Focus

- Delivery and effective use of rich and complex technical content by mobile construction personnel
  - Using tools these personnel would commonly carry
  - Not restrict movement, accessibility, etc.
  - Maintain safety

Information technology landscape

- Server-based computing cycles, memory, and mass storage are very plentiful and infinitely scalable.
- High bandwidth wireless communications are affordable, readily available everywhere.
- Portable smart devices are readily available, affordable and well accepted for certain types of applications.
- Raw computing power, mass storage and memory of these portable devices, while somewhat limited today, it is continually improving.
Enabling technologies

- New computing form factors
  - Handheld, multipurpose
  - New user interface technologies and paradigms
  - Wireless

Enabling technologies

- Virtual reality

Enabling technologies

- Augmented reality
Marker-based Augmented Reality

Enabling technologies
- Digital paper

ProjectWise Dynamic Plot
Potential applications

- Location-based virtual reality
  - Provide portable VR capabilities to mobile users
    - Graphics + business data
    - Content relevant to user location
  - Standard mobile devices
    - Tablet PC, Smart phone, iPhone, iPad
    - Multiple uses beyond VR
    - Does not limit mobility or safety
  - Wireless connectivity
    - Wi-Fi, 3G, 4G
  - User interface appropriate for mobile user
    - Leverage new device capabilities
    - Touch screen, GPS, compass, inertial sensors
Location-based Virtual Reality

Potential applications

• Exposing the unseen with augmented reality
  – Superimpose the virtual over the real
    • Planned work
    • Hidden components
  – Perform digital queries on the real world

Exposing the unseen with Augmented Reality
Potential applications

• Immersive virtual reality in a construction trailer
  – Virtual reality CAVE’s provide a completely immersive virtual experience with many productive uses, BUT…
  • Very expensive
  • Fixed locations
  • Often fixed virtual environments
  – Can we get 80% of the experience for a fraction of the cost?
    • Modest hardware investment
    • Easily set up

Potential applications

• Paper – the new User Interface
  – Digital paper is real today
  • Digital capture of markups made on paper
  – What’s next?
    • Component query
    • Drawing provenance
    • Multimedia comments
    • 3D interaction
    • Integration with markup workflows
Major obstacles

- Transforming digital content for construction use
  - Misalignment in information requirements
    - Scope, structure, level of detail
  - Information requires transformation
    - Normalizing the information into a usable information model
    - Aggregating the information from multiple sources
    - Decomposing high level information to the necessary level of detail
    - Filtering information for a specific purpose or task
    - Re-organizing information to be consistent with a specific task or application
    - Delivering the information in the appropriate format for a given application
  - Today largely a manual process

- Accurate real-time positioning
  - No single technology provides solution
    - Comprehensive, accurate
  - Accuracy is critical for many applications
Major obstacles

- Transforming digital content for construction use
- Accurate real-time positioning
- User interfaces for construction
  - Downsizing the desktop is inadequate
  - Additional requirements for construction workers
    - They are mobile; cannot be encumbered and restrict their mobility
    - They work in a hazardous environment; distractions jeopardize their safety
    - The job site is temporary and must mobilize and demobilize quickly
    - They often work outdoors and other extreme environments wearing gloves and protective gear

---

Summary

- The construction industry is poised to realize potentially dramatic improvement in productivity, quality, and safety enabled by construction engineering and information technology
- Basic information technology platform and tools are in place
- The “killer apps” will depend on addressing 3 key issues:
  - Transforming design information into construction information
  - Accurate, real-time positioning
  - User interfaces appropriate for construction