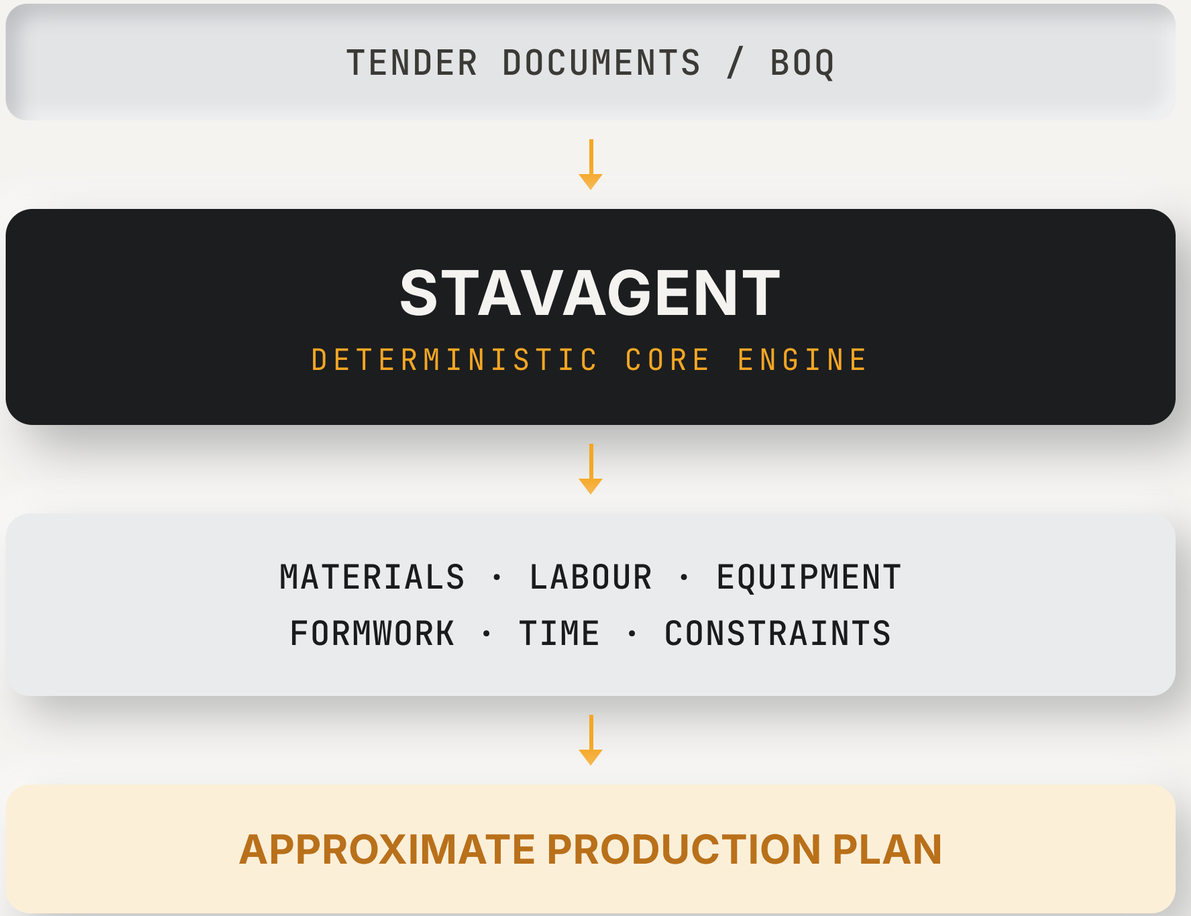
STAVAGENT
THE CONSTRUCTION OS

# From an estimate to a buildable production plan.

A deterministic production-planning engine for construction — with optional agentic access.

**Focus today:** cast-in-place concrete — often on the critical path of structural construction. Hard curing gates · shared formwork sets · continuous pours. Architected to extend to other trades.

- Catalogue software prices the work.
- Schedulers draw the dates.
- **STAVAGENT computes the production in between.**




CEMEX Ventures Construction Startup Competition 2026 · Preconstruction Tech

Alexander Prokopov, Founder · stavagent.cz

# The Missing Production Layer

Estimates describe cost. Schedules describe dates. Neither explains the production logic in between.

### BOQ / Estimate

- Catalogue items
- Quantities
- Unit prices
- Total cost

Describes what is paid.

→

THE MISSING LAYER

### Production Engineering

- Work decomposition
- Technology variants
- Labour norm-hours
- Cycles
- Constraints
- Crew composition
- Equipment
- Formwork
- Curing
- Durations

Usually reconstructed manually in the engineer's head.

→

### Macro-Schedule

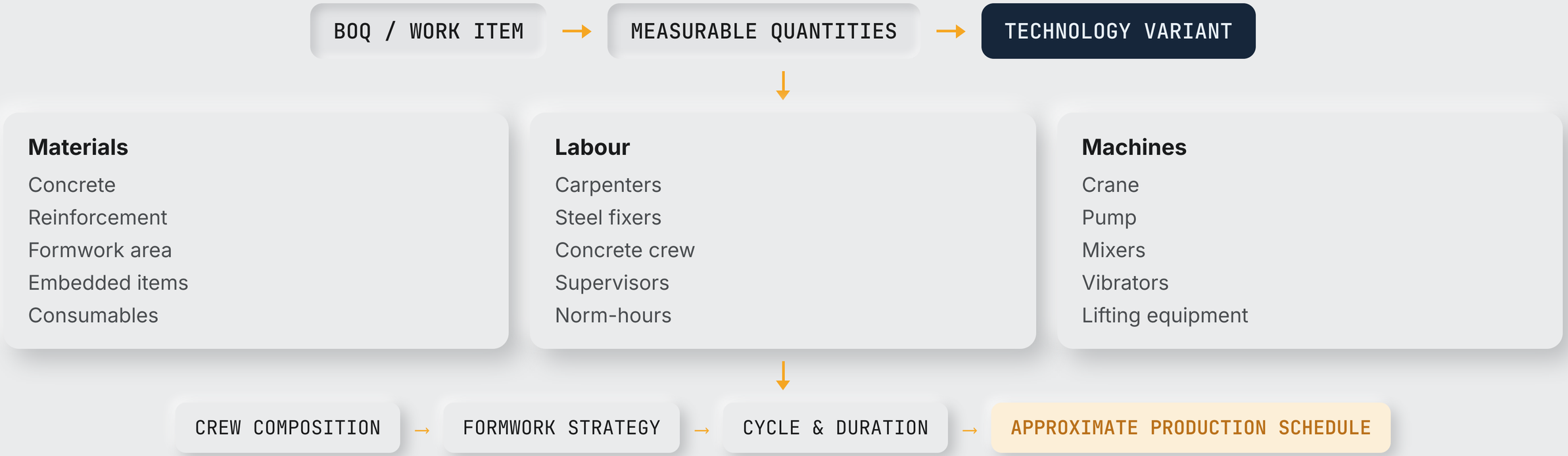
- Activities
- Milestones
- Start / finish
- Critical path

Describes when — but not how.

**Automating documents is not the same as automating production engineering.**

# From Work Items to a Buildable Production Model

A priced work item is not a production plan.




STAVAGENT converts a priced item into an **executable production assumption**.

# Seven Steps. One Production Model.

From element classification to a resource-constrained and risk-adjusted schedule.

**1**

### Classify the Element

24 construction profiles · orientation · reinforcement ratio · pour-rate limit · formwork category.

**2**

### Define the Pour Strategy

Expansion units · sections · working joints · T-window · pump count.

**3**

### Model the Formwork

First assembly · intermediate relocation · final dismantling · h/m² · pressure filtering.

**4**

### Calculate Reinforcement

`mass × labour norm ÷ crew capacity`

**5**

### Simulate the Concrete Pour

`effective rate = MIN(pump, plant, trucks, element limit)`

**6** INTEGRATION

### Build the Resource-Constrained Schedule

`DAG → RCPSP → CPM → Gantt`

**7** UNCERTAINTY

### Quantify Schedule Risk

`10,000 Monte Carlo · P50/P80/P90/P95`

The modules do not produce separate answers. They produce **one connected production scenario**.

# Physics First. Catalogues Last.

Construction work is universal. Catalogue codes are local.

PROJECT EVIDENCE

- Technical specification
- Drawing / DXF
- BOQ
- User input

UNIVERSAL WORK ITEM

**Install reinforcement for a cast-in-place retaining wall**

| | |
|---|---|
| Work ID | WALL-REBAR-001 |
| Unit | t |
| Quantity | CALCULATED |
| Formula | Rebar mass × labour norm |
| Source | Drawing + technical specification |
| Method | Deterministic calculation |
| Confidence | 1.00 |

Material · Labour h · Crew · Equipment · Technology · Duration

Code and price may remain empty until the physical work is verified.

LOCAL MARKET ADAPTERS

**Czech Republic**
ÚRS · RTS · OTSKP · KROS

**DACH**
GAEB · BKI · Sirados

**Spain**
FIEBDC-3 · BEDEC

**Other markets**
local catalogue · labour data · compliance

**The engine decides what the work physically is before asking how a local market codes and prices it.**

One ontology · many adapters

# Deterministic by Design

The AI may interpret the request. It never calculates the engineering result.

```
VERIFIED INPUTS + ENGINEERING FORMULAS + IMPLEMENTED STANDARDS + EXPLICIT CONSTRAINTS = REPEATABLE RESULT
```

Same inputs. Same configuration. Same result.

## The Core Engine Calculates

- Quantities
- Labour norm-hours
- Fresh-concrete pressure
- Pump requirements
- Resource bottlenecks
- Formwork cycles
- Curing gates
- Critical path
- Rental assumptions
- Preliminary costs

## AI May Assist

- Read descriptions
- Classify the element
- Identify missing inputs
- Recommend a workflow
- Orchestrate tools
- Explain the result

**AI does not calculate quantities, pressure, resources, durations or costs.**

**Concrete**
ČSN EN 13670 · EN 206+A2 · Nurse-Saul

**Formwork & temporary works**
DIN 18218 · ČSN EN 12812 · ČSN 73 6244

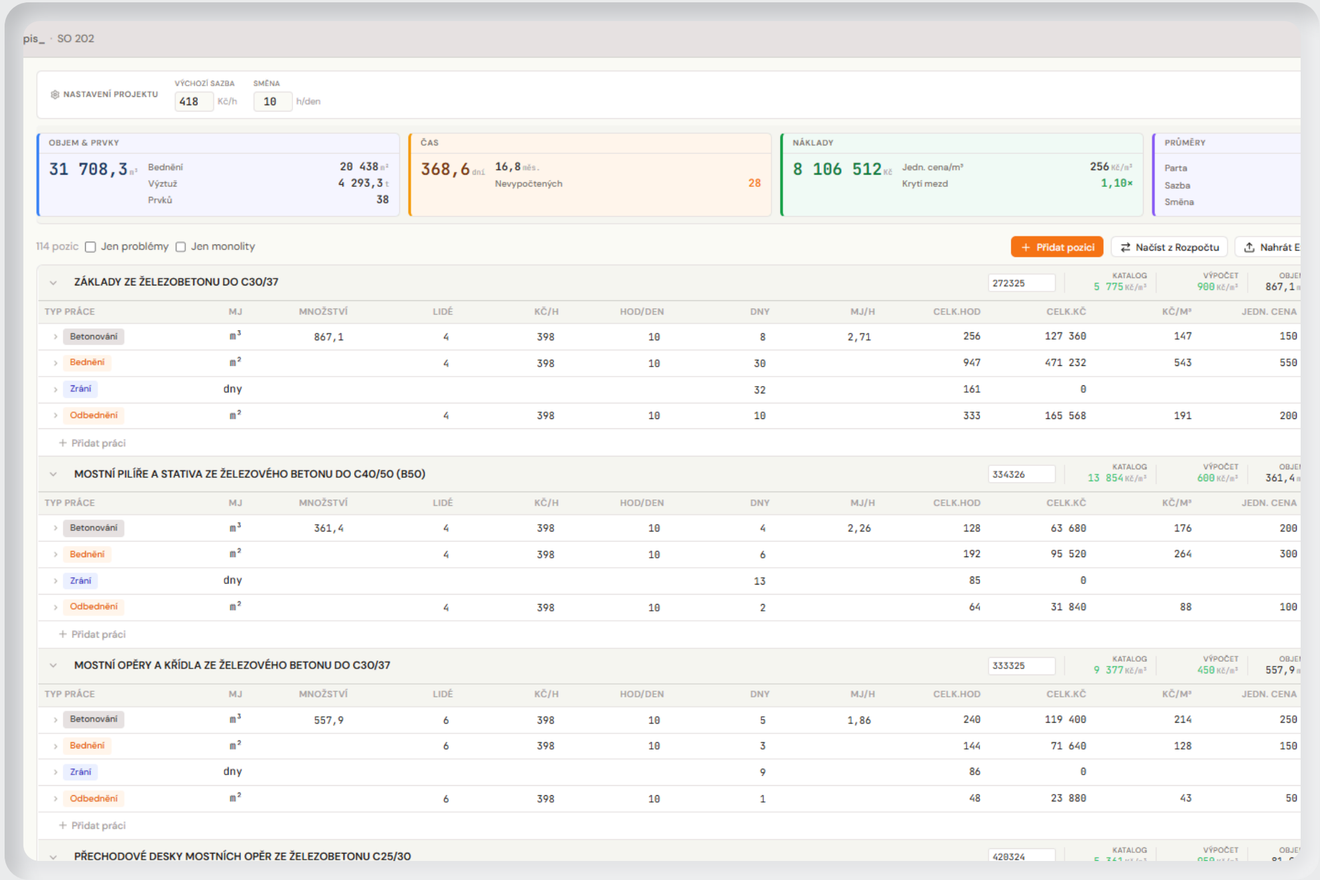
**Labour & planning**
ČSN 73 0210 · Czech labour · CPM · PERT · RCPSP

**Catalogues**
OTSKP · KROS · manufacturer data

*Implemented standards and catalogues relevant to the current calculation modules. Manufacturer data does not imply partnership or endorsement.*

# The Interface Makes the Engine Usable. The Logic Makes It Valuable.

A professional workspace is expected. What it exposes is the differentiator.




### 01 Work Structure

Group by work type, structural element, section, phase or project object.

### 02 Material Structure

Aggregate concrete, reinforcement, formwork and other materials across the project.

### 03 Resource Structure

Review labour norm-hours, crews, equipment, formwork sets and crane requirements.

### 04 Procurement Support

Prepare supplier-facing material lists and enquiry packages when required.

### 05 Scenario Views

Compare technology variants, crew sizes, formwork sets and preliminary durations.

**The frontend is optional depth: users can work simply, or open the full production model.**

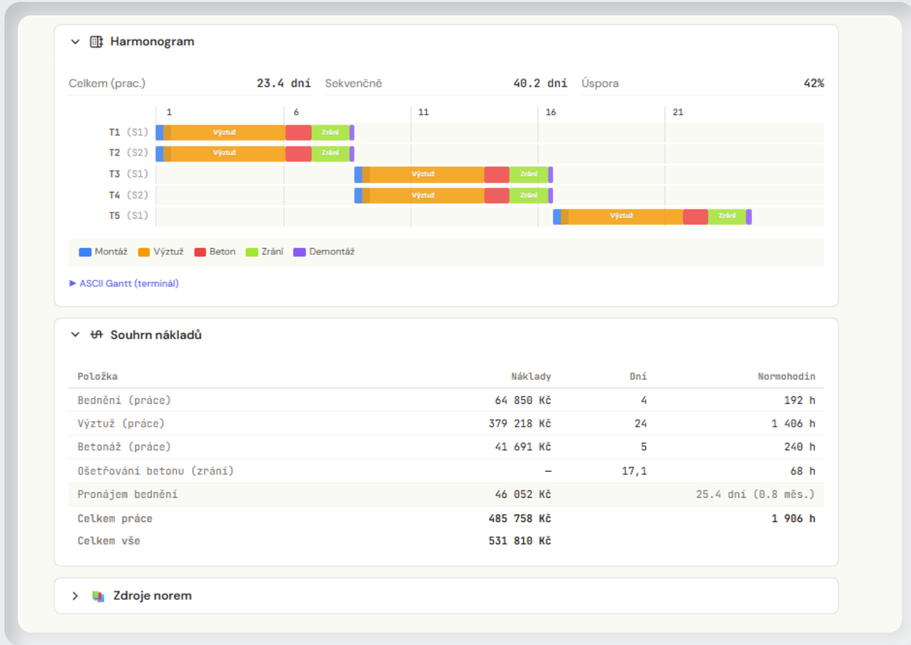
# One Engine. Two Ways to Work.

Manual control or agentic automation — the same deterministic core.

MANUAL

## SaaS Frontend

The estimator imports data, groups works and materials, and reviews the production scenario — here, the calculated schedule and cost summary.




AGENTIC **MCP Access**

An external AI reads the documentation, identifies inputs and calls the same deterministic tools.

TASK INPUT

✳ Using STAVAGENT, decompose a cast-in-place RC retaining wall (zárubní zeď): 30 × 4.0 × 0.40 m, C30/37, XC4. Return concrete volume, formwork area, rebar tonnage, crew and pour + curing time — with the formula, source norm and confidence for each.

Opus 4.8 · High

DETERMINISTIC OUTPUT

| QUANTITY | VALUE | FORMULA | SOURCE / NORM | CONF. |
|---|---|---|---|---|
| **Concrete volume** | 48 m³ | V = L·W·H = 30×4.0×0.40 | Geometric · ČSN EN 206 | 1.00 |
| **Formwork area** | 240 m² | A = 2·L·H = 2×30×4.0 | Měření · ČSN 73 0210 | 0.95 |
| **Rebar tonnage** | 4.32 t | m = ρ·V = 90 kg/m³ × 48 | ČSN 73 0210 · oborové | 0.70 |
| **Crew** | 4 / 4 / 4 | carpenters → rebar → pour | methvin labour norms | 0.85 |
| **Pour time** | ~2.4 h | t = V / Q = 48 / 35 m³/h | pour engine · 35 m³/h | 0.85 |
| **Curing** | strip 1.5 d | Saul maturity Σ(T+10)·Δt | ČSN EN 13670 · NA.2 | mod. |

MANUAL SAAS
AGENT VIA MCP → DETERMINISTIC CORE → SOURCED RESULT

**AI reads and orchestrates. Determinism computes.** You choose who drives.

# One Deterministic Core, Exposed as 20 Tools

External agents (Claude, ChatGPT) call the engine through MCP. The agent orchestrates — it never computes the result itself.

**External agent**
Claude · ChatGPT

→

**MCP Gateway**
auth · policy · billing · audit

→

**Deterministic Core**
the engine

→

**Result**
value + source + confidence

### Catalogue & Norms — 3

Look up national catalogue codes and search local construction norms.

### Classification — 2

Identify the structural element and object type from the inputs.

### Deterministic Calc — 2

Compute concrete works and pump requirements deterministically.

### Document Extraction · UEP — 6

Extract quantities and fields from project documents — with coverage, reconciliation and DWG-conversion handling.

### Parsing & Validation — 4

Parse budgets and documents, extract spec (TZ) fields, validate drawing elements.

### Breakdown · Output · Advisory — 3

Build the work breakdown, export the soupis, and advise on next steps.

**MCP is the access layer, not the moat. Every call returns a value with its source and confidence — or an honest gap (NEPOČÍTÁNO). The agent decides which tool; the deterministic core decides the number.**

# Every Result Has a Calculation Path

Missing information becomes a visible engineering gap — never an invented number.

QUANTITY PASSPORT

VERIFIED

**42.0** $m^2$

FORMULA
A = perimeter × height

SOURCE
Technical Specification §6.3
DXF layer: WALL_FORMWORK

METHOD
Deterministic geometry calculation

CONFIDENCE
1.00

## Method tags

EXTRACTED · CALCULATED · PROFILE ESTIMATE · HUMAN VERIFIED · LLM FALLBACK

## Confidence ladder

- 1.00 Deterministic formula / regex / catalogue / DXF
- 0.99 Human-confirmed value
- 0.85 Verified external database
- 0.70 LLM semantic fallback
- – NEPOČÍTÁNO · insufficient evidence

Trust is useful. **Traceability is defensible.**

# Preliminary Formwork Selection Before Tender Commitments

A technically grounded preselection — before the final supplier design.

$$p = \rho \times g \times h \times k$$

Simplified lateral-pressure model — DIN 18218 inputs and limits

ρ, g, height, consistency k-factor · per-stage height caps

**Geometry**
element type · height · thickness · area · corners · openings

**Concrete behaviour**
consistency · pour rate · temperature · standard / plastic / SCC

**Execution conditions**
crane · access · working height · repetition · sections · cycle target

**Project conditions**
suppliers · assembly space · transport · safety · compatibility

CANDIDATE SYSTEMS

▼

PRESSURE CAPACITY

▼

GEOMETRY COMPATIBILITY

▼

CYCLE & LABOUR PERFORMANCE

▼

ACCESS & CRANE

▼

SHORTLIST

PRELIMINARY FORMWORK STRATEGY

- System category
- Pressure requirement
- Approximate panel area
- Ties and supports
- Number of sets
- Cycle assumptions
- Labour norm-hours
- Crane demand
- Risk flags

**One manufacturer per structural element. Do not mix unverified connection systems within one element.**

*Preliminary tender-stage selection. Final supplier design and approval remain required.*

# From Formwork Choice to Rental Time and Labour Norm-Hours

FORMWORK AREA → PRODUCTIVITY h/m² → 3-PHASE LABOUR → CREW × SHIFT × UTIL → TASK DURATION → SETS × CYCLES → RENTAL DURATION → RENTAL COST

**First Assembly**
+15%
mobilisation

**Relocation**
cycle
standard rate

**Dismantling**
-10%
demobilisation

*+15% / −10% — adjustable model assumptions, not code values.*

Labour duration =
quantity × norm-hours ÷ (crew × shift × utilisation)

**Editable inputs**

formwork crews · workers / crew · shift 8/10/12 h · utilisation · formwork sets · repetition

PRELIMINARY FORMWORK PLAN

| | |
|---|---|
| System type | CALCULATED |
| Sets required | INPUT / CALCULATED |
| Cycles | CALCULATED |
| Labour norm-hours | CALCULATED |
| Crane hours | CALCULATED |
| Rental duration | PRELIMINARY |
| Final supplier price | QUOTATION REQUIRED |

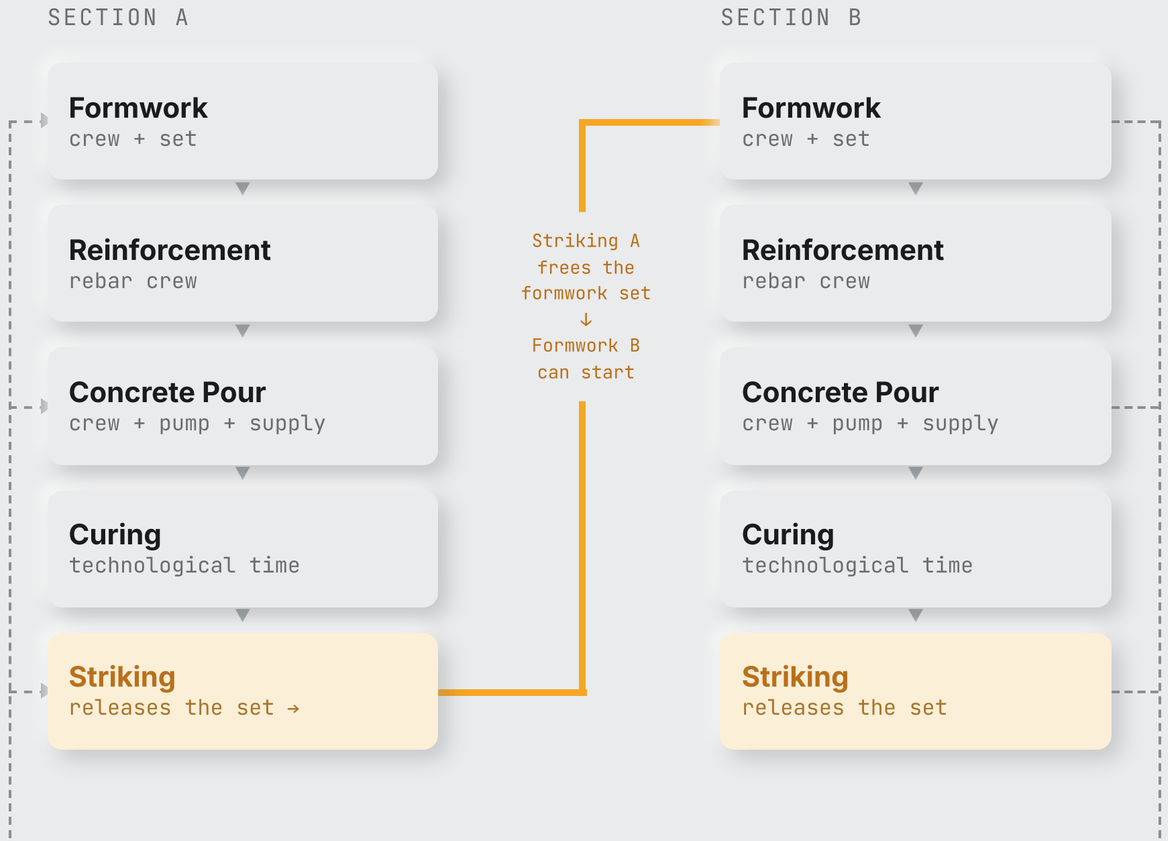
**Optional RFQ package**

geometry · area · system assumptions · pressure · sets · rental period · access · crane · delivery dates

STAVAGENT estimates the **commercial consequence** before the supplier quotation arrives.

# The Schedule Is Computed, Not Drawn

Section B cannot start until section A frees the formwork set — the date is dictated by a resource, not drawn by hand.




**DAG**
Defines the technological order

▼

**RCPSP**
Allocates limited resources — who waits for which set / crane / pump

▼

**CPM**
Finds the critical path

▼

`resource-constrained schedule · P50 / P80`

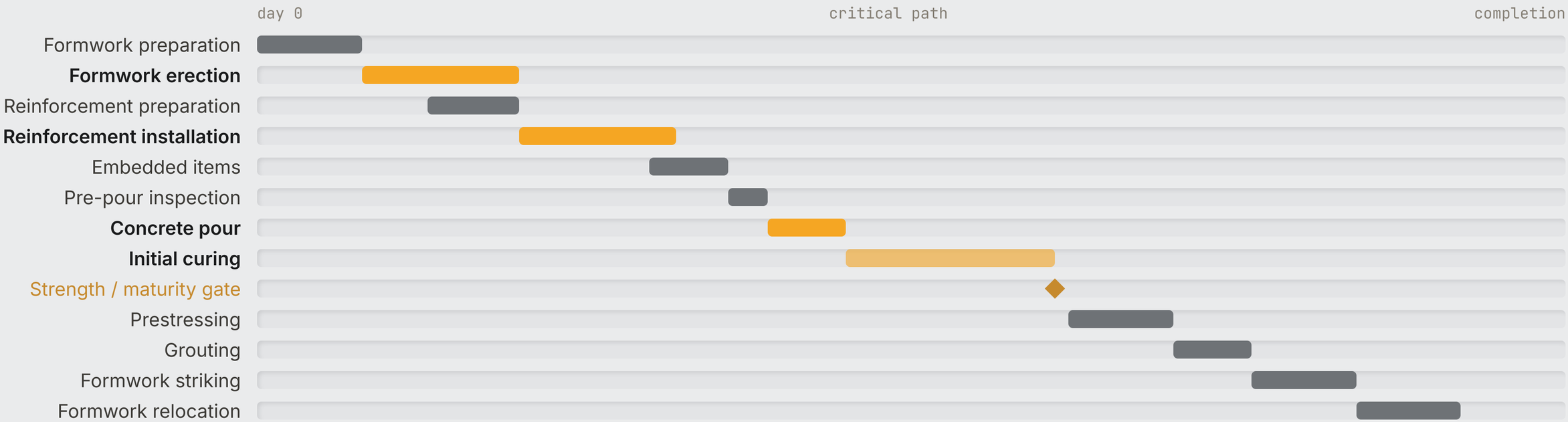
SHARED RESOURCES `crane → Formwork` `formwork sets → Formwork + Striking` `pumps → Pour` `maturity gate → Striking`

**The schedule emerges from physical dependencies and resource availability — deterministically. Same inputs, same plan.**

# An Approximate Schedule Built from Physical Logic

Dates are derived from quantities, resources, cycles and technological gates.

CONCEPTUAL OUTPUT STRUCTURE




DAG → GREEDY FORWARD PASS → RESOURCE ALLOCATION → BACKWARD PASS → SLACK → CRITICAL PATH

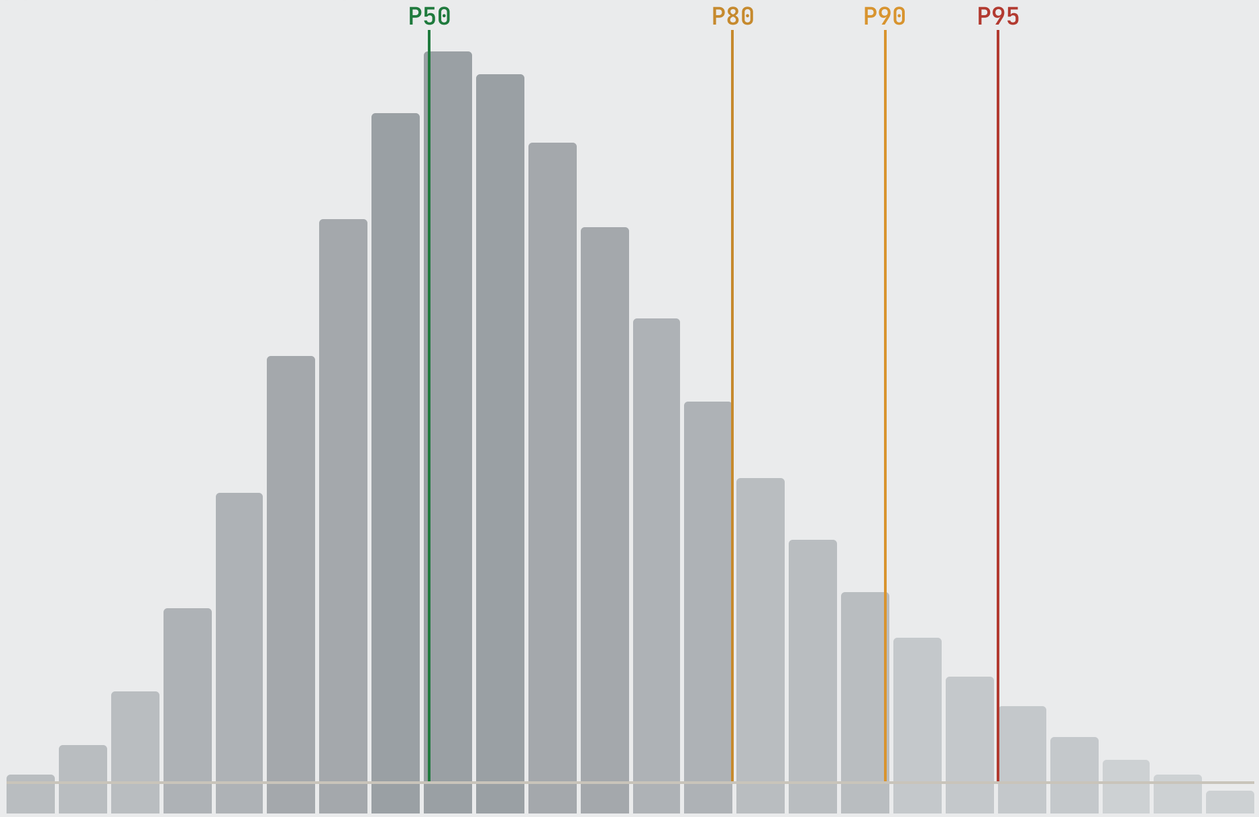
critical ◆ hold point

*Tender-stage production scenario — not a final contractual schedule.*

# One Production Model. Four Confidence Levels.

The deterministic schedule defines the logic. Monte Carlo measures the uncertainty around its duration.

COMPLETION-DATE DISTRIBUTION




Baseline expected duration uses PERT weighting — `t = (o + 4m + p) / 6`. The engine runs 10,000 iterations, sampling each task's three-point range with a triangular distribution, to produce the P50 / P80 / P90 / P95 bands.

| Optimistic | Most likely | Pessimistic |
|---|---|---|

`t = (o + 4m + p) / 6` · `σ = (p - o) / 6`

**10,000** Monte Carlo simulations

**P50** Median scenario — 50% probability of completion by this date.

**P80** Conservative tender planning level.

**P90/95** Higher protection against schedule uncertainty.

**The simulation does not replace the deterministic schedule. It runs around it.**

A single date looks precise. A percentile shows how much confidence it deserves.

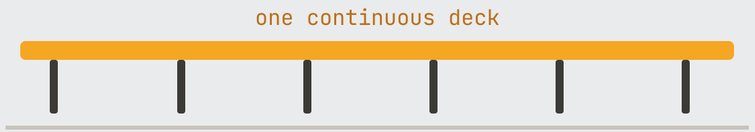
# Equivalent BOQ. Different Production.

Equivalent BOQ language can hide opposite execution strategies.

SAME BOQ GROUP C35/45 concrete · reinforcement · formwork · prestressing · bridge superstructure

## Bridge A

SO 202 · KV→OV




6 spans

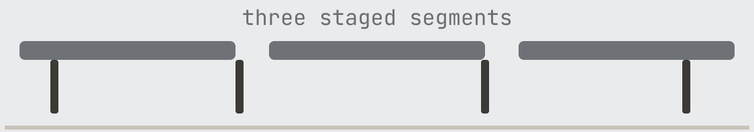
**One continuous mega-pour**

No working joints in the superstructure

One critical uninterrupted production window

## Bridge B

SO 202 · OV→Žalmanov




3 spans

**Three construction stages**

Stage-by-stage production cycle

Repeated formwork and curing cycles

| A | B |
|---|---|
| Continuous | Stage cycles |
| Standby logistics | Stage logistics |
| Crew rotation | Reset by stage |
| Global curing | Curing per stage |
| Interruption risk | Interface risk |
| Continuous support | Stage-adapted |

**The catalogue cannot tell them apart. A production engine must.**

Catalogue equivalence ≠ production equivalence

# A Mega-Pour Is Not a Quantity. It Is a 20-Hour Operation.

The estimate provides the quantity. STAVAGENT calculates the operation.

**Verified pour quantity** — VERIFIED

▼

**Batching-plant capacity** — INPUT

▼

**Truck cycle & interval** — INPUT

▼

**Pump capacity** — CALC / INPUT

▼

**Effective pour rate**
MIN of all constraints

▼

**≈20 h**
continuous-pour window

```
Effective pour rate = MIN(pump, plant,
        trucks, element limit)
```

**Equipment**
Large continuous pour → **standby pump required**.

**Labour**
Duration above 12 h → **two rotating crews**.

**Technology**
Continuous-pour requirement → staged / 6-takt scenario **REJECTED**.

EXECUTABLE POUR PLAN

| | |
|---|---|
| Pour mode | **Continuous** |
| Duration | **≈20 h** |
| Crews | **2 rotations** |
| Pumps | **Main + standby** |
| Curing | **Class 4** |
| Min. curing | **9 days*** |

MATURITY GATE

Temperature history

▼

Nurse-Saul maturity

▼

Strength threshold

▼

**Striking / prestressing release**

**STAVAGENT calculates the complete production chain: logistics, labour, equipment, curing and release gates.**

**Subject to verified plant, truck, pump and site inputs.*

# Already Run on Real Czech Tenders

PRE-REVENUE · PILOT-STAGE PRODUCT

**25** **structures**
20 bridges + 5 retaining walls

Quantities and resource forecasts **computed with STAVAGENT** across two D6 motorway tenders and a design-build bridge — **all prepared to tender stage**.

TENDER WON ✓

### D6 Karlovy Vary – Olšová Vrata

motorway tender
estimated by the founder
tender won by the firm

TENDER-READY

### D6 Olšová Vrata – Žalmanov

motorway tender
quantities + resources
computed with STAVAGENT

DESIGN & BUILD

### Most 2062-1 · Žihle

bridge · design & build
tender-ready

The founder's own live tender projects — **estimated as a practising preconstruction estimator and computed with STAVAGENT**.

# Why CEMEX — Your Customers Pour Our Plans

Concrete often sits on the critical path of structural construction — and it is the production discipline **STAVAGENT models most deeply**.

`Curing gates · shared formwork sets · continuous pours · supply constraints`

Catalogue software does not calculate these interactions. Conventional schedules usually require them to be entered manually.

CLOSED LOOP · FEEDBACK

Tender documents

▼

**Verified production scenario**

`concrete quantity` `pour sequence` `delivery window` `pump assumptions` `curing requirements`

▼

Supplier planning

▼

Site execution

▼

Actual feedback

EXPECTED PILOT OUTCOMES

### Better planning

Structured visibility into quantities, delivery windows and pour sequences.

### Fewer disruptions

Fewer emergency orders and avoidable interruptions.

### Lower avoidable waste

Better alignment between contractor planning and concrete supply.

**We make the planning and execution around your core product more predictable, traceable and reviewable.**

# Business Model and Scale

## SaaS

Per seat or per project for estimators, preconstruction teams and project-controls specialists.

`calculators` `project workspace` `tables` `scenarios` `supplier enquiries` `exports`

## Enterprise and API

Controlled integration into contractor workflows, estimating systems and document platforms.

`API` `MCP access` `corporate norms` `catalogue adapters` `audit controls`

## Construction physics travels. Market rules do not.

The production engine is market-agnostic. What changes per country is the commercial and regulatory layer — **a defined adapter, not a new engine**.

CORE STANDARDS ALREADY IMPLEMENTED

ČSN EN 13670 · ČSN EN 206+A2 · ČSN EN 12812 (European EN, nationally adopted) · DIN 18218 (DE — formwork pressure) · TKP 18 · ČSN 73 6244 / 73 0210 (CZ execution)

```
universal work ontology + national standards & annexes + local labour data + local catalogue adapter = market-specific output
```

**CZ is the proof ground today. DACH & Spain are roadmap markets, enabled through validated local adapters — a new market is a new adapter, not a new engine.** (Not a claim of current market presence.)

# What We Are Asking to Prove

INPUTS

- One live tender
- One CEMEX-family contractor
- BOQ or completed estimate
- Technical specification & drawings
- Available supplier assumptions
- One or two domain advisors

→

**STAVAGENT PILOT**

→

RETURNED PACKAGE

- Decomposed work model
- Grouped work & material tables
- Labour norm-hours
- Crew & equipment assumptions
- Formwork preselection
- Estimated rental duration
- Resource-constrained schedule
- P50 / P80 / P90 / P95
- Concrete logistics assumptions
- Quantity passports
- Unresolved evidence gaps
- Optional supplier RFQ package

PILOT KPIS

Time to first scenario · Quantities with source & formula · Unresolved gaps · Invalid scenarios blocked · Contractor review time · Schedule confidence · Audit completeness

STAVAGENT turns estimates into traceable production scenarios. A live CEMEX tender pilot proves the value locally — the **universal work ontology** lets the same engine scale internationally (roadmap).

## We're not asking CEMEX to believe a demo.
## We're asking you to test the production engine on one live tender.

One live tender · one contractor · one measurable pilot

**Alexander Prokopov — Founder.** A practising preconstruction estimator and the product's first user — he faces this production-planning gap on real tenders. Solo domain founder, seeking engineering, cloud & commercial partners for validation and international scale.

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