VMX (Vision Matrix) — Documentation

N4S — Luxury Residential Advisory Platform

1. Overview

What is VMX?

The VMX (Vision Matrix) module is the N4S platform's cost analysis engine. It translates your project's spatial program, quality tier, location, and site conditions into a structured budget trajectory using a 7-category elemental cost model based on ASTM UniFormat II.

VMX provides two viewing modes: **Lite** for a streamlined client-facing summary, and **Pro** for full matrix control, benchmark editing, and detailed cost engineering. Both modes draw from the same underlying engine and produce consistent results.

The 7-Category Cost Model

VMX breaks construction costs into seven elemental categories. Each category has three benchmark bands (Low / Medium / High) expressed in dollars per square foot ($/SF). The categories are:

#	Category	What it Covers
1	**Site Prep & Infrastructure**	Demolition, earthworks, utilities, site access, temporary works
2	**Substructure**	Foundations, basement construction, retaining walls, waterproofing
3	**Shell**	Structural frame, exterior envelope, roofing, windows, exterior doors
4	**Interiors**	Interior finishes, millwork, flooring, wall treatments, ceilings, doors
5	**Equipment & Furnishings**	FF&E, appliances, built-in equipment, audio/visual, specialty items
6		

Services (MEP)

Mechanical, electrical, plumbing, fire protection, controls, low voltage

7

Exterior Improvements

Landscaping, pools, hardscape, exterior lighting, fencing, outbuildings

Each category's $/SF value is driven by the selected **quality tier**, adjusted by **location** and **site typology** multipliers, and optionally influenced by **program bias** from the FYI module's zone allocation.

Quality Tiers

VMX uses four quality tiers that define the benchmark price points for each cost category. Tiers are typically set in KYC (P1.A.4 Interior Quality Tier) and flow into VMX automatically.

Tier KYC Mapping Character
Select Standard High-quality residential — well-appointed but cost-conscious
Reserve Premium Elevated luxury — curated materials, considered detailing
Signature Luxury Bespoke luxury — custom everything, artisan-level finishes
Legacy Ultra Generational estate — museum-grade materials, no compromise

Lite Mode vs Pro Mode

Lite Mode

"Give me the bottom line and the key risks."

- KPI summary cards (Direct Hard, Contract, Soft, Grand Total)
- Category allocation table
- Key cost drivers (typology + location impact)
- Budget watchouts (over/under allocation risks)
- Compare Mode for side-by-side scenarios
- PDF and Client Pack export

Best for: Client presentations, stakeholder reviews, early feasibility

Pro Mode

"I need full control over every assumption."

- Interactive cost matrix (7 categories × 3 bands)
- Interior Tier Override (mix tier levels)
- Delta Heat analysis (B − A comparisons)
- Construction Indirects (GC fee, conditions, contingency)
- Soft Costs & Cashflow (owner-side costs + escalation)
- Benchmark Admin (edit $/SF values per region/tier)
- Guardrails & Provenance configuration
- Key Drivers with baseline controls
- Grand Total Project Cost roll-up

Best for: Advisors, cost consultants, budget calibration sessions

N4S Integration — Where VMX Gets Its Data

VMX is deeply integrated with other N4S modules. Several fields are auto-populated and locked (marked "from KYC") to maintain data integrity across the platform.

VMX receives data from KYC and FYI through three mechanisms:

Always Synced (read-only): Client name, project name, quality tier lock status, and KYC budget constraints update in real-time whenever KYC data changes.

Seed Once: Scenario values like target area, location preset, and typology are populated from KYC/FYI when VMX first loads for a project. After initial seeding, these values become independently editable by the advisor without being overwritten by KYC changes.

Editable: All scenario parameters (cost bands, multipliers, overrides) are fully advisor-controlled and never overwritten by upstream modules.

VMX Field	Source Module	Behavior
Client Name	KYC (Portfolio Context)	Always Synced — display only
Project Name	KYC (Project Parameters)	Always Synced — display only
Target Area (SF)		

	KYC targetGSF → FYI targetSF fallback	Seed Once — editable after initial load
Quality Tier	KYC (P1.A.4 Interior Quality Tier)	Always Synced — locked when set in KYC
Location Preset	KYC (Property Location)	Seed Once — advisor can change after load
Site Typology	KYS (Selected Site)	Seed Once — advisor can change after load
Land Cost	KYC → KYS fallback	Always Synced from KYC
Program Bias	FYI (Zone SF totals)	Always Synced — auto-calculated from FYI zones
Budget Framework	KYC (P1.A.4)	Always Synced — read-only reference panel

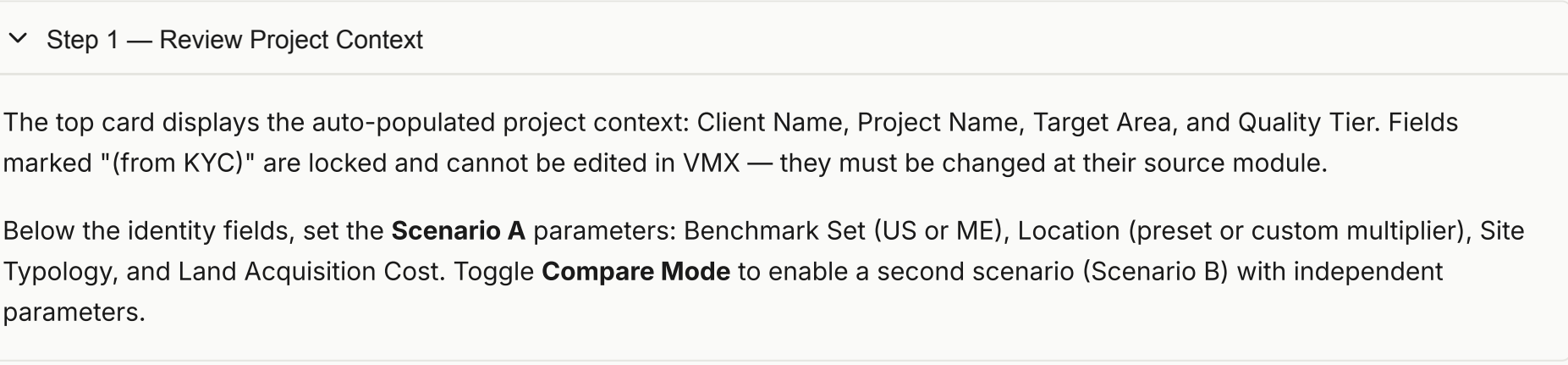
2. Workflow

VMX Workflow

VMX is organized into two progressive modes. Start with Lite for a quick budget trajectory, then switch to Pro when you need full control over assumptions and benchmark data.

Lite Mode — Client Dashboard

Lite mode presents a read-friendly summary of the project's cost trajectory. All calculations happen automatically based on the project context flowing from KYC, FYI, and KYS.



Step 1 — Review Project Context

The top card displays the auto-populated project context: Client Name, Project Name, Target Area, and Quality Tier. Fields marked "(from KYC)" are locked and cannot be edited in VMX — they must be changed at their source module.

Below the identity fields, set the **Scenario A** parameters: Benchmark Set (US or ME), Location (preset or custom multiplier), Site Typology, and Land Acquisition Cost. Toggle **Compare Mode** to enable a second scenario (Scenario B) with independent parameters.

Step 2 — KYC Budget Framework Reference

If KYC has budget data (P1.A.4), a gold-accented reference card appears showing the client's stated Total Project Budget, Interior Budget, Budget Flexibility, and derived $/SF tier indicator. This is read-only context to help advisors calibrate VMX scenarios against client expectations.

Step 3 — Read the KPI Summary

Each scenario card displays six key performance indicators:

KPI What it Shows
Direct Hard Costs Sum of all 7 categories × area (sticks and bricks)
Construction Contract Direct Hard + Construction Indirects (GC fee, conditions, contingency)
Owner Soft + Escalation Architecture, design, permits, project management + escalation
Land Acquisition Land cost from KYC or KYS
All-in Grand Total Contract + Soft + Escalation + Land
All-in $/SF Grand Total ÷ Target Area — the all-in per-square-foot cost

Step 4 — Allocation Snapshot

Below the KPIs, a table breaks down the Direct Hard Costs across all 7 categories showing absolute cost and percentage of total. This reveals the cost distribution — for example, whether Interiors dominate (typical in luxury) or whether Site Prep is unusually high (common in hillside sites).

Step 5 — Key Cost Drivers

Two driver analyses compare your scenario against baselines:

Typology Impact shows how your site type (e.g., Hillside) changes costs vs the Suburban baseline. Only categories with ≥ 5% movement are shown.

Location Impact shows how your location multiplier (e.g., Florida at 1.18×) changes costs vs the National Average baseline. High-cost locations apply damping to Interiors and FF&E to reflect the fact that premium finishes have less geographic variance.

Step 6 — Budget Watchouts

Watchouts flag categories where the allocation percentage falls outside the target range for the selected tier. For example, if Interiors is consuming 42% of costs but the tier norm caps at 38%, a watchout alerts the advisor. Up to 3 watchouts are shown, ranked by severity.

Step 7 — Compare Mode (Optional)

Toggle Compare Mode to add Scenario B with independent region, location, typology, and land cost. In Lite mode, both scenarios appear side-by-side as cards. A "Key Differences" table shows category-level deltas (B − A).

Step 8 — Export

Export PDF Report generates a print-optimized report (via browser print dialog) with a branded header, all scenario data, and provenance metadata.

Export Client Pack (.zip) bundles a CSV of deltas, scenario summaries, and metadata into a downloadable archive for offline distribution.

Pro Mode — Full Matrix Control

Pro mode adds the interactive cost matrix, benchmark editing tools, construction indirects, soft costs, and advanced comparison analytics. Everything from Lite mode remains visible — Pro adds layers on top.

Step 1 — Pro Controls Card

The Pro Controls card provides two key settings:

Benchmark Editor Target — In Compare Mode, choose whether the Benchmark Admin below edits Scenario A's or B's benchmark data.

Interiors + FF&E Package (4-Tier Override) — Override the tier used for Categories 4 (Interiors) and 5 (Equipment & Furnishings) independently of the overall tier. For example, set the structure to Reserve but the interiors to Signature. When set to "Match overall Tier", all categories use the same benchmark tier.

Step 2 — The Cost Matrix

The matrix displays all 7 categories with their benchmark $/SF values across three bands: **Low**, **Medium**, and**High**. Click a band cell to select it for each category. The selected band determines the $/SF used in the cost calculation.

The matrix shows real-time totals: per-category cost, percentage of total, and a running grand total at the bottom. Target range indicators highlight when a category's allocation percentage falls outside norms.

In Compare Mode, two matrices appear side-by-side (Scenario A and B), each with independent band selections.

Step 3 — Delta Heat Analysis (Compare Mode)

When Compare Mode is active, the **Delta Heat** panel shows a detailed comparison of B − A across all categories.

Each category row shows: direction (Increase / Decrease / Flat), delta cost, delta as percentage of total, impact bar, and heat level (Low / Medium / High). Heat thresholds and driver rules are configurable in the Guardrails panel.

Summary cards at the top show total delta, A total, and B total, plus the largest increases and decreases across categories.

Step 4 — Advisory Readout (Compare Mode)

Below the Delta Heat, the Advisory Readout provides a narrative summary of Scenario A vs B differences, highlighting which categories drive the most significant cost deltas and their implications for the project.

Step 5 — Benchmark Library Admin

The Benchmark Library Admin allows authorized users to edit the $/SF values and target allocation ranges for each category, band, region, and tier combination. This is where benchmark calibration happens.

Changes to benchmarks are stored in the project data and affect all calculations immediately. A "Reset to Demo" button reverts any region/tier combination to its factory defaults.

Step 6 — Guardrails & Provenance

The Guardrails panel configures:

Dataset Provenance — Name, last-updated date, and assumptions text that appear in reports and exports. Auto-stamp updates the date whenever benchmarks change.

Delta Heat Thresholds — The percentage thresholds that define Medium and High heat levels in the delta analysis.

Driver Rules — Choose between "Top N" (flag the top N categories by impact) or "Percentage" (flag categories exceeding a threshold percentage).

Step 7 — Construction Indirects

The Construction Indirects panel calculates the gap between Direct Hard Costs and the Construction Contract. Four line items are computed as percentages of the cost base:

Line Item Description
General Conditions Site staff, temporary works, site logistics
GL Insurance General Contractor's liability insurance (pass-through)
Construction Contingency Hard contingency for unforeseen conditions
GC Fee (O&P) Contractor overhead & profit — applied to Cost of Work

Rates default to tier-appropriate values and are adjusted by site typology (e.g., Waterfront doubles GL Insurance, Urban increases General Conditions). All rates are editable.

Step 8 — Soft Costs & Cashflow

Owner-side soft costs are calculated as percentages of the hard cost base. Default line items include Architect Fee, Interior Design Fee, Landscape Design Fee, Permits & Entitlements, Project Management, Legal & Accounting, and Owner's Contingency.

Escalation is applied based on project duration and an annual rate (default 6%). The escalation scope can be set to hard costs only or hard + soft.

Cashflow Schedule distributes the total project cost across the construction duration using configurable year-by-year draw weights, producing a cumulative spend curve.

Step 9 — Key Drivers (Location & Typology)

The Key Drivers panel isolates the cost impact of location and typology choices by comparing each scenario against configurable baselines. Both a Baseline Location and a Baseline Typology can be set independently.

For each scenario, two driver analyses are shown: **Typology Impact**(same location, different site type) and **Location Impact**(same typology, different location). Only categories with ≥ 5% movement are listed.

Step 10 — Grand Total Project Cost

The Grand Total table rolls up all cost components into a single summary:

Direct Hard Costs (7 categories) + Construction Indirects + Land Acquisition + Soft Costs + Escalation = **Grand Total (All-in Project Cost)**.

In Compare Mode, both scenarios appear with a delta column. This is the definitive "all-in" number for the project.

3. Gates & Validation

Guardrails & Validation Logic

VMX uses a layered system of multipliers, guardrails, and validation rules to ensure cost estimates remain realistic and internally consistent.

Location Multiplier Logic

Location presets apply a global multiplier to all 7 categories. However, for high-cost locations (factor > 1.10), VMX applies **damping**to Categories 4 (Interiors) and 5 (FF&E).

Damping Formula: For Interiors and FF&E when the global factor exceeds 1.10, the applied factor is:

```
damped = 1 + ((globalFactor − 1) × 0.5)
```

Rationale: Premium interior finishes and furnishings are sourced from global markets and have less geographic price variance than labor-intensive site work. A $200/SF Italian marble slab costs roughly the same in Miami and Denver — the labor to install it varies, but not as dramatically as foundation work on a hillside.

Location	Global Factor	Cat 4/5 Factor (Damped)
National Average	1.00×	1.00× (no damping)
Florida	1.18×	1.09×
Colorado (Aspen/Vail)	1.50×	1.25×

New York (NYC/Hamptons)

1.42×

1.21×

Typology Category Factors

Unlike location (which applies broadly), typology modifiers are **category-targeted**. Each site type adjusts specific categories that are most affected by that site condition.

Typology Categories Affected Key Impact
Suburban None (baseline) All factors = 1.0×
Hillside Site Prep ×1.30, Substructure ×1.75, Shell ×1.15, Exterior ×1.50 Deep foundations, retaining walls, difficult access
Waterfront Site Prep ×1.20, Substructure ×1.40, Shell ×1.10, Exterior ×1.25 Marine conditions, flood protection, corrosion resistance
Urban Site Prep ×1.25, Exterior ×0.50 Tight site logistics, less exterior scope
Rural Site Prep ×1.75, Exterior ×1.10 Infrastructure bring-in, long haul distances
Desert

Site Prep ×1.10, Shell ×1.10, Services ×1.15, Exterior ×1.20

Thermal envelope, cooling demand, water management

Typology × Construction Indirects

Site typology also adjusts Construction Indirect rates:

Typology	General Conditions Factor	GL Insurance Factor
Suburban	1.00×	1.00×
Hillside	1.20×	1.00×
Waterfront	1.10×	2.00× (marine risk)
Urban	1.40×	1.00×
Rural	1.15×	1.00×
Desert	1.05×	

1.00×

Program Bias (FYI Zone Weighting)

When FYI has a completed space program, VMX automatically calculates program bias to adjust categories that are sensitive to the program mix.

Interiors + FF&E Boost: When front-of-house zones (Arrival/Public + Entertainment) exceed 26% of the total program, Categories 4 and 5 are boosted up to +12%. FOH-heavy programs imply more guest-facing finish intensity.

Services (MEP) Boost: When MEP-driver zones (Entertainment + Wellness + Outdoor) exceed 18% of the total, Category 6 is boosted up to +12%. These zones demand higher mechanical/electrical loads.

Budget Watchout Rules

Each category has a target allocation range (min% to max% of Direct Hard Costs) defined in the benchmark data. When a category's actual percentage falls outside its range, a watchout is triggered:

Under: Category allocation is below the minimum target — may indicate under-investment in that area.

Over: Category allocation exceeds the maximum target — may indicate cost concentration risk.

The top 3 watchouts by severity are shown in Lite mode. Pro mode provides range indicators directly in the matrix.

Delta Heat Thresholds

In Compare Mode, each category's delta is classified by heat level based on its absolute cost delta as a fraction of Scenario A's total:

Heat Level	Default Threshold	Meaning
Low	< 1.5%	Negligible difference — noise level
Medium	≥ 1.5%	Material difference — worth discussing
High	≥ 3.0%	Significant driver — requires attention

Thresholds are configurable in the Guardrails panel. Drivers are determined by either "Top N" (default: top 3 by |Δ Cost|) or "Percentage" (categories exceeding a configurable threshold).

4. Reference

VMX Reference

Quick-reference tables and glossary for VMX terminology, data structures, and default configuration values.

Glossary

Direct Hard Costs

The sum of all 7 elemental cost categories — the "sticks and bricks" construction cost before any contractor markups, soft costs, or escalation.

Construction Indirects

Contractor overhead layered on top of Direct Hard Costs: General Conditions, GL Insurance, Construction Contingency, and GC Fee (O&P). Together with Direct Hard Costs, these form the Construction Contract value.

Soft Costs

Owner-side professional fees and expenses: architect, interior designer, landscape architect, permits, project management, legal, and owner's contingency.

Escalation

Cost inflation applied over the construction duration. Default is 6% annually, compounded over the project timeline.

Grand Total

The all-in project cost: Direct Hard + Indirects + Land + Soft Costs + Escalation.

Heat Band (LOW / MEDIUM / HIGH)

The three benchmark tiers for each cost category. LOW represents a conservative/efficient approach, MEDIUM is the recommended baseline, HIGH represents premium scope or difficult conditions.

Target Range

The expected allocation percentage range (min–max) for each category as a proportion of total Direct Hard Costs. Used to flag budget watchouts.

Location Factor

A multiplier applied to benchmark $/SF values to account for geographic cost variation. Preset values range from 1.00× (National Average) to 1.50× (Aspen/Vail).

Damping

The reduced location factor applied to Interiors (Cat 4) and FF&E (Cat 5) in high-cost locations. Reflects the lower geographic variance of premium materials.

Typology

Site condition classification (Suburban, Hillside, Waterfront, Urban, Rural, Desert) that applies category-targeted cost adjustments.

Program Bias

Automatic cost adjustment derived from FYI zone allocations. FOH-heavy programs boost Interiors/FF&E; MEP-driver zones boost Services.

Delta Heat

Compare Mode analysis showing the magnitude of cost differences between Scenario A and B, classified by impact level.

Interior Tier Override

Pro mode feature allowing Interiors (Cat 4) and FF&E (Cat 5) to use a different quality tier than the remaining categories. Useful when the client wants a Reserve structure but Signature finishes.

Benchmark Set

A region-specific collection of $/SF values for all 7 categories × 3 bands × 4 tiers. Currently available: US and ME (Middle East).

Provenance

Metadata describing the benchmark dataset — name, last updated date, and assumptions text. Appears in reports and exports for audit trail purposes.

Snapshot Panel

Pro mode tool to capture and compare point-in-time snapshots of Scenario A results, enabling before/after analysis during calibration sessions.

Cost of Work

In Construction Indirects, this is the subtotal used as the base for GC Fee calculation: Direct Hard + General Conditions + GL Insurance + Contingency.

Location Presets

Preset ID	Label	Factor
national	National Average	1.00×
florida	Florida (Miami / Palm Beach)	1.18×
co_denver	Colorado (Denver)	1.10×
co_aspen	Colorado (Aspen / Vail)	1.50×
ca_la	California (LA / OC)	1.30×
ny_hamptons	New York (NYC / Hamptons)	1.42×

custom

Custom...

User-defined

Default Construction Indirect Rates by Tier

Line Item	Select	Reserve	Signature	Legacy
General Conditions	6%	8%	10%	12%
GL Insurance	1.0%	1.0%	1.25%	1.5%
Contingency	5%	5%	8%	10%
GC Fee (O&P)	10%	12%		

14%

16%

Fee Base

Cost of Work (recommended)

Note: GC Fee is applied to the Cost of Work subtotal (Direct Hard + General Conditions + GL Insurance + Contingency), not to Direct Hard Costs alone.

Default Soft Cost Line Items

Line Item	Basis	Default Rate
Architect Fee (fee-only)	Hard Costs	6%
Interior Design Fee (fee-only)	Hard Costs	6%
Landscape Design Fee	Hard Costs	3%
Permits & Entitlements	Hard Costs	2%
Project Management / Owner's Rep	Hard Costs	4%
Legal & Accounting	Hard Costs	1%

Owner's Contingency	
Hard Costs	
5%	

Default escalation: 6% annually over a 4-year project duration, applied to hard costs only (configurable to hard + soft).

Benchmark Regions

VMX ships with two benchmark regions. Additional regions can be added via the Benchmark Library Admin in Pro mode.

Region ID	Name	Currency
us	United States	USD
me	Middle East	USD

Middle East projects are auto-detected when the KYC project country is UAE, Saudi Arabia, Qatar, Bahrain, Kuwait, or Oman.

VMX Version & Provenance

The provenance bar at the bottom of the Pro view displays:

VMX Version — Engine version for tracking behavior changes.

Dataset Name — Identifies which benchmark dataset is active.

Last Updated — Timestamp of the last benchmark or guardrail change. Can be manually stamped or auto-stamped on benchmark edits.

Assumptions — Free-text field describing the basis and limitations of the dataset (appears in all exports).