Class Ratemaking for Workers Compensation: New Developments in Loss Development

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ABSTRACT

For loss cost filings beginning in October 2009, NCCI implemented the largest set of changes in 40 years to the methodology used to determine class pure premiums in workers compensation.

This paper describes the new loss development methodology NCCI has implemented, the applied research approach, and some analyses of actual results achieved after making the modifications. It illustrates how specific areas of class ratemaking were modified, namely, loss development, limiting large claims, and applying expected excess provisions.

KEYWORDS

Workers compensation, NCCI ratemaking, NCCI loss cost filings, class ratemaking, loss development by part of body, expected excess by hazard group

1. Introduction

In the late 2000s, NCCI modified the methodology used to determine class pure premiums for workers compensation insurance. The new methodology was filed in NCCI states' loss cost filings beginning October 1, 2009. Key changes made that are covered in this paper are (1) a new method for developing losses to ultimate value and (2) a new method for handling large claims. The class ratemaking methodology was last modified with some minor changes in 1993, which were: (a) the number of policy periods used in determining pure premiums for each class was increased from three to five, (b) the underlying class credibility formulae were modified, and (c) the number of industry groups used for targeting class loss cost changes was increased from three to five.

The following topics are referenced in this paper, but not covered in detail:

- The methodology to determine the change in a state's overall indicated loss cost level
- The new methodology for mapping class codes to the seven hazard groups
- The methodology underlying excess loss factors
- The derivation of a loss cost for a class code.

Many of my colleagues at NCCI made significant contributions to the success of this huge undertaking, and are duly mentioned in the acknowledgement. This could not have been possible without their valuable insights, hard work, and support.

2. Background and Methods

The motivation underlying the applied research approach is:

- To improve the equity of loss costs across class codes
- To improve year-to-year stability of loss cost changes by class code
- To explore the potential use of new data elements which NCCI began collecting in the 1996 Unit Report Expansion (URE).

2.1. Availability of new URE data elements

The source data used for class ratemaking is the Workers Compensation Statistical Plan (WCSP) data (a.k.a Unit Statistical Plan). Most NCCI states approved the collection of the URE data elements in 1996. The first complete policy period available in most states is policy year 1997. Some states did not approve the collection of URE data in their state for a few more years (the last state was approved in 2002). Thus, in a few states, the database is less complete historically, adding further to the challenges of our research agenda.

Data historically collected in the WCSP includes the employer's payroll and indemnity and medical case incurred losses by claim by injury type (e.g., fatal, permanent total, permanent partial, temporary total, and medical only). Some, but not all, of the URE data elements reported to NCCI by carriers are:

- Paid ALAE (case reserves were optional)
- Paid losses separate from "paid + case" losses
- Injured Part of Body
- Nature of Injury
- Cause of Injury
- Deductible Reimbursement Amounts
- Lump Sum Indicator

Effective with policy period 1999 and subsequent, carriers began mandatory reporting to NCCI all URE data elements and WCSP data elements beyond a fifth report, up to and including a tenth report.

2.2. Overview of the methodology changes

Significant changes to the NCCI class ratemaking were implemented in the following six areas:

1. Loss development factors (LDF) are derived using claim characteristics such as injured part of body, the open and closed claim status at first report, and the injury type category.
2. The loss development triangles are being expanded from five reports out to, eventually, ten reports.
3. Large claims will be capped at $500,000 and expected excess factors (derived from the new seven

hazard group mapping by class code) will be used to calculate ultimate losses.

4. Serious and non-serious partial pure premium components were eliminated, and replaced by one indemnity pure premium component.
5. The computation of the indicated losses within the industry group differential calculation was modified to include the new loss development approach
6. The full credibility standards for indicated and national pure premiums were modified.

This paper does not cover the credibility standards.

2.3. Background: The prior loss development approach

Understanding the nuances of the former approach will help the reader gain a better appreciation for the reasoning behind the newly implemented changes to loss development. The previous approach to determine loss development factors (LDF) for class ratemaking was to segregate the dollars of loss generated from claims into two loss development categories. They were (a) the serious grouping and (b) the non-serious grouping. An arbitrary dollar value, referred to as the critical value, which varied significantly by state, was determined for each state's loss cost filing. All permanent partial claims whose indemnity dollar amount exceeded the critical value, as measured on a "paid + case" basis, were categorized into the serious grouping, and referred to as major permanent partial claims. This was done to provide a greater volume of serious losses to derive LDFs.

In workers compensation, different levels of indemnity benefits are paid based upon the injury types: fatal (Fa), permanent total (PT), permanent partial (PP), temporary total (TT), and medical only (MO).

For each state, four loss development triangles were compiled from the WCSP data using unlimited "paid + case" losses associated with claims across five policy periods. The four triangles consisted of indemnity and medical, each having a serious and non-serious component. Loss development factors were unlimited in the prior methodology. Figures 1a and 1b illustrate how the injury types were formerly mapped and the typical indemnity loss development pattern:

The losses were evaluated at first through fifth report (@18, @30, @42, @54, and @66 months, respectively). A tail factor was applied to the serious loss development triangles only, and was derived from NCCI financial call data used in the overall aggregate loss cost indication for the state. It was assumed that all loss development beyond fifth report was generated by serious claims only. Balancing to the financial data tail, a large tail factor was applied to the serious losses to generate a fifth-to-ultimate LDF, while a tail factor of unity was applied to the non-serious losses. An illustration of the prior tail factor derivation is shown in Figure 2.

The prior loss development approach had five shortcomings:

1. Claim severity was not a good indicator of the propensity of a claim to develop in the future.
2. As claims matured, many would "crossover" the critical value at subsequent reports, and be re-assigned into the serious grouping, or vice versa.
3. Critical value crossover distorts the predictive ability of the loss development factors in the serious and non-serious triangles.
4. The medical dollar amount was ignored in determining whether or not a claim was categorized as serious or non-serious.
5. No distinction between serious and non-serious loss dollars was made within the medical loss triangles from first through fifth report (i.e., total medical was used). However, a fifth-to-ultimate medical tail factor was applied to the total medical loss dollars associated with the serious lost-time claims.

2.4. The problem of critical value crossover

The critical value methodology was used in class ratemaking at NCCI beginning in 1966. Figure 3 demonstrates the distorting impact that critical value "crossover" inflicts on a dataset of permanent partial claims countrywide. Claims below the critical

Figure 1a. Serious indemnity losses for NCCI State—unlimited loss amounts

Serious Losses
Fatal, Permanent Total, and Major Permanent Partial Combined

1st Report Start: 1/1/2003
1st Report End: 12/31/2003

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report
1/98-12/98			460,401,442	535,321,008	574,106,684
1/99-12/99		340,191,451	489,175,745	560,465,442	592,806,690
1/00-12/00	141,410,721	312,882,740	450,176,823	526,656,041	
1/1-12/1	128,481,157	295,773,844	438,063,233		
1/2-12/2	108,611,922	260,153,546			
1/3-12/3	105,915,019				

Link Ratios	1:2	2:3	3:4	4:5
1/98-12/98			1.163	1.072
1/99-12/99		1.438	1.146	1.058
1/00-12/00	2.213	1.439	1.170	
1/1-12/1	2.302	1.481		
1/2-12/2	2.395			

AVERAGE DEV.	1:2	2:3	3:4	4:5
2 Year Averages	2.349	1.460	1.158	1.065

2 YR. DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U
Unadjusted	5.082	2.164	1.482	1.280	1.202

Figure 1b. Non-Serious indemnity losses for NCCI State—unlimited loss amounts

Non-Serious Losses:
Temporary Total and Minor Permanent Partial Combined

1st Report Start: 1/1/2003
1st Report End: 12/31/2003

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report
1/98-12/98			437,508,261	432,646,920	431,589,463
1/99-12/99		507,462,094	503,838,453	499,819,176	498,146,055
1/00-12/00	513,724,388	580,792,681	577,827,036	573,577,900	
1/1-12/1	491,994,692	545,990,644	542,748,392		
1/2-12/2	484,992,408	535,107,606			
1/3-12/3	454,969,833				

Link Ratios	1:2	2:3	3:4	4:5
1/98-12/98			0.989	0.998
1/99-12/99		0.993	0.992	0.997
1/00-12/00	1.131	0.995	0.993	
1/1-12/1	1.110	0.994		
1/2-12/2	1.103			

AVERAGE DEV.	1:2	2:3	3:4	4:5
2 Year Averages	1.107	0.995	0.993	0.998

2 YR. DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U
Unadjusted	1.092	0.986	0.991	0.998	1.000

Source: NCCI WCSP Data

Figure 2. Derivation of the prior serious tail factor to ultimate for NCCI State

Unlimited Indemnity
(using 2-year average development)

FIRST REPORT 1/3-12/3	(1) Incurred Losses	(2) Development 1:5	(3) Amendment Factor	(4) Modified Losses (1)x((2)x(3))
Fatal	13,262,549	4.228	1.098	61,564,752
Permanent Total	22,327,493	4.228	0.752	70,979,100
Major PPD	70,324,977	4.228	0.907	269,696,287
Minor PPD	135,337,672	1.092	0.907	133,984,295
Temporary Total	319,632,161	1.092	0.983	342,965,309
Medical Only				
Contract Medical				

SECOND REPORT 1/2-12/2	(5) Incurred Losses	(6) Development 2:5	(7) Amendment Factor	(8) Modified Losses (5)x((6)x(7))
Fatal	11,800,628	1.800	1.258	26,716,622
Permanent Total	57,888,155	1.800	0.569	59,277,471
Major PPD	190,464,763	1.800	0.807	276,745,301
Minor PPD	182,412,684	0.986	0.807	145,200,496
Temporary Total	352,694,922	0.986	0.960	334,002,091
Medical Only				
Contract Medical				

CALCULATION OF SERIOUS FIFTH-TO-ULTIMATE	
(9) Combined Serious Losses	764,979,533
(10) Combined Non-Serious Losses	956,152,191
(11) Combined Total Losses	1,721,131,724
(12) Financial Data Fifth-to-Ultimate Development Factors	1.090
(13) Fifth-to-Ultimate Loss Development (13) = ((12)-1)x(11)	154,901,855
(14) Fifth-to-Ultimate Serious Loss Development Factors (14) = ((9)+(13))/(9)	1.202

Source: NCCI WCSP Data

value are deemed minor while those that exceed it are deemed major. Various link ratios were computed for comparison from first to fourth report.

2.5. How we solved the crossover problem

A fresh approach was initiated by investigating a new field, the injured part of body, which NCCI began collecting on its Unit Report Expansion starting with policies effective in 1996. NCCI's actuaries researched to determine whether the injured body part provided any causal relationship in predicting whether or not a claim's loss dollar amount developed upward at later reports. The initial approach proceeded as follows:

1. Extract a large volume of claims containing claim specific information such as injury type, report level, injured body part, open/closed claim indicator, and associated dollars of "paid + case" loss.
2. Assess the impact that critical value "crossover" (illustrated earlier) and injury type "crossover" may have upon loss development factors. (A common example of injury type "crossover" is a temporary total claim eventually becoming a permanent partial claim at a later age.)

Figure 3. An illustration of the distorting impact of critical value "crossover." The true distortion is illustrated within the second and third rows of the indemnity and medical sections, where the status changed from major to minor, and vice versa, between the first and fourth reports.

Policy Year 1997
Countrywide - NCCI States
Dollars in 000's

Status of Claim @ 1st	Status of Claim @ 4th	(1) Indemnity $ @ 1st	(2) Indemnity $ @ 4th	(3) (2)/(1) Indemnity Link Ratio		(4) Link Ratio Based on Status @ 1st	(5) Link Ratio Incl. Crossover	
Major	Major	613,982	820,980	1.337	}	1.156	2.033	*
Major	minor	149,180	60,947	0.409				
minor	Major	207,820	730,279	3.514	}	1.339		
minor	minor	1,186,650	1,137,543	0.959			0.859	**

Status of Claim @ 1st	Status of Claim @ 4th	(1) Medical $ @ 1st	(2) Medical $ @ 4th	(3) (2)/(1) Medical Link Ratio		(4) Link Ratio Based on Status @ 1st	(5) Link Ratio Incl. Crossover
Major	Major	420,359	500,436	1.190	}	1.100	1.743
Major	minor	92,458	63,417	0.686			
minor	Major	211,613	393,183	1.858	}	1.075	
minor	minor	1,154,461	1,074,742	0.931			0.833

* 2.033=(820,980+730,279)/(613,981+149,179)

** 0.859=(60,947+1,137,543)/(207,820+1,186,650)

Range of Critical Values across NCCI states = [$20K, $90K]

Source: NCCI WCSP Data

3. Determine if claim severity is an indicator of the propensity of a claim to develop.
4. Analyze the injured body part to determine if it is a predictor of a claim's propensity to develop (or not develop).
5. Group the body part and injury type combinations into those more likely-to-develop (L) and those not-likely-to-develop (N) so that the groupings are more predictive than the serious and non-serious groupings.

True loss development can best be measured if claims are not allowed to migrate across different development groups. Figure 3, which illustrated the distortion to link ratios that "crossover" causes provided valuable insight supporting this. Because claims were moving across the critical value and also across the injury types, a solution was needed to assess whether or not the injured body part was a determining characteristic of loss development. The solution was to "lock down" the entire dataset of claims being studied at each link ratio. Thus, the exact same claims were observed at adjacent reports, such as first to second, and the loss development measured accordingly. Note, the set of claims used to observe the loss development from second to third report could be a different set of claims than those observed at first to second report.

This "lock down" approach helped NCCI determine which injured body parts developed more or less than others.

2.5.1. How was the injured body part approach determined?

Two new loss development triangles were created. The first was a grouping of claims whose injured body parts, and associated loss dollars, were likely to

develop upwards significantly over time. The second grouping would consist of claims whose injured body parts, and associated loss dollars, were *not* likely to develop over time. The creation of body part groupings made sense, as there were 55 body part codes, and generating a credible volume of losses at a state level for each injured part of body was a concern. Within a state, loss development between the two groups was compared relative to one another, as the losses in some states develop significantly more than others. For example, a back claim filed within a state having significant attorney involvement and longer benefit durations would be expected to develop more than a similar back claim in a state with little attorney involvement and shorter durations. (Some states have time limits for collecting benefits (i.e., duration), such as 425 weeks for permanent partial claims)

Determining which of the 55 body part codes would be mapped into the likely-to-develop and not-likely-to-develop was the next step.

Two different analyses were completed for body part grouping. The result of the first analysis is shown in Figure 4. It measured loss development dollars by the "lock down" approach from first through fourth report (initially, fifth report was unavailable). The metric quantifying the observed average loss development per claim was

$$\frac{\left(\text{Reported Losses @ 4th} - \text{Reported Losses @ 1st}\right)}{\text{Number of claims}}$$

This approach provided insight into which body parts developed more than others.

In Figure 4, the body part codes contributing to the largest amount of upward loss development per case were the back, head, neck, multiple body, and internal organs. The downside of using this metric as the only measure for making decisions is that much loss development in workers compensation happens beyond fifth report. NCCI later began collecting sixth reports of open claims for policy year 1999 and beyond, eventually collecting up to tenth report.

Therefore, a second measure was applied to group the body parts into likely-to-develop and not-likely-to-develop categories. The second metric determined what percentage of claims remained open at fifth report, sorted by part of body. Figure 5 shows an illustration for permanent partial claims.

Staff calculated the same two metrics for temporary total claims, which yielded similar results as permanent partial claims.

Actuarial judgment also played a role in the final decisions to determine into which groupings the various body parts were ultimately placed. Consideration was given to the fact that certain parts of body are considered scheduled injuries in many states having scheduled permanent partial injuries. Body parts like toes, fingers, hands, feet, arms, and legs are often mandated a pre-determined dollar amount in statutory benefit schedules. Therefore, they are not likely to develop upward. A listing of all body part codes and the grouping to which they were mapped is provided in the Appendix.

2.5.2. How was the injury type considered?

Once the body parts were mapped to the likely-to-develop (L) and not-likely-to-develop (N) groupings, a few different tests were performed. The first characteristic considered was the claim's injury type.

Two injury types initially examined in depth were temporary total (TT) and permanent partial (PP), where the majority of claims and loss dollars reside. The first test was whether or not claim severity was a good indicator of the likelihood of a claim developing and the second test was to observe if the groupings of body parts produced link ratios that were larger for the L grouping than the N grouping. The second test would substantiate the mapping of body parts to the L and N groupings.

Figure 6 provides three key observations:

1. Claim severity is not predictive of higher loss development (claims *below* $26,000 produced much higher LDFs for TT than those which began at a value *greater* than $26,000), suggesting the critical value approach is conceptually flawed
2. The medical pattern behaves differently than indemnity, in that the LDF from first to fifth is about the same whether above or below the $26,000, and

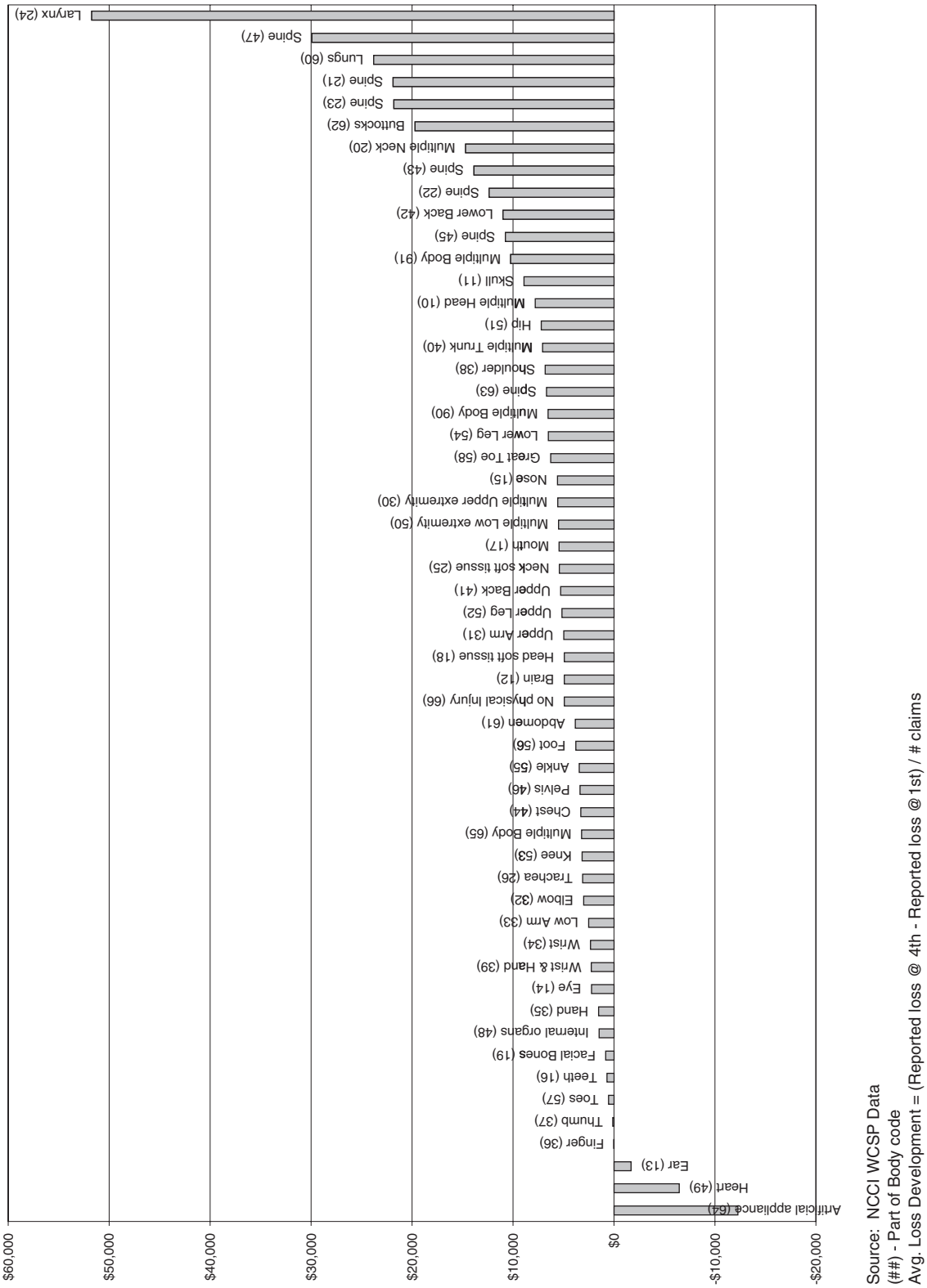


Figure 4. The observed average dollars of loss development per case is sorted by injured part of body for permanent partial claims.

Source: NCCI WCSP Data
(##) - Part of Body code
Avg. Loss Development = (Reported loss @ 4th - Reported loss @1st) / # claims

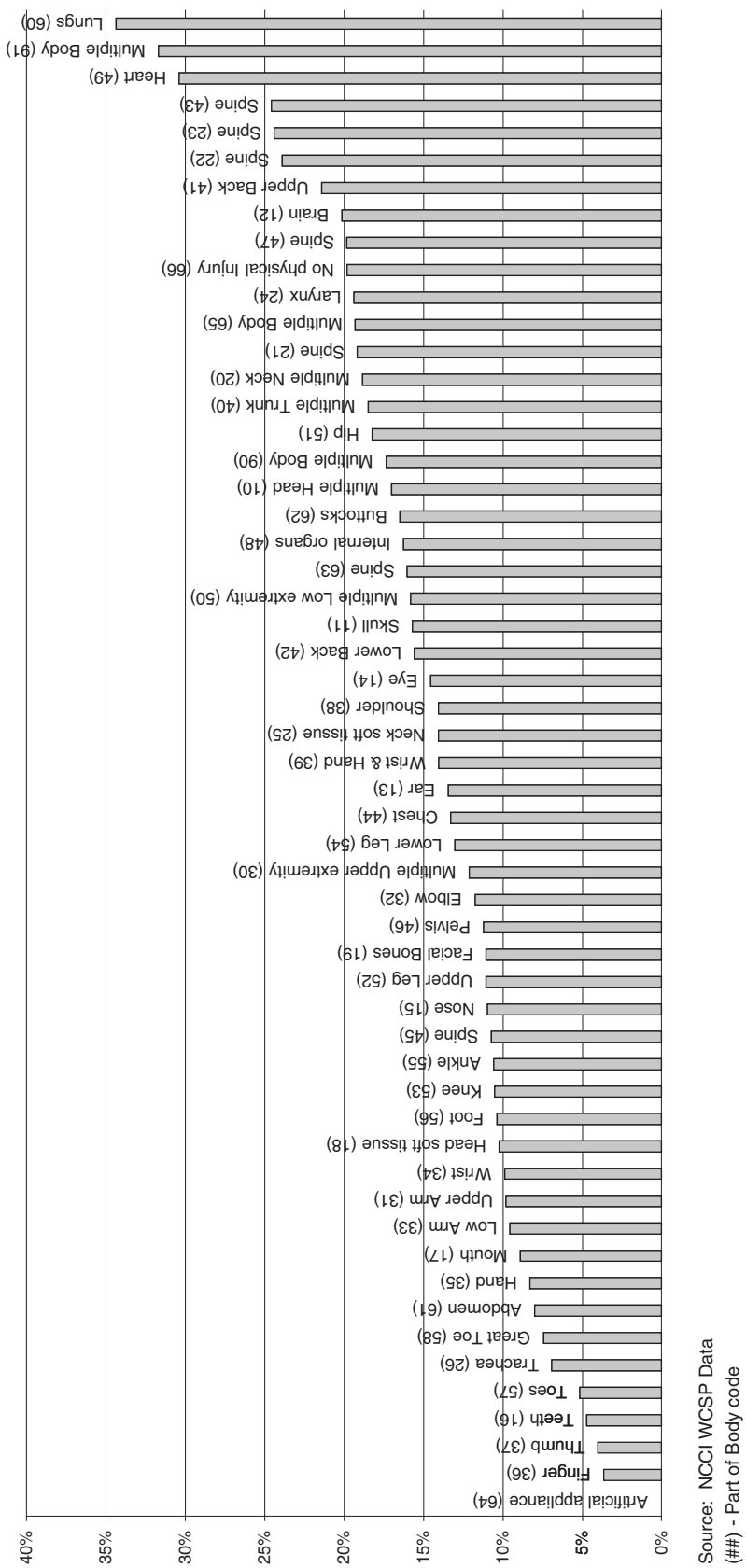


Figure 5. Parts of body having a higher percentage of open claims at fifth report were categorized likely-to-develop. NCCI observed that the back, head, neck, multiple body, and internal organs had the highest percentage of permanent partial claims open at fifth report.

Figure 6. Using a critical value of $26,000,[1] the claims are locked down at each adjacent link ratio to eliminate both critical value and injury type "crossover." This allowed NCCI to observe the true loss development patterns to validate the body part mapping.

Cumulative 1st to 5th report *

	Indemnity	Medical
TT<=26K	1.548	1.080
TT>26K	1.162	1.083
TT-L<=26K	1.797	1.170
TT-N<=26K	1.373	1.014
TT-L>26K	1.226	1.168
TT-N>26K	1.084	0.953
TT-L	1.522	1.170
TT-N	1.271	1.001
PP-L	1.387	1.183
PP-N	1.234	1.028

TT- Temporary total disability claims
PP- Permanent partial disability claims
L - Includes claims having likely-to-develop body parts.
N - Includes claims having NOT likely-to-develop body parts.
> 26K - Includes claims whose initial report was greater than 26K.

* Loss development factors exclude all crossover.
Source: NCCI WCSP Data

3. The L group develops more than the N group for both PP and TT, as evidenced by the higher link ratios.

Next, the new groupings and their loss development patterns were compared by state to the prior serious and non-serious LDFs. Figures 7a (indemnity) and 7b (medical) provide LDF comparisons for two states, identified only as ***NCCI state*** (based on the same dollars as Figure 1a) and ***Another NCCI state***.

Figures 7a and 7b show LDFs on an unlimited basis and on a limited (@ $500K) basis. Unlimited factors were used in the prior methodology. The new class ratemaking enhancements include limiting individual claims at $500K. Thus, a portion of the difference in the magnitude of LDF from prior to new methodology is due to a loss limitation being applied within the new methodology.

[1]$26,000 was an indemnity dollar amount determined arbitrarily assuming a typical weekly indemnity benefit of $500 per week for 52 weeks.

Figures 7a and 7b illustrate LDF patterns using the following groupings of claims based upon injured part of body and injury type combinations:

$$\text{Likely } (\text{L}) = \text{Fatal} + \text{PT} + \text{PP-L} + \text{TT-L}. \quad (2.1)$$

$$\text{Not Likely } (\text{N}) = \text{PP-N} + \text{TT-N} + \text{MO}. \quad (2.2)$$

$$\text{Serious} = \text{Fatal} + \text{PT} + \text{Major PP}. \quad (2.3)$$

$$\text{Non-serious} = \text{Minor PP} + \text{TT} + \text{MO}. \quad (2.4)$$

Because many fatal and permanent total claims are open at fifth report, each is originally placed into the L grouping. Medical-only claims are assigned to the N grouping because most open and close out quickly, unlikely to develop upward.

The injury types providing the biggest challenges are the permanent partial and temporary total claims because:

- Many temporary total claims evolve into permanent partial claims at the end of the healing period, when injured workers reach maximum medical improvement.
- Both critical value crossover and injury type crossover are common for temporary total and permanent partial claims.
- These two injury types comprise between 70% and 80% of all loss dollars incurred.

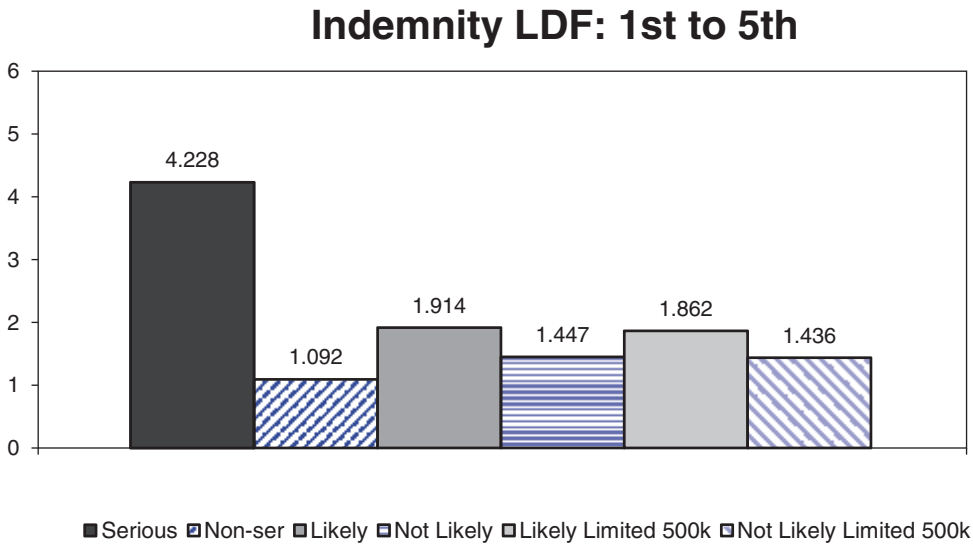
The team of NCCI actuaries started investigating injury type loss development patterns by state, exploring if other URE data elements could be used to further refine the L and N groupings.

2.5.3. The search for the optimal loss development groupings

Some of the data elements explored were claims including allocated loss adjustment expense (ALAE), the nature of injury, and the cause of injury. None of these provided any clear solutions.

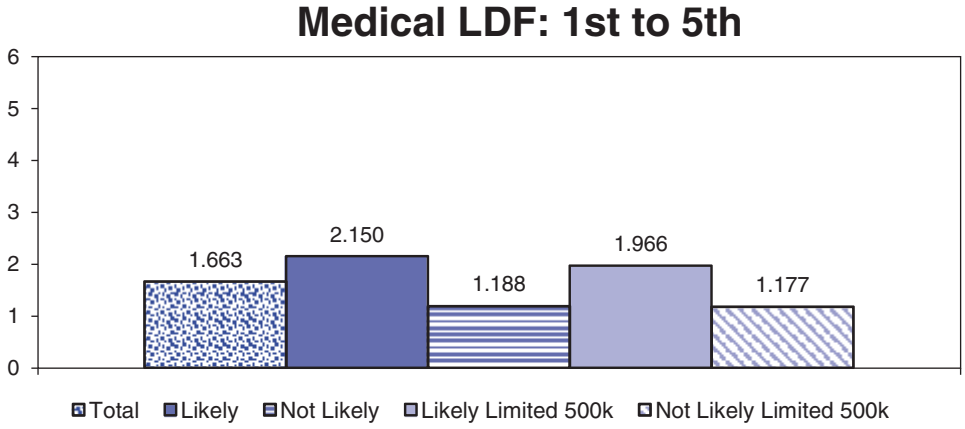
However, there was one data element that was clearly correlated with the propensity of a claim to develop (or not), the open/closed claim status indicator. The majority of loss development observed was coming from claims which were **open at first**

Figure 7a. Comparison of loss development factors, NCCI State.



Likely (L) = Fatal + PT + PP-L + TT-L
Not Likely (N)= PP-N + TT-N
Serious = Fatal + PT + Major PP
Non-Serious = Minor PP + TT

Figure 7b. Comparison of medical loss development factors for Another NCCI state. Starting from the left, the prior methodology provides a total medical LDF from first to fifth report. Under the new mapping, an improvement is that LDFs are bifurcated into two homogeneous groupings (L and N) having distinctly different loss development patterns.



Likely (L) = Fatal + PT + PP-L + TT-L
Not Likely (N)= PP-N + TT-N + MO
Total = Fatal + PT + Major PP + Minor PP + TT + MO

report, which is logical. Closed claims are not likely to develop (however, a few claims do close and reopen in workers compensation).

A new countrywide (i.e., all NCCI states) data extract was created. Dollars of loss were compiled for each policy year and state as follows:

- By injury type at each report level, for policy years 1999–2002 (1999 had 6 annual reports available at the time)
- By the claim status open (O) or closed (C) at first report and each subsequent report level
- By the injured part of body assignment to category L or N
- Large claims were limited at $500,000
- Indemnity and medical losses were aggregated separately, but combined across all states
- Only states and years in URE format.

Claims having an injured body part mapped to the L grouping are referred to as "likely" body parts. Similarly, claims having an injured body part mapped to the N grouping are referred to as "not-likely" body parts.[2] **All claims are "locked down" at every report level to examine true loss development, not allowing any to move across subcategories.** This variation of the "lock down" is different than that used earlier in the initial research of injured part of body, where the set of claims is fixed only at adjacent reports for determining each link ratio.

Once "locked down" at the initial report, no claims are allowed to enter or leave the group throughout the entire observed development time frame (i.e., first through sixth report). The loss dollars for each injury type are segregated into four new subcategories and LDFs are computed:

- LO—"likely" body part and claim open at first report
- LC—"likely" body part and claim closed at first report
- NO—"not-likely" body part and claim open at first report
- NC—"not-likely" body part and claim closed at first report.

Three important observations for permanent partial (PP) and temporary total (TT) claims follow from Figure 8a:

1. Losses from claims in the L body part categories consistently develop upward more than its N counterpart, confirming that the body part assignments are sound.
2. Claims open (O) at first report develop much more than the closed (C) claims do. **Thus, the combination of L** and **O at first report better differentiates the LDF.**
3. Focus on the arrows on Figure 8a for TTLC and PPLC. Claims assigned to L for a particular body part, but which were closed (C) at first report, align more closely with the TT-N and PP-N LDF grouping. **Thus, by moving claims having the combination of L and C at first report into the N grouping further refines the LDF patterns.**

NCCI constructed various alternatives based upon the observations from Figure 8a. The combinations of injury type/part of body grouping (L or N)/claim status (O and C) were organized into new options in Figure 8b to compare with the "original" research proposal (refer to Equations 2.1 and 2.2).

2.5.4. How are the fatal and permanent total injury types treated?

Observe in Figure 8a that claims from the permanent total (PT) and fatal (Fa) injury types demonstrate unique loss development characteristics. That is, the L and N body part categories do not discern loss development patterns as it does in other injury types. The LDF behaves in the opposite manner (i.e., $L < N$ and $C > O$).

Research was conducted on the development patterns of fatal and PT claims. Because injury type

[2]NCCI later references the "likely" body parts as Part of Body Group A and the "not-likely" body parts as Part of Body Group B to differentiate the body part mapping assignments from the loss development groupings.

Figure 8a. This LDF analysis provides insight leading to the final loss development proposal. Each injury type is separated into four subcategories for policy years 1999 and 2000. (The LDFs are first—sixth report and first—fifth report, respectively.) The LDF patterns suggest further refinements could be made to better differentiate the LDFs.

Development 1st to x report (1:x) -- Limited Incurred Losses
Claims Locked at 1st

Injury Type Category	Description	Ind 1999 1:6	Ind 2000 1:5	Med 1999 1:6	Med 2000 1:5
TTLO	TT Likely Body Part, Open at 1st	1.680	1.670	1.268	1.277
TTLC	TT Likely Body Part, Closed at 1st	1.196	1.184	1.125	1.116
TTNO	TT Not Likely Body Part, Open at 1st	1.475	1.465	1.089	1.085
TTNC	TT Not Likely Body Part, Closed at 1st	1.140	1.124	1.085	1.074
TTL	TT Likely Body Part	1.577	1.569	1.235	1.241
TTN	TT Not Likely Body Part	1.378	1.370	1.088	1.082
PPLO	PP Likely Body Part, Open at 1st	1.483	1.494	1.252	1.266
PPLC	PP Likely Body Part, Closed at 1st	1.100	1.064	1.125	1.101
PPNO	PP Not Likely Body Part, Open at 1st	1.325	1.324	1.047	1.058
PPNC	PP Not Likely Body Part, Closed at 1st	1.068	1.061	1.071	1.063
PPL	PP Likely Body Part	1.425	1.428	1.237	1.246
PPN	PP Not Likely Body Part	1.270	1.268	1.052	1.059
MoLO	Mo Likely Body Part, Open at 1st	---	---	1.552	1.592
MoLC	Mo Likely Body Part, Closed at 1st	---	---	1.204	1.175
MoNO	Mo Not Likely Body Part, Open at 1st	---	---	1.188	1.265
MoNC	Mo Not Likely Body Part, Closed at 1st	---	---	1.111	1.118
MoL	Mo Likely Body Part	---	---	1.270	1.252
MoN	Mo Not Likely Body Part	---	---	1.120	1.135
FaLO	Fa Likely Body Part, Open at 1st	0.884	0.914	0.710	0.829
FaLC	Fa Likely Body Part, Closed at 1st	1.047	1.089	1.051	0.997
FaNO	Fa Not Likely Body Part, Open at 1st	0.948	0.933	0.847	0.994
FaNC	Fa Not Likely Body Part, Closed at 1st	1.018	0.999	1.095	1.018
FaL	Fa Likely Body Part	0.899	0.926	0.750	0.852
FaN	Fa Not Likely Body Part	0.953	0.937	0.875	0.996
PTLO	PT Likely Body Part, Open at 1st	0.895	0.900	0.942	0.966
PTLC	PT Likely Body Part, Closed at 1st	0.994	0.989	0.984	1.008
PTNO	PT Not Likely Body Part, Open at 1st	0.937	0.960	0.957	0.873
PTNC	PT Not Likely Body Part, Closed at 1st	1.015	0.981	1.048	0.985
PTL	PT Likely Body Part	0.904	0.906	0.944	0.967
PTN	PT Not Likely Body Part	0.949	0.962	0.967	0.882

Data: **Applies the single claim loss limitation at $500K**

Notes: **Injury Type Category = Injury Type + Body Part category + Claim Status at 1st**

Injury Types:
- **Fa = Fatal**
- **PT = Permanent Total**
- **PP = Permanent Partial**
- **TT = Temporary Total**
- **Mo = Medical Only**

Body Part Categories:
- **N = Not likely body part**
- **L = Likely body part**

Claim Status:
- **C = Closed at 1st**
- **O = Open at 1st**

Figure 8b. Option 1 demonstrates that more differentiation in LDF magnitude occurs when the likely and closed (LC) claims were removed from PP and TT and placed in the N grouping. This is seen by a comparison of Option 1 relative to the grouping labeled "Original" in the row above it. (Within Option 1, L = Fatal + PT + PPLO + TTLO.) Option 2 represents NCCI's final selection.

Analysis of Development Grouping Combinations:
Loss Development 1st to x report (1:x) -- Limited Incurred Losses
Claims Locked at 1st

Proposals	Devel. Category	Injury Type Categories Included	Ind 1999 1:6	Ind 2000 1:5	Med 1999 1:6	Med 2000 1:5
Original	Likely	Fa + PT + PPL + TTL	1.443	1.444	1.221	1.229
	Not Likely	All Other	1.459	1.454	1.105	1.106
Opt 1	Likely	Fa + PT + PPLO + TTLO	1.500	1.504	1.242	1.253
	Not Likely	All Other	1.409	1.402	1.107	1.106
Opt 2	Likely	Fa -Fa1 + PT + PPLO + TTLO	1.556	1.561	1.247	1.258
	Not Likely	All Other	1.375	1.369	1.105	1.105

Claims Not Locked
-- Includes Injury Type Crossover and Arisings on Subs

Proposals	Devel. Category	Injury Type Categories Included	Ind 1999 1:6	Ind 2000 1:5	Med 1999 1:6	Med 2000 1:5
Original	Likely	Fa + PT + PPL + TTL	1.694	1.678	1.394	1.384
	Not Likely	All Other	1.411	1.426	1.096	1.106
Opt 1	Likely	Fa + PT + PPLO + TTLO	1.771	1.757	1.426	1.419
	Not Likely	All Other	1.394	1.402	1.113	1.118
Opt 2	Likely	Fa -Fa1 + PT + PPLO + TTLO	1.832	1.826	1.426	1.421
	Not Likely	All Other	1.375	1.377	1.114	1.119

Notes: Injury Type Category = Injury Type + Body Part category + Claim Status at 1st

Injury Types:
Fa = Fatal
PT = Permanent Total
PP = Permanent Partial
TT = Temporary Total
Mo = Medical Only

Fa1 = Fatal at 1st
LO = Likely body part, open at 1st

Body Part Categories:
N = Not likely body part
L = Likely body part

Claim Status:
C = Closed at 1st
O = Open at 1st

Data: Applies the single claim loss limitation at $500K
Arising means claims emerging after first report.

"crossover" complicates the analysis, three subgroups of fatal and PT claims were created and the LDF observed (Figures 8c and 8d):

- Those claims which remained within the injury type across all report levels
- Those claims which moved into the fatal and PT injury types after initially being reported as another injury type at first report
- Those claims which migrated out of the injury type at later reports after initially being reported as fatal and PT at first report.

Figure 8c. Assuming the latest reported injury type is the best observation for fatal claims, NCCI observed the injury type of these same claims at first report. The injury type was observed at sixth report for PY 1999 claims. Conclusions #1 and #2 are based upon this analysis.

FATAL
PY 1999

Category at 1st	Category at 6th	Ind+Med Losses at 1st	Ind+Med Losses at 6th	Loss Development $$	Injury Type Development
Claims that stay within Injury Type					
FaLO	FaL	172,831,898	149,614,886	-23,217,012	-23,217,012
FaLC	FaL	18,522,409	19,393,256	870,847	870,847
FaNO	FaN	11,940,325	11,054,696	-885,629	-885,629
FaNC	FaN	1,101,646	1,140,701	39,055	39,055
Total: Fa to Fa		204,396,278	181,203,539	-23,192,739	**-23,192,739**
Claims which move into Injury Type					
PTLO	FaL	5,948,628	5,110,187	-838,441	5,110,187
TTLO	FaL	12,678,675	16,950,679	4,272,004	16,950,679
MoLO	FaL	213,376	1,369,657	1,156,281	1,369,657
PPLO	FaL	13,519,287	15,965,816	2,446,529	15,965,816
----	FaL	0	12,583,421	12,583,421	12,583,421
----	FaN	0	1,366,094	1,366,094	1,366,094
TTLC	FaL	339,998	520,788	180,790	520,788
MoLC	FaL	23,952	979,881	955,929	979,881
PPLC	FaL	265,121	226,770	-38,351	226,770
TTNO	FaN	1,265,655	1,498,696	233,041	1,498,696
MoNO	FaN	30,028	938,698	908,670	938,698
PPNO	FaN	1,321,388	2,025,430	704,042	2,025,430
TTNC	FaN	37,411	55,284	17,873	55,284
MoNC	FaN	6,722	38,582	31,860	38,582
PPNC	FaN	53,961	71,656	17,695	71,656
Total: Other Types to Fa		35,704,202	59,701,639	23,997,437	**59,701,639**
Other LO to Fa		32,359,966	39,396,339	7,036,373	39,396,339
Arising to Fa		0	13,949,515	13,949,515	13,949,515
All other to Fa		3,344,236	6,355,785	3,011,549	6,355,785
Claims which move out of Injury Type					
FaLO	PTL	597,761	954,391	356,630	-597,761
FaLO	TTL	3,373,971	3,034,733	-339,238	-3,373,971
FaLO	MoL	254,232	32,821	-221,411	-254,232
FaLO	PPL	208,664	205,713	-2,951	-208,664
FaLC	PTL	2,888	2,888	0	-2,888
FaLC	TTL	33,168	58,565	25,397	-33,168
FaLC	MoL	21,257	1,255	-20,002	-21,257
FaNO	TTN	383,884	403,289	19,405	-383,884
FaNO	MoN	6,500	0	-6,500	-6,500
FaNO	PPN	183,853	155,381	-28,472	-183,853
FaNC	TTN	18,617	22,089	3,472	-18,617
FaNC	PPN	5,650	8,364	2,714	-5,650
Total: Fa to Other Types		5,090,445	4,879,489	-210,956	-5,090,445

Injury Type Development: Claims "Locked Down"

	204,396,278	181,203,539		
	5,090,445	4,879,489	Difference	LDF
Total	**209,486,723**	**186,083,028**	**-23,403,695**	**0.888**

Injury Type Development: Allow Cross Over

	204,396,278	181,203,539		
	5,090,445	59,701,639	Difference	LDF
Total	**209,486,723**	**240,905,178**	**31,418,454**	**1.150**

Notes: Injury Type Category = Injury Type + Body Part category + Claim Status at 1st

Injury Types:
- Fa = Fatal
- PT = Permanent Total
- PP = Permanent Partial
- TT = Temporary Total
- Mo = Medical Only

LO = Likely body part, open at 1st

Body Part Categories:
- N = Not likely body part
- L = Likely body part

Claim Status:
- C = Closed at 1st
- O = Open at 1st

Data: Applies the single claim loss limitation at $500K
Arising means claims emerging for the first time beyond first report.

Figure 8d. The *third observation* is an overwhelming number of PT claims (at sixth report), which were reported initially as other injury types at first report, developed significantly upward by $754M from first through sixth report (see gray row within middle section of Figure 8d).

PERMANENT TOTAL
PY 1999

Category at 1st	Category at 6th	Ind+Med at 1st	Ind+Med at 6th	Ind+Med Development	Injury Type Development
Claims that stay within Injury Type					
PTLO	PTL	83,291,688	81,330,910	-1,960,778	-1,960,778
PTLC	PTL	7,474,144	7,494,083	19,939	19,939
PTNO	PTN	24,646,111	24,954,711	308,600	308,600
PTNC	PTN	4,647,731	4,751,566	103,835	103,835
Total: PT to PT		120,059,674	118,531,270	-1,528,404	**-1,528,404**
Claims which move into Injury Type					
FaLO	PTL	597,761	954,391	356,630	954,391
TTLO	PTL	58,296,074	180,949,875	122,653,801	180,949,875
MoLO	PTL	1,350,219	12,210,680	10,860,461	12,210,680
PPLO	PTL	90,115,408	271,054,396	180,938,988	271,054,396
----	PTL	0	38,971,217	38,971,217	38,971,217
----	PTN	0	17,518,210	17,518,210	17,518,210
FaLC	PTL	2,888	2,888	0	2,888
TTLC	PTL	779,756	4,115,315	3,335,559	4,115,315
MoLC	PTL	50,962	6,193,259	6,142,297	6,193,259
PPLC	PTL	503,709	3,619,431	3,115,722	3,619,431
TTNO	PTN	27,315,144	94,919,491	67,604,347	94,919,491
MoNO	PTN	218,603	4,241,846	4,023,243	4,241,846
PPNO	PTN	35,247,948	111,113,846	75,865,898	111,113,846
TTNC	PTN	452,656	2,778,277	2,325,621	2,778,277
MoNC	PTN	38,566	2,329,502	2,290,936	2,329,502
PPNC	PTN	679,326	3,250,047	2,570,721	3,250,047
Total: Other Types to PT		215,649,020	754,222,671	538,573,651	**754,222,671**
Other LO to PT		150,359,462	465,169,342	314,809,880	465,169,342
Arising to PT		0	56,489,427	56,489,427	56,489,427
All other to PT		65,289,558	232,563,902	167,274,344	232,563,902
Claims which move out of Injury Type					
PTLO	FaL	5,948,628	5,110,187	-838,441	-5,948,628
PTLO	TTL	4,953,081	3,961,440	-991,641	-4,953,081
PTLO	MoL	1,363,527	27,013	-1,336,514	-1,363,527
PTLO	PPL	16,564,439	12,898,826	-3,665,613	-16,564,439
PTLC	TTL	336,156	193,243	-142,913	-336,156
PTLC	MoL	5,760	5,756	-4	-5,760
PTLC	PPL	237,237	278,250	41,013	-237,237
PTNO	TTN	2,660,188	2,452,291	-207,897	-2,660,188
PTNO	MoN	155,104	51,436	-103,668	-155,104
PTNO	PPN	7,046,099	5,241,309	-1,804,790	-7,046,099
PTNC	TTN	187,636	201,725	14,089	-187,636
PTNC	MoN	9,936	7,836	-2,100	-9,936
PTNC	PPN	19,788	44,490	24,702	-19,788
Total: PT to Other Types		39,487,579	30,473,802	-9,013,777	-39,487,579

Injury Type Development: Claims "Locked Down"

	120,059,674	118,531,270		
	39,487,579	30,473,802	Difference	LDF
Total	**159,547,253**	**149,005,072**	**-10,542,181**	**0.934**

Injury Type Development: Allow Cross Over

	120,059,674	118,531,270		
	39,487,579	754,222,671	Difference	LDF
Total	**159,547,253**	**872,753,941**	**713,206,688**	**5.470**

Notes: Injury Type Category = Injury Type + Body Part category + Claim Status at 1st

Injury Types:
- Fa = Fatal
- PT = Permanent Total
- PP = Permanent Partial
- TT = Temporary Total
- Mo = Medical Only

LO = Likely body part, open at 1st

Body Part Categories:
- N = Not likely body part
- L = Likely body part

Claim Status:
- C = Closed at 1st
- O = Open at 1st

Data: Applies the single claim loss limitation at $500K
Arising means claims emerging for the first time beyond first report.

Three observations follow from these injury type "crossover" analyses.

First observation: Fatal claims at sixth report, which were reported initially as a fatality at first report, distinctly developed downward from first through sixth report (see top section of Figure 8c).

Conclusion #1: **Move fatal claims at first report into the N grouping, and no longer assign them as likely-to-develop.**

Reasoning: There is no need for carriers to estimate medical case reserves since the injured worker has died. The dependents receive indemnity benefits, defined as streams of payments over time in most states, and in a few states they also receive a predetermined burial allowance.

Second observation: Claims which become fatalities at subsequent reports (second through sixth) developed significantly upward by about $60M after first report (see middle section of Figure 8c).

Conclusion #2: **Claims which become fatalities at second and subsequent reports will be categorized in the L grouping.**

Reasoning: A claimant's condition deteriorates to the point where the injured worker dies, and fatal benefits are paid out. Large amounts of upward loss development dollars are observed, and it is often in the medical component.

Figure 8b, Option 2 demonstrates that a greater differentiation in LDF magnitude occurs, particularly for indemnity, when the fatal claims at first report were removed from the L grouping and placed in the N grouping. This is seen by comparing Option 2 to the groupings labeled 'Original' and 'Option 1' in the rows above it.

Conclusion #3: **Categorize all PT claims into the L grouping for all reports.**

Reasoning: Many PT claims were initially reported as another injury type, and conditions deteriorated to the point where the injured worker became permanently totally disabled. On Figure 8d, large amounts of upward loss development are observed.

Option 2 at the bottom of Figure 8b represents the selected final L grouping, which excludes fatalities at first report, includes all PT claims, and includes only likely-to-develop, open claims for PP and TT. The equation is:

$$L = \text{Fatal} - \text{Fatal@1st} + \text{PT} + \text{PPLO} + \text{TTLO}. \quad (2.5)$$

Finally, NCCI decided to keep all medical-only (MO) claims in the N grouping for two reasons: (a) less than 1% of all MO losses would shift to likely, and (b) some carriers report their entire inventory of MO claims as closed claims when reporting WCSP data to NCCI, which would be problematic.

2.5.5. The class ratemaking tail factor: Prior methodology

The tail factor in workers compensation presents a formidable challenge to NCCI actuaries. In aggregate ratemaking, in order to determine a state's overall indicated loss cost/rate level change, a tail factor is estimated separately for indemnity and medical, and then attached currently at a 19th report. NCCI financial call data is used as the source data to a 19th report. However, only five reports of the WCSP data, the source data for class ratemaking, were required to be reported to NCCI by its affiliated carriers.

In the prior NCCI class ratemaking methodology, the financial tail factor was the starting point for the class ratemaking tail factor. NCCI assumed that 100% of loss development beyond the fifth report was due to development on serious claims, and 0% due to development on non-serious claims. Figure 2 shows how a class fifth—ultimate LDF was computed from the state financial data fifth—ultimate LDF, referred to below as Fin5U. The following formula was used for indemnity losses to determine the class ratemaking fifth—ultimate LDF, referred to as Class $5U_I$. It was applied to serious losses at fifth report.

$$\text{Class } 5U_I = \frac{\left[\begin{array}{l}\text{SER\$}_I + \left(\text{SER\$}_I + \text{NS\$}_I\right) \\ * \left(\text{Fin5U}_I - 1.000\right)\end{array}\right]}{\text{SER\$}_I} \quad (2.6)$$

where

Class $5U_I$ = Unlimited fifth–ultimate indemnity (I) tail factor applied to serious losses at

fifth report. No tail is applied to non-serious losses;

$Fin\ 5U_I$ = Unlimited statewide financial data fifth–ultimate LDF for indemnity (I); and

$SER\$_I$ = two years of unlimited "paid+case" serious indemnity loss dollars on-leveled and developed to fifth report for the state.

$NS\$_I$ = two years of unlimited "paid+case" non-serious indemnity loss dollars on-leveled and developed to fifth report for the state

The same approach was also used to determine a fifth—ultimate tail factor for medical losses, but is not shown here. Only the subscript would change from (I) to (M).

By rearranging the formula, the following is derived:

$$\text{Class } 5U_{\text{I}} = \text{Fin } 5U_{\text{I}} + \left[\begin{array}{c}\left(\text{NS\$}_{\text{I}}/\text{SER\$}_{\text{I}}\right) \\ *\left(\text{Fin } 5U_{\text{I}} - 1.000\right)\end{array}\right]. \quad (2.7)$$

Formula (2.7) illustrates that the prior class tail factor was highly leveraged to the relative share of non-serious to serious loss dollars as determined by the critical value. The lower the statewide share of serious losses, the higher the prior class ratemaking tail factor became. By eliminating the critical value, and thus the serious and non-serious distinction, the new class ratemaking loss development methodology reduces this highly leveraged tail factor phenomenon.

2.5.6. The class ratemaking tail factor: New methodology

The tail factor under the new methodology uses analogous notation except the serious and non-serious groupings are replaced by likely-to-develop (L) and the not-likely-to-develop (N). Furthermore, the prior methodology assumed that all loss development in the tail beyond fifth report was due to serious claims only, which implied that 100% of the tail loss dollars were applied to serious and 0% applied to non-serious. NCCI is modifying this assumption so that a percentage of tail development, y, will be applied to the N grouping dollars of loss and (1-y) will be applied to the L grouping dollars of loss. This allows a portion of tail development to be applied to the not-likely-to-develop losses. Thus, two new class ratemaking tail factors are applied at the ***t***th report, one for L and one for N.

The new methodology tail factor formulas may be written in a general form to account for the various tail attachment points and the new assumptions as follows:

$$\text{Class } tU_{\text{L,I}} = \frac{\left[\begin{array}{c}\text{L\$}_{\text{I}} + (1-\text{y}) * \left(\text{L\$}_{\text{I}} + \text{N\$}_{\text{I}}\right) \\ *\left(\text{Fin } tU_{\text{I}} - 1.000\right)\end{array}\right]}{\text{L\$}_{\text{I}}}, \quad (2.8)$$

and

$$\text{Class } tU_{\text{N,I}} = \frac{\left[\begin{array}{c}\text{N\$}_{\text{I}} + \text{y} * \left(\text{L\$}_{\text{I}} + \text{N\$}_{\text{I}}\right) \\ *\left(\text{Fin } tU_{\text{I}} - 1.000\right)\end{array}\right]}{\text{N\$}_{\text{I}}} \quad (2.9)$$

where,

t = time t representing the report level of WCSP data at which the attachment point for the class ratemaking tail is applied, t = 5, ... , 10;

$L\$_I$ = two latest years of limited (at $500K) likely-to-develop "paid+case" indemnity loss dollars on-leveled and developed to tth report for the state;

$N\$_I$ = two latest years of limited (at $500K) not-likely-to-develop "paid+case" indemnity loss dollars on-leveled and developed to tth report for the state;

$Class\ tU_{L,I}$ = a likely-to-develop tth–ultimate indemnity (I) tail factor applied to likely-to-develop losses at tth report for each class code. It is limited at aggregate state threshold T;

$Class\ tU_{N,I}$ = a not-likely-to-develop tth–ultimate indemnity (I) tail factor applied to not-likely-to-develop losses at tth report for each class code. It is limited at aggregate state threshold T.

$Fin\ tU_I$ = limited (at T) aggregate statewide financial data tth–ultimate LDF for indemnity (I); and

$\boldsymbol{y}$ = percentage between 0% and 100% used to allocate a portion of tail development dollars to the not-likely-to-develop grouping.

Note all claims are limited at $500K at all report levels up to the tail attachment point under the new methodology. The $\boldsymbol{Fin\ 5U_i}$ LDF were unlimited under the prior methodology, but are capped at the state aggregate threshold T under the new methodology. The same approach is used to determine a *t*th—ultimate tail factor for medical losses, but is not shown here. Only the subscript would change from (I) to (M) within the formulas above.

Based on research observing actual WCSP loss development patterns through seventh report, NCCI is initially using a value of 20% for $\boldsymbol{y}$ for both indemnity and medical for all tail attachment points out to tenth report. Thus, 80% of the total dollars of tail development will be assigned to the likely-to-develop loss triangle, and 20% of the dollars assigned to the not-likely triangle.

From an analysis of several states, the pro-rata loss share for L and N is much closer to 50% each than was the share of losses for serious and non-serious. This reduces the leverage on the class tail factor and produces more tail stability from year to year.

The tail factor is an area that warrants continued research. Possible future enhancements are that *y* could vary between indemnity and medical or *y* could vary as the tail attachment moves out toward tenth report. For example, at fifth report, **y** may be a higher percentage than what **y** would be at tenth report.

2.5.7. Summary of the new loss development proposal

Under NCCI's new loss development methodology, claim dollars are assigned to one of the following four development categories for each state:

- Medical—Likely-to-Develop
- Medical—Not-Likely-to-Develop
- Indemnity—Likely-to-Develop
- Indemnity—Not-Likely-to-Develop.

This assignment is a function of three claim characteristics: (1) injury type, (2) part of body, and (3) claim status (open vs. closed). NCCI also modified the loss development methodology from fifth-ultimate. Table 1 summarizes the combinations of claim characteristics used to assign claims to their appropriate groups. It introduces the terminology Part of Body (POB) Group A and Group B to refer to the mapping of body parts to the likely-to-develop (L) and the not-likely-to-develop groupings (N), respectively. Group A consists of claims having a greater potential to develop upward over time such as injuries to the back, head, lungs, heart, shoulders, trunk, and multiple body parts. Group B consists of the others.

Table 1 illustrates the claim status (open vs. closed) and body part, each evaluated at first report, which is used for the purpose of determining the development category. Not all claims are "locked in" their development grouping, however. At subsequent reports (second through tenth), changes in injury type are monitored for the purpose of potentially reassigning a few claims to a different development grouping.

For claims in which there is no first report, but that are reported at second report or subsequent, they will be assumed to be open at first report for the purpose of development category assignment. **The body part and claim status are based upon the initial report submitted to NCCI, while the injury type is monitored at all reports for appropriate grouping determination.**

The new loss development methodology will significantly reduce, but not completely eliminate, instances of crossover from one development grouping to the other. The following list provides common examples of how crossover may occur under the new methodology in certain injury types:

- Medical Only (MO)—MO claims in POB Group A, open at first report, which migrate to another injury type at a later report, will move from N to L.
- Temporary Total (TT) or Permanent Partial (PP)—Crossover can occur on TT or PP claims, originally categorized in the N grouping, which evolve into a PT or fatality at a later report.

Table 1. Claim characteristics underlying loss development groupings

Injury Type	Claim Status	Part of Body	LDF Grouping
1st Report			
Fatal	Open	Group A	Not Likely
	Open	Group B	Not Likely
	Closed	Group A	Not Likely
	Closed	Group B	Not Likely
Permanent Total (PT)	Open	Group A	Likely
	Open	Group B	Likely
	Closed	Group A	Likely
	Closed	Group B	Likely
Permanent Partial (PPD)	Open	Group A	Likely
	Open	Group B	Not Likely
	Closed	Group A	Not Likely
	Closed	Group B	Not Likely
Temporary Total (TT)	Open	Group A	Likely
	Open	Group B	Not Likely
	Closed	Group A	Not Likely
	Closed	Group B	Not Likely
Medical Only (MO)	Open	Group A	Not Likely
	Open	Group B	Not Likely
	Closed	Group A	Not Likely
	Closed	Group B	Not Likely

Exhibits 2–4 in the Appendix illustrate loss triangles and the class tail calculation using the new loss development methodology.

2.5.8. Advantages and disadvantages of the new loss development groupings

The most important advantage the new loss development methodology provides is more predictive and stable loss development factors. Expanding the triangles out to tenth report also improves the predictive ability. Most crossover has been mitigated due to the elimination of the critical value, and the new data element combination of body part, injury type, and claim status has improved the LDF groupings. Most importantly, class equity improves as the class codes with more head, back, trunk, multiple body, etc. injuries will have higher loss costs than class codes with less complex injuries, all else equal. Class loss costs become more equitable.

The use of injured body part in conjunction with the open and closed claim status is a logical combination that most regulators, actuaries, and non-actuaries should readily understand.

The only disadvantage the new methodology has is that as claims evolve over time and change injury types, a small amount of dollar crossover from one grouping to another occurs. Certain changes in the reported injury type for a given claim are a natural progression in workers compensation that NCCI chooses to reflect within the new loss development structure.

2.6. Loss limits, expected excess, and the new hazard group mapping

The prior class ratemaking methodology limited large claims for a class code at a loss limit equal to five times the state's serious average cost per case. For NCCI states, these limits ranged from $300,000

to about $1.1M during the 2006 filing season. A multi-claim occurrence was capped at twice the single claim limit. The excess dollars removed from the individual class codes were distributed to the industry group to which the class code belonged. This was done by deriving an unlimited-to-limited ratio for each industry group within the industry group differential calculations. Summarizing, the prior class ratemaking methodology limited large claims on a class code level, but unlimited loss dollars were used in deriving loss development factors and industry group differentials.

The most noteworthy changes in the new class ratemaking methodology are:

1. Standardizing the single claim loss limit for class codes to be $500,000 in each state (and the multi-claim occurrence limit is now three times the single claim limit).
2. Basing loss development factors on claims limited at $500,000.
3. Applying a multiplicative factor to estimate the expected losses in excess of $500,000 using excess ratios from the new seven hazard group mapping (Corro and Engl 2006 and Robertson 2009).
4. Removing the unlimited-to-limited ratio from the class code conversion factors and from the industry group differential calculations, and replacing it with expected excess dollars summed across all class codes within each industry group.
5. Computing the indicated losses within each industry group is the sum of the limited ultimate losses and the excess dollars referenced in step (4).

Limited loss amounts for claims above the threshold are allocated to indemnity and medical in the proportion that their values contribute to the total unlimited value of the claim.

2.6.1. Application of the excess ratios

Excess losses are defined as the sum of the excess portion of claims above a given per claim threshold. NCCI produces excess ratios with each loss cost or rate filing. NCCI redefined its excess ratios in 2004 to exclude the cost of events $50M or greater, the new catastrophic event threshold. For a detailed discussion of the methodology underlying NCCI excess ratios, see Engl and Corro (2006).

The excess ratio, XS_T, for a given threshold T, T < $50M, is defined as

$$XS_T = \frac{\text{Expected Excess Losses Between Threshold } T \text{ and \$50M}}{\text{Expected Total Losses Below \$50M}} \qquad (2.10)$$

The ratio of excess losses to total losses is at an ultimate value. In class ratemaking, excess ratios are applied to calculate full value ultimate losses from limited ultimate losses. The threshold T for capping claims in every class code is currently $500,000, uniform in all states. The actual excess dollars greater than $500,000 are removed from class ratemaking.

The excess ratio applied is on a per-claim basis and varies by state and hazard group. This differs from an excess loss factor as excess loss factors are on a per-occurrence basis, and also may include a provision for expenses.

The adjusted, per-claim excess ratio is applied as a factor, $1/(1 - XS_{500K})$, to a class code's limited (@500K) ultimate losses that have been developed, on-leveled, and trended to the midpoint of the proposed filing effective period. Similarly, the excess ratio applied has also been trended to the midpoint of the proposed filing effective period.

NCCI uses five policy periods as the experience period for each class code. For each policy period, the same factor $1/(1 - XS_{500K})$ is applied to both indemnity and medical losses, since the size-of-loss distributions for excess ratios are on a combined indemnity and medical basis.

In 2006, NCCI completed an analysis of country-wide excess ratios by class code, and a new mapping of class codes to seven hazard groups was implemented (previously there were four). The seven hazard groups range from A to G. Class codes having the highest excess ratios were mapped to G, considered the most hazardous classes. Class codes having the lowest excess ratios were mapped to A, considered

the least hazardous classes. See Robertson (2009) for more detail.

Excess ratios for all seven hazard groups are updated annually for every state. The allocation of expected excess dollars to class codes by hazard group is an excellent refinement in the new class ratemaking because

- Expected excess provisions are more stable from year to year than the prior unlimited-to-limited ratio approach, which was based upon five years of actual large loss amounts.
- Excess losses are distributed to class code more equitably via hazard group than industry group.

2.6.2. Simulation and expected excess

Results from 16 different potential capping and excess-spreading alternatives were explored using a Monte Carlo simulation technique. Figure 9 illustrates all of the options considered and analyzed.

Figure 9. Alternatives for limiting losses and allocating excess. Certain alternatives allocated expected excess to classes while others allocated actual excess dollars. The alternatives tested capped individual claims at three different loss limits: $300K, $500K, and $1.0M. One alternative used unlimited losses. NCCI selected Alternative 11, using the $500,000 limit for the new class ratemaking.

Alt k =	Class Loss Limit	Using Actual Excess
0	Unlimited	
1	$1M	Allocates Actual IG Excess Uniformly by Class Within the IG
2	$300k	Allocates Actual IG Excess Uniformly by Class Within the IG
3	$300k	Allocates Actual HG Excess Uniformly by Class Within the HG
4	$300k	Same as k=3 with factor to balance to IG Unlimited Losses
5	$300k	Allocates Actual IG Excess by Class Within IG Using Limited Losses x [XS / (1-XS)]
6	$300k	Allocates HG Actual Excess by Class Within HG Using Limited Losses x [XS / (1-XS)]
7	$300k	Allocates Actual State Excess by Class Using Limited Losses x [XS / (1-XS)]

Alt k =	Limit	Using Actual Excess
8	$300k	Allocates Actual IG Excess by Class Within IG Using Unlimited Losses x XS
9	$300k	Allocates Actual HG Excess by Class Within HG Using Unlimited Losses x XS
10	$300k	Allocates Actual State Excess by Class Using Unlimited Losses x XS
13	Vary by Class* $100k, $300k, $1M	Allocates Actual State Excess by Class Using Unlimited Losses x XS

Alt k =	Limit	Using Expected Excess
11	$300k	Limited Actual Losses x 1 / (1- XS)
12	$300k	Limited Losses + [XS x Unlimited Expected Losses (i.e. Mu)]
14	Vary by Class* $100k, $300k, $1M	Limited Actual Losses x 1 / (1- XS)
15	Vary by Class* $100k, $300k, $1M	Limited Losses + [XS x Unlimited Expected Losses (i.e. Mu)]

Legend: IG - Industry Group
HG - Hazard Group
XS - per claim adjusted excess ratio at class loss limit; 0 <= XS <= 1.0; XS varies by HG and limit

Note: Alt 3 and Alt 6 are equivalent
* Alts 13 - 15 proposed three loss limits: $100K for small classes, $300K for medium classes & $1M for large classes.

The simulation approach of testing the alternatives was completed as follows:

1. Five years of simulated losses were produced for every class code in two large states and two small states.
2. The claim counts were based on actual national incidence rates for the class code. A Poisson distribution was assumed with lambda equal to the national incidence rate by injury type multiplied by the actual payroll for the class in each state.
3. The excess loss distributions by injury type by state (Corro and Engl 2006) were used for determining the average cost per case. In determining the state distributions, each class was scaled to the state's average cost per case adjusted for hazard group.
4. One hundred different simulation trials by class code were produced. Each simulation generates five years of unlimited loss data for the given class.
5. The simulated claims' loss data was then modified by the specific capping and excess spreading alternative in Figure 9 to provide modified expected unlimited losses.
6. The performance of each alternative was assessed using four metrics. Two of the metrics measured loss cost adequacy and two measured loss cost stability across the 100 simulation trials.

The following four metrics were used to assess the success of the various alternatives for limiting claims and allocating the excess loss.

Adequacy Metric 1: Desired range [–0.25, +0.25]

$$\frac{\bar{L}^{(k)} - \mu}{\mu} \tag{2.11}$$

where

L_n = 5 years of simulated losses for the nth trial whereby n = [1, 2, ... , 100],

$L_n^{(k)}$ = 5 years of simulated losses for the nth trial whereby the losses were capped as in alternative k for limiting losses and allocating the excess (see Figure 9 for alternatives),

μ = hypothetical mean mu, the expected losses for a class code based on simulated frequency and actual severity times actual class payroll for that state, and

$\bar{L}^{(k)}$ = the average losses for a specific class code over N simulations for alternative k.

Mathematically, it equals:

$$\bar{L}^{(k)} = \left(\sum_{n=1}^{N} L_n^{(k)}\right) \Big/ N \tag{2.12}$$

Adequacy Metric 2: Desired range [0, +0.50]

$$= \sum_{n=1}^{N} \left| L_n^{(k)} - u \right| \Big/ 100u \tag{2.13}$$

This metric differs from the first in that the high and low values cannot cancel out due to the absolute value.

Stability Metric 1: Desired range [0, +0.10]

$$CV_c^{(k)} = \frac{\text{standard deviation}}{\text{mean}} = \frac{\sqrt{\dfrac{\sum_{n=1}^{N} \left(L_{n,c}^{(k)} - \bar{L}_c^{(k)}\right)^2}{N}}}{\bar{L}_c^{(k)}} \tag{2.14}$$

where

$CV_c^{(k)}$ = the coefficient of variation for class code c under alternative k,

$L_{n,c}^{(k)}$ = 5 years of simulated losses for the nth trial for class c whereby the losses were capped as in alternative k, and

$\bar{L}_c^{(k)}$ = average of simulated losses for alternative k over all simulations.

Stability metric 1 is the coefficient of variation for a specific class under the conditions of alternative k.

Stability Metric 2: Desired range [0, +0.50]

$$\frac{\sum_{n,m} \dfrac{\left| L_{n,c}^{(k)} - L_{m,c}^{(k)} \right|}{u_c}}{N(N-1)} \tag{2.15}$$

where

$L^{(k)}_{n,c}$ = 5 years of simulated losses for the nth trial for class c whereby the losses were capped as in alternative k,

$L^{(k)}_{m,c}$ = 5 years of simulated losses for the mth trial for class c whereby the losses were capped as in alternative k, and

μ_c = hypothetical mean expected losses for a class code based on simulated frequency and actual severity times actual class payroll for that state.

For the performance measurement of stability metric 2, the average absolute change in losses for a class is computed across all combinations of the 100 simulations for each alternative k.

2.6.3. Choosing the final alternative for capping claims and allocating excess losses

Figure 10 provides two illustrative examples of the type of exhibits that were generated and observed for all four of the metrics for each state. Several statistics were analyzed, such as minimum and maximum values, the classes which comprised these outliers, and various different percentile levels such as the 90th, 10th, and the median. It was noted which alternatives were succeeding the most and which ones were not. Outlier classes were sometimes reviewed, and often a class that performed poorly contained little data. Typically, the outlier class had no losses for almost all of the simulation trials. This is a real-life challenge that the various class credibility formulae attempt to address.

The final two loss limits NCCI considered were $300,000 and $500,000. The $1M loss limit was eliminated based on class stability considerations and it would have increased the loss limit significantly in most states. The expected excess factors observed at $300,000 were very large upon reviewing the results of indicated pure premiums by class code in states with high excess ratios. This made $300,000 a less attractive choice.

The choice of the $500,000 limit provides a nice balance between allowing a significant amount of actual loss experience of the class code into the pure premium calculation combined with less reliance on the expected excess provision. For most states, it is significantly lower than the loss limit used in the prior methodology—five times the state serious average cost per case (SACC). NCCI observed that the 95th percentile of all countrywide large claims over a five year period was 2.5 times the SACC, one-half of the prior methodology's loss limitation. $500,000 was selected after trending that value forward to the implementation date in 2009 and further consideration that the loss limit coincides with the limit on the NCCI Large Loss Call #31. The loss limit may

Figure 10a. Alternative k = 0, which uses unlimited losses, performs most poorly as measured by the stability metric 1. Alternatives 11 and 12, which use expected excess, perform the best.

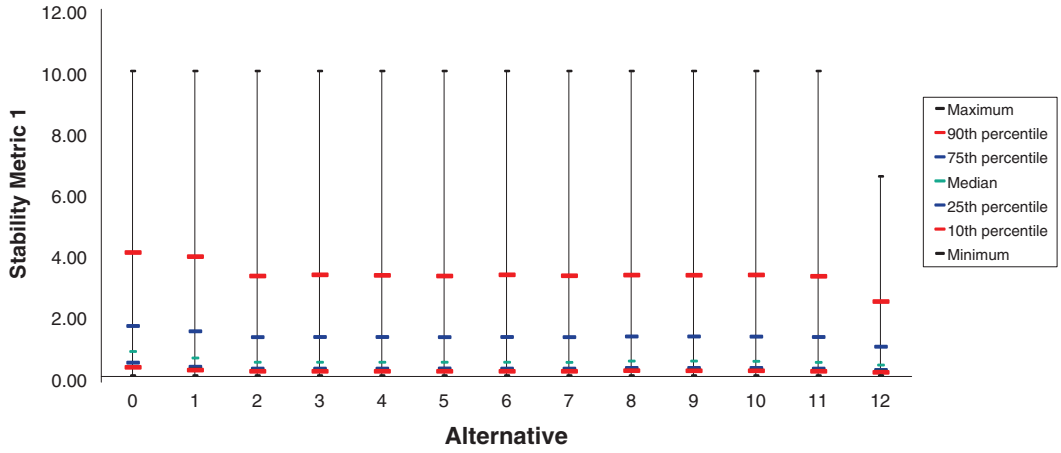
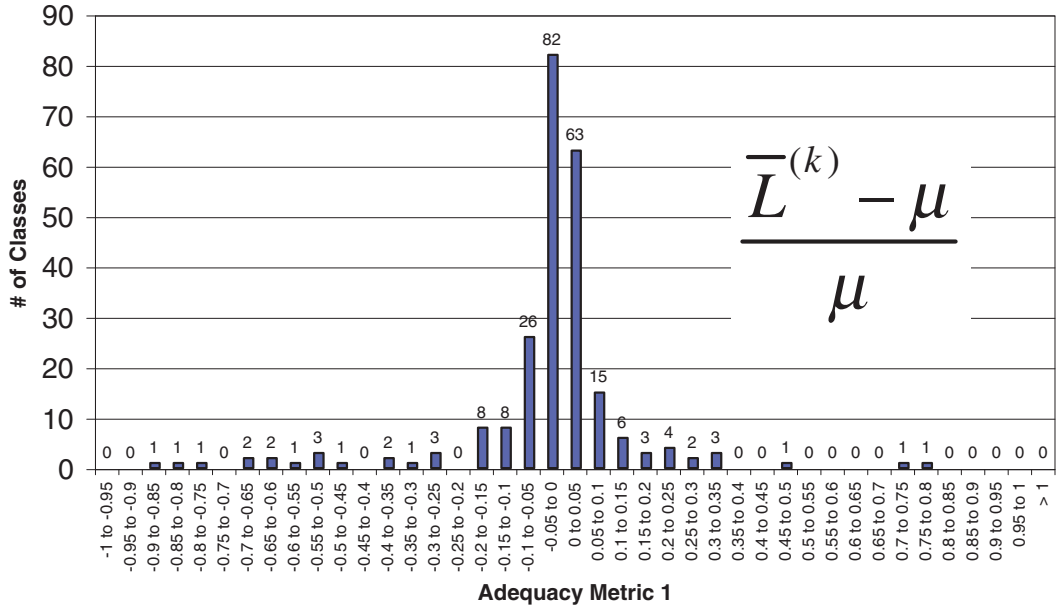


Figure 10b. This illustrates another exhibit produced for each alternative quantifying how many classes were changing within an industry group and by how much. This shows a drill down on Alternative 12 for adequacy metric 1 using a $300K limit.



desired range (-.25, 0, .25)

min	-0.864
unweighted average	-0.031
weighted average	-0.007
max	0.766

be updated for inflation periodically after observing results of the new methodology.

After reviewing the indicated pure premiums derived under the best performing alternatives for several states, Alternative 11 was selected by NCCI for allocating excess losses (over $500K) to classes because

1. Alternative 11 performed exceptionally well on the four metrics;
2. The use of the multiplicative excess factor, $1/(1 - XS_{500K})$, is consistent with the methodology used for determining the overall statewide indicated loss cost change;
3. Given two class codes of similar size within the same hazard group and state, the class with greater primary losses would receive a greater proportional share of excess losses under alternative 11;
4. After application of the 3-way pure premium credibility procedure, alternative 11 produced comparable results to the other leading alternatives.

2.6.4. Transfer of excess loss dollars from indemnity to medical

As varying amounts of credibility are assigned separately for indemnity and medical pure premiums in the new class ratemaking methodology, a refinement is made to account for the fact that the majority of excess loss in workers compensation is due to the medical component. Because the excess ratios are produced on a combined indemnity and medical basis, the indemnity and medical distribution of excess losses, when calculated under Alternative 11, is equivalent to the primary split of indemnity and medical losses for every class code. Figure 11 was prepared to determine if this was appropriate.

For each class code, NCCI initially applies the factor $1/(1 - XS_{500K})$ to indemnity and medical primary (below $500,000) losses separately to compute the correct total excess dollar amount. Secondly, 40% of the total excess dollars produced within the indemnity pure premium component are transferred to the

Figure 11. This analysis shows the indemnity and medical case incurred splits of the primary and excess dollars for 20,000 claims greater than $500,000. The approximate split of the excess dollars is 71.5% medical while the primary medical dollar split is 53%. Similar results were derived using WCSP data. As a result, NCCI decided to transfer 40% of indemnity excess dollars to the medical component.

PY	Primary		Excess		Excess Split		Claim
	Indemnity	Medical	Indemnity	Medical	Ind.	Med.	Count
Prior	169,816,166	139,683,834	70,279,751	182,840,412	27.8%	72.2%	619
1982	13,995,376	14,004,624	8,619,005	13,163,124	39.6%	60.4%	56
1983	62,784,206	65,715,794	39,612,997	119,661,433	24.9%	75.1%	257
1984	174,613,643	172,386,357	124,779,440	258,040,159	32.6%	67.4%	694
1985	189,175,924	179,824,076	127,426,362	269,832,016	32.1%	67.9%	738
1986	231,461,635	228,538,365	139,680,186	284,920,944	32.9%	67.1%	920
1987	251,592,143	251,907,857	164,604,780	340,891,816	32.6%	67.4%	1,007
1988	266,459,073	290,040,927	183,851,067	409,875,986	31.0%	69.0%	1,113
1989	263,077,846	281,922,154	177,611,338	370,323,060	32.4%	67.6%	1,090
1990	250,790,173	284,709,827	155,166,315	386,803,697	28.6%	71.4%	1,071
1991	211,153,813	258,346,187	126,792,831	374,456,842	25.3%	74.7%	939
1992	213,866,898	244,633,102	120,914,845	331,330,704	26.7%	73.3%	917
1993	177,959,200	215,040,800	112,139,690	298,596,771	27.3%	72.7%	786
1994	178,857,458	212,142,542	108,183,294	324,031,769	25.0%	75.0%	782
1995	166,982,566	223,017,434	101,467,025	308,899,713	24.7%	75.3%	780
1996	211,737,505	248,762,495	128,285,636	313,703,083	29.0%	71.0%	921
1997	235,761,313	279,738,687	148,148,864	430,926,448	25.6%	74.4%	1,031
1998	270,545,487	311,954,513	174,634,718	435,518,901	28.6%	71.4%	1,165
1999	279,735,890	312,764,110	183,062,743	429,648,973	29.9%	70.1%	1,185
2000	282,319,912	306,680,088	181,576,108	365,938,213	33.2%	66.8%	1,178
2001	244,889,269	281,610,731	161,786,219	410,967,203	28.2%	71.8%	1,053
2002	177,579,023	249,920,977	129,992,203	404,432,908	24.3%	75.7%	855
2003	133,019,301	215,480,699	112,305,448	425,846,975	20.9%	79.1%	697
2004	56,015,676	79,484,324	44,337,439	111,049,945	28.5%	71.5%	271
Total	4,714,189,497	5,348,310,503	3,025,258,303	7,601,701,096	28.5%	71.5%	20,125
Primary Split:	47%	53%					

Note: Claims < $500,000 are excluded from the analysis.
Primary represents claim dollars less than or equal to $500,000.
Excess represents claim dollars greater than $500,000.

medical pure premium component for each class. The reasons for transferring 40% of the indemnity excess dollars to the medical component are:

- More excess dollars are justifiably allocated to medical.
- It preserves state and class differences as it is a function of the actual primary indemnity and medical split.
- It achieves the desired higher proportion of medical excess (i.e., close to the 70% figure across all states combined).
- It prevents a medical excess provision percentage from being less than the medical primary provision percentage for any class or state.

2.6.5. Implications on the industry group (IG) differential methodology

NCCI is maintaining its IG differential methodology, which is very similar to how it was done under the prior methodology. The value that the IG differential calculation adds to class ratemaking is:

- It reflects wage trend differences by industry group.
- The industry group rate change is applied to determine the present-on-rate-level pure premiums, which are important for low credibility class code pure premiums.
- It was the point where losses were brought to an unlimited basis in the previous methodology.

Oversimplified, the IG differential is a ratio of five years of indicated losses to five years of expected losses, both brought to the proposed level. The ratios by IG are normalized to unity. As a result of the new methodology, certain changes are addressed within the calculations:

1. The unlimited-to-limited ratio by IG is removed.
2. The indicated losses (limited at $500K) are developed to an ultimate level using the new loss development groupings.
3. The ultimate indicated losses limited at $500K are brought to an expected unlimited level via the multiplicative excess factor.
4. 40% of the indemnity excess loss is transferred to medical.
5. The full credibility standard is changed to 12,000 lost-time cases. It previously ranged from 7,000 to 11,000 by IG. For more details, see Daley (2009).

An example of NCCI's new IG differential calculation is found in the Appendix.

3. What is the impact of the methodology changes?

NCCI implemented the new methodology in loss cost and rate filings effective October 1, 2009, and subsequent. It has been adopted in all 37 states in which it's been filed. Near the end of the first filing season, NCCI analyzed the results of the first 30 states in which the new methodology was filed. Because the 2009/2010 filing season was the transition year from the prior methodology to the new, the new methodology changes were introduced into the indicated pure premiums in year one. After all of the states were filed in year one, the national pure premiums were updated for the new methodology in preparation for the 2010/2011 filing season (i.e., year two). This approach gradually introduced the methodology.

3.1. First-year results

The following analysis represents the results achieved during the first NCCI filing season across the first 30 states that approved the methodology. Note the following caveats:

- NCCI staff has not run the states with the prior and new methodology using the same five policy years of WCSP data.
- This analysis shows both the prior-to-new methodology changes and the class experience changes that naturally occur from year to year. Hence, experience changes may have offset or added to the impact of the new methodology.

Results are observed across industry groups, hazard groups, and class codes. Each state's values are given equal weight. The following relative change metric is used to generate observations in every state:

$$\text{Relativity} = \frac{\text{Industry Group (or Hazard Group or Class Code) Loss Cost Change}}{\text{Overall Statewide Loss Cost Change}} \qquad (3.1)$$

3.2. Industry group (IG) and hazard group (HG) results in the first year

NCCI studied the methodology changes extensively after both the implementation year and year two. NCCI's class ratemaking methodology targets loss cost changes at an IG level by state. Figures 12a and 12b provide IG differentials or relativities based upon (3.1).

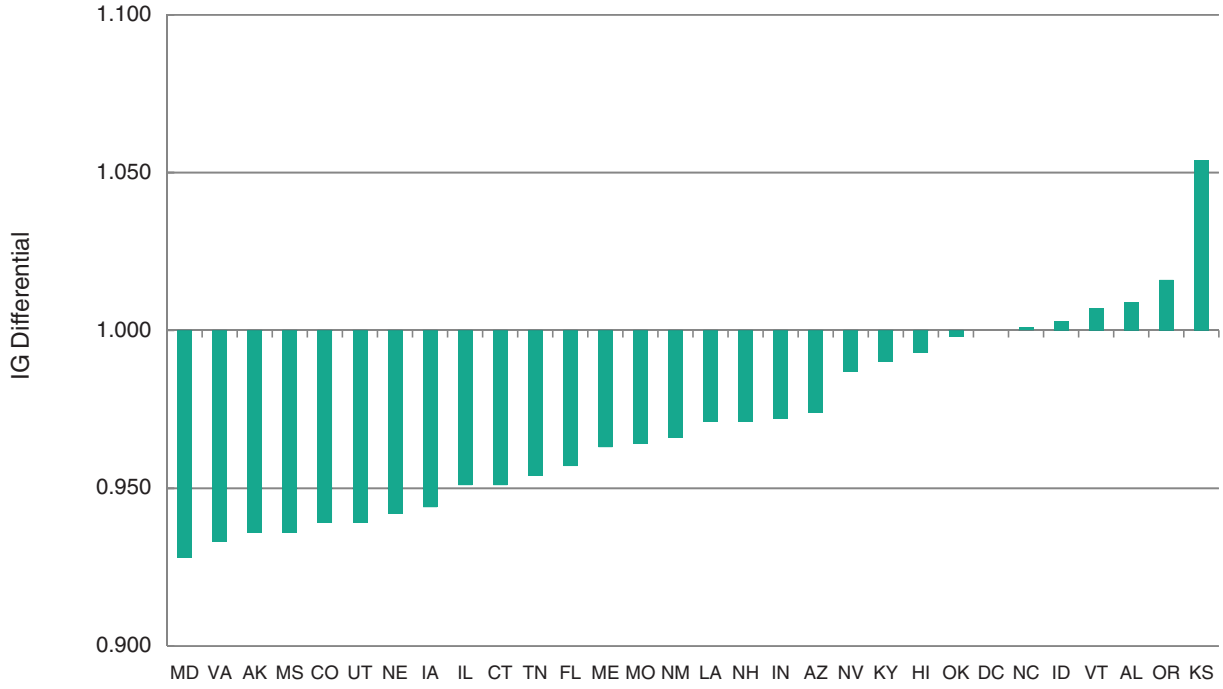
These results are primarily because:

- Due to the high severity nature of contracting classes, the prior critical value methodology generated a higher proportion of serious losses within contractor classes. The serious LDFs then overdeveloped these losses.
- The Goods & Services classes consisted of higher proportions of non-serious losses, which were underdeveloped in the prior methodology by the non-serious LDFs.

Although loss cost changes are not targeted by hazard group, NCCI studied the impact of allocating expected excess losses greater than $500,000 by quantifying loss cost changes by HG across states.

A priori, one may anticipate that the numbers in Figure 13a would consistently increase from A to G

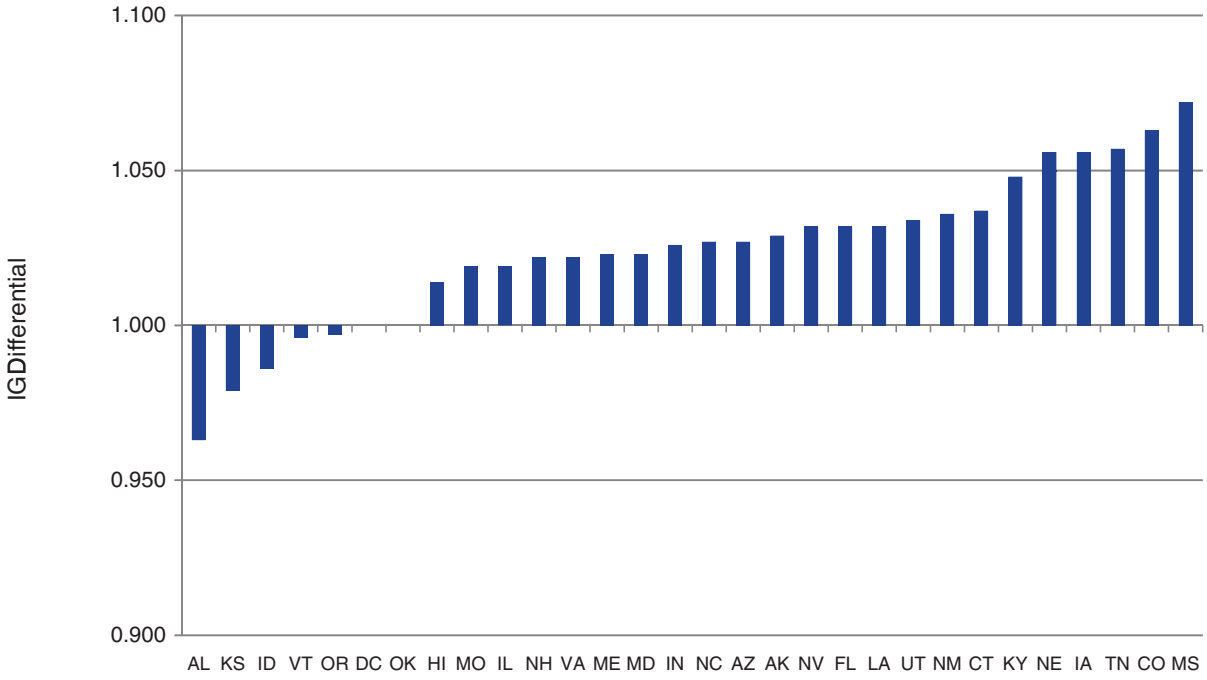
Figure 12a. The new methodology put downward pressure on the Contracting group loss costs.



IG differentials for DC always equal 1.00
1.00

Weighted Average: 0.964

Figure 12b. Upward pressure on the loss costs resulted for the Goods & Services group due to the methodology change.



IG differentials for DC always equal 1.00

Weighted Average: 1.026

Figure 13a. This chart provides the counts of state increases versus decreases across HG for the 30 states.

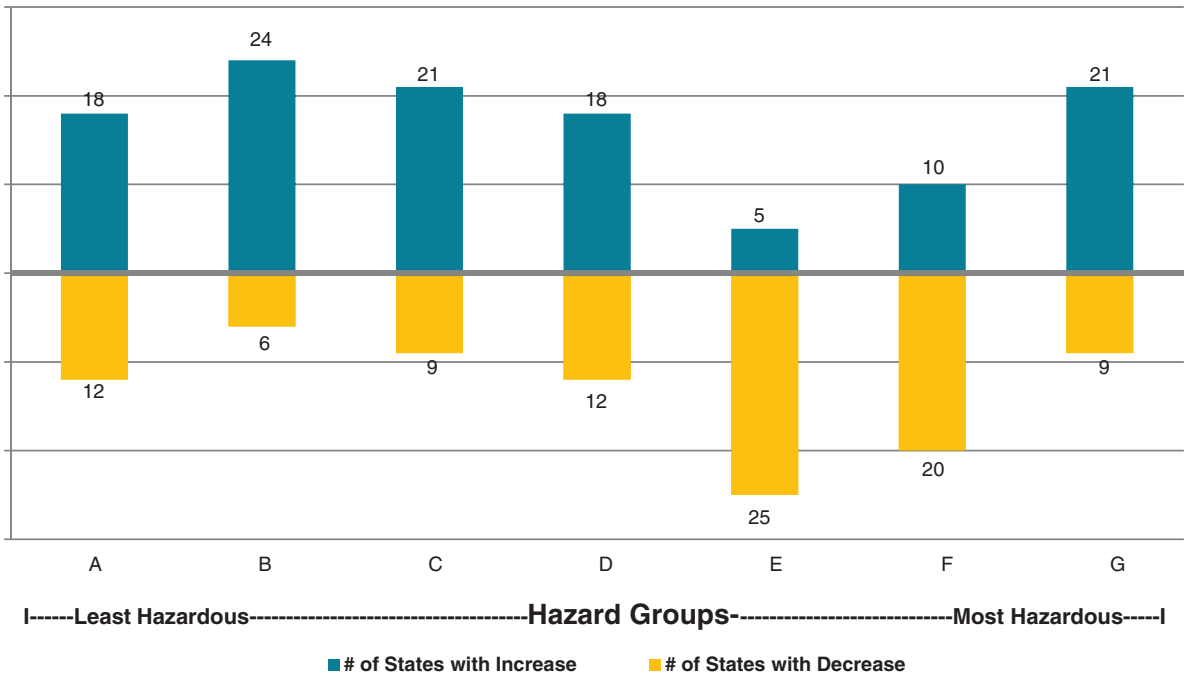
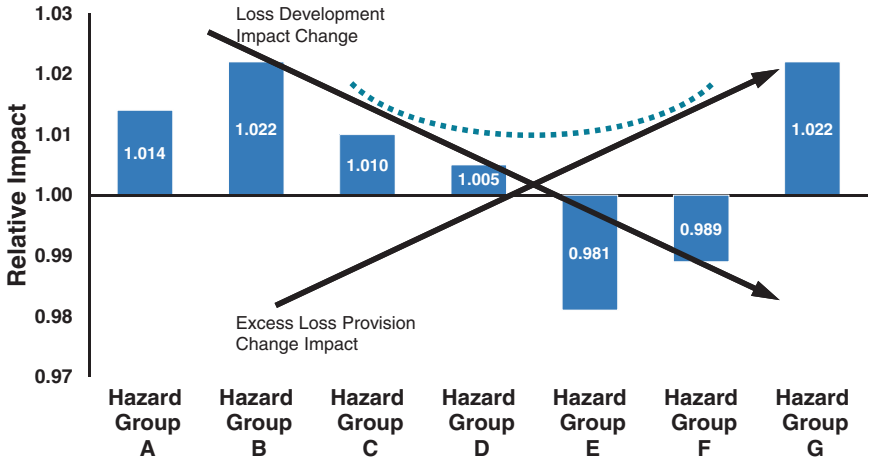


Figure 13b. This chart provides the average loss cost changes achieved across the hazard groups for 30 states. The two arrows represent a key attribute of the new methodology: the application of the expected excess offsets the impact that the new loss development approach creates on the primary layer of the loss cost below $500,000. The new loss development methodology exerts a greater impact on loss costs than the excess loss factors because the primary portion of the loss cost accounts for the majority of the total loss cost.



Impact in loss costs relative to statewide average
Note: Results exclude F-Class codes

because the excess ratio factors increase from A to G. However, the loss cost changes for hazard groups E and F were consistently negative across the states. This phenomenon, as illustrated on Figure 13b, happened because

- The contractor classes dominate the volume within E and F, and
- The high volume of not-likely-to-develop losses underlying class codes within hazard groups A-C, combined with the higher LDFs (compared to prior non-serious), provide strong upward pressure on loss costs

Because excess ratio factors vary significantly from HG A to G, NCCI computed the same relativity change as was done by industry group.

3.3. Class code results in the first year

Results for the top 25 class codes reflect the impact of the new methodology because these class codes were fully credible in many states. The loss cost change is driven by state data (i.e., the indicated pure premium) with little weight applied to the national pure premium. Table 2 shows average results achieved during the first filing season across the first 30 approved states.

Table 2. Top 25 classes in terms of premium, ranked by average relativity change

Rank by Premium Volume	Class Code	Industry Group	Hazard Group	Class Description	# of Applicable States	# States Below Unity	# States Above Unity	Average Relativity Chg*
9	7228	Miscellaneous	E	Trucking—Local Hauling	24	20	4	0.930
8	5190	Contracting	E	Electrical Wiring—Within Building	30	23	7	0.939
11	5183	Contracting	E	Plumbing	30	25	5	0.942
13	5403	Contracting	F	Carpentry—NOC	30	22	8	0.957
22	5213	Contracting	F	Concrete Construction NOC	30	21	9	0.973
1	8810	Office And Clerical	C	Clerical	30	24	6	0.973
21	3724	Contracting	F	Machinery or Equipment Repair	30	16	14	0.981
20	5221	Contracting	E	Concrete or Cement Work	30	15	15	0.983
2	5645	Contracting	F	Carpentry—One or Two Dwelling	30	16	14	0.986
17	5022	Contracting	F	Masonry	30	17	13	0.989
12	7219	Miscellaneous	F	Trucking—NOC (7 States)	7	6	1	0.989
14	6217	Contracting	F	Excavation & Drivers	30	20	10	0.993
23	9015	Goods And Services	C	Building Operation	30	14	15	0.996
6	8380	Goods And Services	D	Auto Repair Centers	26	11	14	0.996
16	8833	Office And Clerical	C	Hospital—Professional	30	14	16	0.997
24	5474	Contracting	F	Painting	30	15	15	0.998
4	8742	Office And Clerical	E	Salespersons	30	15	15	1.005
19	8018	Goods And Services	B	Store—Wholesale	30	10	20	1.011
3	9082	Goods And Services	A	Restaurant	29	14	15	1.018
5	7229	Miscellaneous	F	Trucking—Long Hauling	24	10	14	1.021
10	7380	Miscellaneous	D	Drivers, Chauffeurs, Etc.	28	14	14	1.022
25	8832	Office And Clerical	C	Physician & Clerical	30	11	19	1.028
15	8829	Goods And Services	C	Convalescent or Nursing Homes	28	5	23	1.032
7	8017	Goods And Services	B	Store—Retail	30	5	25	1.049
18	5551	Contracting	G	Roofing—All Kinds	30	10	19	1.076

$$*\text{Relativity Change} = \frac{(\text{Class Code Rate Change})_{\text{Prior to New Method}}}{(\text{Statewide Rate Change})_{\text{Prior to New Method}}}$$

These 25 class codes represent about 40% of all NCCI states' premium. Note the prevalence of contracting group codes within hazard groups E and F experienced the most decreases. Two class codes in Goods & Services, retail stores and nursing homes, experienced mainly increases across the states. Because of the large excess factor for HG G, the roofing code experienced the largest average increase across the states.

3.4. Stability results measured after the second year

In 2011, NCCI performed an analysis aimed at measuring the stability of the new methodology, after 31 state filings were approved in the second year. Figure 14 illustrates the results of the stability analysis for industry groups, while Figures 15a, b, and c are measurements of observed class code results.

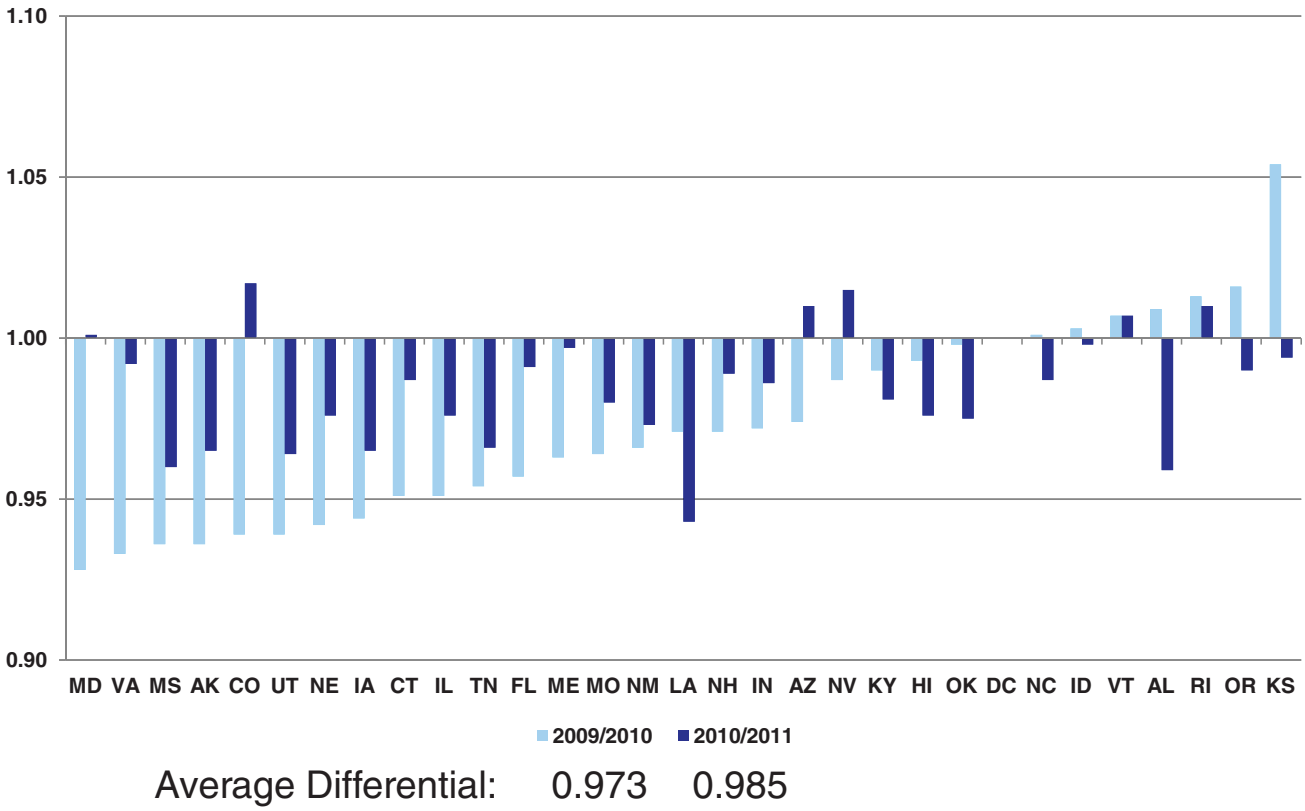
Under the new methodology, the IG differentials are more consistently within the range [.95, 1.05] because

- The unlimited-to-limited ratio of the prior method was eliminated, and replaced with expected excess, and
- An increase in the full credibility standard for the IG differential methodology provides more year-to-year stability in smaller states.

NCCI also created a metric measuring the variance of relative class code loss cost changes across the most recent five filing seasons across all 31 states. The metric is

$$\text{Variance} = \sum_{i=1}^{i=31}\sum_{j=1}^{j=N_i} \frac{\left(\begin{array}{c}\text{Class Code } j \text{ Loss Cost Change}_i \\ - \text{ Overall Statewide Change}_i\end{array}\right)^2}{\sum_{i=1}^{i=31} N_i} \qquad (3.2)$$

Figures 14a and 14b update the IG differentials for the Contracting group and the Goods & Services group, respectively, for years one and two. Similar to the first year, the Contracting group decreased in most states in year two while the Goods & Services group increased again in most states. Also, the average differential for the 31 states is closer to 1.000 in year two, which implies more stability.



Figures 14a and 14b (*Continued*)

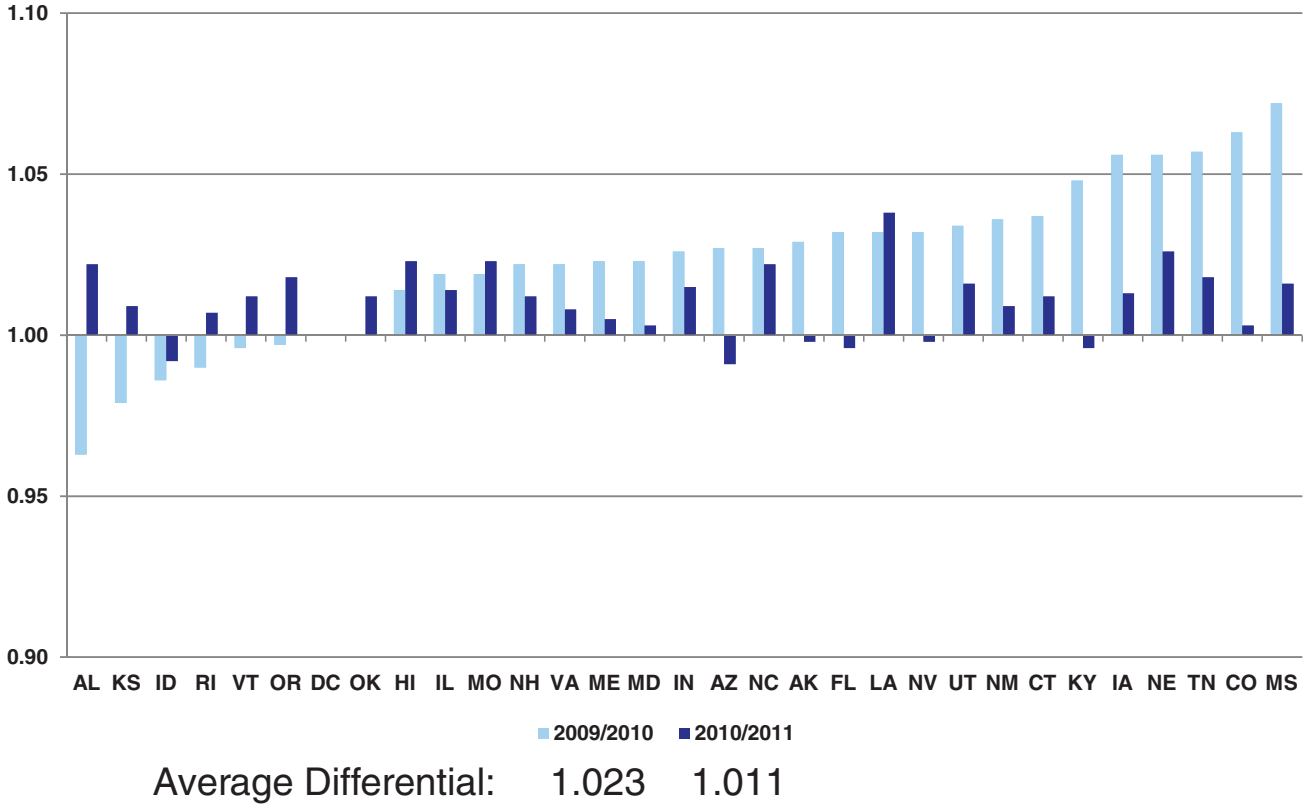
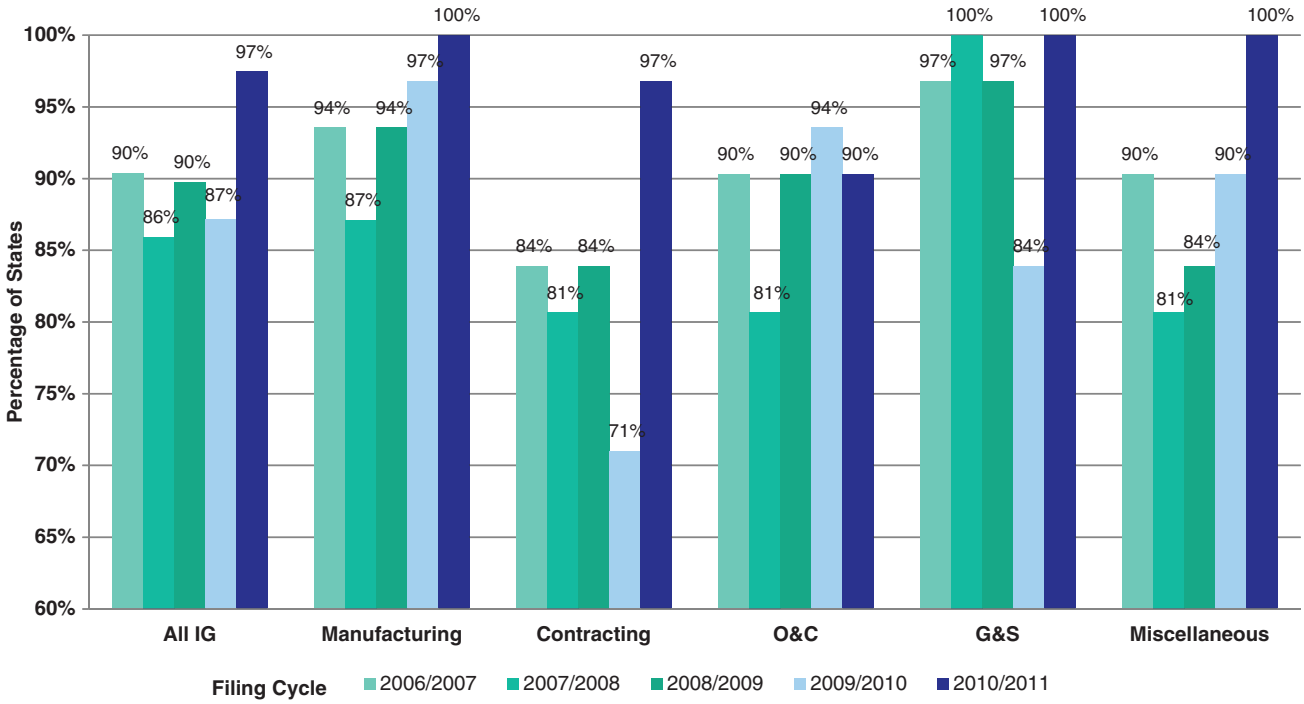
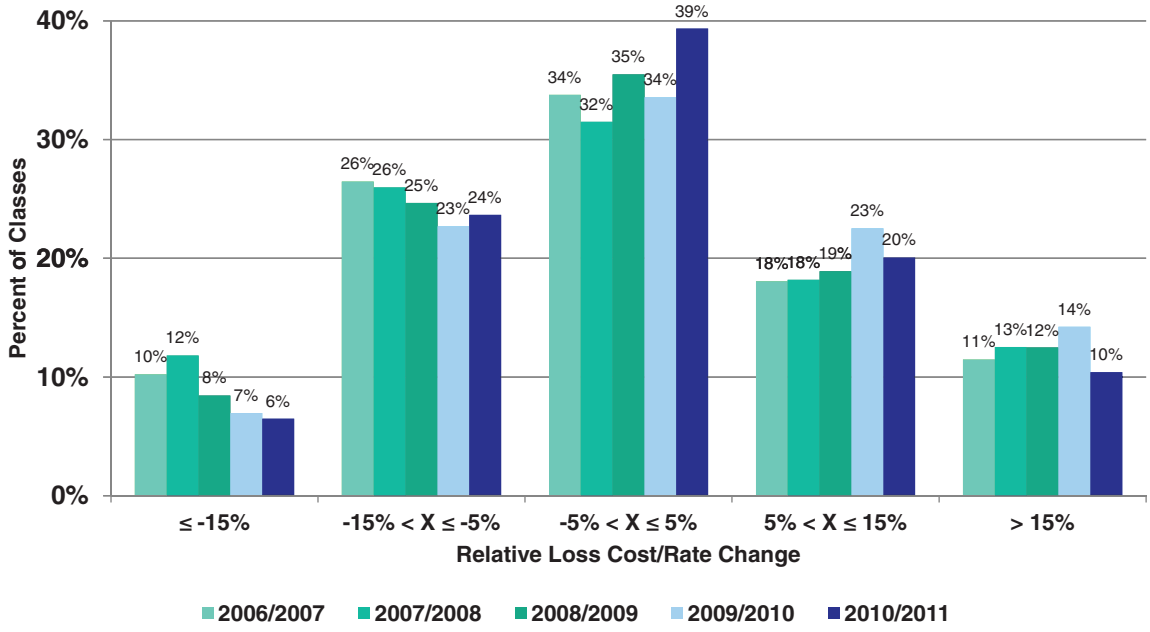


Figure 14c. This chart analyzes the volatility for industry group differentials across five recent filing seasons. The green shaded bars in the chart represent the prior methodology, while the blue bars represent the first and second implementation years of the new methodology.

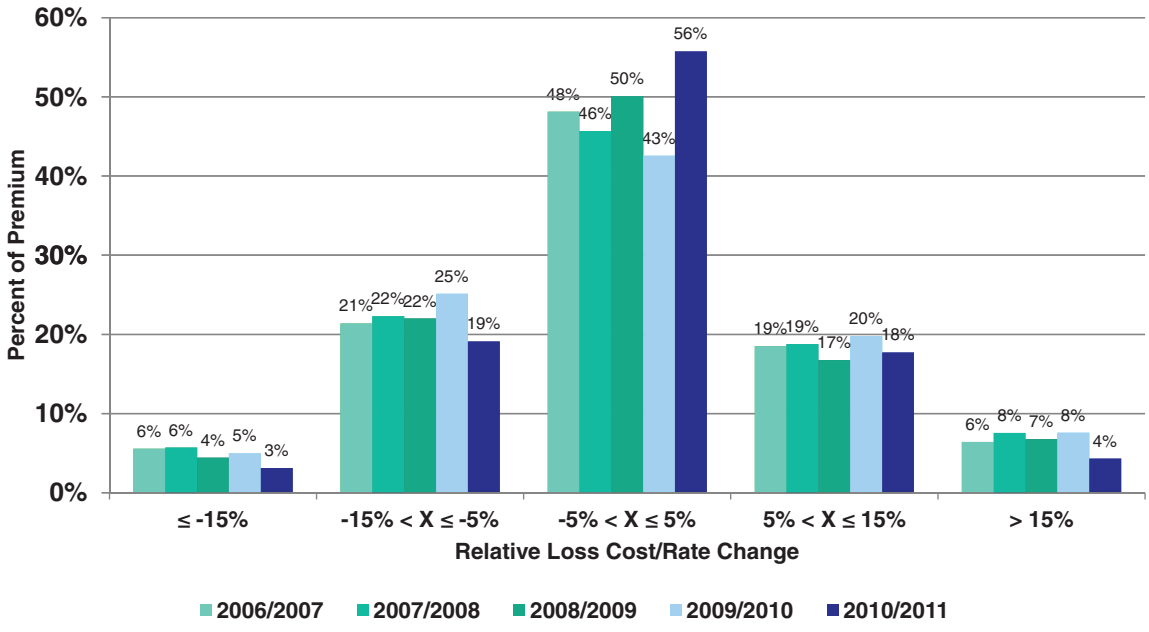


Includes AL, AK, AZ, CO, CT, DC, FL, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MO, MS, NE, NV, NH, NM, NC, OK, OR, RI, TN, UT, VT and VA.

Figures 15a and 15b illustrate evidence of class code level stability under the new methodology. The blue bars represent the first and second implementation years of the new methodology. The loss cost changes by class code are more stable in year two under the new methodology than in the first transition year (light blue bar).

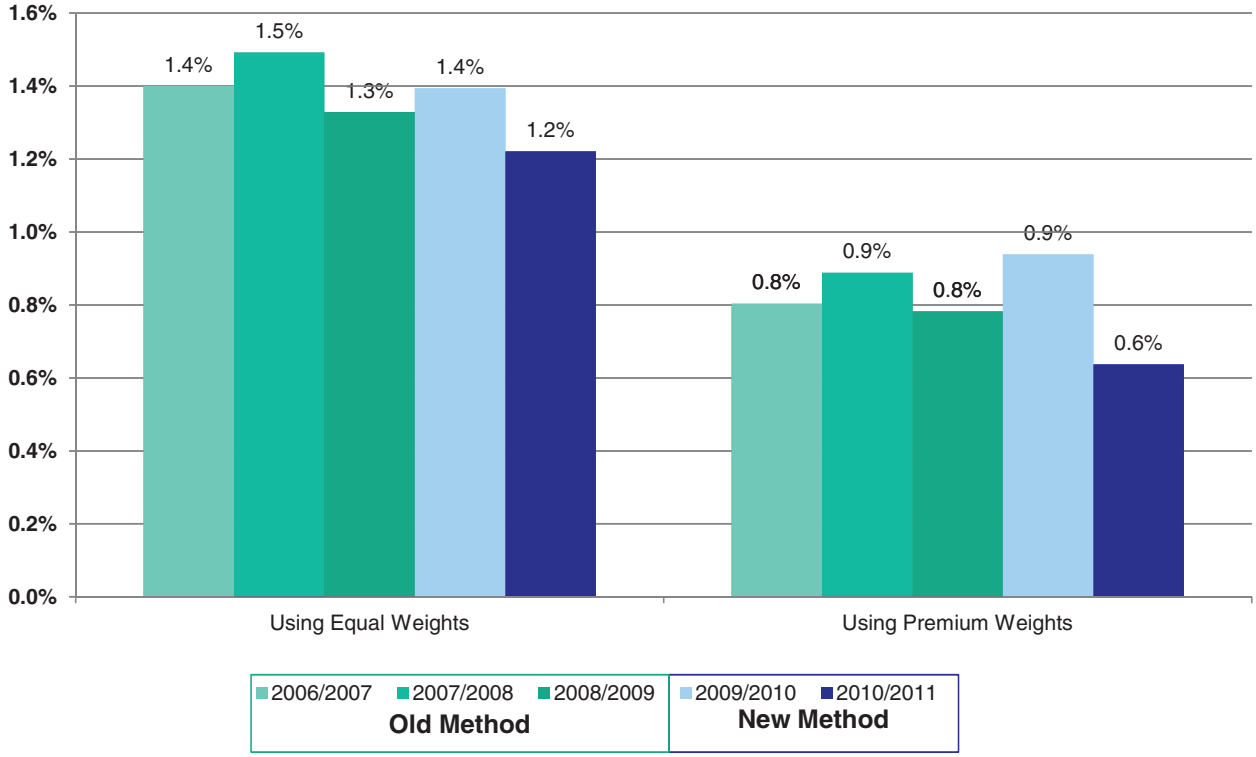


Includes AL, AK, AZ, CO, CT, DC, FL, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MO, MS, NE, NV, NH, NM, NC, OK, OR, RI, TN, UT, VT and VA.



Includes AL, AK, AZ, CO, CT, DC, FL, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MO, MS, NE, NV, NH, NM, NC, OK, OR, RI, TN, UT, VT and VA.

Figure 15c. Although the 2009/2010 transition year from prior methodology to new did not reduce the variance, the dark blue bar illustrates that the variance of loss cost changes for successive filings of the new methodology in the 2010/2011 year is lower than the prior methodology produced.



Includes AL, AK, AZ, CO, CT, DC, FL, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MO, MS, NE, NV, NH, NM, NC, OK, OR, RI, TN, UT, VT and VA.

where

Class Code j Loss Cost Change i = the percentage change, expressed as a factor, from one filing to the next for class code j in the ith state. For example, a –8.0% change = 0.920;

Overall Statewide Change i = the average premium change across all classes within the loss cost filing for the ith state, also expressed as a factor; and

N_i = the number of class codes within the loss cost filing for the ith state.

4. Conclusions

This paper documents several important changes that were implemented in the class ratemaking process used to determine workers compensation loss costs and rates. Implementing large modifications to class ratemaking brings many positive enhancements, including more stability from year to year on a class code level. Long-term loss cost adequacy should also be improved by some of the innovations leveraged from the expected excess of the new seven hazard group mapping and the new loss development methodology. The use of new data elements such as injured body part helps invigorate the methodologies.

Most importantly, the changes support the long-term goals of loss cost/rate adequacy, and stability, and promote class ratemaking consistency across NCCI states.

Acknowledgments

The author acknowledges Jim Davis, the project leader, who helped present the results with me. The author acknowledges contributions by Pam Barlow and Chris Poteet for their innovative efforts on the body part loss development research; and excellent contributions by Nadege Bernard-Ahrendts, Angela

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Corro, D. R., and G. J. Engl, "The 2004 NCCI Excess Loss Factors," Casualty Actuarial Society *Forum,* Fall 2006, pp. 513–571

Daley, T. V., "Class Ratemaking for Workers Compensation: NCCI's New Methodology," Casualty Actuarial Society e*Forum,* Winter 2009, pp. 48–147.

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Appendix—Exhibits

1. Parts of Body Codes/Mapping
2.–3. Likely-to-Develop Loss Triangles
4.–5. Not-Likely-to-Develop Loss Triangles
6. Likely-to-Develop Tail Calculation
7. Not-Likely-to-Develop Tail Calculation
8. Industry Group Differentials

Appendix Exhibit 1. URE Workers Compensation Statistical Plan: Part of Body—Injury Codes and Descriptions

Code*	Narrative Description	
I.	**Head**	
10	Multiple Head Injury	Any combination of Head injuries
11	Skull	
12	Brain	
13	Ear(s)	Includes: Hearing, Inside Eardrum
14	Eye(s)	Includes: Optic Nerves, Vision, Eyelids
15	Nose	Includes: Nasal Passage, Sinus, Sense of Smell
16	Teeth	
17	Mouth	Includes: Lips, Tongue, Throat, Taste
18	Soft tissue	
19	Facial Bones	Includes: Jaw
II.	**Neck**	
20	Multiple Neck Injury	Any combination of Neck injuries
21	Vertebrae	Includes: Spinal Column Bone, "Cervical Segment"
22	Disc	Includes: Spinal Column cartilage, "Cervical Segment"
23	Spinal Cord	Includes: Nerve Tissue, "Cervical Segment"
24	Larynx	Includes: Cartilage and Vocal Cords
25	Soft Tissue	Other than Larynx or Trachea
26	Trachea	
III.	**Upper Extremities**	
30	Multiple Upper Extremities	Any combination of Upper Extremity injuries, excluding Hands and Wrists combined
31	Upper Arm	Humerus and Corresponding Muscles, excluding Clavicle and Scapula
32	Elbow	Radial Head
33	Lower Arm	Forearm—Radius, Ulna and Corresponding Muscles
34	Wrist	Carpals and Corresponding Muscles

(*continued on next page*)

Appendix Exhibit 1. URE Workers Compensation Statistical Plan: Part of Body—Injury Codes and Descriptions (*Continued*)

Code*		Narrative Description
35	Hand	Metacarpals and Corresponding Muscles—excluding Wrist or Fingers
36	Finger(s)	Other than Thumb and Corresponding Muscles
37	Thumb	
38	Shoulder(s)	Armpit, Rotator Cuff, Trapezius, Clavicle, Scapula
39	Wrist(s) & Hand(s)	
IV.	**Trunk**	
40	Multiple Trunk	Any combination of Trunk injuries
41	Upper Back Area	(Thoracic Area) Upper Back Muscles, excluding Vertebrae, Disc, Spinal Cord
42	Lower Back Area	(Lumbar Area and Lumbo Sacral) Lower Back Muscles, excluding Sacrum, Coccyx, Pelvis, Vertebrae, Disc, Spinal Cord
43	Disc	Spinal Column Cartilage other than Cervical Segment
44	Chest	Including Ribs, Sternum, Soft Tissue
45	Sacrum and Coccyx	Final Nine Vertebrae—Fused
46	Pelvis	
47	Spinal Cord	Nerve Tissue other than Cervical Segment
48	Internal Organs	Other than Heart and Lungs
49	Heart	
60	Lungs	
61	Abdomen	Excluding Injury to Internal Organs Including Groin
62	Buttocks	Soft Tissue
63	Lumbar and/or Sacral Vertebrae (Vertebra NOC Trunk)	Bone Portion of the Spinal Column
V.	**Lower Extremities**	
50	Multiple Lower Extremities	Any combination of Lower Extremity injuries
51	Hip	
52	Upper Leg	Femur and Corresponding Muscles
53	Knee	Patella
54	Lower Leg	Tibia, Fibula and Corresponding Muscles
55	Ankle	Tarsals
56	Foot	Metatarsals, Heel, Achilles Tendon and Corresponding Muscles—excluding Ankle or Toes
57	Toes	
58	Great Toe	
VI.	**Multiple Body Parts**	
64	Artificial Appliance	Braces, etc.
65	Insufficient Info to Properly Identify—Unclassified	Insufficient information to identify part affected
66	No Physical Injury	Mental Disorder
90	Multiple Body Parts (Including Body Systems & Body Parts)	Applies when more than one Major Body Part has been affected, such as an Arm and a Leg and Multiple Internal Organs
91	Body Systems and Multiple Body Systems	Applies when functioning of an Entire Body System has been affected without specific injury to any other part, as in the case of Poisoning, Corrosive Action, Inflammation, Affecting Internal Organs, Damage to Nerve Centers, etc.; does NOT apply when the systemic damage results from an External Injury affecting an External Part such as a Back Injury that includes damage to the Nerves of the Spinal Cord.

*Shaded areas are part of body codes considered "likely to develop."

Appendix Exhibit 2. Limited Indemnity Loss Development: *Likely—All Carriers*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
5/95-4/96	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0
5/96-4/97	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0
5/97-4/98	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0
5/98-4/99	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0
5/99-4/00	*0*	*0*	*0*	*0*	0	0	0	0	0	0
5/00-4/01	*48,788,496*	*70,608,712*	*84,270,057*	87,771,920	89,112,088	90,378,791	91,784,838	91,805,735	91,133,628	
5/01-4/02	*48,559,807*	*72,037,182*	83,351,307	87,676,736	89,020,967	88,951,882	89,255,661	90,197,539		
5/02-4/03	*45,778,080*	63,587,381	68,516,473	69,984,726	70,648,291	70,996,622	70,431,501			
5/03-4/04	41,013,101	55,034,451	60,517,275	63,740,375	65,850,025	66,464,583				
5/04-4/05	48,461,929	64,039,918	71,065,826	73,860,686	76,070,314					
5/05-4/06	46,850,217	63,124,543	71,424,506	74,685,744						
5/06-4/07	44,482,507	60,492,928	69,520,732							
5/07-4/08	42,758,913	59,501,716								
5/08-4/09	37,943,346									

Link Ratios	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10
5/95-4/96									
5/96-4/97									
5/97-4/98									
5/98-4/99									
5/99-4/00									
5/00-4/01	*1.447*	*1.193*	*1.042*	1.015	1.014	1.016	1.000	0.993	
5/01-4/02	*1.483*	*1.157*	1.052	1.015	0.999	1.003	1.011		
5/02-4/03	*1.389*	1.078	1.021	1.009	1.005	0.992			
5/03-4/04	1.342	1.100	1.053	1.033	1.009				
5/04-4/05	1.321	1.110	1.039	1.030					
5/05-4/06	1.347	1.131	1.046						
5/06-4/07	1.360	1.149							
5/07-4/08	1.392								

(*continued on next page*)

Appendix Exhibit 2. Limited Indemnity Loss Development: *Likely—All Carriers (Continued)*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
AVERAGE DEV.	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10	
2 Year Averages	1.376	1.140	1.043	1.032	1.007	0.998	1.006			
3 Year Averages	1.366	1.130	1.046	1.024	1.004	1.004				
4 Year Averages	1.355	1.123	1.040	1.022	1.007					
5 Year Averages	1.352	1.114	1.042	1.020						
5 Yr Ex-Hi Lo Avgs	1.350	1.114	1.046	1.020						
AVG DEV. TO 7TH	1:7	2:7	3:7	4:7	5:7	6:7				7th:Ult
2 Year Averages	1.697	1.233	1.082	1.037	1.005	0.998				1.062
3 Year Averages	1.665	1.219	1.079	1.032	1.008	1.004				1.062
4 Year Averages				0.000	0.000					
5 Year Averages				0.000						
5 Yr Ex-Hi Lo Avgs				0.000						
AVG DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U	6:U	7:U			
2 Year Averages	1.801	1.309	1.148	1.101	1.067	1.060	1.062			
3 Year Averages	1.769	1.295	1.146	1.096	1.070	1.066	1.062			
4 Year Averages					0.000					
5 Year Averages										
5 Yr Ex-Hi Lo Avgs										

Source: NCCI WCSP Data

Appendix Exhibit 3. Limited Indemnity Loss Development: *Not-Likely—All Carriers*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
5/95-4/96	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0
5/96-4/97	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0
5/97-4/98	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0
5/98-4/99	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0
5/99-4/00	*0*	*0*	*0*	*0*	0	0	0	0	0	0
5/00-4/01	*59,949,293*	*77,398,591*	*84,480,874*	85,744,728	86,233,624	85,472,485	85,427,969	85,179,919	84,941,558	
5/01-4/02	*57,036,645*	*68,095,359*	72,056,829	73,496,168	73,618,253	74,014,895	74,123,043	73,443,559		
5/02-4/03	*57,198,667*	66,994,736	72,299,362	72,973,296	73,116,657	72,998,856	72,994,493			
5/03-4/04	60,026,814	68,338,729	73,138,840	74,651,671	74,581,539	74,232,131				
5/04-4/05	57,491,227	66,886,459	70,325,411	72,565,249	73,975,397					
5/05-4/06	64,847,367	74,709,564	78,555,014	80,257,396						
5/06-4/07	67,574,263	78,660,486	85,022,793							
5/07-4/08	69,084,558	83,904,742								
5/08-4/09	65,367,628									

Link Ratios	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10
5/95-4/96									
5/96-4/97									
5/97-4/98									
5/98-4/99									
5/99-4/00									
5/00-4/01	*1.291*	*1.092*	*1.015*	1.006	0.991	0.999	0.997	0.997	
5/01-4/02	*1.194*	*1.058*	1.020	1.002	1.005	1.001	0.991		
5/02-4/03	*1.171*	1.079	1.009	1.002	0.998	1.000			
5/03-4/04	1.138	1.070	1.021	0.999	0.995				
5/04-4/05	1.163	1.051	1.032	1.019					
5/05-4/06	1.152	1.051	1.022						
5/06-4/07	1.164	1.081							
5/07-4/08	1.215								

(*continued on next page*)

Appendix Exhibit 3. Limited Indemnity Loss Development: *Not-Likely—All Carriers (Continued)*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
AVERAGE DEV.	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10	
2 Year Averages	1.190	1.066	1.027	1.009	0.997	1.001	0.994			
3 Year Averages	1.177	1.061	1.025	1.007	0.999	1.000				
4 Year Averages	1.174	1.063	1.021	1.006	0.997					
5 Year Averages	1.166	1.066	1.021	1.006						
5 Yr Ex-Hi Lo Avgs	1.160	1.067	1.021	1.003						
AVG DEV. TO 7TH	1:7	2:7	3:7	4:7	5:7	6:7				7th:Ult
2 Year Averages	1.311	1.102	1.034	1.007	0.998	1.001				1.012
3 Year Averages	1.288	1.094	1.031	1.006	0.999	1.000				1.012
4 Year Averages				0.000	0.000					
5 Year Averages				0.000						
5 Yr Ex-Hi Lo Avgs				0.000						
AVG DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U	6:U	7:U			
2 Year Averages	1.328	1.116	1.047	1.019	1.010	1.013	1.012			
3 Year Averages	1.303	1.107	1.043	1.018	1.011	1.012	1.012			
4 Year Averages					0.000					
5 Year Averages										
5 Yr Ex-Hi Lo Avgs										

Source: NCCI WCSP Data

Appendix Exhibit 4. Tail Development to Ultimate: *Limited Indemnity—All Carriers (using 2-year average development)*

NCCI State: 2011 Filing FIRST REPORT 5/08-4/09	(1) Limited Incurred Losses	(2) Development 1:7	(3) Amendment Factor	(4) Modified Losses (1)×((2)×(3))
Fatal-Likely	0	1.697	1.030	0
Fatal-Not Likely	5,818,343	1.311	1.030	7,854,763
Permanent Total	1,081,241	1.697	1.012	1,856,491
Perm. Partial-Likely	29,137,702	1.697	1.018	50,349,949
Perm. Partial-Not Likely	38,620,044	1.311	1.018	51,557,759
Temp. Total-Likely	7,724,403	1.697	1.012	13,262,800
Temp. Total-Not Likely	20,929,241	1.311	1.012	27,773,103

SECOND REPORT 5/07-4/08	(5) Limited Incurred Losses	(6) Development 2:7	(7) Amendment Factor	(8) Modified Losses (5)×((6)×(7))
Fatal-Likely	1,429,363	1.233	1.055	1,859,601
Fatal-Not Likely	6,371,160	1.102	1.055	7,409,659
Permanent Total	3,121,104	1.233	1.022	3,932,591
Perm. Partial-Likely	48,903,921	1.233	1.032	62,205,788
Perm. Partial-Not Likely	58,647,390	1.102	1.032	66,682,082
Temp. Total-Likely	6,047,328	1.233	1.022	7,619,633
Temp. Total-Not Likely	18,886,192	1.102	1.022	21,265,852

CALCULATION OF LIKELY 7TH-TO-ULTIMATE	
(9) Combined Likely Losses	141,086,853
(10) Combined Not-Likely Losses	182,543,218
(11) Combined Total Losses	323,630,071
(12) Financial Data 7th-to-Ultimate Development Factors	1.034
(13) 7th-to-Ultimate Loss Development $(13) = \{(12) - 1\} \times (11)$	11,003,422
(14) % of Loss Development attributable to Not-Likely Losses at 7th rpt	0.200
(15) 7th-to-Ultimate Likely Loss Development Factors $(15) = \{(9) + [1 - (14)] \times (13)\}/(9)$	1.062
(16) 7th-to-Ultimate Not-Likely Loss Development Factors $(16) = \{(10) + (14) \times (13)\}/(10)$	1.012
(17) 7th-to-Ultimate Loss Development for Fatal	1.034
(18) 7th-to-Ultimate Loss Development for Permanent Partial $(18) = \frac{(15) \times \{PP\text{-}L^*\} + (16) \times \{PP\text{-}NL^*\}}{\{PP\text{-}L^*\} + \{PP\text{-}NL^*\}}$	1.036
(19) 7th-to-Ultimate Loss Development for Temporary Total $(19) = \frac{(15) \times \{TT\text{-}L^*\} + (16) \times \{TT\text{-}NL^*\}}{\{TT\text{-}L^*\} + \{TT\text{-}NL^*\}}$	1.027

*The weights are the latest two years of on-leveled losses developed to the tail attachment point.
Source: NCCI WCSP Data

Appendix Exhibit 5. Limited Medical Loss Development: *Likely—All Carriers*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
5/95-4/96	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0
5/96-4/97	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0
5/97-4/98	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0
5/98-4/99	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0
5/99-4/00	*0*	*0*	*0*	*0*	0	0	0	0	0	0
5/00-4/01	*48,436,848*	*59,125,352*	*69,854,008*	79,234,015	85,203,557	89,130,600	91,413,397	94,048,181	95,142,190	
5/01-4/02	*50,426,639*	*63,271,888*	74,642,378	79,766,744	83,908,255	88,724,259	90,322,823	92,151,478		
5/02-4/03	*45,691,100*	52,734,898	58,491,449	64,355,799	67,874,290	69,327,569	71,595,644			
5/03-4/04	44,191,691	51,283,143	57,300,635	61,819,499	64,103,593	66,449,270				
5/04-4/05	52,401,085	60,644,484	67,776,572	71,742,565	75,633,038					
5/05-4/06	53,933,880	61,898,030	64,681,837	69,386,979						
5/06-4/07	53,106,570	58,343,573	64,312,344							
5/07-4/08	52,577,510	59,014,094								
5/08-4/09	45,918,125									

Link Ratios	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10
5/95-4/96									
5/96-4/97									
5/97-4/98									
5/98-4/99									
5/99-4/00									
5/00-4/01	*1.221*	*1.181*	*1.134*	1.075	1.046	1.026	1.029	1.012	
5/01-4/02	*1.255*	*1.180*	1.069	1.052	1.057	1.018	1.020		
5/02-4/03	*1.154*	1.109	1.100	1.055	1.021	1.033			
5/03-4/04	1.160	1.117	1.079	1.037	1.037				
5/04-4/05	1.157	1.118	1.059	1.054					
5/05-4/06	1.148	1.045	1.073						
5/06-4/07	1.099	1.102							
5/07-4/08	1.122								

AVERAGE DEV.	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10	
2 Year Averages	1.111	1.074	1.066	1.046	1.029	1.026	1.025			
3 Year Averages	1.123	1.088	1.070	1.049	1.038	1.026				
4 Year Averages	1.132	1.096	1.078	1.050	1.040					
5 Year Averages	1.137	1.098	1.076	1.055						
5 Yr Ex-Hi Lo Avgs	1.142	1.109	1.074	1.054						
AVG DEV. TO 7TH	1:7	2:7	3:7	4:7	5:7	6:7				7th:Ult
2 Year Averages	1.405	1.265	1.178	1.105	1.056	1.026				1.515
3 Year Averages	1.460	1.300	1.195	1.117	1.065	1.026				1.504
4 Year Averages				0.000	0.000					
5 Year Averages				0.000						
5 Yr Ex-Hi Lo Avgs				0.000						
AVG DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U	6:U	7:U			
2 Year Averages	2.128	1.915	1.783	1.673	1.599	1.554	1.515			
3 Year Averages	2.197	1.956	1.798	1.680	1.602	1.543	1.504			
4 Year Averages					0.000					
5 Year Averages										
5 Yr Ex-Hi Lo Avgs										

Source: NCCI WCSP Data

Appendix Exhibit 6. Limited Medical Loss Development: *Not-Likely—All Carriers*

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

PY Data	1st Report	2nd Report	3rd Report	4th Report	5th Report	6th Report	7th Report	8th Report	9th Report	10th Report
5/95-4/96	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0
5/96-4/97	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0
5/97-4/98	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0
5/98-4/99	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0
5/99-4/00	*0*	*0*	*0*	*0*	0	0	0	0	0	0
5/00-4/01	*95,194,199*	*101,832,915*	*105,970,113*	107,773,952	110,897,064	111,064,408	112,412,291	113,876,587	114,196,428	
5/01-4/02	*89,459,742*	*95,129,601*	97,546,943	98,864,668	100,147,099	101,534,909	102,590,253	102,399,216		
5/02-4/03	*87,430,192*	90,666,566	92,627,029	94,139,817	94,635,553	96,178,683	97,336,999			
5/03-4/04	94,278,118	94,959,404	96,728,975	98,576,388	99,767,514	100,483,407				
5/04-4/05	97,794,646	99,408,564	102,344,718	103,508,542	104,070,858					
5/05-4/06	113,931,232	113,172,835	115,165,065	115,294,831						
5/06-4/07	114,703,991	117,853,131	120,027,154							
5/07-4/08	118,551,687	120,931,131								
5/08-4/09	113,067,193									

Link Ratios	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10
5/95-4/96									
5/96-4/97									
5/97-4/98									
5/98-4/99									
5/99-4/00									
5/00-4/01	*1.070*	*1.041*	*1.017*	1.029	1.002	1.012	1.013	1.003	
5/01-4/02	*1.063*	*1.025*	1.014	1.013	1.014	1.010	0.998		
5/02-4/03	*1.037*	1.022	1.016	1.005	1.016	1.012			
5/03-4/04	1.007	1.019	1.019	1.012	1.007				
5/04-4/05	1.017	1.030	1.011	1.005					
5/05-4/06	0.993	1.018	1.001						
5/06-4/07	1.027	1.018							
5/07-4/08	1.020								

AVERAGE DEV.	1:2	2:3	3:4	4:5	5:6	6:7	7:8	8:9	9:10	
2 Year Averages	1.024	1.018	1.006	1.009	1.012	1.011	1.006			
3 Year Averages	1.013	1.022	1.010	1.007	1.012	1.011				
4 Year Averages	1.014	1.021	1.012	1.009	1.010					
5 Year Averages	1.013	1.021	1.012	1.013						
5 Yr Ex-Hi Lo Avgs	1.015	1.020	1.014	1.010						

AVG DEV. TO 7TH	1:7	2:7	3:7	4:7	5:7	6:7				7th:Ult
2 Year Averages	1.082	1.057	1.038	1.032	1.023	1.011				1.072
3 Year Averages	1.077	1.063	1.040	1.030	1.023	1.011				1.072
4 Year Averages				0.000	0.000					
5 Year Averages				0.000						
5 Yr Ex-Hi Lo Avgs				0.000						

AVG DEV. TO ULT.	1:U	2:U	3:U	4:U	5:U	6:U	7:U
2 Year Averages	1.161	1.134	1.114	1.107	1.097	1.084	1.072
3 Year Averages	1.156	1.141	1.116	1.105	1.097	1.084	1.072
4 Year Averages					0.000		
5 Year Averages							
5 Yr Ex-Hi Lo Avgs							

Source: NCCI WCSP Data

Appendix Exhibit 7. Tail Development to Ultimate: *Limited Medical—All Carriers (using 2-year average development)*

NCCI State: 2011 Filing FIRST REPORT 5/08-4/09	(1) Limited Incurred Losses	(2) Development 1:7	(3) Amendment Factor	(4) Modified Losses (1)×((2)×(3))
Fatal-Likely	0	1.405	1.015	0
Fatal-Not Likely	524,060	1.082	1.015	575,418
Permanent Total	2,063,084	1.405	1.015	2,941,958
Perm. Partial-Likely	30,315,125	1.405	1.015	43,229,368
Perm. Partial-Not Likely	47,129,070	1.082	1.015	51,747,719
Temp. Total-Likely	13,539,916	1.405	1.015	19,307,920
Temp. Total-Not Likely	35,935,447	1.082	1.015	39,457,121
Medical Only	29,478,018	1.082	1.015	32,366,864
Contract Medical	598	1.082	1.015	657

SECOND REPORT 5/07-4/08	(5) Limited Incurred Losses	(6) Development 2:7	(7) Amendment Factor	(8) Modified Losses (5)×((6)×(7))
Fatal-Likely	507,887	1.265	1.025	658,729
Fatal-Not Likely	336,012	1.057	1.025	363,901
Permanent Total	4,443,171	1.265	1.025	5,762,793
Perm. Partial-Likely	43,209,667	1.265	1.025	56,042,938
Perm. Partial-Not Likely	54,281,483	1.057	1.025	58,786,846
Temp. Total-Likely	10,853,369	1.265	1.025	14,076,820
Temp. Total-Not Likely	32,256,931	1.057	1.025	34,934,256
Medical Only	34,024,367	1.057	1.025	36,848,389
Contract Medical	32,338	1.057	1.025	35,022

CALCULATION OF LIKELY 7TH-TO-ULTIMATE	
(9) Combined Likely Losses	142,020,526
(10) Combined Not-Likely Losses	255,116,193
(11) Combined Total Losses	397,136,719
(12) Financial Data 7th-to-Ultimate Development Factors	1.230
(13) 7th-to-Ultimate Loss Development $(13) = \{(12) - 1\} \times (11)$	91,341,445
(14) % of Loss Development attributable to Not-Likely Losses at 7th rpt	0.200
(15) 7th-to-Ultimate Likely Loss Development Factors $(15) = \{(9) + [1 - (14)] \times (13)\}/(9)$	1.515
(16) 7th-to-Ultimate Not-Likely Loss Development Factors $(16) = \{(10) + (14) \times (13)\}/(10)$	1.072
(17) 7th-to-Ultimate Loss Development for Fatal	1.230
(18) 7th-to-Ultimate Loss Development for Permanent Partial $(18) = \frac{(15) \times \{PP\text{-}L^*\} + (16) \times \{PP\text{-}NL^*\}}{\{PP\text{-}L^*\} + \{PP\text{-}NL^*\}}$	1.282
(19) 7th-to-Ultimate Loss Development for Temporary Total $(19) = \frac{(15) \times \{TT\text{-}L^*\} + (16) \times \{TT\text{-}NL^*\}}{\{TT\text{-}L^*\} + \{TT\text{-}NL^*\}}$	1.209

*The weights are the latest two years of on-leveled losses developed to the tail attachment point.
Source: NCCI WCSP Data

Appendix Exhibit 8. Indicated Losses to Expected Losses Calculation of IG Differentials

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

I. Balancing of Indicated Losses to Expected Losses

Policy Year	(1) Converted Indicated Total Losses*	(2) Converted Expected Total Losses**	(3) Factor to Adjust Indicateds to Expecteds (2) / (1)	(4) Current Ratio of Manual to Standard Premium	(5) Proposed Ratio of Manual to Standard Premium	(6) Off-Balance Adjustment	(7) Balancing Factor (3) × ((4) / (5))	(8) WCSP Experience Change (ELRs) (1) / (2) × (5) / (4)
5/2004-4/2005	437,711,332	412,837,839	0.943	1.058	1.034	1.023	0.965	
5/2005-4/2006	454,235,842	447,562,825	0.985	1.057	1.055	1.002	0.987	
5/2006-4/2007	466,503,481	470,477,055	1.009	1.058	1.081	0.979	0.988	
5/2007-4/2008	478,505,253	502,829,322	1.051	1.059	1.095	0.967	1.016	
5/2008-4/2009	441,489,740	477,383,343	1.081	1.057	1.077	0.981	1.060	
Latest 3 Years	1,386,498,474	1,450,689,719	1.046	1.058	1.084	0.976		0.979

*These expected unlimited losses are at ultimate, on-level, trended, and include the proposed experience and LBE changes as well as any miscellaneous premium adjustments.
**These expected losses are payroll extended underlying pure premiums adjusted to include the proposed experience, trend, benefit and LBE changes as well as any misc. premium adjustments.

II. Derivation Of Industry Group Differentials

a) INDUSTRY GROUP WAGE TREND ADJUSTMENT

Industry Group	(1) Converted Indicated Indemnity Losses*	(2) Converted Indicated Medical Losses*	(3) Converted Indicated Total Losses*	(4) QCEW Average Weekly Wage Trends	(5) Wage Trend Differential	(6) Medical Loss Wage Trend Adjustments	(7) Normalized Medical Loss Wage Trend Adjustments
I	216,254,775	368,230,990	584,485,765	1.057	1.009	1.006	1.006
II	157,961,997	243,352,234	401,314,231	1.083	0.985	0.991	0.991
III	86,445,398	167,590,089	254,035,486	1.070	0.997	0.998	0.998
IV	252,385,553	498,975,006	751,360,559	1.064	1.003	1.002	1.002
V	227,308,696	343,836,653	571,145,349	1.067	1.000	1.000	1.000
VI	0	0	0	0.000	1.000	1.000	1.000
ALL	940,356,418	1,621,984,971	2,562,341,390	1.067		1.000	1.000

*These expected unlimited losses are at ultimate, on-level, include the proposed experience and loss based expense changes and any miscellaneous premium adjustments (excludes trend).

(*continued on next page*)

Appendix Exhibit 8. Indicated Losses to Expected Losses Calculation of IG Differentials (*Continued*)

NCCI State: 2011 Filing

1st Report Start: 5/1/2008
1st Report End: 4/30/2009

b) EXPECTED LOSSES

Industry Group	(8) Latest Year CURRENT Manual Pure Premium*	(9) Five Year CURRENT Manual Pure Premium*	(10) Five Year PROPOSED Manual Pure Premium*	(11) Current Ratio of Manual to Standard Premium	(12) Proposed Ratio of Manual to Standard Premium	(13) Latest Year CURRENT Expected Losses** (8) × (11) / (12)	(14) Five Year CURRENT Expected Losses** (9) × (11) / (12)	(15) Five Year PROPOSED Expected Losses** (10) × (11) / (12)	(16) Current / Proposed (14) / (15)	(17) Adjustment to Proposed for Current Relativities (16) / 1.080
I	104,513,125	566,283,807	524,375,268	1.078	1.091	103,267,781	559,536,154	518,126,983	1.080	1.000
II	80,482,259	383,036,832	354,576,686	1.122	1.130	79,912,473	380,325,067	352,066,408	1.080	1.000
III	54,637,321	253,067,812	234,405,590	1.034	1.037	54,479,258	252,335,696	233,727,464	1.080	1.000
IV	157,979,982	735,486,019	681,239,944	0.982	0.993	156,229,952	727,338,641	673,693,480	1.080	1.000
V	117,927,386	557,952,356	516,492,895	1.105	1.115	116,869,741	552,948,299	511,860,672	1.080	1.000
VI	0	0	0	1.000	1.000	0	0	0	0.000	0.000
ALL	515,540,073	2,495,826,826	2,311,090,383			510,759,205	2,472,483,857	2,289,475,007	1.080	1.000

*The CURRENT pure premiums are payroll extended underlying pure premiums. The PROPOSED pure premiums are adjusted to include the proposed experience, trend, benefit and loss based expense changes as well as any miscellaneous premium adjustments.
**The CURRENT expected losses are payroll extended underlying pure premium adjusted by the change in off-balance by industry group. The PROPOSED pure premiums are further adjusted to include the proposed experience, trend, benefit and loss based expense changes as well as any miscellaneous premium adjustments.

c) INDUSTRY GROUP DIFFERENTIALS

Industry Group	(18) Converted Indicated Balanced Losses*	(19) Five Year Ind to Exp Ratios (w/o Wage Trend) (18) / [(15) × (17)]	(20) Indicated Differentials (w/o Wage Trend) (19) / 0.998	(21) Five Year Ind to Exp Ratios (w/ Wage Trend) (19) × (7)	(22) Lost-Time Cases	(23) Full Standard for Credibility Lost-Time Cases	(24) Credibility Minimum of 1.00 and [(22) / (23)] ^ 0.50	(25) Credibility Weighted Ind to Exp Ratios (24) × (21) + [1 – (24)] × (21) Total	(26) Normalized Credibility Weighted Ind to Exp Ratios (aka IG Differentials)	(27) Final Industry Group Differentials
I	520,287,113	1.004	1.006	1.010	11,447	12,000	0.98	1.010	1.010	1.010
II	354,809,835	1.008	1.010	0.999	4,306	12,000	0.60	0.999	0.999	0.999
III	228,093,802	0.976	0.978	0.974	4,625	12,000	0.62	0.984	0.984	0.984
IV	675,954,042	1.003	1.005	1.005	18,048	12,000	1.00	1.005	1.005	1.005
V	506,623,319	0.990	0.992	0.990	8,516	12,000	0.84	0.991	0.991	0.991
VI	0	1.000	1.000	1.000	0	12,000	0.00	1.000	1.000	1.000
ALL	2,285,768,111	0.998		0.999				1.000		1.000

*These expected unlimited losses are at ultimate, on-level, trended, and include the proposed experience and LBE changes as well as any miscellaneous premium adjustments.
These losses have also been balanced to the proposed level via the balancing factors in section A.6.
Source: NCCI WCSP Data

Reviewers *for* Variance, *Volume 6*

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