egis

Egis Insights | Thought Leadership

AI in Structures for the Engineer of Tomorrow



As a Responsible and Creative company, Egis believes the future structural engineer is the one who thinks with AI.

Hani Akkari
Technical Director – Structures, Egis

Introduction

Five Ideas Reshaping Structural Design Now_

Across our practice at Egis, we are building AI tools that learn from what has been done, turning every project into knowledge for the next. The future is not engineer versus AI. It is an engineer with AI.

For two decades our profession has evolved from drafting tables to BIM, from hand calculations to FEA(Finite Element Analysis). The next shift is bigger, and it is already underway. Generative AI, large language models, and data-driven design tools are reshaping how engineers approach the earliest, most consequential decisions of a project.

This article presents five ideas every structural engineer should understand. The thesis is simple: engineers who combine human judgment with AI prediction and automation are measurably more effective than those who don't. We call this archetpe the **Super Engineer**.

Inside this article — the map

Data is the Fuel
Capture, clean, contextualize — every project is training data for the next.

AI vs FEA
Two different tools. AI estimates fast. FEA validates exactly. Together, they cover ground neither can alone.

Trust in AI Output?
Reliable AI is constrained AI. Predictions filtered through code, reviewed by engineers.

EGIS AI Apps
ColumnsEgis.AI and CoreWallsEgis.AI — concept-stage tools shipping inside our practice.

Prompting
English is becoming a programming language. Engineers can build tools without writing code.

Client Value & Sustainability
Why the SuperEngineer is what clients want: earlier certainty, lower carbon emissions, fewer late changes.

FUNDAMENTALS
APPLICATIONS
FUTURE PRACTICE
CLIENT VALUE

20+
Years of Egis structural archives are now training data

~5x
Faster concept-stage decisions with AI-augmented sizing

1
New engineering archetype : the SuperEngineer

01 – Foundations

Data is the Fuel of AI

Structural engineers learn from what they have done. AI learns from what has been done.

The difference is scale: an engineer's career holds dozens of patterns; a model trained on twenty years of Egis projects holds thousands. But scale alone is not enough. AI systems are only as good as the data on which they are trained. In our practice, that means capturing, for every project, the features that matter and tagging the exceptions; a 1.5 m beam on a 5 m span (for a non-structural reason) should not teach the wrong lesson.

In AI, data behaves like material in structural design. Poor input, poor performance.

The AI Data Pipeline

01 **Historical Projects**
15+ years 1000s of designs

02 **Data Lake**
Clean · tagged · validated

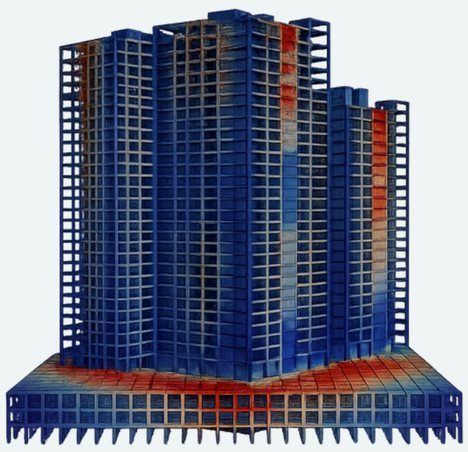
03 **AI Models**
Trained on Egis context

04 **Engineering Insight**
Filtered · safe · usable

02 – Methods

AI vs FEA

FEA
Physics

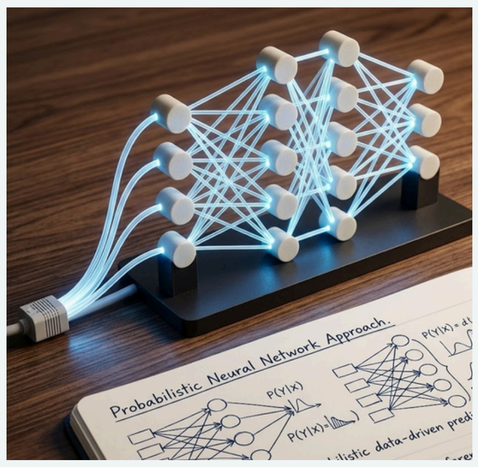


Deterministic · Exact

- First-principles equations
- Stiffness matrices
- Detailed verification
- Exact relationships

Wrong formula → Wrong results

AI application
Learning



Probabilistic · Learned

- Pattern recognition
- Neural networks
- Fast estimation
- Concept optioneering

Bad data → Bad results

AI estimates. · FEA validates. · Engineers decide.

03 – Trust

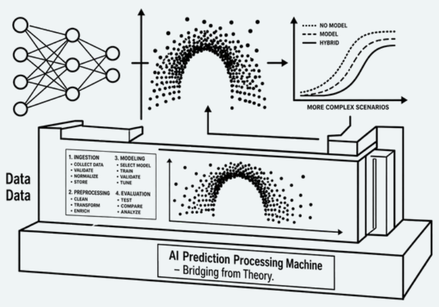
Reliable AI is Constrained AI

Engineers carry liability. AI does not. The question is not whether AI predictions can be trusted in the abstract, but how predictions can be constrained so that what reaches the engineer is already **filtered against the building code.**

01

AI Prediction

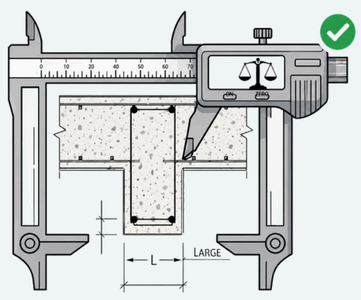
Propose a design from history



02

Building Code Filter

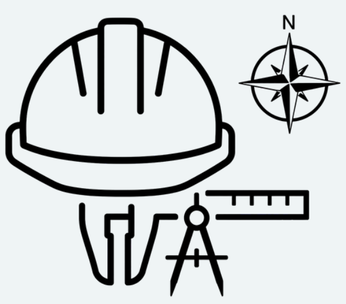
Building-code equations



03

Engineer Review

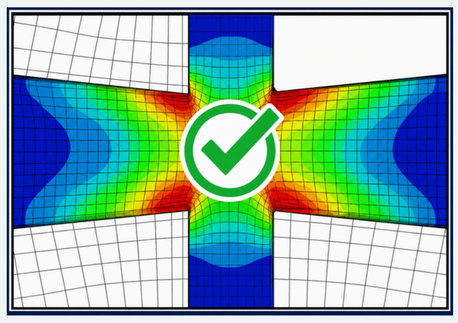
Judgement & Content



04

Safe Output

Verified preliminary design



AI is not a black box if engineers refuse to let it be one. Code-filtered, human-supervised, accountable.

Not A Black Box ✓ Code-filtered ✓ Human-supervised ✓

04 – In Practice

What we are Building at Egis

At Egis, we began our journey to develop AI applications based on our needs. Below are some examples of these apps:

Application 1

ColumnsEgis.AI

Rapid concept sizing for vertical members. Junior engineers start from validated options, not blank screens.



Concept sizing

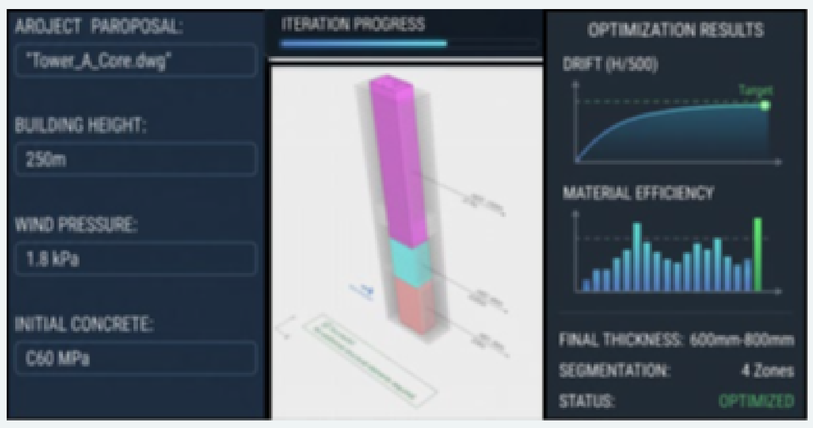
Multiple options

Code-filtered

Application 2

CoreWallsEgis.AI

Drift-driven core sizing targeting an allowable drift. Material-efficient FEM starting points for early stages



H/500 target

Material-efficient

FEM-ready

Senior engineers calculate less, decide more.

05 – Tooling

Prompting is the New Coding

Until recently, building a structural tool meant writing code. Today, an engineer can describe the tool in plain English to a large language model and receive a working prototype in minutes.

Step 01 · The Prompt (English)

> "Build a tool that computes development length of reinforcement to ACI 318-19, SI units. Inputs: db (mm), f'c, fy (MPa), top-bar, hooks."

~ 8 seconds · 5 Lines of English

Step 02 · A working APP

ℓd calculator —written in English, by an engineer, in minutes.

Straight (tension)	• ℓd —mm
Std. hook (90°/ 180°)	• ℓdh —mm
Code-checked	✓ACI 318-19 §25.4 (SI)



Prototype with prompts

Accelerate coding

Faster workflows

Then & Now · The Same Tool, Two Ways

Yesterday · ~3 Weeks · 2,300 Lines

```
def development_length_si(db, fc, fy, psi_t, psi_e, psi_s, lam, cb, Ktr):
# db, cb, Ktr in mm · fc, fy in MPa
cb_term = min((cb + Ktr) / db, 2.5)
ld = (fy * psi_t * psi_e * psi_s) / (1.1 * lam * fc**0.5 * cb_term) * db
return max(ld, 300.0) # mm · min 12·db
# + UI, hook ldh branch, tests, IT…
```

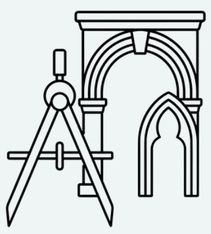
Today · ~30 Minutes · 1 Prompt

"Build a development-length calculator for reinforcement to ACI 318-19 in SI units (mm, MPa). Inputs: db, f'c, fy, top-bar, hooks. Output ℓd and ℓdh."

↓ 1 Engineer · 0 It Tickets · 1 Prompt

The Thesis

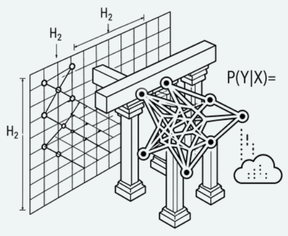
The *Super*Engineer



Human Expertise

- Judgment
- Creativity
- Leadership

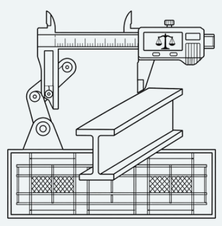
+



Artificial Intelligence

- Prediction
- Patterns
- Knowledge

+



Automation

- Speed
- Scale
- Repeatability

=

Results



SuperEngineer

Next-generation structural practice

Four Observations

"Data is the new concrete of AI."
On Materials

"AI should estimate. Engineers should decide."
On Judgment

"Prompting is becoming an engineering skill."
On Tooling

"The future is not engineer versus AI. It is engineer with AI."
On the Thesis

Why the *Super*Engineer is what Clients Want

The value added is not faster drafting. It is more options on day one, fewer surprises in month nine, and a structure that is buildable, fundable, and low-carbon decided when change is still cheap.

Two Voices · What "Value-added" Sounds Like

Client / Developer

"Tell me on day one which scheme is buildable, fundable, and lowest-carbon. Don't make me wait six weeks for a study."

Earlier certainty on cost and feasibility before the design is committed.

Contractor

"Give me a structure engineered for how it gets built, not how it draws nicely."

Constructability and tonnage discipline baked into the design, not bolted on.

Project Economics · What The Value-added Looks Like

~25%
More design options validated at concept stage

AI-assisted Iteration

2–3×
Faster turn-around on client queries

Tooling on Demand

~ 20–40%*
Less embodied CO_2at the concept stage through AI-enabled optioneering and smarter material use.

Tooling on Demand

100%
Code-checked outputs every option

ACI 318-19 · Eurocode

**The greatest potential for emissions reductions arises during early design phases. less embodied carbon by 2030 — sector target (≥40%) · vision World Green Building Council (worldgbc), bringing embodied carbon upfront (Sept 2019).*

Sustainability · The Carbon Dividend

Every kilo of over-design is carbon we didn't need to pour.

The structural frame carries roughly half of a typical building's embodied carbon[1]. The leverage isn't in the detail — it's in the scheme. AI-augmented design lets us test more schemes when change is cheapest.

Where the Carbon Lives

~50%*

Of a typical building's embodied carbon sits in the structural frame.

Where the Leverage is

~20–40%**

Upfront-carbon reduction achievable when concept-stage decisions prioritise embodied carbon.

* INSTITUTION OF STRUCTURAL ENGINEERS (ISTRUCTE), HOW TO CALCULATE EMBODIED CARBON, (JAN 2025).
** WORLD GREEN BUILDING COUNCIL (WorldGBC), BRINGING EMBODIED CARBON UPFRONT (SEPT 2019)

Four Levers · How AI Tools Lower Embodied Carbon

01

Right-size members

Sweep many section options, not the safe default. Less steel, less concrete, same code.

02

Lower-carbon mixes

Screen SCM-blended concretes against the same loads, with code-compliant strength.

03

Smarter framing

Test grid spacing and slab systems at concept stage, when geometry is still cheap to change.

04

Re-use the archive

Find what worked on past projects: efficient details that already met the same code.

In Closing

The Question is No Longer whether AI will Affect Structural Engineering. It is how Engineers will use AI to Become Better Engineers

From data, to estimation, to intelligent decision support — at the speed of a concept conversation.

Egis · 2026 Structures

01

Capture data carefully

Every project becomes training data when its features are tagged, validated, and complete from the start.

02

Constrain predictions

AI proposes. The building code filters. The engineer reviews. Constrained AI is reliable AI.

03

Decide earlier

Concept-stage decisions made with AI insight are decisions made when change is cheap and impact is highest.

The Egis View

The future is not engineer versus AI. It is Engineer with AI and at Egis, that is the engineer we are building for.



Hani Akkari

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Hani leads structural design and digital transformation at Egis Middle East, with a focus on AI-augmented design workflows for tall buildings.

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