Bulk Materials Handling: Cost Efficiency & Compaction Case Studies

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Key Areas of Impact

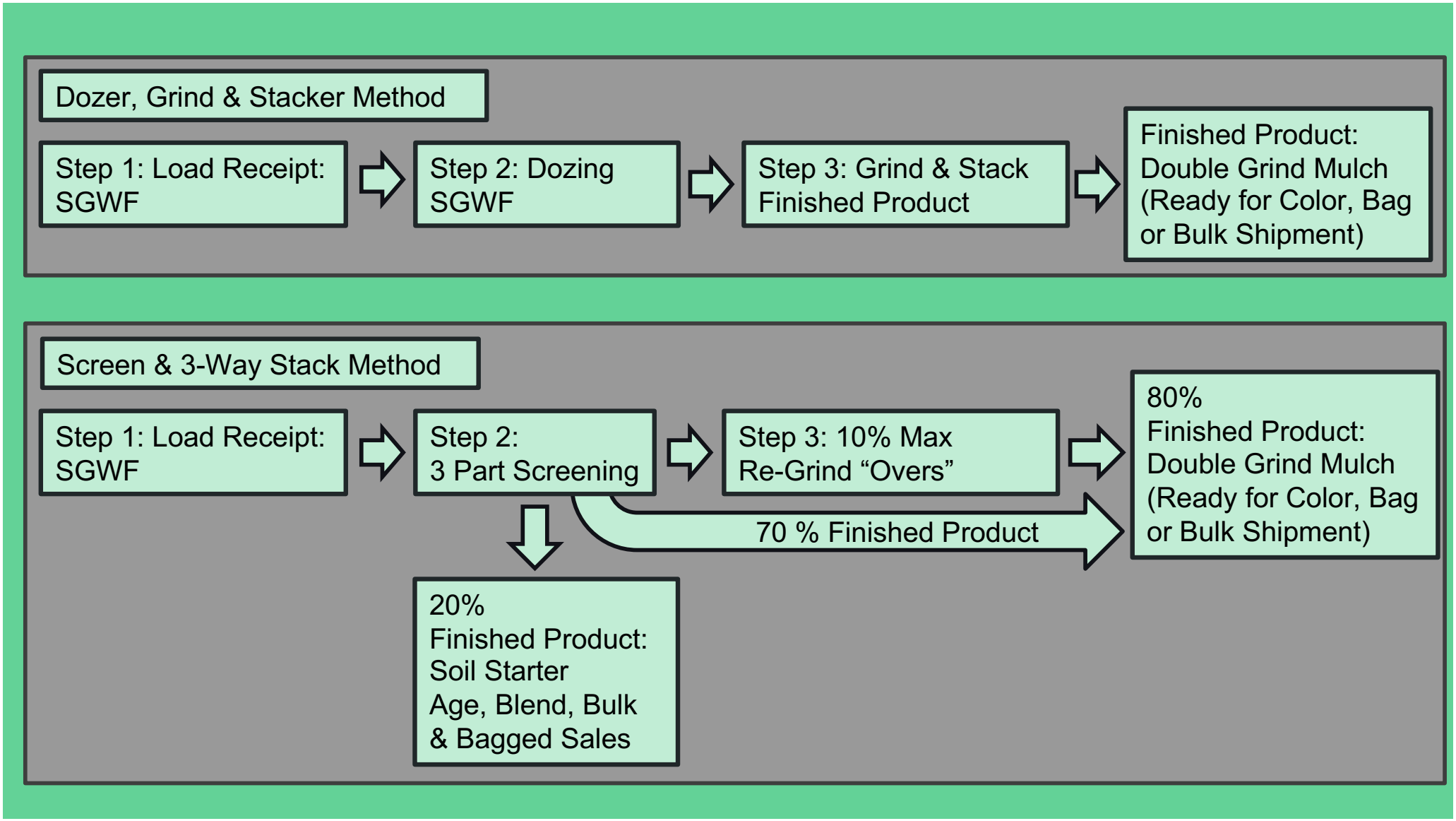
Product &
Production

Operations
& Logistics

Marketing &
Sales

Sourcing: Vendor Evaluation

Category	Excellent (3 pts)	Good (2 pts)	Fair (1 pt)	Poor (0 pts)
Raw Material	“Virgin” bark, wood chips, single species (Cedar or Cypress) or category (Hardwood or Softwood), Whole-Log or Whole Tree	Mixed-Species, Tops, Mill Residuals, Tree Service Piles, Recycled pallets	C & D, Yard Waste, Arborist Chips, Landscape Scrap, Stumps, Brush,	Made from non-renewable or potentially harmful materials (e.g., rubber, plastic, railroad ties, telephone poles, treated wood)
Source	Locally sourced, minimizing transportation needs	Regionally sourced	Sourcing from a distant location or with many unknown materials	Unknown or unsustainable sourcing practices
Processing	Minimal processing, naturally appealing, takes and holds color well	Additional processing, moderate natural appeal, takes and holds color	Heavy processing required, removal of contaminants required molds/degrades quickly	Heavy amounts of harmful contaminants, overs or fines, product too wet or too dry to hold color
Quality	Consistent particle size, free of contaminants (e.g., plastics, garbage)	Mostly consistent size, minimal contaminants	Inconsistent size, noticeable contaminants	Large amounts of contaminants or debris


Dozer, Grind & Stacker Method
Step 1: Load Receipt: SGWF
Step 2: Dozing SGWF
Step 3: Grind & Stack Finished Product
Finished Product: Double Grind Mulch (Ready for Color, Bag or Bulk Shipment)
Screen & 3-Way Stack Method
Step 1: Load Receipt: SGWF
Step 2: 3 Part Screening
Step 3: 10% Max Re-Grind "Overs"
80% Finished Product: Double Grind Mulch (Ready for Color, Bag or Bulk Shipment)
70 % Finished Product
20% Finished Product: Soil Starter Age, Blend, Bulk & Bagged Sales

Case Study - 100 yd^3 “Double Grind” Improvement

Method: Dozer, Grind & Stack

Equipment Used: CAT D6 Dozer (6 Yard Blade)

2 Minute “Push” x 17 “Pushes”

34 Minutes Labor = \$0.34 / yd^3

Total Fuel Used= \$0.12 / yd^3

Total Pushing Cost: \$0.46/ yd^3

\$46.00 / 100 yd^3 Truckload

Case Study - 100 yd^3 “Double Grind” Improvement

Method: Grind & Stack

Equipment used: Vermeer HG 6800

25 Minutes to Stack 100 yd^3

Total Fuel Used: $4.29 / yd^3

25 Minutes Labor = $0.25 / yd^3

Grind & Stack Cost: $4.55 / yd^3

$454.00 / 100 yd^3 Truckload

Case Study - 100 yd^3 “Double Grind” Improvement

Method: Screen & 3-Way Stack

Equipment used: XXL Multistar

20 Minutes to Process 100 yd^3

Total Fuel Used: $0.07 / yd^3

20 Minutes Labor = $0.20 / yd^3

Finished Product 1 Cost:
($19 Yields 70 yd^3)

Product 2 Cost:
($48 Yields 10 yd^3)

Finished Product 3 Cost:
($5 Yields 20 yd^3)

TOTAL Finished Product 1 Cost:
($67 Yields 80 yd^3)

Case Study - 100 yd^3 Double Grind Improvement

Dozer Grind & Stack	Screen & 3-Way Stack
- Creates More Fines in product - Increased Bulk Density - Product Quality - 2 Operators Required - Ties up high-horsepower machine on low-horsepower projects - Greater Fire Risk	- Creates 2 - 3 ready to use Products - Reduces Bulk Density - Enhanced product quality - Less wear & tear on grinder - Increased Volume Yield (% unknown)

Case Study - 100 yd^3 Double Grind Improvement

Dozer Grind & Stack:	**Screen & 3-Way Stack:**
$46 Dozer Pile $454 for 100 yd^3 Stacked Double Grind **$500 / 100 yd^3 Truckload** **2500 Truckloads:** **Annual Cost: $1,250,000**	$67 for 80 yd^3 Stacked Double Grind $5 for 20 yd^3 Soil Starter **$72.00 / 100 yd^3 Truckload** **2500 Truckloads:** **Annual Cost: $180,000**

Annual Savings: $1,070,000

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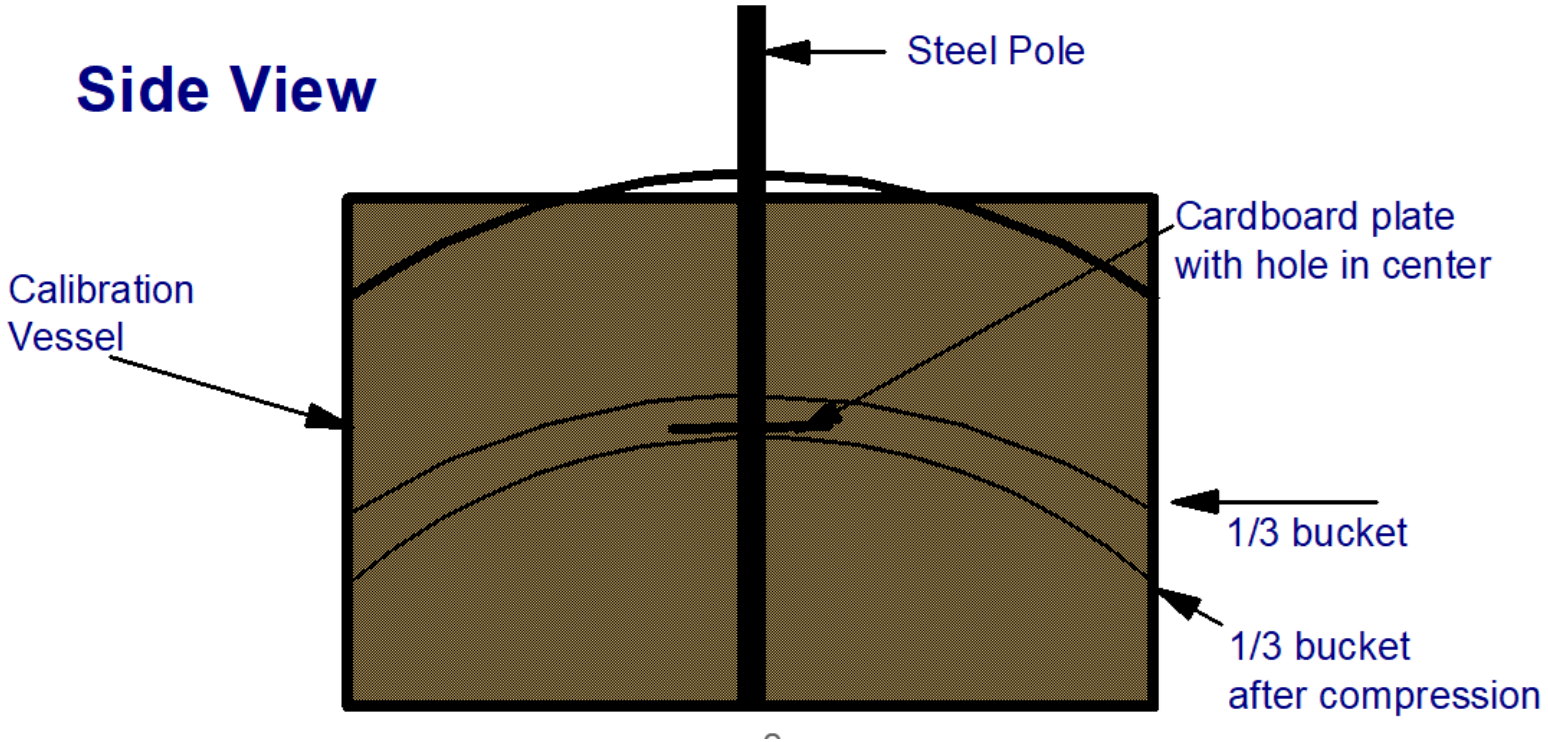
Bulk Volume Compaction/Compression Case Study

- Sylva conducted a case study to further the work done by Scott's Miracle Gro, however, utilizing load scanning technology (Both SR Measure & Walz Scanner Technology as a verification method)

SR Measure

Compression Test - Our vessel had a steel pole positioned in the center. 1/3 bucket of a was dumped into the vessel. A 1' square piece of cardboard with hole in center was placed over the pole and the height of the mulch was marked on the steel pole. The rest of the bucket was dumped. The vessel was removed, and the mulch carefully pulled from the pole to reveal a 3" compression in 30"



Compression at Time of Loading

- Our study revealed that pine mulch compression approaches 10% when dumped from a height of 4 feet.
- Bulk trailers will average over 8 feet of free fall when material is loaded from the top with loaders.

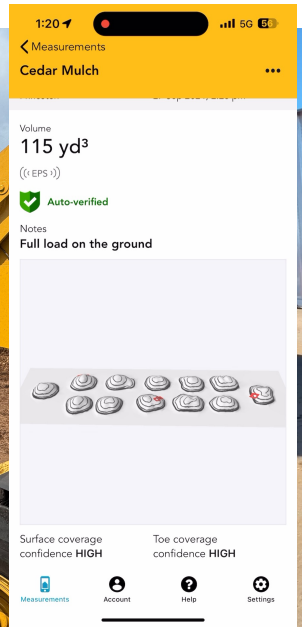
Settling and Compression during Travel

- After loading, and travel, bulk loads experience a measurable settling and / or compaction that approaches 10%. (on this control mulch stock)

Method of Determination Deviation	Cubic / Yds. Volume	Cubic / Yds. Deviation	Percent
Stated -11Buckets @ 8 Yds	88	0	0%
Measured After Loading	86.247	-1.753	-1.99%
Calculated using Weight as Comparison	103.046	+15.036	+17.09%
Measured After Traveling	79.565	- 8.435	- 9.58%
Measured after Walking on & Raking OWM Field Method	79.201	- 8.799	- 9.99%
Load through Calibration Vessel	85.036	- 2.964	- 3.37%
Load Yield Through Vessel Exponential Compaction	91.772	+ 3.772	+ 4.29%

What We Learned – Case Study on Mulch

- Compression takes place as the loader scoops up mulch.
- Compression takes place as mulch drops into a trailer floor
- Compression and settling takes place as loads travel to over roads
- Using weight cross-references with accurate bulk densities, compression claims can be supported.
- Using pre-travel measurements of mulch while understanding settling and compression, claims can be further supported.
- Demonstrating and identifying compression in the calibration vessel can yet again support compression claims.
- Dumping and re-loading product through a calibration vessel validates compaction and supports volume consistency.
- Loading/dumping product in a truck, compression can approach 10%
- During transport, settling and compaction is approx. 10%



Product	Bucket Measure	”Fluffed Load” Scan	Unloaded Measure	Reloaded into Walking Floor & Scanned			Unloaded Measure
				Bucket Measure	Initial Scan	After 30 Miles Scan	
Cedar Mulch	96	102.5	118 (18.64% Gain)	104	96.4	90.6	(22% Loss) 92
Red Mulch	96	97.2	101 (5% Gain)	96	91.8	89.6	(10% Loss) 94

COMPACTION TESTING

				Box Size:	18 CY					
Loader Opertor:	Mike	Loader Unit #	E 73	Bucket Size	8 CY					
Product:	Cedar Mulch		107 CY AVG LOAD 310 Lbs/Cubic Yard AVG Bulk Density	# Buckets	Bulk Density / Cubic Yard	Pile CY per Walz SCAN	"Fulff Factor" Walz Scan VS Rated Bucket	Pile CY per SR Measure	"Fluff Factor" SR Measure Vs. Rated Bucket	"Fulff Factor" SR Measure Vs Walz Scan
				1	331	9.0	13%	9	13%	0%
				2	354	8.2	2%	7	-13%	-15%
				3	334	8.2	2%	11	38%	34%
				4	339	8.2	2%	10	25%	22%
				5	340	8.5	7%	12	50%	41%
				6	335	8.6	8%	10	25%	16%
				7	330	8.0	0%	9	13%	13%
				8	289	9.0	13%	10	25%	11%
				9	327	8.2	2%	10	25%	22%
				10	345	8.0	0%	9	13%	13%
				11	352	9.6	20%	12	50%	25%
				12	329	9.0	13%	9	13%	0%
				Averages:	333.75	8.55	6.81%	9.83	22.92%	15%

1.) Load into **Small Dump Truck**, scan with Walz Scan / Scale 2.) Dump load on Hard Surface 3.) Scan Pile via SR Measure App	**# of Buckets**	**"Bucket" Measure**	**A. Bucket Loaded Volume**	**B. Total Scanned Volume Onboard**	**"Fluffed Bucket Factor": (B-A)/B**	**C. Total SR Measure Volume Offload**	**"Fluff" Factor from Scanned to Unloaded: (C-B)/C**	**TOTAL "Fluff" Factor Bucket Volume to Dumped Unload Volume: (C-A)/C**
	12	**8**	**96**	**102.5**	**6.38%**	**118**	**13.10%**	**18.64%**
4.) Re-Load **Full Walking Floor** Truckload and run through the Walz Scan / Scale System	**# of Buckets**	**"Bucket" Measure**	**D. Bucket Loaded Volume**	**E. Total Scanned Volume**	**Full Loading Compaction (C-E)/C**		**Compaction From Bucket to Full load (D-C)/D**	**TOTAL Compaction From Bucket to Full WF load Measure (E-C)/E**
	13	**8**	**104**	**96.4**	**-18.31%**		**-13.46%**	**-22.41%**
5.) Scan/Scale Load **after 30 mile round trip** with Walz Scan / Scale 6.) Scan Pile Via SR Measure app Unloaded Product	Trailer #	S34		**G. Total Scanned Volume**	**Compaction from Total Scanned Volume to Compacted Trip Scanned volume (G-E)/E**	**H. Full UNLOAD Load SR Measure APP**	**TOTAL "Fluff" Factor Bucket Volume to Unloaded Volume: (H-G)/H**	**TOTAL Compaction From Bucket to Full load Measure AFTER 30 Mile Trip & WF unload(C-H)/C**
				90.6	**-6.02%**	**92**	**1.52%**	**-22.03%**
NOTES: Drone Measurement & Other SR Measure Options				**F. Full Load SR Drone Measure (To Compare to C)**	**115**	**I. Full Load SR Measure DRONE**	**124**	**Compaction VS Fluff Variance:** **3.39% - 3.77%**

COMPACTION TESTING

				Box Size:	18 CY	Calibrated empty: 10,100 lbs		CONFIDENTIAL WORK PRODUCT FOR MSC DISCUSSION PURPOSES ONLY			
Loader Opertor:	Mike	Loader Unit #	E 73	Bucket Size	8 CY						
Product:	5* Red Mulch			# Buckets	Bulk Density / Cubic Yard	Pile CY per Walz SCAN	"Fulff Factor" Walz Scan VS Rated Bucket	Pile CY per SR Measure	"Fluff Factor" SR Measure Vs. Rated Bucket	"Fulff Factor" SR Measure Vs Walz Scan	
				1	555	8.4	5%	9	13%	7%	
				2	550	8.0	0%	8	0%	0%	
				3	556	8.2	2%	8	0%	-2%	
				4	540	8.0	0%	8	0%	0%	
				5	542	8.0	0%	8	0%	0%	
				6	540	8.4	5%	9	13%	7%	
				7	567	7.8	-3%	9	13%	15%	
				8	580	9.0	13%	9	13%	0%	
				9	558	8.0	0%	9	13%	13%	
				10	562	8.0	0%	8	0%	0%	
				11	553	7.6	-5%	8	0%	5%	
				12	554	7.8	-3%	8	0%	3%	
				Averages:	554.75	8.10	1.25%	8.42	5.21%	4%	

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	12	**8**	**96**	**97.2**	**1.23%**	**101**	**3.76%**	**4.95%**
4.) Re-Load **Full Walking Floor** Truckload and run through the Walz Scan / Scale System	**# of Buckets**	**"Bucket" Measure**	**D. Bucket Loaded Volume**	**E. Total Scanned Volume**	**Full Loading Compaction (C-E)/C**		**Compaction From Bucket to Full load (D-C)/D**	**TOTAL Compaction From Bucket to Full WF load Measure (E-C)/E**
	12	**8**	**96**	**91.8**	**-9.11%**		**-5.21%**	**-10.02%**
5.) Scan/Scale Load **after 30 mile round trip** with Walz Scan / Scale 6.) Scan Pile Via SR Measure app Unloaded Product	Trailer #	S34		**G. Total Scanned Volume**	**Compaction from Total Scanned Volume to Compacted Trip Scanned volume (G-E)/E**	**H. Full UNLOAD Load SR Measure APP**	**TOTAL "Fluff" Factor Bucket Volume to Unloaded Volume: (H-G)/H**	**TOTAL Compaction From Bucket to Full load Measure AFTER 30 Mile Trip & WF unload(C-H)/C**
				89.6	**-2.40%**	**94**	**4.68%**	**-6.93%**


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