<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>KICT-IfcRoad Extension</td>
<td>609 days</td>
<td>Wed 15-07-01</td>
<td>Tue 17-10-31</td>
</tr>
<tr>
<td>Initial IfcRoad Extension Deadline</td>
<td>0 days</td>
<td>Tue 17-10-31</td>
<td>Tue 17-10-31</td>
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<tr>
<td>Scoping the IfcRoad Extension</td>
<td>24 days</td>
<td>Tue 15-09-01</td>
<td>Fri 15-10-02</td>
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<tr>
<td>Identify IfcRoad Extension Schedule</td>
<td>4 days</td>
<td>Tue 15-09-01</td>
<td>Fri 15-09-04</td>
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<tr>
<td>Define the entire IfcRoad Schema V1.0</td>
<td>3 days</td>
<td>Mon 15-09-07</td>
<td>Wed 15-09-09</td>
</tr>
<tr>
<td>Confiure Pset Outline with PSD.XML for IfcRoad Converter</td>
<td>3 days</td>
<td>Thu 15-09-10</td>
<td>Mon 15-09-14</td>
</tr>
<tr>
<td>Define Information Delivery Manual for IfcRoad</td>
<td>12 days</td>
<td>Thu 15-09-10</td>
<td>Fri 15-09-25</td>
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<tr>
<td>Confiure MVD outlines</td>
<td>4 days</td>
<td>Tue 15-09-29</td>
<td>Fri 15-10-02</td>
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<tr>
<td>Final IfcRoad Schema based on IFC4</td>
<td>5 days</td>
<td>Mon 15-09-07</td>
<td>Fri 15-09-11</td>
</tr>
<tr>
<td>Review of Final IfcRoad Schema V1.0</td>
<td>5 days</td>
<td>Mon 15-09-07</td>
<td>Fri 15-09-11</td>
</tr>
<tr>
<td>Complete Pset for IfcRoad</td>
<td>14 days</td>
<td>Tue 15-09-01</td>
<td>Fri 15-09-18</td>
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<tr>
<td>Completion of Final Pset for Road</td>
<td>5 days</td>
<td>Mon 15-09-07</td>
<td>Fri 15-09-11</td>
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<tr>
<td>Completion of Earthwork, Drainage, Subsidiary etc</td>
<td>5 days</td>
<td>Mon 15-09-14</td>
<td>Fri 15-09-18</td>
</tr>
<tr>
<td>Conversion of Pset template to PSD.XML</td>
<td>12 days</td>
<td>Tue 15-09-01</td>
<td>Wed 15-09-16</td>
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<tr>
<td>Final review of Pset for IfcRoad</td>
<td>2 days</td>
<td>Thu 15-09-17</td>
<td>Fri 15-09-18</td>
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<tr>
<td>Develop IDM with Use case</td>
<td>9 days</td>
<td>Wed 15-09-09</td>
<td>Mon 15-09-21</td>
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<tr>
<td>Define Use case (Quantity Takeoff) for using IfcRoad</td>
<td>2 days</td>
<td>Wed 15-09-09</td>
<td>Thu 15-09-10</td>
</tr>
<tr>
<td>Identify a BIM process of corresponding use case</td>
<td>2 days</td>
<td>Thu 15-09-10</td>
<td>Fri 15-09-11</td>
</tr>
<tr>
<td>Configure Process Map of IDM for IfcRoad</td>
<td>2 days</td>
<td>Fri 15-09-11</td>
<td>Mon 15-09-14</td>
</tr>
<tr>
<td>Analyze Information and Data requirements for each process unit</td>
<td>2 days</td>
<td>Mon 15-09-14</td>
<td>Tue 15-09-15</td>
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<td>Configure EIR (Exchange Requirements) Template for the use case</td>
<td>2 days</td>
<td>Tue 15-09-15</td>
<td>Wed 15-09-16</td>
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<tr>
<td>Review of Final IDM for IfcRoad</td>
<td>3 days</td>
<td>Thu 15-09-17</td>
<td>Mon 15-09-21</td>
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<tr>
<td>Apply Case Study for Real on-going Road Construction Projects</td>
<td>4 days</td>
<td>Fri 15-09-11</td>
<td>Wed 15-09-16</td>
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<tr>
<td>Define Case Study Outline and Process</td>
<td>2 days</td>
<td>Fri 15-09-11</td>
<td>Sat 15-09-12</td>
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<tr>
<td>Configure Case Study Implementation Contexts</td>
<td>3 days</td>
<td>Mon 15-09-14</td>
<td>Wed 15-09-16</td>
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<tr>
<td>Develop HTML version of IfcRoad Specifications</td>
<td>16 days</td>
<td>Thu 15-09-17</td>
<td>Thu 15-10-08</td>
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<td>Identify IfcDocTools</td>
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<td>Thu 15-09-17</td>
<td>Wed 15-09-23</td>
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<td>Prepare HTML version of IfcRoad Spec. (with only Road part)</td>
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<td>Thu 15-09-24</td>
<td>Tue 15-10-06</td>
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<td>3 days</td>
<td>Tue 15-10-06</td>
<td>Tue 15-10-08</td>
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<tr>
<td>Expert Meeting</td>
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<td>Mon 15-09-28</td>
<td>Mon 15-09-28</td>
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<tr>
<td>Technical review by professionals</td>
<td>0 days</td>
<td>Mon 15-09-28</td>
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<td>Configure MVD Templates for IfcRoad</td>
<td>54 days</td>
<td>Mon 15-10-19</td>
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<td>64 days</td>
<td>Mon 16-01-04</td>
<td>Thu 16-03-31</td>
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<td>61 days</td>
<td>Fri 16-04-01</td>
<td>Fri 16-06-24</td>
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<td>40 days</td>
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<td>Fri 16-08-19</td>
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<td>Mon 16-08-22</td>
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<td>bSI in Singapore (InfraRoom Meeting)</td>
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<tr>
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<td>0 days</td>
<td>Tue 15-10-15</td>
<td>Tue 15-10-13</td>
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<tr>
<td>Develop an Improved IfcRoad Converter and Viewer based on Revit and Civil3D 132 days</td>
<td>109 days</td>
<td>Wed 15-07-01</td>
<td>Thu 15-12-31</td>
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<tr>
<td>Develop an Improved IfcRoad Converter</td>
<td>109 days</td>
<td>Wed 15-07-01</td>
<td>Thu 15-12-31</td>
</tr>
<tr>
<td>Integrate IfcRoad schema with IfcAlignment</td>
<td>65 days</td>
<td>Mon 15-08-03</td>
<td>Fri 15-10-30</td>
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<tr>
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<td>Mon 15-11-30</td>
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<td>22 days</td>
<td>Tue 15-12-01</td>
<td>Wed 15-12-30</td>
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<td>Distribute IfcRoad input *.dlf</td>
<td>1 day</td>
<td>Thu 15-12-31</td>
<td>Thu 15-12-31</td>
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<td>BIM Validation Testing</td>
<td>65 days</td>
<td>Mon 15-11-02</td>
<td>Fri 16-01-29</td>
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<td>Verifying that the export of information from a software</td>
<td>65 days</td>
<td>Mon 15-11-02</td>
<td>Fri 16-01-29</td>
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<td>Final delivery process</td>
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<td>Mon 16-10-17</td>
<td>Fri 17-03-17</td>
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<tr>
<td>Finalize as new IFC4 Extension</td>
<td>55 days</td>
<td>Mon 16-10-17</td>
<td>Fri 16-12-30</td>
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<td>Full implementation</td>
<td>55 days</td>
<td>Mon 17-01-02</td>
<td>Fri 17-03-17</td>
</tr>
</tbody>
</table>
Chapter 2

IfcRoad Development History

Feb. 22 2016

Dr. Hyounseok Moon
Korea Institute of Civil Engineering and Building Technology
Contents

1. Outlines of Infra BIM Projects
2. IfcRoad Development Schedule
3. IfcRoad Extensions
4. IfcRoad Data Schema
5. Pset and Qset for IfcRoad
6. IDM with Use Case (QTO)
7. IfcRoad Documentation
8. IfcRoad Verification
9. Case Study for a Real Road Project with IfcRoad
10. Future Plan
### IfcRoad Development Outline

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Development of Information Model Standard and Verification Technique for Infra BIM</th>
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</thead>
<tbody>
<tr>
<td>Duration</td>
<td>Jan. 1, 2012 to Dec. 31, 2016 (5 years) – Current in 4th year</td>
</tr>
<tr>
<td>Cost</td>
<td>Approximate $ 3,000,000</td>
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</tbody>
</table>
1. Outlines of Infra BIM Projects

Overall Research Objectives

Vision
Leading BIM Application for Public SOC Projects and Establishing Application Base

Development of Preparation and Delivery Standards for Infra BIM

Objective 1: Development of Draft IFC Standard for Infra BIM

Objective 2: Verification of Deliverables and Development of Utilization System for Infra BIM
1. Outlines of Infra BIM Projects

Entire Research Contents
2. IfcRoad Development Schedule

Planned Schedule for IfcRoad Completion

We are here now
3. IfcRoad Extensions

IfcRoad Extension Scope

The focus of IfcRoad extensions is to develop a complete exchange standard, which supports 3D road design data with alignments, partial terrain layers, and subsidiary facilities between different BIM software in civil engineering. Based on the official IFC4, Road-IFC will be consistently linked with IFC4 structure by Express-G (ISO 10303-11) representation maintaining the IFC4 structure without any change.
3. IfcRoad Extensions

**Development Necessity of IfcRoad**

1. Most designers is still designing and delivering **2D drawings** for civil projects.
2. There are no standardized common exchange format internationally for ensuring data interoperability of road project. (Currently, Korea and V-Con)
3. International efforts and needs for GIS integration of IfcRoad to apply Infra BIM.
4. International needs for integrating life cycle data of civil facilities into IfcRoad.
5. Need to have a top position in moving forward to ISO16739 revision (IFC5) in IfcCivilElement & IfcCivilElementType in IFC4.
6. IfcRoad will be based on IfcCivilElement & IfcCivilElementType in IFC4.
3. IfcRoad Extensions

Target, Scope and View Perspective of IfcRoad Extension

Phase
- Plan
- Basic Design
- Detailed Design
- Construction
- Maintenance

View
Object Shape Representation of Civil Elements, Components and Basic Attributes

Delivering 3D Models to Government

Road Project
STA (-) 0+227.500 ~ 4+510.000

Road
Earthwork/Pavement
Drainage (Distribution)
Subsidiary Facilities

2016-08-26
3. IfcRoad Extensions

Extension Scope to IFC4 Entity for Road

Structure of IFC4

Physical Relationship

1. Space
2. Facility
3. Components/Part
4. Types

Materials & Units
3. IfcRoad Extensions

Extension Scope to IFC4 Entity for Road

Definition Criteria of Schema Structure

For New Civil Facilities
For Common Elements
For New Components in Civil Facilities
For New Types to Architecture Distribution

Reference Models (LandXML, JHDM etc.)
Road Design Guidance
Standardized 2D Drawings
3D Modeling S/W (Autodesk, Bentley)
3. IfcRoad Extensions

Spatial Extension for IfcRoad (3 Spatial Concepts)

- a. Topographical Space (Site)
- b. Structural Space (Structure)
- c. Line Reference Space

Spatial Structure Hierarchy

- ifcSite ⊆ ifcCur.S.A_K ⊆ CurvilinearNodeSpace_K ⊆ IfcVerticalSubspace_K ⊆ ifcSpace

- a. Site  b. Structural Space  c. Reference Space
## 3. IfcRoad Extensions

### Structures and its Elements Extension for IfcRoad (4 Stages)

#### Why do we need this?

- **Classification**
  - Analysis of Common WBS in Road Projects
    - [Identification of Hierarchical Structure]

- **Categorization 1**
  - Analysis of Current Reference Model for Road Projects
    - [Identification of Facility Elements]

- **Categorization 2**
  - Analysis of Design Data for Road Facilities
    - [Identification of Detailed Facility Elements with Parts/Components]

- **Normalization**
  - Configurations of Entity and Attribute for Road
    - [Definition of Detailed Attributes and Resource Layer-Tech
      incal Terminology for Road]

### Processes

- **Need to classify and compose Spatial Group with Road Entities, and specify their relationships**

- **Need to identify and extract standardized road entities**

- **Need to identify and extract standardized road entities and their attributes**

- **Need to define standardized terminology of entire entities with attributes toward bsDD**

### Referred Data
3. IfcRoad Extensions

**IfcRoad history since 2012**
- The IfcRoad Ver.1.0 was completed in Sept. 30 2015 based on **IFC4 ADD1** (The IfcRoad is incorporated with a new converter and viewer software.)
- In addition to this, we have configured **property and quantity sets** for each IFC entity in a PSD-XML type.
- To secure practical usability of IfcRoad in the high level, preparation of IDM including use cases was strongly required, so that was developed.
- Performed consulting processes by external expert group; IFC experts, Road Engineers, Construction Company etc.
- Verifying IfcRoad schema through validation system with converter and viewer (Suitability of IFC conversion, Checking spatial structure and missing entities for each structure)
  - Converting 3D models with any infra objects into IfcRoad schema in commercial software(eg. Autodesk Revit/Civil3D)
  - Identifying the converted 3D model with ifcRoad schema visually in self stand-alone system
- Performed In-depth review of IfcRoad schema by Dr. Thomas Liebich for 5 days in Korea
- Real application of pilot projects with one road projects under construction in Korea
4. IfcRoad Data Schema

**IfcCivilSpatialElement_K**

- **IfcSpatialElementType**
  - **IfcSpatialZone**
    - **PredefinedType**
      - **IfcSpatialZoneTypeEnum**
      - **IfcCivilSpatialStructureElement_K**
      - **IfcRoad_K**
        - **PredefinedType**
          - **IfcRoadTypeEnum_K**
      - **IfcBridge_K**
        - **PredefinedType**
          - **IfcBridgeTypeEnum_K**
      - **IfcTunnel_K**
        - **PredefinedType**
          - **IfcTunnelTypeEnum_K**
    - **IfcCivilSpatialBoundary_K**
      - **PredefinedType**
        - **IfcCivilSpatialBoundaryTypeEnum_K**
        - **IfcLinearRefSpace_K**
          - **PredefinedType**
            - **IfcLinearRefSpaceTypeEnum_K**
        - **IfcCurvlinearNodeSpace_K**
          - **PredefinedType**
            - **IfcCurvlinearNodeSpaceTypeEnum_K**
        - **IfcVerticalSubspace_K**
          - **PredefinedType**
            - **IfcVerticalSubspaceTypeEnum_K**

2016-08-26
4. IfcRoad Data Schema

**IfcRoadElement_K, IfcEarthworkElement_K, IfcSubsidiaryFacility_K, IfcCivilStructureElement_K, IfcCivilElementProxy_K**
4. IfcRoad Data Schema

Road Drainage in IfcGutterSegment_K, IfcGutterFitting_K
4. IfcRoad Data Schema

**IfcElementComponent**
4. IfcRoad Data Schema

Civil Materials and Others
4. IfcRoad Data Schema

**IFC4 Architecture Extension**

**Shared Layer Extension related to road facilities**

- Shared Road Elements
- Shared Bridge Elements
- Shared Tunnel Elements
- Shared Civil Service Elements
- Shared Earthwork Elements
- Shared Railway Elements

**Product Extension**

IfcCivilSpatialElement (Entity, Type)
5. Pset & Qset for IfcRoad

**PropertySets (Pset) with PSD-XML for IfcRoad Entities**

- The Pset was developed in order to support external parameters and attribute for any use cases.
- The Pset was configured in PSD-XML format (buildingSMART guideline) using Altova XMLSpy 2015 trial version.
- The Pset was also incorporated into a converter and viewer, and that can support external PSD-XML typed Psets.

---

**XML Schema Structure of PSD_IFC4**

**XMLSpy Contents Model of PSD-XML Schema Structure**

An example of PsetBeamCommon for IfcBeam
5. Pset & Qset for IfcRoad

**PropertySets (Pset) Configuration of IfcRoad**

- Psets for IfcRoadElement_K, IfcCaisson_K, IfcCulvert_K, IfcRetWall_K

![PropertySet Template](image1.png)

![List up of prepared PSD-XML file of Psets for Road Elements](image2.png)
5. Pset & Qset for IfcRoad

A PropertySet Sample

- Pset_RoadProjectMgmtCommon_K for IfcRoadElement_K
5. Pset & Qset for IfcRoad

**QuantitySet(Qset) for IfcRoad**

- Qsets were made to support IDM QTO Process and based the exchange requirements from the IDM document.
- Incorporated into a converter and viewer like Pset.

---

**List up of Qsets for Road Elements**

**QuantitySet Template in Exchange Requirements from IDM QTO Process**
6. IDM with Use Case (QTO)

**IDM overview for IfcRoad (1/2)**

- IDM Development History
  - IDM V0.8 for IfcRoad for Internal Review : Feb. 10 2015 – Jul. 12 2015 (Distributed)
  - IDM V0.9 for IfcRoad QTO for external distribution : Jul. 13 2015 – Sept.22 (Distributed)
    > Review of QTO process with stakeholders for Road Projects
    > Preparation of BIM-based QTO process for Road Projects
    > In-depth Analysis of exchange data for transferring IfcRoad schema for QTO between stakeholders
    > Preparation of BIM-based QTO process map, Exchange Requirements (ER), and Functional Parts (FP) for road projects
    > Entire Documentation of IDM for QTO

- Reference Data
  - bSI IDM Template (http://iug.buildingsmart.org/idms/template)
    > “IDM for Geographical Referencing”
    > “IDM for Building Programming (draft)”
  - GSA’s AECOO-1 IDM for QTO

- Point of View
  - Focusing on QTO for Road in Detailed Design Stage
  - Exchange Data in ER were described in the perspective of the entities of IfcRoad schema
  - Of many use cases including asset management, design change etc., only QTO for road projects are selected.
6. IDM with Use Case (QTO)

IDM overview for IfcRoad (2/2)

• ‘Road design to QTO’ scenario is dealing with information exchange process using road element includes road space, road facilities, earthwork, drainage facilities, and subsidiary facilities.
• The quantity take-off process is executed based on calculation and estimation of physical feature of the road projects.

• In Scope
  - From preparation task of BIM model for QTO to approval task in detailed design phase
  - Automate takeoff from object parameters
  - Only the object properties required for QTO information exchange

• Out of Scope
  - Manual takeoff for modeled objects
  - Virtual takeoff for non-modeled objects
  - The object properties not related to QTO (ex. specification, management properties)
6. IDM with Use Case (QTO)

IDM Documentation Structure

Table of Contents

1. Process Map
   1.1 Overview
   1.1.1 Scope of the BIM Project
   1.1.2 Quantities Take-Off of Road Projects at Design Phase
   1.2 Process Map - Quantities Take-Off of Road Projects at Design Phase
   1.2.1 Specification of Processes
   1.2.1.1 Precheck Detailed Design BIM Model [3.1]
   1.2.1.2 Define Modification Items for QTO BIM Model [3.2]
   1.2.1.3 Modify Road Spatial Model [3.3]
   1.2.1.4 Modify Earthwork Model [3.4]
   1.2.1.5 Modify Road Body Model [3.5]
   1.2.1.6 Modify Drainage Model [3.6]
   1.2.1.7 Modify Substation Facility Model [3.7]
   1.2.1.8 Validate BIM Model for QTO [3.8]
   1.2.1.9 Export 2D File [3.9]
   1.2.1.10 Calculate Quantities & Costs [3.10]
   1.2.1.11 Review Quantity & Cost Analysis Results [3.11]
   1.2.1.12 Prepare Submission for Review & Approval [3.12]
   1.2.1.13 Validate BIM Model for QTO [3.13]
   1.2.1.14 Calculate Quantities & Costs [3.14]
   1.2.1.15 Review Quantity & Cost Analysis Results [3.15]
   1.2.1.16 Prepare Quantity Analysis Report [3.16]
   1.2.1.17 Evaluate Quantities & Cost Breakdown [3.17]
   1.2.1.18 Prepare Evaluation Results [3.18]
   1.2.2 Specification of Decision Point Gateways
   1.2.2.1 Validate BIM Model for QTO
   1.2.2.2 Results Acceptable*
   1.2.2.3 Validate BIM Model for QTO
   1.2.2.4 Perform Client QTO Cost Analysis*
   1.2.2.5 Results Complete*
   1.2.2.6 Approved*
6. IDM with Use Case (QTO)

Process Map (PM) : Road Design to Quantity take-off

- **Precondition of PM**
  - BPMN Diagram
  - The Reference data differ between countries.
  - The range of QTO is divided by road spatial boundary.
  - The quantities is calculated through object parameter based functions in BIM software.
6. IDM with Use Case (QTO)

**Exchange Requirements table: Road Design to Quantity take-off**

- Exchange Requirements: 12 Element Groups, 27 Elements
- Mapping to IFC Definitions: IfcRoad (22 New Entities) / Ifc4 (8 Entities)

*The items included in the QTO report*

*The calculation results by BIM S/W*
7. IfcRoad Documentation

**IfcRoad Specifications**
8. IfcRoad Verification

IfcRoad Converter and Viewer

Autodesk Revit API for Road, Bridge, Tunnel etc.

Autodesk Civil3D API
8. IfcRoad Verification

Road and Earthwork

Road

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<thead>
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<th>NO</th>
<th>명칭</th>
<th>Civil 3D 레이어</th>
<th>IFC</th>
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<th>비고</th>
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<td>1</td>
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<td>IfcRoadMedian Strip_K</td>
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<td>보장</td>
<td>Pave1</td>
<td>IfcRoadPavement_K</td>
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<td>4</td>
<td>보장</td>
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<td>IfcRoadPavement_K</td>
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<td>Pave4</td>
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Earthwork

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<td>IfcEarthworkElement_K</td>
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<tr>
<td>3</td>
<td>절토</td>
<td>Cutting</td>
<td>IfcEarthworkElement_K</td>
<td>CUTTING</td>
<td></td>
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</tr>
</tbody>
</table>
8. IfcRoad Verification

**Bridge and Tunnel**

### Bridge 1

![Bridge 1 Diagram]

### Tunnel 1

![Tunnel 1 Diagram]
8. IfcRoad Verification

IfcRoad Conversion and Visualization
8. IfcRoad Verification

**IfcRoad Viewer**

- IFC File Open
- Project Manager
  - Project Create (New Project)
  - Add / Delete IFC to Project
  - Delete Project
- Tree View
- Properties
- Model View
- Capture Window
- Model view
- View Object
- View Mode
- Measure
- Section View
- Decomposition
- User View
- Mini Map
8. IfcRoad Verification

- IfcRoad Converter and Viewer

Validation of Infra BIM Schema by IFC Converter & Viewer
9. Case Study for a Real Road Project with IfcRoad

Case Study Outline

- **Aim**: For verifying IfcRoad schema applicability into real road projects in terms of delivering BIM design model, and sharing the final results for BIM-based QTO processes
- **Case Study Duration**: July 1 2015 - November 30 2015 (about 5 months)
- **Case Study Budget**: about 120,000 dollar (3D shop modelling, IfcRoad Adoption in Delivering, Economical Evaluation)
- **Target Modeling**: Road, Earthwork, Bridge, Tunnel, Subsidiary Facilities with component/part, rebar

Road Project Overview

- **Road Project Name**: Seolak-Cheongpyeong Road Construction Project (Gyeonggi province, Gapyeong)
- **Road Facilities**: Road Body, Earthwork (Filling / Cutting), ED type bridge (Cheongpyeong Bridge, 720m), NATM type Tunnel (Seolak Tunnel, 924m), entire subsidiary facilities, and Road drainage facilities etc.
- **Total Length**: 3.9km, **Width**: 10.5m - 11.5m (2 lane)
- **Utilization business with BIM**: Civil complaint, Design change, QTO, Schedule management / Constructivity
9. Case Study for a Real Road Project with IfcRoad

Case Study Process

3D Modeling

Design Coordinations

4D Modeling
[3D Model+Schedule]

5D Modeling
[Input of QTO Sets+Cost]

Input of QTO related Data

Comparison Analysis of QTO between 2D and BIM model

Analysis of Civil Complaint

3D Design change of Civil complaint sections

Review of Design Change Target [for QTO]

Delivering Test of Converted 3D Road Design Models

Review and Analysis of IfcRoad Schema

Feasibility Documentation
9. Case Study for a Real Road Project with IfcRoad

Application of Case Study with IfcRoad

- 3D Modeling: 3D Shop Drawing with component/ parts and rebar (Model Coordination)
- 4D Modeling: using planned construction schedule
- 5D Modeling: Quantity Takeoff
- IfcRoad Conversion and Delivering Test: Verification of a new Converter and Viewer based on an improved IfcRoad schema (Geometrical shape representation test in commercial software which include Revit and Civil3D, Conversion error checking, Delivery process analysis etc.)
- Economical Evaluation (Infra BIM feasibility report) for road project delivery by government agency
- Benefit analysis Target Business: Civil complaint, Design change, QTO, Schedule management/Constructability analysis
9. Case Study for a Real Road Project with IfcRoad

BIM Conversion for Delivering, QTO, Alternative Review and BIM Support for Site
9. Case Study for a Real Road Project with IfcRoad

3D modeling sample for the road project

Road and Terrain model

Structures

BIM Library

Combination of Corridor and Terrain
9. Case Study for a Real Road Project with IfcRoad

BIM Model : Terrain and Road (Corridor)

BIM Model : Bridge

Bridge 1

Bridge 2

Bridge 3 (ED Bridge)
9. Case Study for a Real Road Project with IfcRoad

**BIM Model : Tunnel**

- Tunnel Office
- Tunnel 1

**BIM Model : Extra Structure**

- Drainage
- Culvert
- Eco-Overpass
9. Case Study for a Real Road Project with IfcRoad

Shop Drawing (Rebar) for Coordination
9. Case Study for a Real Road Project with IfcRoad

Design coordination

Intersection

Road Model (Civil 3D)

Bridge 1

Bridge Model (Revit)

Road Model (Civil 3D)

Bridge 1 (Revit)

Slope and bridge interference
9. Case Study for a Real Road Project with IfcRoad

2D Drawing Extraction and Mutual Comparison

Bridge 1

3D Model (.rvt) vs 2D Drawing

Bridge 2

3D Model (.rvt) vs 2D Drawing

Bridge 1

3D Based Drawing vs 2D Drawing

Bridge 2

3D Based Drawing vs 2D Drawing
9. Case Study for a Real Road Project with IfcRoad

3D based Quantity Takeoff for Road

3D Model (.rvt)

2D drawing based QTO statements vs 3D Model based QTO statements
Thank you for your attention!!