

From Capability to Confidence: EVOLVE-AI for Asphalt Contractors

The Answer First: The AI LLM and machine learning capabilities an asphalt contractor needs are already demonstrated in published research and in the field. What's been missing is a disciplined way to assemble them so the numbers can be reproduced and the physical result verified. EVOLVE-AI supplies that discipline: a Claude Project that houses the knowledge, deterministic tools that do the math, side by side deterministic verification that checks it, and lab and field testing that prove it, with the professional deciding at the end. This case study shows the top use cases, one worked example, and the proof that the method already works.

Top Use Cases for an Asphalt Contractor

Use case	What it does	How the result is proven
Mix design optimization at best price	Screen aggregate, RAP, binder, and gradation options for an efficient mix that meets the spec at the lowest cost	Plant lab makes and tests the candidate
QC / QA predictability	Use intelligent compaction and paving data to flag compaction variability and support real time QC decisions	Cores and gauges confirm acceptance
Alternate and recycled materials	Screen higher RAP and alternate materials before committing plant time	Laboratory and field validation on local materials
Binder grade decision support	Compare grade options (58S-28, 58H-28, or 58E-28, as applicable to the INDOT pay item and traffic level) on climate, cost, and logistics	Agency specification and materials engineer decide
Estimating and bid reference ranges	Build competitive reference ranges from INDOT and in-house bid and cost history	Deterministic estimating tools; estimator owns the bid
Proposals and workforce training	Draft and objective-check proposals; build role-based training from approved material	Human proposal lead and subject-matter expert review

The strongest entry points are the ones whose output can be physically verified: mix design and QC/QA. The study cited at the end supports the mix property prediction point specifically; it does not by itself validate every use case in the table.

Worked Example: Mix Design Optimization

This follows the EVOLVE sequence (Evaluate, Validate, Optimize, Learn, Verify, Expand) and the ACCURACY execution steps, with deterministic math and physical testing holding authority.

1. Evaluate and house the knowledge in a Claude Project. Load the specification, aggregate and RAP properties, binder options, haul and plant costs, and the EVOLVE-AI knowledge base into one Claude Project. A contents index and a cross reference bridge document make retrieval reliable, and the Retrieval Budget keeps each prompt to 3 to 5 named files.

2. Validate inputs and set up the ML method with disciplined prompting. Published models predict mixture properties. The LLM does not reproduce the trained ML prediction but can approximate it. The LLM organizes the inputs, identifies missing variables, and prepares the inputs and calculations and performs deterministic calculations. It provides worked examples to be verified using standard deterministic software. The process is iterative and step by step, using EVOLVE-AI's prompting discipline.

3. Optimize with deterministic calculation, not model arithmetic. The cost and volumetric math runs in a deterministic tool, then is checked in a spreadsheet or estimating system; never in model text.

Illustrative raw material calculation (illustrative inputs; not a placed HMA bid price).

Blended raw material cost per ton of HMA, FOB plant, equals the sum of each component weight fraction times its price. Candidate A (25% RAP, 5.0% virgin PG binder): \$ 41.80 per ton. Candidate B (35% RAP, 4.5% virgin binder): \$ 37.94 per ton. Saving: 3.86 dollars per ton, about 9.2 percent, or roughly 19,300 dollars on a 5,000-ton job.

Assumptions (illustrative). Virgin PG binder 600.00 dollars per ton (an illustrative rounded value generally consistent with 2026 INDOT binder index levels, not the current price); virgin aggregate \$ 14.88 per ton; internally owned RAP processing and handling \$ 5.54 per ton (a contractor's internal cost, not an open market RAP purchase price). Actual estimator inputs should come from current supplier quotes, plant cost records, and the current INDOT binder index. For the binder replacement illustration only, assume RAP contains 5.0 % binder by mass, so each candidate contains 6.25 % total binder: Candidate A has a 20.0 percent Binder Replacement and Candidate B has a 28.0 % Binder Replacement.

4. Verify side by side, two independent ways. Method 1 (weight fractions) and Method 2 (pounds per 2,000 pound ton) both return 41.80 and 37.94. An order of magnitude check confirms the binder term dominates (about 30 and 27 dollars). The results agree, so the arithmetic is VERIFIED; the mix itself REQUIRES VERIFICATION until the lab confirms it. A second model runs an independent QA/QC pass (EVOLVE-AI multi-model verification). Note that these raw material figures are not comparable to placed HMA bid prices, which are much higher because they also include plant production, fuel, hauling, paving, traffic control, overhead, and profit.

5. Screen against specifications, then prove it in the lab and field. Current INDOT QC/QA HMA provisions (401-R-820) limit Binder Replacement to 25.0 % for the applicable mixture categories (2, 3, and 4). Under the illustrative 5.0 percent RAP binder assumption, Candidate A calculates to 20.0 percent and passes this screening check; Candidate B calculates to 28.0 percent and is therefore screened out as shown, before any lab evaluation. Actual compliance is determined using the approved DMF, the measured recycled material binder content, and current contract documents and specifications. The plant lab then makes the specification compliant candidate selected after the compliance screen and tests volumetrics and performance; intelligent compaction and cores support and confirm density in the field. The AI output is a starting hypothesis; the lab and the responsible materials engineer decide.

6. Learn, document, and expand. Capture the result as a dated .docx file in the Project, update the handoff, and only then repeat the method on the next mix or plant. Single deliverable conversations and compute balancing keep quality from degrading.

Why This Is Credible: The Method Is Already Working Here

This report demonstrates the workflow, and the method behind it is real. EVOLVE-AI is not theory we are proposing; it's the discipline that produced this analysis through deep internet AI research, analyses, iterative passes, multi-model QA/QC checks and final human review and reporting. EVOLVE-AI was used to evaluate AI use for asphalt contractors, research successful applications, analyze the research, pricing history, methodologies, and case studies, and follow a step by step process with deterministic calculations to build this example. The example mix is illustrative and not a real project; it shows how the method would perform. The Candidate B result is deliberate: the cost screen finds it cheaper, and the specification screen then stops it, which is exactly the discipline EVOLVE-AI exists to enforce.

The bottom line. The capabilities are real, the math is deterministic and checked two independent ways, the physical result would then be confirmed through required laboratory and field verification, and the whole effort lives in one Claude Project that a fresh conversation can resume without starting over.

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