

Flow of Events for Use Case – Show Roof

Change Log	
16/10/2004	Renamed from UC-ShowRoof
01/11/2004	Finalized for pre-integrated model

Overview

For a particular physical property, determines and captures the area of the roof.

Two roof areas are dealt with in this use case

1. The area of the roof projected onto a 2D horizontal plane which is relevant for massing studies and simplified representations.
2. The total face area of the roof taking into account all individual parts which are relevant

Note that roof areas are not considered possible to determine for orders of representation that do not have an instance of IfcRoof.

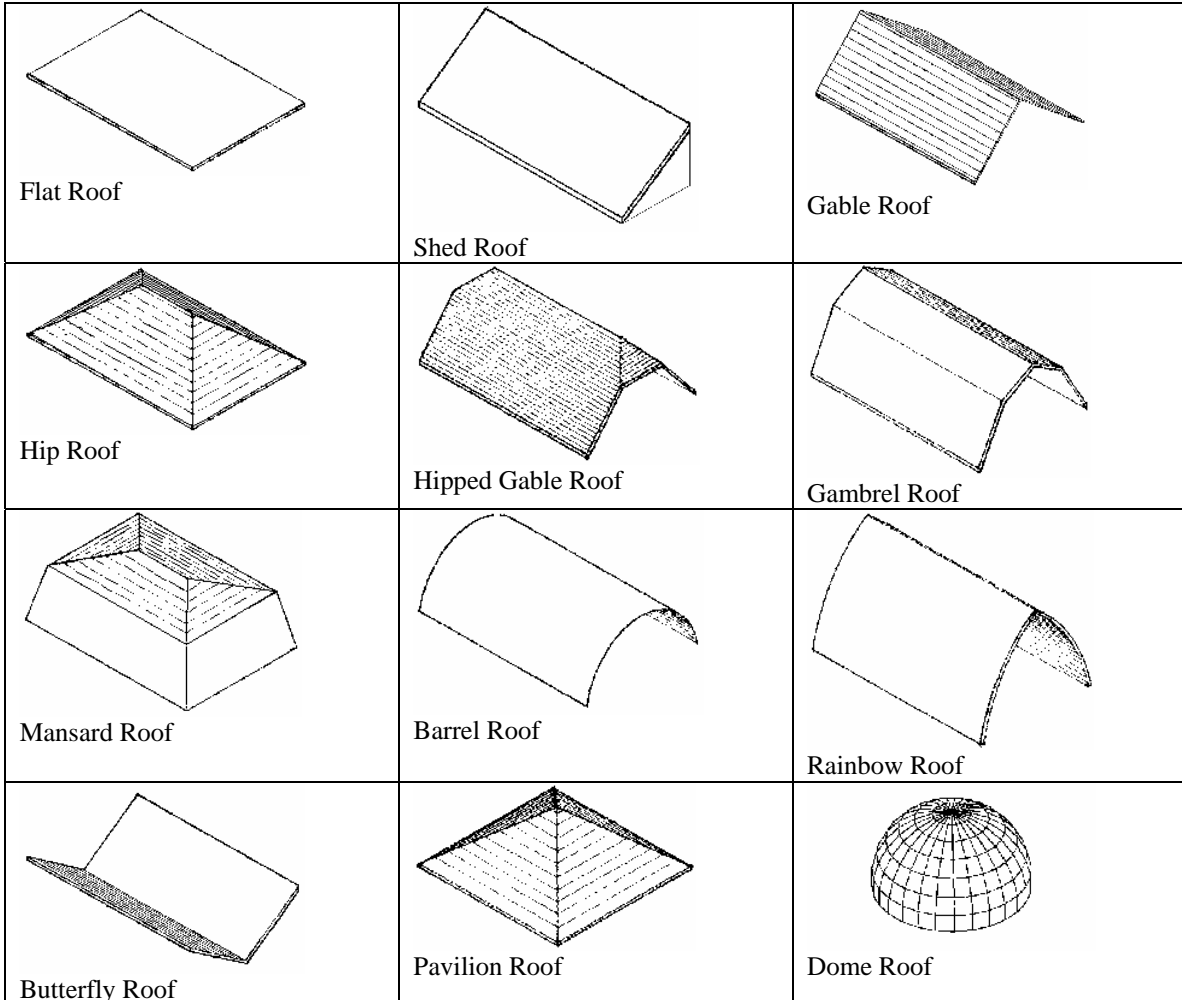


Figure 1: Roof types

Process

Preconditions

Property for which the roof area is to be determined must be defined and located

Property must have an instance of IfcRoof placed in addition to any instance or instances of a geometric mass defining the building or construction (as an instance of IfcBuilding).

Actors

Applicant

Main Flow

Flow	Entity
1. Roof area can be determined according to its projected shape onto a 2D plane or as the sum of its components <ul style="list-style-type: none">• If determining the area as a projected shape then <S1>• If determining the area as the sum of its components then either <S2> or <S3> (see below)	IfcRoof
2. In the IFC model, a roof can either have a single shape representation or its shape representation can be determined according to its individual components. <ul style="list-style-type: none">• If the roof has a single shape representation then <S2>• If roof shape representation is determined by its individual components then <S3>	IfcShapeRepresentation
3. If the representation of the roof is 2D (the above items referring to representations that are 3 dimensional), then <S4>	
4. On completion of area calculations, area values may be added as annotation elements as required.	

Subflows

S1: Get area of roof as a projected shape

Flow	Entity
1. For all components within the roof, determine the outer edges.	
2. Construct a list of the points within the edges ensuring that the list represents a closed area by being represented twice within the list (once as a start point of an edge and once as an end point of an edge)	
3. Normalise the list such that edges represent and ordered, continuous sequence (so that the end point of one edge occurs at the same place as the start point of the next edge and that the final edge end point is the same place as the first edge start point to ensure closure).	
4. Further normalise the list to remove duplicate	

points and to imply that the start point and end point are the same. (e.g. $P_0, P_1, P_2, P_3, \dots, P_n$ and imply P_0 as end point as well as start point).	
5. Calculate the area of the projected shape	
6. Capture the area as the property 'ProjectedArea' in Pset_RoofCommon	Pset_RoofCommon

S2: Get area of roof as a single component

Flow	Entity
1. IFC documentation specifies that if the IfcRoof has no components defined (empty set of SELF\IfcObject.IsDecomposedBy) then the IfcRoof may be represented by an IfcShapeRepresentation with the RepresentationType = 'Brep'.	IfcRoof
2. In this case, area of the roof must be determined as the sum of the areas of the geometric components of the boundary representation.	
3. Capture the area as the property 'TotalArea' in Pset_RoofCommon	Pset_RoofCommon

S3: Get area of roof as the sum of component areas

Flow	Entity
1. If the IfcRoof has components (referenced by SELF\IfcObject.IsDecomposedBy) then IFC specifies that no independent geometric representation shall defined for the IfcRoof. The IfcRoof is then geometrically represented by the geometric representation of its components. The components are accessed via SELF\IfcObject.IsDecomposedBy[1].RelatedObjects.	IfcRoof
2. Each component of the roof is specified by an IfcSlab that has its own shape representation.	IfcSlab
3. Determine the area of each component.	
4. Add together the areas of all of the components to give the total area.	
5. Capture the area as the property 'TotalArea' in Pset_RoofCommon	Pset_RoofCommon

S4: Get area of roof from a 2D representation

Flow	Entity
1. A roof that is represented 2 dimensionally must be defined as a set of components that are aggregated into an instance of IfcRoof using IfcRelAggregates. In this way, the ridge lines for the roof are identifiable as the points at which the roof components intersect.	IfcRoof IfcRelAggregates
2. Determine the pitch angle of the roof component from the specified 'PitchAngle'	Pset_SlabCommon

property in Pset_SlabCommon.	
3. Determine the plan area of each component.	
4. Apply the pitch angle to trigonometrically determine the actual area of the roof component	
5. Add together the areas of all of the components to give the total area.	
6. Capture the area as the property 'TotalArea' in Pset_RoofCommon	Pset_RoofCommon

Post Conditions

- Roof area is determined and captured in property the Pset_RoofCommon property set.
- Roof area may be added as annotation if necessary (not specified as part of this use case)

IFC Usage and Extension Requirements

Existing Entity/Class Usage

<i>Entity Class Name</i>	<i>Usage</i>
IfcObject	Used for decomposition of the roof into components
IfcRelAggregates	Used for aggregation of instances of IfcSlab to give the IfcRoof
IfcRoof	Specifies the complete roof (either as a single instance with an own shape representation or as an aggregation of instances of IfcSlab)
IfcSlab	Specifies a component of an aggregated IfcRoof.

Existing Entity/Class with Proposed Modification

<i>Entity Class Name</i>	<i>Usage</i>

<i>A R M</i>	<i>Attribute</i>	<i>Cardinality</i>	<i>Datatype</i>	<i>Definition</i>

<i>A R M</i>	<i>#</i>	<i>Type (DER, U, WHERE)</i>	<i>Proposition</i>

New Entity/Class Requirement

<i>Entity Class Name</i>	<i>Usage</i>

<i>Attribute</i>	<i>Cardinality</i>	<i>Datatype</i>	<i>Definition</i>

<i>#</i>	<i>Type (DER, U, WHERE)</i>	<i>Proposition</i>

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Existing Property Set Usage

<i>Property Set Name</i>	<i>Usage</i>

Existing Property Set with Proposed Modification

<i>Property Set Name</i>	<i>Usage</i>
Pset_RoofCommon	Extended to provide additional area properties

<i>ARM</i>	<i>Property</i>	<i>Type</i>	<i>Datatype</i>	<i>Unit</i>	<i>Definition</i>
A	ProjectedArea	IfcPropertySingleValue	IfcAreaMeasure	AREAUNIT	Area of the roof projected onto a 2D horizontal plane
A	TotalArea	IfcPropertySingleValue	IfcAreaMeasure	AREAUNIT	Total exposed area of the roof

<i>Property Set Name</i>	<i>Usage</i>
Pset_SlabCommon	Extended to provide additional pitch angle property

<i>ARM</i>	<i>Property</i>	<i>Type</i>	<i>Datatype</i>	<i>Unit</i>	<i>Definition</i>
A	PitchAngle	IfcPropertySingleValue	IfcPlanAngleMeasure	PLANEANGLEUNIT	Angle of the slab to the horizontal when used as a component for the roof (specified as 0 degrees or not asserted for cases where the slab is not used as a roof component).

New Property Set Requirement

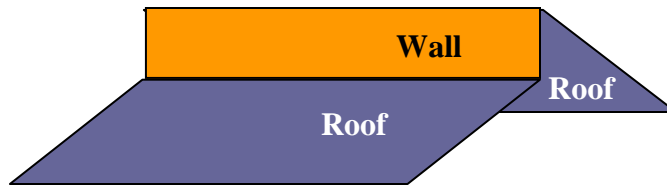
<i>Name:</i>	
<i>Applicability:</i>	
<i>Applicable Classes:</i>	
<i>Applicable Type Value:</i>	
<i>IFC Version:</i>	
<i>Definition:</i>	

<i>Property</i>	<i>Type</i>	<i>Datatype</i>	<i>Unit</i>	<i>Definition</i>

Issue List

<i>Question</i>	<i>Answer</i>
In a split level roof where one part of the total roof is higher than the other part and separated by an instance of IfcWall, the assumption made is that each part of the roof is an instance of IfcRoof. This implies that an aggregation to form an instance of IfcRoof must comprise contiguous components.	

Need to confirm that this is a valid assumption??



Split level roof: each roof is an instance of IfcRoof