



BEXEL **MANAGER**

Mesh Optimization – V1.0

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Introduction

To render the objects in your BIM Model, each object needs to convert each object geometry into a [triangulated mesh](#). Depending in the source quality and/or complexity of the geometry, this may result in an excessive number of triangles being rendered. Small numbers of triangles are ok, but once the total number begins to rise significantly, the performance of the viewer can suffer.

With this experimental feature, Bexel will attempt to reduce the number of triangles according to settings defined in the configuration file. After optimization, it's possible to significantly reduce the total number of triangles.

The best use-case for this feature is for model categories that usually have an unnecessarily high level of geometric detail, such as furniture, bathroom appliances/equipment, custom equipment, trees etc. It's not uncommon for objects such as these to have more complexity than the rest of file combined!

How to use

Disclaimer:

Optimizing meshes is a time-consuming process. As this process is performed during initial project-loading, the overall loading time may be increased significantly. Additionally, the process of reducing the triangle count is heavily dependent on the quality of the input geometry, that's to say; the worse the quality of the mesh, the worse the final output of the reduction algorithm will be.

On Project-Load

When creating a new project or version, you will be presented with the regular window as shown below. Clicking on "Choose" under "Mesh Optimization:" will allow you to choose a configuration from the default Knowledge Base / Mesh Optimization folder. Optionally, you can choose a custom configuration file that you've created yourself.



The 'Add New Project' dialog box contains the following fields and sections:

- Project:** Name (*): [text field], Description: [text area]
- Version:** Name (*): [text field], Description: [text area]
- File (*):** [text field]
- Buttons:** Choose..., Choose from Samples...
- Culture:** English (United States) [dropdown]
- Project Configurations:**
 - Quantity Calculation: Choose... [text field]
 - Mesh Optimization: **Choose...** [text field]
 - Mesh Splitting: Choose... [text field]
- Buttons:** OK, Cancel

Figure 1 - New Project Form

Once you’ve filled in the other fields in the form, go ahead and click on “OK” to load the project.

Once the project is loaded, we need to load a custom breakdown structure from the “Knowledge Base” to quickly assess the results of the optimization. Select all the model elements and then follow the following steps:

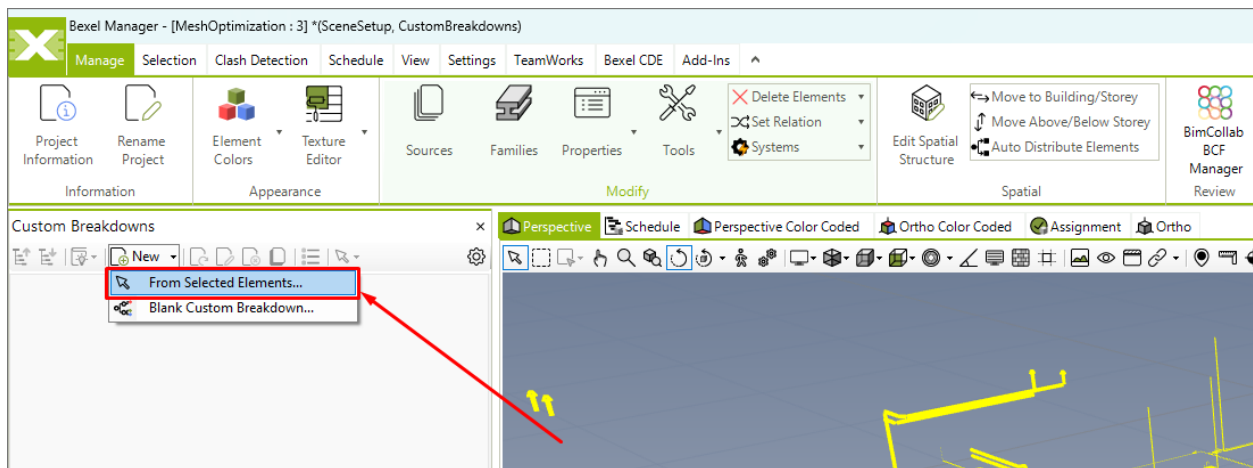


Figure 2 - Custom Breakdown 1/2



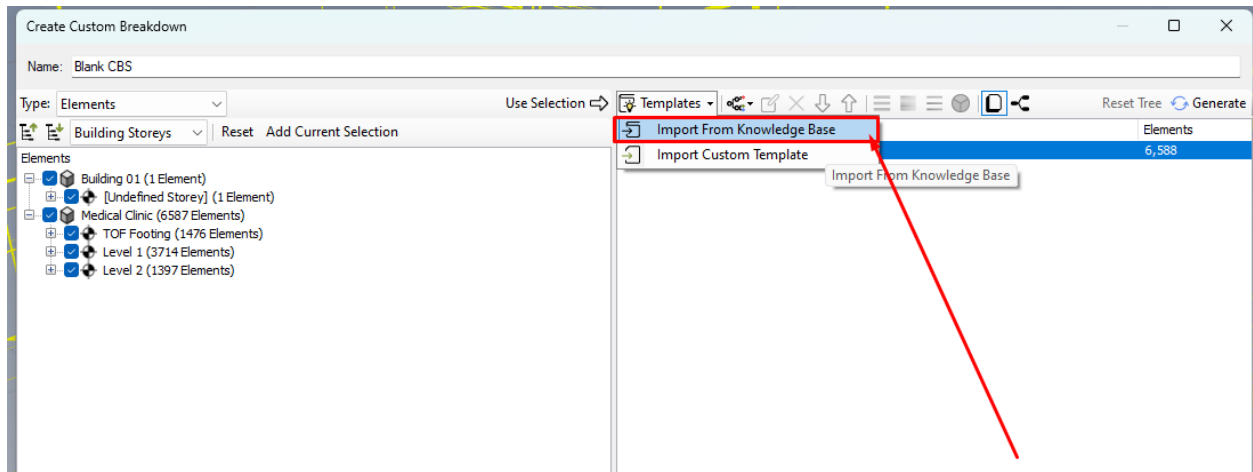


Figure 3 - Custom Breakdown 2/2

- Choose the template related to Mesh Optimization and then click on “OK”

Change your viewer to “Perspective Color Coded” mode and you should see similar results to that below:

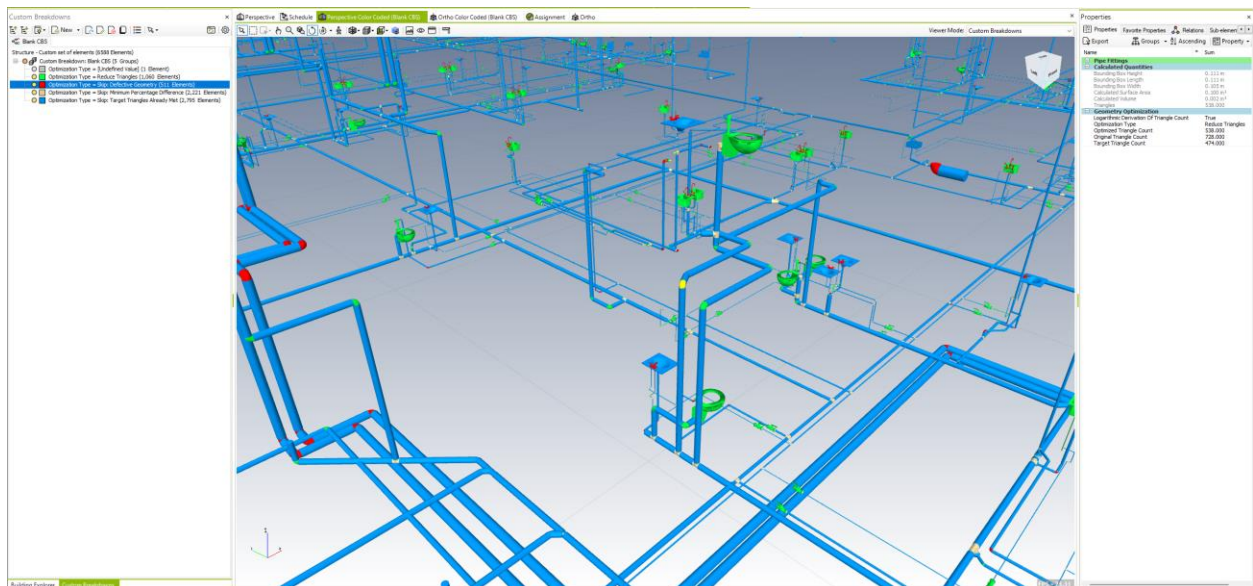


Figure 4 - Results with Custom Breakdown

The viewer now visualizes the results of the mesh optimization according to the following result outputs:

- **Ignore** – Optimization was ignored for this project (configuration setting)
- **Ignore: No Geometry** – The object in question has no geometry

- **Ignore: Excluded Category** – The object category was excluded from optimization in the configuration file
- **Skip: Defective Geometry** – The optimization failed because errors were identified in the geometry
- **Skip: Non Manifold** – Similar to “**Skip: Defective Geometry**”.
- **Skip: Target Triangles Already Met** - The target triangle count was equal to or less than the existing number of triangles
- **Skip: Min Percentage Difference** - The final optimized triangle count was less than the specified percentage in the configuration file.
- **Reduce Triangles** – The optimization was successful.
- **Oriented Bounding Box** – the object was converted to an oriented bounding box.
- **Oriented Bounding Box – Small Volume** – the object was converted to an oriented bounding box as per the configuration file settings
- **Convex Hull** – the object was converted to a 3d convex hull encompassing the object
- **Skip: Internal Error** – The algorithm encountered an error during the optimization process
- **Ignore: Profile Geometry** – optimization was skipped because the input geometry was already optimal.

In addition the optimization type, additional data pertaining to the optimization is stored on the object under Mesh Optimization:

The screenshot shows a 'Properties' window with a table of properties. The 'Geometry Optimization' section is highlighted with a red box. The table contains the following data:

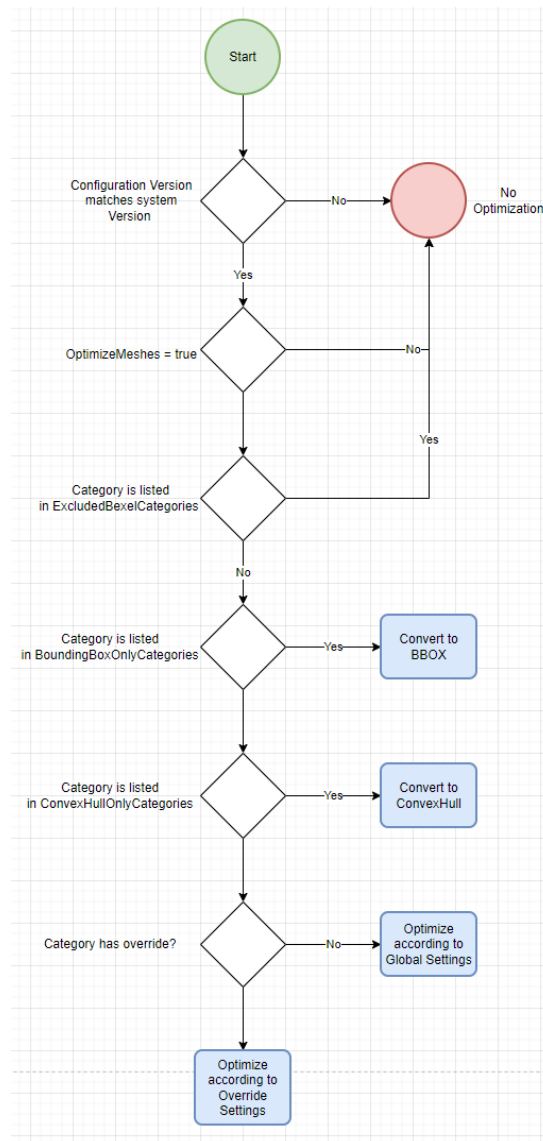
Name	* Sum
Pipe Fittings	
Calculated Quantities	
Bounding Box Height	0.111 m
Bounding Box Length	0.111 m
Bounding Box Width	0.105 m
Calculated Surface Area	0.100 m ²
Calculated Volume	0.002 m ³
Triangles	538.000
Geometry Optimization	
Logarithmic Derivation Of Triangle Count	True
Optimization Type	Reduce Triangles
Optimized Triangle Count	538.000
Original Triangle Count	728.000
Target Triangle Count	474.000

Figure 5 - Geometry Optimization Properties

- **Logarithmic Derivation Of Triangle Count** – whether the target triangle count was obtained using a logarithmic formula. See [Configuration](#) for more information.
- **Optimization Type** – See paragraph above.
- **Optimized Triangle Count** – The final triangle count after optimization.
- **Original Triangle Count** – The original triangle count of the object.
- **Target Triangle Count** – The target triangle count passed to the optimization algorithm



Editing the Configuration (Advanced)



To be able to edit the configuration file, its important to reference the optimization flow first:

Core Settings

- **Version:** example: 1.0.0.0 - The version of the configuration. This needs to match the version expected by Bexel Manager. If unsure, refer to the file "MeshOptimizerConfig.cfg", found in "*C:\Users\YourUserName\AppData\Roaming\BEXEL\Bexel Manager 24\Knowledge Base\MeshOptimizerConfig.cfg*".

Figure 6 - Optimization Flow



- **OptimizeMeshes:** true/false - (Default true). This setting directly controls whether mesh optimization will be performed on the model. If false, all other settings will be ignored and no optimization will be performed.
- **ExcludedBoxelCategories:** Example: ["Road","Slab","Railing","Site"] (Default []) - Categories listed in this setting will not be optimized
- **BoundingBoxOnlyCategories:** Example: ["Pipe", "PipeFitting"] (Default [])- Categories listed in this setting will be converted to Oriented Bounding Box (OBB) (Aligned to the Z (Vertical) axis).

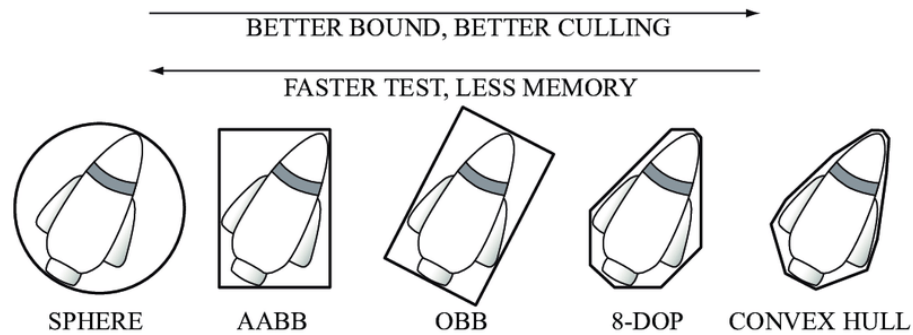


Figure 7 - Bounding Volumes (Sphere, AABB and 8-DOP are not used by Boxel Manager)

ConvexHullOnlyCategories: Example: ["Pipe", "PipeFitting"] (Default []) - Categories listed in this setting will be converted to convex hulls. (See Image above)

- **PerCategoryOverride:** (Default {}) Element meshes can either be optimized using the global settings listed in the config file, or those precisely defined in the override. See Base Optimization Settings below for more information.

Base Optimization Settings

The flow when calculating the target triangle count used by the algorithm is as follows:

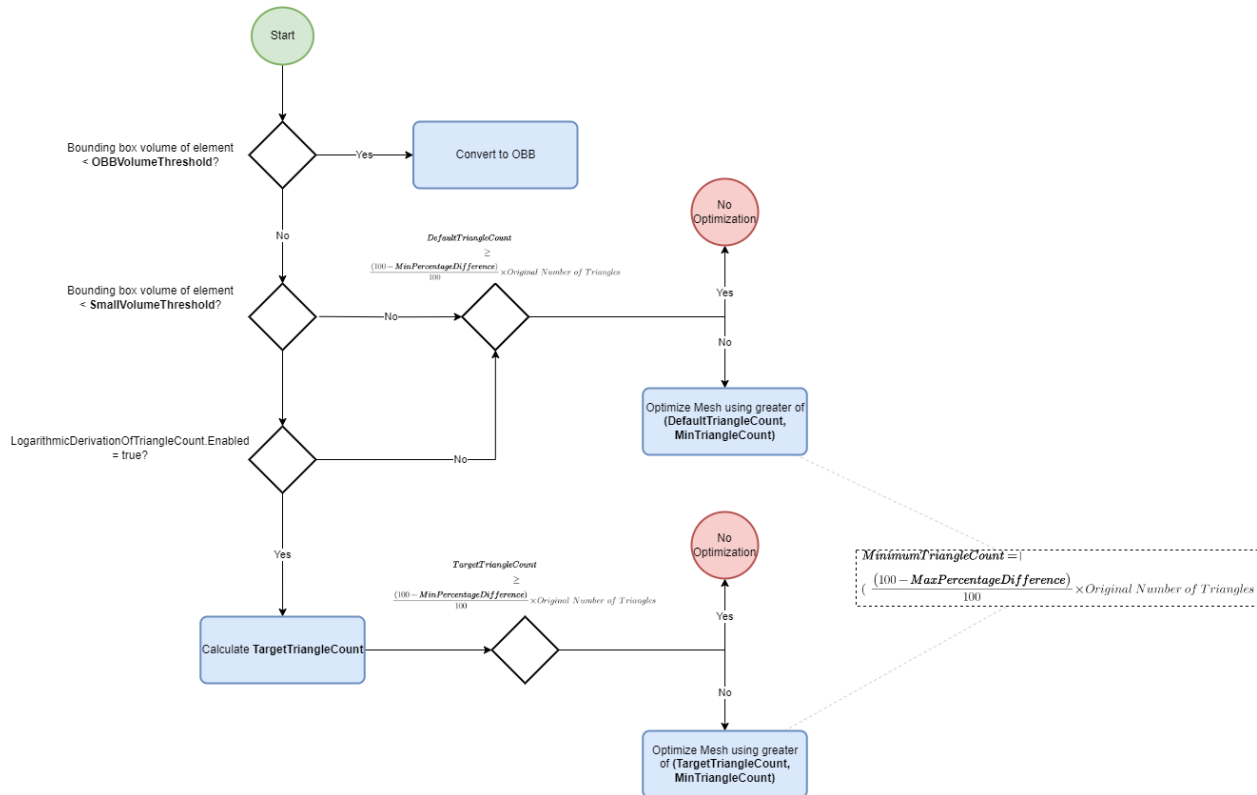


Figure 8 - Triangle Count Calculation

- **DefaultTriangleCount:** (Default 150) - This will be used as the target triangle count the optimization algorithm will try to achieve
- **OBBVolumeThreshold** - (Default 0.0001) If the OBB Volume of the mesh is lower than this value, then the geometry will automatically be converted to an OBB.
- **SmallVolumeThreshold** - (Default 0.001) If the OBB Volume of the mesh is lower than this value, the algorithm will attempt to achieve the target triangle count to the DefaultTriangleCount, ignoring the logarithmic formula.
- **OptimizeNonManifoldMeshes** - (Default false) - If this is set to true and the algorithm detects a non-manifold mesh, it will attempt to construct a manifold version. Expect unattractive results if the input geometry is bad. (Non-manifold topology polygons have a configuration that cannot be unfolded into a continuous flat piece. Many geometry tools and software cannot work properly with non-manifold geometry. This is the main reason why simplification of non-manifold meshes can lead to unexpected results.)



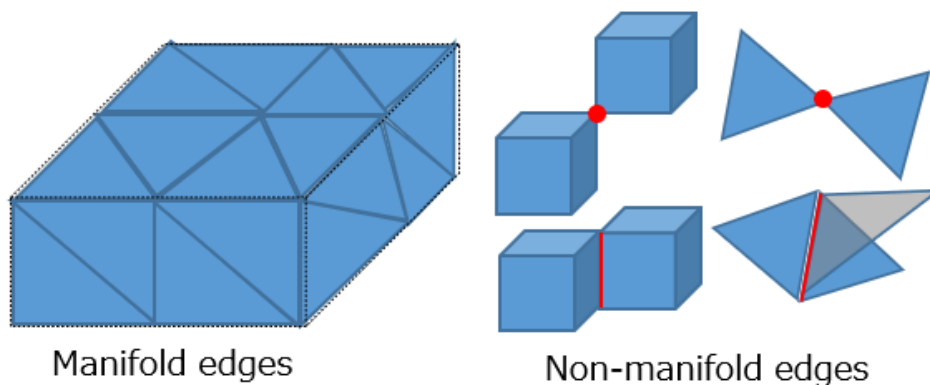


Figure 9: [Non-Manifold Edges](#)

- **OptimizeNonValidMeshes** - (Default false) - A comprehensive check of the integrity of the mesh is performed each time. If the mesh has errors and this option is set to true, the optimization will still attempt to work - possible leading to unexpected results. Use only when desperate for reductions in mesh complexity.

- **LogarithmicDerivationOfTriangleCount**

- Formula

$$TargetTriangles = NumStartingTriangles + \log_{LogBase}(OBBVolume) \times InnerMultiplier \times OuterMultiplier$$

Figure 10 - [Logarithmic Derivation of Triangle Count](#)

- **Enabled**: if false, the target triangle count will simply be the DefaultTriangleCount
- **NumStartingTriangles** (See Formula) - (Default 250)
- **LogBase** - the base to use in the logarithmic calculation (See Formula) - (Default 10)
- **InnerMultiplier** (See Formula) - (Default 1000)
- **OuterMultiplier** (See Formula) - (Default 250)
- **MinPercentageDifference** - (Default 25) Used when evaluating the final target triangle count to be passed to the algorithm. See Figure 3.
- **MaxPercentageDifference** - (Default 90) Used when evaluating the final target triangle count to be passed to the algorithm. See Figure 3.

Limitations

As this feature is still experimental at this stage, there are some limitations that you need to be aware of:

- Additional loading time – Optimizing triangulates meshes is a tricky process that requires analyzing the geometry in detail. This is obviously multiplied by the number of objects being optimized and may result in a significantly longer initial load-time if there are a lot of objects in the model. Our personal experience is that a combination of optimization and bounding-box-conversion leads to the best results, both in terms of loading time, triangle reduction and visual aesthetic.
- Degeneration of object geometry - Reducing the number of triangles decreases the “resolution” of the geometry, and as such if it is pushed too far the resulting geometry may look either jumbled up or unfit for use. Start with small reductions and experiment with higher degrees of simplification for certain categories once you get a good feel for how the results end up.
- Input Mesh Quality – The simplification works best when the quality of the mesh is high. This means no holes, manifold edges and internal consistency. Most of these aspects will be out of your control but are important nevertheless to keep in mind if the optimization leads to poor results.
- Using the optimization feature is currently disabled when updating an existing project, or when loading a Bexel Manager “.besIn” file.



Appendix 1 – (Mapping) IFC Class to Bexel Manager Category

IfcSite: Site

IfcBuilding: Building

IfcBuildingStorey: Storey

IfcSpace: Space

IfcSpatialZone: Space

IfcSpatialZoneType: Space

IfcBeam: Beam

IfcBeam_Structural Framing: Beam

IfcBeamStandardCase: Beam

IfcChimneyType: GenericModel

IfcProxy: GenericModel

IfcBuildingElementProxy: GenericModel

IfcBuildingElementProxy_COMPUTER: DataDevice

IfcBuildingElementProxy_Communication Devices: CommunicationDevices

IfcBuildingElementProxy_Duct Accessory: DuctAccessory

IfcBuildingElementProxy_Electrical Equipment: ElectricalEquipment

IfcBuildingElementProxy_Electrical Fixture: ElectricalFixture

IfcBuildingElementProxy_Lighting Device: LightingDevice

IfcBuildingElementProxy_Mass: Mass

IfcBuildingElementProxy_Mechanical Equipment: MechanicalEquipment

IfcBuildingElementProxy_Security Devices: SecurityDevices

IfcBuildingElementProxy_Specialty Equipment: SpecialtyEquipment

IfcBuildingElementProxy_Parking: Parking

IfcBuildingElementProxy_Planting: Planting

IfcBuildingElementProxy_Plumbing Fixture: PlumbingFixture

IfcBuildingElementProxy_Data Device: DataDevice



IfcBuildingElementProxy_Toposolid: Toposolid

IfcBuildingElementProxy_MEP Fabrication Ductwork Stiffeners:
FabricationDuctworkStiffener

IfcBuildingElementProxy_Plumbing Equipment: PlumbingEquipment

IfcBuildingElementProxy_Slab Edges: Slab

IfcBuildingElementProxy_Structural Framing: Beam

IfcBuildingElementProxy_Parts: Part

IfcBuildingElementProxyType: GenericModel

IfcBuildingElementProxyType_COMPUTER: DataDevice

IfcBuildingElementProxyType_Communication Devices: CommunicationDevices

IfcBuildingElementProxyType_Duct Accessory: DuctAccessory

IfcBuildingElementProxyType_Electrical Equipment: ElectricalEquipment

IfcBuildingElementProxyType_Electrical Fixture: ElectricalFixture

IfcBuildingElementProxyType_Lighting Device: LightingDevice

IfcBuildingElementProxyType_Mass: Mass

IfcBuildingElementProxyType_Mechanical Equipment: MechanicalEquipment

IfcBuildingElementProxyType_Security Devices: SecurityDevices

IfcBuildingElementProxyType_Specialty Equipment: SpecialtyEquipment

IfcBuildingElementProxyType_Parking: Parking

IfcBuildingElementProxyType_Planting: Planting

IfcBuildingElementProxyType_Plumbing Fixture: PlumbingFixture

IfcBuildingElementProxyType_Data Device: DataDevice

IfcColumn: Column

IfcColumnStandardCase: Column

IfcCovering: Covering

IfcCovering_CEILING: Ceiling

IfcCovering_CLADDING: Covering



IfcCovering_FLOORING: Slab
IfcCovering_INSULATION: Insulation
IfcCovering_MEMBRANE: Covering
IfcCovering_ROOFING: Roof
IfcCovering_SLEEVING: Covering
IfcCovering_WRAPPING: Covering
IfcCoveringType: Covering
IfcCoveringType_CEILING: Ceiling
IfcCoveringType_CLADDING: Covering
IfcCoveringType_FLOORING: Slab
IfcCoveringType_INSULATION: Insulation
IfcCoveringType_MEMBRANE: Covering
IfcCoveringType_ROOFING: Roof
IfcCoveringType_SLEEVING: Covering
IfcCoveringType_WRAPPING: Covering
IfcCurtainWall: CurtainWall
IfcCurtainWall_Curtain System: CurtainSystem
IfcDoor: Door
IfcDoorStandardCase: Door
IfcFooting: StructuralFoundation
IfcFooting_Structural Columns: StructuralColumn
IfcFooting_Structural Framing: Beam
IfcMember: Member
IfcMember_MULLION: CurtainWallMullion
IfcMember_Curtain Wall Mullion: CurtainWallMullion
IfcMemberType: Member
IfcMemberType_MULLION: CurtainWallMullion



IfcMemberType_Curtain Wall Mullion: CurtainWallMullion

IfcMemberStandardCase: Member

IfcMemberStandardCase_MULLION: CurtainWallMullion

IfcMemberStandardCase_Curtain Wall Mullion: CurtainWallMullion

IfcPile: StructuralColumn

IfcPile_Structural Foundations: StructuralFoundation

IfcPlate: Plate

IfcPlate_CURTAIN_PANEL: CurtainPanel

IfcPlate_Curtain Panel: CurtainPanel

IfcPlateType: Plate

IfcPlateType_CURTAIN_PANEL: CurtainPanel

IfcPlateType_Curtain Panel: CurtainPanel

IfcPlateStandardCase: Plate

IfcPlateStandardCase_CURTAIN_PANEL: CurtainPanel

IfcPlateStandardCase_Curtain Panel: CurtainPanel

IfcRailing: Railing

IfcRamp: Ramp

IfcRampFlight: Ramp

IfcRoof: Roof

IfcShadingDevice: GenericModel

IfcSlab: Slab

IfcSlab_ROOF: Roof

IfcSlab_BASESLAB: StructuralFoundation

IfcSlab_Roof: Roof

IfcSlab_Structural Foundation: StructuralFoundation

IfcSlabType: Slab

IfcSlabType_ROOF: Roof

IfcSlabType_BASESLAB: StructuralFoundation

IfcSlabType_Roof: Roof



IfcSlabType_Structural Foundations: StructuralFoundation

IfcSlabElementedCase: Slab

IfcSlabElementedCase_ROOF: Roof

IfcSlabElementedCase_BASESLAB: StructuralFoundation

IfcSlabElementedCase_Roof: Roof

IfcSlabElementedCase_Structural Foundations: StructuralFoundation

IfcSlabStandardCase: Slab

IfcSlabStandardCase_ROOF: Roof

IfcSlabStandardCase_BASESLAB: StructuralFoundation

IfcSlabStandardCase_Roof: Roof

IfcSlabStandardCase_Structural Foundations: StructuralFoundation

IfcStair: Stairs

IfcStairFlight: Stairs

IfcWall: Wall

IfcWall_Generic Models: GenericModel

IfcWallElementedCase: Wall

IfcWallStandardCase: Wall

IfcWallStandardCase_Generic Models: GenericModel

IfcWindow: Window

IfcWindowStandardCase: Window

IfcDistributionElement: SpecialtyEquipment

IfcDistributionControlElement: SpecialtyEquipment

IfcDistributionControlElement_FLOATING: MechanicalControlDevice

IfcActuator: SpecialtyEquipment

IfcAlarm: SecurityDevices

IfcController: SpecialtyEquipment

IfcController_FLOATING: MechanicalControlDevice

IfcControllerType: SpecialtyEquipment

IfcControllerType_FLOATING: MechanicalControlDevice

IfcFlowInstrument: SpecialtyEquipment

IfcProtectiveDeviceTrippingUnit: SpecialtyEquipment

IfcSensor: SpecialtyEquipment



IfcUnitaryControlElement: SpecialtyEquipment
IfcDistributionChamberElement: GenericModel
IfcEnergyConversionDevice: MechanicalEquipment
IfcAirToAirHeatRecovery: MechanicalEquipment
IfcBoiler: MechanicalEquipment
IfcBurner: MechanicalEquipment
IfcChiller: MechanicalEquipment
IfcCoil: MechanicalEquipment
IfcCondenser: MechanicalEquipment
IfcCooledBeam: MechanicalEquipment
IfcCoolingTower: MechanicalEquipment
IfcElectricGenerator: MechanicalEquipment
IfcElectricMotor: MechanicalEquipment
IfcEngine: MechanicalEquipment
IfcEvaporativeCooler: MechanicalEquipment
IfcEvaporator: MechanicalEquipment
IfcHeatExchanger: MechanicalEquipment
IfcHumidifier: MechanicalEquipment
IfcMotorConnection: MechanicalEquipment
IfcSolarDevice: MechanicalEquipment
IfcTransformer: MechanicalEquipment
IfcTubeBundle: MechanicalEquipment
IfcUnitaryEquipment: MechanicalEquipment
IfcFlowController: FlowAccessory
IfcFlowControllerType: FlowAccessory
IfcAirTerminalBox: AirTerminal
IfcAirTerminalBoxType: AirTerminal
IfcDamper: Damper
IfcDamperType: Damper
IfcElectricDistributionBoard: ElectricalEquipment
IfcElectricDistributionBoardType: ElectricalEquipment
IfcElectricTimeControl: ElectricalEquipment
IfcElectricTimeControlType: ElectricalEquipment
IfcFlowMeter: FlowAccessory
IfcFlowMeterType: FlowAccessory
IfcProtectiveDevice: ElectricalEquipment
IfcProtectiveDeviceType: ElectricalEquipment
IfcSwitchingDevice: ElectricalEquipment



IfcSwitchingDeviceType: ElectricalEquipment
IfcValve: Valve
IfcValveType: Valve
IfcElectricDistributionPoint: GenericModel
IfcFlowMovingDevice: MechanicalEquipment
IfcCompressor: MechanicalEquipment
IfcFan: MechanicalEquipment
IfcPump: MechanicalEquipment
IfcFlowStorageDevice: SpecialtyEquipment
IfcElectricFlowStorageDevice: SpecialtyEquipment
IfcTank: SpecialtyEquipment
IfcFlowTreatmentDevice: FlowAccessory
IfcDuctSilencer: DuctAccessory
IfcFilter: FlowAccessory
IfcInterceptor: FlowAccessory
IfcElementAssembly: Assembly

IfcElementAssembly_BEAM_GRID: StructuralBeamSystem

IfcElementAssembly_TRUSS: Truss

IfcElementAssembly_Structural Beam Systems: StructuralBeamSystem

IfcElementAssembly_Structural Trusses: Truss
IfcBuildingElementPart: Part

IfcBuildingElementPart_Generic Models: GenericModel

IfcBuildingElementPart_Structural Framing: Beam
IfcDiscreteAccessory: DiscreteAccessory
IfcDiscreteAccessoryType: DiscreteAccessory
IfcFastener: Fastener
IfcFastenerType: Fastener
IfcMechanicalFastener: Fastener
IfcMechanicalFastenerType: Fastener
IfcReinforcingBar: StructuralRebar
IfcReinforcingMesh: StructuralRebar
IfcTendon: Tendon
IfcTendonType: Tendon
IfcTendonAnchor: Tendon



IfcTendonAnchorType: Tendon

IfcEquipmentElement: SpecialtyEquipment

IfcEquipmentElement_FLOATING: MechanicalControlDevice

IfcEquipmentElement_BATH: PlumbingEquipment

IfcFurnishingElement: Furniture

IfcFurniture: Furniture

IfcSystemFurnitureElement: FurnitureSystem

IfcTransportElement: Transport

IfcTransportElementType: Transport

IfcGrid: Empty

IfcFlowFitting: FlowFitting

IfcFlowFitting_Cable Tray Fitting: CableTrayFitting

IfcFlowFitting_Conduit Fitting: ConduitFitting

IfcFlowFitting_Duct Fitting: DuctFitting

IfcFlowFitting_Pipe Fitting: PipeFitting

IfcFlowFittingType: FlowFitting

IfcFlowFittingType_Cable Tray Fitting: CableTrayFitting

IfcFlowFittingType_Conduit Fitting: ConduitFitting

IfcFlowFittingType_Duct Fitting: DuctFitting

IfcFlowFittingType_Pipe Fitting: PipeFitting

IfcCableCarrierFittingType: CableTrayFitting

IfcCableCarrierFittingType_Conduit Fitting: ConduitFitting

IfcCableCarrierFitting: CableTrayFitting

IfcCableCarrierFitting_Conduit Fitting: ConduitFitting

IfcCableFitting: ConduitFitting

IfcCableFitting_Cable Tray Fitting: CableTrayFitting

IfcCableFitting_Conduit Fitting: ConduitFitting

IfcDuctFittingType: DuctFitting

IfcDuctFitting: DuctFitting

IfcJunctionBoxType: ElectricalFixture

IfcJunctionBox: ElectricalFixture



IfcPipeFittingType: PipeFitting

IfcPipeFitting: PipeFitting

IfcFlowSegment: FlowSegment

IfcFlowSegment_Cable Tray: CableTray

IfcFlowSegment_Conduit: Conduit

IfcFlowSegment_Duct: Duct

IfcFlowSegment_Flex Duct: FlexDuct

IfcFlowSegment_Pipe: Pipe

IfcFlowSegmentType: FlowSegment

IfcFlowSegmentType_Cable Tray: CableTray

IfcFlowSegmentType_Conduit: Conduit

IfcFlowSegmentType_Duct: Duct

IfcFlowSegmentType_Flex Duct: FlexDuct

IfcFlowSegmentType_Pipe: Pipe

IfcCableCarrierSegment: CableTray

IfcCableCarrierSegment_CONDUITSEGMENT: Conduit

IfcCableCarrierSegment_Conduit: Conduit

IfcCableCarrierSegmentType: CableTray

IfcCableCarrierSegmentType_CONDUITSEGMENT: Conduit

IfcCableCarrierSegmentType_Conduit: Conduit

IfcCableSegment: Conduit

IfcCableSegmentType: Conduit

IfcDuctSegment: Duct

IfcDuctSegment_FLEXIBLESEGMENT: FlexDuct

IfcDuctSegmentType: Duct

IfcDuctSegmentType_FLEXIBLESEGMENT: FlexDuct

IfcPipeSegment: FlexPipe

IfcPipeSegment_FLEXIBLESEGMENT: FlexPipe



IfcPipeSegment_Flex Pipes: FlexPipe

IfcPipeSegmentType: Pipe

IfcPipeSegmentType_FLEXIBLESEGMENT: FlexPipe

IfcFlowTerminal: FlowTerminal

IfcFlowTerminal_Air Terminal: AirTerminal

IfcFlowTerminal_Electrical Equipment: ElectricalEquipment

IfcFlowTerminal_Electrical Fixture: ElectricalFixture

IfcFlowTerminal_Lighting Fixture: LightingFixture

IfcFlowTerminal_Plumbing Fixture: PlumbingFixture

IfcFlowTerminal_Sprinkler: Sprinkler

IfcFlowTerminalType: FlowTerminal

IfcFlowTerminalType_Air Terminal: AirTerminal

IfcFlowTerminalType_Electrical Equipment: ElectricalEquipment

IfcFlowTerminalType_Electrical Fixture: ElectricalFixture

IfcFlowTerminalType_Lighting Fixture: LightingFixture

IfcFlowTerminalType_Plumbing Fixture: PlumbingFixture

IfcFlowTerminalType_Sprinkler: Sprinkler

IfcAirTerminalType: AirTerminal

IfcAirTerminal: AirTerminal

IfcAudioVisualApplianceType: AudioVisualDevice

IfcAudioVisualAppliance: AudioVisualDevice

IfcCommunicationsAppliance: CommunicationDevices

IfcCommunicationsAppliance_ANTENNA: DataDevice

IfcCommunicationsApplianceType: CommunicationDevices

IfcCommunicationsApplianceType_ANTENNA: DataDevice

IfcElectricApplianceType: ElectricalFixture

IfcElectricApplianceType_DISHWASHER: PlumbingFixture

IfcElectricApplianceType_FREEZER: SpecialtyEquipment

IfcElectricApplianceType_FRIDGE_FREEZER: SpecialtyEquipment



IfcElectricApplianceType_MICROWAVE: SpecialtyEquipment
IfcElectricApplianceType_REFRIGERATOR: SpecialtyEquipment
IfcElectricApplianceType_TELEPHONE: TelephoneDevice
IfcElectricApplianceType_COMPUTER: DataDevice
IfcElectricApplianceType_Data Devices: DataDevice
IfcElectricAppliance: ElectricalFixture
IfcElectricAppliance_DISHWASHER: PlumbingFixture
IfcElectricAppliance_FREEZER: SpecialtyEquipment
IfcElectricAppliance_FRIDGE_FREEZER: SpecialtyEquipment
IfcElectricAppliance_MICROWAVE: SpecialtyEquipment
IfcElectricAppliance_REFRIGERATOR: SpecialtyEquipment
IfcElectricAppliance_TELEPHONE: TelephoneDevice
IfcElectricAppliance_COMPUTER: DataDevice
IfcElectricAppliance_Data Devices: DataDevice
IfcElectricHeaterType: ElectricalFixture
IfcFireSuppressionTerminal: FireProtection
IfcFireSuppressionTerminal_SPRINKLER: Sprinkler
IfcFireSuppressionTerminalType: FireProtection
IfcFireSuppressionTerminalType_SPRINKLER: Sprinkler
IfcGasTerminalType: SpecialtyEquipment
IfcLampType: LightingDevice
IfcLamp: LightingDevice
IfcLightFixtureType: LightingFixture
IfcLightFixture: LightingFixture
IfcMedicalDeviceType: MedicalEquipment
IfcMedicalDevice: MedicalEquipment
IfcOutletType: ElectricalFixture
IfcOutlet: ElectricalFixture
IfcSanitaryTerminalType: PlumbingFixture
IfcSanitaryTerminalType_BATH: PlumbingEquipment
IfcSanitaryTerminal: PlumbingFixture



IfcSanitaryTerminal_BATH: PlumbingEquipment

IfcSpaceHeater: GenericModel

IfcStackTerminalType: GenericModel

IfcStackTerminal: GenericModel

IfcWasteTerminalType: GenericModel

IfcWasteTerminal: GenericModel

IfcGeographicElementType: GenericModel

IfcGeographicElement: GenericModel

IfcGeographicElement_TERRAIN: Toposolid

IfcCivilElementType: GenericModel

IfcCivilElement: GenericModel

IfcAnalyticalMember: Analytical

IfcAnalyticalMemberType: Analytical

IfcAnalyticalPanel: Analytical

IfcAnalyticalPanelType: Analytical

Appendix 2 - Bexel Manager Categories

Abutment

BridgeFraming

ExpansionJoints

Pier

StructuralTendons

VibrationManagement

AudioVisualDevice

FireProtection

FoodServiceEquipment

Hardscape

MedicalEquipment

Signage

TemporaryStructure

VerticalCirculation

Bearing

BridgeCable

BridgeDeck



Road
Zone
MechanicalControlDevice
PlumbingEquipment
Analytical
DataDevice
FabricationDuctworkStiffener
StructuralBeamSystem
StructuralFabricArea
StructuralFabricReinforcement
StructuralFraming
Toposolid
Truss
Wall
Window
Door
Slab
Ceiling
Roof
Column
Ramp
Stairs
Railing
Furniture
Casework
AirTerminal
Pipe
FlexPipe
PipeFitting
Duct
FlexDuct
DuctFitting
PlumbingFixture
SpecialtyEquipment
MechanicalEquipment
Parking
CurtainPanel
CurtainWallMullion



StructuralFoundation
StructuralColumn
Beam
Space
WallSweep
GenericModel
Wire
ElectricalEquipment
Sprinkler
PipeAccessory
DuctAccessory
LightingDevice
TelephoneDevice
LightingFixture
ElectricalFixture
CurtainWall
CableTray
CableTrayFitting
Conduit
ConduitFitting
Planting
Part
FireAlarmDevice
Mass
CommunicationDevices
SecurityDevices
StructuralRebar
FurnitureSystem
CurtainSystem
StructuralConnection
Covering
Insulation
Member
Assembly
FlowSegment
FlowAccessory
FlowTerminal
FlowFitting



Valve
Damper
Tendon
Fastener
Plate
Transport
DiscreteAccessory
Site

