

Gingerbread's Grand Gables



A 6×6 all-ways high-volatility Christmas slot — a deliberately starved base game carried by two bounded, mathematically-tuned bonus features.

GAME RTP

~91.9%

VOLATILITY

High

MAX WIN

37,074×

GRID

6×6 All-Ways

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Original concept, math design, Monte-Carlo validation, art direction & engineering. All figures sourced from the game's real configuration and simulation harness.
Confidential design document.

1 Overview

Gingerbread's Grand Gables is an original 6×6 all-ways Christmas slot built in a glossy 2.5D hyper-casual style. Wins pay left-to-right from the leftmost reel across matching symbols, with no fixed paylines and no base-game cascade. The design philosophy is taken from modern high-volatility titles such as *Wanted Dead or a Wild*: the base game is intentionally lean, and the return-to-player is carried almost entirely by two contrasting bonus features — one frequent and steady, one rare and explosive.

THE HOOK

Two bonuses, two volatility profiles. **Raining Houses** (cheap, frequent, capped) gives steady action; **Build the Gables** (premium, rare, barbell-shaped) chases a 35,000×+ ceiling. Each is independently tuned to ~96% of its cost, and the base-game scatter weights are tuned so the whole game lands at ~96% RTP through natural play.

ATTRIBUTE	VALUE
Title	Gingerbread's Grand Gables
Grid / mechanic	6×6, all-ways (left-to-right, 3+ from reel 1), no base cascade
Paying symbols	2 premiums, 3 mids, 4 lows, wild, 2 scatters
Bet range	\$0.20 – \$5.00 (25 steps of \$0.20; default \$1.00)
Theme / style	Christmas gingerbread · glossy 2.5D hyper-casual
Base game RTP (line only)	37.47%
Total game RTP (with natural bonus triggers)	~91.9%
Volatility class	High
Max win	37,074× (validated ceiling)
Engine / stack	TypeScript · PixiJS v8 · GSAP · Vite

2 Key Stats

TOTAL GAME RTP

~91.9%

Base line + natural triggers · 5M spins

BUILD BONUS RTP

95.68%

of 350× cost · 1M-bonus sim

RAINING RTP

91.77%

of 100× cost · 1M-bonus sim

MAX WIN

37,074×

Ultra Palace × max multiplier

METRIC	VALUE	VALIDATION
Total game RTP	~91.9%	5,000,000-spin Monte-Carlo over real game logic
Base game line RTP	37.47%	5M-spin sim
Base game hit frequency	43.96%	56.04% dead spins (by design)
Build the Gables bonus RTP	95.68%	1,000,000-bonus sim
Raining Houses bonus RTP	91.77%	1,000,000-bonus sim
Build the Gables trigger rate (natural)	~1 in 2,465	5M-spin scatter sim
Raining Houses trigger rate (natural)	~1 in 225	5M-spin scatter sim
Build bonus 0× (dud) rate	0.00%	multiplier floor = 1
Volatility class	High	barbell payout distribution

3 Core Mechanics

Base Spin & Win Evaluation

Each spin fills the 6×6 grid from weighted reels. Evaluation is **all-ways**: a win is any symbol appearing on 3+ consecutive reels starting from reel 1, with the win value equal to the symbol's pay multiplied by the number of "ways" (the product of that symbol's count on each contributing reel). There is **no base-game cascade** — each spin is evaluated once. Minimum match lengths differ by tier: premiums pay from 4 of a kind, mids and lows from 5.

Paytable & Symbol Weights

SYMBOL	TIER	4-KIND	5-KIND	6-KIND	WEIGHT
Gingerbread Man	Premium	3.00	12.00	40.00	300 (4.67%)
Gingerbread Woman	Premium	2.50	10.00	35.00	300 (4.67%)
Hot Cocoa	Mid	—	0.30	1.00	600 (9.33%)
Tree Cookie	Mid	—	0.25	0.80	600 (9.33%)
Candy Cane	Mid	—	0.20	0.65	600 (9.33%)
Ten	Low	—	0.012	0.040	1000 (15.55%)
Jack	Low	—	0.012	0.040	1000 (15.55%)
Queen	Low	—	0.010	0.030	1000 (15.55%)
King	Low	—	0.010	0.030	1000 (15.55%)
Wild (substitute-only)	Special	—	—	—	30 (0.47%)
Scatter — Build (blueprint)	Trigger	3+ triggers bonus			5.2
Scatter — Rain (falling house)	Trigger	3+ triggers bonus			56.5

Pay values are ×total bet, per winning way. Premiums pay from 4 of a kind; mids & lows from 5. Weights are reel-pool shares (non-scatter pool = 6,430). Scatters use a separate per-spin eligibility model: one scatter type is drawn per spin (build 8.4% / rain 91.6% of spins) and occupies a shared scatter slot at ~0.95% per cell.

Wilds & Scatters

The **wild** substitutes for all paying symbols (substitute-only; it does not pay a line itself). Two distinct **scatter** symbols each trigger their own bonus on 3+: the blueprint scatter triggers Build the Gables, the falling-house scatter triggers Raining Houses. Only one scatter type is eligible per base spin, removing mixed-trigger ambiguity. If both were to qualify, Build the Gables takes priority.

DESIGN NOTE — TWO-SCATTER TRIGGER

Rather than a single scatter opening a choice popup (which would let players always take the more valuable bonus for free), each bonus has its own scatter with its own weight. The premium bonus's scatter is far rarer, which both protects the value of its 350× buy and keeps the natural-trigger RTP contribution controllable.

4 Bonus Features

Build the Gables — Premium Bonus (buy 350×)

A two-phase hoard-then-showdown feature. **Phase 1 (Collect)**: a respin board where bricks accumulate. Each respin can drop a brick (1.40% per cell), an icing +1 (0.40%) or icing +2 (0.10%); collecting anything resets respins to 3, three dead respins end the phase, and the board caps at 36 bricks. The brick total resolves to a house tier; the multiplier starts at **1** and climbs with collected icing. **Phase 2 (Showdown)**: theatrical reveal spins that pay a fixed tier prize × the collected multiplier — bounded by design, never an unbounded all-ways evaluation.

TIER	BRICKS	PRIZE (×BET)	FREQUENCY
Cottage	4	2.65	40.55%
Manor	8	8.00	32.11%
Mansion	14	18.50	17.61%
Palace	22	45.00	5.27%
Grand Palace	28	93.00	2.89%
Ultra Palace	36	1002.00	1.59%

Frequencies from the 1M-bonus validation run. Cottage is a guaranteed floor (bricks < 4 still resolve to Cottage). Final payout = TIER_PRIZE × multiplier × bet.

VALIDATED — BUILD THE GABLES

RTP **95.68%** of 350× · max win **37,074×** · **0%** dud rate · avg multiplier 5.54× · barbell distribution with Ultra Palace at just 1.59% of bonuses. Ultra Palace at a stacked multiplier produces the game's ceiling.

Raining Houses — Standard Bonus (buy 100×)

12 free spins. Each spin, one outcome is drawn from a weighted table: ~68.5% **no house**, otherwise a gingerbread house of one of seven sizes (1×1 up to a full-board 6×6 Ultra Palace) rains onto a valid position and acts as a **non-sticky wild** for that spin only. The win evaluates all-ways with that house as wild, then is bounded by a **per-spin cap of 400×**. A 3% chance per spin adds a ×2/×3 icing multiplier; 3+ scatters retrigger +5 spins.

OUTCOME	WEIGHT	NOTE
No house	68.5	dry spin — bounds RTP, adds suspense
1×1 single wild	17.90	common
Cottage 2×2	10.24	
Manor 2×4	2.89	
Mansion 4×4	0.315	
Palace 4×6	0.089	rare
Grand 5×6	0.049	rare
Ultra 6×6	0.020	full-board wild · ~1 in 5,000 spins

VALIDATED — RAINING HOUSES

RTP **91.77%** of 100× · max win **1,725×** · cap fires on ~0.95% of spins · no-house on 68.5% of spins · retrigger rate 5.03%.
Steadier, lower-ceiling profile — the deliberate counterweight to Build the Gables.

5 Math & RTP Design

The whole game was tuned against a **Monte-Carlo harness that runs the real game logic** — not an abstract spreadsheet model. The simulator mirrors the engine's RNG, weights, and payout code exactly; whenever the two diverged, the game was treated as source of truth and the sim was corrected to match, then re-tuned. Every headline number below comes from that harness.

Target & Result

Target: high volatility with the base game deliberately starved and the bonuses carrying the return. Final validated result (5M-spin run): base line 37.47%, Raining Houses contributing ~40.8% ($1/225 \times 91.77\times$), Build the Gables ~13.6% ($1/2465 \times 334.9\times$), for a self-consistent total of ~91.9% through natural play — all figures computed from the measured bonus simulations rather than any assumed averages.

```
// total base-game RTP — how the ~96% is composed
TOTAL = base_line(37.47%) + rain_trigger_rate(1/225) × rain_avg(91.77×) // ≈ 40.8%
+ build_trigger_rate(1/2465) × build_avg(334.9×) // ≈ 13.6%
// ≈ 91.9% (computed from the measured bonus RTPs)
```

Key Tuning Levers (in order of leverage)

LEVER	EFFECT
Build Phase-1 brick rate	Controls the tier distribution. Initially produced Ultra Palace on 41% of bonuses; lowered to 1.40% to make Ultra a ~1.6% rare event.
Tier prize table	Sets Build RTP once the distribution is fixed; tuned down ~8% after the multiplier-floor fix.
Build scatter weight	Highest-leverage base-game dial: each natural Build trigger is worth ~336×, so small weight changes move total RTP fast.
Raining no-house % + per-spin cap	Bounds Raining's average; no-house tuned to 68.5%, cap to 400×.

Problems Solved During Tuning

THE EXPLOSION

Both bonuses were first built to pay all-ways over a board of accumulated wilds. With a full-board wild, all-ways evaluation compounds exponentially — RTP readings ran into the **millions of percent**. The fix was structural: replace all-ways-over-wilds with **bounded payout models** — a fixed tier-prize table for Build, a per-spin cap for Raining.

THE FEEL-BUG

Build's multiplier originally started at 0, so collecting no icing meant a built house paid **nothing** — a 9.5% "won a bonus, got zero" rate that the average RTP hid. Flooring the multiplier at 1 removed the dud rate entirely (0%); the tier prizes were then re-tuned down to hold 96%.

THE IMPOSSIBLE TARGET

An early lush board-frame target proved mathematically un-fittable (measured via alpha-channel analysis: its clear opening forced the frame 409px taller than the screen allowed). Documented here as an example of measure-first problem-solving — the board was rescaled to create the needed margin rather than distorting the asset.

6 Design Intent

The intended experience is a lean, suspenseful base game punctuated by two distinct bonus fantasies. Most base spins are quiet by design (high dead-spin rate), which makes a scatter trigger feel like an event. The two bonuses deliberately occupy opposite ends of the volatility spectrum so the player has a genuine choice of fantasy.

Raining Houses — the steady play

Frequent, cheaper, capped at 1,725×. A run of dry spins broken by a house raining in; the rare full-board Ultra is the spike. Low-variance comfort.

Build the Gables — the dream chase

Premium, rare, barbell-shaped. Most buys disappoint (~64% under 50×); the return lives in rare Ultra Palace hits at stacked multipliers, up to 37,074×. This is the high-roller fantasy.

VOLATILITY AS A DELIBERATE LEVER

Both bonuses feel completely different despite their shared design DNA. The ~21× gap between their ceilings (37,074× vs 1,725×) is the design statement: same starved-base philosophy, opposite volatility experience. The "feels punishing" of Build is the volatility working as intended, not a flaw.

7 Tech & Architecture

AREA	IMPLEMENTATION
Engine / stack	TypeScript (strict) · PixiJS v8 · GSAP · Vite
Math model	Server-authoritative: a dev MockServer owns all RNG & outcomes; the client only renders
Single source of truth	All weights, prizes, thresholds & caps live in config; the sim mirrors them exactly
Validation	Python Monte-Carlo harness running the real game logic (50k tuning runs, 200k–1M confirmation runs)
Info screen	Data-driven payable overlay — reads live from the real constants, can never drift from the math
Audio	Procedurally synthesized SFX (numpy/scipy) + state-driven background music per game mode

Notes & Sourcing

All headline figures were audited against the live code and simulation runs. The notes below cover the one interpretive choice (which total-RTP number to publish) and cosmetic items.

RESOLVED — Paytable, reel weights, bet range, base-game stats, both bonus configs & RTPs, and scatter trigger rates have all been sourced from the live code and 1M–5M simulation runs (see tables above). The items below are the remaining notes.

[NOTE] Total RTP figure — This document quotes ~91.9%, computed from the *measured* bonus RTPs (Raining 91.77×, Build 334.9×). The raw simulator prints 94.86% using a legacy hardcoded RAIN_BONUS_AVG=98.4 constant that runs ~7% high; the ~91.9% figure is the self-consistent, honest number and should be the one published.

[NOTE] Raining Houses RTP — At 91.77% of its 100× cost, Raining Houses runs below the ~96% design target. It is presented here as-built and honest; a future tuning pass (lower NO_HOUSE % or raise the per-spin cap) could lift it toward 96% if a higher total RTP is desired.

[NOTE] Sim label cosmetics The simulator prints "Grand/Ultra" for the top two tiers; the live game and this document use the full "Grand Palace / Ultra Palace" names (weights & prizes identical).