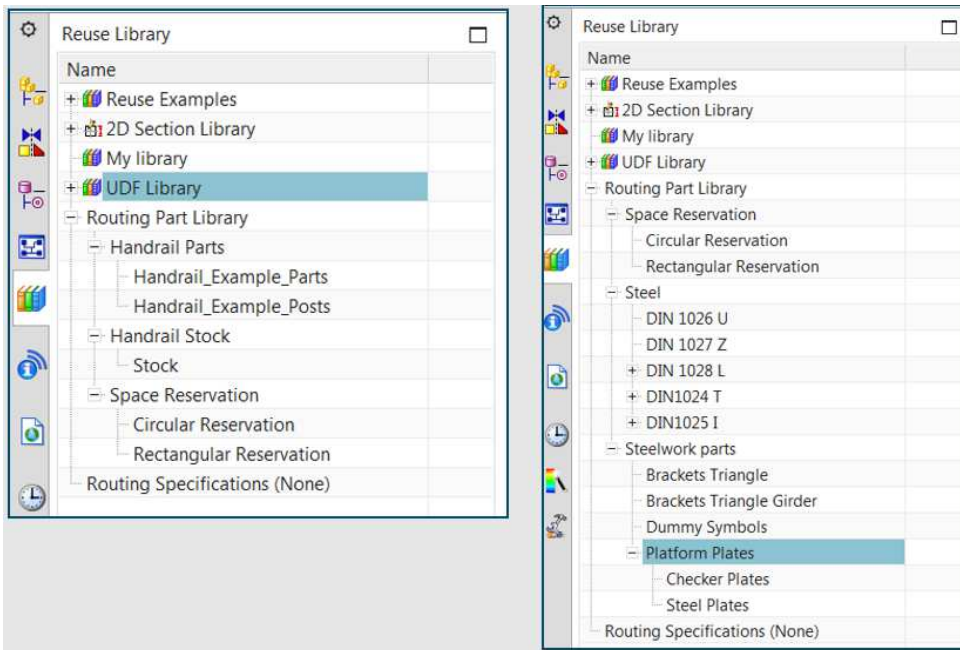
Figure 24. Re-use Library in NX /Teamcenter

5.6 List of Existing Re-Use Library Components

In the Customer NX / Teamcenter integration approximately 857 components were found available in use from Classification reuse library. Most of the components are non-qualified for routing which means they are missing the proper ports and anchor points. This can be fixed by qualifying them in the system for routing use.

The below components that are available in classification (Quantities)

- Stocks L bar - (70), U bar (28), RHS bar (95), I beam (51), Flat bar (62)

- Steel plate - (242), Sleeve -(07), Frame Foots - (26), Handrail -(80+72)

- Lifting Lug - (50), Pipe Clamps - (49), Safety Gates - 10

- Grating Fixing - (06), Grating - (09)

5.7 Configuration of Systems

The platform and handrail features are based on routing mechanical application. Before routing designers can design routing or platform Handrail discipline in NX,

The routing administrator must configure the routing applications and set up standard routing part libraries /4/.

The system administrators must do the following configurations:

- Setup environment variables, so that NX can locate configuration files

- Configure the routing applications using application view (APV) files.

  APV file sets up disciplines that filters parts and stock, so that the routing

  reuse library displays only parts that are relevant to the design intent

- Create or obtain standard routing parts, part families, and template assemblies for routing designer to use

- Ensure and get Qualify part

- Configuring the routing reuse library

6 STUDY OUTCOME AND KEY BENEFITS OF USING NX

The aim of the thesis is to identify, and study possibilities to utilize NX /Teamcenter as a platform design application. The study introduces the features platform handrail in NX / Teamcenter, further searches for the feature functionalities and associated background study has been carried out to check the key benefits in the NX /Teamcenter application. The evaluation of the platform design process was done, and facts are compared between the PDMS application and the NX /Teamcenter application. The key elements are listed. During the study the design process is introduced for platform handrail in NX /Teamcenter. Design tests are carried out to check performance in the NX routing discipline, multiple recommendations are given.

6.1 Application Capability

The NX /Teamcenter integration is well known and leading design and product life cycle management application, provided by Siemens. Several big automobiles manufacturers, and other industries are using these applications, Total market user share of NX /Teamcenter 28.4% globally. There are several aspects that increase application capability to next extent level.

6.1.1 Integration

NX / Teamcenter enables global data accessibility and shearing, flexibility for accessing and sharing of data will increase the competence of the organization. It makes the project planning and resourcing globally easy and also improves it. Integration makes it possible to follow a complete life cycle process of product from design to final approving. A single source of product information can be easily sheared with stakeholders and keep higher levels of understanding and communication among product teams throughout the supply chain.

6.1.2 Design

In NX / Teamcenter, different specific design modules give a common platform to perform advance design and validation. This increases the productivity. 3D Design, Drafting, Load stress calculation, reports will be done within NX /Teamcenter. This will reduce the

development cycle times for distributed global design teams and faster product changes and approval process to reduce the total cycle time. In case of revisions, revision handling is easy and faster to do. It is possible to vault, manage and control multiple revisions of any component.

6.1.3 Support

Siemens provides its high-end customer support. Siemens has provided help library for end-user and this makes it easy to find information. Siemens provides services to customers in case of customized or specific requirements. Siemens online official forums are available for discussion and sharing of information and knowledge.

6.2 Specific Feature Benefits

NX has several advanced features, some of them will increase the productivity if used in platform design.

6.2.1 Layers

Modeling objects can define the properties for individually with different layers. Layers are useful to manage the displaying of design environment by controlling layers Hide and show. This will help when making a 3D design or drafting where some of part properties are to be shown or hidden.

6.2.2 Assembly Arrangement

Assembly Arrangement is used to show Alternative positions or arrangement for one or more components or subassemblies. This makes possible to show various concepts of design in assembly from the same common components.

6.2.3 Wave link

The wave link is used to link interfaced assemblies or components from one assembly to another assemblies. This will be useful when we have multiple subassemblies and a need to keep interface references in between assemblies to avoid clashes or mismatch. This will ensure and increase the quality of design.

7   CONCLUSIONS AND RECOMMANDATIONS

7.1 Result

The study found that the NX /Teamcenter application has tremendous capabilities in 3D design and Product Life cycle management compared to the PDMS application. The advancement of NX application extends various types of functionalities for industrial design. NX /Teamcenter's strong integration helps to increase team design flexibility and makes it easy to share and search for data.

A possible of platform handrail design with the NX /Teamcenter integration would require predefined routing parts under the re-use library as explained in Chapter 5 above.

Currently Customer has quite standardised existing data available for platform and handrail design in classification within NX /Teamcenter and they are in use of this data in current design production.

However, this existing component in classification is non-qualified for routing use. Thus, data cannot be used in designing a platform and handrail through the NX/ Teamcenter integration. Possibly, existing components can be used but it would need additional work for getting them qualified for routing purpose. Also, the system must be set for routing configuration for each discipline in NX application as explained in Chapter 5 above.

The pilot project, platform handrail features testing done in the native NX and test results are documented. The study found these features performed well in the native NX. The components used for study are from the native NX system. The design test is not possible with the NX /Teamcenter integration due to unavailable qualified routing parts and stock library.

Customer has done a platform using the general design modular with NX /Teamcenter using existing components. The design output results are equally similar, but they are two different functionalities differing in design approach and this must be considered in future development.

Transferring to these Platform Handrail features with a new functionality requires many pre-requirements and configuration to be done in the system and this needs proper expertise as well as it will costly to the company and it may not add any additional value or be feasible in the end.

Considering this all, it is up to business to decide if they willing to go or no go.

7.2 Recommendation

Even though, Customer is not going for these Platform Handrail design features, it is recommended to get the existing component data qualified for routing applications.

A proper classification root for respective design discipline must be checked and if needed, rearranged in NX /Teamcenter for better workability.

The existing stocks for pipes and, steel sections must be checked and properly redefined if needed.

The instructions must be made for designers regarding how to do the qualification of new and existing parts in NX /Teamcenter for routing application.

Currently the 3D model for the power plant and engine hall is configured in PDMS, since the current NX models of engine and auxiliary modules are too detailed and heavy to be assembled in NX.

Also, the platform design in engine auxiliary area is done in cooperation with civil, electrical and, piping disciplines, which creates challenges when integrating NX model with other design tools. It is mandatory to simplify the detailed NX models to ensure smooth transfer to the plant model.

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