FRESCON

BIM 4D
Implementation Plan

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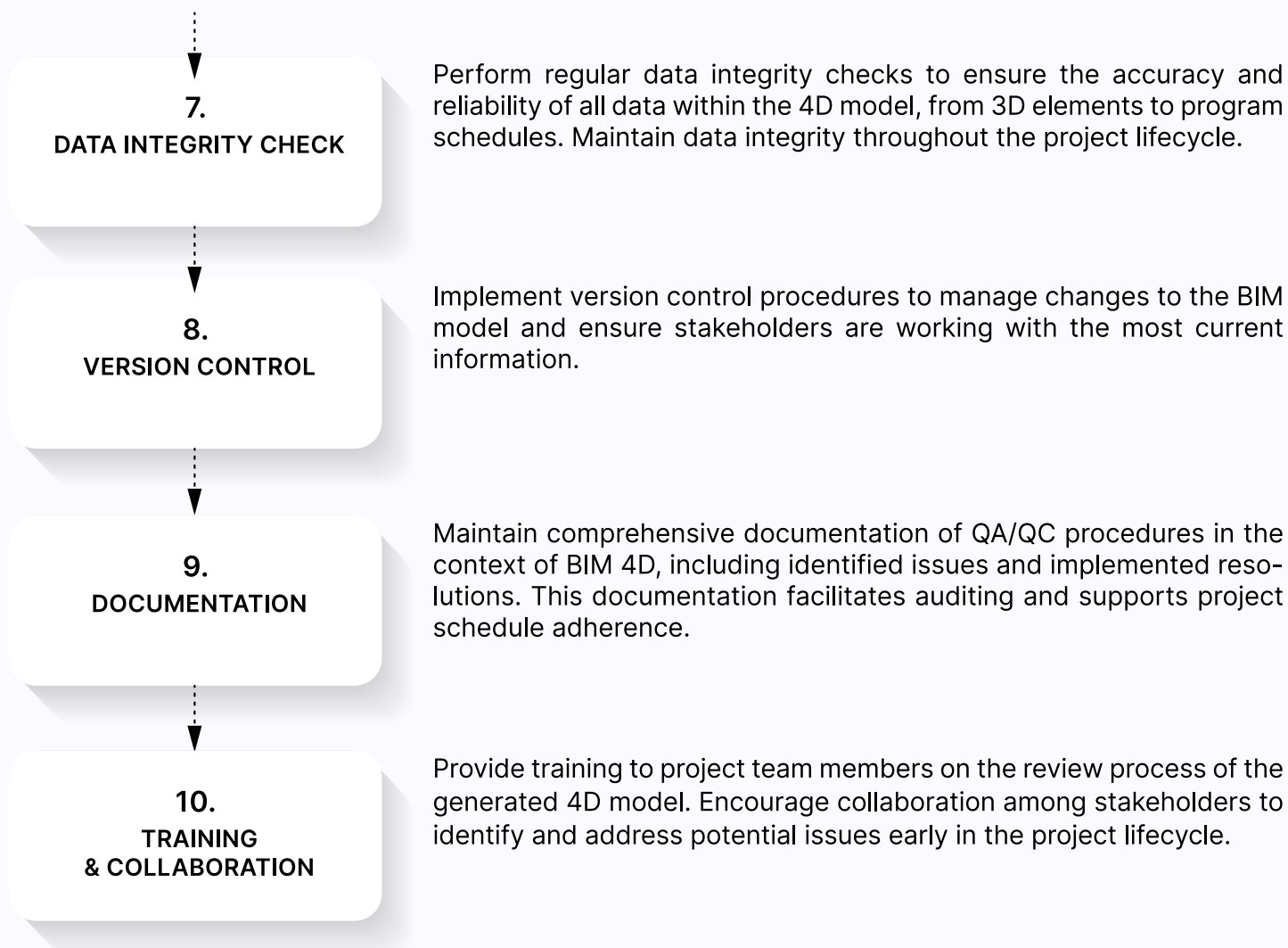
QA/QC Process

Quality assurance and quality control procedures within the scope of BIM 4D involve ensuring the accuracy, completeness, and reliability of the time-related data within the BIM model. By implementing these QA/QC procedures, project teams can enhance the reliability and effectiveness of BIM 4D models, as well as the project program, leading to improved project outcomes and reduced risks.

**1.
MODEL VALIDATION**

Prior to integrating the updated construction program, it's imperative to ensure that the 3D models within the 4D model are current and accurately represent the building design. This involves thorough checks for inconsistencies, errors, or missing elements within the model.

**2.
MODEL INTEGRATION
& RESOURCE ALLOCATION**

Verify that all 3D elements have been precisely integrated and that links to program activities remain intact. In case of errors, any unlinked 3D elements should be correctly relinked to the respective activities. Ensure proper allocation/linking of all 3D elements within the 4D model.

**3.
SCHEDULE INTEGRATION**

Confirm the accurate integration of the construction schedule into the 4D model. This entails reviewing construction activities, their durations, and dependencies. Additionally, assess if any new activities have been added or removed, requiring corresponding assignment or reassignment of 3D elements.

**4.
TIME SIMULATION
VALIDATION**

Conduct simulations to validate the fidelity of the 4D model in representing the updated construction program. Review the simulation alongside the construction team to identify any discrepancies between the simulation and planned activities.

**5.
CLASH DETECTION**

Continuously monitor and update the 4D model to reflect construction progress. Compare planned versus actual timelines and make necessary adjustments to maintain project schedule adherence.

**6.
PROGRESS TRACKING**

Update the 4D model to reflect construction progress accurately. Continuously compare planned versus actual timelines and adjust as needed to keep the project on schedule.

7.
DATA INTEGRITY CHECK

Perform regular data integrity checks to ensure the accuracy and reliability of all data within the 4D model, from 3D elements to program schedules. Maintain data integrity throughout the project lifecycle.

8.
VERSION CONTROL

Implement version control procedures to manage changes to the BIM model and ensure stakeholders are working with the most current information.

9.
DOCUMENTATION

Maintain comprehensive documentation of QA/QC procedures in the context of BIM 4D, including identified issues and implemented resolutions. This documentation facilitates auditing and supports project schedule adherence.

10.
TRAINING & COLLABORATION

Provide training to project team members on the review process of the generated 4D model. Encourage collaboration among stakeholders to identify and address potential issues early in the project lifecycle.

Set Up Workflow to bring P6 into Synchro

To ensure an efficient and accurate updating process of the BIM 4D model throughout the project, the set-up workflow to bring P6 into Synchro and its steps are crucial.

1. **Folder Structure** – A maintainable folder structure should be created to ensure version control for all generated and shared P6 programme schedules and BIM 4D models.

2. **Model Preparation** – All native 3D design models should be modelled in such way as to facilitate the linking of all P6 programme activities to the corresponding 3D elements. Such as division of 3D elements into zones referenced within the P6 construction schedule.

3. **Supporting Models** – Any supporting models, such as Site Safety, Logistics and Equipment elements are to be prepared and modelled in an additional 3D model and integrated into the BIM 4D model.

4. **3D Model Integration** – The integration of 3D models is facilitated through a federated Navisworks model, ensuring the seamless incorporation of new revisions while maintaining manageability.

5. **P6 Preparation** – All construction activities within the P6 schedule should include unique identification numbering to enable the synchronisation of the P6 schedule to the 3D elements. Construction activities should be structured to accurately represent the real construction process. This entails breaking down large-area activities into zones or smaller areas. Such segmentation facilitates a more effective review process for all stakeholders, enabling the early identification and resolution of potential issues in the project.

6. **Schedule Integration** – Before integrating the construction schedule, ensure the file is saved in the appropriate version and location within the established folder structure. Following the integration of the new or updated P6 schedule, save the BIM 4D model in a new version to signify the schedule update.

7. **4D Model setup** – Before linking all 3D elements to the integrated P6 schedule, organise the 3D elements to correspond with the specific zones, areas, and activities referenced in the P6 schedule.

8. **Linking Procedure** – Establish various Appearance Profiles within the BIM 4D model to streamline the review process of the construction simulation for the project team.

9. **Linking Process** – Linking of all set-up 3D resources within the 4D model to the construction schedule, ensuring the completeness of this process.

10. **Assigning Equipment to Activities** - Associate each piece of equipment with the corresponding construction activities in the project schedule. This involves determining when and where each piece of equipment will be used during the construction process and aligning it with the sequencing of activities. If necessary, separate tasks linked to the construction programme should be set up to enable a proper equipment visualisation .

11. **Views & Export Process** – Configure pertinent viewpoints and export settings to streamline the regular model exporting process, ensuring efficient review by the project team.
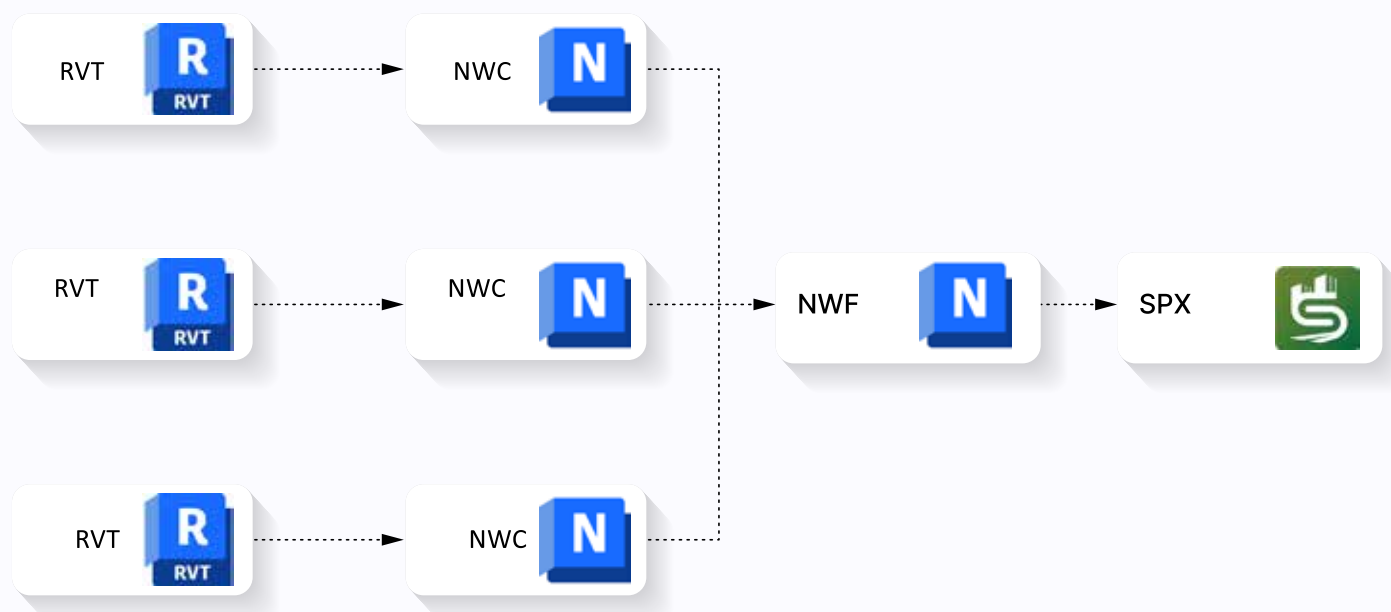
Licences

In an implementation plan for BIM 4D models, licenses play a critical role in ensuring that the necessary software tools and resources are available to support the development and use of the models effectively.
All licenses should align with the end-users' requirements as specified by the client. Additionally, ensure that the types of licenses selected are tailored to the project's needs and the roles of various team members. This might entail individual licenses for designers, planners, schedulers, and construction managers, alongside network licenses allowing concurrent usage by multiple users.

In addition, the specific BIM software tools should be identified that are required for creating, analysing, and visualizing 4D models. Procure the necessary licenses for these software applications, ensuring that they cover all required functionalities and are compatible with the project requirements.

Establish procedures for managing and tracking software licenses throughout the project lifecycle. This includes maintaining an inventory of licenses, monitoring usage to ensure compliance with license agreements, and renewing or updating licenses as needed to accommodate changes in project scope or team composition.

In adherence to the license procedure, ensure consistency in maintaining licenses for all required models and files, whether for 3D models or construction programmes, throughout the project's duration from inception. If a license requires updating, stakeholders must be informed beforehand, and the potential update should undergo review before implementation.

By carefully managing licenses as part of the implementation plan for BIM 4D models, project teams can ensure that they have the necessary tools and resources to effectively leverage the benefits of BIM technology throughout the project lifecycle.

Software Requirements

The following software play a crucial role to facilitate 4D BIM workflows by integrating 3D models with project schedules, enabling advanced visualization, time related clash detection, and simulation of construction sequences. By leveraging these tools, project teams can enhance coordination, improve project planning, and optimize construction schedules to achieve greater efficiency and success in construction projects.

Software use:

AUTODESK REVIT

AUTODESK NAVISWORKS MANAGE

BENTLEY SYNCHRO 4D PRO

PRIMAVERA P6

ADOBE AFTER EFFECTS FOR POSTPRODUCTION
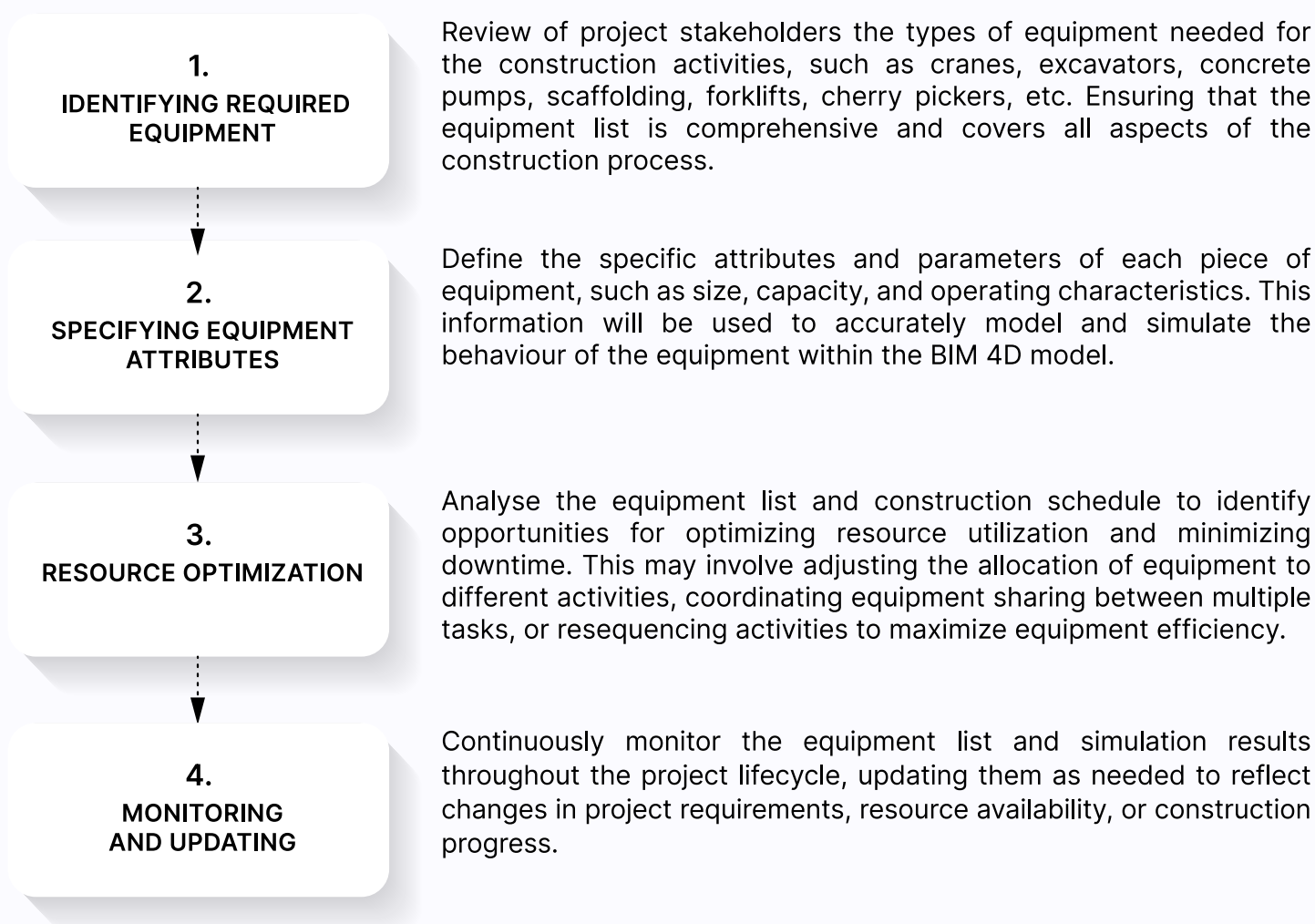
GOOGLE EARTH PRO FOR POSTPRODUCTION

Equipment list

In an implementation plan for BIM 4D models, the equipment list plays a crucial role in accurately representing the resources required for construction activities and simulating the construction process in the virtual environment.

All necessary equipment set up within the BIM model should represent the actual used equipment on site, especially when used to analyse space requirements in space restricted areas.

The equipment should maintain accurate dimensions and space require-ments in terms of the equipment itself as well as it's handling and maintenance if of significance to the construction process.

The below outline some considerations regarding the equipment list that should be integrated within the BIM 4D model.

1.
IDENTIFYING REQUIRED EQUIPMENT

Review of project stakeholders the types of equipment needed for the construction activities, such as cranes, excavators, concrete pumps, scaffolding, forklifts, cherry pickers, etc. Ensuring that the equipment list is comprehensive and covers all aspects of the construction process.

2.
SPECIFYING EQUIPMENT ATTRIBUTES

Define the specific attributes and parameters of each piece of equipment, such as size, capacity, and operating characteristics. This information will be used to accurately model and simulate the behaviour of the equipment within the BIM 4D model.

3.
RESOURCE OPTIMIZATION

Analyse the equipment list and construction schedule to identify opportunities for optimizing resource utilization and minimizing downtime. This may involve adjusting the allocation of equipment to different activities, coordinating equipment sharing between multiple tasks, or resequencing activities to maximize equipment efficiency.

4.
MONITORING AND UPDATING

Continuously monitor the equipment list and simulation results throughout the project lifecycle, updating them as needed to reflect changes in project requirements, resource availability, or construction progress.

By effectively managing the equipment list as part of the implementation plan for BIM 4D models, project teams can optimise resource utilisation, improve construction efficiency, and minimize costs, ultimately leading to successful project outcomes.

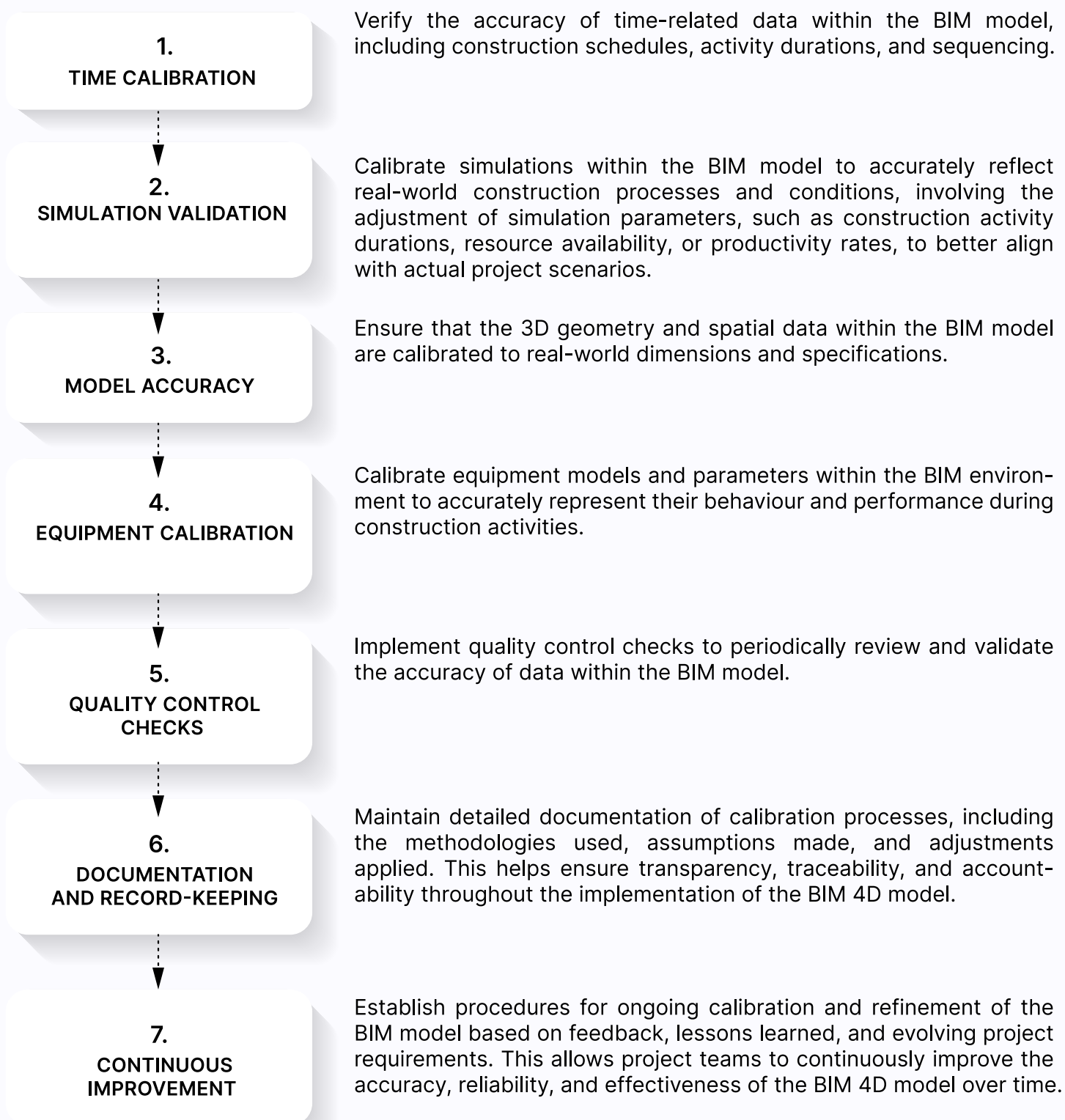## List of implemented and used equipment (non-exhaustive):

- Mobile cranes / Crawler cranes
- Excavators
- Forklifts
- Gantries / Scaffolding
- Delivery trucks
- Fencing / hoarding
- Site welfare and accommodation elements
- Cherry pickers
- Booms
- Hoists
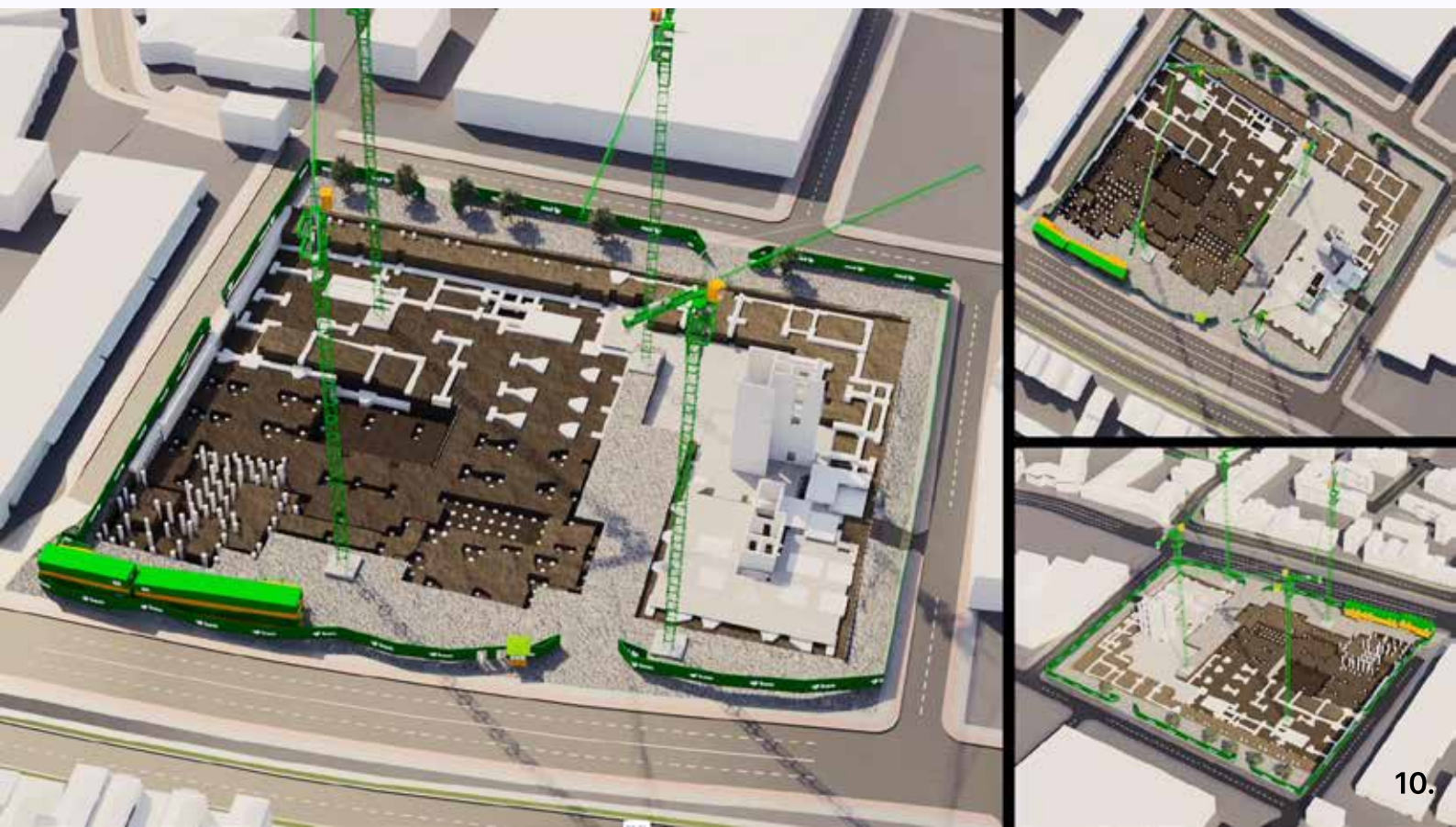
Calibrations

In an implementation plan for BIM 4D models, calibrations are crucial to ensure the accuracy and reliability of the data used within the model, particularly regarding time-related information and simulations.
By incorporating the below calibration processes into the implementation plan for BIM 4D models, project teams can enhance the accuracy, reliability, and utility of the model for planning, analysis, and decision-making throughout the project lifecycle.

1.
TIME CALIBRATION

Verify the accuracy of time-related data within the BIM model, including construction schedules, activity durations, and sequencing.

2.
SIMULATION VALIDATION

Calibrate simulations within the BIM model to accurately reflect real-world construction processes and conditions, involving the adjustment of simulation parameters, such as construction activity durations, resource availability, or productivity rates, to better align with actual project scenarios.

3.
MODEL ACCURACY

Ensure that the 3D geometry and spatial data within the BIM model are calibrated to real-world dimensions and specifications.

4.
EQUIPMENT CALIBRATION

Calibrate equipment models and parameters within the BIM environment to accurately represent their behaviour and performance during construction activities.

5.
QUALITY CONTROL CHECKS

Implement quality control checks to periodically review and validate the accuracy of data within the BIM model.

6.
DOCUMENTATION AND RECORD-KEEPING

Maintain detailed documentation of calibration processes, including the methodologies used, assumptions made, and adjustments applied. This helps ensure transparency, traceability, and accountability throughout the implementation of the BIM 4D model.

7.
CONTINUOUS IMPROVEMENT

Establish procedures for ongoing calibration and refinement of the BIM model based on feedback, lessons learned, and evolving project requirements. This allows project teams to continuously improve the accuracy, reliability, and effectiveness of the BIM 4D model over time.

Documentation

Within the BIM 4D documentation, a BIM 4D Guideline document as well as the BIM 4D Simulation Report should be developed and maintained.

These documents should:

1. **Project Requirements and Objectives –** Document outlining specific requirements and objectives of the BIM 4D implementation, including stakeholder expectations, project goals, and desired outcomes.

2. **BIM Standards and Guidelines –** Document outlining the BIM standards, guidelines, and protocols that will govern the development and use of the BIM 4D models, including standards for data exchange, model organisation, naming conventions, and level of detail (LOD), ensuring consistency and interoperability across project teams.

3. **Modelling and Simulation Procedures –** Documenting the procedures for creating, managing, ana analysing BIM 4D models, including workflow, methodologies, and best practices.

4. **Data Sources and References -** Document the sources of data used within the BIM 4D models.

5. **BIM 4D QA/QC Procedures**

6. **Calibration and Validation Processes -** Document the procedures for calibrating and validating BIM 4D models to ensure accuracy, reliability, and integrity of the data.

7. **Change Management -** Document the procedures for managing changes to the BIM 4D models, including version control, revision history, and change approval processes. This helps track modifications, mitigate risks, and maintain the integrity of the model throughout the project lifecycle.

8. **Training and Education -** Document the training materials, resources, and tutorials used to educate project team members on the review of BIM 4D models, simulations, and reports.

9. **Communication and Collaboration -** Document communication protocols, meeting minutes, and collaboration platforms used to facilitate communication and collaboration among project stakeholders.

10. **Handover & Sig Off** deliverables and process

By documenting key aspects of the implementation plan for BIM 4D models, project teams can ensure consistency, transparency, and accountability in their BIM workflows, ultimately leading to more efficient project delivery and better project outcomes.

Handover & Sign Offs

In an implementation plan for BIM 4D models, handover and signoffs are critical milestones that mark the completion of key project phases and the transfer of deliverables from one party to another.

1. Definition of Deliverables - Clearly define the deliverables associated with each phase of the BIM 4D implementation, including milestones, deadlines, and quality criteria.

2. Handover Procedures - Define the procedures for handing over BIM 4D models and associated documentation from one project phase to another, or from one stakeholder to another.

3. Quality Assurance - Implement quality assurance checks and validation processes to ensure that BIM 4D models meet predefined standards and requirements before they are handed over to the next phase or stakeholder.

4. Stakeholder Involvement - Engage relevant stakeholders in the handover and sign-off processes to ensure that their expectations are met and that any concerns or feedback are addressed in a timely manner.

5. Documentation and Records - Maintain comprehensive documentation and records of handover and sign-off activities, including meeting minutes, correspondence, and formal sign-off documents.

6. Training and Support - Offer comprehensive training and support to stakeholders engaged in the handover and sign-off processes, ensuring they comprehend the delivered 4D models and can conduct thorough reviews.

By incorporating clear procedures and protocols for handover and signoffs into the implementation plan for BIM 4D models, project teams can ensure smooth transitions between project phases, minimize risks, and facilitate successful project delivery.

Need help with BIM 4D?
We're here to support you.
Get in touch today!

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