

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Enabling BIM Based Automated Code Compliance Checking

Richard See
AEC/ST Conference
Anaheim – May 2008

SMARTcodes™
INTERNATIONAL CODE COUNCIL

Purpose

To provide a view to the future of how building information models will be used as a basis for automating the process of determining compliance with building regulations, codes, standards, guidelines and other documents covering building design and construction

SMARTcodes™ INTERNATIONAL CODE COUNCIL

Expected Outcome

An understanding of how automated checking for compliance with codes, standards and other documents can be implemented using building information models

SMARTcodes™ INTERNATIONAL CODE COUNCIL

Building Information Model

A digital representation of physical and functional characteristics of a building (data)

- ... a shared knowledge source or database for intelligent information about a facility that can be maintained over time that
- ... stays with the building forever
- ... can be seamlessly used by all
- ... must follow an established standard if BIMs are to contain needed information in a usable format

SMARTcodes™ INTERNATIONAL CODE COUNCIL

Benefits

Value added in supporting the creation and maintenance of a building information model

“Earlier Decision Making Improves Ability To Control Costs” – Graphs courtesy of Patrick MacLeans, President of HOK and IAI International

Case Study

Case Study: General Motors

General Motors

When General Motors started planning its next generation of automobile factories in 2005, the company wanted to use BIM to help with the design and construction of its new plants. The company wanted to use BIM to help with the design and construction of its new plants. The company wanted to use BIM to help with the design and construction of its new plants.

- 27% faster to completion (9.5 versus 13 months)
- 25% reduction in key metrics for design and construction
- 4 change orders

1. Interoperability in the Construction Industry – McGraw Hill Construction, October 2007

SMARTcodes™ INTERNATIONAL CODE COUNCIL

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Questions to Think About

- How will your practice change in light of new technology that is creating a virtual office at the global level within which to design and construct buildings?
- Will you be prepared to connect to, use and apply as well as create building information models or BIMs?
- Will your future work be founded on a platform of data interoperability?
- Will you help reinvent traditional processes through such initiatives as integrated project delivery?

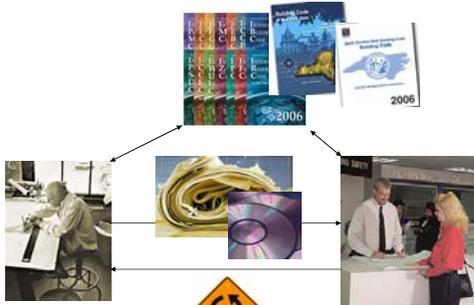
SMARTcodes™ INTERNATIONAL CODE COUNCIL

Questions to Think About

- Will you replace traditional paper and pencil processes that occur in series with virtual collaborative spiral processes?
- How will you capture and apply new IT initiatives in your practice and help more effectively address building regulatory compliance for your clients and other project team members?
- What if you could more effectively collaborate with other disciplines and interests in the design and construction process?

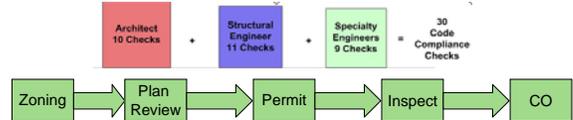
SMARTcodes™ INTERNATIONAL CODE COUNCIL

Code Compliance Today



SMARTcodes™ INTERNATIONAL CODE COUNCIL

Addressing Building Regulatory Compliance

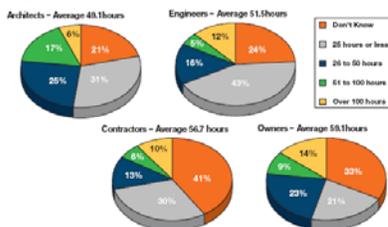


- Linear not circular
- Performed independently for each code not collectively
- Multiple agencies
- Difficulty sharing and collaborating on data
- Does not encourage collaboration with those regulated
- Increases probability of errors
- Inefficient use of time and manpower resources

SMARTcodes™ INTERNATIONAL CODE COUNCIL

Code Checking¹

- 85% of architects are interested in auto code checking
- Architects on average spend almost 50 hours per project on code checking with 11% spending over 100 hours



1. Interoperability in the Construction Industry McGraw Hill Construction, October 2007

SMARTcodes™ INTERNATIONAL CODE COUNCIL

Time Devoted to Code Checking

AEC

- 50 hours per discipline (architect, structural, MEP, contractor) – 200 hours total
- “25 to 30 hours minimum”
- “80 hours for a 60ksf elementary school” (architect)
- “3-4% of design time”
- “up to 1/3 of entire time for some projects”
- “Difficult to assess as clients change things often and then we must respond”
- “2 to 5 months in calendar time”

AHJ

- “15 hours for a 50ksf building”
- “15 to 90 days to approve a commercial building permit”

SMARTcodes™ INTERNATIONAL CODE COUNCIL

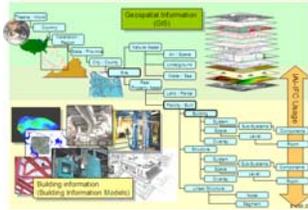
SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Vision

....the dynamic and seamless exchange, updating and maintenance of accurate, useful information on the built environment among all members of the building community throughout the lifecycle of a facility

....a smarter process for managing the lifecycle of a project to enhance public safety

....continual access to and sharing of information about a building



SMARTcodes INTERNATIONAL CODE COUNCIL

BIM Examples



SMARTcodes INTERNATIONAL CODE COUNCIL

Interoperability

Rules and Regulations Bldg, HSW, Planning

Knowledge databases Company External

Functional description Functions Calculations Requirements Constraints

Reuse Refurbishment Demolition Reconstruction

FM Renting, sale and use Maintenance Warranty

BIM software Arch, Struct, Eng Services Civ Eng, PPE

VRML Visualisation 3D models

Simulation Comfort heating cycle costs Light and sound Use Environmental impact Life expectancy

Communication of information between software applications and the ability for anyone to use and act on the information in a useful way

...the seamless and smarter sharing and exchanging of information via integrated technological solutions



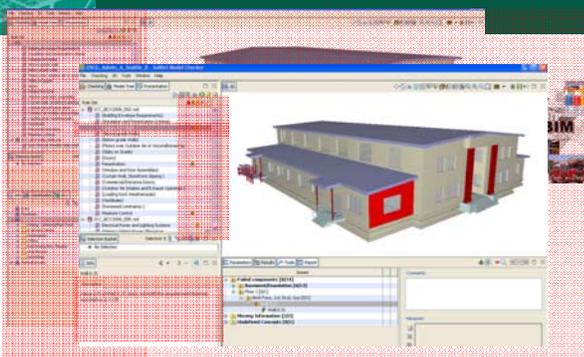
SMARTcodes INTERNATIONAL CODE COUNCIL

Questions to Think About

- What if building owners and developers provided incentives for or required BIMs?
- What if you could create a design and get instant feedback on code compliance?
- What if building regulatory agencies provided incentives for or required BIMs?
- What if you could get plans approved in a matter of days or hours?

SMARTcodes INTERNATIONAL CODE COUNCIL

Automated Code Compliance Checking



SMARTcodes INTERNATIONAL CODE COUNCIL

Code Compliance Tomorrow



SMARTcodes INTERNATIONAL CODE COUNCIL

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Building Regulatory Compliance Tomorrow

SMARTcodes
INTERNATIONAL CODE COUNCIL

Automated Code Checking

SMARTcodes
INTERNATIONAL CODE COUNCIL

Automated Code Checking

SMARTcodes
INTERNATIONAL CODE COUNCIL

ICC SMARTcodes Project Goal

Automate code compliance checking for the I-Codes and Federal, state and locally adopted versions of those codes

SMARTcodes
INTERNATIONAL CODE COUNCIL

Dictionary

- Terms
- Properties associated with each term
- Enumerations of properties
- Data type
- Units associated with each property

Insulation

- Type
- Material
- Density
- STC
- FS
- SDR
- Thickness
- R-value
- continuity

Model View Definition (MVD)

SMARTcodes
INTERNATIONAL CODE COUNCIL

Dictionary

✓ Energy, egress and access

SMARTcodes
INTERNATIONAL CODE COUNCIL

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Online Demonstration

- ✓ Availability of multiple BIMs for application and use in demonstrations and testing
- ✓ Launch of enhanced on-line demonstration of auto code check and manual code search



www.smartcodes.org

SMARTcodes INTERNATIONAL CODE COUNCIL

Automated Code Compliance Checking

Demonstration

SMARTcodes INTERNATIONAL CODE COUNCIL

Possibilities using SMARTcodes

- Auto code check**
 - Output reports
 - Inspection checklists
 - Mini-codes
 - Reference materials
- Manual code search**
 - Code text
 - Reference standards
 - Support information
- Custom Reports**
 - Standardize designs for national accounts
 - Code change impact analysis



SMARTcodes INTERNATIONAL CODE COUNCIL

Future Plans

- ❑ Complete efforts on and make 2006 IECC, egress and accessibility SMARTcodes available
- ❑ Continue creation of SMARTcodes until all key I-Codes are completed
- ❑ Maintain and enhance on-line demonstration to allow 'test driving' of new SMARTcodes

SMARTcodes INTERNATIONAL CODE COUNCIL

Future Plans

- ❑ Help ensure BIMs will contain information to support, and model checking software can perform auto code checking
- ❑ Facilitate availability of "smart" Federal, state and local amendments to I-Codes and referenced standards
- ❑ Provide for manual search of SMARTcodes and availability of support information to augment application of the codes
- ❑ Integrate auto code checking with e-permitting initiatives

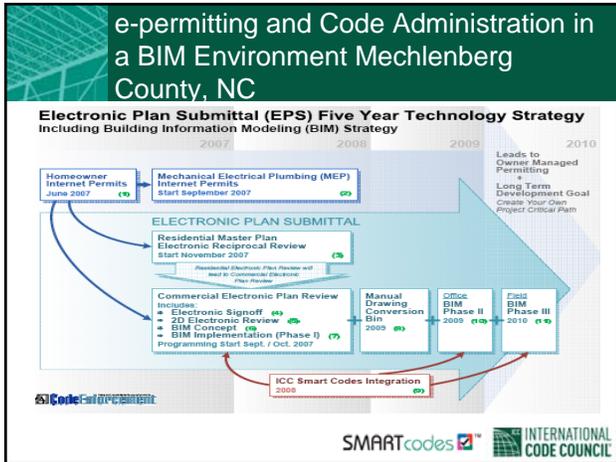
SMARTcodes INTERNATIONAL CODE COUNCIL

Integrating with e-permitting

- ✓ Working with e-permitting software entities to link auto code checking to e-permitting
- ✓ Collaboration with FIATCH Streamlining initiative
- ✓ Demo with Wisconsin DOC to simulate submittal of a BIM for auto code checking by regulatory authority
- ✓ Development of model strategic plan for acceptance of BIM as part of e-permitting

SMARTcodes INTERNATIONAL CODE COUNCIL

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking



Future Outlook for e-Government

Circular, transparent and interoperable

- IT as a foundation for communication and team building
- Standards for BIMs, communication and data interaction
- BIM as a foundation for communication and team building

Future Outlook for e-Government

- A new design and construction process founded on interoperability
- e-Government software and portals for BIM submittal and auto checking
- More timely and accurate review and approval of plans
- More timely and robust construction review and record availability
- Better buildings and increased public safety

Opportunities for Designers

- More quickly resolve prescriptive design and code compliance issues allowing resources to be focused on more project-critical issues
- More timely review of performance alternates to speed up approvals, generate new designs, encourage innovation and enhance the profession
- Engineers that are contract plan reviewers for jurisdictions have an additional resource available to assist in completing their review of submitted plans

Opportunities for Designers

- Building a foundation for a design team that allows the engineer to readily collaborate with other professions in creating and maintaining a BIM
- The ability for more direct interface BIM with performance modeling programs leading to more cost effective solutions for owners
- Establish a new “BIM guru” position that increases interest in a design firm
- Better buildings and increased revenue

Moving Forward

Automate code compliance checking for the I-Codes and Federal, state and locally adopted versions of those codes and facilitate creation of “smart” versions of reference standards by SDOs

SMARTcodes: Enabling BIM Based Automated Code Compliance Checking

Questions?



Richard See
Digital Alchemy

Proxy for Dave Conover
dconover@iccsafe.org
www.smartcodes.org

ICC
500 New Jersey Avenue
6th Floor
Washington, DC 20001

SMARTcodes  INTERNATIONAL
CODE COUNCIL 