Automating MEP design using Dynamo

KAZUMASA YOSHIHARA - Mechanical Engineer, Nihon Sekkei
TETSUYA HISHIDA - Mechanical Engineer, Nihonsekkei
Class Summary

● MEP design utilizing “Information”

● Automated MEP design via Dynamo
● Automatically correct the piping size by referring to the size table
● Automated Quantity survey utilizing the element and space properties.

● The workflow innovation derived from Dynamo
Introduction
NIHON SEKKEI, INC.
is one of the largest Multidisciplinary Consulting firms including Architecture, Urban Design, Urban Planning, and Engineering

Established	September 1st 1967
President, CEO	Yoshinori Chidori (from October 1st 2013)
Capitalization	100 Million Japanese Yen
Our global challenge	more than 40 countries and over 100 cities
Architects and Engineers	approx. 900

Tokyo HQ Office
Shanghai Office
Hanoi Office
Jakarta Office
Designing architecture and urban-design with careful attention to every aspect of the eco environment from landscape to interior designs.
# MEP workflow in Japan

<table>
<thead>
<tr>
<th>Concept</th>
<th>Schematic</th>
<th>Detail 1</th>
<th>Detail 2</th>
<th>Quantity Survey</th>
<th>Construction Draw</th>
<th>Construction Fabrication</th>
<th>Operation</th>
<th>Renovation</th>
</tr>
</thead>
</table>

- **<Japan>**
- **MEP engineer**
- **Revit MEP**
  - Mass model
  
  There seems to be a gap of functionality here

- **Contractor**
  - Ducting, Piping (detail)
  - Fabrication

There seems to be a gap of functionality here.
MEP design utilizing “Information”
MEP design utilizing “Information”

3D geometry

3D coordination

Collision check

Family (Equipment)

MEP System

new in japan
Utilization of **Space** Information in Design and FM
MEP design utilizing “Information”: Space Information

Room specification information is input in the space and used for equipment design and FM.
### MEP design utilizing “Information”: Space Information

<table>
<thead>
<tr>
<th>階</th>
<th>部屋番号</th>
<th>部屋名</th>
<th>Geometry</th>
<th>Room-usage conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>area</td>
<td>CH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### AC condition

<table>
<thead>
<tr>
<th>AC condition</th>
<th>Heat source</th>
<th>AC system</th>
<th>outlet</th>
<th>ventilation</th>
<th>Smoke exhaust</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### AC condition

<table>
<thead>
<tr>
<th>AC condition</th>
<th>Cooling condition</th>
<th>Heating condition</th>
<th>Plug load</th>
<th>Light load</th>
<th>Occupancy load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- MEP: Mechanical, Electrical, and Plumbing design.
- “Information” refers to space information provided for MEP design.
- “Space Information” includes details such as area, capacity, usage conditions, and design conditions for AC (Air Conditioning) systems.
MEP design utilizing “Information”:

Information linking Space and Equipment.

“Target device symbols” required for equipment design are input in the space and used for equipment design.
Utilization of Family (Equipment) Information in Design and FM
MEP design utilizing “Information”: Equipment Information

- **architecture**
  - plan
  - Elevation
  - section
  - Ceiling plan

- **structure**
  - weight

- **electricity**
  - Motive power

**family**

- Device specification, external dimensions, Motive power, weight, costs, Maintenancespace etc..

**Equipment list**

**Panel list**

**Energy saving calculation**
Utilization of **MEP system** Information in Design and FM
Standard and special specifications are set in the duct System or the piping system.
BIM utilization in MEP design – Schematic design phase:

- Architecture
- Structure
- MEP
- Family
- Algorithmic design
- Main duct & pipe sizing via. Duct & pipe connector
- Simulation
- Space pec sheet
- Heat load calc
- Color-coded diagram
- Equipment table
- Panelboards list
- Energy saving calc
- Automated quantity survey
Automated MEP design via Dynamo
Dynamo as a data coordination tool among spaces and elements

Instead of ducts and pipes, Dynamo can connect the parameters

Families which NIHONSEKKEI have provided in anticipation of Dynamo usage.

Heat load calculation software compatible with Revit
Description of Model Building

<Building Overview>
- Application: Office building
- Air-conditioning system: FCU + OHU, AHU
- Total area: 10,000m²

<Functions shown Today>
- Automatic FCU capacity selection
- Automatic louver size selection
- Automatic air volume connector
Automatic FCU Capacity Selection
Automated MEP design via Dynamo

space
cooling and heating load

mechanical equipment

equipment capacity

automatically choose the equipment capacity
Load calculation results are laid out in the space.

The number of indoor units set up in the room is counted.

Devices are changed to types matched to the capacity of each room.
Load calculation results are laid out in the space.

The number of indoor units set up in the room is counted.

Devices are changed to types matched to the capacity of each room.

Space (Room specification information)

Load calculation
HeatLoad Simulation

custom Revit MEP tools to calculate the heat load which meets the Japanese industry standards.

Collect levels, spaces, walls and room information automatically

Add information required for heat load calc

Calculation sheet based on Japanese industry standard

Send back the result to Revit

「STABRO for Revit」
Choosing the FCU automatically from heat load

Dynamo as a data coordination tool among spaces and elements

family (element information)  space (MEP information)

Families which NIHONSEKKEI have provided in anticipation of Dynamo usage.

Instead of ducts and pipes, Dynamo can connect the parameters

Heat load calculation software compatible with Revit

Change FCU families to proper capacity  Count the number Of FCU in each space  Heat load calculation
Series of Type

This family has series of Type embedded.
Automatic Louver Size Selection
automated MEP design via Dynamo

aggregate OA volume
aggregate air volume per each fan & grill

Transfer aggregated air volume information to family

mechanical equipment family

space

air volume summary

air volume
Equipment Design Automation using Dynamo

Space
(OA air volume)

Louver
(Duct terminal)
utilization of Dynamo as a information coordinate tool among space and families

space (OA volume)

Dynamo

grill & machine

DEMO MOVIE
“Outside air intake louver” family is selected from the air terminal (duct terminal) family.

Totaling the OA volume

Acquisition of the louver symbols of each space

Grouping of spaces with the same louver symbols
“Outside air intake louver” family is selected from the air terminal (duct terminal) family.

Acquisition of the louver symbols of each space

Totaling the OA volume

Grouping of spaces with the same louver symbols
Revit Data Hierarchy

- **Category**: Mechanical equipment
- **Family Type**: Fan coil unit _ Cassette type
- **Instance (element)**: Each of the FCU-2CK2 units set up

Since Revit families have a hierarchy, devices are operated at the appropriate hierarchical level.
“Outside air intake louver” family is selected from the air terminal (duct terminal) family.

Acquisition of the louver symbols of each space

Grouping of spaces with the same louver symbols

Totaling the OA volume
Colored Diagram

Louver OAG-5F-2
“Outside air intake louver” family is selected from the air terminal (duct terminal) family.

Acquisition of the louver symbols of each space

Totaling the OA volume

Grouping of spaces with the same louver symbols
Iteration using Python Script

All spaces in the building are searched and the space for each louver is stored in an array. Even if nodes are not sorted, processing can be performed by means such as Python.
“Outside air intake louver” family is selected from the air terminal (duct terminal) family.

Acquisition of the louver symbols of each space

Totaling the OA volume

Grouping of spaces with the same louver symbols
Creating a Family in which the Shape changes according to the Air Volume

W = OA air volume / H / Speed / Aperture ratio
Use of Ducts and Piping Connectors
Use of Ducts and Piping Connectors

Before
Use of Ducts and Piping Connectors

After

“Connector” that aggregates the air volume in the space are is set up at the duct end.

Air flow is totaled without drawing in the duct
Use of Ducts and Piping Connectors

Set Dynamo to Automatic

DEMO MOVIE
The functionality we’re showing today

What we do without ducts and pipes

- Automatical FCU selection
- Automatic Louver Size Selection
- Automatic air volume connector

What we do with ducts and pipes

- Automatically correct the piping size by referring to 『the size table』
- Automatical quantity survey
Automatically correct the piping size by referring to the size table
Automatically correct the piping size by referring to the size table.

Before correction

Load unit aggregation

Flow volume calculation

Piping size selection

After correction
Automatically correct the piping size by referring to 『the size table』

After

Before correction

After correction
Automated quantity survey utilizing element and space information
Various techniques must be devised to select the way of picking up information that meets quantity surveying standards.

A joint is not found, necessitating conversion to a straight pipe length.

Information needs to be found separately based on construction and heat insulation zones.

Various other approaches …
Automated Quantity Survey utilizing Element and Space information

You will enter the classification in spaces

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Main machine room</td>
<td>A</td>
<td>Exposed</td>
<td>1</td>
</tr>
<tr>
<td>Sub machine room</td>
<td>B</td>
<td>Hidden</td>
<td>2</td>
</tr>
<tr>
<td>Storage</td>
<td>C</td>
<td>Humid</td>
<td>3</td>
</tr>
<tr>
<td>Standard</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>outdoor</td>
<td>E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add information to space
Automated Quantity Survey utilizing Element and Space information

Standard and special specifications are set in the duct System or the piping system

<table>
<thead>
<tr>
<th>Type</th>
<th>category</th>
<th>subcategory</th>
<th>subject</th>
<th>air type</th>
<th>material</th>
<th>construction method</th>
<th>seal</th>
<th>paint</th>
<th>pressure</th>
<th>insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1201 Supply Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>SA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>1202 Return Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>RA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>1203 Outdoor Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>OA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>1204 Exhaust Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>EA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2201 Ventilation SA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>SA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2202 Ventilation RA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>RA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2203 Ventilation Air sending</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>OA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2204 Ventilation EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2205 Kitchen EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>hot&amp;humid</td>
<td>stainless angle flange</td>
<td>none</td>
<td>low</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2206 Humid EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>humid</td>
<td>stainless angle flange</td>
<td>none</td>
<td>low</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2207 Swimming pool EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>humid</td>
<td>Resin-coated steel angle flange</td>
<td>none</td>
<td>low</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2211 Bypass</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>Bypass</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>○</td>
</tr>
<tr>
<td>2221 Vent stack</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>DA</td>
<td>vent stack</td>
<td>Resin-coated steel angle flange</td>
<td>none</td>
<td>low</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2231 Pressure relief</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>pressure relief</td>
<td>standard</td>
<td>steel angle flange</td>
<td>none</td>
<td>high</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3201 Smoke Exhaust</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>Smoke Exhaust</td>
<td>standard</td>
<td>galvanized sheet angle flange</td>
<td>none</td>
<td>high</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Automated Quantity Survey utilizing Element and Space information

Information set in the Duct System

<table>
<thead>
<tr>
<th>Type</th>
<th>category</th>
<th>subcategory</th>
<th>subject</th>
<th>air type</th>
<th>material</th>
<th>construction method</th>
<th>seal</th>
<th>paint</th>
<th>pressure</th>
<th>insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1201 Supply Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>SA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>O</td>
</tr>
<tr>
<td>1202 Return Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>RA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>1203 Outdoor Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>OA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>O</td>
</tr>
<tr>
<td>1204 Exhaust Air</td>
<td>1 AC</td>
<td>(2) duct</td>
<td>EA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2201 Ventilation SA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>SA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>O</td>
</tr>
<tr>
<td>2202 Ventilation RA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>RA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2203 Ventilation Air sending</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>OA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>O</td>
</tr>
<tr>
<td>2204 Ventilation EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2205 Kitchen EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>hot&amp;humid</td>
<td>stainless</td>
<td>angle flange</td>
<td>O</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2206 Humid EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>humid</td>
<td>stainless</td>
<td>angle flange</td>
<td>O</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2207 Swimming pool EA</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>EA</td>
<td>humid</td>
<td>Resin-coated steel</td>
<td>angle flange</td>
<td>O</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2211 Bypass</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>Bypass</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>transverse flange duct method</td>
<td>-</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2221 Vent stack</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>DA</td>
<td>vent stack</td>
<td>Resin-coated steel</td>
<td>angle flange</td>
<td>O</td>
<td>none</td>
<td>low</td>
<td>-</td>
</tr>
<tr>
<td>2231 Pressure relief</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>pressure relief</td>
<td>standard</td>
<td>steel</td>
<td>angle flange</td>
<td>-</td>
<td>none</td>
<td>high</td>
<td>-</td>
</tr>
<tr>
<td>3201 Smoke Exhaust</td>
<td>2 ventilation</td>
<td>(2) duct</td>
<td>Smoke Exhaust</td>
<td>standard</td>
<td>galvanized sheet</td>
<td>angle flange</td>
<td>O</td>
<td>none</td>
<td>high</td>
<td>-</td>
</tr>
</tbody>
</table>
### Automated Quantity Survey utilizing Element and Space information

Example of Setting of Heat Insulation Exterior Painting Specifications for each Construction and Heat Insulation Zone

<table>
<thead>
<tr>
<th>Construction Classification</th>
<th>Type</th>
<th>Revit Space Information (Insulation)</th>
<th>Insulation Exterior</th>
<th>Standard Specification (Insulation)</th>
<th>Insulation Material</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Duct</td>
<td>indoor exposed</td>
<td>0120011 Supply Air</td>
<td>WC 3</td>
<td>galvanized steel</td>
<td>J12</td>
<td>glasswool</td>
</tr>
<tr>
<td></td>
<td>storage 4</td>
<td></td>
<td>indoor exposed a</td>
<td>glass wool</td>
<td>GW 50 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>standard 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machineroom / Storage</td>
<td>main machineroom 1</td>
<td></td>
<td>machine room b</td>
<td>aluminum glass cloth tape I1</td>
<td>glasswool</td>
<td>GW 25 mm</td>
</tr>
<tr>
<td></td>
<td>sub machineroom 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>storage 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plenum / Riser</td>
<td>WC 3</td>
<td></td>
<td>hidden c</td>
<td>aluminum glass cloth tape I1</td>
<td>glasswool</td>
<td>GW 25 mm</td>
</tr>
<tr>
<td></td>
<td>storage 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>standard 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor Exposed</td>
<td>standard 5</td>
<td></td>
<td>humid e</td>
<td>stainless K2</td>
<td>glasswool</td>
<td>GW 50 mm</td>
</tr>
<tr>
<td>(Balcony / Corridor)</td>
<td>rooftop 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>outdoor 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Automated Quantity Survey utilizing Element and Space information

Automatic creation of pick-up figure
Automated Quantity Survey utilizing Element and Space information

<table>
<thead>
<tr>
<th>Category</th>
<th>Space Property</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main machine room</td>
<td>Exposed</td>
<td>1</td>
</tr>
<tr>
<td>Sub machine room</td>
<td>Hidden</td>
<td>2</td>
</tr>
<tr>
<td>Storage</td>
<td>Humid</td>
<td>3</td>
</tr>
<tr>
<td>Standard</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>outdoor</td>
<td>E</td>
<td></td>
</tr>
</tbody>
</table>

separately pick up elements for each category and write in to the appropriate pick up table
Automated Quantity Survey utilizing Element and Space information

These pick-up table would be

<table>
<thead>
<tr>
<th>Pick up table</th>
<th>Quantity survey document</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ページ</td>
<td>1ページ</td>
</tr>
</tbody>
</table>

[Image of pick-up tables and quantity survey document]
Automated quantity survey utilizing element and space information

You can get the length of the pipes, separated by space boundary.
What we did by Dynamo and what we did by API coding

What we do without ducts and pipes

- Automatical FCU selection
- Automatic Louver Size Selection
- Automatic air volume connector

What we do with ducts and pipes

- Automatically correct the piping size by referring to 『the size table』
- Automatical quantity survey
What we did by Dynamo and what we did by API coding

What we do without ducts and pipes

- Automatical FCU selection
- Automatic Louver Size Selection
- Automatic air volume connector

What we do with ducts and pipes

- Automatically correct the piping size by referring to the size table
- Automatical quantity survey
The workflow revolution derived from Dynamo
MEP workflow in Japan

<table>
<thead>
<tr>
<th>Concept</th>
<th>Schematic</th>
<th>Detail 1</th>
<th>Detail 2</th>
<th>quantity survey</th>
<th>Construction Draw</th>
<th>Construction Fabrication</th>
<th>Operation</th>
<th>Renovation</th>
</tr>
</thead>
</table>

<Japan>

**MEP engineer**

**Revit MEP**

- Mass model
- Ducting, Piping (detail)
- Fabrication

There seems to be a gap of functionality here

Contractor
MEP workflow in Japan

<table>
<thead>
<tr>
<th>Concept</th>
<th>Schematic</th>
<th>Detail 1</th>
<th>Detail 2</th>
<th>quantity survey</th>
<th>Construction Draw</th>
<th>Construction Fabrication</th>
<th>Operation</th>
<th>Renovation</th>
</tr>
</thead>
</table>

<Japan>

MEP engineer

Revit MEP

Mass model

There seems to be a gap of functionality here

Contractor

Ducting, Piping (detail)

Fabrication
Concept Design
– First Half of Schematic Design
Concept Design– First Half of Schematic Design

Examples of simulation results expressed in 3D printer.

CFD of an aquarium

Autodesk PopUp Gallery
Second Half of Schematic Design
Second Half of Schematic Design

Room specifications are input into the space and used in equipment design.
Room specifications are input into the space and used in equipment design.

Automatic Louver Size Selection

Equipment assorted Color scheme
First Half of Detail Design
First Half of Detail Design

architecture
- plan
- Elevation
- section
- Ceiling plan

structure
- weight

electricity
- Motive power

Device specification, external dimensions, Motive power, weight, costs, Maintenance space etc..

Equipment list
Panel list
Energy saving calculation
(13)コンパクト形空気調和機は、消音チャンバー組込とする。

(7)電気集塵フィルタはNBS90%以上とし、スパーク対策品とする。

(19)ドレン接続用アダプターの材質は鋼製とする。

(16)ユニット形空気調和機のプレフィルターはパネル式とする。

(9)コンパクト形空気調和機の送風機は、電動機直動形とする。

(21)加湿状態点検用ランプは1φ100Vとする。
Second Half of Detail Design and Quantity Survey
Second half of Detail Design

Automatically correct the piping size by referring to "the size table"
Second half of Detail Design

「Rebro Link 2015」
Architecture/structure(released)

MEP (underconstruction)
Introduction of the Japanese MEP BIM Software `Rebro`
Quantity Survey

Machine room

Toilet

pick up table
Workflow revolution derived from Dynamo

2D/3DCAD

Architectural model
Structural model

① place "Space"

② main route
Main machine

③ apparatus · Equipment plot

④ ducting/piping

⑤ valve/damper
input

⑥ adjust drawing
Configure sheet & Tag

⑦ quantity survey

Revit

Rebro

Workflow revolution derived from Dynamo
The key means for efficient MEP design throughout the entire design phase

**<BIM utilization>**

- NASCA
  - structural analysis model
  - structural analysis with same file
- calculation sheet
- family

**2D/3DCAD**

- Architectural model
- Structural model

**Revit**

- Equipment space
- Shaft space
- Equipment Schedule Master data
- equipment schedule
- calculation sheet

**Rebro**

- Equipment assorted
- Color scheme
- Chose type automatically
- equipment space
- shaft space
- Air volume chart
- Energy saving calc
- aggregation automatically

**Equipment**

- Chose type automatically
- automatic
- Auto
- calc
- calculation
- Equipment space
- Shaft space
- Energy saving calc
- Equipment Schedule Master data
- Equipment assorted
- Color scheme

**<Benchmark>**

- Heat load calc (STABRO)
- specification table
- Master data
- Performance order diagram

**<drawing>**

- Duct layout
- Pipe layout
- Pluming layout
- WCdetail layout

**<quantity survey>**

- summery sheet
- Bill of quantity

**Revit**

- Automatic Quantity survey
- Pick up figure
- Pick up table
- Performance order diagram
- equipment schedule
- calculation sheet
- Energy saving calc
There seems to be a gap of functionality here.

It's about bidirectional connection with Fab-Detail MEP software. Not modelling everything in Revit.
Thank you for your attention