Meta AI-optimised concrete mixes

IMPLEMENTED 2022–2026 · CONSTRUCTION AND PROPERTY · US · BAND D · CLAIMED ONLY
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Meta and the University of Illinois built a Bayesian optimisation model that proposes concrete mixes. Mixes it suggested were poured in Meta data centre slabs in Illinois and Minnesota. Results come from Meta and the university; lab validation and engineering sign-off stay in place.

ABOUT THIS SYNOPSIS

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NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

Frontier case: AI used for a scientific, medical or engineering breakthrough. The transformation is potential and unproven; MarLuc grades what has changed in practice so far.

AI used: Machine learning (Bayesian optimisation) that proposes concrete mixes for lab testing.

Implemented: 2022–2026. Grade: band D, Task support, Claimed only.

Headline result, as reported: AI-suggested concrete mix poured in a Meta data centre slab: 43% stronger early strength and 35% less carbon than the baseline, by the university's account

1 · The case

The facts, as reported by the 5 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

Meta, with Amrize, Ozinga and the University of Illinois Urbana-Champaign. Meta is a US technology company. The concrete work covers its data centre construction, with Amrize (a North American cement and concrete manufacturer), Ozinga (a concrete supplier) and the University of Illinois Urbana-Champaign. Workforce size: Not reported. Canvas block: 4. Operations and process. Also 6. Technology and data.

Business challenge

The challenge. Meta said a lifecycle assessment showed concrete contributes significantly to the emissions from building its data centres, per ENR in 2022. Meta's later account says conventional mix design relies heavily on lab trial and error, engineer intuition and accumulated knowledge, and is slow and expensive to adapt to new local materials.

How it was addressed. University researchers trained a model on public concrete data in 2022 and picked five AI-generated formulas for lab testing; Ozinga refined one for local materials and cold weather and poured it at Meta's DeKalb site. For Rosemount, the university says it iterated between lab mixes and the model with materials from Amrize, training on about 60 mixes and producing a final set from more than 100 original mixes. In March 2026 Meta released the improved BOxCrete model and its data as open source. [1] [2] [3] [4] [5]

Who implemented it

In-house (In-house): Meta: Built the open-source Bayesian optimisation model and used the mixes in its data centre projects..
University of Illinois Urbana-Champaign (University or research lab): Research partner that ran the lab mixes and trained the model on them..
Amrize (Industry partner): Cement and concrete producer that supplied materials and checked the final mix; named as a partner in Meta's account..
Quadrel (Software vendor): Ready-mix software company that adapted Meta's framework into its product, by Meta's account..
Amrize and Ozinga are materials suppliers rather than software vendors; the closest listed type is used.

Technology (SEAM pillar E)

SEAM types: T5 Custom / fine-tuned models, T8 Predictive / ML models. Deployment: Not reported. Vendors and products: BOxCrete, Ax (Meta Adaptive Experimentation platform).

Where it was built in: Used by university researchers and the concrete supplier to propose mixes, which are then lab tested, refined by the supplier and poured at data centre sites; one ready-mix software vendor, Quadrel, has built the open-source framework into its product.

What changed

Before: mix designers relied on lab trial and error and experience. After: a model proposes candidate mixes from existing data and test results, and humans still test, refine and sign off. Meta says the process of validation is unchanged. [1] [2] [3] [4] [5]

What it cost

Not reported. The university says the optimised mix was cost-competitive to deploy at large scale; no figures are given.

What it saved

By the university's account (Rosemount): early strength 43% higher and carbon intensity 35% lower than the industry baseline, with similar workability. By Meta's account: full structural strength 43% faster and cracking risk down nearly 10%. A 2022 university release reported a 40%

Governance and control

Meta says the usual lab validation, field trials, engineering sign-off and code compliance continue. The university says Amrize made a final check. Accountable owner and monitoring after pour: Not reported.

S2 · Accountable owner · Not reported
Not reported.

A1 · Safe use · Not reported
Not reported.

A2 · Human in the loop · Claimed
Meta says lab validation, field trials, engineering sign-off and code compliance continue; the university says Amrize checked the final mix. [1] [2]

A3 · Monitoring and assurance · Claimed
Meta says the model improves as each lab and field test result is fed back; strength was measured against targets in the 2022 pour. [1] [3]

A4 · Vendor AI · Not reported
Not reported.

A5 · Agent controls · Not reported
Not reported.

A6 · Standards and regulation · Claimed
Meta says the Minnesota mix met all structural requirements and is qualified for use in other areas of the data centre. [1]

What worked, what did not, what is unproven

WORKED

– Mixes proposed by the model were poured on real projects: about 640 cubic yards at DeKalb in 2022 and a site support section of a data centre slab at Rosemount.

– At Rosemount, by the university's and Meta's accounts, the mix gained strength faster and carried lower carbon than the baseline, with similar workability.

– Meta says the Rosemount mix met all structural requirements and is qualified for further areas of the data centre.

– Meta released the model and data as open source, which allows independent checking by others.

DID NOT

– At DeKalb in 2022 the test mix reached 2,650 psi at five days against a typical target of 3,000 psi, per ENR; the team planned to work on early strength.

– Published results for the later work are not yet peer reviewed; the BOxCrete paper is described as submitted for publication.

UNPROVEN

– Whether the Rosemount gains hold across other cements, climates and suppliers.

– Whether AI-led mix design becomes standard across concrete production. Meta states this as a goal and names one software vendor, Quadrel, as building on the tool.

– Cost and time savings in the accounts of Amrize or Ozinga: Not reported.

Apr 2022 Ozinga pours about 640 cubic yards of an AI-suggested mix for two slabs at Meta's DeKalb, Illinois site; early strength falls short of Meta's target [3]

Oct 2023 Bayesian optimisation for concrete preprint posted by Meta and Illinois researchers [5]

2025 Meta, Amrize and the university win a Slag Cement Award for sustainable concrete project of the year [1]

Oct 2025 University reports the Rosemount, Minnesota data centre mix: 43% stronger early strength, 35% less carbon [2]

Mar 2026 Meta releases BOxCrete and the data behind the Rosemount mix as open source; Quadrel reported as building on it [1]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: A. Grade: D, Task support. Proof: Claimed only. Level of change: Task support.

Task support (Level 1, band D). Engineers do the same validation and sign-off steps; the model changes where they start. Meta's stated aim of an industry-wide shift is a claimed A, unproven.

Graded D, claimed A. Meta says lab validation, field trials, engineering sign-off and code compliance are unchanged, so engineers do the same work with better starting points and fewer tests. Meta describes an industry-wide shift in mix design as its goal. That transformation is potential and unproven: only one adopter, Quadrel, is named as embedding the tool in daily workflows, and that is Meta's own account.

The SEAM view and lessons learnt

This is a field use of a modern ML tool in a conservative engineering process. The model narrows the search; the lab, the supplier and the engineer still decide. For a larger organisation, the lesson is to keep existing sign-off steps, test on low-risk slabs first and publish the data so others can check.

1. Pilot new mixes on low-risk structures first.
2. Keep lab validation and engineering sign-off in place.
3. Publish data and methods so results can be checked.

Evidence

Score 2 of 4. Self-reported: results come from Meta and the University of Illinois; the 2022 pour was reported independently by ENR; the 2023 paper is an open workshop preprint and the 2026 BOxCrete paper is submitted, not yet peer reviewed.

Evaluation method. Company and university announcements, an open preprint (arXiv) and one independent trade press report (ENR, 2022); no independent test of the Rosemount results.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/meta-ai-optimised-concrete

[1] Engineering at Meta: AI for American-Produced Cement and Concrete (30 March 2026)
https://engineering.fb.com/2026/03/30/data-center-engineering/ai-for-american-produced-cement-and-concrete/

[2] Grainger College of Engineering, University of Illinois: Recipe for success, AI-optimized concrete (21 October 2025)
https://grainger.illinois.edu/news/stories/ai-optimized-concrete

[3] Engineering News-Record: Meta Tests AI-Developed Lower-Carbon Concrete on Data Center Project (28 April 2022)
https://www.enr.com/articles/54024-meta-tests-ai-developed-lower-carbon-concrete-on-data-center-project

[4] Coordinated Science Laboratory, University of Illinois: Artificial intelligence produces a recipe for lower-carbon concrete (27 April 2022)
https://csl.illinois.edu/news/46838

[5] arXiv: Sustainable Concrete via Bayesian Optimization (2310.18288)
https://arxiv.org/abs/2310.18288

Meta, with Amrize, Ozinga and the University of Illinois Urbana-Champaign website: https://engineering.fb.com

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