

Building Health Index — Methodology Specification

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1. Purpose

The Building Health Index (BHI) is a single 0–100 score that summarises the measured health of a building across six subsystems. Every BHI figure surfaced in SENSE&VALUE products — dashboards, alerts, valuation packs, signed reports — is computed by the exact procedure defined below. This document is the versioned reference: any deviation is a bug, not a variant.

2. Formula

$BHI = \sum w_i \cdot s_i$ where $s_i \in [0, 100]$ is the normalised subsystem score and w_i is the fixed subsystem weight. Weights sum to 1. A single missing subsystem redistributes its weight proportionally to the remaining subsystems and is flagged in the report.

3. Subsystem weights

Subsystem	Weight	Rationale
Structural	30 %	Life-safety and irreversible damage dominate loss severity.
MEP	25 %	Chillers, pumps, switchgear drive both OPEX and downtime.
Envelope	15 %	Facade, roof, waterproofing — high replacement cost.
Energy	15 %	Directly tied to NOI; measurable in near real-time.
Safety	10 %	Fire, smoke, water, egress — binary event risk.
Finish	5 %	Cosmetic; low weight, tracked for tenant satisfaction.

4. Subsystem score s_i

Each subsystem score is the weighted average of its channel-level indicators, each mapped to $[0, 100]$ via a documented deficiency function. For a channel c with reading x_t at time t , a target band $[lo, hi]$, and a hard limit L :

$$s_c(x_t) = 100 \cdot \exp(-k \cdot d(x_t))$$
$$d(x_t) = \max(0, x_t - hi, lo - x_t) / (L - hi)$$

k is calibrated per channel from field data (v1 uses $k = 2.30$, corresponding to a $10\times$ decay at the hard limit). Missing readings older than the channel's stale-threshold produce $s = \text{null}$ and trigger reweighting.

5. Bands

Score	Band	Meaning
90–100	Excellent	No action required.
75–89	Good	Routine maintenance only.
60–74	Watch	Investigate; degradation trend.
0–59	Critical	Immediate intervention required.

6. Aggregation & audit

A BHI computation writes: (a) the timestamp, (b) the ordered list of subsystem scores with the channels used, (c) the weight vector, (d) any reweighting due to null subsystems, (e) the final BHI value. This tuple is SHA-256 hashed and included as a leaf in the daily Merkle batch anchored to the audit chain. Every BHI figure shown to a user is retrievable by its computation ID and independently reproducible.

7. Change control

This document defines version BHI-1.0. Any change to weights, deficiency function, or bands increments the minor version (BHI-1.1) with a public changelog. A change to formulation increments the major version (BHI-2.0). Historical figures are never retroactively recomputed under a new version — they retain their original version tag.

8. Validation plan

Quarterly, an independent field survey scores a random sample of buildings under BHI-1.0 by hand. The mean absolute error between hand-scored and system-scored BHI must be ≤ 5.0 for the version to remain in production. Failing quarters trigger a v1.x re-calibration and a public post-mortem.