



WHITE PAPER

# The Real Cost of Cardboard

*What buyers miss when they compare single-use cardboard to reusable plastic on unit price alone*

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Published by

**Kiva Container Corporation**

Anaheim, California | Founded 1986

AS9100D | ISO 9001:2015 | Women-Owned

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## Executive Summary

Cardboard looks cheap. On the quote, it almost always is. A 12 x 9 x 6 industrial box runs \$0.92 at ULine. An 18 cube runs \$2.70. A 24 x 18 x 18 runs \$3.59. A heavy-duty 275 pound test postal tote runs \$3.30 at volume. The corrugated plastic equivalents run five to ten times more on a unit basis. The cardboard quote wins the comparison ten times out of ten.

The cardboard quote also misses six other lines on the cost ledger: replacement spend over the program life, disposal, assembly and breakdown labor, storage, damage to parts inside, and quality rework. Once those are on the page, cardboard usually loses by a factor of three to five for any program that ships more than a few hundred units a year on a stable cadence.

This paper uses real numbers, not estimates. The corrugated plastic pricing comes from Kiva's quoted prices at three quantity bands across four standard sizes. The cardboard pricing comes from ULine's published catalog for industrial single-wall (200 pound test) and heavy-duty (275 pound test) cartons. The math comes out the same way across every size tested: a corrugated plastic box pays for itself in roughly five to seven trips. Every trip after that is essentially free packaging.

This paper is not an argument that cardboard is always wrong. Cardboard is the right answer for one-way shipping, e-commerce delivery, low-value parts, and programs without a return path. It is an argument that the unit price comparison hides the real number. Any program shipping the same parts in the same packaging to the same destination on a repeating cadence is paying too much for cardboard whether the buyer sees it on the line item or not.

## 1. Where Cardboard Actually Belongs

Honest read first. Cardboard is the right choice in several real scenarios and this paper would be useless without naming them.

- Truly one-way shipments to a customer that will not return the package. E-commerce, retail fulfillment, gift packaging, sample shipments.
- Low-value contents where the cost of the parts inside is less than the cost of a reusable container.
- Programs without a return logistics setup. If there is no path for the packaging to come back, reusable is single-use at a higher unit price.
- Highly variable shipment profiles where the geometry, weight, and destination change with every order.
- Short-term programs (under six months) where the reusable tooling cost will not amortize.

If the program fits any of these, cardboard is the right answer and the rest of this paper does not apply. The rest of the paper is about the programs that do not fit any of them, which is most industrial and B2B packaging.

## 2. The Seven Hidden Costs

Unit price is one line on the ledger. The other six are below. Add them up and the picture changes.

Hidden cost	What it actually costs
<b>Replacement spend</b>	The unit price gets paid on every cycle. A \$2.70 box used 1,000 times a year is \$2,700 a year, every year. Reusable totes get paid for once and amortize.
<b>Disposal</b>	Cardboard waste runs 10 to 30 percent of an industrial waste stream. Hauler fees average \$50 to \$150 per ton. Baler maintenance, labor to break down, and dumpster rental sit on top.
<b>Assembly and breakdown labor</b>	Folding, taping, and labeling each box runs 30 to 90 seconds. Breaking down at the receiver runs the same. At \$25 per labor hour, 1,000 boxes a year is \$400 to \$1,250 in labor per side.
<b>Storage</b>	Empty cardboard does not nest. Storing 1,000 flat-pack boxes takes 10 to 20 times the floor space of 100 nested reusable totes. Warehouse space averages \$7 to \$14 per square foot per year.
<b>Damage to parts inside</b>	Cardboard fails in predictable ways: crushed corners, blown bottoms, side panel buckling. When it fails, the part inside takes the hit. On a program shipping \$200 parts, a 2 percent damage rate is \$4,000 in losses on a 1,000-unit year.
<b>Quality and rework</b>	Damaged shipments trigger non-conformance reports, rework, and replacement orders. The cost includes the part, the labor, the expedited freight, and the customer relationship.
<b>Sustainability reporting</b>	Disposal of single-use packaging shows up on Scope 3 emissions. For customers with sustainability requirements (most large OEMs by 2026), single-use cardboard adds to the supplier's reporting burden and can disqualify a vendor on procurement scorecards.

*Most buyers see one or two of these line items because they live in different cost centers. Material spend sits in procurement. Disposal sits in facilities. Labor sits in operations. Damage sits in quality. Storage sits in warehouse operations. No one person sees the full bill, so no one runs the full math. That is the structural reason cardboard wins comparisons it should lose.*

## 3. Real Pricing, Real Math

The table below shows actual quoted prices for four standard sizes. ULine cardboard pricing is at the buyer-facing catalog price for industrial single-wall (200 pound test, roughly equivalent to 32 ECT) and

heavy-duty (275 pound test) cartons. Corrugated plastic is Kiva quoted pricing at three production quantities.

Box size and cardboard grade	Plastic spec	Uline cardboard	Kiva 250 qty	Kiva 500 qty	Kiva 1000 qty
12 x 9 x 6 (200# test)	3mm corrugated PP	\$0.92	\$9.15	\$7.70	\$6.62
18 cube 18 x 18 x 18 (200# test)	4mm corrugated PP	\$2.70	\$21.40	\$18.22	\$17.12
24 x 18 x 18 (200# test)	4mm corrugated PP	\$3.59	\$27.50	\$24.65	\$23.45
Postal tote 18 x 13 x 11 (275# test)	4mm wire-reinforced PP	\$3.30	\$19.90	\$17.60	\$15.78

Two notes on the table. First, the postal tote row compares against a heavier-duty 275 pound test cardboard, not the standard 200 pound test, because that is what the postal tote application calls for. Second, the postal tote plastic spec is 4mm corrugated polypropylene with wire reinforcement, the same construction the United States Postal Service standardized on.

The unit-price comparison looks bad for plastic on every row. The cardboard box is cheaper by a factor of five to ten. That is the comparison the procurement spreadsheet shows. It is also the comparison that ignores cycles.

#### 4. Cost per Trip and the Five-to-Seven Cycle Breakeven

Cost per trip is the only number that matters once a program is running on a stable cadence. The table below shows what each box costs per trip at three realistic cycle counts, alongside the cardboard equivalent that gets consumed every trip.

Size (1000 qty Kiva)	Breakeven cycle	50 cycles	100 cycles	250 cycles
12 x 9 x 6 (\$6.62)	7.2 cycles	\$0.13 / trip	\$0.07 / trip	\$0.03 / trip
18 cube (\$17.12)	6.3 cycles	\$0.34 / trip	\$0.17 / trip	\$0.07 / trip
24 x 18 x 18 (\$23.45)	6.5 cycles	\$0.47 / trip	\$0.23 / trip	\$0.09 / trip
Postal tote (\$15.78)	4.8 cycles	\$0.32 / trip	\$0.16 / trip	\$0.06 / trip
Cardboard equivalent	<b>(consumed at 1)</b>	<b>\$0.92 to \$3.59</b>	<b>Same</b>	<b>Same</b>

The breakeven column is the punchline. Across all four sizes, the corrugated plastic box pays for itself in roughly five to seven trips. The postal tote leads at 4.8 cycles because the cardboard it replaces (275

pound test, the heavy-duty grade) costs more, which narrows the apparent gap and accelerates the breakeven.

A buyer who runs the same packaging back and forth weekly is past breakeven inside two months. After that, every additional trip is free packaging. At 100 cycles the cost advantage is 14 to 21x. At 250 cycles it is 35 to 55x.

*The cardboard line shows what the box costs per trip when it gets consumed on cycle one, which is what cardboard actually does in industrial use. The corrugated plastic line shows what the box costs per trip when it gets used the way it is designed to be used. The ratio between those two numbers is the entire argument.*

## 5. The Replacement Cycle Problem

Cardboard is sold as a returnable container in some programs. The math falls apart at the second cycle.

A single-wall 200 pound test box gets one trip before it is unusable. A double-wall or 275 pound test box gets two to three before the corners crush, the flaps tear, or the bottom blows on a heavy load. Returnable cardboard in industrial use averages 1 to 3 cycles before replacement. The unit price gets paid roughly every cycle, every cycle, every cycle.

Corrugated plastic gets 100 to 1,000 cycles depending on gauge, design, and program. The unit price gets paid once. The amortization curve is the entire argument.

A program that thinks it has a returnable cardboard system has a one-way cardboard system with extra steps. The return freight gets paid. The breakdown labor gets paid. The replacement boxes still get bought. The accounting calls it returnable. The cash flow calls it one-way.

## 6. Two Programs That Validate the Math

Theoretical math is one thing. Operational proof is another. Two named programs have already run the experiment at meaningful scale.

### The United States Postal Service

The USPS runs wire-reinforced corrugated plastic totes through its sorting and distribution network at scale. The federal mail service standardized on wire-reinforced corrugated polypropylene because the program economics, measured across millions of cycles in a mechanized environment, required a container that holds geometry, survives automated handling without replacement, and stays in service long enough to amortize.

Kiva's NE.181311 postal tote (the postal tote row in the pricing table) is the same construction category USPS standardized on: 4mm corrugated polypropylene with wire reinforcement and welded seams. The construction is not theoretical. It is what gets run at federal scale in production today.

When a federal agency operating at postal scale standardizes on a material, the math is settled. The USPS does not pick materials that fail.

## The Washington State Liquor Control Board

Previously running heavy-duty solid fiber totes (the upgraded version of cardboard, with denser walls and better moisture resistance), the board switched to corrugated plastic. They stopped counting at 40 times the use of the previous totes.

Stopped counting. Not "reached 40 cycles." Stopped counting. The 40 number is a floor, not a ceiling. The new totes were still in service when the comparison data became uninteresting.

*The "100 to 1,000 cycles" range used throughout this paper is conservative against the field data. State and federal programs running corrugated plastic in production hit those numbers and keep going. The math in section 4 understates the win.*

## 7. The Sustainability Question

Cardboard's environmental positioning is more complicated than either side claims, and aerospace, automotive, and major retail OEMs have stopped accepting the simple version.

The case for cardboard: high recycling rate (roughly 70 to 90 percent in the US, depending on region and reporting period), renewable raw material, biodegradable in the right conditions, low embodied carbon per unit.

The case against cardboard for reusable programs: even high recycling rates leave 10 to 30 percent of cardboard going to landfill or incineration. Producing virgin or recycled cardboard requires significant water and energy. Multiply the per-unit footprint by 1,000 shipments a year and the cumulative impact passes a reusable plastic container's footprint somewhere between trip 10 and trip 25, depending on the lifecycle assumptions.

For programs running 100 cycles or more per container, reusable plastic wins on both cost and carbon. For programs running 5 cycles or fewer, cardboard wins on carbon. The break-even is real and worth modeling for any customer with Scope 3 reporting obligations.

By 2026, most large aerospace, automotive, and retail buyers require Scope 3 emissions data from suppliers. Single-use packaging contributes to that number. Reusable packaging reduces it. The procurement scorecard rewards the reduction whether the buyer says so or not.

## 8. When to Switch and How to Phase It

The switch from cardboard to reusable is not free. It requires tooling, design, a return logistics setup, and a maintenance cycle. The right way to phase it is in steps, not all at once.

### PHASE 1: IDENTIFY THE HIGH-LEVERAGE PROGRAM

Pick the program with the highest combination of shipment frequency, part value, and stable destination set. That is where the cost-per-trip math works hardest. A weekly shipment to three locations with \$200 parts beats a quarterly shipment to a hundred locations with \$20 parts.

### PHASE 2: PROTOTYPE AND VALIDATE

Build a small fleet (50 to 100 totes) using digital routing for low tooling cost. Run them for 60 to 90 days. Measure cycle count, damage rate, and labor delta. The pilot is the only honest way to verify the cost model against the real workflow.

### PHASE 3: MOVE TO PRODUCTION TOOLING

Once the pilot proves the program, transition to a steel-rule die-cut tool or a thermoformed production tool. The pilot data should let you size the fleet correctly. Most programs over-buy on the initial fleet. Smaller, well-utilized fleets cost less and amortize faster.

### PHASE 4: BUILD THE RETURN LOGISTICS

This is the part that breaks most returnable programs. The packaging cannot return itself. Build the return path explicitly: who picks up empty totes, how often, where they stage, and how they get tracked. Without it, the reusable program degrades to one-way over 90 days.

## About Kiva Container Corporation

Kiva Container Corporation is a custom thermoforming and corrugated plastic shop in Anaheim, California. Founded in 1986. AS9100D and ISO 9001:2015 certified. Women-owned. All design, tooling, and production in-house at a single facility.

### WHAT THAT MEANS FOR A CARDBOARD-TO-REUSABLE CONVERSION

- Pioneer flatbed die-cutter (78 by 150 inch) and Gerber M3000 turbo router (75 by 120 inch) for corrugated plastic totes, dunnage, and dividers at any volume
- Thermoforming capability for heavier programs (4 sheet-fed machines, max 46 by 54 inch, 0.015 to 0.300 inch gauge)

- In-house design, prototyping, and tooling. Pilot fleets in days, production tooling in weeks.
- Materials including standard PP, ESD and conductive grades, FDA grades, cleanroom-compatible sheet
- Sonic welding, proprietary flat welding, and wire bending (the same wire-reinforcement category USPS standardized on) for high cycle count programs
- Standard postal tote in inventory: NE.181311, 18 x 13 x 11 inch, 4mm wire-reinforced welded corrugated polypropylene
- 40 years of cardboard-to-reusable conversion experience in aerospace, medical, and material handling

Most customers are packaging engineers and buyers running programs that have outgrown cardboard. The conversion is often started by procurement (the unit cost numbers stop making sense) and finished by operations (the damage and labor numbers stop making sense).

*Have a cardboard program you suspect is costing more than it should? Send us the shipment frequency, the part value, the destination set, and the current per-box cost. We will model the full cost stack and tell you whether the conversion is worth running.*

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