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A survey of automation technology for realising as-built models of services

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NRC-CNRC

From **Discovery**
to **Innovation...**

A survey of automation technology for realising as-built models of services

John Dickinson, Ajit Pardasani, Shafee
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Centre for Computer Assisted Construction
Technologies



National Research
Council Canada

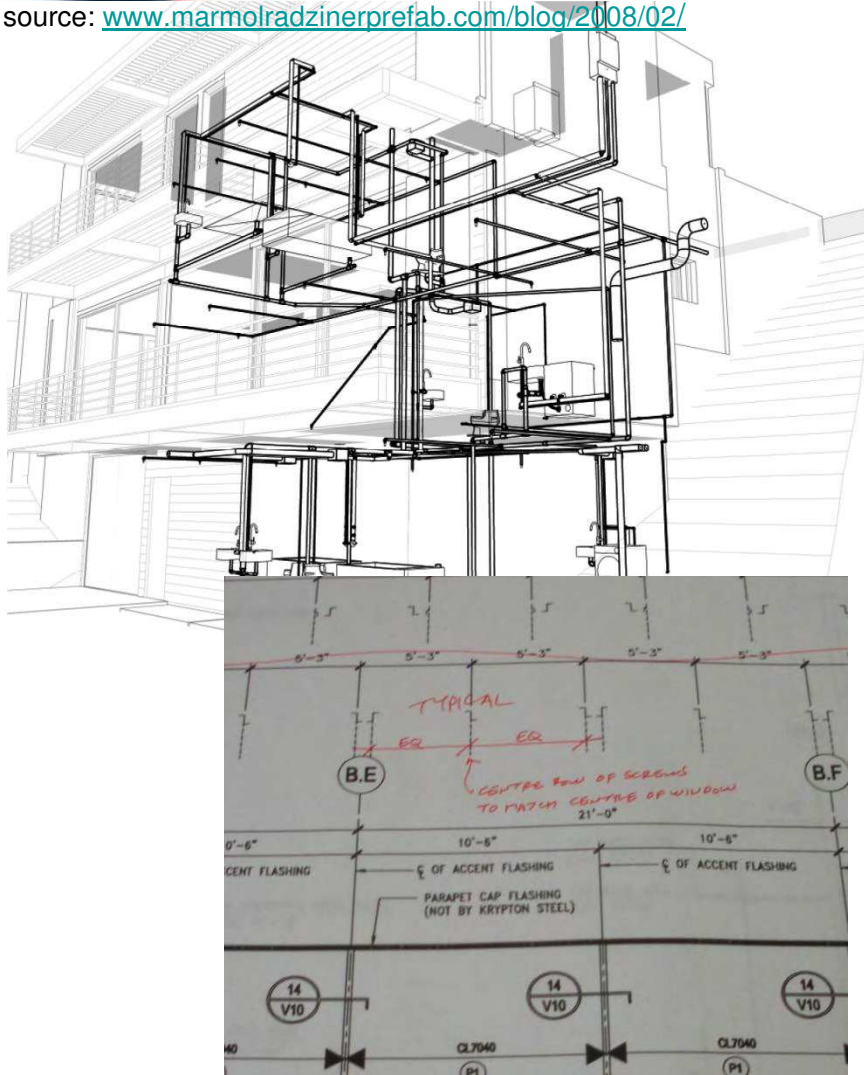
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de recherches Canada

Canada

- As-Built documentation
 - What?
 - Why?
- Role in IDS
- Current processes/technology
 - Manual
 - Video and photographic
 - Photogrammetry
 - Laser
- Future

What is As-Built Documentation?

source: www.marmolradzinerprefab.com/blog/2008/02/



Want:

- Digital model
- Match as-constructed
- Timely and complete

Get:

- On paper, handwritten notes
- Uncorrelated collection of redlined drawings
- End of project, incomplete

Why have As-Builts?

GC – Manage ongoing construction practices:

- Coordinate trades on-site
- Prevent field conflicts (\$0.5 to 2.0 sqft)
- Progress monitoring
- Scheduling/Planning
- Support inspection

Owner/operator – Manage building operations:

- Capture net result (design, change orders, field resolutions)
- Seed FM applications
- Basis for renovations & retrofits
- Data for maintenance contractors
- Commercial apps.

Role in IDS

“minimize structural and process inefficiencies and to enhance the value delivered during design, build, and operation”

Integrated Data and Information Element

- Currently expensive and difficult during construction
- Often 1-off service provided by consultants, contractors

Our focus: MEP services



- Limited number of measurements
- Slow and manually intensive
- Not timely
- Advanced solutions:
 - Tracked pointer
 - Link with design docs



Video and Photographic

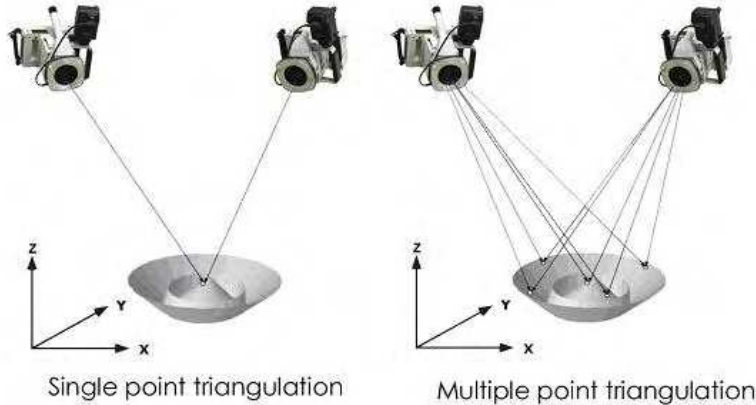


- Time-lapse or video cheap and easy to implement
- Chronological
- Timely, remote access

- Simple capture of changes with digital cameras
- Manual link to docs

- No spatial data

Photogrammetry



- Stereo cameras or multiple images
- Fast, cheap
- Extraction of 3D data possible
 - Camera positions, matched features, image quality
- Correlation with design limited by machine recognition of objects





MS Photosynth

- Automatically match image similarities
- Estimate relative camera position
- Automatically place images

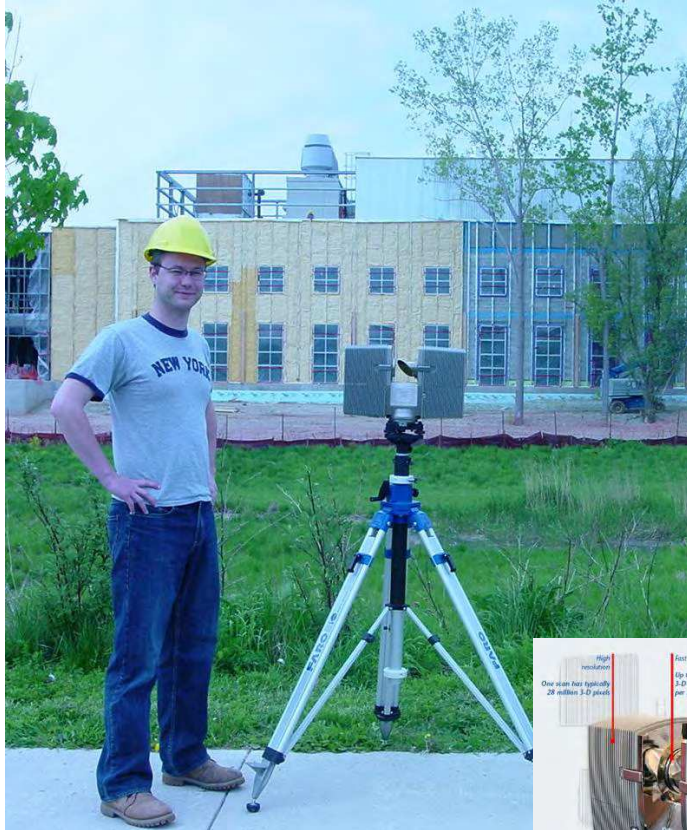
Autodesk ImageModeler

- Manual selection matching points in multiple images
- Add geometric constraints
- Snap primitives to 3D space
- 3D model



Photomodel of Saint-Jean cloister, Chartreuse de Villeneuve-lez-Auignon. Image: Livio De Luca

Laser



- Very accurate 3D data
- Manual model relationships
 - Measurement extraction
 - Element identification
 - Overlay scan data on models
- Still expensive, specialised
- Ongoing research matching scans to faceted models

Have:

- Digital data capture
 - camera, laser
- Portable computation tools
- Remote access electronic project documents
- Semantic knowledge of MEP elements

Need: Automation

- Superposition images on VR models or vice versa
- Correlation as-built to as-designed, schedule, ...

Approaches:

- Image recognition, tagging, RFID, GPS, CBIR
- Calibrated cameras

Questions / Comments



Questions / Comments

