Bridging Demand-Supply Gap

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Geospatial Media and Communications
Major world trends driving change in construction
Global infrastructure + building spend

Buildings (and infrastructure) cost too much

Patrick MacLeamy
Historical Productivity in Construction

Construction productivity has stagnated.

Productivity gains reduce cost of infrastructure

3 LABOUR PRODUCTIVITY IMPROVEMENT COULD RESULT IN 20% REDUCTION IN INFRASTRUCTURE SPEND

Percentage points reduction potential on overall infrastructure spend

Buildings and infrastructure cost too much

1 Estimates from CGLA for 2010-2030 global investments, adjusted for an assumed 15% investment in telecom
2 HOKKS estimates for roads, assumed for all transport classes; EU-KLEMS data for U.S. in 2007 as proxy for water, energy, and telecom

SOURCE: McKinsey Global Institute
Environmental Impact of Buildings

Buildings are responsible for a third of the world’s emissions.
Government mandates and incentives driving change
Global BIM Mandates/Incentives

- **United States**
  - 2006 GSA mandated BIM for new Federal buildings

- **Singapore**
  - From 2015 BIM mandated for building permits for buildings greater that 5000 sq meters

- **United kingdom**
  - BIM mandated for public projects from 2016

- **Norway**
  - 2010 BIM adopted for government projects

- **Denmark**
  - State agencies require BIM for their projects

- **Finland**
  - 2007 State Property Services Agency requires BIM for its projects

- **Hong Kong**
  - Housing Authority requires BIM for all new projects from 2014

- **South Korea**
  - Public Procurement Service made BIM compulsory for all projects over S$50 million and for all public sector projects by 2016
UK motivation: Reduce costs, lower emissions, and export development

<table>
<thead>
<tr>
<th>BIM Drivers – HMG Construction 2025...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower costs</strong></td>
</tr>
<tr>
<td>33% reduction in the initial cost of construction and the whole life cost of built assets</td>
</tr>
<tr>
<td><strong>Faster delivery</strong></td>
</tr>
<tr>
<td>50% reduction in the overall time, from inception to completion, for newbuild and refurbished assets</td>
</tr>
<tr>
<td><strong>Lower emissions</strong></td>
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<tr>
<td>50% reduction in greenhouse gas emissions in the built environment</td>
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<tr>
<td><strong>Improvement in exports</strong></td>
</tr>
<tr>
<td>50% reduction in the trade gap between total exports and total imports for construction products and materials</td>
</tr>
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</table>
UK BIM Level 2 by 2016

Source: Mark Bew and Mervyn Richards
UK BIM Level 2 Standards

- BIM Level 2 Standards, developed as a home-grown effort in the UK, have been submitted to ISO.
- BIM Level 3 Standards will be developed with international standards organizations including ISO, buildingSMART, and OGC.
UK BIM Level 3 – Integrated full lifecycle model

Nick Tune, BRE
Mandated standards: INSPIRE

INSPIRE
Infrastructure for Spatial Information in Europe

Zero Energy Buildings

- EU “nearly zero energy” buildings - European Commission has mandated 2020/2021 when all new buildings have to be designed to be “nearly zero energy”. For public buildings, the deadline is by 2018/2019.

- Japan “zero emissions buildings” - All new public buildings must be designed to be “zero emissions” by 2030.


- California "zero net energy" California Public Utilities Commission (CPUC) mandated all new residential construction in California must be ZNE by 2020, all new commercial construction must be ZNE by 2030, and 50% of existing commercial buildings must be retrofit to ZNE by 2030.

- According to a report from Navigant Research, global zero energy buildings revenue is expected to grow from $629.3 million in 2014 to $1.4 trillion by 2035.
Industry response to demand
BIM Adoption in Finland

BIM Market Transition in Finland

2014

Expected market situation in 5-10 years

Early1990’s

Early market

Forerunners (Innovators)

Visionaries (Early Adopters)

Pragmatists (Early Majority)

Conservatives (Late Majority)

Skeptics (Laggards)

Saturation
Finland: BIM adoption by sector

Use of BIM in Building Projects

The overall adoption of BIM is 20-30% of the volume

- Public Sector:
  - Out of Scope: 40%
  - In Use: 20%
  - Near Future: 20%
  - Long Term: 20%

- Private Sector:
  - No Plans: 80%
  - In Use: 10%
  - Near Future: 10%

- Design:
  - No Plans: 6%
  - In 5 years: 27%
  - In Use: 67%

- Construction:
  - No Plans: 50%
  - Large: 40%
  - Small: 10%

Figures are based on a study conducted in 2013 by buildingSMART Finland and Building Information Foundation RTS.
BIM Market In Finland

BIM - Where are we now?

BIM in Buildings
- BIM is coming into mainstream
- Heterogeneous market with thousands of actors
- IFC is a standard requirement
- Mainly used in Design and Construction
- Not adapted in Operations and Maintenance

BIM in Infra Structures
- Dozens of pilot projects
- Only a few large Clients
- InfraModel3 (LandXML) is required by the large Clients from May 2014
- Scope is wide – from inventories to maintenance
BIM Adoption in U.S.

BIM Adoption: 2007, 2009 and 2012

- Overall Adoption of BIM has increased from 17% in 2007 to 71% in 2012
  - 45% growth over the last 3 years; Over 400% growth over last 5 years

[Diagram showing BIM adoption percentages for 2007, 2009, and 2012]
Laser scanning is transforming construction
Existing buildings

- “Scan to BIM” model is the starting point for energy performance modeling and redesign

- Private sector sees major business opportunity in energy performance modeling for existing buildings.
Energy performance analysis – BIM and geospatial
BIM for Infrastructure

- In 2009 16% of owners, contractors, and A/E firms reported high/very high use of BIM for infrastructure on projects.

- In 2013 52% reported high/very high use of BIM for infrastructure.
“Converged design”
Imagery + geospatial + BIM + 3D

Enables
- Planning
- Right of way
- Sustainable design
- Construction monitoring
- Accurate as-builts
## 5D for financial control

**SF Presidio Parkway Project**

### Schedule

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<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tbody>
<tr>
<td>Total</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
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**Cost Breakdown**

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**Date:** 12/15/2008

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**Autodesk**

Between The Poles
BIM and GPS enable machine control

- McAninch: Reduce fuel consumption by 43%, GHG emissions
- RCPS:
  - Fine grading 214 passes down to 60 – 1 mile of road
  - Providing our clients with a more accurate product – base course grade checking 45% accurate vs 98%

“Traditional processes of paper plans, stakeout sheets and grade stakes used to take up to a week to implement. Now with GPS machine control and 3D models from designers, that same size project can take hours“

- Tim Tometich, GPS division manager, McAninch Corporation
Autonomous vehicles

- Google 10+ vehicle fleet
- Driven a million miles without a driver

“Autonomous vehicles will be data hungry. Already cars are using real-time sensing of their location and what is around them. But I cannot imagine that they would not benefit from knowing about the highway infrastructure.”
Current construction project lifecycle

- Paper Plans
- Design
- Basemap
- Project Development Surveys
- Construction Staking
- New Projects
- Existing Sites
- As-Built Plans

100%
Future construction project lifecycle

Disruptive!
Parsons Brinckerhoff’s software quiver

**Geospatial**
- ESRI
- Global Mapper
- Infraworks (Autodesk Infrastructure Modeler)

**CADD**
- Microstation InRoads
- AutoCAD/Civil 3D
- Solidworks

**Visualization**
- 3ds Max
- Sketchup (Trimble)
- Realtime - UDK, Unity

**Collaboration/4D**
- Navisworks

LiDAR, surveying, image processing, structural engineering, etc
Convergence is the future

- Urbanization and environmental challenges mean massive investment in infrastructure
  - more to do, fewer qualified people to do it
  - less government money
  - productivity -> investment in technology

- Increased private investment is changing how we design, build, and operate infrastructure
  - driving BIM + geospatial + 3D
  - intelligent models of urban infrastructure

- Transforming construction
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http://geospatial.blogs.com