

An Engineering Odyssey: From Design to Delivery of Four Guinness World Records.



Prashant Chavan
Head of Engineering
Rajpath Infracon Pvt. Ltd.



With over 24 years of experience in surveys, evaluation, design and insight and inspection of structures according to standards, he also possesses exceptional planning and execution expertise in National Highways, State Highways, Dams and Airport Projects. He is a Contracts specialist with an unmatched eye for detail and compliance. His exhaustive technical proficiency includes not only quality standards and procedures but also a deep commitment to environmental protection. Prashant currently leads the Engineering Department as General Manager and spends most of his time on roads and in-between various sites of Rajpath Infracon.

Engineering is about bringing imagination into reality - about seeing what does not yet exist and having the

conviction to build it. That journey began the day we walked the rugged hills and deep valleys where the road of Package 2 and 3 of NH544G now stands paved, precise, and proud bearer of 4 Guinness World Records. Those early walks were moments of assessment, imagination, and responsibility- where alignments were visualized, constraints anticipated, and possibilities mapped. Every curve, layer, and gradient that exists today is the outcome of thousands of engineering decisions made under real-world pressures of time, topography, safety, and scale.

From design validation to material behaviour, from logistics to live execution, this project demanded our engineering and execution capabilities be repeatedly translated into measurable performance. **The achievement of four Guinness World Records in a single**

infrastructure project, in a single attempt, on the Greenfield National Highway No. 544G (Package 2 & 3) of the National Highways Authority of India (NHAI) under the Bengaluru Vijayawada Economic Corridor, represents not merely a milestone in speed or scale, but a landmark case study in engineering excellence, resource optimization, and execution under complex geological conditions. Today, the project tells a larger story. It reflects how engineering, when driven by clarity of purpose and discipline, can convert uncharted landscapes into benchmarks of excellence.

Pre-Tender Engineering Reconnaissance

The technical backbone of the project was laid during the pre-tender site visit back in November 2022. Unlike brownfield expansion projects, a greenfield corridor requires complete

terrain validation since no prior roadway exists.

Key Engineering Observations and Issues:

- Undulating topography with multiple hill ranges
- Extensive granite rock strata exposure
- Massive surface boulders across alignment
- Natural drainage channels requiring diversion planning

Proximity to habitation clusters introduced environmental sensitivities that required calibrated execution to minimize disturbance, while communication and language barriers in the region added an additional layer of complexity to coordination and on-ground operations.

The geology comprised of Granite. Being a high-strength igneous formation, that presented significant engineering implications for execution like:

- High drilling resistance
- Requirement of controlled blasting
- Advanced slope stabilization design
- Heavy-duty machinery planning

Such reconnaissance enabled risk forecasting and realistic cost modelling. It prevented design-execution mismatch - one of the most common failure points in greenfield highway projects.

Pre-Construction Complexities in Greenfield Development

Survey validation identified terrain deviations that necessitated geometric recalibration of the alignment. Establishing and maintaining benchmarks and alignment control in the hilly terrain demanded deployment of high-precision instrumentation under continuous expert supervision. To top this, being a Greenfield infrastructure project, it introduced multidimensional challenges:

Technical and administrative barriers like:

- Land acquisition and physical possession to commence activities
- Utility shifting and forest clearances
- Access road creation for heavy equipment mobility

- Camp establishment and storage yards
- Design validation and drawing finalization

Physical excavation commenced in March 2024 following statutory readiness and clearances, with large-scale mobilization of heavy excavators, rock breakers, dumpers, drilling rigs, and specialized controlled blasting teams. As excavation progressed into deeper strata, the geological complexity intensified, introducing harder rock formations and demanding progressively higher levels of technical control and execution precision.

Engineering Challenges during excavations

Granite excavation is structurally demanding owing to its high compressive strength, resulting in prolonged drilling cycles, the need for precision blasting to prevent overbreak, and rigorous post-blast slope stabilization. These conditions accelerated machinery wear, required intensive maintenance regimes, and heightened safety risks, particularly on steep gradients. Recovered rock was selectively processed and reused as sub-base aggregates, reflecting sustainable material utilization, while unsuitable debris was systematically transported to designated dumping zones. The onset of monsoon conditions further intensified execution challenges with is extension of season and erratic patterns, necessitating enhanced slope protection measures, reinforced drainage systems, and temporary stabilization to maintain safety and continuity of works.

Resource Optimization Strategy

Resource optimization was critical in this greenfield project due to challenging terrain, remote location, tight timelines, and record-attempt precision. Optimized deployment of materials, machinery, and manpower minimized downtime, mitigated risk, ensured quality consistency, and enabled uninterrupted execution under variable weather and operational constraints.

■ The achievement of the project's Guinness World Records was enabled by tightly synchronized resource planning across all execution fronts.

■ The machinery strategy incorporated multiple loaders as manual-feeding backups and dedicated maintenance teams for pavers and feeders to eliminate downtime.

■ Manpower deployment combined skilled paver operators, on-site mechanical teams, and additional standby workforce to sustain uninterrupted operations.

■ Quality assurance was anchored by a fully equipped on-site laboratory, continuous testing of bitumen grade, BC mix, and material properties, and ongoing technical training in collaboration with Indian Institute of Technology Bombay.

■ Robust contingency planning included real-time weather tracking, advance material stocking, and readiness with protective polythene sheets to counter sudden rainfall.

■ Throughout execution, environmental sensitivity was maintained through provision of animal underpasses, preservation of wildlife movement, and strict avoidance of disruption to natural fauna corridors.

Execution Strategy for Guinness World Records

Achieving record-breaking performance demanded micro-level execution control across every operational interface. Critical engineering measures included maintaining consistent paver speeds to achieve the set target within 24 hours, strict adherence to thickness and quality specifications, continuous rolling and vibration for effective compaction, verified compaction density, and real-time material tracking. A customised live dashboard displayed hourly construction progress, material consumption, operational efficiency metrics, and seven-day continuous



performance data, integrating engineering precision with digital monitoring to create a transparent, measurable execution model.

Engineering Outcomes of the Four Guinness World Records

The outstanding engineering outcomes of the four Guinness World Records demonstrates that excellence is achieved through disciplined planning, precision execution, teamwork, and resilience. When engineering judgment is combined with data-driven control, proactive risk management, and unwavering safety standards, even the most complex challenges can be transformed into global benchmarks.

- Structural excellence was achieved through uniform pavement thickness, continuous paving that enhanced riding quality, superior compaction density, and tightly controlled geometric alignment, ensuring long-term performance, durability, and user comfort.
- Operational efficiency was achieved

through optimized plant-to-site coordination, minimized downtime, and effective multi-layer execution management, enabling seamless workflow, sustained productivity, and consistent performance across all operational fronts.

- Institutional learning from the project strengthened capabilities in advanced granite excavation handling, refined hill-cut stabilization methodologies, and enhanced expertise in managing logistics for large-scale continuous paving, creating transferable knowledge for future complex infrastructure projects.
- The project's long-term impact lies in strengthened greenfield execution capabilities, the creation of a replicable model for high-speed corridor construction, and enhanced institutional confidence in delivering mega-infrastructure projects with speed, quality, and reliability.

Conclusion

This achievement of four Guinness World Records - with zero accidents - during the construction of the greenfield NH 544G Packages 2 & 3 by Rajpath Infracon represents far more than a symbolic milestone. It stands as a rigorous validation of engineering precision, geotechnical resilience, and disciplined execution. This experience reaffirms a fundamental engineering truth: world records are not a function of speed alone - they are the outcome of meticulous planning, precision in execution, preparedness for risk, and consistent performance under pressure.

The NH-544G corridor in Andhra Pradesh now stands as a benchmark in greenfield highway engineering, reflecting how strategic foresight and disciplined execution can transform geological challenges into record-breaking achievements.