

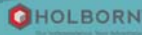
Antitrust Notice

- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
- Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.
- It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.





WillisRe



Introduction

- Assessing Limit and Retention Needs
- Suitable Product Types
- “Optimal” Layering
- Applicability of Aggregate Reinsurance
- “Best Fit” and Maximized Efficiency
- Measuring and Monitoring
- Stochastic Sense-Check



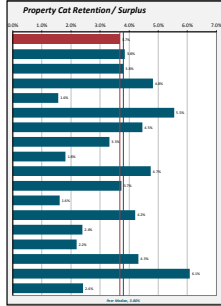
Limit Need and Risk Retention



Key Hurricane OEP Losses (\$Mn):

EP	RP	RMS	AIR
1.00%	100yr	500	400
0.40%	250yr	1,000	800

1938 "Long Island Express" generates \$1.23B of deterministic loss, well in excess of 100yr and 250yr key structural PML estimates. Something to consider in setting prudent amount of GU limit...



Retention is financially prudent (<4% of PHS) and in line with peers.



Product Types

Proportional (QS / SS)

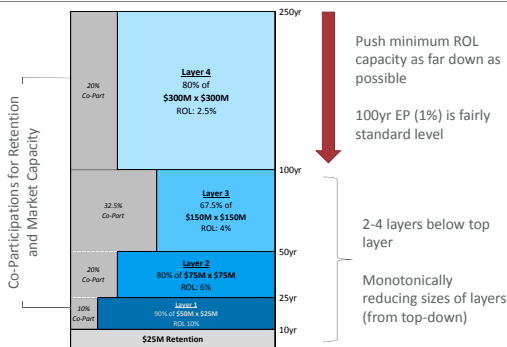
- Premium leverage (Premium:PHS) is an issue
- Geographic Expansion Partnering for expertise
- Override potential

Non-Proportional (XOL)

- More common than Proportional
- Occurrence or Aggregate
- Frequency and severity potential by peril determines form(s) employed




XOL Layering



Aggregate Reinsurance

- Most sensible when frequency risk is a concern
- Occurrence only → set retention amount each and every loss occurrence
- Hedges aberrational frequency of loss within retention
- Can provide a “catch all” for the retained risk net of the Occurrence tower
- Expensive, so assessing value for the additional spend is key
- Typically net retained loss reduction in the tail is the key benefit

June 2019 CARe Seminar on Reinsurance 7 

Aggregate Reinsurance (cont'd)

Cat Occurrence XOL Structure


Layer	Placed	Limit	Retention	Reinst
1st	100%	50	25	1@100%
2nd	100%	75	75	1@100%
3rd	100%	150	150	1@100%
4th	100%	300	300	1@100%

****NOTE: Figures in \$Mn****

Agg 1: \$200M vs \$50M with respect to losses in the \$20M vs \$5M contributing band
 Agg 2: \$200M vs \$50M “catch all” net of Inuring Cat XOL, \$10M per event hard deductible

Event	Loss	UNL Contribution		
		Cat XOL Ceded	Agg 1	Agg 2
1	100	75	20	15
2	50	25	20	15
3	25	-	20	15
4	10	-	5	-
5	400	350	20	40
6	20	-	15	10
7	100	25	20	65
8	10	-	5	-
Total	715	475	125	160
Ceded		475	75	110
Net		240	165	390

*Includes reinstatement premium. Net Impact.

June 2019 CARe Seminar on Reinsurance 8 


External Measuring and Monitoring

Regulators and rating agencies enforce specific Property Cat risk management standards

Falling out of line can result in detrimental action

Property Cat risk is a primary stressor to capital figuring prominently in capital adequacy testing

At a minimum, reinsurance programs must “check all the right boxes”

June 2019 CARe Seminar on Reinsurance 9 

Measuring Relative Program Performance

Decide and define what is important and how important it is

- Profitability
- Expected net retained loss in the tail
- Minimizing ceded premium/margin, etc.

All typically have some importance, and many are "in conflict"

As such, measuring them all in concert is the key

June 2019 CARe Seminar on Reinsurance 10

Company X Summary

Exposure & Assumptions

- North America Earthquake & Hurricane
- PHS = \$1.75 Billion
- Earned Premium Estimate = \$750 Million
- 40% Non-cat Loss Ratio
- Strong Capital Levels

	OEP (x RI Prem)			AEP		
	Total	EQ	HU	Total	EQ	HU
Mean	32.4	16.0	19.4	44.9	17.5	27.4
Std. Dev.	73.8	63.7	43.5	84.0	69.1	49.3
%ile 1 in n years						
50%	2	10.1	0.7	6.5	19.2	0.9
95%	20	144.1	72.2	78.7	179.0	78.4
99%	100	359.3	292.3	226.4	399.4	304.2
99.6%	250	496.3	469.4	305.9	548.8	496.4
99.9%	1,000	882.1	837.2	466.1	938.4	912.8

© 2019 Willis Towers Watson. All rights reserved. **WillisRe MYM** 11

Risk Tolerance

Selecting Baseline Strength Metric

Capital

- Focus on capital and extreme downside
- Focus on balance sheet
- Regulatory audience
- Protect against black swan
- Prevent financial impairment

-vs-

Earnings Volatility

- Meet earnings targets and reduce volatility
- Focus on income statement
- Investor audience
- Protect against grey swan
- Increase operational credibility

Decisions depends on company type, ERM strategy, regulatory concerns, among other things.

© 2019 Willis Towers Watson. All rights reserved. **WillisRe MYM** 12

Company X

Tolerance Selections

	Selected
PML Metric	100yr OEP
% of PHS	7.5%
Cost (as % of SEP)	4.00%

PHS 1.75 Billion

Net PML Tolerance (\$M)	131.25
Gross PML (\$M)	359.34
Limit Need (\$M)	228.09

SEP 750M

Cost Tolerance	30.0M
-----------------------	--------------

Additional Assumptions

- Layer Ceded Margin < 70%

Company X Selections:

Risk Tolerance:
 1:100yr OEP <= 7.5% PHS
 "1% Probability of Loss > 7.5% PHS"

Cost Tolerance:
 4.00% of Subject Premium

© 2019 Willis Towers Watson. All rights reserved.
WillisRe MFLM 13

Iteration 1

Quota Share

Net 100yr OEP: \$131.2M

Net Metric	Scenario	
	No Reinsurance	63.5% QS
NonCatAAL	300.21	109.58
CAT AAL	44.86	16.37
Premium	750.00	273.75
Margin \$	449.79	164.17
Net 1-100	359.34	131.16

Between	Correlation Coefficient	
	CAT-to-Total	87.9%
NonCat-to-Total	47.6%	
CAT-to-NonCAT	-0.1%	

Losses	Mean	Std. Dev.	CV
NonCat	40.03%	6.07%	0.15
CAT	5.98%	11.21%	1.87

✓ Risk Tolerance
 ○ Cost Tolerance
 ○ High correlation between CAT and Total Losses
 ○ CAT volatility significantly higher than NonCat

CAT drives total loss and total volatility. QS will cede high margins without efficiently addressing CAT.

© 2019 Willis Towers Watson. All rights reserved.
WillisRe MFLM 14

Finding the "Sweet Spot"

Like everything in life, there's a proper balance. Far left side = ceding too much and not retaining enough risk and margin to hit profitability targets and ROE expectations. Far right side = ceding too little and overly exposing financials. "Right answer" is somewhere in the middle!

June 2019 CARe Seminar on Reinsurance
15
HOLBORN

Iteration 2 Net 100yr OEP: \$10M

Single Layer to 1000yr

880M
\$870M xs \$10M (1 @ 100%)
10M Retention

Addresses Risk Tolerance, but too expensive.

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 16

Iteration 3 Net 100yr OEP: \$131.3M

Basic Structure

\$230M limit addresses tolerance

~7yr Return Period in-line with peers

280M
\$100M xs \$180M (1 @ 100%)
\$80M xs \$100M (1 @ 100%)
\$50M xs \$50M (1 @ 100%)
50M Retention

*Limit addresses risk tolerance
Raised retention cedes less premium, more volatility
Layering adds pricing efficiencies in the marketplace*

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 17

Additional Consideration

Reinstatement Premium

- 1 @ 100 layering requires reinstatement premium to be paid post-event
- This counts against loss recoveries

		Iteration 3 OEP	
		x RI Prem	w RI Prem
Mean		20.48	22.15
Std. Dev.		41.91	45.00
%ile	1 in n years		
95%	20	50.00	64.75
99%	100	131.34	155.42
99.6%	250	266.35	292.43
99.9%	1,000	652.14	678.22

Reinstatement premium adds ~\$24M to net 1-100yr. No longer within tolerance.

Risk Tolerance applies to total net benefit (net loss + reinstatement)

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 18

Iteration 4

Adjust for Reinstatement Premium

Net 100yr OEP: \$133.7M
Upfront Cost: \$26.9M

	OEP With RI Prem				
		Iteration 3	Iteration 4		
300M	\$50M xs \$250M (Single Shot)	22.15	21.84		
	Mean				
	\$75M xs \$175M (1 @ 100%)	45.00	43.37		
	Std. Dev.				
50M	%ile 1 in n years				
		95%	20	64.75	64.81
		99%	100	155.42	133.74
		99.6%	250	292.43	270.75
	\$50M xs \$50M (1 @ 100%)	678.22	656.54		
	99.9%				

Slightly above tolerance (close enough for now)

Retention

Add Limit and/or convert 1@100 to Single Shot to reduce Reinstatement Premium

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 19

Structure Comparison

Iterations 2-4

- Tolerances:
 - Net 1-100 OEP = \$131.25M
 - Cost = \$30.0M

Iteration	Limit	AAL	Upfront Cost	Margin		Net 1-100 w/ RI Prem
				\$	%	
2	870.00	27.90	69.17	41.26	59.7%	37.77
3	230.00	12.51	26.08	13.57	52.0%	155.42
4	250.00	12.79	26.93	14.13	52.5%	133.74

Below cost tolerance; slightly above risk tolerance. Focus on efficiencies to reduce.

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 20

Maximizing Efficiency

Maximizing efficiency = minimizing ceded margin

Two main components to price: 1) Loss cost (EL), 2) Reinsurer margin

- Every reinsurer will see these differently

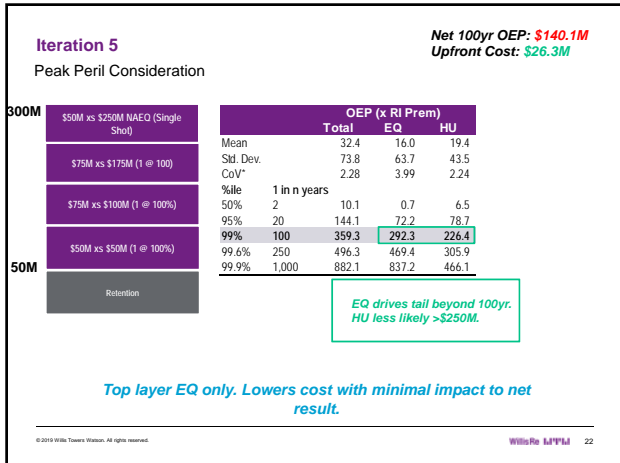
Some approaches for seeking efficiency:

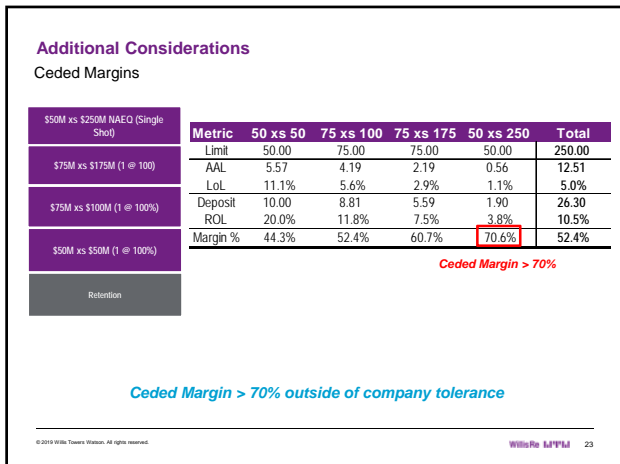
- Geographic- and Peril-specific layers
- Multi-use / shared limit layers (e.g., "top and drop", "top and Agg", etc.)
- Cascading coverage in Occurrence layers
- Accessing "non-traditional" channel

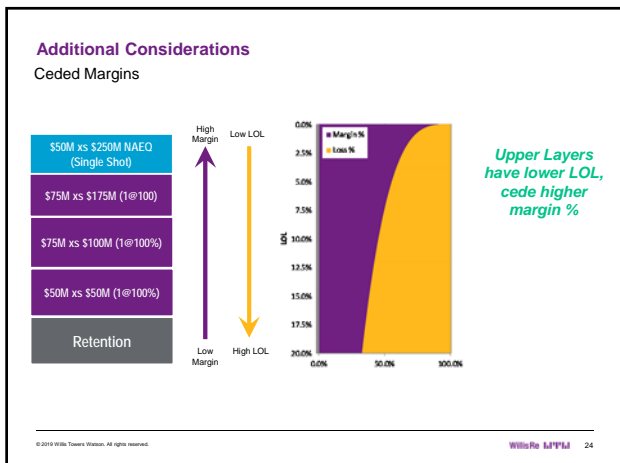
Executing a thoughtful marketing plan is key

- Understand drivers of individual reinsurer portfolios
- Understand how individual reinsurers assess risk (use of vendor models, etc.)

June 2019 CARe Seminar on Reinsurance 21







Iteration 6 Net 100yr OEP: **\$141.2M**
Upfront Cost: **\$27.5M**

Shared Limit (Top & Drop)

\$50M of Total Limit Shared Between:

- \$50M xs \$250M in 1st Event EQ
- \$25M xs \$25M in 2nd & 3rd Event EQ or HU (1st Event erodes AAD)

\$50M xs \$250M NAEQ (Single Shot)

\$75M xs \$175M (1@100)

\$75M xs \$100M (1@100%)

\$50M xs \$50M (1@100)

Retention

Metric	50 xs 50	75 xs 100	75 xs 175	T&D	Total
Limit	50.00	75.00	75.00	50.00	250.00
AAL	5.57	4.19	2.19	1.10	13.06
LoL	11.1%	5.6%	2.9%	2.2%	5.2%
Deposit	10.00	8.81	5.59	3.05	27.45
ROL	20.0%	11.8%	7.5%	6.1%	11.0%
Margin %	44.3%	52.4%	60.7%	63.8%	52.4%

*70.6% on "Top" only

Shared limits increase combined LOL, lowering total ceded margin %. Tradeoff for higher cost.

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 25

Additional Considerations

Reinstatement Premium Protection (RPP)

\$50M xs \$50M

80% Recoveries

20% Reinstatement Cost

Retention

20% Reinstatement Cost is equivalent to 20% Co-participation on 1st Event

- RPP cedes away Reinstatement Cost
- Layer ROL = 20%
- RI Cost = \$10M (20% of \$50M)
- Approx. RPP Cost = 10M * 20% = **\$2M**

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 26

Iteration 7 Net 100yr OEP: **\$131.2M**
Upfront Cost: **\$29.5M**

Reinstatement Premium Protection

\$50M xs \$250M NAEQ (Single Shot)

\$75M xs \$175M (1@100)

\$75M xs \$100M (1@100%)

\$50M xs \$50M (1@100 w/RPP)

Retention

\$25M xs \$25M xs \$25M Drop (1 Free)

RPP increases upfront cost but reduces post-event downside

© 2019 Willis Towers Watson. All rights reserved. WillisRe MFLM 27

Structure Comparison

Iterations 2-7 (\$M)

- Tolerances:
 - Net 1-100 OEP = **\$131.25M**
 - Cost = **\$30.0M**

Iteration	Limit	AAL	Upfront Cost	Margin \$	Margin %	Net 1-100
2	870	27.90	69.17	41.26	59.7%	37.77
3	230	12.51	26.08	13.57	52.0%	155.42
4	250	12.79	26.93	14.13	52.5%	133.74
5	250	12.51	26.30	13.79	52.4%	140.13
6	250	13.06	27.45	14.39	52.4%	141.19
7	250	13.06	29.45	16.39	55.7%	131.19

Both within Risk and Cost Tolerances

Other Considerations

- Collateralized/ILS Markets
- Cascading Layers
- CAT Aggregate XOL
- Multi-year

Sense Checking the Stochastic

- Over-reliance on models breeds both individual and systemic risk
- Model frequency and severity decomposition against own view of risk
- BEWARE: Tail increasingly theoretical the farther one ventures into it
- Peer inside the vendor "black box"...you may be surprised what you find!
- Temporal aspect imbedded in an OEP can be underappreciated
- TVaR (or TCE) is a helpful measure to understand the shape of the tail

Executing in the Market

- The technical must necessarily be weighed against the practical
- Simpler and more easily articulable is always better
- Overly complex = higher margins without the commensurate benefit
- We operate in a very volatile and, in turn, cyclical space
 - Anticipating and accounting for the post-loss behavioral element is critical
 - When "theory meets practice" in the tail, there are inevitably surprises
- Structural stabilizing mechanisms (e.g., multi-year) can be quite helpful



Holborn Disclaimers

The data and analysis herein and any information (collectively "Information") provided in connection with this (presentation/report) is intended to be used solely for the purpose of internal evaluation and has been prepared by Holborn on the condition that it shall be treated as strictly confidential and shall not be communicated in whole, in part, or in summary to any third party, without Holborn's prior written consent.

It should be noted that the information is provided "as is" and that Holborn disclaims all guarantees or warranties, whether express or implied, with respect to the information, including but not limited to, correctness, completeness, currentness, merchantability or fitness for a particular purpose. Further the information is based upon both internal and externally sourced data, the accuracy of which has not been independently verified by Holborn. In no event shall Holborn be liable for loss of profits or any other indirect, special, incidental, or consequential damages of any kind arising from the use of the information.

While the information represents Holborn's best professional judgment, it should be noted that there are many uncertainties and limitations inherent in any actuarial analysis including, but not limited to, limitations in the availability of data, reliance on outside data sources, the underlying volatility of any random event, the exercise of professional judgment in estimates and assumptions, etc. Also, liabilities, claims and losses depend upon future unforeseeable events, including but not limited to unanticipated changes in laws, regulations, inflation, etc. Further estimated cash flows may vary significantly from amounts actually collected, particularly in the event that a reinsurer is unwilling or unable to perform. In that regard it is probable that the actual results will differ from the information projected. Thus it is not recommended that decisions be based solely on the information provided, rather the information should be used to augment other available information.

Statements or analysis provided herein should be understood to be observations or applications based solely on Holborn's experience and expertise as a reinsurance intermediary and risk consultant. Holborn is not authorized to provide legal, accounting, or tax advice all such matters related to these areas should be reviewed with the client's own qualified advisors.



Willis Re disclaimers

This analysis has been prepared by Willis Limited and/or Willis Re Inc. and/or the "Willis Towers Watson" entity with which you are dealing ("Willis Towers Watson") as defined as Willis Limited, Willis Re Inc. and each of their respective parent companies, sister companies, subsidiaries, affiliates, Willis Towers Watson P.U.C. and all member companies thereof on condition that it shall be treated as strictly confidential and shall not be communicated in whole, in part, or in summary to any third party without prior written consent from the Willis Towers Watson entity with which you are dealing.

Willis Towers Watson has relied upon data from public and/or other sources when preparing this analysis. No attempt has been made to verify independently the accuracy of this data. Willis Towers Watson does not represent or otherwise guarantee the accuracy or completeness of such data nor assume responsibility for the total or any error or omission in the data or other materials generated from any source in the preparation of this analysis. Willis Towers Watson shall have no liability in connection with any results, including without limitation, those arising from based upon or in connection with the analysis, misstatements, or misstatements associated with the data or arising from based upon or in connection with any methodologies used or applied by Willis Towers Watson in producing the analysis or any results contained herein. Willis Towers Watson expressly disclaims any and all liability, based on any legal theory, arising from, based upon or in connection with the analysis. Willis Towers Watson assumes no duty in contract, tort or otherwise to any party arising from, based upon or in connection with this analysis, and no party should expect Willis Towers Watson to owe a any such duty.

There are many uncertainties inherent in this analysis including, but not limited to, issues such as limitations in the available data, reliance on client data and outside data sources, the underlying volatility of loss and other random processes, uncertainties that characterize the application of professional judgment in estimates and assumptions. Ultimate losses, liabilities and claims depend upon future contingent events, including but not limited to unanticipated changes in inflation, laws, and regulations. As a result of these uncertainties, the actual outcomes could vary significantly from Willis Towers Watson's estimates in either direction. Willis Towers Watson makes no representation about and does not guarantee the outcome, results, success, or profitability of any insurance or reinsurance program or venture, whether or not the analysis or conclusions contained herein apply to such program or venture.

Willis Towers Watson does not recommend making business decisions based solely on the information contained in this analysis. Rather, this analysis should be viewed as a supplement to other information, including specific business practice, claims experience, and financial situation. Independent professional advisors should be consulted with respect to the issues and conclusions presented herein and their possible application. Willis Towers Watson makes no representation or warranty as to the accuracy or completeness of the document and its contents.

This analysis is not intended to be a complete actuarial communication, and as such is not intended to be relied upon. A complete communication can be provided upon request. Subject to all terms of the Disclaimer, Willis Towers Watson activities are available to answer questions about this analysis.

Willis Towers Watson does not provide legal, accounting, or tax advice. This analysis does not constitute, is not intended to provide, and should not be construed as such advice. Qualified advisors should be consulted in these areas.

Willis Towers Watson makes no representation, does not guarantee and assumes no liability for the accuracy or completeness of, or any results obtained by application of, this analysis and conclusions provided herein.

Where data is supplied by way of CD or other electronic format, Willis Towers Watson accepts no liability for any loss or damage caused to the Recipient directly or indirectly through use of any such CD or other electronic format, even where caused by negligence. Without limitation, Willis Towers Watson shall not be liable for loss or corruption of data, damage to any computer or communications system, indirect or consequential losses. The Recipient should take proper precautions to prevent loss or damage, including the use of a virus checker.

This limitation of liability does not apply to losses or damage caused by death, personal injury, dishonesty or any other liability which cannot be excluded by law.

This analysis is not intended to be a complete Financial Analysis communication. A complete communication can be provided upon request. Subject to all terms of this Disclaimer, Willis Towers Watson analysis are available to answer questions about this analysis.

Willis Towers Watson does not guarantee any specific financial result or outcome, level of profitability, valuation, or rating agency outcome with respect to A.M. Best or any other agency. Willis Towers Watson specifically disclaims any and all liability for any and all damages of any amount or any type, including without limitation, lost profits, unearned profits, consequential damage based on any legal theory, punitive, multiple or statutory damages or fees of any type, based upon, arising from, in connection with or in any manner related to the services provided hereunder. Acceptance of this document shall be deemed agreement to the above.
