A Mobile Design Application for Energy Efficient Buildings

GE Mathews* and EH Mathews*

*North-West University (CRCED Pretoria) and consultants to HVAC International (Pty) Ltd and TEMM International (Pty) Ltd.
Overview of presentation

- Background and motivation
- Development
- Testing and evaluation
- Application interface
- State of development
- Conclusion
Background and motivation
Background

- Poorly designed buildings use large amounts of energy
- Majority of this usage from HVAC systems
• Building design affects energy usage
• Thermal analysis important for initial design phase
• Manage demand-side before construction starts
Motivation

• Modern thermal analysis requires:
  – Requires dedicated computer
  – Detailed information

• Analysis becomes:
  – Complicated
  – Time consuming
Motivation

• Thermal analysis rarely incorporated into preliminary design practice:
  – Preliminary design
  – Consultation with clients

• Current methods:
  – Experience
  – Expert rules
Development
Development

• Design tool needs:
  – User-friendly interface
  – Easily interpreted results
  – Low cost
  – Simulation speed
  – Design comparisons
  – Default values and templates
  – Inclusion of building codes/energy ratings
• Software already exists
• NewQuick
  – Developed and tested in late 1990’s early 2000’s
  – Viewed as quintessential example of simplified design tool by many
  – Development abandoned in mid 2000’s
Development

- NewQuick designed to run on old hardware
- Modern smartphones easily meet resource requirements
- Possibilities as a mobile application
- QUICK Mobile
Development

• QUICK Mobile features:
  – Accurate simulation
  – Fast simulation time (runs in ms)
  – Easy to use

• QUICK Mobile ideal for:
  – Preliminary design
  – Consultation with clients
Testing and evaluation of simulation model
Testing

- NewQuick tested in two tests in 2001
- 89 verification studies/56 building zones
- Two sets of tests:
  1) Using default figures
  2) Using detailed figures
Evaluation

- Test 1 accurate to 3°C - 65% of time
- Test 2 accurate to 3°C - 90% of time
Application Interface
Application Interface

QUICK Mobile

Design Name: Design 1
- Bedroom 1
- Bedroom 2
- Study

Buttons:
- New Design
- Load Design
- Compare
- Add Zone
- Back
- Calculate
Application Interface
Application Interface

Wall Specifications:
- Exterior Wall:
  - Single Stone
- Interior Wall:
  - Single Brick
- Interior Wall Length: 10.0 m

Wall Selection:
- Select Wall Type:
  - Stone
  - Brick
  - Concrete Blocks
  - Concrete
  - Corrugated Iron
  - Wooden Siding
Application Interface

Heat and Orientation:

- Internal Heat Generation:
  - How much heat is generated indoors?
  - None
  - Default
  - Calculate: \( \text{W/m}^2 \)
  - Specify: \( \text{W/m}^2 \)

- Building Orientation:
  - What is the orientation of the North wall?
  - Specify: \( 7^\circ \)

Other Specifications:

- Roof Type:
  - Wood / Airspace / Ceiling

- Ground Floor Type:
  - Wood / Concrete / Ground

- Intermediate Floor Type:
  - Wood / Airspace / Ceiling

Back  Next  Back  Next
Application Interface
State of development

- Application currently in early design phase
- Simulation model already proven
- Currently gauging interest in application
Conclusion

• Need for simplified design tool exists

• Tool should be:
  – Accurate
  – Fast
  – Easy to use

• QUICK Mobile application satisfies these requirements
Questions?