South African Reserve Bank
Prudential Authority

Prudential Standard FSI 4.3

Non-life Underwriting Risk Capital Requirement

Objectives and Key Requirements of this Prudential Standard

This Standard sets out the details for calculating the capital requirement for underwriting risk related to non-life insurance obligations for insurers using the standardised formula to calculate the Solvency Capital Requirement (SCR).

The ultimate responsibility for the prudent management of the financial soundness of an insurer rests with its board of directors. The board of directors must ensure that the insurer has systems and controls in place to adequately calculate its non-life underwriting risk capital requirement according to the Financial Soundness Standards for Insurers.

The calculation of the capital requirement for non-life underwriting risk is based on a mixture of linear formulas and specified scenarios applied to the following risk components of non-life underwriting risk:

- *Premium and reserve risk;*
- *Lapse risk; and*
- *Catastrophe risk.*

The overall capital requirement for non-life underwriting risk is determined by aggregating the capital requirements of each individual risk component using a correlation matrix prescribed in this Standard.

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1. Application

1.1. This Prudential Standard applies to all non-life insurers licensed under the Insurance Act, 2017 (the Act), other than microinsurers, Lloyd's and branches of foreign reinsurers.

1.2. Unless otherwise indicated, all references to "insurer" in this Standard can be read as a reference to non-life insurers and non-life reinsurers. Similarly, a reference to "insurance" obligations/policies in this Standard can be read as a reference to "reinsurance" obligations/policies, unless otherwise specified.

2. Roles and Responsibilities

2.1. Ultimate responsibility for the prudent management of the financial soundness of an insurer rests with the insurer's board of directors. The board of directors must ensure the insurer meets the Solvency Capital Requirement (SCR) on a continuous basis, regardless of the approach taken to its computation. The board of directors must also ensure that the insurer has in place appropriate systems, procedures and controls to meet the principles and requirements of this Standard on an ongoing basis.

2.2. An insurer's head of actuarial function is responsible for expressing an opinion to the board of directors regarding the accuracy of the calculations and the appropriateness of the assumptions underlying the capital requirement for non-life underwriting risk.

2.3. An insurer's auditor, appointed under section 32 of the Act, must audit the financial soundness of an insurer in accordance with its legal and regulatory obligations. The auditor must report to the board of directors and Prudential Authority any matters identified during the performance of its responsibilities that may cause the insurer to be not financially sound.

2.4. The roles and responsibilities of the board of directors and the head of actuarial function are described in more detail in the Governance and Operational Standards for Insurers (GOI 3).

3. Commencement and Transition Provisions

3.1. This Standard commences on 1 July 2018.

Version Number	Commencement Date
1	1 July 2018

3.2. For insurers that have approval to apply insurer-specific parameters in calculating the capital requirement for non-life underwriting risk, the adjustment factors specified in section A.6 of Attachment 7 to this Standard must be applied for a period of five years from the effective date of this Standard.

4. Scope and Key Elements of Non-Life Underwriting Risk

4.1. Non-life underwriting risk is the risk arising from non-life insurance obligations, such as from poor claims experience, expense over-runs and policy lapses.

4.2. The non-life underwriting risk capital requirement takes into account the uncertainty related to an insurer's existing insurance obligations, as well as to the new business expected to be written over the coming 12 months.

4.3. The non-life underwriting risk capital requirement under the standardised formula requires separate calculation of capital requirements associated with each of the following individual risk components:

a) Premium and reserve risk;
b) Lapse risk; and
c) Catastrophe risk.

4.4. The calculation of the non-life underwriting risk capital requirement also allows for an optional adjustment to account for the loss-absorbing or amplification capacity of insurance policies that involve an element of risk sharing between one or more parties to the contract. The methodology to combine and aggregate the capital requirements of each individual risk component above, as well as the optional adjustment for policies that include risk-sharing features, is set out in section 4.8 below.

4.5. In calculating the capital requirement for non-life underwriting risk, allowance may be made for the risk mitigating effect of eligible reinsurance and other eligible risk mitigation instruments taking care not to double-count the impact thereof. The risk of impairment from counterparty default on such instruments, however, must be taken into account in the calculation of the non-life underwriting risk capital requirement. The method for assessing counterparty default risk on eligible risk mitigation instruments is set out in Attachment 2 of FSI 4 (Calculation of the SCR Using the Standardised Formula).

4.6. The impairment for counterparty default risk of eligible risk mitigation instruments should be calculated for each of the risk components within the non-life underwriting risk module, as described in Attachment 2 of FSI 4 (Calculation of the SCR Using the Standardised Formula). This impairment should be applied to the credit taken for eligible risk mitigation instruments (i.e. the reduction in the capital requirement) and applied at the level at which the risk mitigation is assumed to take place. When two or more scenarios are considered, the insurer should select the scenario which leads to the largest net SCR, after allowing for the impairment of eligible risk mitigation Instruments for counterparty default risk.

4.7. Under the standardised formula approach, insurers may apply simplifications where provided for in the Standards and where the simplified calculations can be justified as proportionate to the nature, scale and complexity of the risks. Attachment 1 to this Standard sets out the criteria and approach insurers may take to simplifications for first-party insurance structures (including captive insurers, first-party cells within a cell captive insurer and first-party contingency policies).

Calculating the overall non-life underwriting risk capital requirement

4.8. The capital requirement for non-life underwriting risk (SCR_{NL}) must be calculated by combining the capital requirements for each non-life underwriting risk component using the following formula:

$$SCR_{NL} = \sqrt{\sum_{r,c} CorrNL_{r,c} \cdot NL_r \cdot NL_c} - RM_{SL} - RM_{other} + IMP_{SL\_Other} - ADJLoss_{abs} + SCR_{nl\_fp}$$

Where:

$CorrNL_{r,c}$ = The entries of the correlation matrix $CorrNL$ below

NL_r , NL_c = Capital requirements for individual non-life underwriting risk components r and c according to the rows and columns of correlation matrix $CorrNL$

RM_{SL} = Allowance for risk mitigation from stop-loss reinsurance arrangements that apply to a combination of premium, reserve and catastrophe risk related losses, which have not been allowed for elsewhere in the non-life underwriting risk module[1]

RM_{other} = Allowance for the effect of other eligible risk mitigation instruments that apply to a combination of premium, reserve and catastrophe risk related losses, which have not been allowed for elsewhere in the non-life underwriting risk module

IMP_{SL_Other} The capital requirement for the risk of impairment from counterparty default on stop-loss reinsurance arrangements and other eligible risk mitigation instruments that have not been allowed for elsewhere in the non-life underwriting risk module

$ADJLoss_{abs}$ = An optional adjustment to the capital requirement for premium and reserve risk (NL_{pr}) to allow for the loss-absorbing or amplification capacity of insurance policies that involve an element of risk sharing between one or more parties to the contract. Attachment 2 of this Standard provides further details regarding the calculation of this adjustment factor.

SCR_{nl_fp} = The capital requirement for non-life underwriting risk for first-party insurance structures, as calculated under the simplified method set out in Attachment 1

The correlation matrix $CorrNL$ is defined as:

$CorrNL$	Premium and reserve	Lapse	Catastrophe
Premium and reserve	1		
Lapse	0	1	
Catastrophe	0.25	0	1

[1] In calculating this amount, insurers should determine which portion of the overall 1-in-200 year loss is covered by the terms of the stop-loss reinsurance arrangement, and ensure there is no duplicate allowance for risk mitigation. A suitable expected loss ratio assumption should be used to determine the combined ratio in a 1-in-200 year scenario, taking into account that expected profits would likely offset a portion of the 1-in-200 year loss prior to the stop-loss being triggered.

5. Premium and Reserve Risk

5.1. Premium risk refers to the risk of fluctuations in the timing, frequency and severity of insured events. Premium risk relates to insurance policies to be written or renewed during the period, and to unexpired risks on existing policies. Premium risk includes the risk that premium provisions turn out to be insufficient to compensate claims or need to be increased.[2]

5.2. Reserve risk refers to the risk of fluctuations in the timing and amount of claim settlements.

5.3. The capital requirement for combined premium and reserve risk (NL_{pr}) must be calculated as:[3]

$$NL_{pr} = 3 \cdot \sigma \cdot V$$

Where:

V	=	Overall volume measure
σ	=	Overall standard deviation for non-life premium and reserve risk

5.4. The overall volume (V) measure and standard deviation (σ) must be determined using the following two-step process:

a) Step 1: Determine the volume measure and standard deviation for each individual line and/or sub-line of business[4] for both premium and reserve risk; and
b) Step 2: Aggregate the volume measures and standard deviations from Step 1 to derive the overall volume measure (V) and standard deviation (σ).

5.5. Where an insurer can allocate its inwards non-proportional and/or inwards other insurance risk mitigation reinsurance to the various direct (sub-)lines of business, a diversified combined volume measure and standard deviation should be calculated for inwards non-proportional (i.e. 18b and 18e combined) and inwards other insurance risk mitigation (i.e. 18c and 18f combined) (sub-)lines of business respectively by performing steps 1 and 2. The entries of the correlation matrix $CorrSlb$ for the direct lines of business, as set out in Attachment 6, should be used to perform these calculations. These results should be used as inputs to the overall volume (V) measure and standard deviation (σ) in section 5.4 above.

Step 1: Determining volume measures and standard deviations for (sub-)lines of business

5.6. The premium and reserve risk calculation must be segmented by the respective (sub-)lines of business in Attachment 3 of this Standard. For inwards proportional reinsurance business, the (sub-)line of business should correspond to the relevant direct insurance (sub-)line of business.

[2] Premium risk also includes the risk arising from the volatility of expense payments. Expense risk is implicitly included as part of the calculation of the premium risk capital requirement.

[3] The formula assumes a normal distribution of the underlying risk, and rounds the resulting 99.5% value-at-risk calibration to 3.

[4] The term "(sub-)line of business" is used throughout the remainder of this Standard to refer to a line and/or sub-line of business.

5.7. For all (sub-)lines of business in Attachment 3, other than line of business 10 (which reflects stand-alone Liability insurance cover), third-party liability cover that is provided together with the primary cover (e.g. Motor third-party liability in respect of property damage) must be included in the (sub-)line of the policy's primary cover (i.e. where Liability is not reported separately).

5.8. For each (sub-)line of business, the volume measures and standard deviations for premium and reserve risk are denoted as follows:

$V_{prem,slb}$	=	Volume measure for premium risk
$V_{res,slb}$	=	Volume measure for reserve risk
$\sigma_{prem,slb}$	=	Standard deviation for premium risk
$\sigma_{res,slb}$	=	Standard deviation for reserve risk

5.9. All volume measures for premium and reserve risk are subject to a minimum of zero, to avoid negative input values.

5.10. The volume measure for premium risk for each individual (sub-)line of business ($V_{prem,slb}$) must be calculated as:

$$V_{prem,slb} = max\left(P_{slb}\,, P_{last,slb}\right) + FP_{existing,slb} + FP_{future,slb}$$

Where:

P_{slb}	=	Estimate of the premiums[5] to be earned for each (sub-) line of business in the next 12 months
$P_{last,slb}$	=	Premiums[6] earned by the insurer for each (sub-)line of business over the past 12 months
$FP_{existing,slb}$	=	Present value of premiums[7] of existing policies which are expected to be earned after the next 12 months for each (sub-) line of business. Discount rate assumptions should be consistent with those used for the valuation of technical provisions.
$FP_{future,slb}$	=	Present value of premiums[8] expected to be earned after the next 12 months for policies where the initial recognition date falls in the next 12 months for each (sub-)line of business. Discount rate assumptions should be consistent with those used for the valuation of technical provisions.

5.11. The terms $FP_{existing,slb}$ and $FP_{future,slb}$ are only relevant for policies with a coverage period that exceeds the next 12 months. For annual policies without renewal options, these terms should be set to zero. Insurers are not required to calculate these terms where they are unlikely to be material compared to P_{slb} .

[5] Refer to section 5.15 and 5.16 of this Standard for the measure of earned premium to be used in these calculations.

[6] Ibid.

[7] Ibid.

[8] Ibid.

5.12. Insurers may choose not to calculate P_{slb}, provided that the following conditions are met:

a) The insurer's board of directors has confirmed that its earned premiums in the (sub-)line of business in the next 12 months will not exceed $P_{last,slb}$;
b) The insurer has established effective control mechanisms to ensure that the limits on earned premiums referred to in point a) will be met; and
c) The insurer has notified the Prudential Authority of the board of directors' confirmation referred to in point a), including the reasons supporting this confirmation.

5.13. The volume measures above should be segmented by the respective lines and sub-lines of business in Attachment 3, wherever possible. If segmentation at the sub-line of business level is not possible, insurers must, for each line of business separately, consolidate all sub-lines of business that cannot be segmented accurately into the sub-line of business attracting the highest capital charge for the relevant line of business.

5.14. The volume measures above should include cash-flows allowed for in "Other Technical Provisions" calculated under section 6.18 of FSI 2.2 (Valuation of Technical Provisions).

5.15. Earned premiums for each of the above volume measures and (sub-)lines of business should be calculated as:

Earned premium = unearned premium provisions (brought forward) +

written premiums –

unearned premium provisions (carried forward)

where written premiums and premium provisions are valued in accordance with International Financial Reporting Standards (IFRS).

5.16. Earned premiums should be net of applicable reinsurance. Applicable reinsurance includes proportional reinsurance (e.g. surplus) and certain non-proportional reinsurance (e.g. risk excess-of-loss), to the extent that they can be allocated to a specific (sub-)line of business. Earned premiums may allow for expected policy lapse and cancellation rates, subject to such assumptions being consistent with those used in the valuation of technical provisions.

5.17. The volume measure for reserve risk for each individual (sub-)line of business ($V_{res,slb}$) must be calculated as:

$$V_{res,slb} = PCO_{slb}$$

where PCO_{slb} is the best estimate for provisions for claims outstanding for each (sub-) line of business valued in accordance with FSI 2.2 (Valuation of Technical Provisions). This amount should be net of the amount recoverable from applicable reinsurance. This figure should include unallocated loss adjustment expenses (ULAE) and exclude cash-flows allowed for in "Other Technical Provisions" calculated under section 6.18 of FSI 2.2 (Valuation of Technical Provisions).

5.18. The standard deviation parameters for premium risk and reserve risk for each (sub-) line of business ($\sigma_{prem,slb}$ and $\sigma_{res,slb}$) are set out in Attachment 4.

Step 2: Deriving the overall volume measure and standard deviation

5.19. The combined volume measure for each (sub-)line of business (V_{slb}) must be calculated as:

$$V_{slb} = \left(V_{prem,slb} + V_{res,slb}\right) \cdot (0.75 + 0.25 \cdot DIV_{slb})$$

Where:

DIV_{slb}	=	$\frac{\sum_j (V_{prem,j,slb} + V_{res,j,slb})^2}{\left(\sum_j (V_{prem,j,slb} + V_{res,j,slb})\right)^2}$ subject to the conditions set out in section 5.20 below
j	=	The index to denote the regions set out in Attachment 5
$V_{prem,j,slb}$, $V_{res,j,slb}$	=	The volume measures defined in sections 5.10 and 5.17, respectively, but taking into account only insurance obligations where the underlying risk is situated in region j

5.20. DIV_{slb} must be set to 1 for the (sub-)lines of business 11, 12, 13, as well as corresponding (sub-)lines of business 18b and 18e as set out in Attachment 3. An insurer may choose to allocate all of its business in a (sub-)line of business to the main region in which it holds exposures to simplify the calculation. If this simplification is applied, DIV_{slb} must be set to 1.

5.21. The overall volume measure (V) must be calculated as the sum of all combined volume measures across each (sub-)line of business.

5.22. The standard deviation for premium and reserve risk for each (sub-)line of business (σ_{slb}) must be calculated as:

$$\sigma_{slb} = \frac{\sqrt{(\sigma_{prem,slb} \cdot V_{prem,slb})^2 + 2 \cdot \alpha \cdot \sigma_{prem,slb} \cdot \sigma_{res,slb} \cdot V_{prem,slb} \cdot V_{res,slb} + (\sigma_{res,slb} \cdot V_{res,slb})^2}}{V_{prem,slb} + V_{res,slb}}$$

where the correlation coefficient α should be set equal to 0.5.

5.23. The overall standard deviation (σ) must be calculated as:

$$\sigma = \frac{1}{V} \cdot \sqrt{\sum_{r,c} CorrSlb_{r,c} \cdot \sigma_r \cdot V_r \cdot \sigma_c \cdot V_c}$$

Where:

V	=	The overall volume measure of the insurer as calculated in accordance with section 5.21 above
$CorrSlb_{r,c}$	=	The entries of the correlation matrix $CorrSlb$ set out in Attachment 6
σ_r , σ_c	=	Combined standard deviations for (sub-)lines of business r and c respectively, according to the rows and columns of $CorrSlb$

V_r , V_c = Combined volume measures for (sub-)lines of business r and c respectively, according to the rows and columns of $CorrSlb$

Insurer-specific parameters

5.24. Insurers may apply to the Prudential Authority to determine the following subset of standard parameters using their own insurer-specific parameters for the purposes of calculating the capital requirement for premium and reserve risk (NL_{pr}):

a) The volume measure for premium risk ($V_{prem,slb}$);
b) The standard deviation for premium risk ($\sigma_{prem,slb}$); and
c) The standard deviation for reserve risk ($\sigma_{res,slb}$).

All other parameters must be calculated using the standard formulas above.

5.25. Where an insurer applies to use insurer-specific parameters for only certain (sub-) lines of business, the insurer must explain to the Prudential Authority why it believes that its methodology should not apply to the other (sub-)lines of business.

5.26. Insurer-specific parameters should be calibrated on the basis of an insurer's internal data or on the basis of data that is directly relevant for the insurer's operations. The data used for the calculation of insurer-specific parameters must satisfy the data quality requirements set out in Attachment 7.

5.27. The use of insurer-specific parameters requires the application of credibility factors to account for potential estimation error. These credibility factors, the methodologies that should be applied to determine insurer-specific parameters, governance and data requirements associated with the use of insurer-specific parameters, are also set out in Attachment 7.

6. Lapse Risk

6.1. Non-life insurance policies may include contractual options which influence the obligations arising from them.[9] Where such contractual options are included in a non-life insurance policy, the calculation of premium provisions must take into account the lapse risk associated with the exercise rates of these options. Lapse risk is the risk that assumptions regarding the exercise of contractual options are different to those assumed in the valuation of premium provisions.

6.2. Where non-life insurance policies do not include contractual options, or where the assumptions about the exercise rate of such options have no material influence on premium provisions, such policies do not need to be included in the calculation of the lapse risk capital requirement.

6.3. The capital requirement for lapse risk in relation to non-life insurance obligations must be calculated as the change in the value of an insurer's basic own funds that results from the combination of two shocks. That is, the capital requirement for lapse risk (NL_{lapse}) must be calculated as:

[9] For non-life insurance policies, these contractual options should include options for the policyholder to terminate a policy before the end of the previously agreed insurance period, and options to renew the policy according to previously agreed conditions.

$$NL_{lapse} = \Delta BOF\big| \left(lapseshock_1 + lapseshock_2\right)$$

Where:

ΔBOF	=	Change in the value of basic own funds (not including changes in the risk margin of technical provisions)
$lapseshock_1$	=	Lapsing of 40 % of the in-force insurance policies for which lapsing would result in an increase of technical provisions excluding the risk margin
$lapseshock_2$	=	Decrease of 40% in the number of future insurance policies or reinsurance contracts that are allowed for in the valuation of technical provisions, but not in-force at the valuation date, where this decrease would result in an increase in technical provisions excluding the risk margin

6.4. $lapseshock_1$ and $lapseshock_2$ must apply uniformly to all insurance policies and reinsurance contracts subject to lapse risk. In relation to reinsurance contracts, $lapseshock_1$ must apply to the underlying insurance policies.

6.5. For the purpose of determining the change in the value of basic own funds under $lapseshock_1$, an insurer must base the shock on the type of lapse which most negatively affects its basic own funds on a per policy basis.

7. Catastrophe Risk

7.1. Catastrophe risk for non-life insurance is the risk of loss, or of adverse change in the value of insurance obligations, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events. Catastrophe risk stems from extreme or irregular events that are not sufficiently captured by the capital requirements for premium and reserve risk.

7.2. In calculating the capital requirement for non-life underwriting risk, appropriate allowance should be made for collateral. Where catastrophe scenarios are considered to be independent, use of the whole available collateral can be assumed in each scenario as it is assumed that the scenarios do not occur simultaneously. In other situations care should be taken not to double-count the available collateral.

7.3. The non-life catastrophe risk capital requirement under the standardised formula should be calculated using one of the following methods, or a combination of both:

a) Method 1: Standardised scenarios; and/or
b) Method 2: Factor-based methods.

7.4. Method 1 should be used for exposures within South Africa, where an insurer is able to segment the business into the underlying (sub-)lines of business.[10] In addition to this, inwards non-proportional reinsurance exposures outside the boarders of South Africa should also be included within Method 1.

7.5. Where possible, insurers should use Method 1 to calculate its non-life catastrophe risk capital requirement. Insurers should use Method 2 in the following instances, as well as other instances indicated in this Standard:

[10] The portion of the business that cannot be segmented must be subject to Method 2.

a) Circumstances where it is not possible to calculate the non-life catastrophe risk capital requirement using Method 1;
b) Circumstances where the standardised scenarios under Method 1 do not adequately assess the risk profile of their insurance obligations;
c) Exposures outside of South Africa[11] (with the exception of inwards non-proportional reinsurance); or
d) Insurance business that is classified in the Miscellaneous, Agriculture – Equipment, Agriculture – Other, Inwards Non-Proportional – Accident and Health and Inwards Other Risk Mitigation (sub-)lines of business.

7.6. If an insurer uses both Method 1 and Method 2, the capital requirement for non-life catastrophe risk (NL_{CAT}) must be combined using the following formula:[12]

$$NL_{CAT} = \sqrt{(NL_{CAT1})^2 + (NL_{CAT2})^2}$$

Where:

NL_{CAT1}	=	The non-life catastrophe risk capital requirement under Method 1
NL_{CAT2}	=	The non-life catastrophe risk capital requirement under Method 2

Method 1: Standardised scenarios

7.7. The catastrophe standardised scenarios under Method 1 are broadly classified into the following categories:

a) Natural catastrophes;
b) Man-made catastrophes; and
c) Catastrophe scenarios specific to inwards non-proportional reinsurance.

7.8. Natural catastrophes are extreme or exceptional events arising from perils such as:

a) Windstorm;
b) Flood and subsidence;
c) Earthquake; and
d) Hail.

7.9. Man-made catastrophes are extreme or exceptional events relating to:

a) Motor;
b) Fire to Property;
c) Marine;
d) Aviation;
e) Liability;
f) Consumer Credit, Trade Credit and Guarantees;
g) Terrorism; and
h) Accident and Health.

7.10. Catastrophe risk for inwards non-proportional reinsurance is treated as a separate category due to the inherent differences of the risk profile of inwards non-proportional reinsurance business relative to other non-life insurance business. In particular, the

[11] Given that the standardised scenarios prescribed under Method 1 are based primarily on events impacting South Africa only.

[12] This aggregation formula assumes independence between catastrophe risks calculated under the two methods.

total insured values and loss ratios on inwards non-proportional reinsurance business would typically be more variable from year-to-year relative to direct or proportional reinsurance business. Such differences require a separate approach to the calculation of the capital required for catastrophe risks arising from non-proportional reinsurance.

7.11. Based on the three categories of catastrophe risk noted above, the non-life catastrophe risk capital requirement under Method 1 (NL_{CAT1}) must be calculated as:

$$NL_{CAT1} = \sqrt{(NL_{CAT1,NatCat})^2 + (NL_{CAT1,ManMade})^2 + (NL_{CAT1,NP})^2}$$

Where:

$NL_{CAT1,NatCat}$	=	Capital requirement for natural catastrophe risk, net of risk mitigation, after allowing for counterparty default impairment on eligible risk mitigation instruments
$NL_{CAT1,ManMade}$	=	Capital requirement for man-made catastrophe risk, net of risk mitigation, after allowing for counterparty default impairment on eligible risk mitigation instruments
$NL_{CAT1,NP}$	=	Capital requirement for the catastrophe risk of inwards non-proportional reinsurance, after allowing for counterparty default impairment on eligible risk mitigation instruments

Natural catastrophe risk

7.12. The capital requirement for natural catastrophes must be calculated as the maximum loss, net of risk mitigation, resulting from the following scenarios:

a) A 1-in-200 year single Earthquake event;
b) A 1-in-200 year single Hail event; or
c) Three distinct 1-in-10 year natural catastrophe events, plus a 1-in-20 year natural catastrophe event in the same year covering all perils noted in section 7.8 above ("more frequent catastrophe events" scenario).[13]

7.13. The capital requirement for natural catastrophes, net of risk mitigation, under Method 1 ($NL_{CAT1,NatCat}$) must be calculated as:

$$NL_{CAT1,NatCat} = max\left(MER_{1\_in\_200\_EQ}, MER_{1\_in\_200\_H}, MER_{Horizontal}\right)$$

Where:

$MER_{1\_in\_200\_EQ}$	=	The maximum event retention (MER) for a 1-in-200 year Earthquake event, net of risk mitigation, after allowing for the impairment of the credit taken for eligible risk mitigation instruments

[13] The events should be considered in the order specified, as the assumptions about the impact of Eligible Reinsurance and other Eligible Risk Mitigation Instruments could be different for a different order, e.g. reinstatement of reinsurance coverage limits that have been reduced or exhausted by loss payments under such coverages may have an impact on the result.

$MER_{1\_in\_200\_H}$ = The MER for a 1-in-200 year Hail event, net of risk mitigation, after allowing for the impairment of the credit taken for eligible risk mitigation instruments

$MER_{Horizontal}$ = The sum of the MER for all of the scenarios i set out in section 7.12c) above, net of risk mitigation, after allowing for the impairment of the credit taken for eligible risk mitigation instruments for each of the scenarios i

7.14. Attachment 8 of this Standard sets out further details for calculating the MER for each of the natural catastrophe event scenarios noted in section 7.12 above.

7.15. When calculating the MER for each scenario, insurers may recognise the risk mitigating effects of eligible reinsurance contracts, after allowing for the impairment of the credit taken for eligible risk mitigation instruments. In calculating the MER (i.e. net of risk mitigation), insurers should include reinstatement premiums directly related to the scenario. Both outwards reinstatement premiums associated with reinstating risk transfer protection, and inwards reinstatement premiums in respect of assumed reinsurance business, should be included where relevant.

7.16. Where there are separate reinsurance programs per peril, the aggregation (across perils) should be undertaken net of eligible reinsurance.

Man-made catastrophe risk

7.17. The capital requirement for man-made catastrophes, net of risk mitigation, ($NL_{CAT1,ManMade}$) must be calculated as:

$$NL_{CAT1,ManMade} = \sqrt{\sum_{x} (CAT_{x\_net})^2}$$

Where:

CAT_{x_net} = Capital requirement for man-made catastrophe risk *x*, net of risk mitigation, after allowing for the impairment of the credit taken for eligible risk mitigation instruments

x = Individual man-made catastrophe events arising from Motor, Fire to Property, Marine, Aviation, Liability, Consumer Credit, Trade Credit and Guarantees, Terrorism and Accident and Health

7.18. Attachment 9 provides further details for calculating the capital requirements for each man-made catastrophe risk (CAT_{x_net}).

7.19. When calculating the capital requirement for each man-made catastrophe risk, insurers may recognise the risk mitigating effects of eligible reinsurance and other eligible risk mitigation instruments, after allowing for the impairment of the credit taken for eligible risk mitigation instruments. In calculating the capital requirements net of risk mitigation, insurers should include reinstatement premiums directly related to the scenario. Both outwards reinstatement premiums associated with reinstating risk transfer protection, and inwards reinstatement premiums in respect of assumed reinsurance business, should be included where relevant.

7.20. Where applicable, insurers may also recognise the effect of national arrangements which provide cover for particular non-life insurance risks in South Africa when assessing their capital requirements net of risk mitigation.[14]

7.21. Where there are separate reinsurance programs per peril, the aggregation (across perils) should be undertaken net of eligible reinsurance.

Catastrophe risk of inwards non-proportional reinsurance

7.22. The capital requirement for catastrophe risk of inwards non-proportional reinsurance ($NL_{CAT1,NP}$) must be calculated as the instantaneous loss from each inwards non-proportional reinsurance contract. Specifically, the capital requirement must be calculated as:

$$NL_{CAT1,NP} = \sqrt{(NL_{NP,Property})^2 + (NL_{NP,CCTCG})^2}$$

Where:

$NL_{NP,Property}$	=	The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to the property component across all the (sub-)lines of business (i.e. all lines of business except lines 9 to 14 and Miscellaneous (sub-)lines of business without a property component)
$NL_{NP,CCTCG}$	=	The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to Consumer Credit, Trade Credit and Guarantees insurance (lines of business 11, 12 and 13)

7.23. The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to property $NL_{NP,Property}$ must be calculated as:

$$NL_{NP,Property} = \Delta BOF\left|L_{NP,Property}\right.$$

Where:

$L_{NP,Property}$	=	$2.5 \cdot \left(0.5 \cdot DIV_{NP,Property} + 0.5\right) \cdot P_{NP,Property}$
$DIV_{NP,Property}$	=	The factor DIV_{slb} as defined in section 5.19 above, but based on the premiums earned by the reinsurer in respect of obligations in (sub-)lines of business 18b and 18e (excluding inwards non-proportional reinsurance obligations in relation to lines of business 9 to 14 and Miscellaneous (sub-)lines of business without a property component)
$P_{NP,Property}$	=	$max\left(P_{NP,Property\ (next)}, P_{NP,Property\ (last)}\right)$

[14] These national arrangements include insurance cover provided by SASRIA (for terrorism and political risks) and the Road Accident Fund (RAF).

$P_{NP,Property\ (next)}$ = Estimate of the premiums[15] to be earned in the next 12 months in respect of inwards non-proportional reinsurance related to the property component across all the (sub-)lines of business (i.e. all lines of business except lines 9 to 14 and Miscellaneous (sub-)lines without a property component)

$P_{NP,Property\ (last)}$ = Premiums[16] earned by the insurer over the past 12 months in respect of inwards non-proportional reinsurance related to the property component across all the (sub-)lines of business (i.e. all lines of business except lines 9 to 14 and Miscellaneous (sub-)lines without a property component)

7.24. Insurers may adjust their gross catastrophe risk exposures for the effects of eligible reinsurance and other eligible risk mitigation instruments to arrive at the capital requirement for catastrophe risk net of risk mitigation.

7.25. The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to Consumer Credit, Trade Credit and Guarantees insurance ($NL_{NP,CCTCG}$) must be calculated as:

$$NL_{NP,CCTCG} = \Delta BOF\left|_{L_{NP,CCTCG}}\right.$$

Where:

$L_{NP,CCTCG}$ = $1.5 \cdot P_{NP,CCTCG}$

$P_{NP,CCTCG}$ = $max\left(P_{NP,CCTCG\ (next)}, P_{NP,CCTCG\ (last)}\right)$

$P_{NP,CCTCG\ (next)}$ = Estimate of the premiums[17] to be earned in the next 12 months in respect of inwards non-proportional reinsurance related to lines of business 11, 12 and 13

$P_{NP,CCTCG\ (last)}$ = Premiums[18] earned by the insurer over the past 12 months in respect of inwards non-proportional reinsurance related to lines of business 11, 12 and 13

7.26. Insurers may adjust their gross catastrophe risk exposures for the effects of eligible reinsurance and other eligible risk mitigation Instruments to arrive at the capital requirement for catastrophe risk net of risk mitigation.

7.27. The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to Liability is included in the calculation in Attachment 9 section E.

7.28. The capital requirement for catastrophe risk of inwards non-proportional reinsurance related to Accident and Health should be calculated using Method 2.

[15] For the purpose of this calculation, premiums must be gross, without deduction of premiums for outwards retrocession contracts. Refer to section 5.15and 5.16 of this Standard for the measure of earned premium to be used in these calculations.

[16] For the purpose of this calculation, premiums must be gross, without deduction of premiums for outwards retrocession contracts. Refer to section 5.15and 5.16 of this Standard for the measure of earned premium to be used in these calculations.

[17] Ibid.

[18] Ibid.

Method 2: Factor based method

7.29. Refer to section 7.4 above for circumstances where insurers should use Method 2.

7.30. The calculation of the non-life catastrophe risk capital requirement under Method 2 (NL_{CAT2}) must be calculated as:[19]

$$NL_{CAT2} = \sqrt{\sum_{t=1}^{16}(c_t \cdot P_t)^2 + (c_{17} \cdot P_{17} + c_{18} \cdot P_{18})^2}$$

Where:

P_t = Estimate of the gross earned premium in the next 12 months for the relevant lines of business which are affected by catastrophe event t

c_t = The gross factors by event as set out in the table below[20]

t = The index to denote the catastrophe events set out in the table below

t	Events (t)	(Sub-)lines of business affected (and (sub-)line of business number)	c_t
1	Storm	• Motor – personal lines (1a); • Motor – commercial lines (1b); • Property – personal lines (2a); • Property – commercial lines (2b); • Agriculture (3ii and 3iii); • Engineering (4ii); • Rail (8i); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	175%
2	Flood	• Motor – personal lines (1a); • Motor – commercial lines (1b); • Property – personal lines (2a); • Property – commercial lines (2b); • Agriculture (3ii and 3iii); • Engineering (4ii); • Rail (8i); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	113%

[19] The calculation under Method 2 assumes independence across catastrophe events, and allows for no diversification between direct insurance, proportional reinsurance and non-proportional reinsurance for the same line of business.

[20] These factors should apply to exposures in all countries.

t	Events (t)	(Sub-)lines of business affected (and (sub-)line of business number)	c_t
3	Earthquake	• Motor – personal lines (1a); • Motor – commercial lines (1b); • Property – personal lines (2a); • Property – commercial lines (2b); • Agriculture (3ii and 3iii); • Engineering (4ii); • Rail (8i); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	120%
4	Hail	• Motor – personal lines (1a); • Motor – commercial lines (1b); • Property – personal lines (2a); • Property – commercial lines (2b); • Agriculture (3ii and 3iii); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	30%
5	Major fires, explosions	• Motor – personal lines (1a); • Motor – commercial lines (1b); • Property – personal lines (2a); • Property – commercial lines (2b); • Agriculture (3 ii and 3iii); • Engineering (4ii); • Rail (8i); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	175%
6	Major Marine, Aviation and Transit (MAT) disaster	• Marine (5i); • Aviation (6i); and • Transport (7i).	100%
7	Major Professional Indemnity liability disaster	• Liability – Professional Indemnity (10v); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	150%
8	Major Public liability disaster	• Liability – Public liability (10vi); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	80%
9	Major Employers liability disaster	• Liability – Employers liability (10ii); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	200%

t	Events (t)	(Sub-)lines of business affected (and (sub-)line of business number)	c_t
10	Major Directors and Officers liability disaster	• Liability – Directors and Officers liability (10i); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	300%
11	Major Product liability disaster	• Liability – Product liability (10iv); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	60%
12	Major Other liability disaster	• Engineering – Liability (4i); • Marine – Liability (5ii); • Aviation – Liability (6ii); • Transport – Liability (7ii) • Rail – Liability (8ii); • Liability – Fidelity Guarantee (10iii); • Liability – Other (10vii); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	85%
13	Consumer Credit, Trade Credit and Guarantees	• Consumer Credit (11); • Trade Credit (12); • Guarantees (13); and • Corresponding proportional reinsurance (sub-)lines of business to those above (18a and 18d).	139%
14	Miscellaneous	• Miscellaneous (16); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	40%
15	Non-Proportional Reinsurance (Other)	• Non-proportional reinsurance (18b and 18e) excluding non-proportional reinsurance allowed for in event 17	250%
16	Other Risk Mitigation	• Other insurance risk mitigation (18c and 18f)	250%
17	Major Accident and Health disaster	• Accident and Health (14); and • Corresponding proportional reinsurance (sub-)lines of business (18a and 18d).	85%
18	Non-Proportional Reinsurance (Accident and Health)	• Non-proportional Major Accident and Health disaster reinsurance (18b and 18e in relation to underlying obligations in line of business 14)	250%

7.31. Insurers may adjust their gross catastrophe risk exposures for the effects of eligible reinsurance and other eligible risk mitigation instruments to arrive at the capital requirement for catastrophe risk net of risk mitigation.

7.32. Where an insurer considers some of their insurance policies to have no material exposure to non-life catastrophe risk, the insurer may apply to the Prudential Authority for an exemption to calculate the capital requirement for non-life catastrophe risk for these policies. For the purposes of calculating the capital requirement for non-life catastrophe risk, insurers may exclude Motor warranty policies without Prudential Authority approval.

Attachment 1: Simplifications for First-Party Insurance Structures

This Attachment details the approach insurers may take to applying simplifications under the standardised formula for calculating the SCR for first-party insurance structures. First-party insurance structures include:

a) Captive insurers;
b) First-party cells within a cell captive insurer; and
c) First-party contingency policies.

Simplifications for first-party insurance structures are allowed for under the Financial Soundness Standards for Insurers as such structures:

a) Only underwrite the risks of their parent companies and operate as an extension of their parents (i.e. the ultimate risks lie with the parent entity);
b) Typically have a simple risk structure compared to commercial insurers;
c) Are generally limited in size and day-to-day management is normally outsourced; and
d) Generally have the majority of risks reinsured (especially catastrophe and liability exposures).

A. Limitations on the application of first-party insurance simplifications

1. The application of the simplifications in this Attachment is limited to first-party insurance structures, or that portion of the business written by an insurer that relates to business which can be defined as the business of a first-party insurer.

2. Third-party cells must follow the standardised formula without simplification. A captive insurer that writes any business to third parties (e.g. underwriting risks of its customers) must not apply these simplifications in calculating its SCR.[21]

3. Cells (within a cell captive insurer) that write business to both first parties and third parties in the same cell must not apply these simplifications in calculating its SCR.[22]

4. If an insurer cannot separately identify its first-party contingency policies separately, those policies must be grouped with all other policies, and the insurer must not apply these simplifications in calculating its SCR.

5. Irrespective of whether the first-party insurance structure makes use of these particular simplifications, it can make use of the general simplifications for insurers, provided the criteria relating to those simplifications are fulfilled.

6. No simplifications are allowed in the calculation of the Minimum Capital Requirement (MCR). The simplifications relate to the calculation of the non-life underwriting risk capital requirement (SCR_{NL}) under the standardised formula approach only.

[21] Consistent with section 25 of the Act, 2017, captive insurers that write business to third parties will be prohibited from doing so upon relicensing within a period of two years following the commencement of the Act.

[22] Ibid.

B. Calculating the SCR for first-party insurance structures

1. The capital requirement for non-life underwriting risk for first-party insurance structures (SCR_{nl_fp}) under the simplified method must be calculated as:

$$SCR_{nl\_fp} = \sqrt{\sum_{i} \left(SCR_{nl\_fp\_i}\right)^2}$$

Where:

$SCR_{nl\_fp\_i}$	=	The non-life underwriting risk capital requirement of each individual first-party insurance structure i of the insurer, as calculated under section 2 below

2. The non-life underwriting risk capital requirement of each individual first-party insurance structure i ($SCR_{nl\_fp\_i}$) must be calculated as the sum of the capital requirements for each (sub-)line of business (SCR_{slb}) of the individual first-party insurance structure, i.e.:

$$SCR_{nl\_fp\_i} = \sum_{slb} SCR_{slb}$$

3. The capital requirement for each line of business (SCR_{slb}) of the individual first-party insurance structure must be calculated as:

$$SCR_{slb} = max\left(0, Factor_{slb} \cdot NAR\_DEF_{slb} - max(NWP_{slb}\ , EAB_{slb})\right)$$

Where:

NAR_DEF_{slb}	=	Net aggregate retention for the (sub-)line of business allowing for default risk of the relevant reinsurers[23]
NWP_{slb}	=	Net written premium from the past 12 months for the (sub-)line of business
EAB_{slb}	=	Experience account balance for the (sub-)line of business, if applicable
$Factor_{slb}$	=	The (sub-)line of business factors set out in the table below

[23] Net aggregate retention is the total sum insured after allowing for the effect of policy limits and reinsurance arrangements.

(Sub-)Line of Business (*slb*)		$Factor_{slb}$			
		$Losses_{ret\_slb}$ ≤ 15%	15% < $Losses_{ret\_slb}$ ≤ 50%	50% < $Losses_{ret\_slb}$ ≤ 75%	$Losses_{ret\_slb}$ > 75%
1a	Motor – Personal lines	40%	75%	90%	100%
1b	Motor – Commercial lines	40%	75%	90%	100%
2a	Property – Personal lines	50%	80%	100%	100%
2b	Property – Commercial lines	50%	80%	100%	100%
3a	Agriculture – Crop	50%	80%	100%	100%
3b	Agriculture – Equipment	50%	80%	100%	100%
3c	Agriculture – Other	50%	80%	100%	100%
4a	Engineering – Liability	100%	100%	100%	100%
4b	Engineering – Other	60%	90%	100%	100%
5a	Marine – Property	60%	90%	100%	100%
5b	Marine – Liability	100%	100%	100%	100%
6a	Aviation – Property	60%	90%	100%	100%
6b	Aviation – Liability	100%	100%	100%	100%
7a	Transport – Property	60%	90%	100%	100%
7b	Transport – Liability	100%	100%	100%	100%
8a	Rail – Property	60%	90%	100%	100%
8b	Rail – Liability	100%	100%	100%	100%
9	Legal Expense	50%	80%	95%	100%
10a	Liability – Directors and officers	100%	100%	100%	100%
10b	Liability – Employer liability	100%	100%	100%	100%
10c	Liability – Fidelity guarantee	100%	100%	100%	100%
10d	Liability – Product liability	100%	100%	100%	100%

(Sub-)Line of Business (*slb*)		$Factor_{slb}$			
		$Losses_{ret\_slb}$ ≤ 15%	15% < $Losses_{ret\_slb}$ ≤ 50%	50% < $Losses_{ret\_slb}$ ≤ 75%	$Losses_{ret\_slb}$ > 75%
10e	Liability – Professional indemnity	100%	100%	100%	100%
10f	Liability – Public liability	100%	100%	100%	100%
10g	Liability – Other	100%	100%	100%	100%
11	Consumer Credit	60%	90%	100%	100%
12	Trade Credit	60%	90%	100%	100%
13	Guarantees	60%	90%	100%	100%
14	Accident And Health	60%	90%	100%	100%
15	Travel	50%	80%	95%	100%
16a	Miscellaneous – Warranty	50%	80%	95%	100%
16b	Miscellaneous – Pet insurance	50%	80%	95%	100%
16c	Miscellaneous – Other	50%	80%	95%	100%
17a	Terrorism – Motor	50%	80%	95%	100%
17b	Terrorism – Property	50%	80%	95%	100%
17c	Terrorism – Engineering	50%	80%	95%	100%
17d	Terrorism – Other	50%	80%	95%	100%
18a, 18d	Reinsurance – Proportional	As per corresponding (sub-)line of business			
18b, 18c, 18e, 18f	Reinsurance – Non-Proportional and Other (Marine Aviation, Transport and Rail)	60%	90%	100%	100%
18b, 18c, 18e, 18f	Reinsurance – Non-Proportional and Other (Property excluding Terrorism)	50%	80%	100%	100%
18b, 18c, 18e, 18f	Reinsurance – Non-Proportional and Other (Terrorism)	50%	80%	95%	100%

(Sub-)Line of Business (*slb*)		$Factor_{slb}$			
		$Losses_{ret\_slb}$ ≤ 15%	15% < $Losses_{ret\_slb}$ ≤ 50%	50% < $Losses_{ret\_slb}$ ≤ 75%	$Losses_{ret\_slb}$ > 75%
18b, 18c, 18e, 18f	Reinsurance – Non-Proportional and Other (Liability)	100%	100%	100%	100%

The term $Losses_{ret\_slb}$ in the table above should represent the three-year average net losses as a percentage of net aggregate retention for the (sub-)line of business, calculated as:

$$Losses_{ret\_slb} = \frac{\sum_{i=1}^{3} Loss\ in\ year\ i}{\sum_{i=1}^{3} Net\ aggregate\ retention\ in\ year\ i} \cdot 100$$

Attachment 2: Optional Adjustment for Insurance Policies with Risk Sharing Features

1. Insurers may choose to apply the optional adjustment factor ($ADJLoss_{abs}$) when calculating the non-life underwriting risk capital requirement if they satisfy the requirements set out in this Attachment.

2. The factor adjusts the capital requirement for premium and reserve risk (NL_{pr}) to account for the loss absorbing or amplification effect of insurance policies that involve an element of risk sharing between one or more of the parties to the contract (e.g. between the underwriting manager, policyholder, insurer and/or reinsurer). Products with such features will typically have their technical provisions valued separately under section 6.18 of FSI 2.2 (Valuation of Technical Provisions).

3. The adjustment factor will be positive if there is a loss amplification effect, and negative if there is a loss-absorbing effect.

4. The calculation of the adjustment factor must be performed separately to the calculation of other components of the standardised formula, and must be accompanied by a dedicated report issued by the head of actuarial function of the insurer.[24]

5. The adjustment factor must appropriately allow for the impact of all component terms of NL_{pr}, as well as on the aggregation of the component terms.

6. The adjustment factor must not exceed an amount that results in an increase to the insurer's SCR cover ratio (i.e. eligible own funds divided by the SCR expressed as a percentage) of more than 25%, or lower percentage as prescribed by the Prudential Authority on a case-by-case basis.

7. The adjustment factor must consider all features of the insurance policies that involve an element of risk sharing between one or more of the parties to the contract. The insurer must not elect to model some risk sharing features while omitting others. Moreover, once the insurer elects to model the adjustment, it must continue to do so in all future calculations unless otherwise specified by the Prudential Authority.

8. The Prudential Authority retains the right to disregard the adjustment factor if there are material factual grounds for it to doubt the insurer's financial soundness, system of governance and/or risk management in general.

9. The adjustment factor will not be permitted if the features of the insurance policies do not comply in all respects with market conduct or other relevant Prudential Standards.

[24] The dedicated report on the calculation of the adjustment factor should be set up in accordance with any relevant guidance that may be issued by the Actuarial Society of South Africa. Such report and the insurer's ORSA report must both positively attest to the appropriateness of the non-life underwriting risk module's structure and calibration for the insurer's risk profile, in order for the insurer to be considered eligible to use the adjustment.

Attachment 3: Lines and Sub-lines of Business for Non-Life Insurance

The following table sets out each line and sub-line of business for non-life insurance and reinsurance obligations (including the numbering system used in this Standard):

Line of Business[25]		**Sub-Line of Business[26]**	
1.	Motor	a.	Personal lines
		b.	Commercial lines
2.	Property	a.	Personal lines
		b.	Commercial lines
3.	Agriculture	i.	Crop
		ii.	Equipment
		iii.	Other
4.	Engineering	i.	Liability
		ii.	Other
5.	Marine	i.	Property
		ii.	Liability
6.	Aviation	i.	Property
		ii.	Liability
7.	Transport	i.	Property
		ii.	Liability
8.	Rail	i.	Property
		ii.	Liability
9.	Legal Expense		
10.	Liability	i.	Directors and officers
		ii.	Employers liability[27]
		iii.	Fidelity guarantee

[26] Reporting (sub-)lines of business should be aggregated to the (sub-)lines of business contained in this table.

[27] Products underwritten by insurers authorised under the Compensation for Occupational Injuries and Diseases Act (COIDA), will be classified under employers' liability. Applying the substance over form principle, all products similar to life insurance business provided by insurers authorised under COIDA should not be included in this risk module, but rather in the life underwriting risk module.

Line of Business[25]		Sub-Line of Business[26]	
		iv.	Product liability
		v.	Professional indemnity
		vi.	Public liability
		vii.	Other
11.	Consumer Credit		
12.	Trade Credit		
13.	Guarantees		
14.	Accident and Health		
15.	Travel		
16.	Miscellaneous	i.	Warranty
		ii.	Pet insurance
		iii.	Other
17.	Terrorism	i.	Motor
		ii.	Property
		iii.	Engineering
		iv.	Other
18.	Reinsurance	a.	Proportional Treaty[28]
		b.	Non-Proportional Treaty
		c.	Other insurance risk mitigation Treaty
		d.	Proportional Facultative[29]
		e.	Non-Proportional Facultative
		f.	Other insurance risk mitigation Facultative

[28] The (sub-)line of business for all inwards proportional reinsurance business should correspond to the relevant (direct) insurance (sub-)line of business as per section 5.6 of this Standard.

[29] Ibid.

Attachment 4: Standard Deviation Parameters for Premium and Reserve Risk

The following table sets out the standard deviation parameters for premium risk and reserve risk for each (sub-)line of business.

Line of Business		Sub-Line of Business		Standard deviation for premium risk ($\sigma_{prem,slb}$)	Standard deviation for reserve risk ($\sigma_{res,slb}$)
1.	Motor	a.	Personal lines	6.3%	6.0%
		b.	Commercial lines	7.0%	6.5%
2.	Property	a.	Personal lines	5.9%	11.7%
		b.	Commercial lines	13.8%	14.5%
3.	Agriculture	i.	Crop[30]	40.0%	20.0%
		ii.	Equipment	10.0%	9.0%
		iii.	Other	9.1%	23.2%
4.	Engineering	i.	Liability	10.9%	13.5%
		ii.	Other	10.9%	13.5%
5.	Marine	i.	Property	14.6%	10.7%
		ii.	Liability	14.6%	10.7%
6.	Aviation	i.	Property	14.5%	12.6%
		ii.	Liability	14.5%	12.6%
7.	Transport	i.	Property	14.6%	10.7%
		ii.	Liability	14.6%	10.7%
8.	Rail	i.	Property	14.6%	10.7%
		ii.	Liability	14.6%	10.7%
9.	Legal Expense			6.9%	13.0%
10.	Liability	i.	Directors and officers	12.8%	10.1%
		ii.	Employer liability	12.8%	10.1%
		iii.	Fidelity guarantee	12.8%	10.1%
		iv.	Product liability	12.8%	10.1%

[30] An implicit allowance for catastrophe risk is included in the standard deviation parameters for this sub-line of business.

Line of Business		Sub-Line of Business		Standard deviation for premium risk ($\sigma_{prem,slb}$)	Standard deviation for reserve risk ($\sigma_{res,slb}$)
		v.	Professional indemnity	12.8%	10.1%
		vi.	Public liability	12.8%	10.1%
		vii.	Other	12.8%	10.1%
11.	Consumer Credit			12.1%	19.7%
12.	Trade Credit			12.1%	19.7%
13.	Guarantees			12.1%	19.7%
14.	Accident and Health			9.1%	23.2%
15.	Travel			12.3%	19.3%
16.	Miscellaneous	i.	Warranty	9.1%	23.2%
		ii.	Pet insurance	9.1%	23.2%
		iii.	Other	9.1%	23.2%
17.	Terrorism	i.	Motor	14.9%	11.0%
		ii.	Property	14.9%	11.0%
		iii.	Engineering	14.9%	11.0%
		iv.	Other	14.9%	11.0%
18.	Reinsurance	a.	Proportional Treaty	As per corresponding (sub-)line of business	As per corresponding (sub-)line of business
		b.	Non-Proportional Treaty	17.5%	20.0%
		c.	Other insurance risk mitigation Treaty	20.0%	22.0%
		d.	Proportional Facultative	As per corresponding (sub-)line of business	As per corresponding (sub-)line of business
		e.	Non-Proportional Facultative	17.5%	20.0%
		f.	Other insurance risk mitigation Facultative	20.0%	22.0%

Attachment 5: Geographical Regions and Zones

Region		Zone			
URN	**Name and Description**	**URN**	**Name**	**Description**	**Postal Codes[31]**
R1	South Africa, Lesotho and Swaziland	Z1	Gauteng - South	A sub-zone of South Africa CRESTA Zone 1 which, together with Z17, Z18, Z19 and West Rand comprise the full South Africa CRESTA zone 1	Transvaal South (1800-1999)
		Z2	Karoo	South Africa CRESTA Zone 2	Karoo 2 (6900-7099) Namakwa (8100-8299) Kalahari (8300-8499) Vaalhartz (8500-8699) Herbert (8700-8799) Gordonia (8800-8999)
		Z3	Kwazulu-Natal	South Africa CRESTA Zone3, but with the addition of all risks situated in the national borders of Swaziland and Lesotho and excluding the postal codes included in the Durban zone	Natal 1 (2900-3199) Natal 2 (3200-3399) Umvoti (3400-3599) Natal 3 (3700-3799) Zululand (3800-3999) South Coast (4150-4299) North Coast (4450-4499) Natal Cape (4500-4699) Pondo (4700-4899) Swaziland (all postal codes) Lesotho (all postal codes)
		Z4	Free State	South Africa CRESTA Zone 4 excluding Drakensberg (9750-9799)	Bloemfontein (9300-9399) OFS North 1 and 2 (9400-9699) Drakensberg (9700-9749) Drakensberg (9800-9899) OFS South (9900-9999)
		Z5	Pretoria	South Africa CRESTA Zone 5	Pretoria (0001-0199)
		Z6	Johannesburg and West Rand	South Africa CRESTA Zone 6 and including West Rand	Rand West (1700-1799) Johannesburg (2000-2199)
		Z7	East Rand	South Africa CRESTA Zone 7	Rand East (1400-1699)
		Z8	Cape Town	South Africa CRESTA Zone 8 extended to the north and east to improve Cape Town exposure aggregation	East and North of CT (7100-7199) Northeast of CT (7400-7599) Cape Town (7700-8099)

[31] Postal codes 9000-9299 do not exist in South Africa and are therefore missing from the mapping table.

Region		Zone			
URN	**Name and Description**	**URN**	**Name**	**Description**	**Postal Codes[31]**
		Z9	Durban	South Africa CRESTA Zone 9 enlarged to more closely represent the exposure aggregation in the Ethekwini Metro	Natal 3 (3600-3699) Durban (4000-4099) South Coast (4100-4149) North Coast (4300-4449)
		Z10	Swartland and Overberg	South Africa CRESTA Zone 10 excluding the extension to the north and east of Cape Town	East and North of CT (7200-7399)
		Z11	Boland	South Africa CRESTA Zone 11 excluding the extension to the north and east of Cape Town	Karoo 1 (6800-6899) Northeast of CT (7600-7699)
		Z12	Cape South Coast	South Africa CRESTA Zone 12	Langkloof (6300-6499) Coast 2 (6500-6699) Coast 1 (6700-6799)
		Z13	Port Elizabeth	South Africa CRESTA Zone 13	Port Elizabeth (6000-6099)
		Z14	Eastern Cape (EAST)	South Africa CRESTA Zone 14 including Drakensberg (9750-9799) from Z4 and Tembu 2 (5300-5599) from Z16	Tembu 2 (5300-5599) Ciskei (5600-5799) Cape Mid 1 (6100-6199) Drakensberg (9750-9799)
		Z15	East London	South Africa CRESTA Zone 15	East London (5200-5299)
		Z16	Eastern Cape (WEST)	South Africa CRESTA Zone 16 excluding Tembu 2 (5300-5599)	Tembu 1 (4900-5199) Cape Mid 2 (5800-5999) Cape Mid West (6200-6299)
		Z17	Northwest Province (EAST)	A sub-zone of South Africa CRESTA Zone 1 which, together with Z1, Z18, Z19 and West Rand comprise the full South Africa CRESTA zone 1	Bushveld (0200-0399) Transvaal South West (2500-2699) Transvaal Mid West (2700-2799) Transvaal North West (2800-2899)
		Z18	Limpopo	A sub-zone of South Africa CRESTA Zone 1 which, together with Z1, Z17, Z19and West Rand comprise the full South Africa CRESTA	Transvaal North (0400-0999)

Region		Zone			
URN	**Name and Description**	**URN**	**Name**	**Description**	**Postal Codes[31]**
				zone 1	
		Z19	Mpumalanga Province	A sub-zone of South Africa CRESTA Zone 1 which, together with Z1, Z17, Z18 and West Rand comprise the full South Africa CRESTA zone 1	Transvaal East (1000-1399) Highveld (2200-2399) Transvaal South East (2400-2499)
R2	Namibia and Botswana	Z20	Namibia and Botswana	All risks situated within the national borders of the countries listed below: - Namibia - Botswana	All postal codes
R3	East Africa (Rift Valley)	Z21	East Africa (Rift Valley)	All risks situated within the national borders of the countries listed below: - Burundi - Democratic Republic of the Congo - Ethiopia - Kenya - Malawi - Mozambique - Rwanda - Somalia - Tanzania - Uganda - Zambia - Zimbabwe	All postal codes
R4	Rest of Sub-Sahara and West Africa	Z22	Rest of Sub-Sahara and West Africa	All risks situated within the national borders of the countries listed below: - Angola - Benin - Burkina Faso - Cameroon - Cape Verde - Central African Republic - Chad - Comoros - Congo - Côte d'Ivoire - Djibouti - Equatorial Guinea	All postal codes

Region		Zone			
URN	**Name and Description**	**URN**	**Name**	**Description**	**Postal Codes[31]**
				- Eritrea - Gabon - Gambia - Ghana - Guinea - Guinea-Bissau - Liberia - Madagascar - Mali - Mauritania - Mauritius - Mayotte - Niger - Nigeria - Réunion - Saint Helena - São Tomé and Príncipe - Senegal - Seychelles - Sierra Leone - South Sudan - Sudan - Togo - Western Sahara	
R5	North Africa	Z23	North Africa	All risks situated within the national borders of the countries listed below: - Algeria - Egypt - Libya - Morocco - Tunisia	All postal codes
R6	Rest of World	Z24	Rest of World	All risks situated within the national borders of the countries not listed elsewhere in this table	All postal codes

Attachment 6: Correlation Matrix for Premium and Reserve Risk Calculation

The top left of the correlation matrix *CorrSlb* for use in Step 2 of the calculation of the premium and reserve risk capital requirement is defined as:

slb	1a	1b	2a	2b	3i	3ii	3iii	4i	4ii	5i	5ii	6i	6ii	7i	7ii	8i	8ii	9	10i	10ii
1a	1																			
1b	0.75	1																		
2a	0.25	0.25	1																	
2b	0.25	0.25	0.75	1																
3i	0.25	0.25	0.25	0.25	1															
3ii	0.25	0.25	0.25	0.25	0.75	1														
3iii	0.25	0.25	0.25	0.25	0.75	0.75	1													
4i	0.25	0.25	0.5	0.5	0.25	0.25	0.25	1												
4ii	0.25	0.25	0.5	0.5	0.25	0.25	0.25	0.75	1											
5i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1										
5ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.75	1									
6i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1								
6ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.75	1							
7i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.5	1						
7ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.5	0.75	1					
8i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	1				
8ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.75	1			
9	0.5	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1		
10i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	
10ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1

The bottom left of the correlation matrix $CorrSlb$ for use in Step 2 of the calculation of the premium and reserve risk capital requirement is defined as:[32]

slb	1a	1b	2a	2b	3i	3ii	3iii	4i	4ii	5i	5ii	6i	6ii	7i	7ii	8i	8ii	9	10i	10ii
10iii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.25
10iv	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.25
10v	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.25
10vi	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
10vii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5
11	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.25	0.25
12	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.25	0.25
13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.25	0.25
14	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
16i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
16ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
16iii	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
17i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
17ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
17iii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
17iv	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18b; 18e	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18c; 18f	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

[32] The entries for sub-lines of business 18a and 18d for inwards proportional reinsurance should correspond to the entries for the respective direct sub-lines of business. The entries for sub-lines of business 18b, 18c, 18e and 18f for inwards non-proportional reinsurance and inwards other insurance risk mitigation should correspond to the entries for the respective direct sub-lines of business only to the extent that these can be allocated to specific direct sub-lines of business.

The bottom right of the correlation matrix $CorrSlb$ for use in Step 2 of the calculation of the premium and reserve risk capital requirement is defined as:[33]

slb	10iii	10iv	10v	10vi	10vii	11	12	13	14	15	16i	16ii	16iii	17i	17ii	17iii	17iv	18b; 18e	18c; 18f
10iii	1																		
10iv	0.25	1																	
10v	0.5	0.25	1																
10vi	0.25	0.25	0.25	1															
10vii	0.5	0.5	0.5	0.5	1														
11	0.25	0.25	0.5	0.25	0.25	1													
12	0.25	0.25	0.5	0.25	0.25	0.75	1												
13	0.25	0.25	0.5	0.25	0.25	0.75	0.75	1											
14	0.25	0.25	0.25	0.25	0.25	0.25	0.75	0.75	1										
15	0.25	0.25	0.25	0.5	0.25	0.25	0.25	0.25	0.25	1									
16i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1								
16ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1							
16iii	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1						
17i	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1					
17ii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.75	1				
17iii	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	1			
17iv	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1		
18b; 18e	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	
18c; 18f	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1

[33] The entries for sub-lines of business 18a and 18d for inwards proportional reinsurance should correspond to the entries for the respective direct sub-lines of business. The entries for sub-lines of business 18b, 18c, 18e and 18f for inwards non-proportional reinsurance and inwards other insurance risk mitigation should correspond to the entries for the respective direct sub-lines of business only to the extent that these can be allocated to specific direct sub-lines of business.

Attachment 7: Insurer-Specific Parameters

This Attachment sets out methods that insurers should apply to calculate insurer-specific parameters, where they have been granted approval by the Prudential Authority to do so. It also sets out general requirements in relation to the use of insurer-specific parameters, including those associated with governance and data quality.

A. General requirements

1. The insurer should calculate all three of the insurer-specific parameters – the volume measure for premium risk, and the standard deviations for premium and reserve risk – for all (sub-)lines of business approved by the Prudential Authority.

2. The use of insurer-specific parameters must incorporate a credibility factor to account for potential estimation error for all parameters.

3. The credibility factors an insurer must apply will differ by line of business and the number of years of data that are available to calculate the insurer-specific parameters. Insurers with less than 5 years of credible data available to estimate a parameter will not be permitted to apply an insurer-specific estimate for that parameter.

4. For general Liability, Consumer Credit, Trade Credit and Guarantees lines of business, the credibility factors (c) are set out in the table below:[34]

N_{lb}	5	6	7	8	9	10	11	12	13	14	≥15
c	17%	22%	26%	30%	34%	37%	41%	44%	46%	48%	50%

   where N_{lb} represents the number of years where data are available to calculate the relevant insurer-specific parameter.

5. For all other lines of business, the credibility factors are set out in the table below:

N_{lb}	5	6	7	8	9	≥10
c	17%	26%	34%	41%	46%	50%

6. In addition to the credibility factor, the insurer-specific parameters are also subject to a phase-in adjustment. In particular, the credibility factors above must be adjusted by a factor (f) that increases linearly each year for the first five years of this Standard. The adjustment factors are set out in the table below:

Year	1	2	3	4	≥5
f	20%	40%	60%	80%	100%

7. Based on the credibility factors (c) and adjustment factors (f) above, the insurer-specific parameters should be calculated as:

[34] For clarity, these reflect lines of business 10 to 13 in Attachment 3 of this Standard.

For the volume measure for premium risk:

$V_{prem,slb} = (c \cdot f) \cdot V_{I,prem,slb} + (1 - (c \cdot f)) \cdot V_{S,prem,slb}$

Where:

$V_{I,prem,slb}$	=	The insurer-specific volume measure for premium risk for each (sub-)line of business
$V_{S,prem,slb}$	=	The standardised formula volume measure for premium risk for each (sub-)line of business

For the standard deviation for premium risk:

$\sigma_{prem,slb} = c \cdot \sigma_{I,prem,slb} + (1 - c) \cdot \sigma_{S,prem,slb}$

Where:

$\sigma_{I,prem,slb}$	=	The insurer-specific estimate of the standard deviation for premium risk for each (sub-)line of business
$\sigma_{S,prem,slb}$	=	The standard parameter of the standard deviation for premium risk per (sub-)line of business as set out in Attachment 4

For the standard deviation for reserve risk:

$\sigma_{res,slb} = c \cdot \sigma_{I,res,slb} + (1 - c) \cdot \sigma_{S,res,slb}$

Where:

$\sigma_{I,res,slb}$	=	The insurer-specific estimate of the standard deviation for reserve risk for each (sub-)line of business
$\sigma_{S,res,slb}$	=	The standard parameter of the standard deviation for reserve risk per (sub-)line of business as set out in Attachment 4

B. Insurer-specific volume measure for premium risk

1. The insurer-specific volume measure for premium risk for each (sub-)line of business must be calculated as:

   $V_{I,prem,slb} = V_{S,prem,slb} \cdot CR_{slb}$

   Where:

CR_{slb}	=	Combined ratio for the (sub-)line of business

2. The combined ratio per (sub-)line of business must be calculated as:

   $CR_{slb} = \max\left(LR_{slb}^{t}, LR_{slb}^{t-1}, LR_{slb}^{avg}\right) + \max(ER_{slb}^{t}, ER_{slb}^{t-1})$

   Where:

LR_{slb}^{t}	=	Estimate of the loss ratio over the next 12 months for the (sub-)line of business

LR_{slb}^{t-1} = Loss ratio over the past 12 months for the (sub-)line of business

LR_{slb}^{avg} = Weighted average loss ratio over the past 10 years or maximum number of years for which the data is available (i.e. between 5 years and 10 years) for the (sub-)line of business

ER_{slb}^{t} = Estimate of the expense ratio over the next 12 months for the (sub-)line of business

ER_{slb}^{t-1} = Expense ratio over the past 12 months for the (sub-)line of business

3. The loss ratios should be calculated net of outwards reinsurance arrangements, i.e.:

   $LR = Net\ claims\ incurred / Net\ earned\ premiums$

4. The expense ratios should be calculated as:

   $ER = Total\ expenses\ incurred / Net\ earned\ premiums$

C. Insurer-specific standard deviation for premium risk

1. Insurers that have approval to calculate insurer-specific standard deviations for premium risk may choose between one of three methods to calculate the parameter. The three methods are set out in further detail below. Insurers should choose the method that is most suitable by taking into account the assumptions underlying each method and the data required to calculate the parameter under each method.

2. In estimating insurer-specific standard deviation parameters for premium risk per (sub-)line of business, insurers should:

   a) Analyse claims payments excluding amounts for expenses (claims and expense volatility are assumed to be similar, and thus no additional adjustments are needed);
   b) Adjust their data for inflation, where the inflationary experience implicitly included in time series used is not representative of the inflation that might occur in the future; and
   c) Use net earned premiums as the volume measure, and the net ultimate claims after 12 months, to derive the standard deviation estimates.

Method 1

3. Under Method 1, the standard deviation for premium risk per (sub-)line of business ($\sigma_{I,prem,slb}$) should be calculated as:

   $$\sigma_{I,prem,slb} = \frac{\hat{\beta}_{slb}}{\sqrt{V_{slb}}}$$

   Where:

   $$\hat{\beta}_{slb} = \sqrt{\frac{1}{N_{slb}-1} \cdot \sum_{Y} \frac{\left(U_{Y,slb} - V_{Y,slb} \cdot \frac{\sum_Y U_{Y,slb}}{\sum_Y V_{Y,slb}}\right)^2}{V_{Y,slb}}}$$

V_{slb} = The result from the volume measure calculation from the current year, defined in the same way as $V_{prem,slb}$ in section 5.10 of this Standard

$U_{Y,slb}$ = The ultimate claims amount after 12 months, by accident year Y and (sub-)line of business slb, assuming an ultimate loss distribution:

$$U_{Y,slb} \sim V_{Y,slb} \cdot \mu_{slb} + \sqrt{V_{Y,slb}} \cdot \beta_{slb} \cdot \varepsilon_{Y,slb}$$

μ_{slb} = Expected loss ratio for the (sub-)line of business slb

$V_{Y,slb}$ = Earned premium by accident year Y for the (sub-)line of business slb

N_{slb} = The number of data points available for the (sub-)line of business slb

$\varepsilon_{Y,slb}$ = An unspecified random variable with distribution with mean zero and unit variance

4. Method 1 relies on the least squares fitting approach to derive the estimator $\hat{\beta}_{slb}$ and makes the following assumptions:

   a) The expected loss is proportional to the premium for any year and (sub-)line of business;
   b) The insurer has a different but constant expected loss ratio for any year and (sub-)line of business;
   c) The variance of the loss is proportional to the earned premium; and
   d) The least squares fitting approach is appropriate.

   Insurers should consider the applicability of these assumptions if they choose Method 1 to derive the insurer-specific standard deviation parameter for premium risk.

5. Insurers should also be able to satisfy the following data requirements if they choose to apply Method 1:

   a) The data should reflect the premium risk that is covered in the (sub-)line of business during the following 12 months, in particular in relation to its nature and composition;
   b) The data should be adjusted to remove catastrophe claims to the extent they are addressed in the non-life catastrophe risk capital requirement;
   c) Claims should be net of reinsurance and the data should reflect the reinsurance cover of the insurer for the following 12 months;
   d) Claims should be adjusted for inflation and all data used should be adjusted for any trends which can be identified on a prudent, reliable and objective basis;
   e) Claims should not include unallocated expense payments;
   f) The data should stem from a sufficiently long period such that if cycles exist, at least a full cycle is covered in the data; and
   g) The data should not lead to a material increase of the estimation error compared to the estimated value.

Method 2

6. Under Method 2, the standard deviation for premium risk per (sub-)line of business ($\sigma_{I,prem,slb}$) should be calculated as:

$$\sigma_{I,prem,slb} = \frac{\hat{\beta}_{slb}}{\sqrt{V_{slb}}}$$

Where:

$\hat{\beta}_{slb}$ and $\hat{\mu}_{slb}$ are chosen as the values that maximise the log likelihood function ($\log L$):

$$\log L = \sum_{Y}\left(-\log(S_{Y,slb}) - \frac{\left(\log(U_{Y,slb}) - M_{Y,slb}\right)^2}{2 \cdot S_{Y,slb}^2}\right)$$

$M_{Y,slb}$ = The mean of the logarithm of the ultimate claims amount after 12 months, by accident year Y and (sub-)line of business *slb*, calculated as:

$$M_{Y,slb} = \log\left(V_{Y,slb} \cdot \mu_{slb}\right) - \frac{1}{2} \cdot S_{slb}^2$$

$S_{Y,slb}$ = The standard deviation of the logarithm of the ultimate claims amount after 12 months, by accident year Y and (sub-)line of business *slb*, calculated as:

$$S_{Y,slb} = \sqrt{\log\left(1 + \frac{\beta_{slb}^2}{V_{Y,slb} \cdot \mu_{slb}^2}\right)}$$

V_{slb} = The result from the volume measure calculation from the current 12 months, defined in the same way as $V_{prem,slb}$ in section 5.10 of this Standard

$U_{Y,slb}$ = The ultimate claims amount after 12 months, by accident year Y and (sub-)line of business *slb*, assuming an ultimate loss distribution:

$$U_{Y,slb} \sim V_{Y,slb} \cdot \mu_{slb} + \sqrt{V_{Y,slb}} \cdot \beta_{slb} \cdot \varepsilon_{Y,slb}$$

μ_{slb} = Expected loss ratio for the (sub-)line of business *slb*

$V_{Y,slb}$ = Earned premium by accident year Y for the (sub-)line of business *slb*

$\varepsilon_{Y,slb}$ = An unspecified random variable with distribution with mean zero and unit variance

β_{slb}^2 = Constant of proportionality for the variance of loss for the (sub-)line of business *slb*

7. Method 2 makes the following assumptions in estimating the standard deviation parameter for premium risk per (sub-)line of business:

   a) The expected loss is proportional to the premium for any year and (sub-)line of business;
   b) The insurer has a different but constant expected loss ratio for any year and (sub-)line of business (e.g. does not allow for premium rate changes);
   c) The variance of the loss is proportional to the earned premium;
   d) The distribution of the loss is lognormal; and

e) The maximum likelihood fitting approach is appropriate.

Insurers should consider the applicability of these assumptions if they choose Method 2 to derive the insurer-specific standard deviation parameter for premium risk.

8. Insurers should also be able to satisfy the data requirements stated for Method 1 if they choose to apply Method 2.

Method 3

9. Under Method 3, the calculation of the insurer-specific standard deviation for premium risk is based on the assumption that the claim number per accident year and claim size depend on a random variable $\theta = [\theta_1, \theta_2]$, where θ_1 represents the random fluctuation in the number of claims and θ_2 the random fluctuation in claim size.

10. The standard deviation for premium risk under this method ($\sigma_{I,prem,slb}$), per (sub-)line of business, should be calculated as:

$$\sigma_{I,prem,slb} = \frac{1}{V_{prem,slb}} \cdot \sqrt{Var(S_N)}$$

Where:

$V_{prem,slb}$	=	The volume measure calculation for the (sub-)line of business *slb* calculated in accordance with section 5.10 of this Standard
S_N	=	$\sum_{i=1}^{N} X_i$
N	=	The number of claims (random variable)
X_i	=	The claim size (random variable)

11. The calculation should assume that:

a) $N|\theta_1 \sim Poiss(\lambda(\theta_1))$;
b) $X_i|\theta_2 \sim F(\mu(\theta_2), \sigma(\theta_2))$;
c) *N* and X_i are conditionally independent; and
d) λ , μ and σ denote the parameters of the distributions where:

μ	=	The average value of claim size in the individual (sub-) line of business with an inflation adjustment
σ	=	The standard deviation of claim size in the individual (sub-)line of business with an inflation adjustment estimated by means of the standard estimator
λ	=	The total number of claims, divided by earned premiums, then multiplied by $V_{prem,slb}$ per (sub-)line of business. If a volume measure other than earned premiums appears to be statistically more appropriate and this can be justified by the insurer, the volume measure may replace earned premiums in this calculation.

$Var(\theta)$ = Estimate of the variance of the random factor in the number of claims in the individual (sub-)line of business during the following 12 months, as calculated under section 13 below

12. The variance for S_N should be calculated as:

$$Var(S_N) = Var\big(\lambda(\theta_1)\big) \cdot Var\big(\mu(\theta_2)\big) + Var\big(\lambda(\theta_1)\big) \cdot (E[\mu(\theta_2)])^2 + Var\big(\mu(\theta_2)\big) \cdot E[\lambda(\theta_1)]^2 + E\big(\lambda(\theta_1)\big) \cdot E[\mu(\theta_2)]^2 + E\lambda(\theta_1) \cdot E[\sigma(\theta_2)]^2$$

13. The parameter $Var(\theta)$ should be calculated as:

$$Var(\theta) = \left(c \cdot \frac{v_\bullet}{J}\right)^{-1} \cdot \left(\frac{V_F}{\bar{F}} - 1\right)$$

Where:

F_j = $\frac{N_j}{v_j}$

$v_\bullet$ = $\sum_{j=1}^{J} v_j$

$\bar{F}$ = $\sum_{j=1}^{J} \frac{v_j}{v_\bullet} \cdot F_j$

V_F = $\frac{1}{J-1} \cdot \sum_{j=1}^{J} v_j \cdot \left(F_j - \bar{F}\right)^2$

c = $\sum_{j=1}^{J} \frac{v_j}{v_\bullet} \cdot \left(1 - \frac{v_j}{v_\bullet}\right)$

J = Maximum numbers of years with available data based on which insurer calculates the insurer-specific parameter

N_j = Numbers of claims in year *j*

v_j = *A priori* expected number of claims in year *j*

14. The data used to estimate μ, σ, λ and $Var(\theta)$ under this Method should meet the same data requirements as under Method 1 and Method 2. In addition:

a) The data used to estimate $Var[\lambda(\theta)]$ should cover at least 5 years; and
b) The earned premiums used to estimate $E[\lambda(\theta)]$ should not lead to a material increase in the estimation error compared to the estimated value. Any other volume measure used should reflect the number of claims.

D. Insurer-specific standard deviation for reserve risk

1. Insurers that have approval to calculate insurer-specific standard deviations for reserve risk may choose between one of three methods to calculate the parameter. These three methods are set out in further detail below. Insurers should choose the

method that is most suitable by taking into account the assumptions underlying each method and the data required to calculate the parameter under each method.

2. In estimating insurer-specific standard deviation parameters for reserve risk, insurers should:

   a) Analyse claims payments excluding amounts for expenses (claims and expense volatility are assumed to be similar, and thus no additional adjustments are needed);
   b) Assume that the effect of discounting will be the same in the stressed scenario as in the best estimate (as a result, no modification to the result is necessary for discounting);
   c) Adjust their data for inflation, where the inflationary experience implicitly included in time series used is not representative of the inflation that might occur in the future;
   d) Use the opening value of the net reserves as the volume measure, and the net claims development result after 12 months for these exposures to derive the standard deviation estimates; and
   e) Use net paid or net incurred triangles (rather than gross).

Method 1

3. Under Method 1, the insurer-specific standard deviation ($\sigma_{I,res,slb}$) should be calculated as:

$$\sigma_{I,res,slb} = \frac{\hat{\beta}_{slb}}{\sqrt{PCO_{slb}}}$$

Where:

$\hat{\beta}_{slb}$ = $$\sqrt{\frac{1}{N_{slb}-1} \cdot \sum_{Y} \frac{\left(R_{Y,slb} - V_{Y,slb}\right)^2}{V_{Y,slb}}}$$

$V_{Y,slb}$ = Volume measure by calendar year Y for the (sub-)line of business *slb*, calculated as:

$$V_{Y,slb} = \sum_{i+j=Y+1} PCO_{slb,i,j}$$

$PCO_{slb,i,j}$ = The best estimate for provisions for claims outstanding for the (sub-)line of business *slb* for accident year i and development year j

$R_{Y,slb}$ = The best estimate for provisions for claims outstanding and incremental paid claims for the exposures covered by the volume measure, but in 12 months' time by calendar year and (sub-)line of business *slb*, i.e.:

$$R_{Y,slb} = \sum_{\substack{i+j=Y+2 \\ i \neq Y+1}} PCO_{slb,i,j} + \sum_{\substack{i+j=Y+2 \\ i \neq Y+1}} I_{slb,i,j}$$

where the best estimate for provisions for claims outstanding and incremental paid claims is assumed to

follow the distribution:

$$R_{Y,slb} \sim V_{Y,slb} + \sqrt{V_{Y,slb}} \cdot \beta_{slb} \cdot \varepsilon_{Y,slb}$$

$I_{slb,i,j}$	=	The incremental paid claims for the (sub-)line of business *slb* for accident year *i* and development year *j*
N_{slb}	=	The number of data points available for the (sub-)line of business *slb* where there is both a value of $V_{C,Y,slb}$ and $R_{C,Y,slb}$
$\varepsilon_{Y,slb}$	=	An unspecified random variable with distribution with mean zero and unit variance
β_{slb}^2	=	Constant of proportionality for the variance of the best estimate for provisions for claims outstanding in 12 months plus the incremental claims paid over the 12 months for the (sub-)line of business *slb*
PCO_{slb}	=	The best estimate for provisions for claims outstanding for the (sub-)line of business *slb*

4. Method 1 relies on the least squares fitting approach to derive the estimator $\hat{\beta}_{slb}$ and makes the following assumptions:

   a) The expected reserves in 12 months plus the expected incremental paid claims in 12 months is the current best estimate for provisions for claims outstanding;
   b) The variance of the best estimate for provisions for claims outstanding in 12 months plus the incremental claims paid over the 12 months is proportional to the current best estimate for provisions for claims outstanding; and
   c) The least squares fitting approach is appropriate.

   Insurers should consider the applicability of these assumptions if they choose Method 1 to derive the insurer-specific standard deviation parameter for reserve risk.

5. Insurers should also be able to satisfy the following data requirements if they choose to apply Method 1:

   a) The data should reflect the reserve risk that is covered in the (sub-)line of business during the following year, in particular in relation to its nature and composition;
   b) The data should be adjusted to remove catastrophe claims to the extent they are addressed in the non-life catastrophe risk capital requirement;
   c) Best estimates and payments should be net of reinsurance and the data should reflect the reinsurance cover of the insurer for the following year;
   d) Best estimates and payments should be adjusted for inflation and all data used should be adjusted for any trends which can be identified on a prudent, reliable and objective basis;
   e) Best estimates and payments should not include expenses;
   f) The data should stem from a sufficiently long period such that if cycles exist, at least a full cycle is covered in the data;
   g) The data should cover at least 5 years; and
   h) The data should not lead to a material increase of the estimation error compared to the estimated value.

Method 2

6. Method 2 is based on the mean squared error of prediction of the claims development result over 12 months and fitting a model to these results.

7. Under Method 2, the standard deviation for reserve risk ($\sigma_{I,res,slb}$) should be calculated as:

$$\sigma_{I,res,slb} = \frac{\sqrt{MSEP}}{PCO_{slb}}$$

where $MSEP$ is the mean squared error of prediction of the claims development result over 12 months.[35]

8. Insurers using Method 2 should be able to satisfy the following requirements:

a) The estimation should be made on complete claims triangles for payments;
b) The data should stem from a sufficiently long period such that all material payments can be estimated from the triangle, and should cover at least 5 years;
c) The data should reflect the reserve risk that is covered in the line of business during the following 12 months, in particular in relation to its nature and composition;
d) Payments should be net of reinsurance, and the data should reflect the reinsurance cover of the insurer for the following 12 months;
e) Best estimates and payments should be adjusted for inflation, and all data used should be adjusted for any trends which can be identified on a prudent, reliable and objective basis;
f) The claims triangle should be consistent with the model assumptions of the Merz and Wüthrich method; and
g) The data should not lead to a material increase of the estimation error compared to the estimated value.

Method 3

9. Method 3 is also based on the mean squared error of prediction of the claims development result, with the volume measure used to calculate the standard deviation substituted by the best estimate for provisions for claims outstanding estimated via the development factor method. In particular, the standard deviation for reserve risk per (sub-)line of business under this method should be calculated as:

$$\sigma_{I,res,slb} = \frac{\sqrt{MSEP}}{CLPCO_{slb}}$$

where $CLPCO_{slb}$ is the best estimate for provisions for claims outstanding estimated via the development factor method for (sub-)line of business slb.

10. The additional requirements set out in section D.8 above for Method 2 apply equally to the use of Method 3.

[35] The mean squared errors should be calculated using the approach detailed in: *Modelling The Claims Development Result For Solvency Purposes*, by Michael Merz and Mario V Wüthrich, Casualty Actuarial Society E-Forum, Fall 2008 ("Merz and Wüthrich").

E. Governance requirements

1. An insurer with approval to use insurer-specific parameters must establish a system of governance associated with the use of insurer-specific parameters that includes:

    a) Establishing internal reporting and communication of information related to the use of insurer-specific parameters at all relevant levels within the insurer;
    b) Well-defined, clear, consistent and documented lines of responsibility across the insurer;
    c) Ensuring that all Senior Management and personnel responsible for calibrating and monitoring the insurer-specific parameters possess sufficient qualifications, knowledge and experience;
    d) Comprehensive documentation of the methods and data used to calibrate the insurer-specific parameters; and
    e) Establishing adequate processes and controls for the calibration, review and use of insurer-specific parameters.

2. An insurer must establish effective communication and regular reporting to the board of directors and Senior Management on the use of insurer-specific parameters. The board of directors and Senior Management must have an understanding of why the use of insurer-specific parameters is more appropriate to the insurer than the standardised formula parameters, the key processes and controls to calibrate the insurer-specific parameters, and the insurer's compliance with the requirements related to the use of insurer-specific parameters.

3. The use of insurer-specific parameters must be subject to ongoing internal review and validation. Insurers that have approval to use insurer-specific parameters must not revert to standardised formula parameters without the approval of the Prudential Authority.

F. Data quality

1. In addition to the data requirements that are applicable to the specific methodologies set out in Parts B to D above, insurers with approval to use insurer-specific parameters must satisfy the following data quality requirements.

2. Data used for the purpose of calibrating insurer-specific parameters must be:

    a) Accurate: The data are sufficiently accurate to avoid material distortions in the calibration of the parameters;
    b) Complete: The data provide comprehensive information for the insurer to estimate the parameters; and
    c) Appropriate: The data do not contain biases or material estimation errors which make it unfit for purpose.

3. The data used to calibrate the insurer-specific parameters must be:

    a) Consistent with the underlying assumptions of the standardised formula methodology;
    b) Representative of the expected conditions in the coming year;[36] and
    c) Easily adapted and incorporated into one of the methods for calibrating parameters set out in this Attachment.

[36] When insurer-specific parameters are calibrated on the basis of historic data, all historic data should be representative of the future environment and conditions.

4. Insurers should identify whether there are any biases in the data, and analyse their impact. Any adjustments that are made to the data must only be applied to make the data more relevant and appropriate. Any adjustments to data must be documented and provided to the Prudential Authority.

5. Insurers may use external data to estimate insurer-specific parameters. Where external data is used, insurers must:

    a) Document the external data used;
    b) Be able to explain the reasons for using external data;
    c) Demonstrate a detailed understanding of the external data used, including their limitations;
    d) Have clearly articulated strategies for validating and regularly reviewing the integrity of external data used; and
    e) Be able to demonstrate that the external data used is directly relevant to the operations of the insurer and is reflective of the risk profile of the insurer.

6. Where external pooled data is used to calibrate insurer-specific data, the following additional criteria must be met by insurers:

    a) A system of governance in relation to the pooling mechanism and collection of data is established, and signed and fulfilled by members of the pooling mechanism;
    b) The pooling mechanism is transparent and auditable;
    c) The rules of the pooling mechanism require that the data provided to the pool by different members are sufficiently comparable; and
    d) The pool must comprise similar insurers with similar risk profile (both as a collective whole, and to the insurer).

7. Insurers must perform regular data quality reviews to ensure the data used to calibrate insurer-specific parameters remain accurate, complete and appropriate. As part of the regular data quality reviews, insurers should be able to demonstrate that:

    a) The data are free from material mistakes, errors and omissions;
    b) Comprehensive data for all relevant business lines are available for use in the calibration;
    c) No relevant data available are excluded from consideration without justification;
    d) The data used are relevant to the businesses and risks being analysed; and
    e) Data are collected, processed and applied in a transparent and structured manner.

8. Insurers must establish a data policy covering details of the insurer’s data quality requirements with respect to insurer-specific parameters, and how these requirements are implemented by the insurer. This data policy must be available to the Prudential Authority on request.

Attachment 8: Capital Requirement for Natural Catastrophe Risk Under Method 1

This Attachment sets out the calculation of the capital requirement for each of the natural catastrophe scenarios defined in section 7.12 of this Standard. The calculations derive a gross estimate of the capital requirement for each scenario (i.e. prior to the effects of eligible reinsurance and other eligible risk mitigation instruments). Insurers may adjust the gross capital requirements calculated for eligible reinsurance and other eligible risk mitigation Instruments to derive the MER[37] for each scenario net of risk mitigation, after allowing for the impairment of the credit taken for eligible risk mitigation Instruments.

A. 1-in-200 year Earthquake event

1. The gross capital requirement for the 1-in-200 year single Earthquake event ($CAT_{1\_in\_200\_EQ}$) must be calculated as:

$$CAT_{1\_in\_200\_EQ} = Q_{1\_in\_200\_EQ} \cdot \sqrt{\sum_{r,c} Corr_{EQ,r,c} \cdot RF_{EQ,r} \cdot EXP_{EQ,r} \cdot RF_{EQ,c} \cdot EXP_{EQ,c}}$$

Where:

$Q_{1\_in\_200\_EQ}$	=	The earthquake risk factor, which must be set to 0.34%
r, c	=	The index to denote the following types of cover: • Residential buildings (RES); • Commercial and industrial buildings (CCI); • Contents; • Engineering (ENG); and • Motor.
$Corr_{EQ,r,c}$	=	The entries of the correlation matrix $Corr_{EQCover}$ as defined below
$RF_{EQ,r}$, $RF_{EQ,c}$	=	The earthquake risk factors in respect of covers r and c as per risk factors table $RF_{EQCover}$ as defined below
$EXP_{EQ,r}$, $EXP_{EQ,c}$	=	The earthquake risk exposures in respect of covers r and c according to the rows and columns of the correlation matrix $Corr_{EQCover}$, as calculated under section 2 below

The correlation matrix $Corr_{EQCover}$ is defined as:

$Corr_{EQCover}$	Residential Buildings (RES)	Commercial and Industrial Buildings (CCI)	Contents	Engineering (ENG)	Motor
RES	1				
CCI	0.97	1			
Contents	1	0.86	1		
ENG	0.75	0.67	0.84	1	

[37] $MER_x = CAT_x$ net of risk mitigation, after allowing for the impairment of the credit taken for risk mitigation instruments, where x denotes the event.

Motor	1	0.97	1	0.75	1

The risk factors $\boldsymbol{RF_{EQCover}}$ are defined as:

Cover (c)	$\boldsymbol{RF_{EQCover}}$
RES	1.3721
CCI	0.9039
Contents	0.4339
ENG	0.9379
Motor	0.7985

2. The exposures for earthquake risk in respect of each cover$c$ ($EXP_{EQ,c}$) must be calculated as:

$$EXP_{EQ,c} = \sqrt{\sum_{i,j} Corr_{EQ\_cover\_c,i,j} \cdot WSI_{EQ\_cover\_c,i} \cdot WSI_{EQ\_cover\_c,j}}$$

Where:

i, j	=	The index to denote the zones set out in Region 1 of Attachment 5
$Corr_{EQ\_cover\_c,i,j}$	=	The entries of the correlation matrices below, which set out the correlation coefficients between zones i and j, for each cover c
$WSI_{EQ\_cover\_c,i}$, $WSI_{EQ\_cover\_c,j}$	=	The weighted sums insured for earthquake risk in zones i and j respectively, for cover c, as calculated under section 3 below

The correlation matrix for residential buildings cover ($Corr_{EQ\_RES}$) is defined as:

Zones	**Z1**	**Z2**	**Z3**	**Z4**	**Z5**	**Z6**	**Z7**	**Z8**	**Z9**	**Z10**	**Z11**	**Z12**	**Z13**	**Z14**	**Z15**	**Z16**	**Z17**	**Z18**	**Z19**
Z1	1																		
Z2	0	1																	
Z3	0.30	0.30	1																
Z4	0.46	0.48	0.42	1															
Z5	0.72	0	0	0.17	1														
Z6	1	0	0	0.21	0.91	1													
Z7	0.69	0	0	0.04	0.84	0.88	1												
Z8	0	0	0	0	0.29	0.14	0.08	1											
Z9	1	1	1	1	1	1	1	1	1										
Z10	0	0.19	0.26	0.05	0	0	0	0.66	1	1									
Z11	0.22	0.26	0.50	0.20	0	0	0	0.76	1	0.65	1								
Z12	0.15	0.35	0.44	0.20	0	0	0.04	0	1	0.39	0.53	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0	0.21	0	0.17	0	0	0	0	1	0	0	0.22	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0.97	0.43	0	0	0	0	0	1	0.34	0.19	1	0	1	0	1			
Z17	0.69	0.02	0.13	0.38	0.73	0.75	0.40	0	1	0	0.12	0.04	0	0	0	0	1		
Z18	0.28	0.33	0.48	0.26	0.73	0.11	0.11	0	1	0.24	0.35	0.40	0	0.21	0	0.65	0.18	1	
Z19	0.42	0	0.27	0.06	0.67	0.50	0.42	0.02	1	0	0.14	0.12	0	0	0	0	0.23	0.40	1

The correlation matrix for commercial and industrial buildings cover ($Corr_{EQ\_CCI}$) is defined as:

Zones	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19
Z1	1																		
Z2	0.09	1																	
Z3	0.04	0.51	1																
Z4	0.35	0.67	0.25	1															
Z5	0.48	0.43	0.19	0.09	1														
Z6	0.80	0	0	0.25	0.98	1													
Z7	0.52	0.08	0.07	0.10	0.76	0.89	1												
Z8	0.17	0.18	0.06	0	0.29	0.22	0.13	1											
Z9	1	1	1	1	1	1	1	1	1										
Z10	0	0.42	0.18	0.05	0	0	0	0.71	1	1									
Z11	0	0.29	0.26	0.01	0.16	0	0.05	0.68	1	0.58	1								
Z12	0	0.41	0.18	0.06	0	0	0	0.09	1	0.37	0.17	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0	0.01	0	0.10	0	0	0	0	1	0	0	0.04	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0	0.01	0.01	0	0	0	0	1	0	0	0.01	0	0.79	0	1			
Z17	0.53	0.24	0.18	0.26	0.64	0.73	0.42	0	1	0	0.15	0	0	0	0	0	1		
Z18	0.23	0.28	0.37	0	0.51	0.32	0.22	0.19	1	0	0.33	0	0	0	0	0	0.33	1	
Z19	0.38	0	0.02	0.05	0.63	0.37	0.45	0.27	0	0	0	0	0	0	0	0	0.17	0.12	1

The correlation matrix for contents cover ($Corr_{EQ\_Contents}$) is defined as:

Zones	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19
Z1	1																		
Z2	0.18	1																	
Z3	0	0.35	1																
Z4	0.41	0.41	0.09	1															
Z5	0.64	0.01	0	0.07	1														
Z6	1	0	0	0.19	0.93	1													
Z7	0.66	0	0	0.02	0.77	0.89	1												
Z8	0.06	0	0	0	0.25	0.24	0.08	1											
Z9	1	1	1	1	1	0	1	1	1										
Z10	0	0.22	0.21	0.01	0	0	0	0.59	1	1									
Z11	0.19	0.28	0.20	0.13	0	0	0	0.77	1	0.71	1								
Z12	0.11	0.35	0.32	0.03	0	0	0	0	1	0.27	0.42	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0	0.11	0.13	0.29	0	0	0	0	1	0	0	0.04	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0.33	0.47	0	0	0	0	0	1	0.06	0	0.28	0	1	0	1			
Z17	0.68	0.05	0	0.35	0.65	0.78	0.44	0	1	0	0.14	0	0	0	0	0	1		
Z18	0.34	0.03	0	0	0.59	0.34	0.31	0.27	1	0	0.21	0.02	0	0	0	0	0.29	1	
Z19	0.43	0	0.30	0	0.54	0.41	0.47	0.24	1	0	0.06	0	0	0	0	0	0.30	0.60	1

The correlation matrix for engineering cover ($Corr_{EQ\_ENG}$) is defined as:

Zones	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19
Z1	1																		
Z2	0.02	1																	
Z3	0	0.47	1																
Z4	0.32	0.40	0.94	1															
Z5	0.67	0	0	0	1														
Z6	0.65	0	0	0	0.74	1													
Z7	0.70	0	0	0.02	0.77	0.71	1												
Z8	0	0	0.19	0.14	0	0	0	1											
Z9	0	1	1	1	0	0	0	1	1										
Z10	0	0	0	0	0	0	0	0	0	1									
Z11	0	0	0.06	0	0	0	0	0.65	1	0	1								
Z12	0	0	0.03	0	0	0	0	0	1	0	0.45	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0.16	0	0	0.02	0	0	0	0	1	0	1	1	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0.95	1	1	0	0	0	0.07	1	0	0.52	0.44	0	1	0	1			
Z17	0.65	0.24	0	0.13	0.71	0.67	0.48	0.01	0	0	0	0	0	0	0	0	1		
Z18	0.38	0	0	0	0.67	0.53	0.52	0	0	0	0	0	0	0	0	0	0.92	1	
Z19	0.22	0	0	0	0.48	0.40	0.41	0	0	0	0	0	0	0	0	0	0.39	1	1

The correlation matrix for motor cover ($Corr_{EQ\_Motor}$) is defined as:

Zones	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19
Z1	1																		
Z2	0	1																	
Z3	0.30	0.30	1																
Z4	0.46	0.48	0.42	1															
Z5	0.72	0	0	0.17	1														
Z6	1	0	0	0.21	0.91	1													
Z7	0.69	0	0	0.04	0.84	0.88	1												
Z8	0	0	0	0	0.29	0.14	0.08	1											
Z9	1	1	1	1	1	1	1	1	1										
Z10	0	0.19	0.26	0.05	0	0	0	0.66	1	1									
Z11	0.22	0.26	0.50	0.20	0	0	0	0.76	1	0.65	1								
Z12	0.15	0.35	0.44	0.20	0	0	0.04	0	1	0.39	0.53	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0	0.21	0	0.17	0	0	0	0	1	0	0	0.22	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0.97	0.43	0	0	0	0	0	1	0.34	0.19	1	0	1	0	1			
Z17	0.69	0.02	0.13	0.38	0.73	0.75	0.40	0	1	0	0.12	0.04	0	0	0	0	1		
Z18	0.28	0.33	0.48	0.26	0.73	0.11	0.11	0	1	0.24	0.35	0.40	0	0.21	0	0.65	0.18	1	
Z19	0.42	0	0.27	0.06	0.67	0.50	0.42	0.02	1	0	0.14	0.12	0	0	0	0	0.23	0.40	1

3. The weighted sum insured for earthquake risk for each zone *i* and cover *c* ($WSI_{EQ\_cover\_c,i}$) must be calculated as:

$$WSI_{EQ\_cover\_c,i} = TSI_{EQ\_cover\_c,i} \cdot W_{EQ\_cover\_c,i}$$

Where:

$TSI_{EQ\_cover\_c,i}$ = The total sum insured for cover c and zone i

$W_{EQ\_cover\_c,i}$ = The risk weight for earthquake risk for cover c and zone i as per the table below

Zone (*i*)[38]		$W_{EQ\_cover\_c,i}$				
		Cover (*c*)				
URN	**Name**	***RES***	***CCI***	***Contents***	***ENG***	***Motor***
Z1	Gauteng - South	2.2916	2.8778	2.5338	3.8734	2.4299
Z2	Karoo	0.0002	0.0004	0.0002	0.0016	0.0003
Z3	Kwazulu-Natal	0.0263	0.0340	0.0322	0.0104	0.0279
Z4	Free State	0.2983	0.4169	0.3252	0.0981	0.3163
Z5	Pretoria	1.9635	2.4051	2.1885	3.4333	2.0820
Z6	Johannesburg and West Rand	2.1754	2.6419	2.4415	3.0686	2.3067
Z7	East Rand	2.0789	2.5487	2.3124	3.5854	2.2043
Z8	Cape Town	1.5655	1.9120	1.7283	1.9347	1.6600
Z9	Durban	-	-	-	-	-
Z10	Swartland and Overberg	0.2365	0.3022	0.2542	-	0.2508
Z11	Boland	0.9500	0.9354	1.0396	2.1951	1.0073
Z12	Cape South Coast	0.0018	0.0088	0.0029	0.0168	0.0019
Z13	Port Elizabeth	-	-	-	-	-
Z14	Eastern Cape (EAST)	0.0001	0.0001	0.0001	-	0.0001
Z15	East London	-	-	-	-	-
Z16	Eastern Cape (WEST)	-	-	-	-	-
Z17	Northwest Province (EAST)	1.3281	1.5492	1.4806	0.9515	1.4082
Z18	Limpopo	0.1965	0.1179	0.1697	0.0766	0.2083
Z19	Mpumalanga Province	0.8426	1.1819	0.9676	0.6646	0.8935

[38] Should the insurer be unable to segment its exposure data into all or some of these zones, the exposure data must be allocated to the zone carrying the highest capital charge in each case.

4. In measuring the total sum insured values ($TSI_{EQ\_cover\_c,i}$), the following types of cover must be included:

   a) For residential, commercial and industrial buildings, cover for business interruption and loss of rent;
   b) For engineering, cover for property, work-in-progress, machinery and/or plant, but excluding machinery breakdown; and
   c) All inwards proportional reinsurance business for the corresponding (sub)-lines of business as the cover.

B. 1-in-200 year Hail event

1. The gross capital requirement for the 1-in-200 year single Hail event ($CAT_{1\_in\_200\_Hail}$) must be calculated as:

   $$CAT_{1\_in\_200\_Hail} = Q_{1\_in\_200\_Hail} \cdot \left(EXP_{Hail,r} + EXP_{Hail,c}\right)$$

   Where:

$Q_{1\_in\_200\_Hail}$	=	The hail risk factor, which must be set to 0.46%
r, c	=	The index to denote the following types of cover: • Residential, commercial and industrial buildings (RCI); and • Motor.
$EXP_{Hail,r}$, $EXP_{Hail,c}$	=	The hail risk exposures in respect of covers r and c – namely, residential, commercial and industrial buildings and motor – as calculated under section 2 below

2. The exposures for hail risk in respect of each cover c ($EXP_{Hail,c}$) must be calculated as:

   $$EXP_{Hail,c} = \sqrt{\sum_{i,j} Corr_{Hail,i,j} \cdot WSI_{Hail\_cover\_c,i} \cdot WSI_{Hail\_cover\_c,j}}$$

   Where:

i, j	=	The index to denote the zones set out in Region 1 of Attachment 5
$Corr_{Hail,i,j}$	=	The entries of the correlation matrix $Corr_{Hail}$ below, which set out the correlation coefficients between zones i and j, for both residential, commercial and industrial buildings and motor cover
$WSI_{Hail\_cover\_c,i}$, $WSI_{Hail\_cover\_c,j}$	=	The weighted sums insured for hail risk in zones i and j respectively, for cover c, as calculated under section 3 below

The correlation matrix ($Corr_{Hail}$) is defined as:

Zones	**Z1**	**Z2**	**Z3**	**Z4**	**Z5**	**Z6**	**Z7**	**Z8**	**Z9**	**Z10**	**Z11**	**Z12**	**Z13**	**Z14**	**Z15**	**Z16**	**Z17**	**Z18**	**Z19**
Z1	1																		
Z2	0	1																	
Z3	0	0	1																
Z4	0	0	0	1															
Z5	0.25	0	0	0	1														
Z6	0.25	0	0	0	0.25	1													
Z7	0.25	0	0	0	0.25	0.25	1												
Z8	0	0	0	0	0	0	0	1											
Z9	0	0	0	0	0	0	0	0	1										
Z10	0	0	0	0	0	0	0	0	0	1									
Z11	0	0	0	0	0	0	0	0.25	0	0	1								
Z12	0	0	0	0	0	0	0	0	0	0	0	1							
Z13	0	0	0	0	0	0	0	0	0	0	0	0	1						
Z14	0	0	0	0	0	0	0	0	0	0	0	0	0	1					
Z15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
Z16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1			
Z17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
Z18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Z19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

3. The weighted sum insured for hail risk for each zone i and cover c ($WSI_{Hail\_cover\_c,i}$) must be calculated as:

$$WSI_{Hail\_cover\_c,i} = TSI_{Hail\_cover\_c,i} \cdot W_{Hail\_cover\_c,i}$$

Where:

$TSI_{Hail\_cover\_c,i}$ = The total sum insured for cover c and zone i

$W_{Hail\_cover\_c,i}$ = The risk weight for hail risk for cover c and zone i as per the table below

Zone (i)[39]		$W_{Hail\_cover\_c,i}$	
		Cover (c)	
URN	**Name**	***RCI***	***Motor***
Z1	Gauteng - South	0.376	1.8800
Z2	Karoo	0.206	1.0300
Z3	Kwazulu-Natal	0.428	2.1400
Z4	Free State	0.502	2.5100
Z5	Pretoria	0.980	4.9000
Z6	Johannesburg and West Rand	0.940	4.7000
Z7	East Rand	0.980	4.9000
Z8	Cape Town	0.010	0.0500
Z9	Durban	0.064	0.3200
Z10	Swartland and Overberg	0.002	0.0100
Z11	Boland	0.002	0.0100
Z12	Cape South Coast	0.012	0.0600
Z13	Port Elizabeth	0.040	0.2000
Z14	Eastern Cape (EAST)	0.238	1.1900
Z15	East London	0.038	0.1900
Z16	Eastern Cape (WEST)	0.258	1.2900
Z17	Northwest Province (EAST)	0.376	1.8800
Z18	Limpopo	0.376	1.8800
Z19	Mpumalanga Province	0.376	1.8800

[39] Should the insurer be unable to segment its exposure data into all or some of these zones, the exposure data must be allocated to the zone carrying the highest capital charge in each case.

4. In measuring the total sum insured values ($TSI_{Hail\_cover\_c,i}$), the following types of cover must be included:

   a) For residential, commercial and industrial buildings, cover for business interruption and loss of rent; and
   b) All inwards proportional reinsurance business for the corresponding (sub)-lines of business as the cover.

C. More frequent catastrophe events

1. The gross capital requirement for the more frequent catastrophe events scenario ($CAT_{Horizontal,}$) must be calculated as:

   $$CAT_{Horizontal} = CAT_{(1st,1in10)} + CAT_{(2nd,1in10)} + CAT_{(3rd,1in10)} + CAT_{(only,1in20)}$$

   Where:

$CAT_{(1st,1in10)}$, $CAT_{(2nd,1in10)}$ and $CAT_{(3rd,1in10)}$	=	The capital requirements for each of the distinct natural catastrophe risk events with a stand-alone 1-in-10 year return period, as calculated under section 2 below, prior to the effects of eligible reinsurance and other eligible risk mitigation instruments[40]
$CAT_{(only,1in20)}$	=	The capital requirement for the natural catastrophe risk event with a stand-alone 1-in-20 year return period, as calculated under section 2 below, prior to the effects of eligible Reinsurance and other eligible risk mitigation instruments

2. The values of $CAT_{(e,1in10)}$ and $CAT_{(e,1in20)}$ must each be calculated as follows for all events e:

   $CAT_{(e,1in10)} = 0.019\% \cdot TSI$ for each of the 1-in-10 year events and

   $CAT_{(e,1in20)} = 0.0315\% \cdot TSI$ for the 1-in-20 year event

   Where:

TSI	=	The total sum insured of the insurer for residential, commercial and industrial buildings (including all sums insured in respect of business interruption and loss of rent), contents, engineering (including property, work-in-progress, machinery and/or plant and excluding machinery breakdown), as well as motor cover. All inwards proportional reinsurance business for the corresponding (sub)-lines of business to the types of cover above should also be included in this measure.

[40] Each of the three terms must be in respect of distinct events.

Attachment 9: Capital Requirements for Man-made Catastrophes Under Method 1

A. Motor

1. The capital requirement for Motor catastrophe risk (CAT_{Motor_net}) must be calculated as the greater loss, net of risk mitigation, resulting from the following scenarios:

   a) A major motor collision in South Africa ("Scenario A"); and
   b) A large accumulation of losses of multiple insured vehicles in a single location in South Africa ("Scenario B")

2. In particular, the capital requirement for Motor catastrophe risk must be calculated as:

   $$CAT_{Motor\_net} = max\ (CAT_{Motor\_net\_A}, CAT_{Motor\_net\_B})$$

   where $CAT_{Motor\_net\_A}$ is the loss arising from Scenario A, and $CAT_{Motor\_net\_B}$ is the loss arising from Scenario B, both net of risk mitigation.

3. The loss arising under Scenario A must first be calculated without taking into account the effects of eligible reinsurance and other eligible risk mitigation instruments. In particular, the gross loss arising from Scenario A ($\mathrm{CAT}_{Motor\_gross\_A}$) must be calculated as the solution to the following formula:[41]

   $$-\log_e(0.995) = F_{UNLIM}\left(CAT_{Motor\_gross\_A}\right) + F_{LIM}\left(CAT_{Motor\_gross\_A}\right)$$

   Where:

   $$F_{UNLIM}(x) = F_{MTPL} \cdot LIM_{FAIL} \cdot VY \cdot \left(\frac{GL_{MTPL}}{x}\right)^{\alpha}$$

   $$F_{LIM}(x) = F_{MTPL} \cdot [(1 - LIM_{FAIL}) \cdot VY] \cdot \left(\frac{GL_{MTPL}}{x}\right)^{\alpha},$$

   where $x < LIM$

LIM	=	Highest sum insured offered on commercial lines; in the absence of policy limits, this parameter should be regarded as unlimited
$F_{UNLIM}(x)$	=	Frequency of a loss of size x, where LIM is unlimited
$F_{LIM}(x)$	=	Frequency of a loss of size x, where LIM is a limited monetary amount
VY	=	Number of heavy commercial motor vehicles insured in South Africa by the insurer with liability insured limits greater than R50 million

[41] An underlying assumption in this calculation is that every insured heavy commercial motor vehicle insured in South Africa is equally likely to be involved in the types of incident envisaged by the scenario.

F_{MTPL} = Frequency of the scenario per vehicle per annum, calculated as:

$$F_{MTPL} = \frac{-\log_e\left(1 - \frac{1}{RP_{MTPL}}\right)}{VY_{MTPL}}$$

VY_{MTPL} = Total vehicle years assumed in the scenario, which must be set as 3.2 million

RP_{MTPL} = Return period of the scenario, which must be set as 50 years[42]

GL_{MTPL} = Gross loss assumed for the scenario, which must be set as R100 million

F_{TOTAL} = Total expected frequency of scenario loss for insurer, calculated as:

$$F_{TOTAL} = F_{MTPL} \cdot VY$$

α = The Pareto shape parameter[43], which must be set as 2

LIM_{FAIL} = Proportion of the extreme losses assumed to exceed the cover under the original policy, which must be set as 6%

4. In the absence of policy limits, the frequency of the scenario per million vehicles (F_{MTPL}) can be used with the insurer exposure (VY) to calculate the gross risk capital requirement under this scenario ($CAT_{Motor\_gross\_A}$) using the following formula:

$$CAT_{Motor\_gross\_A} = \frac{GL_{MTPL}}{\left(\frac{-\log_e(0.995)}{F_{TOTAL}}\right)^{1/\alpha}}$$

5. Insurers must, however, consider limits of coverage in this scenario. The calculation above therefore includes a "limit failure factor" (LIM_{FAIL}), which represents a proportion of the extreme losses that are considered to occur in such a way that the cover under the original policy is unlimited.

6. The $CAT_{Motor\_gross\_A}$ outcome derived from the formula above should then be adjusted for the effect of any eligible reinsurance and other eligible risk mitigation instruments to estimate the net capital requirement for Motor (i.e. $CAT_{Motor\_net\_A}$). The capital requirement net of risk mitigation should be calculated by allowing for any additional contingent premiums payable.

7. The capital requirement under Scenario B ($CAT_{Motor\_net\_B}$) must be calculated as the largest possible loss accumulation from multiple insured vehicles in a single location, net of risk mitigation, after allowing for the impairment of the credit taken for eligible reinsurance and eligible risk mitigation instruments. An example of a man-made

[42] A 1-in-50 year South African loss is considered to exceed a 1-in-200 year loss for most individual insurers in South Africa.

[43] Extreme losses in this scenario are assumed to follow a Poisson/Pareto model, with vehicle years setting the Poisson frequency and the South Africa-wide scenario setting some of the Pareto parameters. The remaining parameter needed to estimate losses is the Pareto shape parameter (α).

catastrophe event that may be considered under this scenario is an explosion or fire at a depot or location with multiple insured vehicles.

B. Fire to Property

1. Insurers with exposure to fire or other damage to property must calculate the capital requirement for Fire catastrophe risk based on one of the following methods:

   a) Method 1, which calculates the loss (net of risk mitigation) resulting from an insurer's largest fire concentration; or
   b) Method 2, which calculates the maximum loss (net of risk mitigation) resulting from scenarios that take accumulation of risk into account.

2. Insurers should adopt Method 1 for calculating the capital requirement for Fire catastrophe risk as the default approach. Method 2 should only apply if an insurer does not have the necessary geo-locational data available to perform the calculation under Method 1.

3. In order to calculate the capital requirement for Fire under Method 1 ($CAT_{Fire\_gross,Method1}$), an insurer must first calculate the maximum gross sum insured of the set of buildings fully or partly located within a radius of 200 metres from the largest fire concentration an insurer's portfolio is exposed to in respect of the fire peril, i.e.:

   $$CAT_{Fire\_gross,Method1} = SI_{gross}$$

   where SI_{gross} is the maximum sum insured of buildings exposed to fire concentration, gross of any reinsurance.

4. From the maximum gross sum insured amount calculated in section B.3 above, an insurer may apply an adjustment to account for the effects of any eligible reinsurance and other eligible risk mitigation instruments. The amount that is derived after applying any adjustments for reinsurance is the capital requirement for Fire catastrophe risk, net of risk mitigation, under Method 1 ($CAT_{Fire\_net,Method1}$), i.e.:

   $$CAT_{Fire\_net,Method1} = SI_{net}$$

   where SI_{net} is the maximum sum insured of buildings exposed to fire concentration after taking into account the effects of any eligible reinsurance and other eligible risk mitigation instruments.

5. Any adjustment applied to account for the effect of risk mitigation should include any additional contingent premiums payable.

6. The capital requirement for Fire catastrophe risk calculated under Method 2 requires an insurer's portfolio to be split according to residential, commercial and industrial property exposures.

7. Similar to Method 1, the calculation under Method 2 must first consider an insurer's exposures without taking into account the effects of eligible reinsurance and other eligible risk mitigation instruments. In particular, insurers must first calculate the following parameters in relation to their residential, commercial and industrial property exposures:

LSR_{Res_gross} = Maximum loss (sum insured or insured limit, if less than the sum insured) for the largest single risk in respect of residential property exposure[44], which should be set as the highest of:

- The total exposure to a single high rise residential block;
- The total exposure to a single residential complex or similar; and
- The exposure to the largest single residential property.

LSR_{Comm_gross} = Maximum loss (sum insured or insured limit, if less than the sum insured) for the largest single risk in respect of commercial property exposure, which should be set as the highest of:

- The total exposure to a major shopping centre and surrounds;
- Total exposure to an office park; and
- The exposure to the largest single commercial risk.

LSR_{Ind_gross} = Maximum loss (sum insured or insured limit, if less than the sum insured) for the largest single risk in respect of industrial property exposure, which should be set as the highest of:

- The total exposure to a mine at a single location;
- The total exposure at a single location to a large industrial plant; and
- The exposure to the largest single industrial corporation risk at a single location.

8. Insurers may apply adjustments to LSR_{Res_gross}, LSR_{Comm_gross}, and LSR_{Ind_gross} for the effects of any eligible reinsurance and other eligible risk mitigation instruments. Any adjustments for the effect of risk mitigation should allow for any additional contingent premiums payable.

9. The capital requirement for Fire catastrophe risk, net of risk mitigation, under Method 2 ($CAT_{Fire\_net,Method2}$) must then be calculated as:

$$CAT_{Fire\_net,Method2} = max\left(LSR_{Res\_net}, LSR_{Comm\_net}, LSR_{Ind\_net}\right)$$

Where:

LSR_{Res_net} = LSR_{Res_gross} net of any adjustments to take into account the effects of eligible reinsurance and other eligible risk mitigation instruments

[44] The exposure measure for each of these parameters should be the sum insured or the insured limit, if the insured limit is less than the sum insured.

LSR_{Comm_net}	=	LSR_{Comm_gross} net of any adjustments to take into account the effects of eligible reinsurance and other eligible risk mitigation instruments
LSR_{Ind_net}	=	LSR_{Ind_gross} net of any adjustments to take into account the effects of eligible reinsurance and other eligible risk mitigation instruments

C. Marine

1. The capital requirement for Marine catastrophe risk (CAT_{Marine_net}) must be calculated as the greater loss, net of risk mitigation and excluding salvages, resulting from the following scenarios:

   a) A collision between two container carriers, where the two container carriers are those where the insurer has the largest gross exposure. Gross exposure includes exposure to marine cargo and liability. ("Scenario A");
   b) A collision between two pleasure crafts, two commercial fishing vessels or between a pleasure craft and commercial fishing vessel, where the two crafts/vessels are those where the insurer has the largest gross exposure for hull and liability cover ("Scenario B"); and
   c) A claim from the insurer's largest gross exposure to marine liability insurance ("Scenario C").

2. Insurers should first calculate its maximum gross exposures to the three scenarios without taking into account the effects of eligible reinsurance and other eligible risk mitigation instruments. In particular, an insurer must first calculate the following:

SI_{C1} & SI_{C2}	=	The maximum gross exposures to marine cargo for the two container carriers described in Scenario A
SI_L	=	The maximum gross exposure to marine liability relating to the two container carriers with the maximum gross exposures to marine cargo
SI_{P1}& SI_{P2}	=	The maximum gross exposure to hull insurance for the two crafts/vessels described in Scenario B
SI_{PL}	=	The maximum gross exposure to marine liability relating to the two pleasure craft or commercial fishing vessels with the maximum gross exposure to hull insurance
SI_{ML}	=	The maximum gross exposure to marine liability insurance

3. Insurers may then adjust each of the exposure amounts above to account for the effect of any eligible reinsurance and other eligible risk mitigation instruments. Any adjustment applied to account for the effect of risk mitigation should include any additional contingent premiums payable. Insurers must make no allowance for salvage when making adjustments for risk mitigation.

4. The capital requirement for Marine catastrophe risk (CAT_{Marine_net}), net of risk mitigation, must then be calculated as:

$$CAT_{Marine\_net} = max\left(\left(SI_{C1\_net} + SI_{C2_{net}} + SI_{L\_net}\right), \left(SI_{P1\_net} + SI_{P2\_net} + SI_{PL\_net}\right), SI_{ML\_net}\right)$$

where the terms SI_{C1_net}, SI_{C2_net}, SI_{L_net}, SI_{P1_net}, SI_{P2_net}, SI_{PL_net}, and SI_{ML_net} are the same as those defined in section C.2 above, net of risk mitigation.

D. Aviation

1. The capital requirement for Aviation catastrophe risk ($CAT_{Aviation\_net}$) must be calculated as the greatest loss, net of risk mitigation, resulting from the following scenarios:

   a) A mid-air collision between two aircrafts, where the two aircraft vessels are those where the insurer has the largest gross exposure, and where the gross exposure includes 10% of liability exposures ("Scenario A"); and
   b) The accumulated loss of all aircrafts insured in a single location due to a single event such as an explosion or a collision ("Scenario B").

2. In particular, the capital requirement for Aviation catastrophe risk must be calculated as:

   $$CAT_{Aviation\_net} = max\left(CAT_{Aviation\_net\_A}, CAT_{Aviation\_net\_B}\right)$$

   where $CAT_{Aviation\_net\_A}$ is the loss arising from Scenario A, and $CAT_{Aviation\_net\_B}$ is the loss arising from Scenario B, both net of risk mitigation after allowing for counterparty default impairment on eligible reinsurance and other eligible risk mitigation instruments.

3. The capital requirement for Aviation catastrophe risk under Scenario A ($CAT_{Aviation\_net\_A}$) must be calculated as:

   $$CAT_{Aviation\_net\_A} = \left(SHARE_{Hull} - MIT_{Hull}\right) + \left(10\% \cdot \left(SHARE_{Liability} - MIT_{Liability}\right)\right) - WAP$$

   Where:

$SHARE_{Hull}$	=	Insurer's share for hull of the two aircrafts as described in Scenario A
MIT_{Hull}	=	Eligible reinsurance and other eligible risk mitigation instruments' cover for hull of both aircrafts
$SHARE_{Liability}$	=	Insurers share for liability (legal liability to third parties and passengers liability) of both aircrafts
$MIT_{Liability}$	=	Eligible reinsurance and other eligible risk mitigation instruments' cover for liability of both aircrafts
WAP	=	Whole account protection, if applicable

4. The capital requirement for Aviation catastrophe risk under Scenario B ($CAT_{Aviation\_net\_B}$) must be calculated as:

   $$CAT_{Aviation\_net\_B} = \left(LSR_{Gross} \cdot DF\right) - MIT$$

   Where:

LSR_{Gross} = Maximum exposure to hull losses arising from the single event impacting all insured vessels at a single location described in Scenario B, assuming 100% of insured values are destroyed

DF = The damage factor applicable for the single event, which must be set as 50%

MIT = Eligible reinsurance and other eligible risk mitigation instruments' cover for hull arising from Scenario B

E. Liability

1. In order to calculate the capital requirement for Liability catastrophe risk net of risk mitigation, insurers must first calculate the capital requirement without taking into account the effect of eligible reinsurance and other eligible risk mitigation instruments. That is, insurers must first calculate $CAT_{Liability\_gross}$ based on the following formula (excluding the allowance for eligible reinsurance and other eligible risk mitigation instruments):

$$CAT_{Liability\_gross} = \sqrt{\sum_{r,c} CorrCAT_{liability,r,c} \cdot V_{liability,r} \cdot V_{liability,c}}$$

Where:

$CorrCAT_{liability,r,c}$ = The entries of the correlation matrix $CorrCAT_{liability}$ as defined below

$V_{liability,r}$ = $max(P_r, P_{last,r}) \cdot f_r$

$V_{liability,c}$ = $max(P_c, P_{last,c}) \cdot f_c$

P_r, P_c = Estimate of the premiums[45] to be earned for (sub-) line liability lines of business r and c respectively, in the next 12 months

$P_{last,r}$, $P_{last,c}$ = Premiums[46] earned by the insurer for liability (sub-) line of business r and c respectively, over the past 12 months

f_r, f_c = Risk factors for the liability sub-line of business r and c respectively, as per the table below

The risk factors (f) per sub-line of business are:

slb	**Sub-line of Business**	**Risk Factor (f_r)**
10.i.	Directors' and Officers' (D&O)	300%

[45] For the purpose of this calculation, premiums must be gross, Refer to section 5.15 and 5.16 of this Standard for the measure of earned premium to be used in these calculations.

[46] Ibid.

slb	Sub-line of Business	Risk Factor (f_r)
10.ii.	Employers' Liability (EL)	200%
10.iii.	Fidelity Guarantee (FG)	225%
10.iv.	Product Liability (PR)	60%
10.v.	Professional Indemnity (PI)	150%
10.vi.	Public Liability (PL)	80%
10.vii.	Other (OT)	160%
18.b.; 18.e.	Inwards Non-Proportional Reinsurance in respect of the Liability line of business (INP)	210%

The correlation matrix $CorrCAT_{liability}$ is defined as:

$CorrCAT_{liability}$	D&O	EL	FG	PR	PI	PL	OT	INP
D&O	1							
EL	0.25	1						
FG	0.25	0	1					
PR	0.5	0.25	0.25	1				
PI	0.5	0.25	0.25	0.25	1			
PL	0.25	0.25	0.25	0.25	0.25	1		
OT	0.25	0.25	0.25	0.25	0.25	0.25	1	
INP	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1

2. Insurers may adjust their gross liability catastrophe risk exposures for the effects of eligible reinsurance and other eligible risk mitigation instruments to arrive at the capital requirement for Liability catastrophe risk net of risk mitigation, ($CAT_{Liability\_net}$).

F. Consumer Credit, Trade Credit and Guarantees

1. The capital requirement for Consumer Credit, Trade Credit and Guarantees catastrophe risk (CAT_{CCTCG_net}), net of risk mitigation after allowing for counterparty default impairment on eligible insurance and other eligible risk mitigation instruments, must be calculated as:

$$CAT_{CCTCG\_net} = \sqrt{(CAT_{CCTCG\_individual\_max\_loss\_net})^2 + (CAT_{CCTCG\_recession\_net})^2}$$

Where:

$CAT_{CCTCG\_individual\_max\_loss\_net}$ = The capital requirement of the maximum loss of individual or group exposures, net of risk mitigation, as calculated under section F.2 below

$CAT_{CCTCG\_recession\_net}$ = The capital requirement of the recession-based scenario, net of risk mitigation, as calculated under section F.3 below

2. The capital requirement of the maximum loss of individual or group exposures ($CAT_{CCTCG\_individual\_max\_loss\_net}$) must be calculated as the greater of the maximum loss derived from the following two scenarios:

   a) The default of the largest two individual exposures of the insurer to Consumer Credit, Trade Credit and Guarantees, based on a probable maximum loss (PML) percentage of 14%, and a recovery rate of 28% of the exposures. The largest exposures should be identified according to the sum of:
      a) The ultimate gross loss amount after the application of the PML and recovery rate; less
      b) The recovery expected from eligible reinsurance and other eligible risk mitigation instruments; plus or minus
      c) Any other variation based on existing legal or contractual commitments, which modify the impact of the claim on the insurer (e.g. reinstatement premiums in respect of existing reinsurance contracts).
   b) The default of the largest two group exposures of the insurer to Consumer Credit, Trade Credit and Guarantees, based on a PML percentage of 14% and a recovery rate of 28%. The identification of the largest group exposures should apply the same methodology as described for individual exposures (i.e. section 2a) above).

3. The capital requirement of the recession-based scenario ($CAT_{CCTCG\_recession\_gross}$) must be calculated as:

$$CAT_{CCTCG\_recession\_gross} = \sqrt{\sum_{r,c} CorrCAT_{CCTCG,r,c} \cdot V_{premium,r} \cdot LR_{Recession,r} \cdot V_{premium,c} \cdot LR_{Recession,c}}$$

   Where:

   $CorrCAT_{CCTCG,r,c}$ = The entries of the correlation matrix $CorrCAT_{CCTCG}$ as defined below

   $LR_{Recession,r}$, $LR_{Recession,c}$ = The recessionary loss ratios for the credit line of business r and c respectively, as set out in the table below

   $V_{premium,r}$ = $max(P_r, P_{last,r})$

   $V_{premium,c}$ = $max(P_c, P_{last,c})$

   Where:

P_r, P_c	=	Estimate of the premiums[47] to be earned for credit lines of business r and c respectively, in the next 12 months for all policies including perils triggered by a recession
$P_{last,r}$, $P_{last,c}$	=	Premiums[48] earned by the insurer for credit lines of business r and c respectively, over the past 12 months for all policies including perils triggered by a recession

Credit Line of Business	Recessionary Loss Ratio ($LR_{Recession,r}$)
Consumer Credit	75%
Trade Credit	55%
Guarantees	75%

The correlation matrix $CorrCAT_{CCTCG}$ is defined as:

$CorrCAT_{CCTCG}$	Consumer Credit	Trade Credit	Guarantees
Consumer Credit	1		
Trade Credit	0.5	1	
Guarantees	0.5	0.6	1

4. Insurers may adjust their gross catastrophe risk exposures of the recession-based scenario for the effects of eligible reinsurance and other eligible risk mitigation instruments to arrive at the capital requirement of the recession-based scenario catastrophe risk net of risk mitigation after allowing for counterparty default impairment on eligible risk mitigation instruments ($CAT_{CCTCG\_recession\_net}$).

G. Terrorism

1. The capital requirement for Terrorism risk ($\mathrm{CAT}_{Terrorism\_net}$) must be calculated as the greatest loss, net of risk mitigation, resulting from the following scenarios:

   a) A 1-in-200 year individual loss from a single terrorism event ("Scenario A");
   b) A 1-in-200 year aggregate loss from 2 terrorism events ("Scenario B"); and
   c) A 1-in-200 year aggregate loss from 3 terrorism events ("Scenario C").

2. The calculation of $CAT_{Terrorism\_net}$ only applies to:

   a) SASRIA;
   b) Insurers that provide top-up terrorism cover above that insured by SASRIA; [49] and

[47] For the purpose of this calculation, premiums must be gross. Refer to section 5.15 and 5.16 of this Standard for the measure of earned premium to be used in these calculations.

[48] Ibid.

c) Reinsurers that provide reinsurance for terrorism.

3. Losses calculated based on the three terrorism scenarios noted above must first be calculated without taking into account the effects of any eligible reinsurance and other eligible risk mitigation instruments (other than cover that is provided by SASRIA in the case of reinsurers and insurers that provide top-up terrorism cover). That is, insurers should first calculate the loss that may arise from each of the three terrorism scenarios by multiplying the "Gross Loss" attached to each scenario by an insurer-specific factor. The insurer-specific factor must reflect the insurer's risk exposures to the terrorism scenarios based on the structure, terms and conditions of the insurer's contracts.

4. The calculation of the capital requirement for Terrorism risk, gross of risk mitigation ($CAT_{Terrorism\_gross}$), and the Gross Loss amounts that must be applied for each scenario is set out below:

$$CAT_{Terrorism\_gross} = max\left(CAT_{Terrorism\_gross\_A}, CAT_{Terrorism\_gross\_B}, CAT_{Terrorism\_gross\_C}\right)$$

Where:

$CAT_{Terrorism\_gross\_i} = \sum_k GL_{i,k} \cdot ISF_{i,k}$

$ISF_{i,k}$ = The insurer-specific factor for event k in relation to scenario i

$GL_{i,k}$ = The Gross Loss for event k in relation to scenario i as set out in the table below

Scenario	Gross Loss (R billion)		
	Event 1	Event 2	Event 3
A	3.813		
B	3.200	0.678	
C	2.474	1.049	0.355

5. Insurers may adjust the losses calculated under each scenario for the effects of eligible reinsurance and other eligible risk mitigation instruments (other than cover provided by SASRIA). The maximum loss to the insurer across the three scenarios, after the application of any adjustments for the effects of risk mitigation, is then taken as the capital requirement for Terrorism events, i.e.:

$$CAT_{Terrorism\_net} = max\left(CAT_{Terrorism\_net\_A}, CAT_{Terrorism\_net\_B}, CAT_{Terrorism\_net\_C}\right)$$

[49] Insurers that do not offer top-up cover and do not have any other exposure to Terrorism events may set their capital requirement for Terrorism risk to nil.

where the terms $CAT_{Terrorism\_net\_A}$, $CAT_{Terrorism\_net\_B}$ and $CAT_{Terrorism\_net\_C}$ are the same as those defined in section G.4 above, after any adjustment for the effect of eligible reinsurance and eligible risk mitigation instruments.

H. Accident and Health

1. The following three scenarios should be considered in the calculation of the capital requirement for Accident and Health catastrophe risk:

   a) The mass accident scenario to all individual and group policies providing benefits under the accident and health sub(-line) of business ("Mass Accident Scenario");
   b) The accident concentration scenario to group policies providing benefits under the accident and health sub(-line) of business ("Concentration Scenario"); and
   c) The pandemic scenario to policies providing benefits due to hospitalisation (for example, hospital cash-back and gap cover) ("Pandemic Scenario").

2. Losses calculated based on the three Accident and Health scenarios noted above must first be calculated without taking into account the effects of any eligible reinsurance and other eligible risk mitigation instruments.

3. The calculation of the capital requirement for Accident and Health catastrophe risk, gross of risk mitigation ($CAT_{A\&H\_gross}$) must be calculated as:

   $$CAT_{A\&H\_gross} = \sqrt{CAT_{ma\_gross}^2 + CAT_{ac\_gross}^2 + CAT_{p\_gross}^2}$$

   Where:

CAT_{ma_gross}	=	Capital requirement of the Mass Accident Scenario
CAT_{ac_gross}	=	Capital requirement of the Accident Concentration Scenario
CAT_{p_gross}	=	Capital requirement of the Pandemic Scenario

   and the calculations for these are set out below:

4. The capital requirement for mass accident risk (CAT_{ma_gross}) in South Africa is equal to the reduction in basic own funds that would result from an instantaneous loss, that without the deduction of the amounts recoverable from eligible reinsurance and other eligible risk mitigation instruments, is calculated as follows:

   $$CAT_{ma\_gross} = 0.01 \cdot \sum_{e} (x_e \cdot E_e)$$

   Where:

E_e	=	Total present value of benefits payable for event type e
x_e	=	Ratio of persons which will be affected by event type e as a result of the accident

   and the sum includes the events type e defined as follows, and x_e is given by the percentages set out in the table below:

Event type e	x_e
Death	10%
Permanent disability[50]	1.5%
Disability that lasts 10 years	5%
Disability that lasts 12 months	13.5%
Hospitalisation	30%

For all event types e, the value of the benefits for a particular event type e is equal to the following:

$$E_e = \sum_i SI_{e,i}$$

where the sum includes all insured persons of the insurer who are insured against event type e and are inhabitants of South Africa, and $\boldsymbol{SI_{e,i}}$ denotes the value of the benefits payable by the insurer for the insured person $\boldsymbol{i}$ in the case of event type e.

The value of the benefits is the sum insured or, where the insurance contract provides for recurring benefit payments, the best estimate of the benefit payments in the case of event type e. Where the benefits of an insurance contract depend on the nature or extent of any injury resulting from event *e*, the calculation of the value of the benefits is based on the maximum benefits obtainable under the contract which are consistent with the event. For policies which do not have a fixed sum insured, such as hospital cash-back and gap cover obligations, the value of the benefits is based on an estimate of the average amounts paid out in the case of event e.

5. The capital requirement for accident concentration risk (CAT_{ac_gross}) is equal to the reduction in basic own funds that would result from an instantaneous loss, that without deduction of the amounts recoverable from eligible reinsurance and other eligible risk mitigation instruments, is calculated as follows:

$$CAT_{ac\_gross} = min(C \cdot \sum_e (x_e \cdot CE_e), PEL)$$

where the sum includes the event types *e* as set out in section H.4 above and

C = The number of people in the largest accident risk concentration of the insurer, as defined below. If this is not easily available then use the total number of insured persons on the policy

N_e = Number of insured persons of the insurer which are insured against event type e and which belong to the largest accident risk concentration of the insurer

[50] For the purpose of the calculation of this scenario, the definition of disability includes any type of benefit that is covered under a personal accident policy, whether it is a lump sum or annuity type benefit.

$SI_{e,i}$ = Present value of the benefits payable for insured person i in the case of event type e

PEL = Policy event limit for the policy with the largest accident risk concentration

The largest accident risk concentration, C, is equal to the largest number of persons for which the following conditions are met:

- The insurer has a single group policy in relation to each of the persons;
- The obligations in relation to each of the persons cover at least one of the events set out in the table in section H.4 above; and
- The persons are working in the same building or location of business.

For all event types, the average sum insured of an insurer for event type e for the largest accident risk concentration is equal to the following:

$$CE_e = \frac{1}{N_e}\sum_{i=1}^{N_e} SI_{e,i}$$

where the sum includes all the insured persons of the insurer which are insured against event type e and which belong to the largest accident risk concentration of the insurer.

The value of the benefits is the sum insured or, where the insurance contract provides for recurring benefit payments, the best estimate of the benefit payments in the case of event type e. Where the benefits of an insurance contract depend on the nature or extent of any injury resulting from event e, the calculation of the value of the benefits is based on the maximum benefits obtainable under the contract which are consistent with the event. For policies which do not have a precise sum insured, such as hospital cash-back and gap cover obligations, the value of the benefits is based on an estimate of the average amounts paid out in the case of event e.

6. The capital requirement for the pandemic scenario (CAT_{p_gross}) is equal to the reduction in basic own funds that would result from an instantaneous loss, that without the deduction of the amounts recoverable from eligible reinsurance and other eligible risk mitigation instruments, is calculated as follows:

   $$CAT_{p\_gross} = 0.01 \cdot N \cdot CH$$

   Where:

   N = Number of insured persons covered by policies which have a hospitalisation benefit

   CH = Best estimate of the amounts payable for an insured person in relation to hospitalisation claims

7. Insurers may adjust their gross Accident and Health catastrophe risk exposures for the effects of eligible reinsurance and other eligible risk mitigation instruments to arrive at the capital requirement for Accident and Health catastrophe risk net of risk mitigation, which is calculated as follows:

   $$CAT_{A\&H\_net} = \sqrt{CAT_{ma\_net}^2 + CAT_{ac\_net}^2 + CAT_{p\_net}^2}$$

where the terms CAT_{ma_gross}, CAT_{ac_net} and CAT_{p_net} are the same as those defined in sections H.4 to H.6 above, after any adjustments for the effect of eligible reinsurance and other eligible risk mitigation instruments.