# MULTIVIEW TECHNOLOGY

# CINNAMON TOAST CRUNCH GRADING STANDARDS — V1.2

*Updated October 2025*

## 1. PURPOSE

This document defines the full Multiview Technology Grading System (v1.2), covering the analytical and AI-driven processes used to evaluate Cinnamon Toast Crunch specimens. It extends previous versions with a detailed technical explanation of the AI visual grading pipeline and system architecture.

## 11. MULTIVIEW AI TECHNICAL PROCESS — EXTENDED DETAIL

When the Multiview AI Grader evaluates a specimen, it performs multi-stage computer vision, geometry analysis, and statistical rule evaluation. Below is a step-by-step breakdown of the underlying mechanics, algorithms, and architecture.

### *Image Ingestion & Normalization*

Each image's metadata (EXIF) is extracted to confirm timestamp and exposure. Colors are normalized by converting to LAB space and applying histogram equalization. Backgrounds are removed via adaptive thresholding (Otsu/Sauvola) and contour isolation.

### *Geometric Reconstruction*

Contours are simplified using Douglas–Peucker reduction. Corners are located via Harris or Shi-Tomasi detection, while PCA defines aspect ratio and symmetry. These geometric descriptors inform the 'Corner' and 'Geometry' subgrades.

### *Surface Topography & Curvature Mapping*

Lighting gradients are interpreted through a Lambertian reflection model to approximate height deviation. Curvature % = (max deviation / half-span) × 100. FFT-based ridge frequency analysis quantifies texture fidelity, while variance mapping identifies micro-pocks.

### *Color & Coating Uniformity*

Mean luminance and hue variance (HSV space) are analyzed. High standard deviation implies uneven coating. A heatmap overlay may be produced for review.

### *Quantitative Scoring & Weighting*

Each subgrade (Corners, Edges, Surface, Coating, Geometry) is numerically scored 0–10. Weighted mean = Σ(weight × subscore). Curvature caps and strict-mode downgrades are then applied.

### *Strict-Mode Enforcement*

If metric confidence < 0.85, the grade defaults downward. Ambiguity never rounds up, ensuring deterministic fairness.

### *Certification & Documentation*

Once finalized, JSON logs, numeric data, and PDFs are saved. Each report may be hashed (SHA256) for provenance tracking. AI text generation summarizes findings for human readability.

## 12. SYSTEM ARCHITECTURE OVERVIEW

| Component | Purpose | Example Implementation |
|---|---|---|
| Preprocessor | Normalize and segment images | OpenCV / Pillow |
| Analyzer | Feature extraction and scoring | NumPy / scikit-image |
| Report Generator | Create PDFs, JSON, and HTML reports | ReportLab / Pydantic |
| Archive System | Log and version grading data | SQLite / JSON logs |
| AI Interface | Narrative generation & interpretation | OpenAI GPT■5 API |
| Frontend (Future) | Public submission and browsing interface | Flask / Next.js |

## 13. DATA FLOW DIAGRAM (SIMPLIFIED)

| Step | Action | Output |
|---|---|---|
| 1 | Image Upload (Front, Back, Side) | Raw Image Set |
| 2 | Preprocessing (Color balance, background removal) | Normalized object mask |
| 3 | Feature Extraction (corners, edges, texture, color) | Quantitative metrics |
| 4 | Weighted Scoring + Curvature Cap Application | Numerical subgrades |
| 5 | Strict■Mode Verification | Adjusted PSA■style grade |
| 6 | Report Generation | PDF + JSON + Hash |
| 7 | Archival & Optional Public Sync | Database entry |

## 14. PATCH NOTES / UPDATE LOG

| Version | Date | Summary of Changes |
|---|---|---|
| v1.0 | Oct 2025 | Initial release: 5■category weighted model and curvature caps. |
| v1.1 | Oct 2025 | Added AI Technical Process, improved formatting and margins. |
| v1.2 | Oct 2025 | Expanded Technical Process with algorithmic detail, added system architecture and data |

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