Syed Nafiz Reja Hasib

Civil engineer · computational structural design · low-carbon shell structures · seismic engineering. Guangdong, China.

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PROFILE

I work on computational design and mechanics of structures: form-finding and optimisation, finite-element analysis and seismic design, with concrete shells as my current test case and embodied carbon as a design variable. My code is open and tested. My bachelor thesis was the full hand design of a four-storey reinforced concrete frame for a seismic site in Sichuan, to the Chinese codes. I now run two open research projects that build on it: ShellBench and ShellForm. Before this I spent two and a half years as a project engineer in precision manufacturing, running durability testing and root-cause analysis.

Interests: computational form-finding and structural optimisation of shells; seismic design and its embodied-carbon consequences; validated, reproducible structural software; machine-learning surrogates for structural design; lightweight structures for extreme environments.

EDUCATION

BEng Civil Engineering (four-year programme) 2019–2023
Southwest Petroleum University, School of Civil Engineering and Geomatics, Chengdu

- Full Chinese Government Scholarship.
- Thesis: structural design of a four-storey RC frame office building in Panzhihua, Sichuan (intensity 7, 0.10 g; GB 50009, 50010, 50011). Member sizing, yield-line slab design, moment distribution, D-value lateral analysis, drift checks and capacity design.
- Selected courses: Structure Mechanics I, University Physics, Design Principles of Concrete Structures, Probability and Statistics.
- Thesis project page.

English and Chinese language programme 2018–2019
Institute of Language, BRAC University, Dhaka

RESEARCH PROJECTS

ShellBench: embodied carbon of thin-shell floors in seismic RC frames 2026–
Lead researcher and developer · Python, OpenSeesPy, CalculiX · MIT licence

- Audited my thesis as the validation case: 16 input inconsistencies and 21 doubtful printed values logged, each with a recorded decision.
- Rebuilt the thesis frame in OpenSeesPy under gravity, wind and earthquake, with GB 50010 member checks and automated tests on every change.
- In progress: a design generator swept over storeys and ground acceleration, a shell-floor module checked against standard benchmarks, pre-registered hypotheses and an open dataset.

ShellForm: the carbon cost of seismic resilience in form-found concrete shells 2026–
Lead researcher and developer · Python, CalculiX, three.js · MIT licence

- Design study of 168 sized shells (two spans, two support types, three rise ratios, two strategies) over 0–0.6 g, with carbon under GB/T 51366 and ICE factors.
- Pre-registered analysis plan, validation tests for the seismic form-finding code, and an interactive design explorer.

Parametric carbon optimisation of an aviation-terminal canopy 2026

Independent computational design project · JavaScript, Python

- Interactive web prototype linking canopy geometry to simplified structural indicators and estimated embodied carbon. Not validated for engineering use.

Nano-modified warm mix asphalt: durability model and life-cycle assessment

2025–2026

Independent research, sole author · Python, LCA

- Moisture-damage model linking tensile strength ratio data to climate loading, with outputs mapped to BIM asset management.
- Cradle-to-gate (A1–A3) comparison: production GWP fell by 5.2% (61.31 to 58.15 $kgCO_2e/t$); a 15% longer service life lowered annualised GWP by 17.5%.

PUBLICATIONS

1. Hossain, M. A., Mostofa, M. G., Babu, M. A., Hasib, S. N. R., & Arafat, H. (2026). Edge AI and IoT for real-time structural health monitoring. *Journal of Artificial Intelligence and Technological Development, 2(5), 80–111.* doi:10.59324/jaitd.2026.2(5).07
2. Raihan, P. M. S., Hasib, S. N. R., & Phiri, M. (2024). Integration of nano-additives in warm mix asphalt: enhancing moisture resistance and long-term durability. *European Journal of Theoretical and Applied Sciences, 2(6), 451–461.* doi:10.59324/ejtas.2024.2(6).39
3. Shimky, S. A., Hasib, S. N. R., Karim, S. M. W., Parven, S., Imran, M., Parvez, M. E. H., & Ali, A. (2024). Application of BIM in civil engineering. *European Journal of Theoretical and Applied Sciences, 2(4), 595–622.* doi:10.59324/ejtas.2024.2(4).51
4. Hasib, S. N. R.. A climate-driven moisture-damage model for nano-modified warm mix asphalt with BIM-ready outputs. Under review, Discover Civil Engineering. Submitted October 2026.
5. Hasib, S. N. R.. Coupled finite-element and life-cycle assessment of nano-silica warm mix asphalt pavements. In preparation. Submission planned November 2026.
6. Hasib, S. N. R.. Whole-building embodied carbon of thin-shell floors in seismic RC frames. In preparation. ShellBench, Paper 1. Submission planned November 2026.
7. Hasib, S. N. R.. Can a machine-learning surrogate choose the low-carbon floor?. In preparation. ShellBench, Paper 2. Submission planned December 2026.
8. Hasib, S. N. R.. The carbon cost of seismic resilience: gravity-only versus seismic-aware form-finding of concrete shells. In preparation. ShellForm. Submission planned early 2027.
9. Hasib, S. N. R.. Lateral-load analysis and capacity design of a four-storey reinforced concrete frame under GB 50011-2010: a fully documented case study from Panzhihua, Sichuan. Preprint / report. Bachelor thesis with full drawings; language-edited. doi:10.13140/RG.2.2.26247.15522
10. Hasib, S. N. R.. From laboratory performance to digital monitoring: integrating nano-modified asphalt durability data into a lightweight BIM and digital-twin framework for climate-resilient pavements. Preprint / report. doi:10.13140/RG.2.2.24448.19202
11. Hasib, S. N. R.. Quantifying the environmental benefit of nano-modified warm mix asphalt: a comparative life-cycle assessment linked to durability performance. Preprint / report. doi:10.13140/RG.2.2.12376.46089

EXPERIENCE

Project engineer, precision manufacturing 2024–2026

Guangdong, China

- Quality control on automated inspection and testing lines, including review of durability (fatigue) test results.
- Investigated non-conformities and led root-cause analysis and corrective and preventive actions.
- Reviewed technical drawings and tolerances and kept traceability records.

Independent research collaborator 2024–

Informal collaboration with a PhD researcher at Hohai University · remote

- Co-authored peer-reviewed reviews on BIM and on nano-additives in asphalt; wrote Python durability models and ran cradle-to-gate LCAs.

SKILLS

- **Structural engineering:** hand design of RC frames to GB 50009, 50010, 50011 and 55002; gravity, wind and seismic analysis (base-shear method, response spectrum); capacity checks; shell form-finding (force density method).
- **Computation:** Python (NumPy, SciPy, Matplotlib, pytest), OpenSeesPy, CalculiX, Gmsh; Git and GitHub Actions; JavaScript web prototypes; LaTeX.
- **Design and BIM:** AutoCAD (advanced); Revit and BIM workflows (working knowledge).
- **Sustainability:** A1–A3 embodied-carbon and life-cycle assessment; GB/T 51366 and ICE carbon factors.
- **Research practice:** pre-registered analysis plans; validation against benchmarks and hand calculations; tagged, reproducible releases; AI-assisted coding with full human review and disclosed AI use.
- **Quality engineering:** inspection and test-line QC, fatigue-test review, root-cause analysis, CAPA, drawing and tolerance review.

COURSES

- Bayesian Statistics: From Concept to Data Analysis, UC Santa Cruz (Coursera), 2023.
- AutoCAD for Design and Drafting, Autodesk certification preparation course (Coursera), 2023.

LANGUAGES

Bengali (native); English (full professional; degree taught in English); Chinese (intermediate, about B1); Hindi (conversational); French (beginner).

SERVICE

Senior ESL instructor and event coordinator, Foreign Language Corner 2019–2023

Southwest Petroleum University, Chengdu

Member, Institution of Engineers, Bangladesh 2023–

AWARDS

Chinese Government Scholarship, full scholarship for the four-year bachelor's degree (2019–2023).

REFERENCES

Available on request.