#### WANAGING EXTREMES WILLIS RE TAMING CATASTROPHE RISK

Portfolio Management and Pricing Strategies for Catastrophe-Exposed Lines

November 17, 2015

### Catastrophe management spans the whole insurance company

Departments	Metrics Decisio			
Finance	PML	Pricing		
Catastrophe Modeling	AAL	Growth		
Actuarial	TVAR	Reinsurance		
Claims	Gross and Net	Portfolio Optimization		
Underwriting	Total Limits	Capital		



### "Don't let perfect be the enemy of good"

- Voltaire

#### Catastrophe exposure management ecosystem



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#### Profitability analysis



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#### Profitability overview



#### **Calculate an income statement for each policy**

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#### **Reinsurance Program Pricing**



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#### **Reinsurance Program Pricing**



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#### **Reinsurance Program Pricing**



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#### Cat Pricing: Example

<b>Reinsurance Layer Pricing</b>							
		Expected	<b>Premium /</b>				
	Premium	Loss	Loss				
Below	40.5	36.8	1.10				
Layer 1	21.9	13.7	1.60				
Layer 2	49.2	22.4	2.20				
Layer 3	51.6	17.2	3.00				
Layer 4	23.	4.6	5.00				
Above	15.	2.1	7.00				
Total	201.2	96.8	2.08				

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**Total catastrophe premium is 2.08 \* expected loss** 

#### Now, shift your framework



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#### Catastrophe cost allocation



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#### Catastrophe cost multiples



\$1 of gross AAL leads to :

- = \$1.20 of cat cost in Dallas, TX
- = \$3 of net cat cost in Cape Cod, MA

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### Profit by policy example

	Profit Comparison				
Ispring	Policy:	1268540	1280561		
	TIV	1,515,750	2,867,799		
Pulgrim	Premium	821	4,164		
Morument O	Reinsurance Cost	775	781		
Plymouth	Net Cat Loss	85	86		
State Parks Annun	Non Cat Loss	164	833		
Rhite Maria	Expense	216	691		
	Net Profit	(419)	1,773		
Ve Jenny Fond/Park Stephens					
SR 3A					
Unprofitable Profitable					

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#### Ranking of policy profitability



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#### Analyze drivers of profitability



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### Highlight key areas of profitability



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## Isolate characteristics that are profitable everywhere

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### Portfolio planning



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# Put the catastrophe models in the Willis Re hands of everyone

	Q Search			View By:	Segment 🔹	•	and the second second			
Filte	er to Extent of Map	Show All Rows •			Re	eset	1000	OK	A CONT	
_		Base TIV	Scenario	Difference	% Change			UN		
•	ANDERSON-TX-BL	45,058,249	56,322,811	11,264,562	25%		- Harde			
A	ANDREWS-TX-BL	22,730,747	28,413,434	5,682,687	25%			and a second		
A	ANGELINA-TX-BL	62,590,500	78,238,125	15,647,625	25%			in the		
A	ARANSAS-TX-BL	34,000	42,500	8,500	25%					
A :	ARCHER-TX-BLEN	7,851,520	9,814,400	1,962,880	25%					-
0	ARMSTRONG-TX	2,414,329	3,017,911	603,582	25%				allas	
1	ATASCOSA-TX-B	22,241,702	27,802,128	5,560,426	25%			AT		
1	AUSTIN-TX-BLEND	5,122,099	6,402,624	1,280,525	25%		50	2	ret	
8	BAILEY-TX-BLEND	4,517,700	5,647,125	1,129,425	25%				and	
	BANDERA-TX-BLE	9,222,356	11,527,945	2,305,589	25%	$\rightarrow$			L.L.	
	BASTROP-TX-BLE	15,215,311	19,019,139	3,803,828	25%			NO.	- Automa	
di-	BAYLOR-TX-BI FN	2.950.735 17.74b	3.688.419	737.684	25%	ALC: NO.			ol Hous	510
		17.740	10.330	-140,020,010	42270	and the		0.0.0		
	-		3.5.10	Comme	anua		San	Antonio		
e	Californi	a	and the states	111 1	10	Carl Carl	Con .	1 Start		
3		San I		and the	real of	A Plant	10.00			
			ANT 14 34 34 3	2.5	100	and the second	100000			

#### Quickly view key catastrophe<sup>~</sup> metrics

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<b>*</b> S	patial <mark>Key</mark>	Willis Recast	Portfolio: 'Re	Cast 12-31	-12' Scenar	io 'June'	Compare Scenarios	٥	Close
	Layers 🔺 Leg	end Scenario 'June' 🔽 🚺	Add Secondary Data	iset +				Edit Sc	enario
Orleans	• Mos			🄅 Settings				Hover over co	slored bars for details,
N	1ap Label		Total	1.41/1.6			-13.51% 1.6		
	Map Label	Total %		Premium 236.45m / 261.83m			-10.73%		
	Palm Beach, F	L -50%	Later and the second second	TIV (Total insured Value) 86.59b / 92.19b			6.46%		
	Broward, FL	-50%					_		
	Miami-Dade, F	L -50%		22.37m / 28.54m					27.55%
	Holmes, FL	-29.77%		Location Count		3.35	26		
	Citrus, FL	-19.29%		393.94k/407.15k					
	Madison, FL	-16.09%		AAL / Premium 0.095 / 0.11			15.22%		
90	Pasco, FL	-8.29%			_				
	Union, FL	-2.77%		OEP (250yr) / Premium 2.06 / 2.45				8.72%	
	Totals	1	Stats of Flo	ข					
C	)	65 unique values	-	-20%	-10%	0%	10% 2 Percent Change	0%	30%
33	3.324.12	4 384.029.4	143 19.6	3%	15.21%	11.2	2% 46	.422	.634
1:100	) Portfolio Loss Siz	e 😥 1:100 Scenario Loss	Size 🕨 Premium	6 Change 🕟	1:100 OEP % Change	AAL%C	hange 🗭 Prem	ium Char	ige 🕩

### Quickly view key catastrophe metrics



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# Refine analysis to see if PML growth is profitable

Portfolio Growth Options										
				Option 1 vs	Option 2 vs					
\$M	Current	Option 1	Option 2	Current	Current					
Gross Premium	100	125	125							
Reinsurance Premium	30	34	40	13.3%	33.3%					
Net Premium	70	91	85	30.0%	21.4%					
Net Retained Losses	35	47	40	34.3%	14.3%					
Expenses	25	31	31	25.0%	25.0%					
Underwriting Result	10	13	14	27.5%	37.5%					
Required Capital	105	137	128	30.0%	21.4%					
Combined Ratio	85.7%	86.0%	83.8%	0.3%	-2.2%					
UW Return on Capital	<b>9</b> .5%	9.3%	10.8%	-1.9%	13.2%					

#### **Underwriting Return on Capital**

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#### **Risk UW and pricing**



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# Implement pricing strategy at the Willis Re front end

😂 Layers 🔺 Legend Click to add more data + DNE 25th St NE 25th St Prospective Risks 0 44 Layers **Prospective Risks** INE 24th St Prospective Risks 2 •) Gross AAL Attribute Value \$964 Change Location History Ag Const Type FIRE1 Ag Occ Type ATC1 NE 22nd Ter TIV 💼 Year Built 1999 2 • As Basemap \$200,000 Num Stories 2 Default \* Opacity sq Feet 1,750 Gross Loss Cost 🛄 Deductible \$1,000 St Gross AAL/TIV(1000) 4.82 UTIV \$200.00k Street Lines 🛄 Premium \$1,500 Gross Loss Ratio Ter Labels under your data • Gross AAL \$963.66 Gross AAL/Premium 64% NW 20th St 20th St Label Multiple At Once Cat Cost Edit \$1687 Cat Cost / 1836 Biscayne Blvd, Miami, FL, 331321023 Premium 112% G Gross AAL: \$963.66 2 TIV: \$200.000 NE 17th Ter Net Return on Gross Loss Cost: 4.82 Gross Loss Ratio: 0.64% Premium (52%) NE 17th St NE 17th St NW.17th St NE 17th S Net Profit NW 16th Ter (\$787)

#### **Real-time monitoring**



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#### Typical catastrophe management Willis Re report

Ground Up OEP Loss Dec 2014, Feb 2015.0 Jun/Jul, 2015.0 % Change Severe **Critical Return** Fire Fire Fire Winter Hurricane Hurricane Severe Hurricane Hurricane Severe Convective LOB 1 LOB 2 Storm Combined Following LOB 1 LOB 2 Combined **Probability Period** Following Storm Following Hurricane Storm Storm Combined 0.01% 10.000 \$1.092.1 \$1.918.571.7 \$94.867.1 \$59.455.4 \$1.918.571.7 \$894.4 \$1,870,027.5 \$94.576.5 \$58.070.0 \$1.870.027.5 (18.1%)(2.5%)(0.3%)(2.3%)(2.5%)0.02% 5,000 \$7.5 \$1,501,606.6 \$67,098.7 \$46,033.0 \$1,501,607.6 \$4.0 \$1,462,318.1 \$66,995.7 \$45,120.3 \$1,462,319.2 (46.8%) (2.6%)(0.2%) (2.0%)(2.6% 0.05% 2.000 \$0.0 \$1.055.969.4 \$43.487.2 \$30.656.1 \$1.055.982.3 \$0.0 \$1.027.013.3 \$43.401.8 \$30.229.3 \$1.027.027.2 0.0% (2.7%)(0.2%) (1.4%)(2.7% 1.000 \$0.0 \$771.780.3 \$0.0 \$750.724.1 \$750.814.4 100.0% (2.7%)(0.3%) (1.3%)(2.7% 0 10% \$31.662.4 \$23.991.1 \$771.884.4 \$31.575.2 \$23.667.7 \$522,479.2 0.20% 500 \$0.0 \$536,748.4 \$22,994.2 \$19,347.0 \$536,910.2 \$0.0 \$22,881.0 \$19,091.5 \$522,644.8 0.0% (2.7%)(0.5%) (1.3%) (2.7% 250 \$0.0 0.40% \$0.0 \$353.232.3 \$16,402.7 \$15.642.4 \$353.532.4 \$344.211.3 \$16.285.9 \$15,448.6 \$344.521.4 0.0% (2.6%) (0.7%) (1.2%) (2.5% (2.5%) 0.50% 200 \$0.0 \$303.951.8 \$14,604,3 \$14,590.0 \$304.299.0 \$0.0 \$296,416.7 \$14,493.9 \$14.411.6 \$296,762.8 0.0% (2.5%)(0.8%)(1.2%)1.00% 100 \$0.0 \$177,518.9 \$9,884.9 \$11,663.7 \$177,996.0 \$0.0 \$173,975.6 \$9,798.5 \$11,536.2 \$174,426.2 0.0% (2.0%)(0.9%) (1.1%) (2.0% 2.00% 50 \$0.0 \$87.249.5 \$6,501.5 \$9,170.6 \$87.968.7 \$0.0 \$86.373.7 \$6.426.9 \$9.079.0 \$87.063.2 0.0% (1.0%)(1.1%)(1.0%)(1.0%) (1.4%) 4.00% 25 \$30,034.8 \$4,164.5 \$6,996.3 \$0.0 \$30,149.4 \$4,108.0 \$6,930.8 \$32,167.4 0.0% 0.4% (0.9%) 0.2% \$0.0 \$32,118.0 10.00% 10 \$1,940.6 \$2,189.2 \$4,467.7 \$8,654.1 \$0.0 \$1,998.6 \$2,160.3 \$4,432.4 \$8,619.6 0.0% 3.0% (1.3%)(0.8%) (0.4% \$0.0 20.00% 5 \$0.0 \$4.6 \$1.247.5 \$2.809.3 \$4.529.8 \$0.0 \$5.2 \$1.231.9 \$2.793.9 \$4.501.5 0.0% 11.6% (1.2%)(0.5%) (0.6% Average Annual Loss \$1.8 \$7,287.7 \$1,703.5 \$2,953.9 \$11,946.9 \$1.7 \$7,165.0 \$1,677.7 \$2,944.3 \$11,788.6 (6.5%) (1.7%)(1.5%)(0.3%)(1.3%)Standard Deviation \$496.7 \$58,440.8 \$3.319.4 \$3.393.3 \$58.635.4 \$477.6 \$56.922.7 \$3.290.7 \$3.359.2 \$57.118.6 (3.8%) (2.6%)(0.9%) (1.0%)(2.6% Coefficient of Variation 277.3 8.0 2.0 1.2 4.9 285.1 7.9 2.0 1.1 4.9 2.8% (1.0%) 0.5% (0.9%) (1.2%)

Gross OEP Loss																
				Year 0					Year 1					% Change		
														Severe		
Critical	Return	Fire	Hurricane	Hurricane	Severe		Fire	Hurricane	Hurricane	Severe		Fire		Convective	Winter	
Probability	Period	Following	LOB 1	LOB 2	Storm	Combined	Following	LOB 1	LOB 2	Storm	Combined	Following	Hurricane	Storm	Storm	Combined
0.01%	10,000	\$1,159.3	\$1,784,786.5	\$93,361.7	\$48,900.5	\$1,784,786.5	\$966.3	\$1,741,311.3	\$93,139.9	\$47,866.4	\$1,741,311.3	(16.7%)	(2.4%)	(0.2%)	(2.1%)	(2.4%)
0.02%	5,000	\$10.0	\$1,381,082.0	\$66,048.6	\$36,778.6	\$1,381,084.1	\$5.7	\$1,346,258.3	\$65,983.6	\$36,142.8	\$1,346,260.8	(43.3%)	(2.5%)	(0.1%)	(1.7%)	(2.5%)
0.05%	2,000	\$0.0	\$956,349.9	\$42,677.8	\$23,312.8	\$956,376.2	\$0.0	\$931,287.3	\$42,639.7	\$23,056.1	\$931,315.3	0.0%	(2.6%)	(0.1%)	(1.1%)	(2.6%)
0.10%	1,000	\$0.0	\$690,584.1	\$30,837.5	\$17,379.2	\$690,683.3	\$0.0	\$672,643.6	\$30,806.5	\$17,218.6	\$672,749.4		(2.6%)	(0.1%)	(0.9%)	(2.6%)
0.20%	500	\$0.0	\$473,518.2	\$21,967.1	\$13,311.1	\$473,759.5	\$0.0	\$461,641.7	\$21,934.8	\$13,202.8	\$461,885.0		(2.5%)	(0.1%)	(0.8%)	(2.5%)
0.40%	250	\$0.0	\$306,007.6	\$15,158.1	\$10,198.3	\$306,411.5	\$0.0	\$298,850.0	\$15,119.1	\$10,133.4	\$299,254.2		(2.3%)	(0.3%)	(0.6%)	(2.3%)
0.50%	200	\$0.0	\$261,516.5	\$13,329.2	\$9,338.0	\$261,968.6	\$0.0	\$255,653.9	\$13,290.5	\$9,284.4	\$256,098.1		(2.2%)	(0.3%)	(0.6%)	(2.2%)
1.00%	100	\$0.0	\$148,896.6	\$8,642.6	\$7,012.7	\$149,456.7	\$0.0	\$146,365.9	\$8,606.1	\$6,988.7	\$146,921.6		(1.7%)	(0.4%)	(0.3%)	(1.7%)
2.00%	50	\$0.0	\$70,250.0	\$5,319.8	\$5,117.8	\$71,150.4	\$0.0	\$69,740.1	\$5,288.6	\$5,110.5	\$70,633.8		(0.7%)	(0.6%)	(0.1%)	(0.7%)
4.00%	25	\$0.0	\$22,085.1	\$3,083.7	\$3,554.2	\$24,585.6	\$0.0	\$22,243.0	\$3,064.3	\$3,555.1	\$24,689.4		0.7%	(0.6%)	0.0%	0.4%
10.00%	10	\$0.0	\$754.5	\$1,359.3	\$1,900.9	\$5,467.3	\$0.0	\$789.2	\$1,355.8	\$1,907.8	\$5,484.5		4.6%	(0.3%)	0.4%	0.3%
20.00%	5	\$0.0	\$0.1	\$672.7	\$971.2	\$2,314.7	\$0.0	\$0.1	\$670.8	\$978.7	\$2,321.6		(3.9%)	(0.3%)	0.8%	0.3%
Average Ann	ual Loss	\$1.8	\$6.059.0	\$957.6	\$934.1	\$7 952 5	\$1.7	\$5 963 7	\$949 7	\$936.8	\$7 852 0	(5.7%)	(1.6%)	(0.8%)	0.3%	(1.3%)
Standard [	Deviation	\$489.9	\$52 702 5	\$3,010,3	\$1,869,1	\$52,823,7	\$475.6	\$51 381 6	\$2 994 5	\$1,857.5	\$51 504 5	(2.9%)	(2.5%)	(0.5%)	(0.6%)	(2.5%)
Coefficient of	Variation	276.2	\$32,702.3	\$3,010.5	20	40 <u>2</u> ,0 <u>2</u> 5.7	284.3	8.6	ψ <u>2</u> ,774.3 3.2	2.0	66	2.7%	(0.9%)	0.3%	(1.0%)	(1.2%)
obernelent of	variation	270.2	0.7	0.1	2.0	0.0	204.3	0.0	J.2	2.0	0.0	2.770	(0.770)	0.370	(1.070)	(1.270)

#### Typical catastrophe management Willis Re report

Ground Up OEP Loss Dec 2014, Feb 2015.0 % Change Severe **Critical Return** Fire Winter Hurricane Hurricane Fire Convective LOB 1 wing Hurricane Storm Storm Combined **Probability Period** Following \$1,092.1 \$1,918,571.7 0.01% 10.000 (2.5%)(0.3%)(2.3%)(2.5%)0.02% 5,000 \$7.5 \$1,501 (2.6%) (0.2%) (2.0%)(2.6% 0.05% 2.000 \$0.0 (0.2%) (1.4%)(2.7% 1.000 \$0.0 (0.3%) (1.3%)(2.7% 0 10% 500 (2.7% 0.20% (0.5%) (1.3%) 250 \$344.211.3 \$16,285.9 0.40% \$0.0 (2.5% \$304,299.0 \$14,411.6 (2.5% 0.50% 200 \$0.0 \$296.416.7 \$14,493.9 (1.2%)1.00% 100 96.0 \$0.0 \$173,975.6 \$9,798.5 \$11,536.2 \$174,4 (1.1%) (2.09 2.00% 50 68 7 \$0.0 \$86.373.7 \$6.426.9 \$9.079.0 \$87.063.2 (1.0%)(1.0% \$32,167.4 4.00% \$0.0 \$30,149.4 \$4,108.0 \$6,930.8 (0.9%) 0.2% 10.00% \$0.0 \$1,998.6 \$2,160.3 \$4,432.4 \$8,619.6 0.0 (0.8%) (0.4% (0.5%) 20.00% \$0.0 \$5.2 \$1.231.9 \$2.793.9 \$4.501.5 0.0% (0.6% 1,287.7 Average Ann \$1,70 \$7,165.0 \$1,677.7 \$2,944.3 \$11,788.6 (6.5%)(1.3% Standard \$58,440.8 \$3.319.4 222.7 \$3.290.7 \$3.359.2 \$57.118.6 (3.8%) (2.6% (1.2% Coefficient of 8.0 2.0 2.0 1.1 4.9 2.8% (1.0 Year 0 Critica lurricane Hurricane Severe Fire Fire Probability LOB 1 LOB 2 Combined Following Hurric m Combined Storm Following 0.01% 4.786.5 \$93.361.7 \$48,900.5 \$1,784,786.5 \$966.3 \$1,741,3 (16.7%) %) (2.4%).7%) \$5.7 \$1,346,258.3 (43.3%) (2.5% 0.02% 82.0 \$66.048.6 \$36,778.6 \$1,381,084.1 1.1%) 0.05% \$42,677.8 \$23,312.8 \$956,376.2 \$0.0 \$931,287.3 (2.6% (0.9%) (2.6% 0.10% \$30,837.5 \$17,379.2 \$690,683.3 \$0.0 \$672,643.6 \$30, 0.20% 21.967.1 \$13,311.1 \$473,759.5 \$0.0 \$461,641.7 \$21,934.8 (0.8%)(2.5%)0.40% \$0.0 (0.6%) (2.39 25 \$10 198 3 \$306,411.5 \$298 850 0 \$15,119.1 0.50% 200 \$9,338.0 \$261,968.6 \$0.0 \$255.653.9 \$13,290.5 \$9.2 (0.6%) (2.2% 100 \$0.0 1.00% \$149,456.7 \$146.365.9 \$8.606.1 \$6 988 (0.3%)(1.79 50 \$0.0 \$69,740.1 \$5,288.6 (0.6%) (0.1%) (0.7% 2.00% 25 4.00% (0.6%) 0.0% 0.4% 10.00% 10 \$0.0 (0.3%)0.4% 0.3% 5 \$0.0 (0.3%) 0.8% 20.00% 1%) 0.3% Average Annual Loss \$1.8 \$6,059.0 (1.6%) (0.8%) 0.3% (1.3%)\$489.9 \$52,702.5 (2.5%)(2.5% Standard Deviation (2.9%) (0.5%)(0.6%)(0.9%) 2.9% (1.2%) Coefficient of Variation 276.2 8.7 0.3% (1.0%)

## Analyze portfolio changes relative to profitability

#### obile ksonville Panama City Beach St. Augustine palachicola Palm Coast Daytona Beach **Portfolio Change New Change** Old 177.1 207.7 17.3% Premium 14.7% **Policy Count** 157,261 180,358 Tac 10.1 Profit 11.8 16.4% sbu Vero Bea Profit / Premium 5.7% 5.7% -0.8% West P Fort My Be **Growth = Red** Fort Lauder **Reduction = Orange** Ali

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### Track exposure change in most Willis Re profitable / unprofitable areas

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#### **Profitable Areas** ksonville Panama Pana **City Beach** City St. Augustine Apalachicola Palm Coast Daytona Beach Tan · Vero Br Fort Laude

Portfolio Change (Profitable)								
	Old	New	Change					
Premium	138.3	162.5	17.5%					
Policy Count	129,300	143,392	10.9%					
Profit	18.5	21.8	17.9%					



Portfolio Change (Unprofitable)								
	Old	New	Change					
Premium	38.8	45.2	16.5%					
Policy Count	27,961	31,040	11.0%					
Profit	-8.3	-10.	-19.7%					

### Event response



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#### Live events provide a great opportunity to make models tangible



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## Use actual vs models to refine your view of risk

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#### Catastrophe exposure management ecosystem



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