BIM for Infrastructure
Bio:

Charles Hixon
Considered an expert on 3D database driven applications for planning and design, Mr. Hixon has authored the synthesis study; “Visualization for Project Development” for the National Cooperative Highway Research Program (NCHRP). He is also a founding Board Member for the Transportation Research Board (TRB) Committee on Visualization and Co-Chairs the Virtual Design and Construction (VDC) and Civil Integrated Management (CIM) Sub-committee.
chixon@edge-gts.com
Why the need for BIM technologies?
Why the need for BIM/Design Technology?

Exponential Growth & How to Manage it.

World population  2014 – 7.2B   2050 – 9.6B – 11B (projected)

3.3B more people in 35yrs, in which 70% will live in urban/city areas

To house 3.3B people, you will need

100 people/building = 33M buildings or 2,600 buildings/day
250 people/ building = 13.2M buildings or 1,000 buildings/day
500 people/building = 6.6M buildings or 500 buildings/day
Design Initiatives

Design Technologies (DT)

BIM use expected to surge in 2017 (Dodge Data Analytics, Jan 2017)

3D, 4D & 5D Design Processes
- Civil Integrated Management (CIM)
- Virtual Design and Construction (VDC)
- Building Information Modeling (BIM)
- Bridge Information Modeling (BrIM)

Emerging Technologies – Drones, AMG, Lidar
Application Development

Design Technologies

Trends

The Internet of Things – SaaS applications
Web Streaming – video
Mobile Applications – in-the-field

Platform companies, owning the front-end.
Application Development

The Push for DT

Construction Leading the Way

Financial Gain – Construction Cost Savings

Tool for Trade Coordination – improves the process

Improved Bidding – Phasing to Materials

Visualization

Benefits

- Coordination and Collaboration
- Conflict Detection and Risk Mitigation
- Faster Drafting without loss of Cost and Quality
- Easy Maintenance of Building Lifecycle
- High Level of Customization and Flexibility
- Optimization of Schedule and Cost

Application Development

Implementing Design Tech

Civil Integrated Management - CIM

Where do you go for CIM Guidance?

Google CIM, then BIM

https://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/3D.cfm
Application Development

Implementing Design Tech

Industry Best Practices

BIM Forum – sponsored by the AGC & AIA

Google CIM the BIM

http://bimforum.org/
https://network.aia.org/technologyinarchitecturalpractice/home/bimstandards
Application Development
Implementing Design Tech

The BIMx Plan
Plan Based on Best Practices
Penn State BIM Execution Planning

http://bim.psu.edu/
# Application Development

## Implementing Design Tech

### The BIMx Plan - *Project* Specific Standards and Guidelines

#### Level of Development/Detail (LOD)

<table>
<thead>
<tr>
<th>LEVEL of DEVELOPMENT</th>
<th>LOD 100</th>
<th>LOD 200</th>
<th>LOD 300</th>
<th>LOD 400</th>
<th>LOD 500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concept (Presentation)</strong></td>
<td><strong>Office Chair</strong></td>
<td><strong>Arms, Wheels</strong></td>
<td><strong>WIDTH</strong>: 700</td>
<td><strong>DEPTH</strong>: 450</td>
<td><strong>HEIGHT</strong>: 1100</td>
</tr>
<tr>
<td><strong>Design Development</strong></td>
<td><strong>Office Chair</strong></td>
<td><strong>Arms, Wheels</strong></td>
<td><strong>WIDTH</strong>: 700</td>
<td><strong>DEPTH</strong>: 450</td>
<td><strong>HEIGHT</strong>: 1100</td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td><strong>Office Chair</strong></td>
<td><strong>Arms, Wheels</strong></td>
<td><strong>WIDTH</strong>: 685</td>
<td><strong>DEPTH</strong>: 430</td>
<td><strong>HEIGHT</strong>: 1085</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td><strong>Office Chair</strong></td>
<td><strong>Arms, Wheels</strong></td>
<td><strong>WIDTH</strong>: 685</td>
<td><strong>DEPTH</strong>: 430</td>
<td><strong>HEIGHT</strong>: 1085</td>
</tr>
<tr>
<td><strong>Facilities Management</strong></td>
<td><strong>Office Chair</strong></td>
<td><strong>Arms, Wheels</strong></td>
<td><strong>WIDTH</strong>: 685</td>
<td><strong>DEPTH</strong>: 430</td>
<td><strong>HEIGHT</strong>: 1085</td>
</tr>
</tbody>
</table>

*Only data in red is useable.*

---

**AIA® Document E202™ – 2008**

*Building Information Modeling Protocol Exhibit*

This Exhibit is incorporated into the accompanying agreement (the “Agreement”) dated the day of in the year.

(In words, indicate day, month and year.)

**BETWEEN:**

(Name, address and contact information, including electronic addresses)

This document is intended for use in the design and construction of the project. It is not intended for use in any other capacity.

© 2013 practicalBIM.net
Application Development

Implementing Design Tech

The BIMx Plan - *Project* Specific Standards and Guidelines

Applications – select the tools that work best for the project

Version Numbers

Translation Paths
Application Development

Implementing Design Tech

The BIMx Plan - *Project* Specific Standards and Guidelines

Design Team – define roles & responsibilities

<table>
<thead>
<tr>
<th>Role/Discipline</th>
<th>Organization</th>
<th>Contact Name(s)</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Technology Coord.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architectural Lead</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Phase / Milestone</th>
<th>Date</th>
<th>Required Attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTXP Kick-off Meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTXP Meeting – (Weekly)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIM Coordination Meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTXP QC Meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;user defined&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Phase / Milestone</th>
<th>Estimated Start Date</th>
<th>Estimated Completion Date</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions Documentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schematic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIM Coordination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract Document</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Application Development

Implementing Design Tech

The BIMx Plan - *Project* Specific Standards and Guidelines

Data Storage - identify capacity needs

Data Sharing – who needs access?

Bandwidth – multi-locations, application constraints
Application Development

Implementing Design Tech

Defined Deliverables

4D Scheduling – detail not as important
5D Design Cost Analysis
Collision Detection
CIM Projects

Implementing Design Tech

CIM Project Study

Kew Gardens Interchange - NYSDOT

Amendment 7 – D263208
ITEM 625.1001 11 - 3D CADD MODEL

DESCRIPTION
This work shall consist of utilizing the 3D CADD Model furnished with the contract documents for updating on a monthly basis and for providing 4D and 5D animations of work planned and completed in correlation to the CPM schedule and including associated payments during construction through completion, and, provide an updated and complete 3D CADD Model as an ‘As-Built’ record. The 3D CADD Model ‘As-Built’ shall include any underground utilities installed and any existing underground utilities encountered during construction as part of the contract, in accordance with the contract documents and as directed by the Engineer.

Identifying Data Frameworks and Governance for Establishing Future Civil Integrated Management (CIM) Standards

Solicitation Number: DTFH6117R00032
https://www.fbo.gov/index?s=opportunity&mode=form&id=eb5dd4bd1374a0350b5979c907e4d453&tab=core&_cview=1
Proposals are due 7/12/17.

The objective of this research effort will be the identification of existing, applicable, digital transportation life cycle data standards and, using these findings, the development of a conceptual data standard, a data governance approach, and an implementation plan. The project will synthesize and analyze national/international information on data interoperability standards and governance in the context of CIM. This project will involve performing a national/international synthesis of data collection and governance standards that have applicability to CIM. Once this is complete, the findings will be examined for commonalities and, especially, congruence with the data needs of the CIM framework. Products will then be developed with the goal of providing leadership toward future efforts in the development of CIM data management, sharing (or interoperability) and governance standards.
CIM Projects

Current Initiatives for CIM

Leveraging Augmented Reality for Highway Construction

Solicitation Number: DTFH6117R00022
https://www.fbo.gov/index?s=opportunity&mode=form&id=622fdaa0ac6ab903704afeb37cd97f7c&tab=core&cview=0

Proposals are due 7/20/17.

FHWA is initiating this study “Leveraging Augmented Reality (AR) for Highway Construction” to identify the availability, accessibility, and reliability of using AR for construction inspection and review, quality assurance, training, and improved project management through real-time information in a real world environment. AR has a potential to reduce the construction cost, improve the delivery time, and assist with overall management of a construction project. The study shall document potential advantages, limitations, shortcomings, and cost of using AR as well as issues which could represent new challenges for the future. The study shall also document methodologies used to store, retrieve, and archive big data information obtained through the use of AR and how it is integrated into highway agency business processes.
Current Initiatives for CIM

Collection, Analysis, and Interpretation of Data Obtained from Unmanned Aerial Systems (UAS) for Bridges

Solicitation Number: DTFH6117R00036

https://www.fbo.gov/index?s=opportunity&mode=form&id=fac715e9c11f7e77e566dabb79460f15&tab=core&_cview=1

Proposals Due: August 9, 2017

FHWA is initiating this study to investigate the use of Unmanned Aerial Systems (UAS) for bridge inspection. The project shall document the state of data collection sensors being used, and include an assessment of quality level needed to perform a satisfactory inspection. It is also of interest to look at return on investment in using this technology with respect to the type of data collected and type of actionable information provided to the owners for bridge inspection. This study shall identify the type, quality, and quantity of information needed by bridge owners to assure the integrity of the bridge during construction and subsequent annual inspections thereafter and compare this to the availability of current UAS technologies. The project will result in best practice guidelines and shall also provide guidance on how the data is procured, analyzed, assessed, presented, and stored for various users (managers, contractors, consultants, bridge owners, researchers, etc.).

There will be no UAS purchased directly or indirectly via this contract.
CIM Projects

Lessons Learned

Develop Best Practices
Each Project is Unique
All DT are viable – there is not one solution
Develop the CIMx Plan
Acknowledge the Technology Gaps
Increased communication
CIM Projects

The Future

**Design Technology Already Here**

- Continue to develop standards
- Centralized location for best practices
- Document results
Application Development

The Future

ABJ95 CIM Sub-Committee Goals

Refine focus – currently too broad

More RNS’s

Case Studies

Guide to Data and Information Sharing Workflows Across the Life Cycle of Transportation Assets

May 12, 2016

David Jeong, PhD., Chuck Jahren, PhD., Jennifer Shane, PhD., Kristen Cetin, PhD.

Tuyen Le (GRA)

NCHRP 10-96: GUIDE FOR CIM AT DOTs

OBJECTIVE, METHODOLOGY, AND GUIDEBOOK DEVELOPMENT

Bharathwaj Sankaran
Ph.D. Candidate (UT Austin)

ABJ 95 CIM Subcommittee
BIM for Infrastructure

Thank You!

Charles Hixon
chixon@edge-gts.com