Growth of mega-cities (>10 million)

- By 2020, more than 30 mega-cities in the now less-developed world. By 2050, nearly 60 such cities.

- Increased population creates need for more resources. World's electricity supply will need to triple by 2050 to keep up with demand, necessitating nearly 10,000 GW of new generating capacity.

Source Massoud Amin, University of Minnesota
Environmental Impact of Buildings

U.S. Building Impacts:

- 12% water use
- 39% CO\(_2\) emissions
- 65% waste output
- 71% electricity consumption
Historical Productivity in Construction

Construction productivity
GVA per hour worked in 2007 PPP $

SOURCE: EUKLEMS; Associated General Contractors of America, 2011; U.S. Bureau of Labor Statistics
Productivity gains reduce cost of infrastructure

Productivity drives investment in technology

1. Estimates from CG/LA for 2010-2050 global investments, adjusted for an assumed 15% investment in telecom.
2. ROCKS 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
Laser scanning in construction
Laser Scanning to Models for ROW, Planning, Design, Construction and O&M
Model-based design (BIM)

BIM for infrastructure

Develop BIM Model - HVAC
Develop BIM Model - Plumbing and Drainage
Develop BIM Model - Electrical
Develop BIM Model - Fire Services
Develop BIM Model - Tower
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
Global BIM Adoption

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

- **Singapore**
  - 2008 BCA implements e-submission. Project teams can submit one BIM model for building permit application

- **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 to require 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
“Converged design”
Imagery + geospatial + BIM + 3D

Enables
- Planning
- Right of way
- Sustainable design
- Construction monitoring
- Accurate as-buils
Ann Kemp, Head of BIM, Atkins Global

“BIM and Geospatial are firmly inter-linked – and the advancement of BIM relies, in part, on integrating geospatial skills and technologies into BIM solutions.”
5D for financial control

SF Presidio Parkway Project

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%
Future construction project lifecycle

Disruptive!
New building electric power optimization

- Begin with an architect’s BIM model

- Extract a simplified BIM model that contains the key elements required for energy modeling
  - simplified walls and floors,
  - room bounding elements,
  - complete volumes, and
  - window frames and curtain walls.

- Export simplified BIM model as gbXML
Building performance analysis

- Thermal, lighting and airflow simulations by integrating BIM and geospatial information
  - Surrounding natural and man made structures
  - Local climatic conditions

- Analyze alternative options
  - Compute annual energy consumption, CO2 emissions, occupant comfort, light levels, airflow, and LEED certification level
  - Ontario Power Authority’s High Performance New Construction (HPNC) program pays $400 to $800 per kW saved over code
- 40% reduction in annual electric power bills achievable
Scan to BIM

Mollenhauer sees a major future business opportunity

- Has identified major business opportunity in energy performance modeling for existing buildings.

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

Mollenhauer (Los Angeles)
Energy performance analysis – BIM and geospatial
Annual smart city technology investment in Asia will quadruple to $11.3 billion by 2023 – Navigant Research

(Source: Navigant Research)
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 means 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