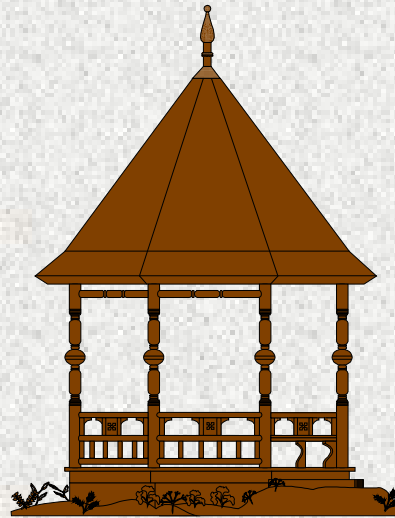


XXX Regulation

Segmented & Unitary Reserves

July 28, 1999

Boston, MA

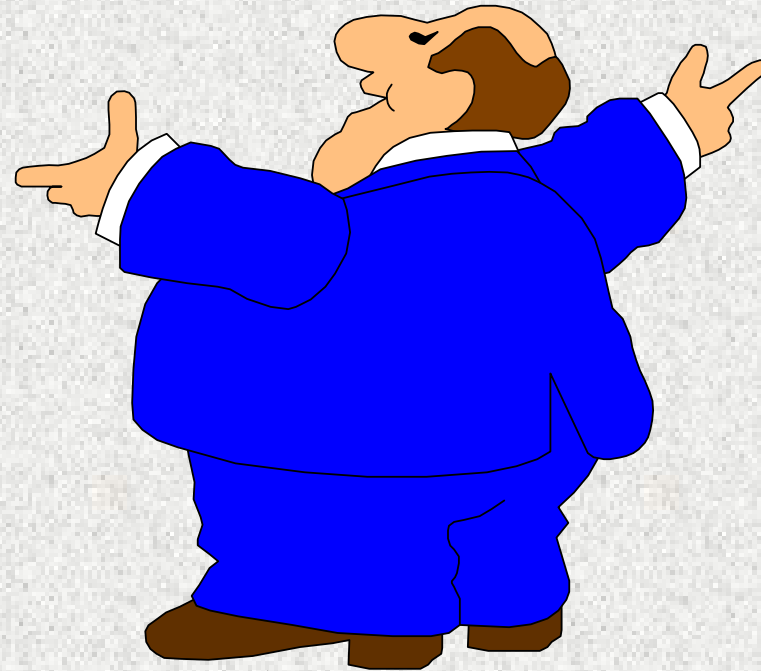


James N. Van Elsen

Consulting Actuary
Van Elsen Consulting
Colfax, Iowa

Presentation Outline

- ◆ Define Segments
- ◆ Sample Segments
- ◆ Unitary Method
- ◆ Sample Unitary
- ◆ Comparison
- ◆ Questions



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Define Segments

- ◆ General Rule: New Segment When Premium Increases Faster Than Mortality
- ◆ GP is **Guaranteed** Gross Premium
- ◆ q is valuation mortality rate used for deficiencies

$$\frac{GP_{x+k+t}}{GP_{x+k+t-1}} > \frac{q_{x+k+t}}{q_{x+k+t-1}}$$

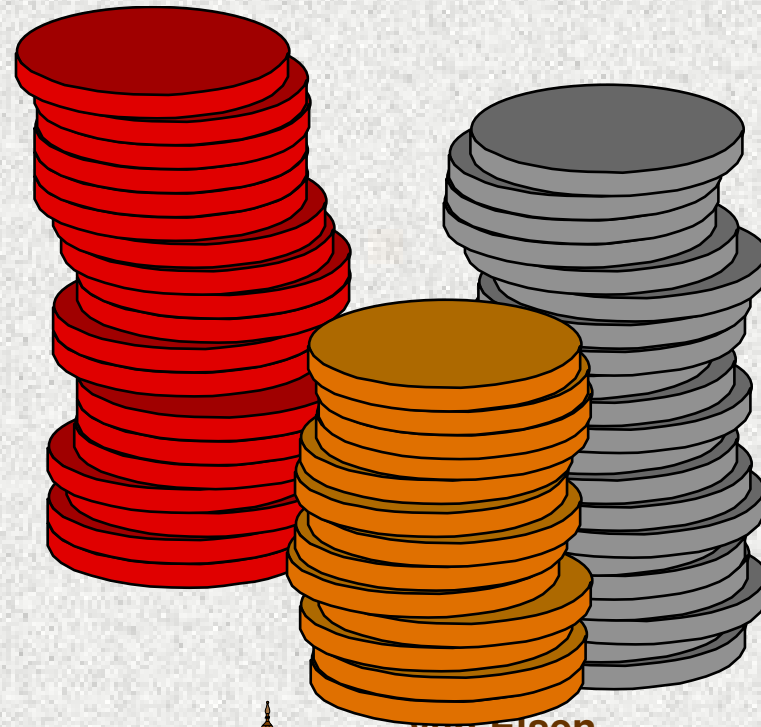


**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Guaranteed Gross Premiums

- ◆ Guaranteed & Determined at Issue
- ◆ Guarantee May be Explicit or Implicit
- ◆ Premiums That Are Dependent on External Events are Not “Determined” at Issue
- ◆ Policy Fees Ignored if Level



**van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Special Rules



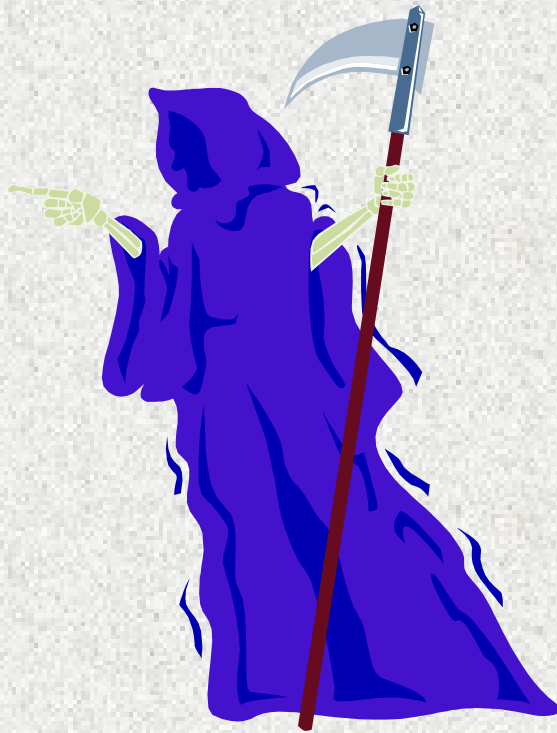
- ◆ If 0 Gross Premium Followed by Positive Premium \Rightarrow New Segment
- ◆ If Both Premiums 0 \Rightarrow Keep Current Segment



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Valuation Mortality Rate



- ◆ Rates Used for Deficiency Reserves
- ◆ No “X” Factor
- ◆ Use Selection Factors if Used for Deficiency Reserves



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Select Factors After 1st Segment?

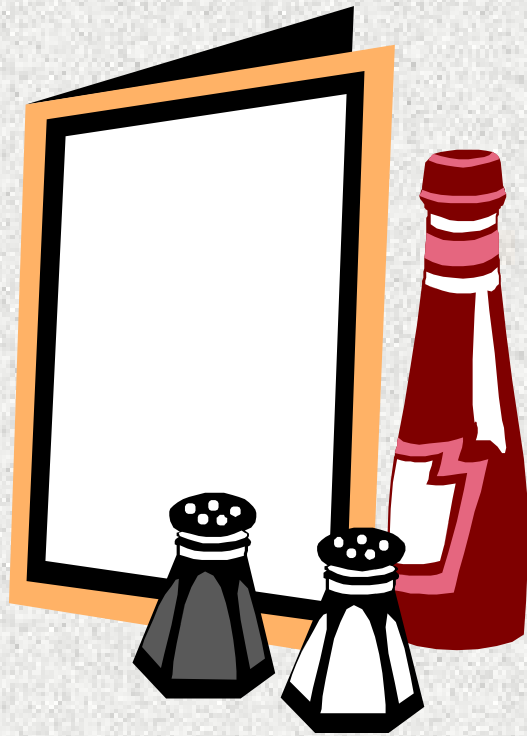
- ◆ May get Circular if Ultimate Rates Used
- ◆ Recommend Using Appropriate Select Factors (**for Segment Testing Only**)
- ◆ Consistent with Intent
- ◆ Only a Factor in a Few Situations



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Options



- ◆ Unusual Cash Values
- ◆ Grade to Unitary
- ◆ Grade to Guaranteed Cash Surrender Values



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

1st Segment Net Premiums

$$P_{x+t} = k \times GP_{x+t}$$

$$k = \frac{A_{x:n} + {}_nCV_x \frac{D_{x+n}}{D_x} + EA_x^{CRVM}}{\sum_{t=1}^n GP_{x+t} \frac{D_{x+t}}{D_x}}$$



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Renewal Segment Net Premiums

$$P_{x+t} = k \times GP_{x+t}$$

$$k = \frac{A_{x:n} + {}_nCV_x \frac{D_{x+n}}{D_x} - CV_x}{\sum_{t=1}^n GP_{x+t} \frac{D_{x+t}}{D_x}}$$



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Examples

Current: 20-Year Level Term, Followed by ART

Guaranteed:

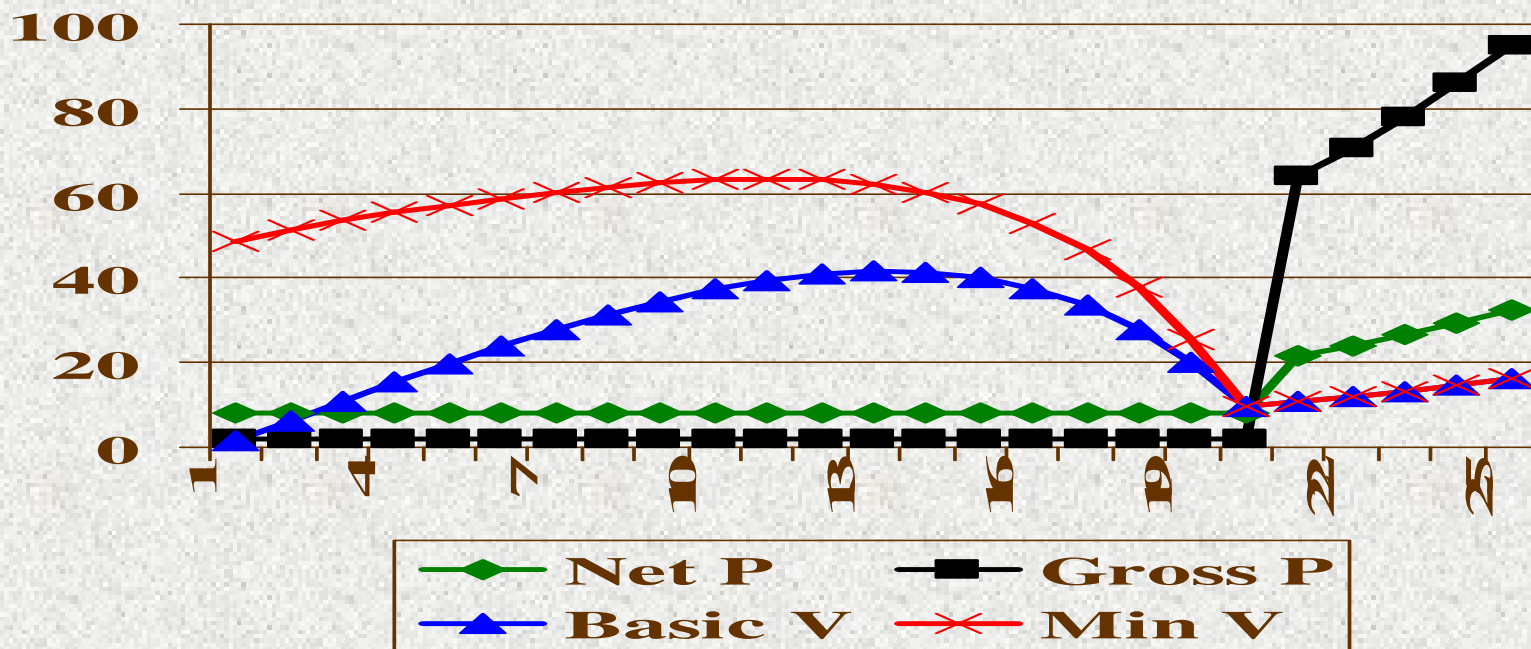
- 1 20-Year Term, Full Guarantee, Followed by ART
- 2 5-Year Guarantee
- 3 Increased Premiums with Full Guarantee
- 4 Original Premiums, Reduced Death Benefits



Van Elsen
Consulting

James N. Van Elsen, FSA, MAAA
Consulting Actuary

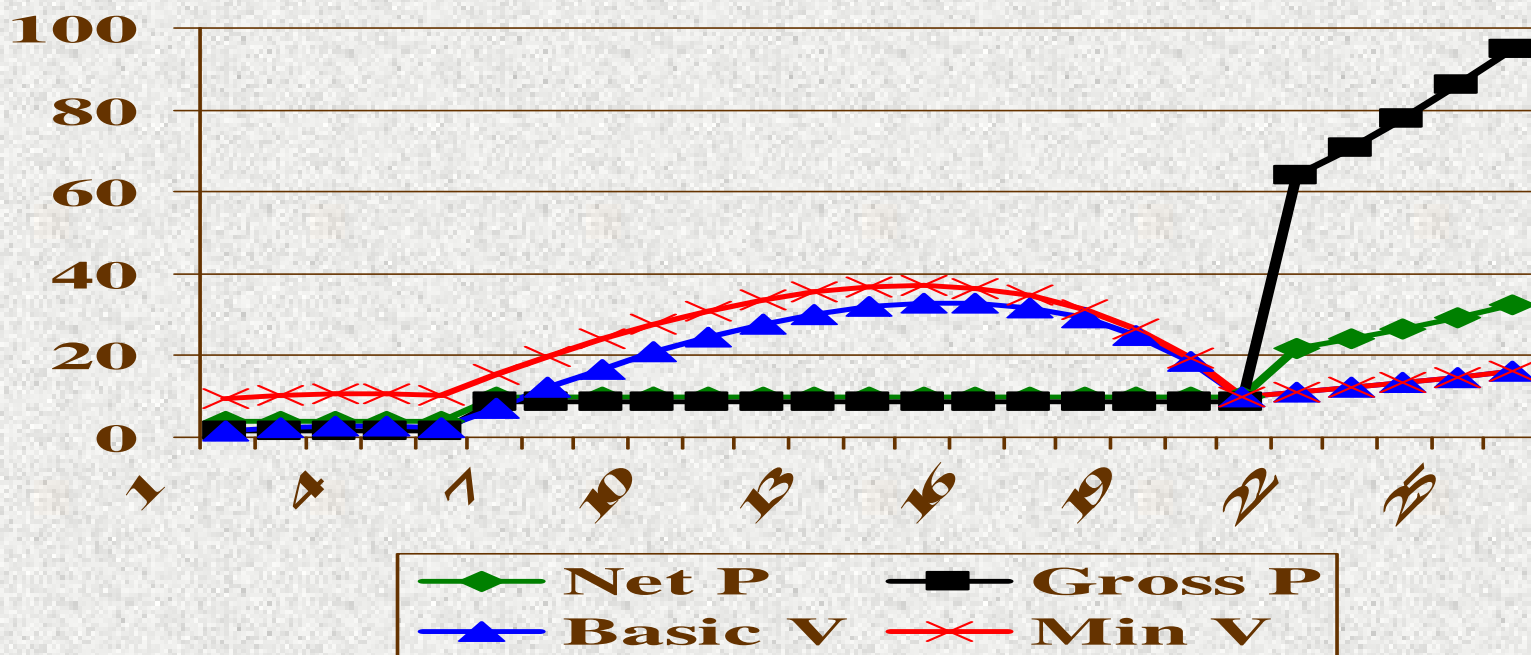
Example #1



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

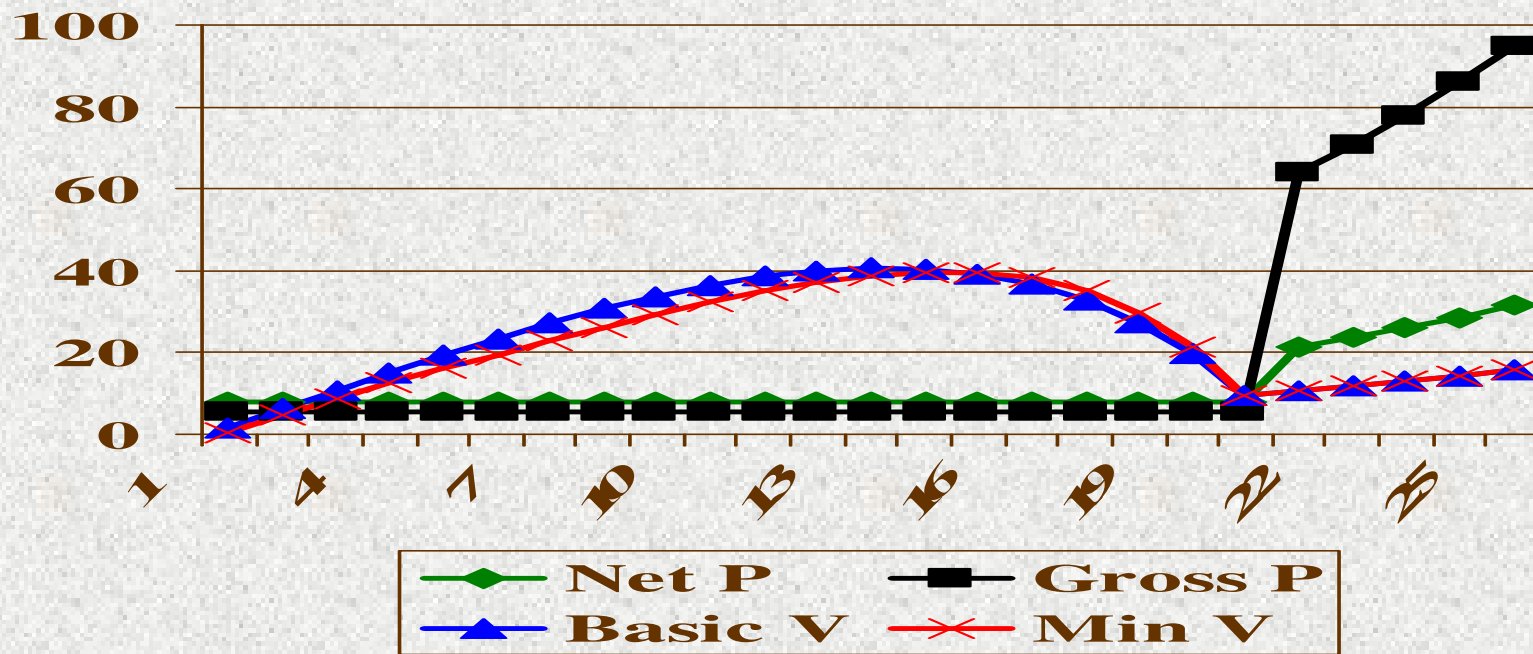
Example #2



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

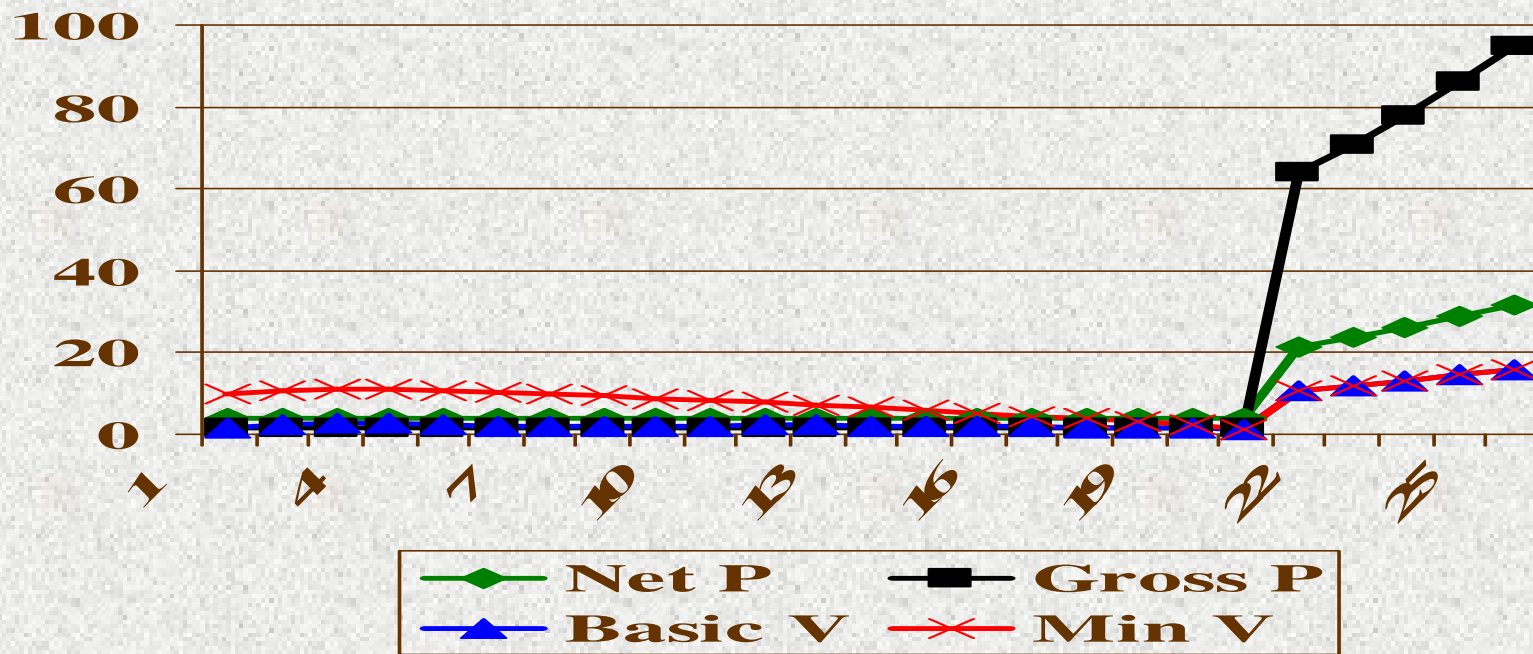
Example #3



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Example #4



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Calculate Unitary Reserves

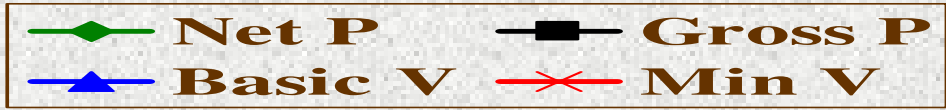
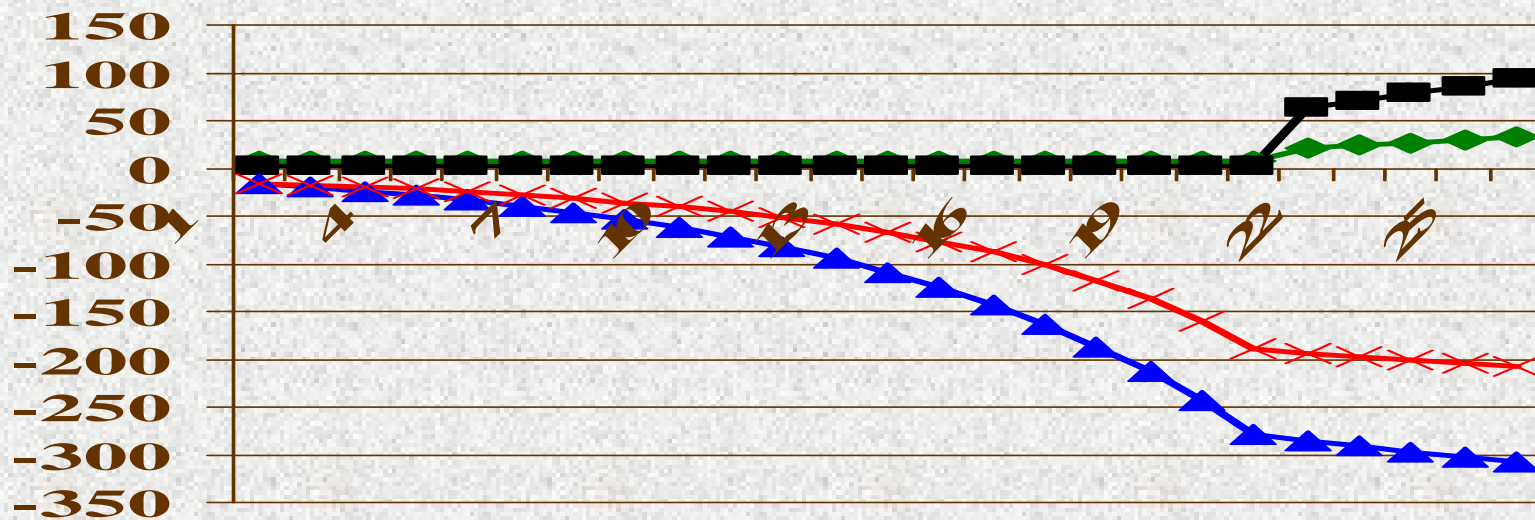
- ◆ Not Often a Factor
- ◆ May Come to Play in Later Durations
- ◆ Essentially the Same as Segmented, Only 1 Segment
- ◆ Must Hold the Greater of Unitary & Segmented



**Van Elsen
Consulting**

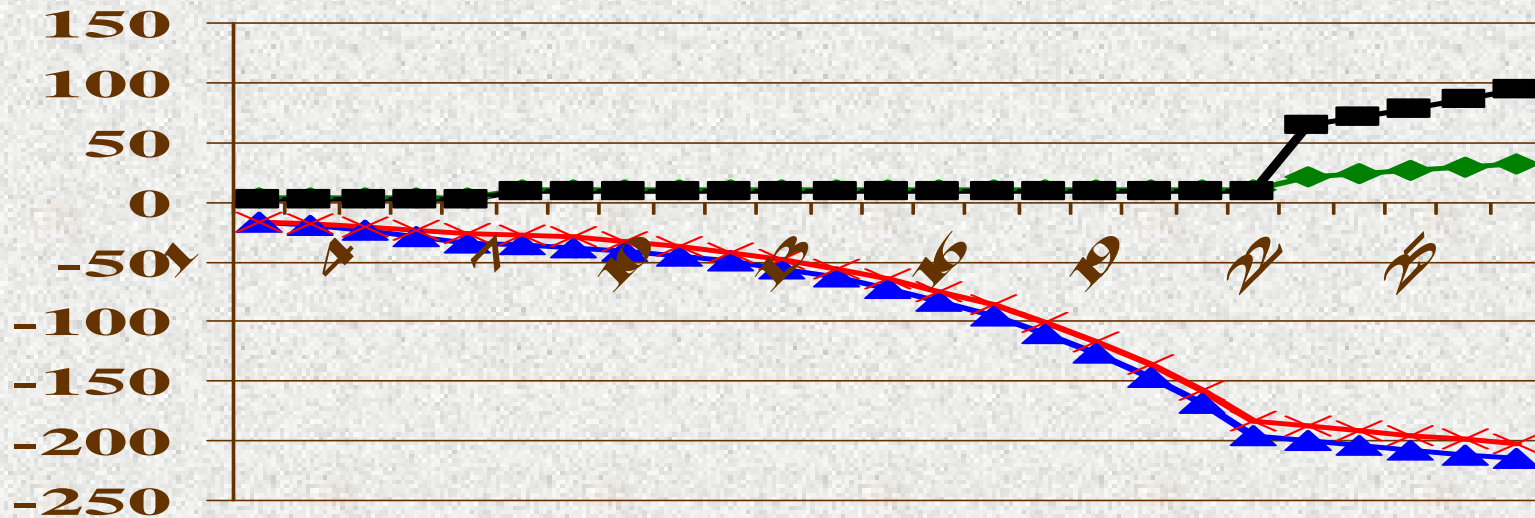
**James N. Van Elsen, FSA, MAAA
Consulting Actuary**

Example #1



Van Elsen Consulting
James N. Van Elsen, FSA, MAAA
Consulting Actuary

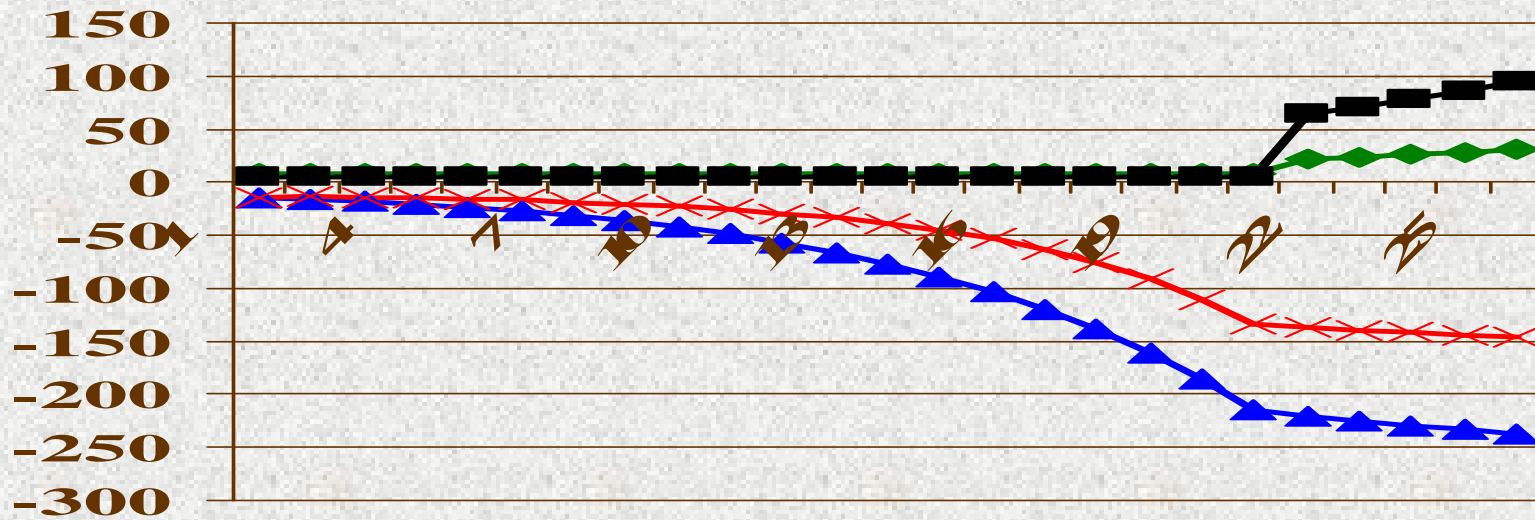
Example #2



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

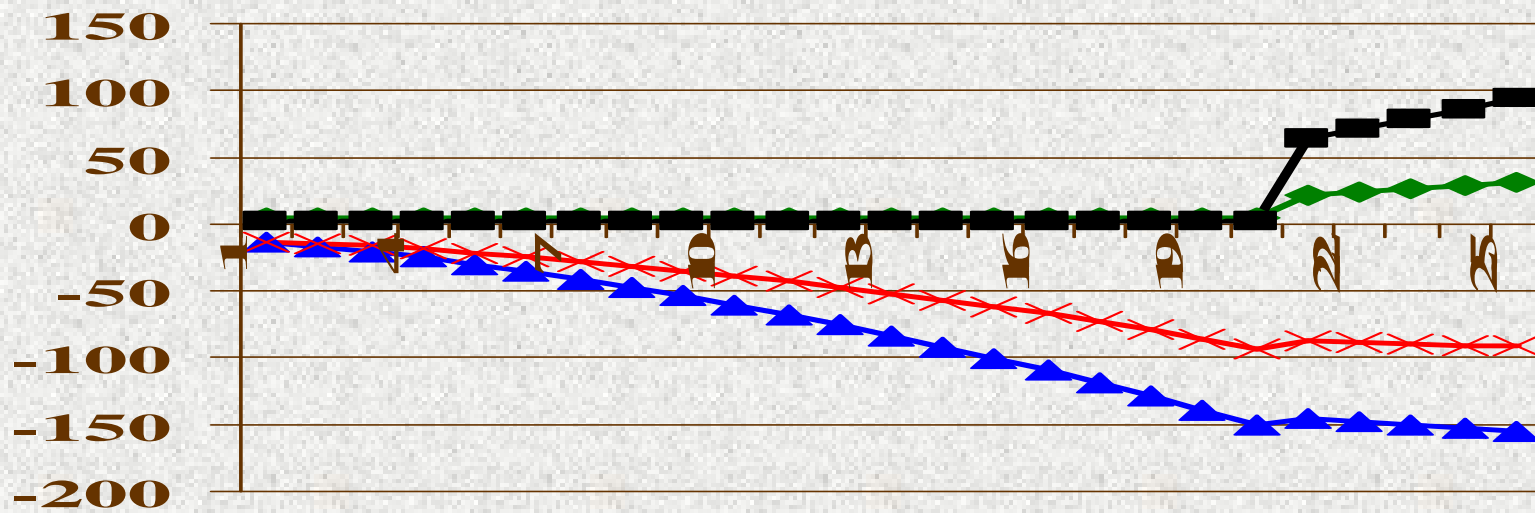
Example #3



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

Example #4



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

But, Not Always!!!



◆ Example #5

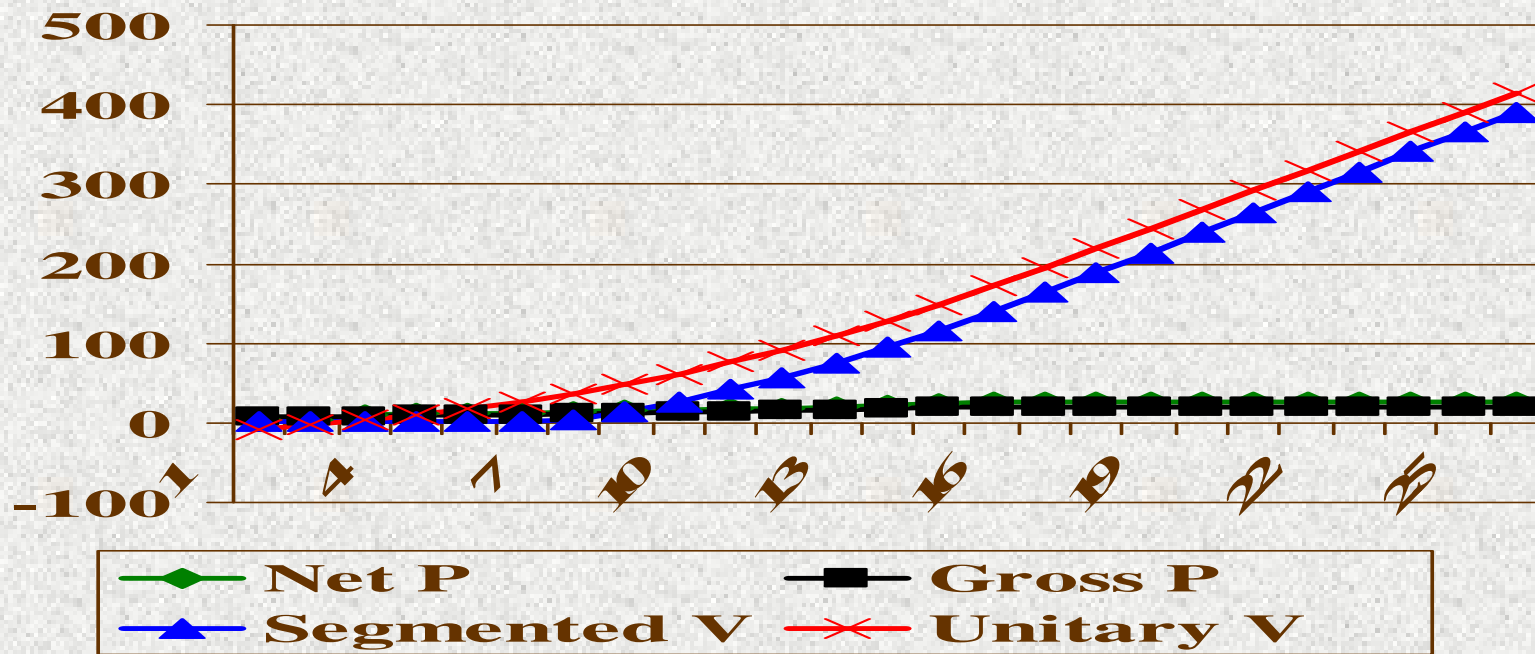
- 15-Year Graded Premium Whole Life
- Segmented Initially Higher
- Unitary Higher in Almost All Durations



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

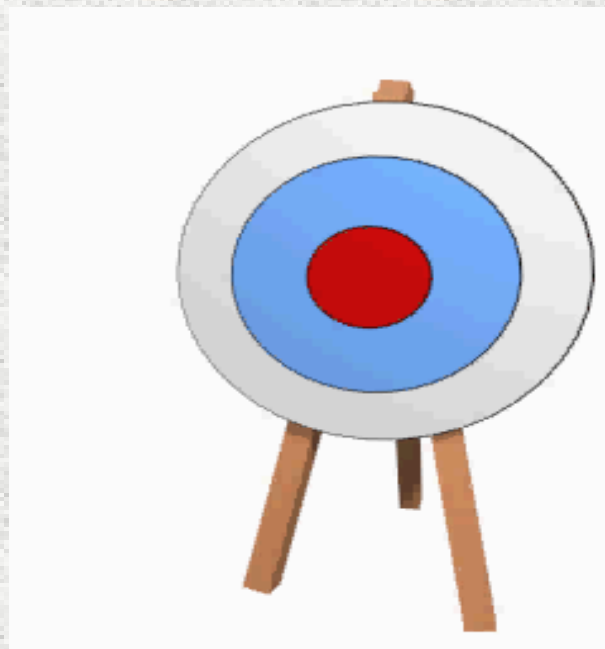
Example #5



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

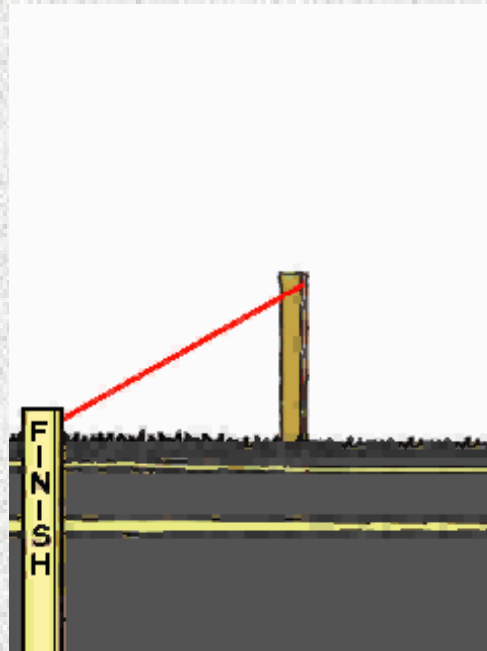
Questions & Answers



**Van Elsen
Consulting**

James N. Van Elsen, FSA, MAAA
Consulting Actuary

The End



**Van Elsen
Consulting**

**James N. Van Elsen, FSA, MAAA
Consulting Actuary**