Lanner Group Limited

Part Queuing Positions Overview

Reference document detailing Part Queuing Positions within 3D geometry

Version 01

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Overview

This is a technical document detailing the behaviour of 3D part queuing positions in WITNESS.

Part queuing position for a WITNESS element is the position relative to the element where parts will start to queue from. A part also queues in a defined direction and each part queue has a length.

Proposed Implementation (WITNESS 14.0 Quick 3D/Pro)

To simplify the information held or maintained by the 3D geometry, it is envisaged that the part queue information will not be maintained as a section in the 3D geometry. Instead it will be maintained on the WITNESS side and dynamically specified during the 3D model build process. This will allow the WITNESS user to import any supported 3D shape for use in a WITNESS model, without first having to specify the part queuing definition.

In its simplest form the queuing position for a geometry will be specified, using a queuing vector, giving the direction items will queue. The queuing position will start from the origin of the shape. Optionally an offset vector can be used to change the start position of the queue.

For more complicated geometries, a robot arm for example, a named node in the geometry will be used to position the part queue. Similar to what is described above, the queuing vector will specify the direction items will queue from the origin of the "Queuing Position" node. This will allow more control over queue placement within the hierarchy at the expense of adding a named node using some third party editing tool (3DS MAX, Blender etc.).

Current use of Queues in WITNESS

Part Queues are used by the following WITNESS elements:

- Machines – and Machine (part queue link option)
- Buffers (Path display)
- Conveyors (Path display)
- Paths (Path display)
- PF Stations
- Vehicles (appear in a WITNESS model in relation to Tracks - Path display)
- Carriers (appear in a WITNESS model in relation to PF Sections - Path display)

Labour elements appear in a WITNESS model in relation to:

- Machines
- Conveyors
- PF Stations
- At their idle queue (labour element)
- At their off shift queue (labour element)

In all cases there will be a mapping from the 2D display item to a 3D geometry. In some cases such as a labour queue at a machine, the 3D geometry will be a "dummy" geometry used just for queue positioning.

Path Display Items

These queuing positions will be defined based on the shape of the drawn path in 2D and the 3D information written in the WITNESS path information dialog. For some of these items there will be a geometry, for example when creating a conveyor, and for others there will be no geometry, for example when specifying the path that labour uses to walk between machines.

Parts can sit above or below the path (under or over slung). The offset vector can be used to position the part an offset from the path.

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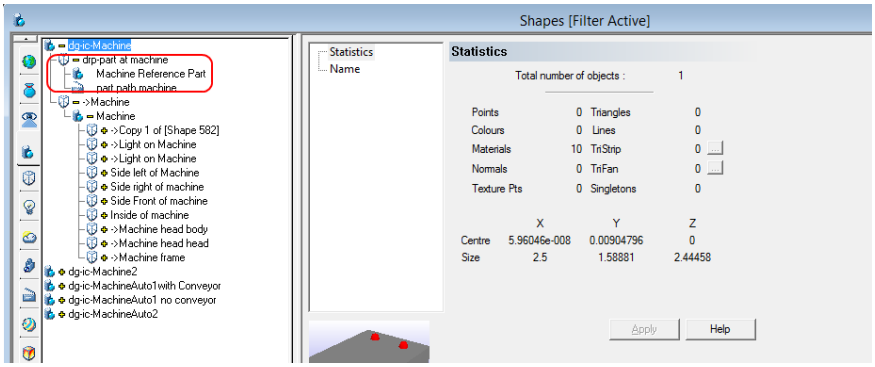
The queuing vector needs to be aligned with any geometry (or where there is none simply in the direction of the path). The alignment should automatically be set to be above or below the geometry (or on the floor position where there is no geometry). Additionally an offset vector can be used to change this alignment.

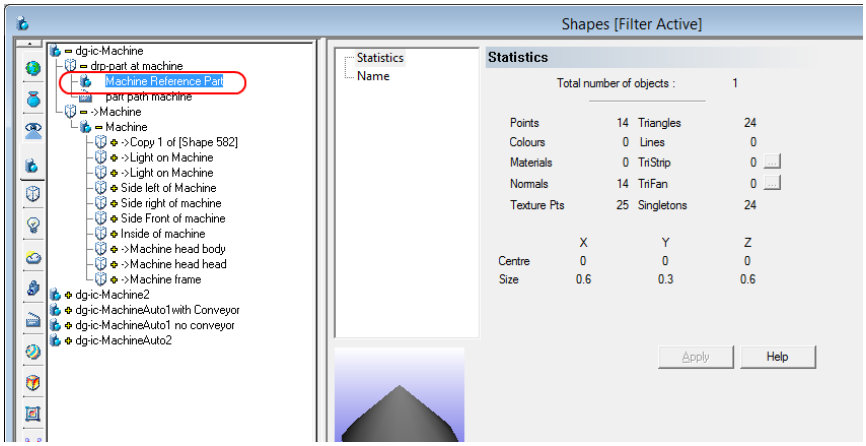
Current Implementation (WITNESS 13.0 Quick 3D - Realimation)

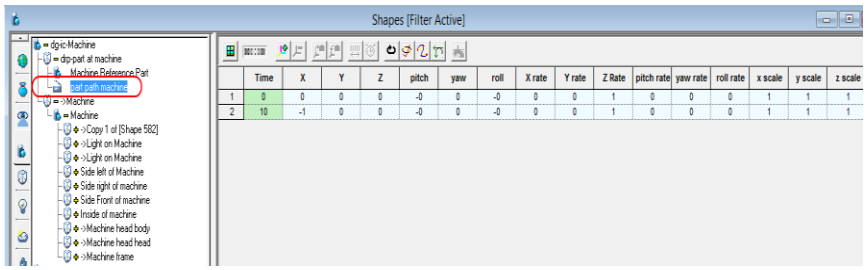
In the currently implementation, the part queuing position is defined in the geometry using a specific node type.

For example in the Machine geometry, **dg-ic-machine,** there are two instances one is **drp-part at machine** instance and one is **Machine** instance.

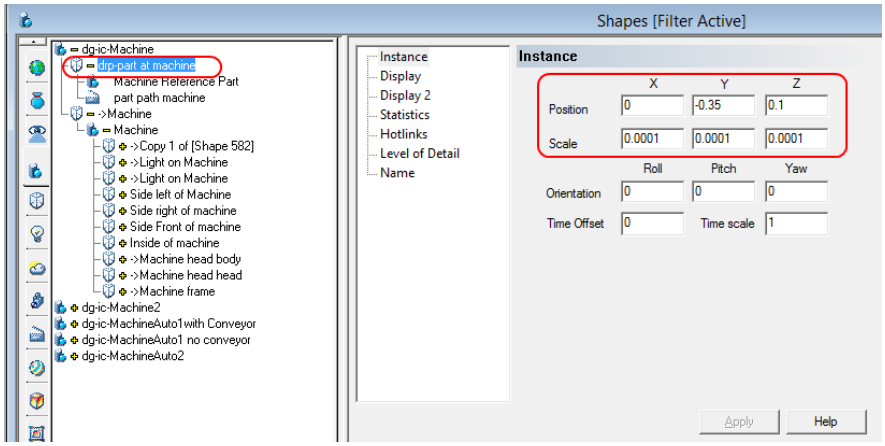


The **drp-part at machine** instance defines the part queue for the object, this is done by a using a **Machine Reference Part** shape which is just a small cone and a **part path machine** which is a path that the **part path machine** is attached to.





The **drp-part at machine** is then positioned within the **dg-ic-Machine** shape.



In the WITNESS VR Plugin, when a part is added to the part queue for a machine the following actions are performed:

- The reference part within the instance is located.
- Enquire the start and end times of the path that the reference part is attached to.
- Using the dimensions of the part instance and the position it needs to be inserted into the queue the instance of the reference part is calculated. For example if the part is 1*1*1 and the part is to be inserted into the queue at the front then the transformation of the reference part at time 0.5 is calculated.
- The transformation is then applied to the part to be added into the queue.

Special cases

- If the defined queue can't accommodate the part (the calculated time is greater than the end time of the path that the reference part is attached to) then it is not drawn.
- If the user has selected that the queue should be auto extended when it is full then the reference part path is extended using the direction defined by the last two nodes in the path and then the part is added to the queue.
- If the path the reference part is attached to is defined as a stack (the path is in the Y direction) a translation is applied to the part to orientate it correctly.

Items to be aware of

Parts scaling is independently controlled.

Parts must not be scaled when added to an element's part queue. WITNESS sizes the footprint of the 3D shape based on the size used on the 2D display.

Maintain queuing direction after sizing / rotating a 3D shape

The queuing direction must be maintained when an element is stretched or rotated.