

### 1. Purpose

This document provides the standards on building Virtual Reality (VR) models with a consistent and appropriate level of detail depending on the intended use.

### 2. Scope

This Standard applies to all projects and designs that will use VR technology for either design or training purposes for use in Melbourne Water and with our customers.

### 3. Technical Specifications

#### 3.1 Hardware

Generally, a PC that is built for gaming will be able to handle Virtual Reality system. However as this technology is rapidly changing, anyone purchasing VR equipment should refer to the equipment's recommended specifications. [HTC VIVE minimum computer standards](#) can be [found here](#).

#### 3.2 Source Structure

AutoCAD files are the preferred file format, however if it is seen to be unfeasible or uneconomical to utilise the software, exceptions can be made as long as the below requirements are met.

- The 3D model is to be one AutoCAD file with no xrefs, prepared in DWG format.
- Any 3rd party software 3D objects (e.g. AutoPLANT objects) are to be turned into native AutoCAD 3D objects.
- All objects are to have their Material set to "ByLayer". Use layers to group objects of same material as much as possible.
- Render Materials are to be assigned to Layers (not objects) from the Autodesk Materials Library.
- Sample renders in JPEG format are to be provided as a visual reference for the Virtual Reality Modeller.

#### 3.3 Deliverable Requirements

The VR Model shall be provided to Melbourne Water as an executable VR model in .exe format.

Specification for the VR model shall be supported by a document detailing the following as a minimum:

- Project Name
- Melbourne Water Project Reference Number and Project Manager (where applicable)
- The name of the service provider who prepared the model
- The service providers Project Reference Number
- The name of the program utilised to prepare the model
- Instructions as to the functions of the controller buttons if they vary from the Section 1.4
- Any information that will help with the loading or interpretation of the model

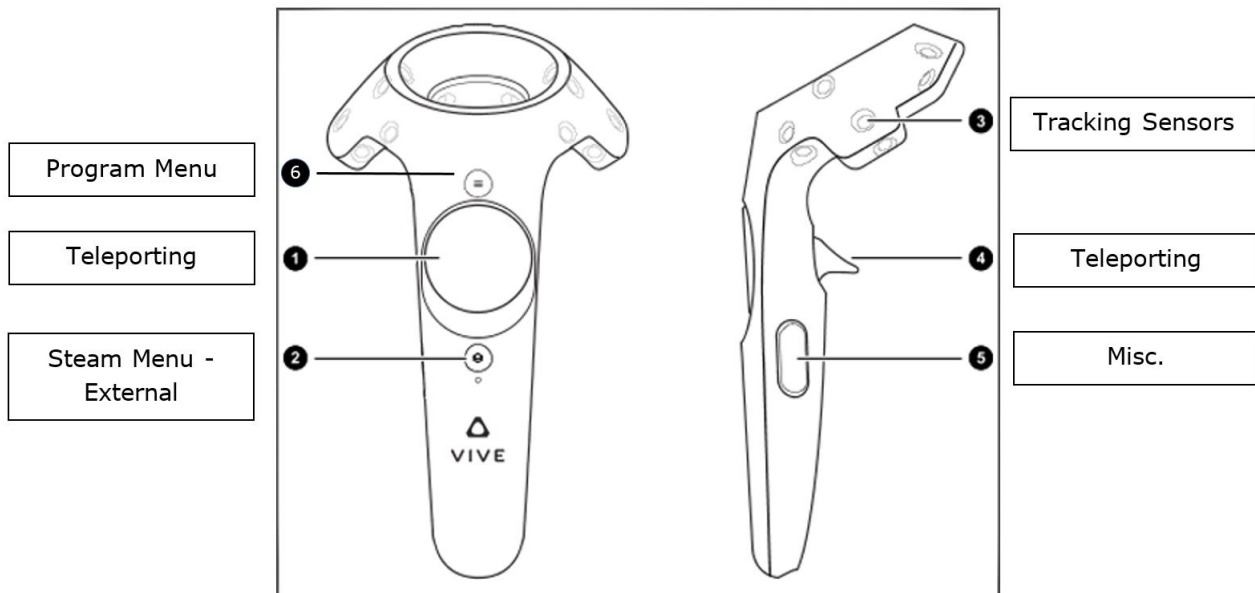
### 3.4 Controller Layout

Button layouts should where possible follow the below layout to minimise confusion when transferring models. Both controllers should be mirrored. If this will differ from the requirements in 1.2 it should be documented in the specifications.

Teleportation should conform to either of the following types of navigation depending on the end user's needs:

- Move using the wand using a point and click method
- Move to predefined areas of interest that have been set up by the designer

Design review models should include the ability to 'Elevate' in the menu to be able to experience the site from different perspectives



### 3.5 Hand Tracking Controls

If hand tracking technology is being used, gestures should use simple movements while also minimising inadvertent activation and the following gestures used:



Fig. 1. Teleporting



Fig. 2. Bringing Up Menu

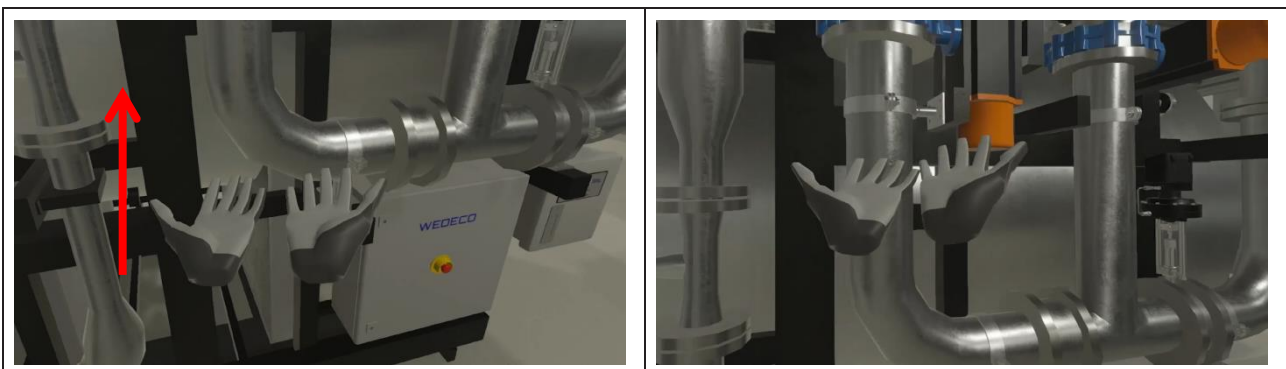


Fig. 3. Hovering

## 4. Minimum Detail Requirements

### 4.1 General Requirements

Regardless of the intended purpose, the VR model should be:

- At a scale of 1:1 to users size
- Clear to a user as to what the equipment is without needing external interpretation
- Textured and have shadows added to depth
- In a colour palette that will closely match the end design
- A skyline and an accurate ground plane are applied

The experience shouldn't be:

- Overly bright or fuzzy for a user which may cause eye strain
- Overly process intensive to avoid lag or ghosting
- Flickering anywhere due to z-fighting. Z-fighting is a flickering that occurs sometimes on overlapping model surfaces, usually as a result of CAD export.

The facilitator should record the following for users that either complete a design review or training:

- First and Last Name
- Company
- Position
- Contact Details

### 4.2 Concept Design Review

Concept Design Reviews shouldn't be conducted until the first Design Review and HAZOP have been completed.

- In addition to the General Requirements these models should clearly show the:
- Process flow and connections to existing plant
- Building layout and orientation
- Junction Boxes and Operator Interface Panels
- IT and Building Security Panels

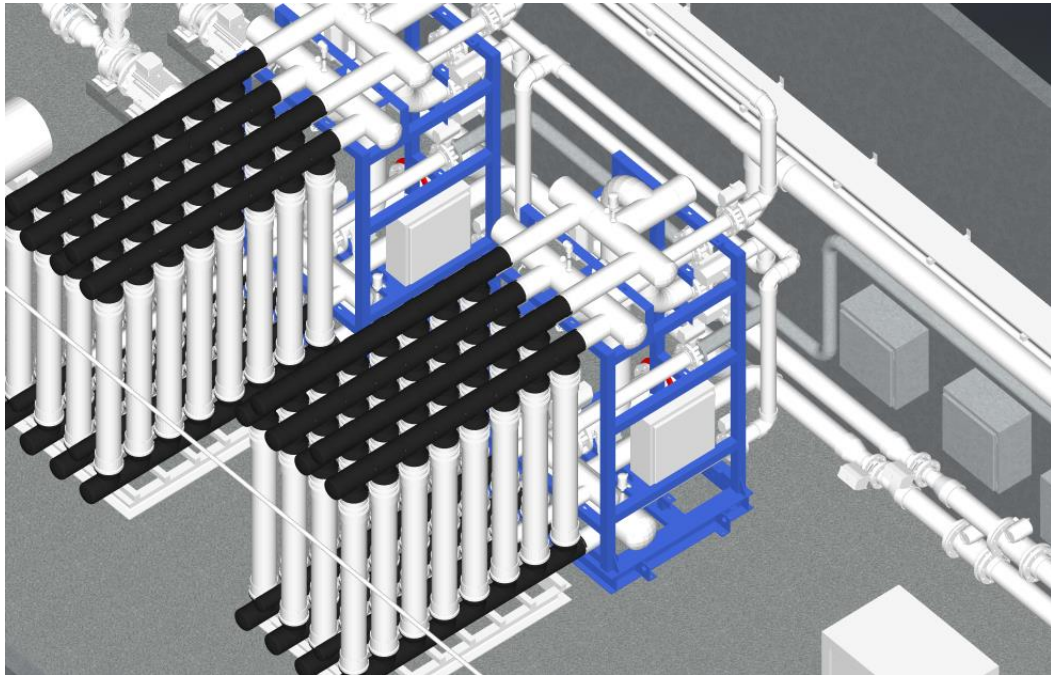


Fig. 4. Appropriate level of detail for Concept Design Review

### 4.3 Detailed Design Review

In addition to the General Requirements these models should ensure:

- All operable equipment is visible. E.g. Isolation Valves and Hose Reels
- Ancillary equipment such as valve actuators and instrumentation valves are modelled to show final positions
- Interaction between existing assets and interface points are represented
- Cable Trays with accurate sizing and proposed path are shown
- Smoke Detection and IT/Security Infrastructure is modelled to assess access requirements
- That the lighting design has been accurately represented
- There is an ability to annotate items



Fig. 5. Appropriate level of detail for Detailed Design Review

### 4.4 Community Engagement

In addition to the General Requirements models used for engagement, developers should ensure that:

- The surrounding area is mapped for context
- Any 'key locations' are highlighted visually or listed as teleport destinations for users



### 4.5 Training

In addition to the General Requirements training models should:

- Have an appropriate level of interaction to match the required outcomes
- Apply a photo-realistic representation of the environment
- Where appropriate, utilise multi-user technology to allow the trainer to be in the environment with the student/s
- Preference hand tracking over controllers when the model is interactive to improve immersion



Fig. 6. Appropriate level of detail for training environment

### 4.6 Usability

All virtual models shall be built with usability as a priority. Models should be intuitive and require minimal end user training to operate.

If training is required for more complex operations, it should be offered within the virtual environment by offering tutorials.

Designers should consider whether the model:

- Can induce vertigo. E.g. Fast movement in model
- Has smooth movement and can be rendered without lagging
- Avoids including areas that a user can end up being stuck
- Menus and text are clear and easy to read and not occluded by objects

## 5. Room Setup

### 5.1 General

Whenever VR is being used, there should be an adequately spaced area allocated for the user to be able to walk around as required.

Developers should work with the assumption that 'room scale' VR will be utilised. This means that users will be standing, and have the ability to move within a 3m x 3m area.

The allocated area should be clear to observers that it is only for use by the person in the virtual environment and their spotter.

Wireless headsets are preferred for the reduction in trip hazards. However if tethered headsets are used, adequate cable length should be supplied to allow user to walk around the room without being tangled by the cables.

An additional TV/Projector for the team that aren't in the virtual world can discuss what the user is seeing.

### 5.2 Permanent Setup

In addition to the General Requirements the following should be implemented for permanent setups:

- Wall brackets for location positioning should be isolated from vibrations caused by nearby equipment or people movement

### 5.3 Temporary Setup

In addition to the General Requirements the following should be implemented for temporary setups:

- Cables should be routed in a way that removes the trip hazard and protects the equipment.
- Lighthouses are kept away from moving surfaces. E.g. Tables that are being used
- Equipment and Lighthouses are not placed in walkways or area that can be knocked by users

## 6. Health Management

### 6.1 Spotters

A spotter should be present when a user is intending to stand or walk around in the virtual world.

Spotters should have an understanding of the technology and ensure that the user is:

- Aware of the electronic fencing that shows where the boundary of the safe area is
- Watched closely during their time in the virtual world
- Kept free of trip hazards such as cables and tripod mounts



### 6.2 Digital Support

VR immersion time should be limited to 15 minute intervals to avoid eye fatigue and strain.

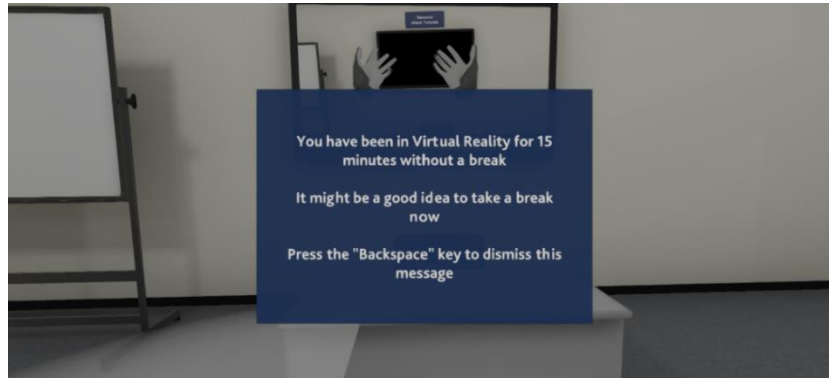


Fig. 7. 15 minute break reminder

Where users are new to working in a virtual world, a physical reference to the real world should be made available to them to support them in entering and exiting the virtual world.



Fig. 8. Real world reference in virtual environment

### 6.3 Accessibility

Any training that is developed to be used in VR should also be available in other forms that do not exclude people that have issues using the technology.

This may be by offering the option to look at the virtual model from the desktop with keyboard controls.

## 7. Document History

Date	Reviewed/ Actioned By	Version	Action
October 2019	SHEQ Manager Innovation and Technology	2	Added document to IMS library, added Doc ID

Date	Reviewed/ Actioned By	Version	Action
October 2019	Scott McMillan	1	New document created to address need for consistency with project outcomes