

NRC Publications Archive Archives des publications du CNRC

Location tracking of prefabricated construction assemblies

Pardasani, A.; Vantorre, L.; Dickinson, J. K.; Thomas, J. R.

This publication could be one of several versions: author's original, accepted manuscript or the publisher's version. /
La version de cette publication peut être l'une des suivantes : la version prépublication de l'auteur, la version acceptée du manuscrit ou la version de l'éditeur.

Publisher's version / Version de l'éditeur:

CIB IDS 2009: Improving Construction and Use through Integrated Design Solutions [Proceedings], pp. 1-12, 2009-06-10

NRC Publications Archive Record / Notice des Archives des publications du CNRC :

<https://nrc-publications.canada.ca/eng/view/object/?id=f0380dee-040c-49c8-ad0a-c5c309de3b4f>

<https://publications-cnrc.canada.ca/fra/voir/objet/?id=f0380dee-040c-49c8-ad0a-c5c309de3b4f>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at

<https://nrc-publications.canada.ca/eng/copyright>

READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site

<https://publications-cnrc.canada.ca/fra/droits>

LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

Questions? Contact the NRC Publications Archive team at

PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the first page of the publication for their contact information.

Vous avez des questions? Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.



NRC-CNRC

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

Location Tracking of Prefabricated Construction Assemblies

Ajit Pardasani, Laurent Vantorre, John Dickinson,
Russ Thomas

Centre for Computer-Assisted Construction
Technologies



National Research
Council Canada

Conseil national
de recherches Canada

Canada

- Location Tracking
 - What & Why?
- Integrated Tracking Tool
 - System Architecture
 - Functionality & UI
- Role in IDS
- Ongoing & Future

Canadian Statistics (2006)

- 1 of 16 workers in the construction industry
- Over 260,000 firms
 - over 65,000 in residential construction
 - 150,000 in trade contracting industry
- Average construction firm is quite small
 - residential sector, ~90% of firms <5 employees
 - non-residential sector, almost 70% <5 employees

- GC, owner and operator were open to observers
- Characteristic of bulk of CAN construction
- Smaller project (\$10m)
- Multiple low-tech firms



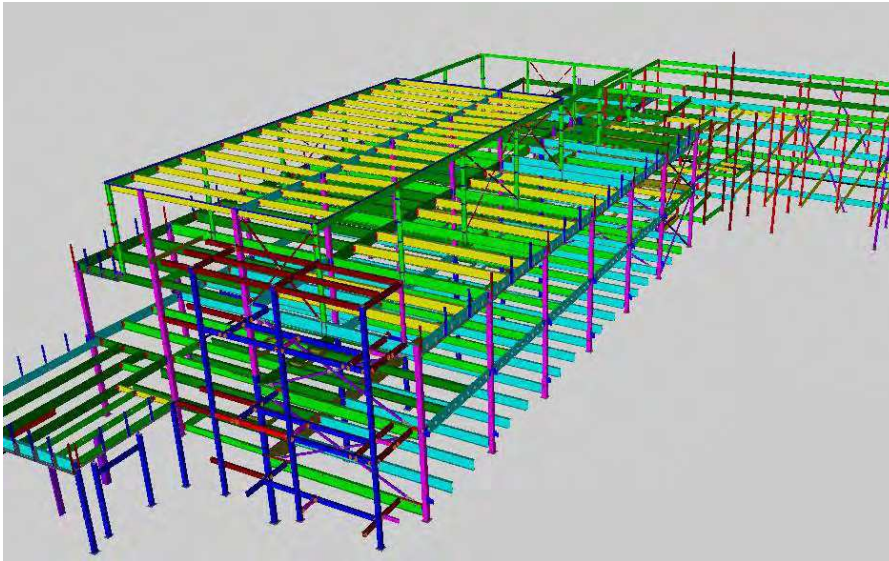
Observations

- Materials hard to locate even in small yards
- Memory and manual paper-based
- Offer: **location & status** of material anytime
- Using technology already on-site



Pilot study tracking structural steel

Partners



**UWO Research Park - 900 Collip Circle
(Owner)**

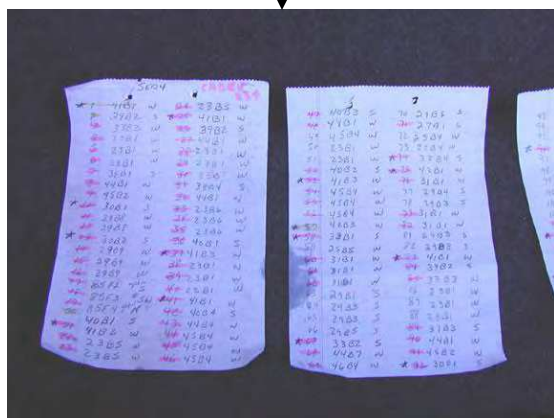


**Spencer Steel Ltd.
(Fabricator)**

Handling of Structural Steel at Site



1. Unload and Shakeout



2. Erection Sequence



3. Locate



4. Assemble

Identification: Current Practice

Piece Marks:

- Hand painted
- Printed tags
- Metal tags
- Bar codes (new)

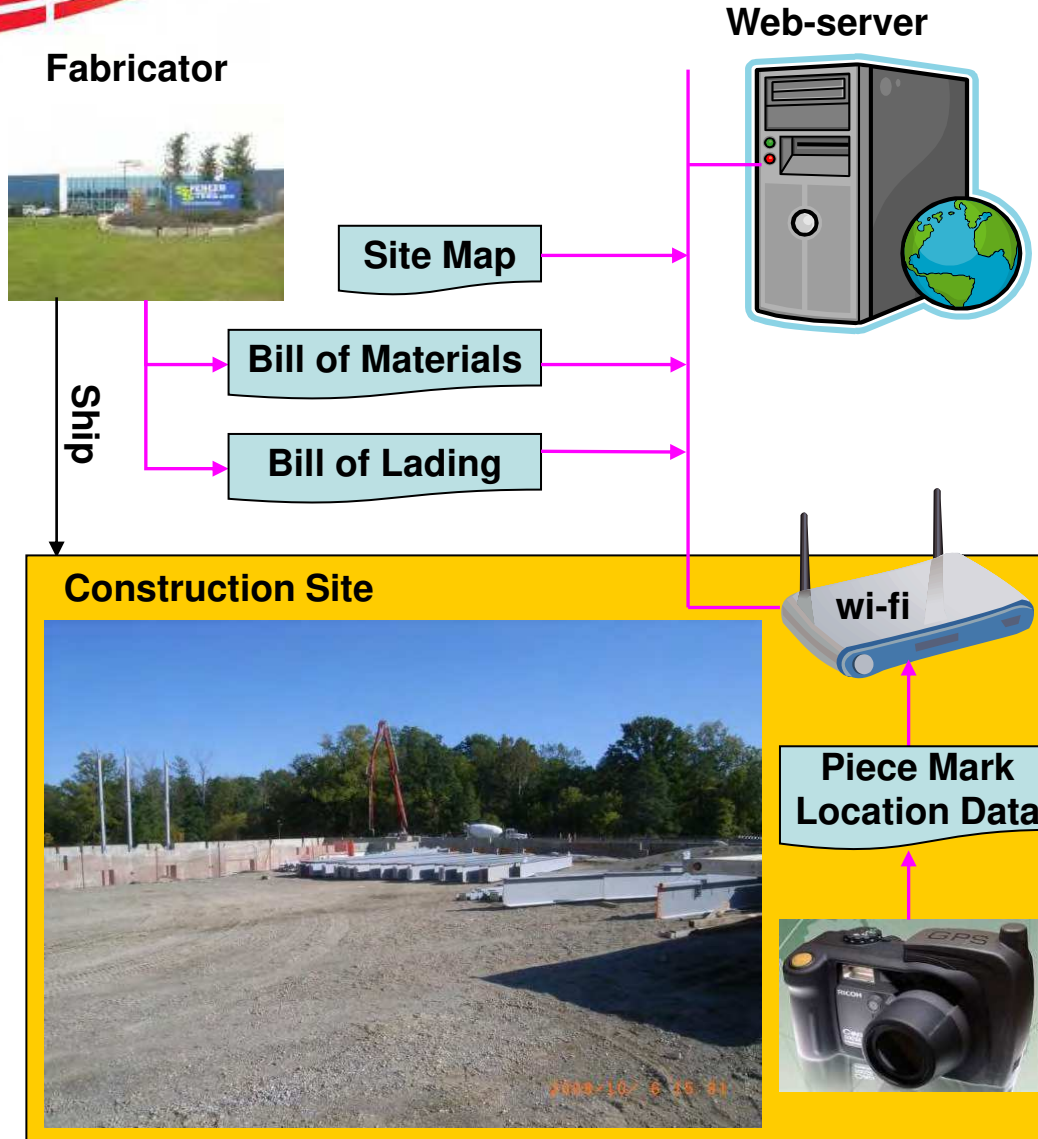


Friendly to current
practices.



System Architecture

Web-based prototype developed



Functionality & UI

- Browser accessible
- Shows piece location on a map or a land survey
- Notes if piece on trailer
- Capable of generating quantities payable

Position - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.steeltrack.dreamhosters.com/index.php

Most Visited Getting Started Latest Headlines Customize Links Et les jeux web? - Foru...

Microsoft Outlook Web Access Tutorial PHP - Utilisation des S... Position steeltrack - FireFTP

Clear Data Load Data

Tracking of structural steel at 900 Collip circle

Mark	Qty	Qty on BOM	Weight	Function
11b5	1	2	39	Misc
11b6	1	1	1076	Beam
11b7	1	1	46	Beam
12b1	1	1	65	Beam
12b2	1	2	97	Beam
13b1	1	1	813	Beam
13b2	1	3	130	Beam
13b3	1	1	844	Beam
13b4	2	2	2616	Beam
13b5	3	3	3516	Beam
13b6	3	3	2618	Beam
13b7	2	2	2616	Beam
14b1	1	1	678	Beam
14b2	1	1	435	Beam
14b3	2	1	435	Beam
14b4	2	2	1945	Beam
14b5	2	2	1562	Beam
14b6	1	2	1564	Beam
14b7	1	1	1728	Beam
15b1	1	2	697	Beam
15b2	1	2	716	Beam
16b2	2	2	1350	Beam
16b3	1	1	1350	Beam
17b1	1	1	1561	Beam
17b2	1	2	1366	Beam
17b3	1	1	1366	Beam
36a3	2	3	49	Misc
39b1	1	1	1421	Beam
39b2	1	1	2554	Beam
47b1	1	2	285	Beam
47b2	1	1	215	Beam

Satellite Zoom 19 Piece Mark Clear Locate info box Map Location? Local Data

Plan Satellite Mode Architect Aerial

Google

Mark 13b6 Latitude Longitude

Do you want to delete? ☒ No ☐ Yes Delete

Done

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

Integrated Data and Information Element

- Active application during construction
→ address construction process inefficiencies
- Current solutions expensive and overly complex for smaller jobs
- Subsequent steps need to integrate tool with design, manufacturing, quality control and materials handling

Economic Benefits of Materials Tracking

- Workers can waste upto 1/3rd of their time searching
- Case study on two similar projects:
 - Manual vs. Automated Search
 - Search Time: 36.8 minutes vs. 4.6 minutes
 - Parts not immediately found: 10% vs. 0.54%
- Projected savings equivalent to \$1 million by tracking precast concrete assemblies using RFIDs on a 1 billion dollar New Jersey's Meadowland pro-football stadium.

Reference: Utilizing Radio Frequency Identification on Precast Concrete Components – Supplier's Perspective by Burcu Akinci, et. al. Carnegie Mellon University

Data-acquisition:

- Bar-code, RFID
- Outside or inside tracking
- Smart phone software version
- Other materials

Integration:

- Supply-chain
- Just-in-time delivery for metropolitan sites
- Scheduling and planning
- Equipment operations (e.g. crane)

Long-term: Into as-built and facilities management

Tracking Pre-cast Concrete Components



Precast Concrete Case Study

- 60 acres yard
- Barcodes to identify each piece
- Some pieces made months in advance – similar pieces are cast at same time.
- 10 workers at the storage area
- Time to locate a component: 30 min to 1 hr.
- When a piece is not found, it is cast again
- Annual penalties for late deliveries: \$60,000

Newer Prototype Views

