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3D Virtual Sub-Station Walkthrough

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SUMMARY

The intent of re-creating a proposed site for potential sustainment and development projects will give Hydro One the ability to clearly illustrate their project plan for assets which are being refurbished and or replaced. Along with this, Hydro One stakeholders (including executive level staff), sectors of the public (during public information hearings) and exclusive Hydro One customers will have the ability to view the surroundings of existing assets and also see the benefits, pressure points, constraints and issues discovered during all phases of the design process.

KEYWORDS

3D Virtual Sub-station Visualization

The implementation of this project will support our goal of improving the quality of our designs, as well as the lack of information we are currently experiencing upon reaching the execution phase of the project. Being able to review a full conceptual model and having the ability to walkthrough an intended design will benefit several organizations within Hydro One to make better decisions leading up to the execution phase of the project. The approach for construction can be digitally interpreted to adhere to constructability comments which can be worked into the final design.

Lines of businesses that are not able to be present during site visits or site meetings will be able to clearly view the intended plan without physically attending. This assists our company with a reduction in cost for travel and further reduces any safety risks for employees being on site.

The impact of not implementing this project will continue to have negative effects on the company in terms of continuing the cost of employee travel and safety risks, poor decision making during planning, as well as falling behind on technology with our direct competitors.

The anticipated outcome of implementing the project will be valuable data to make business decisions. Our aim is to improve not only the quality of the data we capture, but consistency, and to provide several lines of businesses the ability to visualize and avoid potential risks within a sub-station design by generating a conceptual station model. The anticipated benefits of this will be a significant reduction in design complications for issues that are identified at or near the time of execution. All involved lines of businesses will have the ability to visually walkthrough the intended design and add comments to aid in the final production drawings developed for construction.

METHOD

Projects commencing in our capital work program will begin the inclusion of a short animation at the early stages depicting the overall scope of work which will be refined over the duration of the design phases based on major stakeholder input. This will be accessible to any end user for reference or training purposes.

There has been interest from several lines of businesses (LOB) to have the ability to have non-technical views of our projects and work plans so that the constructability methodology can be reviewed and optimized prior to the build.

The intent of re-creating a proposed site for potential sustainment and development projects will give Hydro One the ability to clearly illustrate their project plan for assets which are being refurbished and or replaced. Along with this, Hydro One stakeholders (including executive level staff), sectors of the public (during public information hearings) and production staff will have the ability to view the surroundings of existing assets and also see the benefits, pressure points, constraints and issues discovered during all phases of our estimation process.

Adopting technologies to streamline processes:

- Utilizing the basic layout drawings for an existing or proposed site, a scaled model can be developed and incorporated into a video walkthrough to showcase the proposed design of a refurbishment or Greenfield project (3D scanning can also be leveraged and would be encouraged for reference).

Identifying processes that can be improved:

- During many stages within the project cycle, the importance of having visuals definitely helps to convey the final achievement. This picture or vision is always clear for the design engineer and the surrounding staff working with standard issued drawings. When we look at other lines of businesses, the typical engineered plans may not be as apparent. Having the ability to take a general design and add a proposed conceptual render(s) gives an outside party the ability to capture the full intent of an engineering design plan. Images within a model can be captured to deliver a visual impact that will be impossible to obtain on a 2D layout.

Improving the efficiency of existing process:

- Being able to visually represent any of our proposed projects gives the viewer full disclosure for the final result of our intended work. Being able to virtually take images within any direction at any elevation can be effective in displaying problematic design issues. This can be extremely helpful in determining the design plan during the estimating process. These images can also assist in the executive review meetings to clearly depict the intended plans addressing the investment.

The end users interfacing with the deliverable will deliver feedback on having visual aids and the areas in which may need improvement or further development. This will be analyzed and brought back to the appropriate management structure to work on further enhancements.

The ability to have a scaled model of a transmission station or line section that can be referenced at any time can save engineering cost and time to aid in their design. Within a model, the user will have the ability to utilize camera angles. These can be aligned to snap still images of specific areas pertaining to the replacement or refurbishment of assets deemed end of life. These images can be annotated to show accurate elevations, distances between equipment and overall dimensions.

This can also give the construction staff the ability to review and plan specific methods and procedures to develop their execution plan. Structure identification, excavation paths, laydown areas can all be visually interpreted from a 3D walkthrough which can be reviewed from any remote office. This reduces the risk of travel especially during the challenging winter months.

RESULTS

The current capital projects within our work execution plan currently do not have any method of visualizing or depicting stations builds and designs other than typical drawings with standard issue views. To enhance this deliverable, the 3D Virtual Walkthrough will give multiple end users the ability to walk through a design digitally with the development of a short animation showing the intended design plan.

In working with the current software setup, the compatibility between Autodesk products was one of the reasons for choosing software that align with our current business structure. Having

the ability to import/export multiple file extensions help to integrate models along different platforms.

Autodesk Revit

Part of the family of Autodesk products (currently used within the Hydro One’s software applications) Revit will be used to re-create an existing 2D CAD model to a 3D model with the ability of creating an exportable environment. This software will also have the ability to import all existing 3D models housed within our current Autodesk Vault set up. All CAD formats currently within HONI can be utilized with Revit.

- Implementation of Revit adds value in other business units/agencies by being able to generate digital models of overall site layouts and conditions which can be manipulated to obtain visual depictions of intended designs.
- As existing Autodesk clients, integration to this branch of product will be seamless and models can be exported to all usable formats within our existing approved Autodesk products.

ACT-3D B.V. Lumion

This software will give the ability to create an existing or new 3D environment to visually depict and represent site materials, components, equipment, and structures etc. environment. Models are imported directly from Revit and can be manipulated to show specific views similar to that of a camera lens.

Rendered images can be used and exported exclusively for presentations to visually emphasize the impact of work based on the current engineering approach.

Creating a full site walkthrough can also be achieved by showcasing a route or path for a new or existing station layout. Camera angles can be utilized to give aerial perspectives for fly by simulations related to a proposed site. This can be exported to a viewing format for executive level reviews as well as public showings and town hall presentations.

- Other business units have been able to re-create large scenes seamlessly without any issues of frame clipping or delayed video response
- Rendered images can depict the necessary work visually rather than going into the details of CAD prints etc.
- Obtainable to any large scale organizations as this is commercial off-the-shelf software.

The end users interfacing with the deliverable will give feedback from the visual aids and areas in need of improvement or further development. This will be analyzed and brought back to the appropriate management structure to work on further enhancements. (See table for process and performance measures)

Process / Service	Performance Measure
Rendered Images	Ability to portray the sites final image

Digital Station Walkthrough	Allowing stakeholders to virtually attend the site
Site Re-creation (During Project Definition Stage)	Full view of intended project

Aligning with all areas of the company will provide a significant advantage in planning and developing future projects for sustainment and development. When in the early stages of a project, rendered imagery and animations can be referenced before a full scope of work is developed. Input and feedback incorporated into these deliverables allows for better planning adhering to some of the previous flaws captured and referenced.

When looking at our environment and surrounding communities we work amongst, we have a clear way to depict and visualize the outcome of what our work will be like once we have completed it. This allows members of our community to see how our work will impact their environment and gives full transparency to our plans and allows feedback from our local municipal leaders as well as involved residents.

Further to this, there are some key strategies that can now be leveraged in order to develop a better method of design and a strong deliverable for the entire company.

Visibility

Throughout the organization, any individual with relevant knowledge to the execution of the project will be able to assist in refining and enhancing the build to stakeholders using 3D rendering and animation. All difficult areas within a defined scope of work will be shown and represented using 3D visualization techniques.

Cost saving

Being able to capture design changes before the construction commences gives the ability to reducing spending on re-work or re-designing in execution phase of a project by seeing collisions or missed elements that are typically not address with the traditional 2D planning and design.

Safety

When dealing with energized high voltage sub-stations, there is always an added risk or heightened level of safety that needs to be observed while attending a site. Being able to view and attend a site virtually and view components within the proposed engineering design allows more people full visibility to the plan and less people needing to be present at the actual site. This reduces the risk of travel and potential dangers from being in attendance at a common substation site. Less field presence is needed with digitally represented 3D model.

Efficiency in Design

Walking through the steps of the design and installation gives a very clear perspective on how things are to be constructed. It also allows full visibility to potential pressure points or constraints that are normally not present in the standard approach to design development and reviews.

APPENDIX - ABBREVIATIONS

LOB – Line of Business

2D – Two Dimensional Space

3D – Three Dimensional Space

CAD – Computer Aided Drafting

REFERENCES

www.autodesk.com/revit

www.lumion.com