# TEXAS WINDSTORM INSURANCE ASSOCIATION
# RESIDENTIAL PROPERTY RATE LEVEL REVIEW
**July 2, 2021**

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**Date: July 2, 2021**

# TABLE OF CONTENTS

**INTRODUCTION** ..... **1**

**DISTRIBUTION AND USE** ..... **1**

**RELIANCE UPON DATA** ..... **1**

**LIMITATIONS** ..... **2~~2~~**

**EXECUTIVE SUMMARY** ..... **3~~3~~**

**ACTUARIAL ANALYSIS** ..... **6**

Overview of Analysis ..... 6

Earned Premium at Current Rates ..... 7

Loss Adjustment Expense Factors ..... 7

Projected Non-Hurricane Loss and LAE Ratio ..... 7

Projected Hurricane Loss and LAE Ratio ..... 8

Fixed Expenses and Variable Permissible Loss and LAE Ratio ..... 11

Indicated Rate Change ..... 12

Data Issues ..... 12

Key Differences Versus Prior Indications ..... 12

**SUMMARY OF EXHIBITS** ..... **14**

## INTRODUCTION

The Texas Windstorm Insurance Association (TWIA) has completed studies sufficient to support rate level indications for its residential coverages. This report documents the procedures, methods, assumptions, data and results of this analysis.

## DISTRIBUTION AND USE

This report was prepared for internal use by the management of TWIA and for the Board of Directors of TWIA. A complete copy of the report may be submitted to the Texas Department of Insurance (TDI or Department) for use in the approval of a rate change. Use of this report for other than the stated purpose may not be proper and must be preceded by written authorization.

## RELIANCE UPON DATA

The following data and information used in this analysis were prepared by TWIA and are the responsibility of TWIA's management:

- TWIA losses and loss adjustment expenses
- TWIA written and earned premiums
- History of rate changes impacting TWIA residential premium
- TWIA's statutory annual statements and insurance expense exhibits.

At the time of this analysis, some of the data was unaudited. The data was reviewed for reasonableness and consistency, and the TWIA written premium and paid loss data provided for this analysis were reconciled to TWIA's annual statements

In addition to TWIA's own data, we utilized insurance industry premium and loss data supplied by the TDI.

We also used the results of two different hurricane simulation models -- one model developed by Applied Insurance Research (AIR) and the other model developed by Risk Management Solutions (RMS). Both models utilized TWIA exposure data as of 11/30/2020. TWIA has not directly verified the accuracy of these simulation models, but has relied on documentation provided directly by the modeling firms and submission documentation provided to the Florida Commission on Hurricane Loss Projection Methodology to comply with Actuarial Standard of Practice #38, "Using Models Outside the Actuary's Area of Expertise."

## LIMITATIONS

The indicated rate level change as shown in this report represents a reasonable estimate of the rate level necessary to cover the TWIA's expected costs of providing residential wind/hail coverage. The actual costs of providing residential property coverage for a specific year may differ substantially from the indicated rate level range shown in this report. The possibility of this variability arises from the fact that the events covered by TWIA are inherently unpredictable from year to year. The indicated rate level is, however, our best estimate of the expected average annual cost of providing residential wind/hail coverage.

This actuarial report provides professional insights and guidance to TWIA regarding TWIA's current rate levels; however, the final decision regarding implementation and actual rate level change is a Board decision subject to the approval requirements of the Texas Department of Insurance.

The attached exhibits should be considered an integral part of this report.

EXECUTIVE SUMMARY

This section provides a brief summary of the key findings contained in our study.

1. We have estimated the indicated total rate level change using a combination of two different methodologies for projecting the expected average annual hurricane loss portion of the indicated rate level. The indicated total rate level changes are shown in Exhibit 1 and the following table:

**Indicated Rate Change: Long Term Hurricane Methodologies**

| Hurricane Projection Methodology | Indicated Rate Change |
|---|---|
| Actual Experience and Models Combined | +39% |
| Actual Industry Experience | +32% |
| AIR Hurricane Simulation Models | +54% |
| RMS Hurricane Simulation Models | +38% |

The indicated rate change shown is based on a combination of actual industry experience and hurricane simulation models. The indications based on each of these methodologies alone are also shown for reference. All methodologies rely on a long-term view of event frequency to develop the hurricane portion of the indicated rate level.

The hurricane simulation models utilized are widely used for catastrophe risk management and insurance ratemaking by the insurance industry. Versions of these simulation models have undergone verification and been approved by the Florida Commission on Hurricane Loss Projection Methodology.

2. The differences in indicated rate level changes reflect different hurricane loss projection methodologies. The different methods were used because the actuarial methods used to project hurricane losses in rate indications are still evolving. Traditionally, actuarial methods had been based on insurance industry hurricane loss experience. This traditional method is well recognized as having its limits. For instance, historical results are not representative of future events in many areas, given that exposures change over time (i.e. property values, population movement, building codes and construction techniques, topography, etc.). Furthermore, on-leveling historical hurricane losses and premiums is very challenging due to a lack of robust historical data. In recent decades after Hurricane Andrew, actuarial methods have incorporated the results of hurricane simulation models to minimize the weaknesses of the traditional approaches.

   The method relying on actual industry hurricane experience is a more traditional approach. Specifically, hurricane severity is calculated from 55 years of actual insurance industry premium and loss data, and hurricane frequency is based on 169 years of actual hurricane experience along Texas coastal lines. Severe hurricanes are so relatively infrequent that this limited number of years of actual industry experience may not represent the scope of potential occurrences. Also, the distribution of insured properties has changed dramatically over time with increased population and building values along the Gulf Coast. The alternative method incorporates the results of hurricane simulation models and has the advantage of minimizing many of the theoretical weaknesses of the traditional actuarial methodologies. The overall indication assigns equal weight to both traditional hurricane projection methodology and simulation model-based hurricane projection methodology.

3. The current rate indication is 5% less than the corresponding indication from the prior TWIA residential rate study. Changes in industry hurricane loss ratios, reduced Class I public security repayment provisions and reduced net reinsurance costs are the primary reasons for the decrease.

   Details on the key differences between the current and prior rate indications are described in the Analysis section of this report.

4. The indicated rate changes presented in this report reflect a separate provision for contributions to funding and uncertainties in pricing hurricanes. The total funding and contingency provision is assumed to be equal to 5% of TWIA premium.

   The provision for debt service of 18.6% represents the projected cost of debt service on the Series 2014 Class 1 Pre-Event Bonds. As of June 30, 2018, the available proceeds of the Series 2014 Pre-event Class 1 securities were used to pay claims associated with Hurricanes Harvey.

   The provision for reinsurance expense is 18.6% of TWIA premium. The provision for reinsurance expense reflects the estimated actual net cost of purchasing catastrophe reinsurance (reinsurance premiums paid net of the expected reduction in TWIA retained losses). Catastrophe reinsurance provides TWIA with annually renewable protection against large storm losses.

## ACTUARIAL ANALYSIS

### Overview of Analysis

The goal of the rate level adequacy review is to compare the current rate level to TWIA's expected costs for providing residential property insurance coverage. This comparison is achieved by estimating the projected loss, loss adjustment expense (LAE), and fixed expense ratio for a prospective accident year and then comparing this ratio to the "permissible" loss, LAE, and fixed expense ratio. The permissible ratio is the portion of premium remaining to pay loss, LAE, and fixed expenses after payment of TWIA variable expenses. If the projected ratio is higher than the permissible ratio, then a rate increase is indicated. If the projected ratio is lower than the permissible, then a rate decrease is indicated.

The steps employed to estimate the projected loss, LAE, and fixed expense ratio are as follows:

1. Adjust historical premium to the current rate level (to facilitate calculation of historical loss ratios at current rates).
2. Determine LAE factors to add projected LAE to projected loss.
3. Estimate the projected non-hurricane loss and LAE ratio.
4. Estimate the projected hurricane loss and LAE ratio.
5. Estimate the projected fixed expense ratio.
6. Sum the projected non-hurricane and hurricane loss ratios and the projected fixed expense ratio to obtain the projected total loss, LAE, and fixed expense ratio.

The steps employed to determine the permissible loss and LAE ratio are as follows:

(a) Analyze historical variable expense to premium ratios to estimate the projected total variable expense ratio.
(b) Subtract the projected total variable expense ratio from 1.00 to derive the permissible loss, LAE and fixed expense ratio.

Steps 1-5 and (a)-(b) are described in more detail in the remainder of this report.

Earned Premium at Current Rates

Historical industry earned premium and TWIA earned premium are adjusted to TWIA's current rate level. Earned premium at current rates for prior years permits the calculation of historical loss ratios at the current rate level.

Exhibit 10 shows the calculation of earned premium at current TWIA rates. Industry earned premium is provided by TDI/TICO. Historical TWIA written premium is adjusted to the current rate level and adjusted to an earned basis based on a uniform monthly earning assumption.

Loss Adjustment Expense Factors

In Exhibit 4, the historical ratio of LAE to loss is analyzed to develop LAE factors. Separate LAE factors are developed for hurricane and non-hurricane losses. The hurricane LAE factors are developed based on the LAE to loss ratio for years with hurricanes. The non-hurricane LAE factors are developed based on the ratio for years without hurricanes. TWIA statutory annual statement incurred loss and LAE data is utilized to derive these ratios.

The indicated LAE to loss ratios are shown in Exhibit 4, Sheet 1. For hurricane losses, the indicated LAE ratio of 0.154 is equal to the weighted average of the 10 hurricane years included in the analysis. For non-hurricane losses, the indicated ratio of 0.278 is equal to the weighted average of the most recent 10 non-hurricane years included in the analysis.

The development of these LAE factors is necessary to add LAE to the projected hurricane and non-hurricane loss ratios. The development of these loss ratios is described in the following two sections.

Projected Non-Hurricane Loss and LAE Ratio

Exhibit 2 shows the development of the projected non-hurricane loss and LAE ratio. The loss portion of this ratio is estimated by comparing the indicated ultimate TWIA non-hurricane loss for accident years 2011 - 2020 to the earned premium at current TWIA rates for the same years. The indicated ultimate non-hurricane loss for each year is based on actual TWIA paid loss as of 12/31/2020, and the paid loss development method. LAE is then added to each year's ultimate loss through the non-hurricane LAE factor developed in Exhibit 4.

Paid loss development factors are selected based on the average of all available years and prior selections. Given the positive skewness of the observed age-to-age development factors, a

straight average is more appropriate than an average that excludes the highest and lowest observation to avoid understating the expected development.

Each year's estimated ultimate loss and LAE is compared to the earned premium at present rates.

The resulting loss and LAE ratios are then trended forward based on the expected prospective inflation level. The net trend factor is equal to a loss trend offset by a premium trend. The loss trend is calculated using industry-wide construction cost and consumer price indices. The premium trend is derived from historical changes in average written premium at present rates. Both premiums and losses are trended to current levels by applying the actual historical changes in the appropriate data. Future premium and loss trends are selected based on all available and relevant data. The selected trends are estimates of the future trend between the current and prospective earned and accident dates, and they are not used to trend historical experience to current premium and loss levels.

The indicated loss and LAE ratio for each territory, is the premium-weighted average loss ratio from the 2011 - 2020 accident period. Given the great variability among individual accident years, a premium weighted average across the most recent 10 years has been selected to achieve both high stability and credibility.

The all-territory indicated loss and LAE ratio is then calculated as the weighted average of the individual territory loss and LAE ratios. TWIA 2020 written premium is used in the weighted average calculation.

Projected Hurricane Loss and LAE Ratio

Two different methods are used to develop the projected hurricane loss and LAE ratios. The first method is based on insurance industry experience from the recent 55 years and meteorological hurricane experience from the recent 170 years. The other method is based on hurricane simulation models. The "55/170-year" method is utilized because the Texas Insurance Code requires the consideration of a 30-year minimum experience period. The simulation method is utilized because it minimizes many of the weaknesses of the traditional method. These weaknesses include:

- A 55-year period is insufficient to measure long-term hurricane severity.
- A 55-year period of insurance industry experience includes years where land use, population

densities, construction techniques and materials, engineering techniques and building codes were different than today. These differences diminish the relevance of insurance data from several decades ago in evaluating today's residential property rates.

Differences between the two methods are the result of expected variances in the frequency and severity of hurricanes, and fundamental differences between the historical industry exposures and current TWIA exposures. Because of the readily identifiable nature of hurricanes, there should be no double-counting or understatement of expected future losses resulting from the use of either method.

For each of the two methods mentioned above, the projected hurricane loss ratio is estimated first. LAE is added to loss ratio using the hurricane LAE factor developed in Exhibit 4. Development of the projected hurricane loss ratio for the two methods is described as follows:

*Actual 55/170-Year Industry Hurricane Experience*

In Exhibit 6, the reported Texas insurance industry seacoast dwelling extended coverage premium and loss experience for the period 1966 through 2020 is used in the development of a projected hurricane loss ratio. Insurance industry loss ratios at current rates are calculated using information provided by the TDI. For the years where sufficient detail is available (1983 - 2020), these loss ratios are adjusted to TWIA's rate level.

A projected hurricane loss ratio is developed from these 55 years of loss ratios by separating the 55 years into the 14 hurricane years and 41 non-hurricane years. The 41 non-hurricane years are used to develop an estimated non-hurricane loss ratio.

Hurricane loss ratios are then estimated by subtracting the non-hurricane loss ratio from the total loss ratio in each of the fourteen hurricane years. An average per hurricane loss ratio for hurricane years is calculated as the average of the 14 hurricane loss ratios: 91.4%.

The 55-year period that underlies the selected hurricane loss ratio has experienced significantly fewer hurricanes than the long-term average. As shown in Exhibit 9, the annual hurricane frequency during this 55-year period is 0.327, while the annual frequency during the most recent 170-year period is 0.394. The 55-year period represents all years for which TWIA has been provided industry data by TDI. Because the expected frequency of hurricanes is unrelated to the availability of insurance industry data, there is no reason to use only the most recent 55-year

period to estimate the expected frequency of hurricane activity. Given the relatively infrequent occurrence of hurricanes, the longest experience period should be considered in order to obtain the most credible result. The selected hurricane frequency is therefore set equal to the 170-year historical hurricane frequency. As shown in Exhibit 6, Sheet 1, multiplying the selected loss ratio for hurricane years by the selected hurricane frequency yields a projected hurricane loss ratio of 36%.

*Hurricane Simulation Models*

The projected hurricane loss ratio is determined by averaging two different hurricane simulation models. The model versions utilized are AIR Touchstone v8 and RMS RiskLink v18.1. Both models were run using exposure data provided by TWIA as of 11/30/2020. This exposure data included location-level detail, with physical characteristics of each risk, and all relevant coverages. Both models were run using historical (long-term) event rates and both results include loss amplification (demand surge) and exclude storm surge and loss adjustment expenses. The AIR and RMS models generated 4,749 and 9,774 unique events, respectively, with the following distribution of intensity ratings:

| Saffir-Simpson Category | AIR | RMS |
|---|---|---|
| Category 0 | 12.8% | 45.2% |
| Category 1 | 36.3% | 17.0% |
| Category 2 | 22.9% | 13.1% |
| Category 3 | 19.0% | 13.9% |
| Category 4 | 8.3% | 9.9% |
| Category 5 | 0.8% | 0.8% |

Events shown as Category 0 include events with no U.S. landfall, Category 0 events making landfall or bypass in TX, and events making landfall or bypass in neighboring states or Mexico.

As shown in Exhibits 7 and 8, these models yield projected hurricane loss ratios of 50.7% and 40.6%. The average of these loss ratios is 45.7%.

Fixed Expenses and Variable Permissible Loss and LAE Ratio

Exhibit 11 shows the expense assumptions used to develop the projected fixed expense ratio and the variable permissible loss and LAE ratio. Fixed expenses include general expenses, Class 1 public security interest and principal repayment and the net cost of reinsurance (after modeled recoveries). The sum of these projected expenses provides for a 45.3% fixed expense ratio. Variable expenses include commission, taxes, and projected contributions to the Catastrophe Reserve Trust Fund (CRTF). Subtracting these expenses from 100% yields a permissible loss and LAE ratio of 77.1%.

As stated above, the expenses include a provision for an annual contribution to the CRTF, repayment of Class 1 public securities, and the projected net cost of TWIA's purchasing of reinsurance. The 18.6% provision for reinsurance expense reflects the estimated net actual cost of purchasing reinsurance (reinsurance premiums net of the expected reduction in TWIA retained losses). TWIA's purchasing of reinsurance provides additional current year protection to TWIA, coastal policyholders and TWIA insurance members. Furthermore, TWIA's purchasing of reinsurance helps TWIA fulfills its statutory funding obligations.

Indicated Rate Change

Exhibit 1 summarizes the indicated rate change using a combination of the two hurricane loss ratio projection methods. The individual indications resulting from the use of each methodology are also shown for reference. The indicated rate change for each method is calculated by dividing the total projected loss, LAE, and fixed expense ratio by the variable permissible loss and LAE ratio. This method of calculating the indicated rate change assumes that TWIA's variable expenses vary proportionally with premium while the fixed expenses do not.

Data Issues

*Reconciliation of Data to TWIA's Annual Statements*

Exhibit 12 shows a reconciliation of the premium data provided by TWIA to TWIA's annual statement data. This reconciliation shows the differences between the two data sources. Differences of less than 1% exist for all recent years except 2010.

Key Differences Versus Prior Indications

The indicated rate change shown in this report is 5% less than the comparable indication based on the prior (July 2020) study. The reasons for lower indications are summarized in the following table.

**Reconciliation of Current vs. Prior Indications**

| Rate Indication/Reason for Change | Impact of Change | Rate Indication |
|---|---|---|
| ***Previous Rate Indication (Combined Method)*** | | **+44%** |
| Change in modeled loss ratio | -2% | |
| Change in Reinsurance Provision | -1% | |
| Change in class I bond repayment | -1% | |
| Change due to all other factors | -1% | |
| ***Current Rate Indication (Combined Method)*** | | **+39%** |

These reasons are discussed below:

*Change in modeled loss ratio*

The decrease of 2.4% in modeled hurricane loss ratios reflects both hurricane model version changes and TWIA exposure changes observed in the coastal area.

*Changes in outstanding bond repayment provision, reinsurance provision and general expense provision*

The outstanding class 1 public securities were issued in 2014 and had been depleted from paying for claims associated with Hurricane Harvey. Due to a recent bond redemption in 2020, TWIA's revised annual principal and interest payment is about $69 million, resulting in a provision of 18.6%. Meanwhile, reinsurance provision decreased to 18.6% from 19.5% applied in the prior analysis and general expense provision decreased to 8.1% from 8.5%. Collectively those three provisions add up to a fixed expense provision of 45.3%, which is 2.4% less compared to 2020 rate analysis.

## SUMMARY OF EXHIBITS

| Exhibit Number | Exhibit Title or Purpose |
|---|---|
| 1 | Summary of Indicated Rate Change |
| 2 | Projected Ultimate Non-Hurricane Loss & LAE Ratio |
| 3 | Paid Loss Development Factors and Premium and Loss Trend Analysis |
| 4 | Development of LAE Factor |
| 5 | Summary of Indicated Hurricane Loss & LAE Ratios |
| 6 | Development of Hurricane Loss Ratio – 55/170-Year Method |
| 7 | Hurricane Loss Ratio – AIR Model |
| 8 | Hurricane Loss Ratio – RMS Model |
| 9 | Texas Hurricanes 1850 – 2020 |
| 10 | Earned Premium at Present Rates |
| 11 | Fixed Expenses and Variable Permissible Loss & LAE Ratios |
| 12 | Reconciliation of Premium Data to Annual Statement |