AGENDA

- Why Direct Design?
- Capabilities of Direct Design
- Broader Benefits
- Seeing it in Action: Demo
Why Direct Design?

Engineering: Getting More Complex

Building Codes
• More codes
• More editions
• More pages
• More research
• More events
• More feedback
Engineering: Getting More Complex

Masonry is no exception...

1953 .......... 1983 ............ 2013

40 pgs ....... 40 pgs .......... 400 pgs

Innovating to Respond

Some Materials/Systems Respond:

• Targeted Design Aids,
• Pre-Engineered Solutions
• Pre-Fabricated Solutions
• Specialized Software
What About Masonry?

Lagging behind..................

Relatively simple, regular masonry buildings are also a candidate for simplified approach.
Innovating to Respond

Design Practices Committee

TMS 403
The Direct Design Handbook
Tabulated Designs

Table 3.2-6(3a): Maximum Vertical Spans for Walls without Openings (ft) if 20 psf $< \rho_s \leq 40$ psf for $V$ up to 110 mph

| Vital Category | Occupancy Category | Exposure Category | $L_{prev.}$ (ft) | Unreinforced P.C.L. Metric | Unreinforced Masonry Control Metric | Vertical No. 5 at 120" or
|               |                   |                   |                  | Unreinforced | Unreinforced | (u.g. = 20 lb) |
|               |                   |                   |                  | 17-4          | 17-4         | 15-4          |
|               |                   |                   |                  | 17-4          | 17-4         | 15-4          |
|               |                   |                   |                  | 17-4          | 17-4         | 15-4          |
|               |                   |                   |                  | 17-4          | 17-4         | 15-4          |

- Code compliance
  - Load calculations based on ASCE 7
  - Masonry design checks based on TMS 402
  - Referenced by IBC
Limitations
- Single-Story Construction
- 8 inch Concrete Masonry ($f'_m = 1,500$ psi)
- No. 5 Reinforcement, Grade 60
- Parapets $< 4$ft in height and $< 1/3$ height of wall below
- Wind Exposure Category B or C
- Flexible Diaphragms only
- $0.25/12 <$ Roof Slope $< 12/12$

Software to:
- Automate procedure
- Perform table lookups
Direct Design Software – V1

....and produce drawings

Direct Design Software – V2

Version 2: Minor Updates

2013

Version 2.0
Upon further review.....

Limitations =

“Keep the approach simple, but go beyond simple buildings.”

Table approach abandoned

Software does everything
Direct Design Handbook – 3rd Edition

TMS 403-17
Referenced by IBC 2018

Direct Design Software
Version 3
Re-inventing the Wheel?

But we already have software!!

Problems With Existing Options

One or more of:

- Doesn’t do whole building
- Doesn’t do full engineering workflow
- Not just for masonry (too complex)
- Not transparent enough ("Black Box")
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Capabilities

Direct Design Software is:

• Software for designing typical reinforced concrete masonry structures using Strength Design

• Code compliant per the following:

  • Performs load calculations, analysis, & design checks
  • Produces detailed drawings

Scope

Direct Design-able?

NO
Direct Design-able?

The Essence of “Direct”

Engineering Activities
Typical piecemeal approach:
- LOADS
- ANALYSIS
- DESIGN
- DRAFTING

Direct Design
Transparency

Pulling back the curtain:

Usability

Easy to Learn & Use

• Model easy to enter
• Loading: Pressures calc’d from ASCE 7
• No data exchange: All all-in-one app
• Control joint effects handled automatically
Limitations

Building Geometry

• 60’ maximum height
• No curved or diagonal walls
• Walls must form part of rectangular sections in plan
• Same basic plan layout at each story
• Limited structural irregularities
• Joist spacing of 10 feet or less

Limitations

Building Geometry

• No funky roofs
**Model Geometry**

- Effects of architectural features must be handled manually

**Limitations**

Walls only: No option for pilaster

(but have loads for manual design)
Loading Types

Considers

• Dead Loads
• Live Loads
• Snow Loads
• Wind Loads
• Seismic Loads

Not covered

• Blast loads
• Dynamic loads
• Flood loads
• Ice loads

Loading Constraints

• Mapped wind speed ≤ 250 mph
• Seismic site class A, B, C, or D
• Cladding weight ≤ 50 psf
• Axial load eccentricity t/2 plus 3 inches
Materials

• Units must comply with ASTM C90
  • (concrete masonry only)
• Standard mortar and grout

• Rebar: No. 4 thru No. 9, Grade 60

Limitations

All Masonry Buildings

Direct Design-able Buildings

Past  Present  Future
A continuing journey...

Future: v4, v5, v6....

- DDS Version 3
- DDS Version 2
- DDS Version 1

AGENDA

✅ Why Direct Design?

✅ Capabilities of Direct Design

➢ Broader Benefits

➢ Seeing it in Action: Demo
Aid the design team, mason contractor, and producer early in the planning phase.
Broader Benefits

Help to create the vision:

Idea...

to concept...

to preliminary design...

...in minutes

Sharpen the Pencil!

Cost $$$

An accurate, fast basis for cost estimates

- Better than estimating from an engineer’s rough, conservative preliminary design
- Better than the mason contractor’s rough estimate based on an old job
- Better than the general contractor’s rough number
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Demo

[Live Demo]
Final Thoughts
Questions?

Thank you for your time!

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Direct Design

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